

**UTM20 Series**  
**Ultrasonic Transit-time Flowmeters**  
Installation and Maintenance Instructions

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# 1. Scope of This Manual

This manual is intended to help you get the UTM20 meter up and running quickly. Read this manual carefully before attempting any installation or operation. Keep the manual accessible for future reference.

## 1.1 Typographic Conventions

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- In step-by-step instructions, bold text indicates items on the screen you need to select or act upon.  
**Example:** Click the Setup menu.

---

  - Names of parameters, options, boxes, columns and fields are italicized.  
**Example:** The value displays in the Status field.

---

  - Messages and special markings are shown in quotation marks.  
**Example:** "Error" displays in the title bar.

---

  - In most cases, software screen text appears in the manual as it does on the screen. For example, if a word is capitalized on the screen, it is capitalized when referred to in the manual.
- 

## 2. Unpacking and Inspection

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

### Note

If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

# 3. Safety

## 3.1 Terminology and Symbols

---



Indicates a hazardous situation, which, if not avoided, will result in death or serious personal injury.

---



Indicates a hazardous situation, which, if not avoided, could result in death or serious personal injury.

---



Indicates a hazardous situation, which, if not avoided, could result in minor or moderate personal injury or damage to property.

---

## 3.2 Considerations

The installation of the UTM20 meter must comply with all applicable federal, state, and local rules, regulations, and codes.

Do not use sharp objects when operating the device (such as using a pen to press buttons on the keypad).

When the UTM20 meter is a part of a system, it is configured in a fail-safe operation so that if the transmitter signal is compromised, the UTM20 meter will not cause harm to the system.

## Important

Not following instructions properly may impair safety of equipment and/or personnel.



After de-energizing, delay 5 minutes before opening.

## 4. Introduction

### **⚠ WARNING**

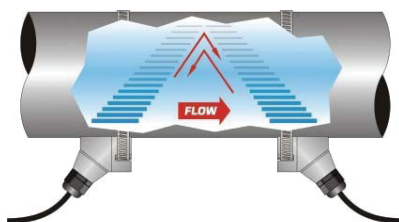
This equipment includes some external non-metallic parts. The user shall therefore ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

The UTM20 transit time meter measures volumetric flow and heating/cooling energy rates in clean liquids as well as those with small amounts of suspended solids or aeration, such as surface water or sewage. UTM20 ultrasonic flow and energy meters clamp onto the outside of pipes and do not contact the internal liquid.

The UTM20 meter is available in two versions:

- 
- A flow meter for water delivery, sewage, cooling water, alcohols, chemical
  - A heating/cooling energy flow meter used in conjunction with dual clamp-on RTDs for temperature measurement—ideal for hydronic process and HVAC applications
- 

Transit time flow meters measure the time difference between the travel time of an ultrasound wave going with the fluid flow and against the fluid flow. The 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 and are sonically conductive.



**Fig. 1 Meter operation**

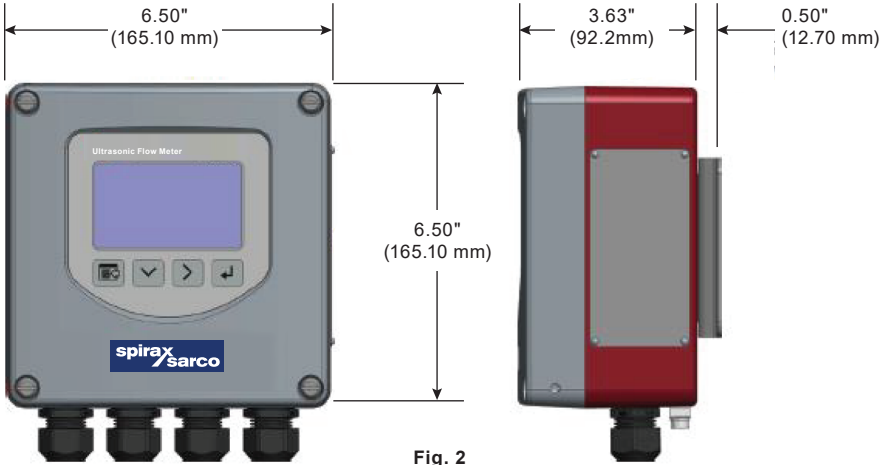
An ultrasonic meter equipped with heat flow capabilities measures the rate and quantity of heat delivered or removed from devices such as heat exchangers. By measuring the volumetric flow rate of the heat exchanger liquid, the temperature at the inlet pipe and the temperature at the outlet pipe, the energy usage can be calculated.

By applying a scaling factor, this heat flow measurement can be expressed in various units (Btu, Watts, Joules, Kilowatts and others).

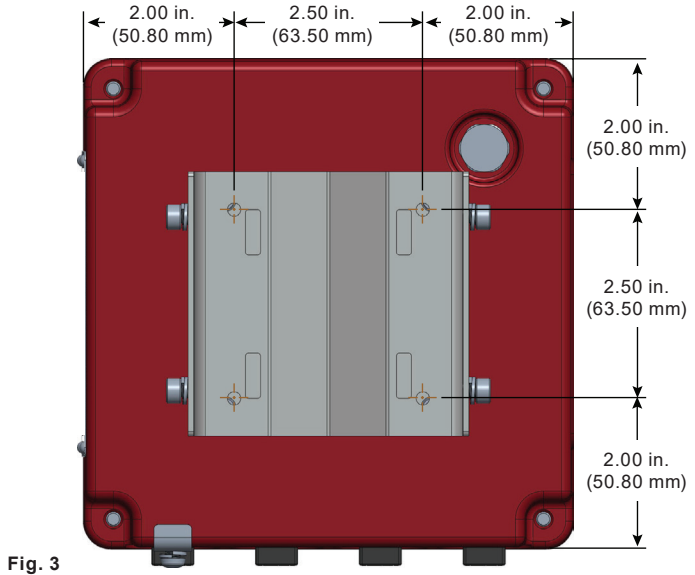
# 5. Dimensions

**Note:** Installation instructions begin on page 15.

## 5.1 Remote Enclosure



## 5.2 Wall Mount Bracket



UTM20 Series Ultrasonic Transit-time Flowmeters

### 5.3 Panel Mount Enclosure

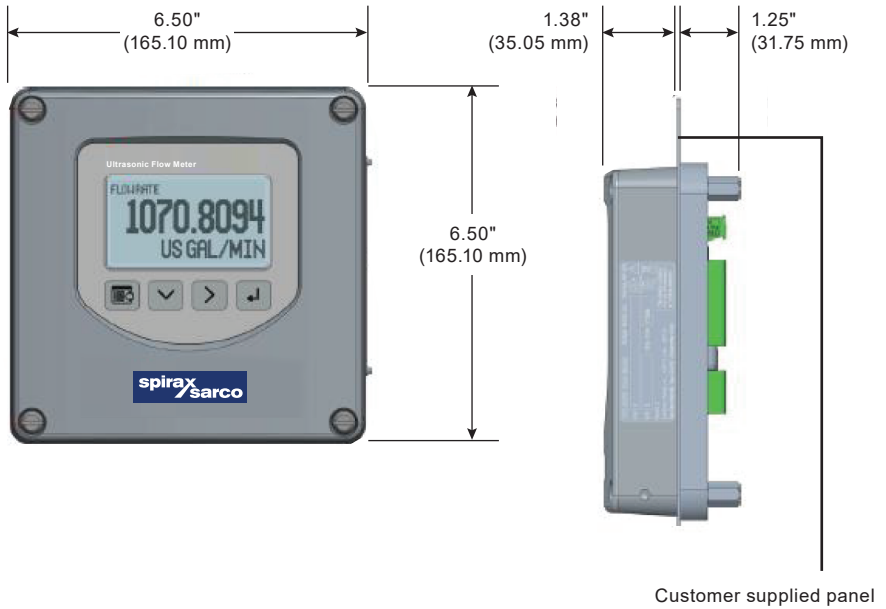


Fig. 4

# 6. Operation

## 6.1 Keypad Operation on the Home Screen



Fig. 5



The MENU/BACK key enters menu structure.



The DOWN ARROW key toggles between flow rate, flow total, velocity and flow rate with flow total.



The RIGHT ARROW key has no function.



The ENTER key has no function.

## 6.2 Keypad Operation in the Menu Structure



Fig. 6

The cursor bar highlights the submenu or parameter that will be viewed or edited. The scroll bar on the right indicates the relative position the cursor bar is at on the list when there are more than 4 items.

- MENU/BACK returns to parent menu (up a level). If at the Main (top level) menu, returns to the Home Screen.
- DOWN ARROW scrolls the list.
- RIGHT ARROW and ENTER have the same function in the menu structure and advance to the submenu or to read/edit a parameter.



## 6.3 Selecting an Option in a Parameter Selection List



Fig. 7

The active option in the parameter list has a filled-in box on the left side. The scroll bar on the right indicates the relative position the cursor bar is at on the list when there are more than 4 items.

- DOWN ARROW scrolls the list.
- ENTER selects the option and the box on the left side fills in to show the item is selected.
- MENU/BACK exits parameter editing and returns to the parent menu (up a level).

## 6.4 Entering a Number



Fig. 8

The parameter name and current value is displayed in the top portion of the screen. Edit the number on the bottom right of the screen.

- MENU/BACK exits parameter editing and returns to parent menu (up a level). The parameter remains at the value displayed in the top portion of the screen.
- DOWN ARROW cycles through the numbers and other options.
- RIGHT ARROW moves the cursor to the right. Once it reaches the rightmost digit or a space, the cursor moves to the leftmost digit.
- ENTER accepts the value.

# 7. Installation

## 7.1 Overview

Each of the installation steps that follow is explained on the following pages. The actual installation procedures differ slightly, depending on whether the transducers are fixed or adjustable.

If the transducers are fixed, you will:

1. Install the transducers.
2. Install the transmitter.
3. Wire the transmitter.
4. Program the meter.

If the transducers are adjustable, you will:

1. Install the transmitter.
2. Wire the transmitter.
3. Set up the meter (select the optimum transmission mode, enter the site information, and enter the fluid and pipe properties).
4. Install the transducers.
5. Complete the meter programming.

## 7.2 Installation Considerations

Mount the transmitter in a location:

- Where little vibration exists.
- That is protected from corrosive fluids.
- That is within the transmitters ambient temperature limits:  
-4 to 140 °F (-20 to 60 °C); relative humidity 0 to 85%, non-condensing; altitude 2000 m max.
- That is out of direct sunlight. Direct sunlight may increase transmitter temperature above the maximum limit.
- That protects the oleophobic vent from materials that may plug or seal the vent.

## 7.3 Equipment Required

- Screwdrivers, wide blade and tiny blade (for securing wires to the terminal blocks)
- User manual for the transducers
- Four #8 or M4 screws, if mounting the transmitter on a wall
- Stainless steel banding straps, if mounting the transmitter on a pipe

## 7.4 Installing the Transducers

See the user manual for your particular transducer for installation instructions.

## 7.5 Installing a Meter with a Remote Transmitter and Fixed Transducers

Locate the transmitter within the length of the transducer cables supplied or exchange the cable for one of proper length.

See the dimensions section for enclosure and mounting dimension details. Allow enough room for door swing, maintenance and conduit entrances.

### Important

When routing wires to the transmitter, make sure the cables are not twisted, pinched or hanging loosely.

1. Install the fixed transducers according to instructions in the transducer user manual.
2. Attach the mounting bracket to a wall (with 4 customer-supplied #8 or M4 screws, see "Wall Mount Bracket" in dimensions) or to a pipe (with mounting straps).

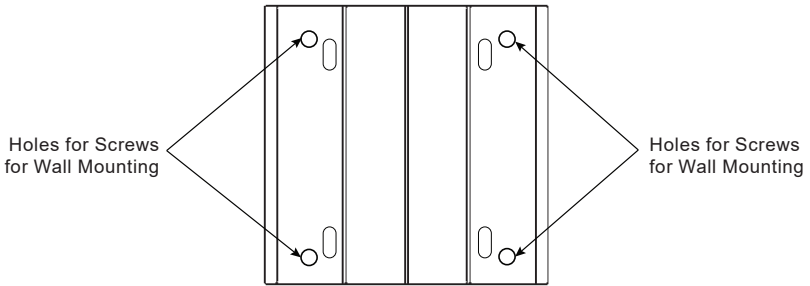


Fig. 9

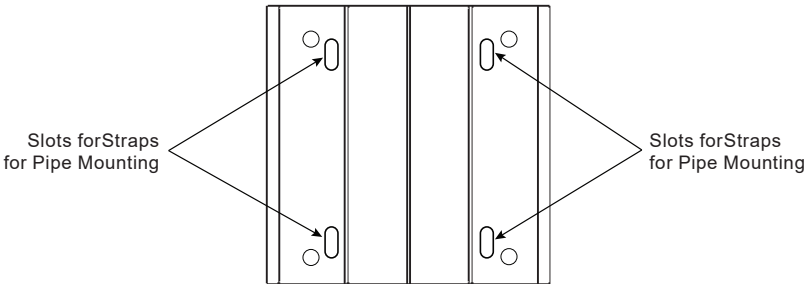


Fig. 10

3. Align the transmitter's bracket with the mounted bracket. Use a 4 mm hex tool to secure the 4 provided screws from the sides through the mating holes. See Figure 9.
4. If necessary, you can rotate the mounting bracket in 90° increments to accommodate the final orientation of the transmitter. From inside the enclosure, remove the 4 screws holding the bracket. Rotate the bracket and replace the screws. See Figure 10.

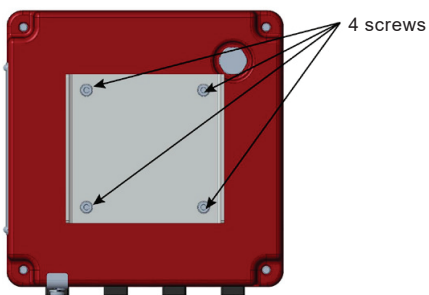


Fig. 11

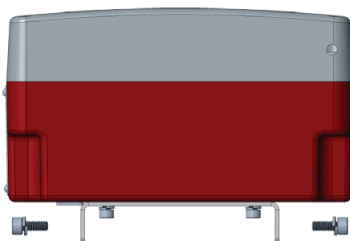


Fig. 12

5. Insert a wire for earth ground under the grounding bracket (see Figure 12 ) and screw it down tight.
6. Partially loosen the 2 enclosure captive screws on the left side of the transmitter cover. Completely loosen the 2 screws on the right side. Grasp and lift the cover and open it to the left. The cover remains attached and the left screws act as a hinge.

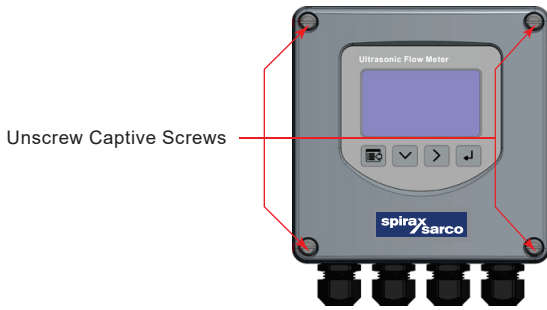


Fig. 13

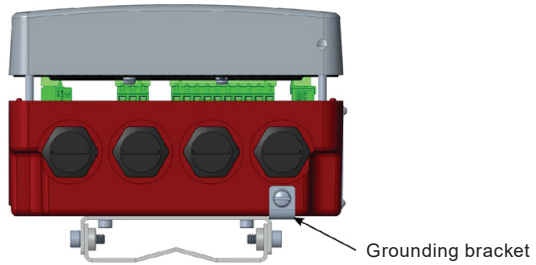


Fig. 14

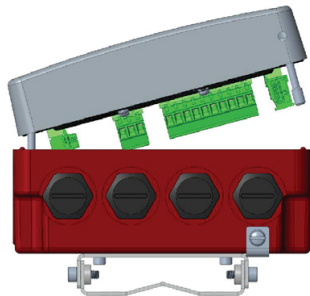
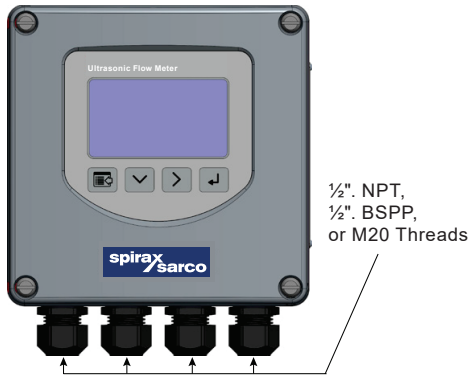


Fig. 15

7. Use conduit holes where cables enter the enclosure from the bottom. Use suitably certified plugs to seal any holes that are not used for cable entry. A cable gland kit is included for inserting the transducer and power cables.



**Note:** Use suitably certified fittings/plugs to maintain the watertight integrity of the enclosure. Generally, the right conduit hole (viewed from front) is used for power, the left conduit hole for transducer connections, and the center holes are used for I/O wiring.

8. Install the wires through the gland nuts and connect the wires to the removable terminal blocks. See "Wiring the Transmitter" on page 26.
9. Wire the transducers to the transmitter.
10. Plug the wired terminal blocks into the main board.
11. Reassemble the cover. Torque the cover screws to 45 in-lb.
12. Set up the meter. See "Initial Meter Setup" on page 41 for instructions.

## 7.6 Installing a Meter with a Remote Transmitter and Adjustable Transducers

- Locate the transmitter within the length of the transducer cables supplied or exchange the cable for one of proper length.
- Install the transducers after entering the pipe settings into the transmitter and determining the spacing and mounting method.
- See pages 9 and 10 for enclosure and mounting dimension details. Allow enough room for door swing, maintenance and conduit entrances.

### Important

When routing wires to the transmitter, make sure the cables are not twisted, pinched or hanging loosely.

1. Attach the mounting bracket to a wall (with 4 customer-supplied #8 or M4 screws, see "Wall Mount Bracket" on page 9 for dimensions) or to a pipe (with mounting straps).
2. Align the transmitter's bracket with the mounted bracket. Use a 4 mm hex tool to secure the 4 provided screws from the sides through the mating holes. See Figure 19 .

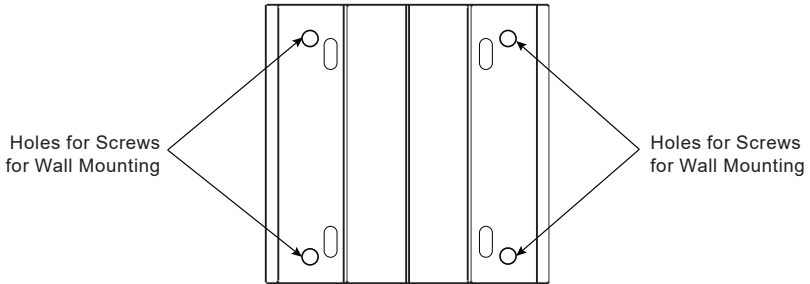


Fig. 17

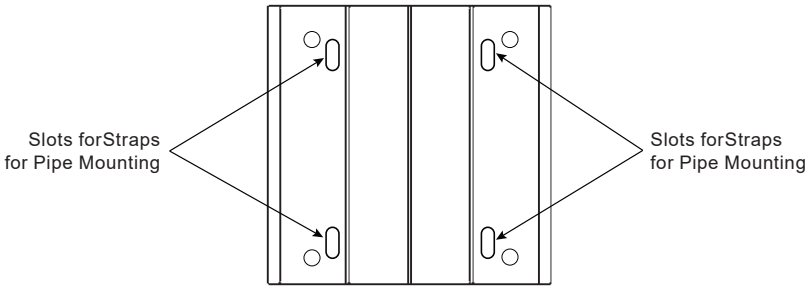


Fig. 18

3. If necessary, you can rotate the mounting bracket in 90° increments to accommodate the final orientation of the transmitter. From inside the enclosure, remove the 4 screws holding the bracket. Rotate the bracket and replace the screws. See Figure 17.



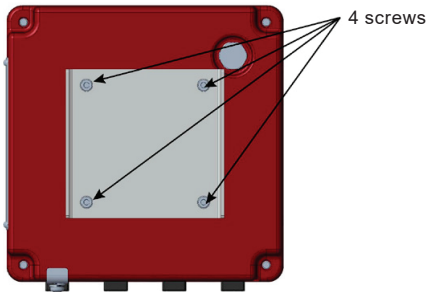


Fig. 19

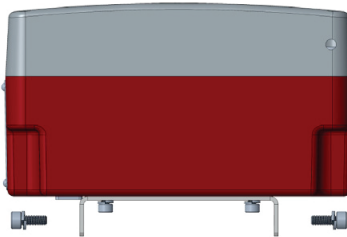


Fig. 20

4. Insert a wire for earth ground under the grounding bracket (see Figure 20 ) and screw it down tight.
5. Partially loosen the 2 enclosure captive screws on the left side of the transmitter cover. Completely loosen the 2 screws on the right side. Grasp and lift the cover and open it to the left. The cover remains attached and the left screws act as a hinge.

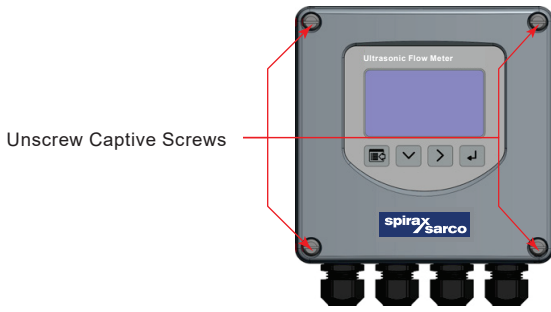


Fig. 21

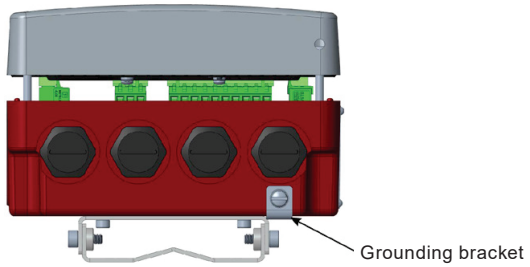


Fig. 22

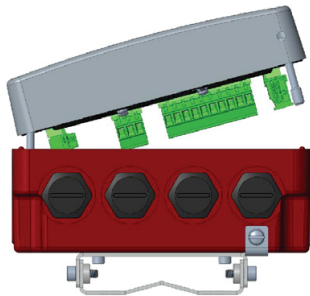


Fig. 23

6. Use conduit holes where cables enter the enclosure from the bottom. Use suitably certified plugs to seal any holes that are not used for cable entry. A cable gland kit is included for inserting the transducer and power cables.

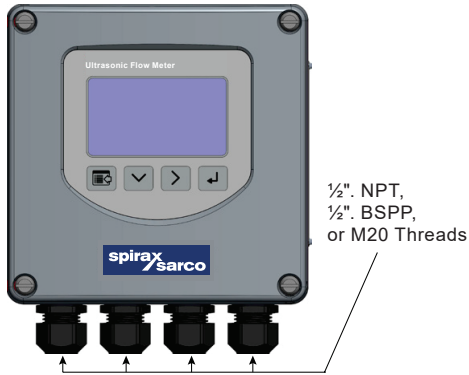


Fig. 24

**Note:** Use suitably certified fittings/plugs to maintain the watertight integrity of the enclosure. Generally, the right conduit hole (viewed from front) is used for power, the left conduit hole for transducer connections, and the center holes are used for I/O wiring.

7. Install the wires through the gland nuts and connect the wires to the removable terminal blocks. See "8. Wiring the Transmitter"
8. Set up the meter. See "Initial Meter Setup" on page 41 for instructions.
9. Install the adjustable transducers according to instructions in the transducer user manual.
10. Wire the transducers to the transmitter.
11. Plug the wired terminal blocks into the main board.
12. Reassemble the cover. Torque the cover screws to 45 in-lb.

## 7.7 Installing a Panel-Mount Meter

1. Measure and cut a mounting hole into the customer-supplied panel to the dimensions seen below .
2. Remove the 4 screws and 4 'O' rings holding the front of the unit to the frame.
3. Verify that the gasket is secure in the mounting bezel.
4. Guide the front of the unit through the panel cutout.
5. Insert the 4 screws through the front of the unit and the panel.
6. Apply one 'O' ring to each screw from the back of the panel.
7. Align the front of the unit to the frame.
8. Tighten the 4 screws and torque them to 45 in-lb.

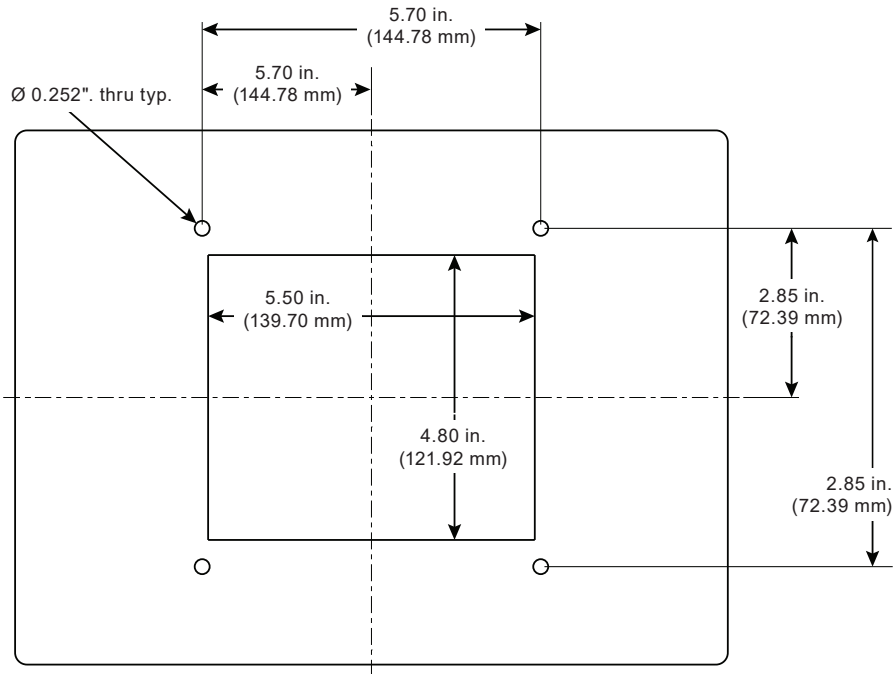


Fig. 25 Panel cut out dimensions

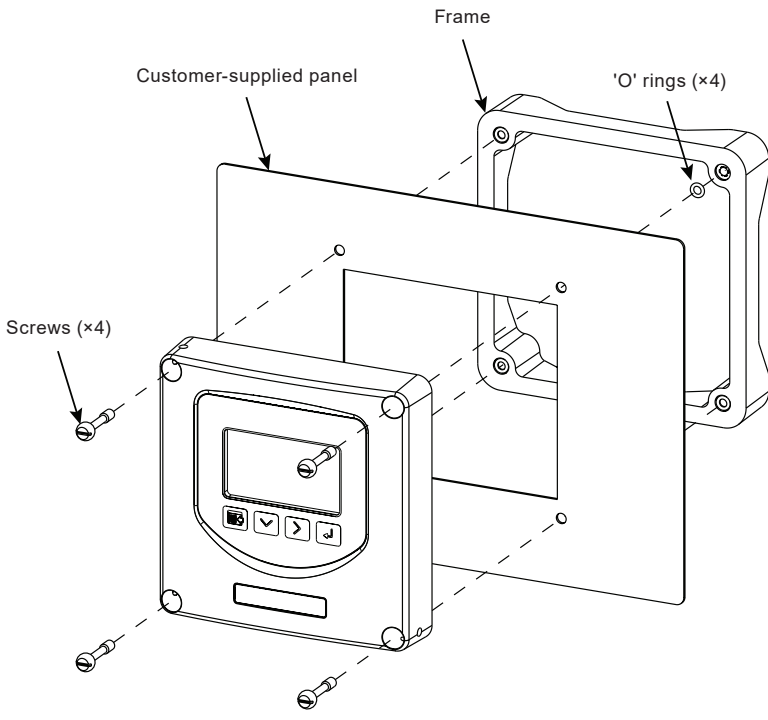


Fig. 26 Installation exploded view

# 8. Wiring the Transmitter

**Important:**

Select field wiring means rated for 5 °C above the maximum area temperature when it is possible that the temperature will exceed 55 °C.

To access terminal strips for wiring, loosen the 4 enclosure captive screws. Grasp and lift the cover and open it to the left. The cover remains attached and the left screws act as a hinge.

## 8.1 Torque Requirements

The tightening torque requirements for the screw connections of the plug-in terminals are 4.4 lb-in. (0.5 Nm) minimum to 5.3 lb-in. (0.6 Nm) maximum.

## 8.2 Electrical Symbols

Function	Direct Current	Alternating Current	Earth (Ground)	Protective Ground	Chassis Ground
Symbol					

Fig. 27 Electrical symbols

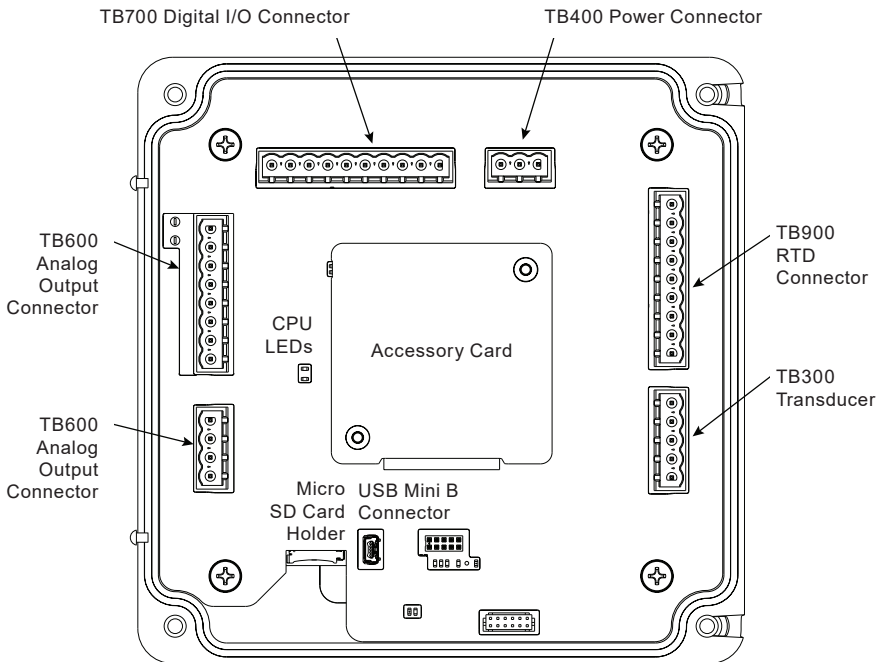


Fig. 28 Wiring connectors

## 8.3 Connection data

Description	Minimum	Maximum
Conductor cross section solid	0.2 mm <sup>2</sup>	2.5 mm <sup>2</sup>
Conductor cross section flexible	0.2 mm <sup>2</sup>	2.5 mm <sup>2</sup>
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm <sup>2</sup>	2.5 mm <sup>2</sup>
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm <sup>2</sup>	2.5 mm <sup>2</sup>
Conductor cross section AWG	24	12
2 conductors with same cross section, solid	0.2 mm <sup>2</sup>	1 mm <sup>2</sup>
2 conductors with same cross section, stranded	0.2 mm <sup>2</sup>	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve	0.25 mm <sup>2</sup>	1 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve	0.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>
AWG according to UL/CUL	30	12

## 8.4 Rated Conditions of Terminals

- Mains AC 85 to 264V AC  
Wire 18 to 12 AWG UL AWM 1007 Type 1007
- 9 to 28V DC, 20 to 26V AC  
Wire 20 AWG UL AWM 1007 Type 1007
- Transducer Cables  
Badger Meter supplied cable
- Digital Outputs/Inputs, Current Output, RS485, RTD or Encoder Interface
- Wire 28 to 12 AWG UL AWM 1007 Type 1007

## 8.5 Wiring the Transducer

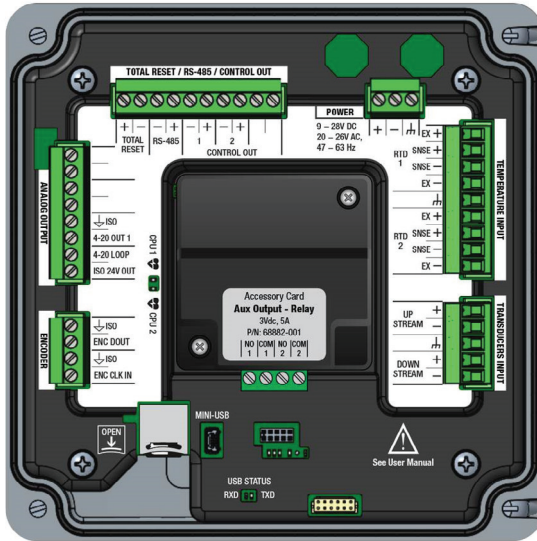


Fig. 29 Wiring connections

### Notes:

- Submersible transducer cables are larger diameter. Each cable requires a separate conduit hole. The standard yellow cable and high temperature cables are small enough to use a single cable gland with a 2-hole grommet.
- Transducer cables have two wire-color combinations. For the blue and white combination, the blue wire is positive (+) and the white wire is negative (-). For the red and black combination, the red wire is positive (+) and the black wire is negative (-). The transducer wires are labeled to indicate which pair is upstream or downstream.



1. Guide the transducer terminations through a conduit hole in the bottom of the enclosure.
2. Secure the transducer cable with the supplied conduit nut (if flexible conduit was ordered with the transducer).
3. Install the ferrite to the cable:
  - a. To open the ferrite, pull the fastener away from the body of the ferrite.
  - b. Wrap the cable tightly around half of the ferrite and place the cable into the groove.
  - c. Snap the ferrite shut.



Fig. 30

4. The terminals within the transmitter are screw-down barrier terminals. Connect the wires at the corresponding screw terminals in the transmitter. Observe upstream and downstream orientation and wire polarity. See below.

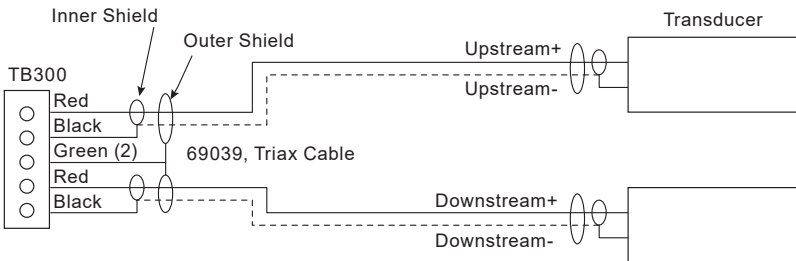


Fig. 31 Upstream/downstream transducer

## 8.6 Power

Connect power to the screw terminal block in the transmitter.

Low voltage power can use any available conduit hole in the enclosure.

Line voltage AC power must use the right conduit hole, which is aligned with the terminal block on the AC power board.

Use wiring practices that conform to local and national codes such as The National Electrical Code Handbook in the U.S.

### **CAUTION**

**Any other wiring method may be unsafe or cause improper operation of the transmitter**

**Note:** This transmitter requires clean electrical line power. Do not operate this transmitter on circuits with noisy components (such as fluorescent lights, relays, compressors, or variable frequency drives). Do not use step-down transformers from high voltage, high amperage sources. Do not run signal wires with line power within the same wiring tray or conduit.

## 8.7 9 to 28V DC Power

The transmitter may be operated from a 9 to 28V DC source, as long as the source supplies a maximum of 8 Watts of power.

Connect the DC power to 9 to 28V DC In, power return, and chassis ground, as below .

**Note:** DC-powered transmitters are protected from major catastrophe with an internal 2.0 Amp slow-blow fuse. If this fuse is blown, replace the transmitter or return it to the factory for repair.

**IMPORTANT:** A Class II DC power supply is required.

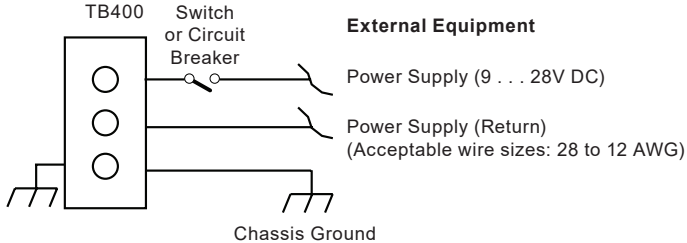
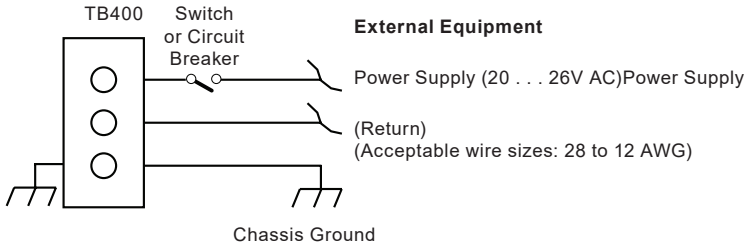


Fig. 32 Power supply 9 to 28V DC

## 8.8 20 to 26V AC Power

The transmitter may be operated from a 20 to 26V AC source, as long as the source supplies a maximum of 8 Watts of power. Connect the AC power to 20 to 26V AC In, power return, and chassis ground, as below .

**Note:** 24V AC powered transmitters are protected from major catastrophe with an internal 2.0 Amp slow-blow fuse. If this fuse is blown, replace the transmitter or return it to the factory for repair.



**Fig. 33 Power supply 20 to 28V AC**

## 8.9 Mains Power

**IMPORTANT:** The measuring device does not have an internal circuit breaker. For compliance with IEC 61010-1, a switch in close proximity to the transmitter is required so that the power supply line can be easily disconnected from the mains.

The transmitter may be operated from 90 to 250V AC, 47 to 63 Hz, 24VA maximum power source.

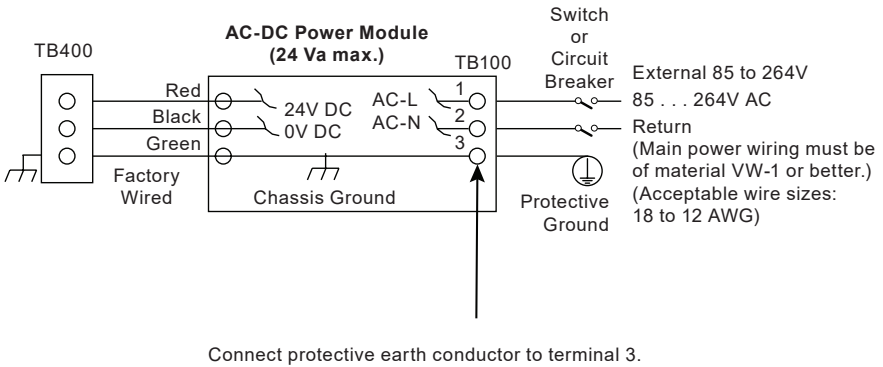
**Note:** Mains AC-powered transmitters are protected with 1A, 250V AC, 5×20 mm, slow-blow, field-replaceable fuse.

### **⚠ WARNING**

**To prevent shorting out the mains AC power, you must replace the terminal block cover on the AC module after wiring the power.**

Remove the terminal block covers before wiring and replace them after wiring:

1. Grasp the sides of the cover and gently pull it up.
2. Insert wires into the slots on the cover and screw them down to secure.
3. Align the cover in its original orientation over the terminal block and push down to connect.

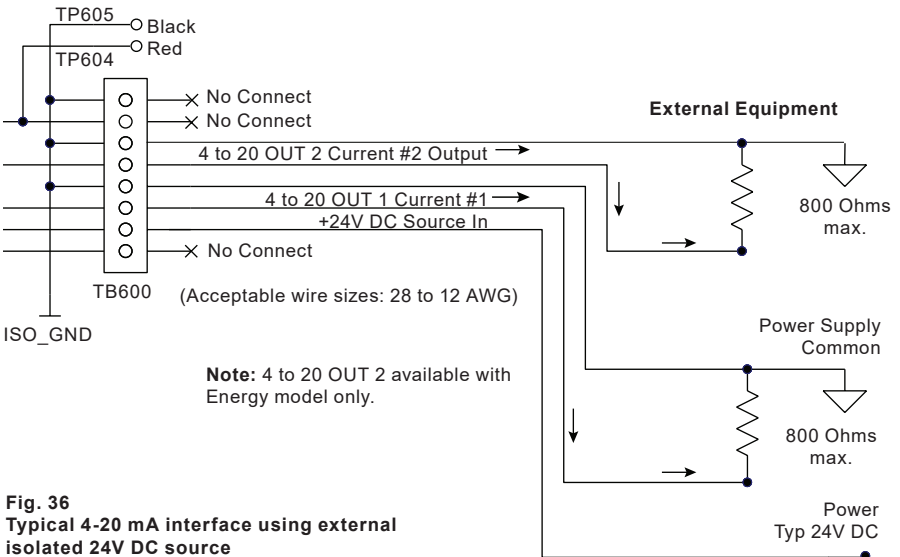
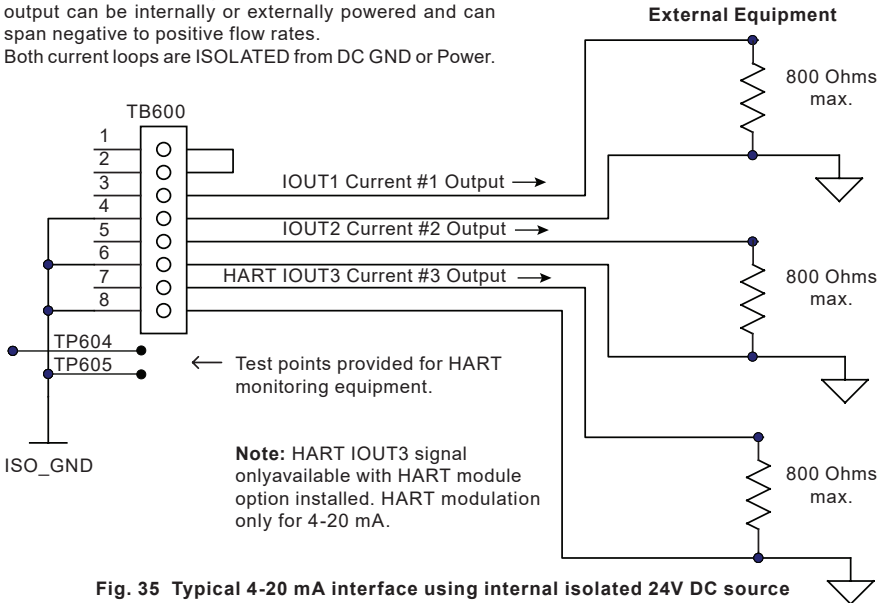


**Fig. 34 AC/DC power connections**

## 8.10 4 to 20 mA Output Wiring

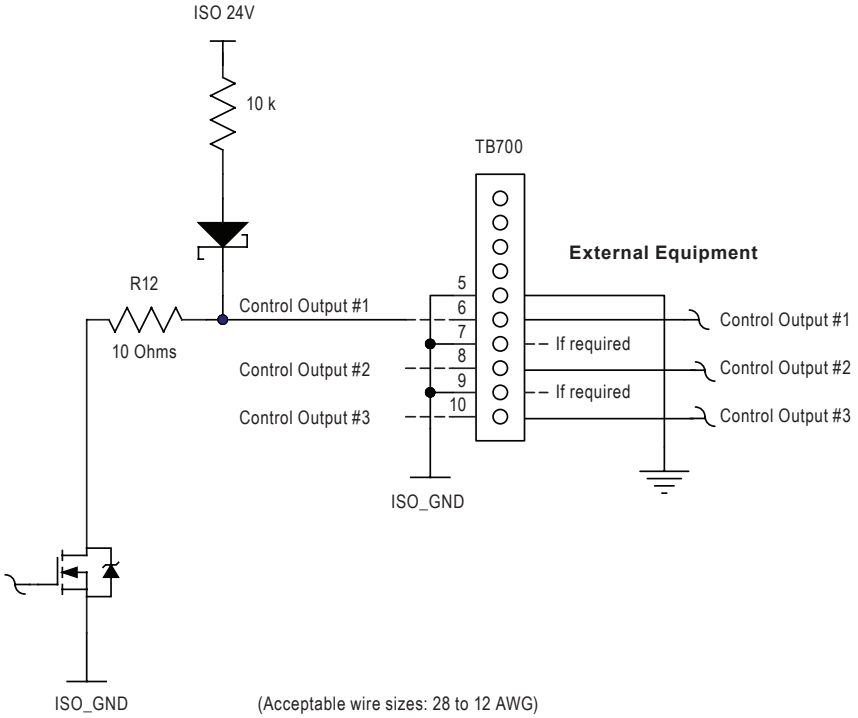
The 4 to 20 mA output transmits an analog current signal that is proportional to system flow rate. The 4 to 20 mA output can be internally or externally powered and can span negative to positive flow rates. Both current loops are ISOLATED from DC GND or Power.

Both current loops are ISOLATED from DC GND or Power.



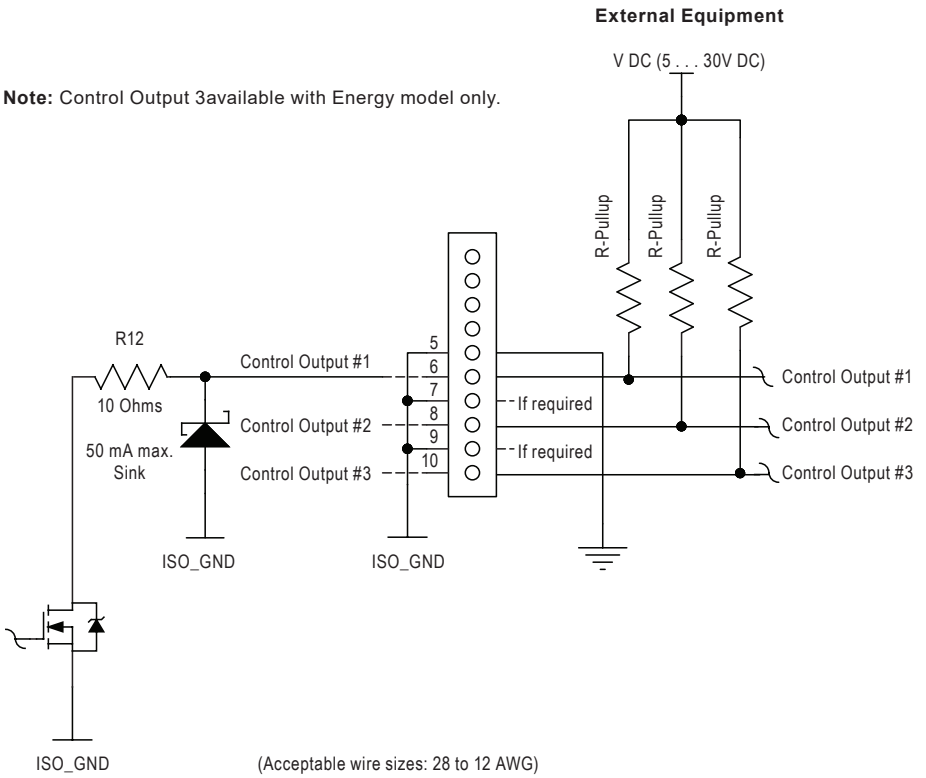
# 8.11 Digital Outputs Wiring

**Note:** Control Output 3 available with Energy model only.



**Fig. 37 Typical control out 1, 2 and 3 interface with internal pullups active**

**Note:** Control Output 3 available with Energy model only.



**Fig. 38 Typical control out 1, 2 and 3 interface with external pullups passive**

## 8.12 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.

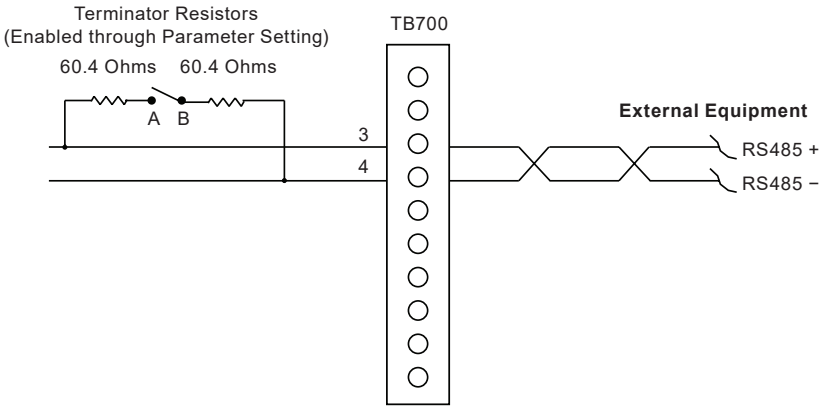


Fig. 39 Typical RS485 interface

## 8.13 Digital Input Wiring

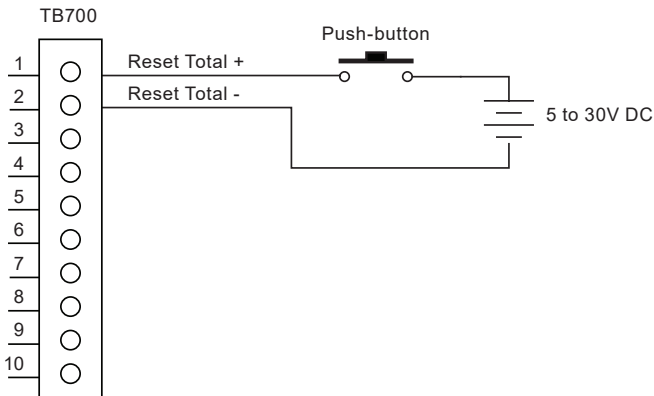


Fig. 40 Digital input—reset totalizer



## 8.14 AquaCUE/BEACON Endpoint Wiring

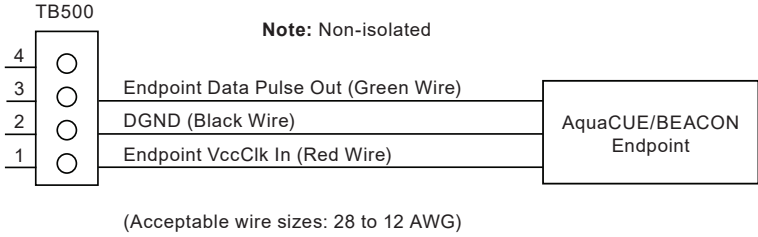


Fig. 41 AquaCUE/BEACON wiring

## 8.15 RTD Interface Wiring (Energy Models Only)

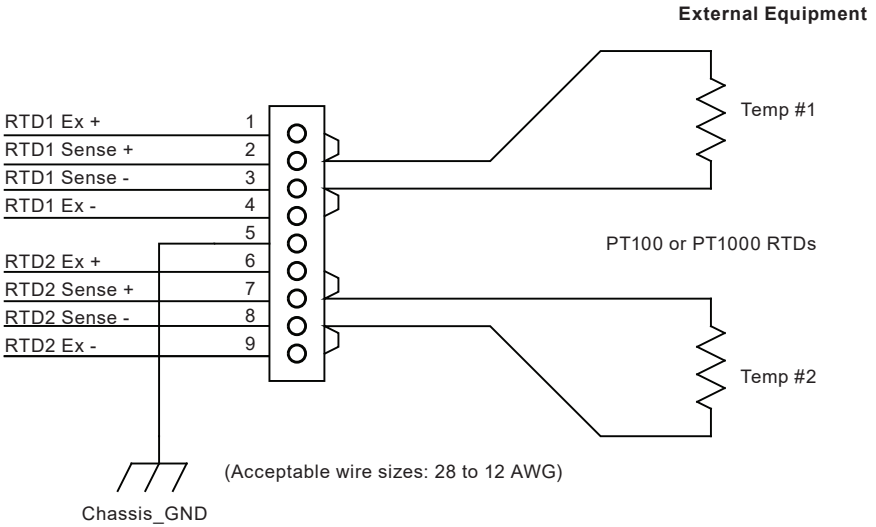


Fig. 42 Two-wire RTD interface

(Note: Wire colors apply to Badger Meter PN 68996.)

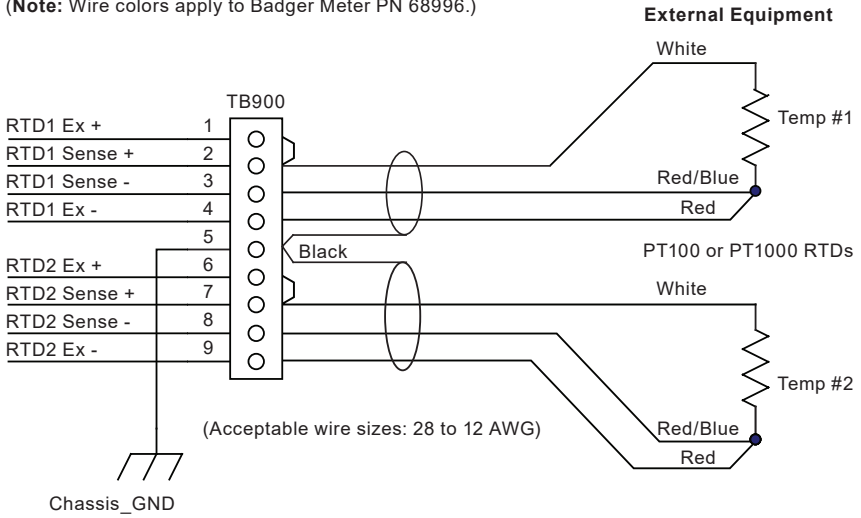


Fig. 43 Three-wire RTD interface

(Note: Wire colors apply to Badger Meter PN 68996.)

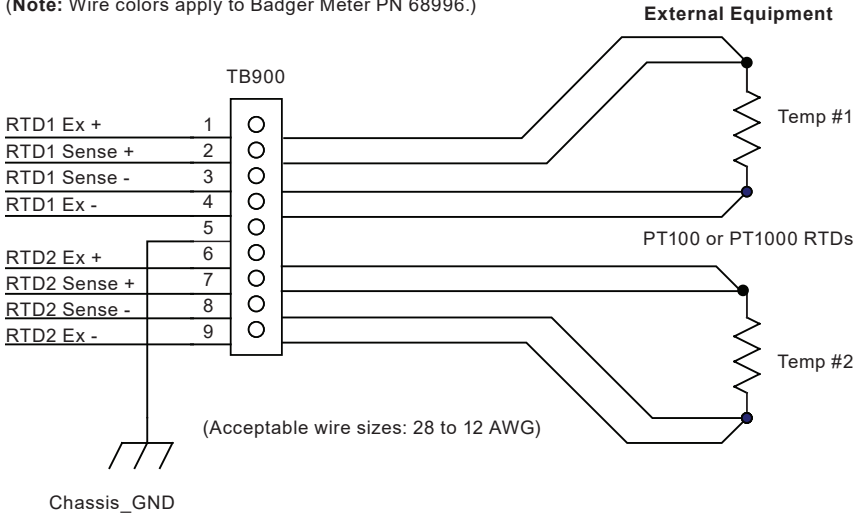


Fig. 44 Four-wire RTD interface

## 8.16 Auxiliary Output Card Wiring

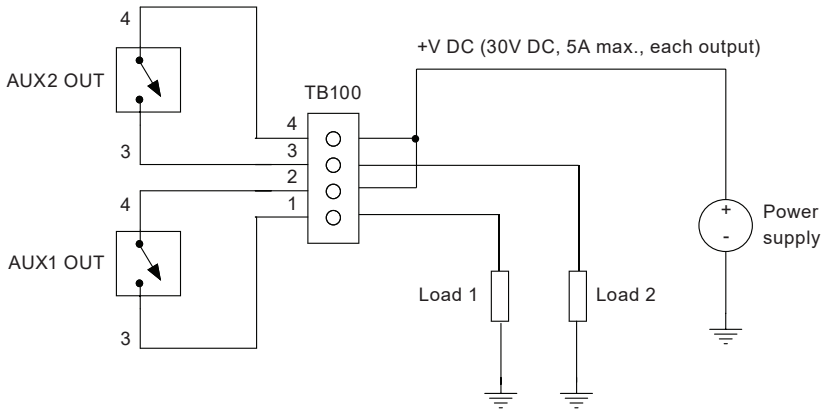


Fig. 45 Auxiliary output interface

## 8.17 Installing the MicroSD Card

### **⚠ WARNING**

In a hazardous location where explosive gas or dust is present, disconnect the power before opening the enclosure and inserting or removing the microsd card. After the card is inserted or removed, close the enclosure before reapplying power.

1. In all locations, turn off power to the unit.
2. Remove the enclosure cover.
3. Put your finger in the groove of the tray and slide the tray downward. The tray springs open.

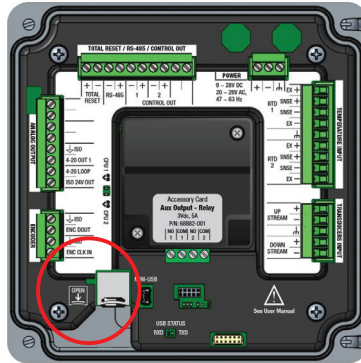


Fig. 46

4. Insert the MicroSD card.
5. Slide the cover up to close.
6. Replace the enclosure cover.

## 8.18 Connecting the USB Cable

Use a USB cable when connecting a UTM20 meter to a computer with SoloCUE® Flow Device Manager software.

### **⚠ WARNING**

Do not use the mini usb port in a hazardous location where explosive gas or dust is present. Do not open the transmitter while powered if water or spray could contact electronics or interior.

1. Open the enclosure cover.
2. Connect the USB cable to the mini USB port, aligning the pins in the cable with the holes in the port.
3. Program the transmitter.
4. Remove the USB cable and close the enclosure cover.

## 8.19 Initial Meter Setup

You can set up the meter using the UTM20 keypad or the SoloCUE Flow Device Manager software. This document addresses procedures using the UTM20 keypad. To use SoloCUE, see the "SoloCUE Flow Device Manager Installation Guide" available at [www.badgermeter.com](http://www.badgermeter.com). For in-depth parameter programming, see "Parameter Descriptions by Menu" on page 44.

### 1. Program the meter settings:

When using the keypad to set up the UTM20 meter to measure flow, press MENU/BACK to enter the main menu. In the SETUP > METER menu, enter the pipe characteristics, transducer, mounting and fluid, and record the calculated spacing as needed. Install transducer. See the transducer user manual for instructions.

### 2. Check calibration:

In the SETUP > METER > CALIBRATION menu, select Field for the Factor Mode. Enter the calibration and sensor factors from the transducers into the scale factor and sensor factor value.

### 3. Zero the meter:

Due to different pipe characteristics, the meter must be zeroed in order to maintain accuracy. The recommended method is to stop flow and make sure there is no flow before zeroing the meter. In situations in which that is not feasible, you may zero the meter while the flow is steady or enter the zero manually. Based on ZERO MODE, the SET ZERO option will be selectable.

#### a. If ZERO MODE is set to NO FLOW:

Check that the pipe is full of liquid and not flowing. Flow must be absolutely zero.

Securely close any valves and allow time for settling to occur.

Select SET ZERO-NO FLOW and click OK to set the new zero.

#### b. If ZERO MODE is set to STEADY FLOW:

Check that the pipe is full of liquid and flowing at a steady rate.

Select SET ZERO-FLOW and click OK to set the new zero.

### 4. Select temperature sensor (energy models only):

In the SETUP > INPUTS/OUTPUT > RTD menu, select the temperature sensor type, range and order for positive and negative energy calculations.

### 5. Select units:

In the SETUP > UNITS menu, select the units and format of flow rate, total and velocity, and for energy meters the energy rate, energy total and temperature.

### 6. Set up the flow settings:

In the SETUP > METER > FLOW SETUP menu, select flow direction, low and maximum flow cutoff, and minimum and maximum signal strength.

# 9. Menu Map

**Note:**

Passcode levels for write access to each menu are as follows:

(O) = Operator, Service or Admin

(S) = Service or Admin

(A) = Admin


If no passcode is entered, all parameters can still be read.

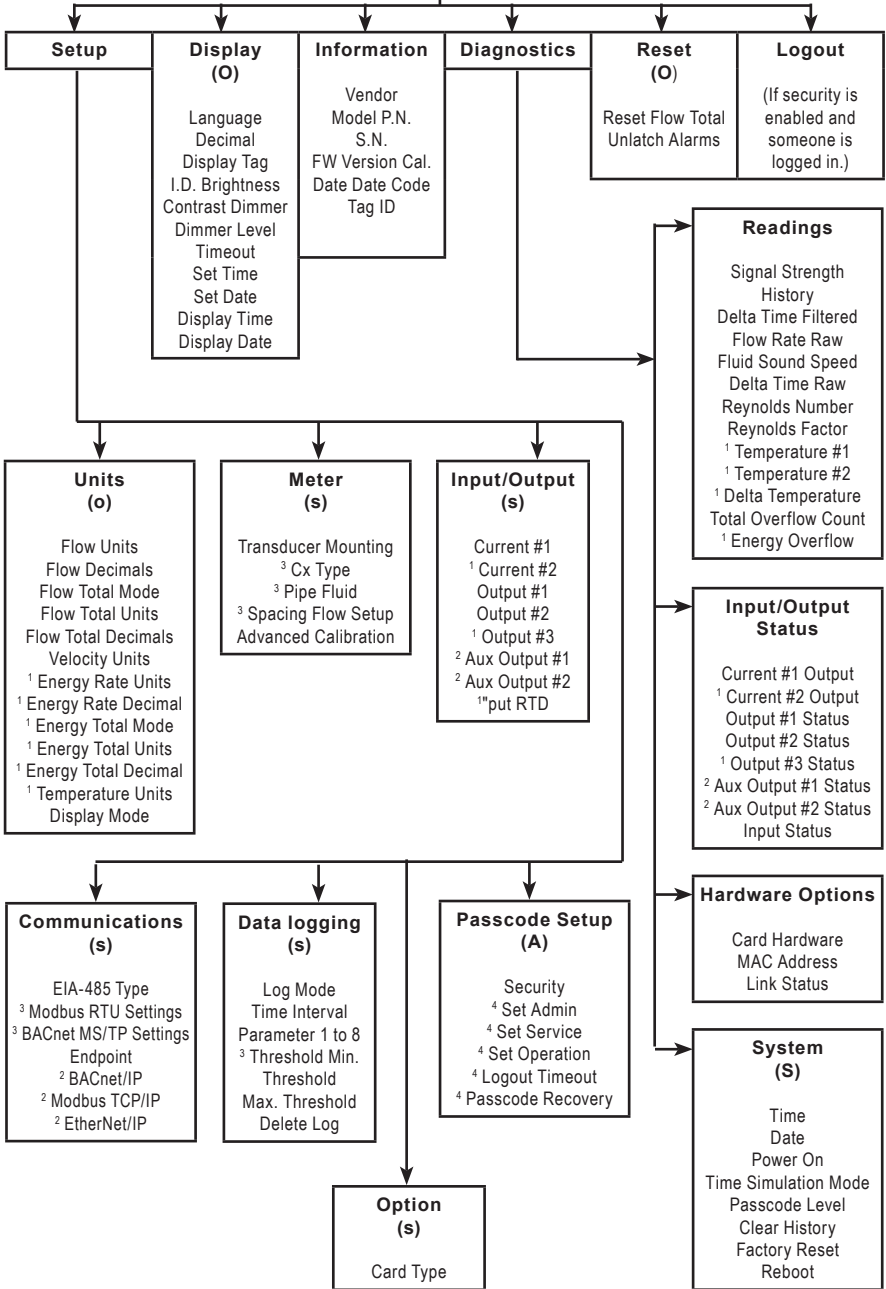
<b>Home screen</b>	
Flow Rate Flow Total Velocity Flow Rate / Flow Total *Energy Rate RecoveryPasscodeSetup	*Energy Total *Temp #1 / Temp #2 *Energy Rate / Delta Temp *Energy Rate / Energy Total Time / Date

1 Energy units only.	2 Optional card installed.	3 Based on selected option.	4 Available when security is enabled.
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Press **V** to toggle the options.

# MAIN MENU (Press to access this menu)

Press  to select a main menu option



UTM20 Series Ultrasonic Transit-time Flowmeters

# 10. Parameter Descriptions by Menu

## 10.1 Main Menu Structure

The transmitter's firmware has a hierarchical menu structure. See "Menu Map" on page 42 for a visual path to the parameters.

The five Main Menus used in the transmitter firmware are as follows:

Menu	Function
<b>SETUP</b>	Contains all of the configuration parameters for initially programming the transmitter to measure flow
<b>DISPLAY</b>	Configures transmitter display functions
<b>INFORMATION</b>	Displays system information, such as the model number and firmware version
<b>DIAGNOSTICS</b>	Displays system status and allows you to clear the history, reset to factory defaults and reboot the system
<b>RESET</b>	Resets the flow total or unlatches alarms

The following pages define the configuration parameters located in each of the menus.

## 10.2 Setup > Units

Use **SETUP > UNITS** to define the measurement standards for the transmitter. Contains all of the configuration parameters for setting the units and decimals for the readings and the totalizer mode. Requires operator level passcode or higher if security is enabled.

An asterisk (\*) indicates the parameter default.



Units Submenus	Options/Descriptions			
<b>FLOW UNITS</b>	Select the flow rate units/interval displayed on the Home Screen FLOW UNITS are automatically converted into the selected option			
	<b>Option</b>	<b>Units/Interval</b>	<b>Option</b>	<b>Units/Interval</b>
	Fluid BBL/D	Fluid Barrels/Day (31 5 Gal)	GAL/S	US Gallons/Second
	IBBL/D	Imperial Fluid Barrels/Day (36 IG)	GAL/MIN	US Gallons/Minute
	L/S	Liters/Second	GAL/H	US Gallons/Hour
	L/MIN	Liters/Minute	MG/D	Million US Gallons/Day
	L/H	Liters/Hour	IG/S	Imperial Gallons/Second
	M3/S	Cubic Meters/Second	IG/MIN	Imperial Gallons/Minute
	M3/MIN	Cubic Meters/Minute	IG/H	Imperial Gallons/Hour
	M3/H	Cubic Meters/Hour	MIG/D	Million Imperial Gallons/Day
	FT3/S	Cubic Feet/Minute	OIL BBL/D	Oil Barrels/Day (42 Gal)
	FT3/MIN	Cubic Feet/Minute	AC-FT/D	Acre Feet/Day
	FT3/H	Cubic Feet/Hour		
	Custom	This selection is only available if Custom Units is enabled through SoloCUE Flow Device Manager Use SoloCUE to change the Custom Units		
	<b>FLOW DECIMALS</b>	This is a numeric entry for the number of decimal places to display Default is 2 Options are 0 to 7		
<b>FLOW TOTAL MODE</b>	*GROSS FLOW FORWARD FLOW REVERSE FLOW NET FLOW		Any flow in forward and reverse direction  Forward flow minus reverse flow A negative total results when reverse flow is greater than forward flow	

Units Submenus	Options/Descriptions			
<b>FLOW TOTAL UNITS</b>	Select the units for the flow total displayed on the Home Screen FLOW TOTAL UNITS are automatically converted into the selected option:			
	<b>Option</b>	<b>Units</b>	<b>Option</b>	<b>Units</b>
	GAL	US Gallons	Fluid BBL	Fluid Barrel (31.5 Gal)
	MGAL	Million US Gallons	L	Liter
	IGAL	Imperial Gallons	HL	Hectoliter
	AC-FT	Acre Foot	M3	Cubic Meters
	MIGAL	Million Imperial Gallons	FT3	Cubic Feet
	Oil BBL	Oil Barrels (42 Gal)		
	Custom	This selection is only available if Custom Units is enabled through SoloCUE Flow Device Manager Use SoloCUE to change the Custom Units		
<b>FLOW TOTAL DECIMALS</b>	This is a numeric entry for the number of decimal places to display Default is 0 Options are 0 to 7			
<b>VELOCITY UNITS</b>	Select the units for the velocity displayed on the Home Screen			
	*FT/S Feet/Second M/S Meters/Second			
<b>ENERGY RATE UNITS (Energy Units Only)</b>	Select the units for the energy rate displayed on the Home Screen ENERGY RATE UNITS are automatically converted into the selected option:			
	<b>Option</b>	<b>Units</b>	<b>Option</b>	<b>Units</b>
	BTU/H	Btu/hour	kJ/H	Kilojoules/hour
	kBTU/H	Thousand Btu/hour	MJ/H	Mega joules/hour
	MMBTU/H	Million Btu/hour	kCAL/H	Kilocalories/hour
	W	Watts	MCAL/H	Mega calories/hour
	*kW	Kilowatts	TON (RT)	Ton (Refrigeration) 1 Ton = 12,000 Btu/h
	MW	Megawatts		
<b>ENERGY RATE DECIMAL (Energy Units Only)</b>	This is a numeric entry for the number of decimal places to display Default is 2 Options are 0 to 7			
<b>ENERGY TOTAL MODE (Energy Units Only)</b>	FORWARD FLOW REVERSE FLOW NET FLOW *GROSS FLOW	Forward flow minus reverse flow A negative total results when reverse flow is greater than the forward flow Any flow in forward and reverse direction		

Units Submenus	Options/Descriptions			
<b>ENERGY TOTAL UNITS (Energy Units Only)</b>	Select the units for the energy total displayed on the Home Screen ENERGY TOTAL UNITS are automatically converted into the selected option:			
	<b>Option</b>	<b>Units</b>	<b>Option</b>	<b>Units</b>
	BTU	British Thermal Unit	kWh	Kilowatt Hour
	kBTU	Thousand Btu	MWh	Megawatt Hour
	MMBTU	Million Btu	kJ	Kilo Joules
	KCAL	Kilo Calories	MJ	Mega Joules
MCAL	Mega Calories	TON-H	Ton-hour (Refrigeration)	
<b>ENERGY TOTAL DECIMALS (Energy Units Only)</b>	This is a numeric entry for the number of decimal places to display Default is 2 Options are 0 to 7			
<b>TEMPERATURE UNITS (Energy Units Only)</b>	°F °C K			
<b>DISPLAY MODE</b>	Select the parameters to display on the Home Screen Alternatively, you can change the display from the Home Screen by pressing the DOWN button			
	*FLOW RATE	ENERGY TOTAL		
	FLOW TOTAL	TEMP #1 / TEMP #2		
	VELOCITY	ENERGY RATE / DELTA TEMPERATURE		
	RATE/TOTAL	ENERGY RATE / ENERGY TOTAL		
	ENERGY RATE	TIME / DATE		

### 10.3 Setup > Meter

Contains all of the configuration parameters for setting the meter Requires service level passcode or higher if security is enabled An asterisk (\*) indicates the parameter default

Meter Submenus	Options/Descriptions	
<b>TRANSDUCER</b>	Select the transducer type:	
	UZ 2 MHZ	Option UZ when ordered with the UTM20 meter
	CX 2 MHZ	Options CA to CS and CZ when ordered with the UTM20 meter
	JZ / KZ EASYRAIL 1 MHZ	Options JZ and KZ when ordered with the UTM20 meter
	NZ / RZ / WZ 1 MHZ	Options NZ, WZ and RZ when ordered with the UTM20 meter
	HZ 1 MHZ	Option HZ when ordered with the UTM20 meter
	LZ / YZ 0.5 MHZ	Option LZ when ordered with the UTM20 meter
<b>MOUNTING</b>	For mounting options, see the transducer user manual Z PATH *V PATH W PATH	
<b>Cx TYPE</b>	DTTC TYPE is substituted for MOUNTING when TRANSDUCER DTTC is selected as the transducer type	
	CA: ½" ANSI CB: ¾" ANSI CC: 1" ANSI CD: 1¼" ANSI CE: 1½" ANSI CF: 2" ANSI CG: ½" COPPER CH: ¾" COPPER CJ: 1¼" COPPER CK: 1½" COPPER CL: 2" COPPER CM: ½" SS TUBE CN: ¾" SS TUBE CP: 1" SS TUBE CQ: 1¼" SS TUBE CR: 1½" SS TUBE CS: 2 SS IN TUBE CT: 1" COPPER	

## 10.4 Setup > Meter > Pipe

An asterisk (\*) indicates the parameter default

Pipe Submenus	Options/Descriptions			
<b>PIPE MATERIAL</b>	STAINLESS 302/303	ALUMINUM	POLYPROPYLENE	
	STAINLESS 304	BRASS NAVAL	HD POLYETHYLENE	
	STAINLESS 304L	CARBON STEEL	LD POLYETHYLENE	
	*STAINLESS 316	COPPER	PFA TEFLON	
	STAINLESS 347	IRON - CAST	PVC CPVC	
	STAINLESS 410	IRON - DUCTILE	PVDF	
	STAINLESS 430			
<b>PIPE TYPE</b>	For the best accuracy, measure the outer diameter and wall thickness with a gauge and select MANUAL" or MANUAL MM			
	If you do not have a gauge, you can select an ASME/ANSI or ASTM definition Schedule, copper tubing and cast iron class are filtered based on pipe material selection			
	If stainless steel pipe, carbon steel, cvc, pcvc material is selected, the following pipe schedules are also available as applicable:			
	SCHEDULE STD	SCHEDULE 40	SCHEDULE 140	
	SCHEDULE 5	SCHEDULE 60	SCHEDULE 160	
	*SCHEDULE 10	SCHEDULE 80	SCHEDULE 180	
	SCHEDULE 20	SCHEDULE 100	SCHEDULE STG	
	SCHEDULE 30	SCHEDULE 120		
	If copper material is selected, the following types are also available:			
	TYPE K	TYPE M	TYPE L	PIPE SIZE
	If cast iron pipe material is selected, the following classes are also available:			
	CLASS A	CLASS C	CLASS E	CLASS G
	CLASS B	CLASS D	CLASS F	CLASS H
If ductile iron pipe material is selected, the following classes are also available:				
CLASS 50	CLASS 52	CLASS 54	CLASS 56	
CLASS 51	CLASS 53	CLASS 55		
If aluminum or brass naval material is selected, the following is also available: PIPE SIZE (in")				
<b>PIPE SIZE</b>	Available only when PIPE TYPE is MANUAL; Numeric entry; min 0.5" (15 mm), max 300 in (7500 mm)			
<b>PIPE SIZE NOMINAL</b>	PIPE SIZE NOMINAL is substituted for PIPE SIZE when a schedule/tubing/class is selected Enumeration based on schedule; min 0.5" (15 mm), max 24" (610 mm) ½, ¾, 1, 1¼, 1½, 2, 2½, 3, 3½, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24			
<b>WALL THICKNESS</b>	Numeric entry; *min 0.00, max 5" (125 mm); WALL THICKNESS is only useful for MANUAL METRIC and MANUAL"; It can be skipped for pipe schedule, tubing and classes			
<b>LINER MATERIAL</b>	NONE	HD POLYETHYLENE	TAR EPOXY	
	ACRYLIC	LD POLYETHYLENE	PFE TEFLON	
	ASBESTOS CEMENT	POLYPROPYLENE	GLASS PYREX	
	EBONITE	POLYSTYRENE	FIBERGLASS EPOXY	
	MORTAR	RUBBER		
<b>LINER THICKNESS</b>	Numeric entry; min 0.00, max 5 in (125 mm)			
<b>I.D. SIZE</b>	Numeric display in" or millimeters, based on PIPE TYPE			

### UTM20 Series Ultrasonic Transit-time Flowmeters

## 10.5 Setup > Meter > Fluid

Fluid Submenus	Options/Descriptions				
<b>FLUID</b>	Water - Tap	Acetone	Ethylene Glycol 30%	Kerosene	Propylene Glycol 30%
	Raw Sewage	Ammonia	Gasoline	Methanol	Stoddard Solvent
	Water - Distilled	Benzene	Glycerin	Oil Diesel #1	Sulfuric Acid 96%
	Water - Sea 3 5%	Ethanol	Isopropanol	Oil Diesel #2	Hydrochloric Acid 36%
	Brine - 3 5%	Ethylene Glycol 100%	Jet Fuel A1/JP8	Propylene Glycol 100%	Hydrofluoric Acid 49%
	Brine - 10%	Ethylene Glycol 50%	Jet Fuel B/JP4	Propylene Glycol 50%	Custom
<b>CUSTOM FLUID</b>	SOUND SPEED	Numeric entry; Units ft/s or m/s based on velocity units			
	SPEED UNITS	Ft/s or m/s			
	SPECIFIC GRAVITY	Numeric entry; Specific gravity (density relative to water), pipe size and viscosity are used to calculate the Reynolds number The Reynolds number indicates whether the fluid is in turbulent, transition or laminar flow and the flow profile			
	VISCOSITY	Numeric entry; Units centipoise (cP) or mPa-s Dynamic viscosity of the fluid			
	VISCOSITY UNITS	Units centipoise (cP) or mPa-s			
	REFERENCE TEMP	Numeric entry, F or C Default 15 °C Reference temperature of viscosity and specific gravity			
	REF TEMP UNITS	F or C			
	SPECIFIC HEAT	Numeric entry; Units: joule/gram °C; min 0 01, max 65 0; Specific heat capacity is the heat capacity per unit mass of a material			

## 10.6 Setup > Meter > Spacing

An asterisk (\*) indicates the parameter default

Spacing Submenus	Options/Descriptions
<b>CALIBRATED SPACING</b>	*Numeric display 0 to 300 units in" or millimeters, based PIPE settings The spacing required between two transducers based on the pipe parameters Take this measurement between the lines scribed into the side of the transducers or use the scale on the rails, if used See the transducer user manual For Cx transducers with fixed spacing, the parameter will not be shown

## 10.7 Setup > Meter > Flow Setup

An asterisk (\*) indicates the parameter default

Flow Setup Submenus	Options/Descriptions
DIRECTION	*FORWARD REVERSE
BIDIRECTIONAL	*ENABLED DISABLED
LOW FLOW CUTOFF	Numeric entry Units and decimals are based on FLOW RATE UNITS Zero and positive values *0 0
SIGNAL CUTOFF	*30%
SIGNAL HIGH	*90%
MINIMUM FLOW	-10000 (default); min -2,000,000 Number of decimals points depends on Home Screen settings
MAXIMUM FLOW	10000 (default); max 2,000,000

## 10.8 Setup > Meter > Advanced

An asterisk (\*) indicates the parameter default

HEAT CALCULATION (Energy meter only)	Dynasonics Calculation EN1434 TYPE Rate of Heat Delivery = $Q \times (T_{in} - T_{out}) \times C \times \rho$	
	Where:	Q = Volumetric flow rate
		T <sub>in</sub> = Temperature at the inlet
		T <sub>out</sub> = Temperature at the outlet
		C = Heat capacity
		ρ = Density of fluid
DAMPING	*40 seconds	
SENSITIVITY	*60%	
HYSTERESIS	*5%	
BAD DATA REJECTION	*3	
FILTER METHOD	*Adaptive	
WAVE	* AUTO automatically selects waveform based on flow speed and signal quality	
	* SIN CARROT TOP is best for low speed flow	
	* BEST BARKER is best for high speed flow	
TEMP COMPENSATION	*MANUAL TEMP #1 TEMP #2	Selection is only available for Energy meter For the Flow meter, manual temperature compensation is always on Temperature compensation adjusts the viscosity of the fluid used in Reynolds number compensation and the fluid speed of sound
MANUAL REF TEMP	Numeric entry -40 to 350 °F (-40 to 176 °C)	
REF TEMP UNITS	°F °C K	Select the units for the manual reference temperature
REYNOLDS	*ENABLED DISABLED	Flow rate compensation based on fluid Reynolds number as the fluid changes from laminar to transitional to turbulent flow

## 10.8.1 Filter Parameters

### Filter Method (Default: Adaptive)

The UTM20 flow meter offers three levels of signal filtering:

- None imposes no filtering on the signal from the transducers
- Simple with Rejection uses Damping and Bad Data Rejection to filter the flow data
- \*Adaptive filtering allows the meter's software routines to alter the filtering, depending on the variability of the transducer's signal The Adaptive filter uses a combination of Damping, Bad Data Rejection, Sensitivity and Hysteresis to modify the flow input data

### Damping (Range 0 to 100 Seconds; Default: 40 Seconds)

Damping is the approximate amount of time the filtering routines use to attain a 99% stable rate value Generally, the higher the damping value, the more stable the rate readings are—but at the expense of response time

### Sensitivity (Range 0 to 100%; Default: 60%)

Sensitivity determines how fast the adaptive filtering responds to a change in rate Increasing the sensitivity decreases the filtering, which allows the display to respond to rate changes more rapidly

### Hysteresis (Range 0 to 25%; Default: 5%)

Hysteresis creates a window around the average flow measurement reading, defining the limits at which the automatic damping increases occur If the rate varies within the hysteresis window, greater damping occurs up to the maximum values set by the flow filter Damping entry The filter also establishes a flow rate window where measurements outside of the window are captured by the Bad Data Rejection window Enter the value as a percentage of actual flow rate

For instance, a Hysteresis setting of 5% allows the flow to vary  $\pm 5\%$  from the currently established flow rate without automatically decreasing the value of the Damping



For example, if the average flow rate is 100 gpm and the Hysteresis is set to 10%, a filter window of 90 to 110 gpm is established. Successive flow measurements that reside within that window are recorded and averaged in accordance with the Damping setting. Flow readings outside of the window are rejected or accepted in accordance with the Bad Data Rejection setting. Filter settings for this example:

<b>Filter Method</b>	<b>Adaptive</b>
<b>Damping</b>	40 seconds
<b>Sensitivity</b>	60%
<b>Hysteresis</b>	10%
<b>Bad Data Rejection</b>	3

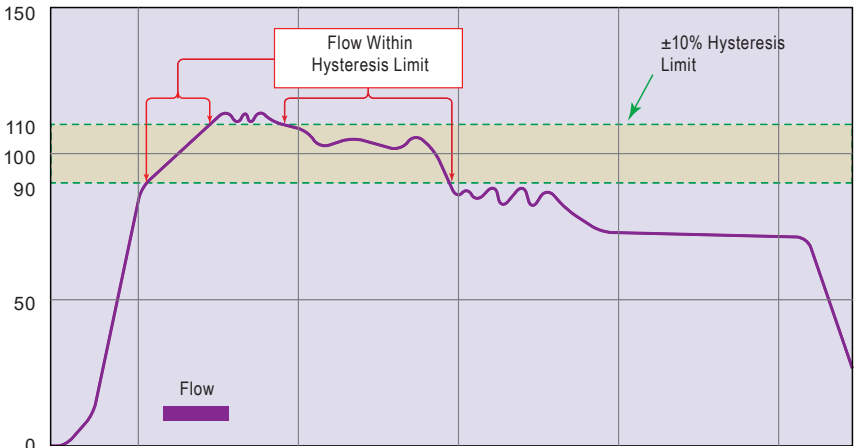


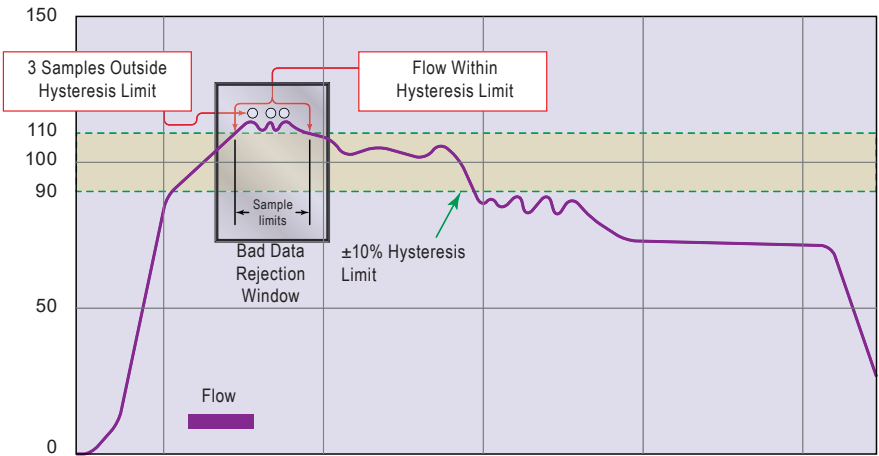
Fig. 47 Hysteresis window

**Bad Data Rejection (Range 0 to 10 Samples; Default: 3)**

The Bad Data Rejection setting is related to the number of successive readings that must be measured outside of a the Hysteresis value before the flow meter considers the new flow value valid. In this example, a Hysteresis setting of 10% produces a  $\pm 10\%$  band centered on the current valid flow rate of 100 gpm.

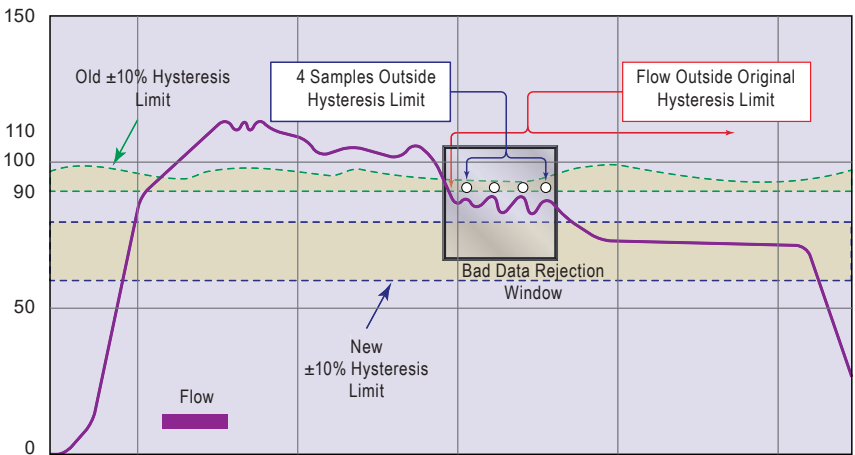
The Bad Data Rejection setting is the number of successive samples that must be outside of the Hysteresis window before the flow meter considers the change in flow as real. Larger values are entered into the Bad Data Rejection window when measuring liquids that contain gas bubbles, as the gas bubbles tend to disturb the ultrasonic signals and cause more extraneous flow readings to occur. Larger Bad Data Rejection values tend to make the flow meter less responsive to rapid changes in actual flow rate.

In Figure 41, flow data falls outside the flow Hysteresis window but does not reach the minimum time specified in the Bad Data Rejection window. When data appears that is outside the Hysteresis band and shorter than the Bad Data Rejection window time, the data is rejected.



**Fig. 48 Bad data (rejection)**

The flow rate is again outside the original  $\pm 10\%$  Hysteresis window, but the data exists for a time period greater than the Bad Data Rejection window. In this instance, the meter interprets the data as a new valid flow rate and moves the Hysteresis window to correspond with the new established flow rate.



**Fig. 49 New valid flow data**

## 10.9 Setup > Meter > Calibration

An asterisk (\*) indicates the parameter default

Calibration Submenus	Options/Descriptions	
<b>FACTOR MODE</b>	FACTORY *FIELD	Select FIELD to set the zero and use the sensor and scale factors of the transducers
<b>FACTORY SETTINGS</b>	ZERO	The zero offset entered during factory calibration ZERO is for reference only and most likely the ZERO VALUE for your installation will be different from the factory ZERO Numeric display; *0 000 ns
	CAL FACTOR	One of two calibration factors unique to each transducer pair if the transmitter was used during factory calibration Numeric display # ###
	SENSOR FACTOR	One of two calibration factors unique to each transducer pair if the transmitter was used during factory calibration Numeric display # ###
<b>ZERO MODE</b>	MANUAL *NO FLOW STEADY FLOW	Due to different pipe characteristics, the meter must be zeroed in order to maintain accuracy The recommended method is to stop flow and make sure there is no flow before zeroing the meter In situations in which that is not feasible, you may zero the meter while the flow is steady or enter the zero manually  Select the method to zero the meter
<b>SET ZERO - NO FLOW</b>	SET ZERO AT NO FLOW in process and confirmation screen	Check that the pipe is full of liquid and not flowing Flow must be absolutely zero Securely close any valves and allow time for settling to occur
<b>SET ZERO - FLOW</b>	SET ZERO AT FLOW in process and confirmation screen	Stabilize the flow to a steady level before zeroing the meter In situations where it is not possible to stop flow, use this method to zero the meter When selected, the meter will calculate the zero typically in 5 to 10 seconds and will indicate if the meter was successful or not in determining the flow
<b>MANUAL ZERO</b>	Numeric entry ## ### ns	Allows for manual entry of the zero value when ZERO MODE is MANUAL
<b>ZERO VALUE</b>	Numeric display ## ### ns	The zero offset used to calculate the flow rate If the meter is not zeroed after installation, this value will match the factory ZERO setting
<b>SENSOR FACTOR</b>	Numeric entry ## ### ns	The value used in calculating the zero value when zeroing the meter at steady flow This value can be found on the transducer label
<b>SCALE FACTOR</b>	Numeric entry	The factor used for linearizing the flow rate calculation when FIELD is selected for FACTOR MODE Enter the CAL FACTOR from the transducer

### 10.9.1 Factory Calibrated Procedure

Each transducer pair has a CAL FACTOR and SENSOR FACTOR on the label Verify FACTOR MODE is set to FIELD and enter the factors from the transducer into the CAL FACTOR and SENSOR FACTOR settings

Zero the meter after entering the CAL FACTOR and SENSOR FACTOR

### 10.9.2 Field Calibration Procedure

To calibrate the UTM20 flow meter, use a master meter or gravimetric test stand

- 1 Verify that FACTOR MODE is set to FIELD and the transducer sensor factor is entered into the SENSOR FACTOR setting
- 2 Set SCALE FACTOR set to 1
- 3 Run calibration test
- 4 Calculate the SCALE FACTOR  
SCALE FACTOR = (actual flow)/(meter flow rate) or (actual total)/(meter total)
- 5 Enter the SCALE FACTOR

### 10.10 Setup > Input/Output > Current #1 (or Current #2)

Requires service level passcode or higher if security is enabled The current output, reset input and frequency/pulse/status output can be set up through the SETUP > INPUT/OUTPUT menus

An asterisk (\*) indicates the parameter default

Current #1 Submenus	Options/Descriptions	
<b>OUTPUT SOURCE</b>	*FLOW RATE TEMPERATURE #1 TEMPERATURE #2 ENERGY FLOW VELOCITY SIGNAL STRENGTH TEST MODE DISABLED	Select the reading to be assigned to the 4 to 20 mA output Temperature and energy options only available with energy meter
<b>RANGE</b>	*4-20 mA 4-20 mA NAMUR 0-20 mA	Current range is NAMUR 43 compliant with lower measuring limit at 3.8 mA and upper limit at 20.5 mA and minimum alarm 3.5 mA and maximum alarm 22.6 mA
<b>MIN VALUE</b>	Enter the value of the reading at 4 mA Can also be the setting for the 0 mA setpoint when 4-20 mA RANGE is selected Units and decimal places based on parameter selected Negative numbers accepted	
<b>MAX VALUE</b>	Enter the value of the reading at 20 mA Units and decimal places based on parameter selected Negative numbers accepted	
<b>FAILURE MODE</b>	*MIN CURRENT MAX CURRENT LAST VALUE TEST CURRENT	When an Fxx error occurs, such as low signal strength, the transmitter will set the current output the selected value
<b>FIXED VALUE</b>	Enter the value for the current output when there is a failure mode This parameter is only displayed with FAILURE MODE is set to FIXED VALUE	
<b>TEST CURRENT</b>	Available only when OUTPUT SOURCE is in TEST MODE Default 12.00 mA To check the wiring to the control system or gauge, you can override the current output with a fixed current Numeric entry mA 0 to 22 mA	
<b>TRIM 4 mA</b>	Available only when OUTPUT SOURCE is in TEST MODE Set the test current to 4 mA or 0 mA, depending on the current range selected Adjusts output until PLC/DCS/BAS reads the desired value	
<b>TRIM 20 mA</b>	Available only when OUTPUT SOURCE is in TEST MODE Set the test current to 20 mA Adjusts output until PLC/DCS/BAS reads 20 mA	

## 10.11 Setup > Inputs/Output > Output #1 (or Output #2 or Output #3)

Output #1, Output #2 or Output #3 can operate independently as a frequency, totalizer pulse, direction status or alarm status output In the SETUP > INPUT/OUTPUTS > OUTPUT #1 (OR OUTPUT #2 OR OUTPUT #3) > MODE menu, select the MODE of operation Then go to the PARAMETERS menu to set up the operation for that MODE

Output #3 is available on the energy unit only An asterisk (\*) indicates the parameter default

Output #1 Submenus	Options/Descriptions		
<b>MODE</b>	*FREQUENCY PULSE TOTAL FLOW DIRECTION ALARM DISABLED		FREQUENCY and PULSE TOTAL modes are not available with AUX OUTPUT #1 and #2 dry contact output
<b>PARAMETERS (Frequency Mode)</b>	OUTPUT SOURCE	*FLOW RATE VELOCITY ENERGY FLOW (Energy meter only) TEST FREQUENCY	Select the reading to assign to the frequency output
	VALUE AT 0 HZ	Numeric entry Units and decimal place based on parameter selected Negative numbers accepted Default -5000	Enter the maximum flow rate or velocity frequency that corresponds to maximum frequency flow rate or velocity Can be negative to indicate reverse flow The units of Maximum match the units in  SETUP > MEASUREMENTS > FLOW UNITS  Example 1: For a system that only has flow in one direction, the maximum flow rate is 100 gal/min, and the corresponding maximum frequency is 2000 Hz, set up the parameters to:
	MAX VALUE	Numeric entry Units and decimal place based on source selected Negative numbers accepted Default 5000	
	MAX FREQUENCY	Numeric entry Units in Hz Default 1 kHz	Example 2: For a system that flow is bidirectional, the flow rate ranges from -100 gal/min to 100 gal/min and the frequency at 100 gal/min is 2000 Hz, set up the parameters to:
	TEST FREQUENCY	Available when TEST MODE is selected for OUTPUT SOURCE To check the wiring to the control system or device, you can override the frequency output with a fixed frequency	

Parameter	Value
Output Source	Flow Rate
Minimum	0 gal/min
Maximum	100 gal/min
Maximum Frequency	2000 Hz

Parameter	Value
Output Source	Flow Rate
Minimum	-100 gal/min
Maximum	100 gal/min
Maximum Frequency	2000 Hz

With this setup at no flow, the frequency output is 1000 Hz

### UTM20 Series Ultrasonic Transit-time Flowmeters

Output #1 Submenus	Options/Descriptions		
<b>PARAMETERS (Pulse Total Mode)</b>	OUTPUT SOURCE	*POSITIVE FLOW NEGATIVE FLOW BIDIRECTIONAL FLOW Also available for energy meters: POSITIVE ENERGY NEGATIVE ENERGY BIDIRECTIONAL ENERGY	Select whether the pulse output accumulates only on positive (forward) flow, only on negative (reverse) flow or anytime flow occurs regardless of the flow direction (bidirectional) For bidirectional, assign the direction status to the other output, if desired
	SCALING FACTOR	Numeric entry Units and decimal place based on flow rate selection Default is 1 unit per pulse Enter the number of totalizer units per pulse The totalizer unit is in the SETUP > MEASUREMENTS menu For example, if the totalizer unit is gallons, setting the PULSES/UNIT to 10 transmits 1 pulse every 10 gallons Setting the SCALING FACTOR to 0.1 transmits 1 pulse every 0.1 gallons	
	PULSE WIDTH	Numeric entry 5 to 2000 ms Default 50 ms Enter the pulse width in milliseconds	
	PULSE STATE	*PULSE LOW PULSE HIGH	PULSE LOW, the pulse totalizer output remains in the off state and the voltage floats at the source voltage level When the pulse is triggered, the output turns on and the voltage drops to the low voltage level This setup uses the least power If the pulse needs to be at the high voltage level, use the PULSE HIGH option
<b>PARAMETERS (Flow Direction Mode)</b>	OUTPUT SOURCE	*FLOW RATE ENERGY FLOW	
	DIRECTION	FORWARD ON *REVERSE ON For energy meters only: ENERGY FORWARD ENERGY REVERSE	Select whether the output is active when the flow is forward or reverse When the absolute value of the flow rate is below the cutoff, the output will not be active.

Output #1 Submenus	Options/Descriptions		
<b>PARAMETERS (Alarm Mode)</b>	ALARM	*ERRORS ONLY HIGH FLOW LOW FLOW HI/ LO FLOW For energy meters only: HIGH ENERGY LOW ENERGY HI/LO ENERGY HIGH TEMP1 HIGH TEMP2 LOW TEMP1 LOW TEMP2	Select the flow condition or meter condition to trigger the alarm and turn on the output
	SET HIGH	Numeric entry Units and decimal place based on FLOW RATE selected Negative numbers accepted Default is 10000	Enter the value that the flow rate must be greater than in order to trigger an alarm SET HIGH is only visible/settable when ALARM is set to HIGH FLOW, OUT OF RANGE or ALL
	SET LOW	Numeric entry Units and decimal place based on FLOW RATE selected Negative numbers accepted Default is 0	Enter the value that the flow rate must be less than in order to trigger an alarm SET LOW is only visible/settable when ALARM is set to LOW FLOW, OUT OF RANGE or ALL
	LATCHING	*DISABLED ENABLED	When ENABLED, the output remains on after the alarm condition clears Resetting alarm latch turns off the output
	ANTI-CHATTER	SET DELAY	Enter how long the alarm condition must occur before activating the output to prevent nuisance trips Numeric entry Units: Milliseconds Default is 100 ms
		HYSTERESIS	Enter how long the alarm condition is cleared before resetting the output to prevent the output from chattering The parameter is only valid if LATCHING is DISABLED Numeric entry Default is 100 ms
MIN ON-TIME		Numeric entry Units: Milliseconds Default is 200 ms	
<b>PULL UP RESISTOR</b>	INTERNAL *EXTERNAL	See "Digital Outputs Wiring" on page 34	

## 10.12 Setup > Inputs/Output > Aux Output #1 (or Aux Output #2)

This menu shows only with card installed for AUTODETECT or CARD TYPE is set to AUX OUTPUT  
An asterisk (\*) indicates the parameter default.

Output #1 Submenus	Options/Descriptions			
<b>MODE</b>	FLOW DIRECTION ALARM DISABLED	FREQUENCY and PULSE TOTAL modes are not available with AUX OUTPUT card ALARM		
<b>PARAMETERS (Flow Direction Mode)</b>	OUTPUT SOURCE	*FLOW RATE ENERGY FLOW		
	DIRECTION	FORWARD ON *REVERSE ON For energy meters only: ENERGY FORWARD ENERGY REVERSE	Select whether the output is active when the flow is forward or reverse When the absolute value of the flow rate is below the cutoff, the output will not be active	
<b>PARAMETERS (Alarm Mode)</b>	ALARM	*ERRORS ONLY HIGH FLOW LOW FLOW HI/LO FLOW For energy meters only: HIGH ENERGY LOW ENERGY HI/LO ENERGY HIGH TEMP1 HIGH TEMP2 LOW TEMP1 LOW TEMP2	Select the flow condition or meter condition to trigger the alarm and turn on the output	
	SET HIGH	Numeric entry Units and decimal place based on FLOW RATE selected Negative numbers accepted Default is 10000	Enter the value that the flow rate must be greater than in order to trigger an alarm SET HIGH is only visible/settable when ALARM is set to HIGH FLOW, OUT OF RANGE or ALL	
	SET LOW	Numeric entry Units and decimal place based on FLOW RATE selected Negative numbers accepted Default is 0	Enter the value that the flow rate must be less than in order to trigger an alarm SET LOW is only visible/settable when ALARM is set to LOW FLOW, OUT OF RANGE or ALL	
	LATCHING	*DISABLED ENABLED	When ENABLED, the output remains on after the alarm condition clears Resetting alarm latch turns off the output	
	ANTI- CHATTER	SET DELAY		Enter how long the alarm condition must occur before activating the output to prevent nuisance trips Numeric entry Units: Milliseconds Default is 100 ms
		HYSTERESIS		Enter how long the alarm condition is cleared before resetting the output to prevent the output from chattering The parameter is only valid if LATCHING is DISABLED Numeric entry Default is 100 ms
MIN ON-TIME			Numeric entry Units: Milliseconds Default is 200 ms	



## 10.13 Setup > Inputs/Output > Input

An asterisk (\*) indicates the parameter default

Input Submenus	Options/Descriptions	
MODE	DISABLED	Select the action to take when the input is active (based on the state)
	*RESET TOTAL	
	UNLATCH ALARM	
STATE	*ACTIVE ON HIGH	Select the voltage level to make the input active
	ACTIVE ON LOW	

## 10.14 Setup > Inputs/Output > RTD (Energy Models Only)

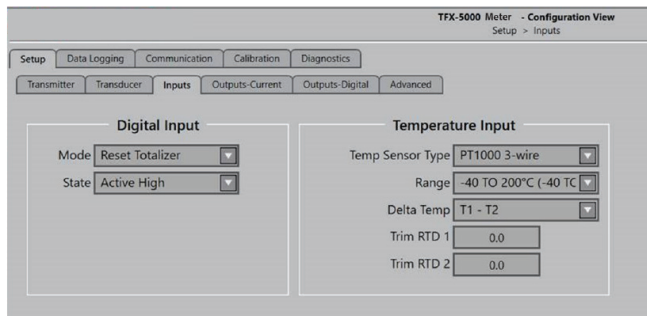
An asterisk (\*) indicates the parameter default

RTD Submenus	Options/Descriptions	
TEMP SENSOR TYPE	Pt1000 2-WIRE      Pt100 2-WIRE Pt1000 3-WIRE      Pt100 3-WIRE Pt1000 4-WIRE      Pt100 4-WIRE	Select the temperature sensor type
RANGE	32 to 122 °F (0 to 50 °C)    -40 to 392 °F (-40 to 200 °C) 32 to 212 °F (0 to 100 °C)    4 to 86 °F (-20 to 30 °C)	Select the temperature range
DELTA TEMP	TEMP #1-TEMP #2 TEMP #2-TEMP #1	Select the order for positive and negative energy calculations
TRIM RTD #1	Adjust the offset for the temperature reading for RTD #1	See "Troubleshooting" on page 74 before adjusting the RTD input
TRIM RTD #2	Adjust the offset for the temperature reading for RTD #2	

### 10.14.1 Trimming the RTDs

- 1 Change the Home Screen on the transmitter to read the temperature of the RTDs
- 2 Connect a computer with SoloCUE Flow Device Manager software to the UTM20 transmitter In the Setup > Input tab, check the Temp Sensor Type and Range
- 3 With a constant temperature controlled heat source at the midpoint of the operating range, heat RTD 1 Allow time for the RTD to heat thoroughly
- 4 Compare the temperature of the heat source with the temperature reading of Temp 1 on the display In SoloCUE, adjust the Trim RTD 1 until Temp 1 matches the heat source temperature
- 5 Repeat steps #3 and #4 for RTD 2

Fig. 50  
Trimming the RTDs



## 10.15 Setup > Communications

Requires service level passcode or higher if security is enabled For addressing information, see the "UTM20 Meter Modbus RTU Protocol" user manual or the "UTM20 Meter BACnet MS/TP Protocol" user manual, available at [www.badgermeter.com](http://www.badgermeter.com)

An asterisk (\*) indicates the parameter default

Communication Submenus	Options/Descriptions	
<b>EIA-485 TYPE</b>	DISABLE *MODBUS RTU BACNET MS/TP	Either disable this feature or select a network type
<b>MODBUS RTU SETTINGS (Displayed when MODBUS RTU is selected as the option for EIA-485 TYPE.)</b>	ADDRESS	Numeric entry 1 to 254
	BAUD RATE	*AUTO, 9600, 19200, 38400, 57600, 76800, 115200
	ACCESS	WRITE/READ allows full access RESET/READ allows you to read any, but only write to Flow Total Reset (cannot set up meter) READ ONLY allows read only
	PARITY	*NONE ODD PARITY EVEN PARITY
	STOP BIT	*1 STOP BIT 2 STOP BITS
	RESISTOR	*DISABLED ENABLED
	WORD ORDER	BIG ENDIAN *LITTLE ENDIAN
	TIMEOUT	Numeric entry 0 to 10000 ms
<b>BACNET MS/TP SETTINGS</b>	MAC ADDRESS	Numeric entry 0 to 127
	BACNET ID	Numeric entry 0 to 4194303
	BAUD RATE	*9600, 19200, 38400, 57600, 76800, 115200
	ACCESS	WRITE/READ allows full access RESET/READ allows you to read any, but only write to Flow Total Reset (cannot set up meter) READ ONLY allows read only
	MAX MASTER	Numeric entry 1 to 127
	PARITY	*NONE ODD PARITY EVEN PARITY
	STOP BIT	*1 STOP BIT 2 STOP BITS
	RESISTOR	DISABLED *ENABLED

Communication Submenus	Options/Descriptions		
<b>ENDPOINT</b>	Select the settings to match the BEACON/AquaCUE settings Only the flow total selected for the Home Screen will be sent Energy totals are not supported		
	DIAL COUNT	7, *8, 9, 10	
	RESOLUTION	*OFF, 1, 10, 100, 1000, 10000, 0.1, 0.01, 0.001, 0.0001	
	PROTOCOL	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">*DISABLED V1 V2 V3</td> <td style="width: 50%; padding: 5px;">When an ORION endpoint is connected to the transmitter, select the settings to match the BEACON/AquaCUE settings Only the flow total selected for the Home Screen will be sent V1 protocol does not support dial counts above 7</td> </tr> </table>	*DISABLED V1 V2 V3
*DISABLED V1 V2 V3	When an ORION endpoint is connected to the transmitter, select the settings to match the BEACON/AquaCUE settings Only the flow total selected for the Home Screen will be sent V1 protocol does not support dial counts above 7		
<b>BACNET/IP</b> (Shows only with card installed for AUTODETECT or CARD TYPE is set to BACNET/IP.)	WEBSERVER	Note: WEBSERVER is READ ONLY *ENABLED DISABLED	
	CLIENT TIMEOUT	0 to 65,535 ms	
	DEVICE INSTANCE	BACnet ID range: 0 to 99,999,999	
	DHCP	*DISABLED ENABLED	
	IP ADDRESS	Numeric entry ### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled	
	SUBNET MASK	Numeric entry ### ### ### ### Enter each value from 0 to 255 Option not available if DHCP is enabled	
	GATEWAY	Numeric entry ### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled	
	DNS PRIMARY	### ### ### ### Enter a value from 1 to 255 for the first value and 0-255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server	
	DNS SECONDARY	### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server	
	PORT	Use SoloCUE if you need to change the UDP port from the default setting: *AUTO NEGOTIATION 10 Mbit HALF DUPLEX 10 Mbit FULL DUPLEX 100 Mbit HALF DUPLEX 100 Mbit FULL DUPLEX	
ACCESS	WRITE/READ allows full access RESET/READ allows you to read any, but only write to Flow Total Reset (cannot set up meter) *READ ONLY allows read only		

**UTM20 Series Ultrasonic Transit-time Flowmeters**

Communication Submenus	Options/Descriptions			
<b>MODBUS TCP/IP</b>	WEBSERVER	Note: WEBSERVER is READ ONLY *ENABLED DISABLED		
	CLIENT TIMEOUT	0 to 65,535 ms		
	WORD ORDER	BIG ENDIAN *LITTLE ENDIAN		
	DHCP	*DISABLED ENABLED		
	IP ADDRESS	Numeric entry ### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled		
	SUBNET MASK	Numeric entry ### ### ### ### Enter each value from 0 to 255 Option not available if DHCP is enabled		
	GATEWAY	Numeric entry ### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled		
	DNS PRIMARY	### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server		
	DNS SECONDARY	### ### ### ### Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server		
	PORT	*AUTO NEGOTIATION 10 Mbit HALF DUPLEX 10 Mbit FULL DUPLEX 100 Mbit HALF DUPLEX 100 Mbit FULL DUPLEX		
ACCESS	WRITE/READ allows full access RESET/READ allows you to read any, but only write to Flow Total Reset (cannot set up meter) *READ ONLY allows read only			

Communication Submenus	Options/Descriptions	
<b>ETHERNET/IP</b> (Shows only with card installed for AUTODETECT or CARD TYPE is set to ETHERNET/IP.)	WEBSERVER	Note: WEBSERVER is READ ONLY *DISABLED ENABLED
	DHCP	*DISABLED ENABLED
	IP ADDRESS	Numeric entry ### ### ## ## Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled
	SUBNET MASK	Numeric entry ### ### ## ## Enter each value from 0 to 255 Option not available if DHCP is enabled
	GATEWAY	Numeric entry ### ### ## ## Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values Option not available if DHCP is enabled
	DNS PRIMARY	### ## ## ## Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server
	DNS SECONDARY	### ## ## ## Enter a value from 1 to 255 for the first value and 0 to 255 for the remaining values It is not recommended to use static IP address in the range of 169 254 0 0 to 169 254 255 255 because clients may not be able to locate the DNS server
	PORT	Use SoloCUE if you need to change the TCP or UDP port from the default setting:
		*AUTO NEGOTIATION 10 Mbit HALF DUPLEX 10 Mbit FULL DUPLEX 100 Mbit HALF DUPLEX 100 Mbit FULL DUPLEX
ACCESS	WRITE/READ allows full access RESET/READ allows you to read any, but only write to Flow Total Reset (cannot set up meter) *READ ONLY allows read only	

## 10.16 Setup > Data Logging (Service Level Access)

Requires service level passcode or higher if security is enabled

Due to FAT32 limitation on the microSD card, if the file size exceeds 4 GB, the log file will be closed and a new file started Both files will be accessible The name of the files are FILE0001 txt, FILE0002 txt, and so on Log files are automatically saved as txt files to the microSD card Before removing the microSD card, change the LOG MODE to DISABLED With an 8 GB microSD card installed, the card will have enough memory to last about 1-1/2 years when logging 8 parameters at a 1 second time interval

Data Logging Submenus	Options/Descriptions		
<b>LOG MODE</b>	Log files can be transferred to a computer by using SoloCUE Data logging will pause during the file transfer New log file created when parameters are added or removed from data log *DISABLED		
	CONTINUOUS	Logs when transmitter is on and operating	
	THRESHOLD	Logs when the threshold value is between the minimum and maximum values For example, only log when process equipment is operational and flow is above cutoff	
<b>TIME INTERVAL</b>	1 SECOND	1 MINUTE	1 HOUR
	2 SECONDS	2 MINUTES	2 HOURS
	5 SECONDS	5 MINUTES	4 HOURS
	10 SECONDS	10 MINUTES	6 HOURS
	20 SECONDS	30 MINUTES	12 HOURS
	30 SECONDS	24 HOURS	
<b>PARAMETER #1</b>  to .  <b>PARAMETER #8</b>	<b>Note:</b> For error/alarm codes, the last 10 codes in the history are logged with commas separating the values		
	FLOW RATE	DELTA TRANSIT TIME	ENERGY TOTAL FORWARD
	FLOW TOTAL GROSS	TEMPERATURE #1	ENERGY TOTAL REVERSE
	FLOW TOTAL FORWARD	TEMPERATURE #2	ENERGY TOTAL NET
	FLOW TOTAL REVERSE	TEMP#1 - TEMP#2	SIGNAL STRENGTH
	FLOW TOTAL NET	TEMP#2 - TEMP#1	SOUND SPEED
	VELOCITY	ENERGY RATE	ERROR/ALARM CODE
	REYNOLDS	ENERGY TOTAL GROSS	NONE
<b>THRESHOLD</b>	If THRESHOLD control is selected, this setting will be active		
	FLOW RATE	TEMPERATURE #2	ENERGY TOTAL
	FLOW TOTAL	DELTA TEMPERATURE	VELOCITY
	TEMPERATURE #1	ENERGY RATE	
<b>MIN THRESHOLD</b>	Numeric entry (plus or minus)	If THRESHOLD log model is selected, this setting will be active	
<b>MAX THRESHOLD</b>	Numeric entry (plus or minus)	If THRESHOLD log model is selected, this setting will be active	
<b>DELETE LOG</b>	Will stop recording and delete all records Prompt with a confirmation screen		

## 10.17 Setup > Options

Options Submenu	Options/Descriptions
<b>CARD TYPE</b>	If CARD TYPE is set to AUTODETECT, the transmitter will automatically detect when a new card is installed and display menu for the card settings. If CARD TYPE is set to a specific communication/contact card, the card settings will remain for that card type even if it is not installed. If a different card is installed or no card is installed, a warning will be displayed on the Home Screen and the card will be inactive.
	If CARD TYPE is set to DISABLED, then the card connection will be disabled and the Ethernet and contact menus will not be displayed.
	DISABLED AUTODETECT BACNET/IP MODBUS TCP/IP ETHERNET/IP AUX OUTPUT

## 10.18 Setup > Passcode Setup > Security

If SECURITY is enabled and you exit the MAIN MENU, you must re-enter your passcode to access the MAIN MENU again. Passcode Setup offers three levels of access. Read-Only access does not require a passcode:

- ADMIN—You must enter the fault ADMIN passcode 000000 to change security from DISABLE to ENABLE
- OPERATOR
- SERVICE

Security Submenus	Options/Descriptions	
<b>SET ADMIN</b>	6-digit passcode	Numeric entry
<b>SET OPERATOR</b>	6-digit passcode	Numeric entry
<b>SET SERVICE</b>	6-digit passcode	Numeric entry
<b>LOGOUT TIMEOUT</b>	1 MINUTE 5 MINUTES *10 MINUTES 20 MINUTES 30 MINUTES 60 MINUTES	When logout occurs, the display returns to the Home Screen

## 10.19 Setup > Passcode Setup > Passcode Recovery

An asterisk (\*) indicates the parameter default

Passcode Setup Submenus	Options/Descriptions	
PASSCODE RECOVERY	Passcode recovery screen	
TEMPORARY PASSCODE	Numeric entry	After 20 attempts to enter the temporary passcode, you will be prompted to generate a new RECOVERY CODE
SECURITY	*DISABLED ENABLED	When SECURITY is enabled, you are prompted to set the service and operator passwords. If you do not, the defaults remain in place.

Only the ADMIN level can reset passcodes. If the ADMIN passcode is lost and the passcodes need to be reset, you can contact Badger Meter, provide a recovery code to the representative and request a temporary passcode.

To generate a recovery code:

- 1 Select PASSCODE RECOVERY
- 2 The next screen prompts you to generate a recovery code or cancel the request. When you request the code, it displays on the screen. Write the number in a safe place.
- 3 Press MENU/BACK and continue to operate the meter in read-only mode.

You will not be prompted to enter a passcode when you navigate the menus. You have the option of canceling the recovery process and continue to use the existing passcodes by entering the ADMIN passcode. The PASSCODE LEVEL in the DIAGNOSTIC menu will be set to RECOVERY until you successfully enter a new ADMIN passcode or cancel the recovery.

When you receive your temporary passcode, select SETUP > PASSCODE SETUP > TEMPORARY PASSCODE and enter your temporary passcode. You will automatically be prompted to enter a new ADMIN passcode (prompt will be either in the SoloCUE software utility or the front panel, depending on where the temporary passcode was entered). If you do not enter a new ADMIN passcode within 15 minutes, the recovery mode is canceled and you must request a new recovery code to reset the passcodes. TEMPORARY PASSCODE can be entered from the SoloCUE software utility or the front panel, regardless of what was used to start it.



## 10.20 Display Menu

Requires operator level passcode or higher if security is enabled An asterisk (\*) indicates the parameter default

Display Submenus	Options/Descriptions	
<b>LANGUAGE</b>	*ENGLISH	English
	DEUTSCHE	German
	ESPAÑOL	Spanish
	FRANÇAIS	French
	ITALIANO	Italian
<b>DECIMAL</b>	## #,#	Select whether the decimal indicator is a period or a comma
<b>DISPLAY TAG ID</b>	*DISABLED ENABLED	Displays the TAG ID on the Home Screen Default is UTM20 Use SoloCUE to change the TAG ID
<b>BRIGHTNESS</b>	Select the display brightness 10 to 100% in increments of 10 Default is 70%	
<b>CONTRAST</b>	Adjust the screen contrast 12 to 37 Default is 24	
<b>DIMMER</b>	*ENABLED DISABLED	Enable the DIMMER to reduce the display BRIGHTNESS after the buttons are not pressed for the TIMEOUT period Select the BRIGHTNESS level Default is 10%
<b>DIMMER LEVEL</b>	OFF 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%	Press any button to awaken the transmitter and return to normal BRIGHTNESS The buttons pressed will not be active for one second after the transmitter is awakened
<b>TIMEOUT</b>	5 MINUTES *10 MINUTES 20 MINUTES 30 MINUTES 60 MINUTES	
<b>SET TIME</b>	Numeric entry for 24 hour clock HH:MM	
<b>SET DATE</b>	Numeric entry for date YYYY-MM-DD	
<b>DISPLAY TIME</b>	24 HOUR AM / PM	Select format of the time to display on the Home Screen and on the SoloCUE dashboard
<b>DISPLAY DATE</b>	YYYY-MM-DD MM-DD-YYYY DD-MM-YYYY	Select format of the date to display on the Home Screen and on the SoloCUE dashboard

## 10.21 Information Menu

An asterisk (\*) indicates the parameter default

Information Submenus	Options/Descriptions
VENDOR	BADGER METER
MODEL	UTM20
P.N.:	Badger Meter part number
S.N.	Serial Number
FW VERSION	Firmware Version xx xx xxx
CAL. DATE	Calibration Date YYYY-MM-DD
DATE CODE	Manufacture Date YYYY-MM-DD
TAG ID	16 characters

## 10.22 Diagnostics Menu

The DIAGNOSTICS menu displays system status and allows you to clear the history, reset to factory defaults and reboot the system An asterisk (\*) indicates the parameter default

Diagnostics Submenus	Options/Descriptions			
READINGS	SIGNAL STRENGTH	Read-only numeric with message to indicate the quality of the ultrasonic signal		
	HISTORY	Chronological list of 120 past errors, alarms and warning messages		
	DELTA TIME FILTERED	Read-only ##.## ns		
	FLOW RATE RAW	Read-only unfiltered flow rate		
	FLUID SOUND SPEED	Read-only; Units are the same as VELOCITY; Measured ultrasound speed of the fluid		
	DELTA TIME RAW	Read-only ns		
	REYNOLDS NUMBER	Read-only; unitless		
	REYNOLDS FACTOR	Read-only; unitless		
	TEMPERATURE #1	Read-only; Energy meters only; Units are the same as the Home Screen.		
	TEMPERATURE #2	Read-only; Energy meters only; Units are the same as the Home Screen.		
	DELTA TEMPERATURE	The temperature difference between the two RTDs, either T1 - T2 or T2 - T1, according to the setting in INPUT/OUTPUT > RTD > DELTA TEMP		
	TOTAL OVERFLOW COUNT	Numeric integer	The TOTAL OVERFLOW COUNT increments each time the flow total exceeds the digits in the display	
	ENERGY OVERFLOW	Numeric integer	The ENERGY OVERFLOW is a counter that increments each time the energy total exceeds the digits in the display	

Diagnostics Submenus	Options/Descriptions			
<b>INPUT/OUTPUT STATUS</b>	CURRENT #1 OUTPUT	Read-only mA		
	CURRENT #2 OUTPUT	Read-only mA; Energy meters only		
	OUTPUT #1 STATUS	*ON OFF FREQUENCY PULSE DISABLED	Status of digital output If the output mode is ALARM or FLOW DIRECTION, then the output status ON or OFF is indicated Frequency and Pulse modes can operate too fast to view the ON and OFF state, so the mode is shown for the status	
	OUTPUT #2 STATUS	ON OFF FREQUENCY PULSE DISABLED		
	OUTPUT #3 STATUS	ON OFF FREQUENCY PULSE DISABLED	Energy meters only	
	AUX OUTPUT #1 STATUS	ON OFF PULSE DISABLED	Only with auxiliary contact output option	
	AUX OUTPUT #2 STATUS	ON OFF PULSE DISABLED	Only with auxiliary contact output option	
	INPUT STATUS	ON OFF	Status of digital input to reset totalizer or unlatch alarm	
<b>HARDWARE OPTIONS</b>	CARD HARDWARE	NONE BACNET/IP MODBUS TCP/IP ETHERNET/IP DRY CONTACTS	Identifies the hardware type of communication card or contact card installed regardless of the settings	
	MAC ADDRESS	xx:xx:xx:xx:xx:xx Read only Ethernet card must be installed and cable must be connected for the MAC Address to display		
	LINK STATUS	CONNECTED DISCONNECTED	Read only Ethernet link status if Ethernet card is installed and enabled	

Diagnostics Submenus	Options/Descriptions		
<b>SYSTEM</b> (Requires service level passcode or higher if security is enabled.)	TIME	HH:MM:SS (24 hour clock)	Displays the time
	DATE	YYYY-MM-DD	Displays the date
	POWER ON TIME	In seconds	
	SIMULATION MODE	OFF 100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%	Flow Simulation provides output and display simulation based on a percentage of the full scale flow Simulation will not accumulate the totalizers The range of simulation includes 0 to 100% of the full scale flow  Use the Flow Simulation parameter to set the range of simulation in 10% increments  To change the Flow Simulation, from the INPUTS/OUTPUTS menu: 1 Select FLOW SIMULATION to view the Flow Simulation display 2 Click RIGHT ARROW to increment the percentage by 10, or click DOWN ARROW to decrement the percentage by 10
	PASSCODE LEVEL	READ ONLY OPERATOR SERVICE ADMIN RECOVERY	Defines the parameters, screens and actions available to a user confirmation screen
	CLEAR HISTORY	CLEAR HISTORY confirmation screen	Clears all alarms, warnings, errors and informational messages from the ALARM HISTORY buffer This is typically done after startup or maintenance on the flow system is successfully completed
	FACTORY RESET	FACTORY RESET confirmation screen	Resets all parameters to the values on the device when it was shipped from the factory Any settings made will be reset
	REBOOT	REBOOT confirmation screen	Reboots the device The UTM20 meter does not require this manual REBOOT for any procedure, but it may be useful for system troubleshooting

## 10.23 Reset Menu

Reset Submenus	Options/Descriptions
RESET FLOW TOTAL	Reset the FLOW TOTAL See the "Reset Flow Totalizer Procedure" below
UNLATCH ALARMS	Only available if alarm latch is enabled Unlatches output if alarm condition occurred and cleared See "Setup > Inputs/Output > Output #1 (or Output #2 or Output #3)" on page 57.

### Reset Flow Totalizer Procedure

The flow meter accumulates the amount of flow passing through the meter into a flow totalizer To reset the flow total:

- 1 Press MENU/BACK
- 2 Select RESET from the Main Menu (Press DOWN to scroll through the list of options When RESET is the top item, press ENTER )
- 3 Select RESET FLOW TOTAL from the Reset menu (With RESET FLOW TOTAL as the top item, press ENTER )
- 4 Select OK to confirm reset

After selecting RESET FLOW TOTAL, you are prompted to confirm the reset of the flow total Press ENTER to confirm or press MENU/BACK to cancel

# 11. Troubleshooting

Warning and alarm messages are classified according to NAMUR 107 standards

## 11.1 Out of Specification Messages

Warning and alarm messages occur when the flow meter is operational, but the readings might be out of specification or an operator might need to take action. If a warning or alarm condition occurs, a warning/alarm icon with code will appear in the at the bottom of the Home Screen. The flow rate and flow total will continue to be displayed.

## 11.2 Error Messages

An error condition occurs when the flow rate cannot be determined, such as when the signal strength is too low. If an error condition occurs, the flow rate will be replaced with the "failed" icon, code and description.

If conditions cause multiple messages to occur, all messages will be saved to the history, but some messages may not be displayed. If an error condition occurs, warning and alarm messages will not be displayed. If multiple errors occur, each error message will cycle through and be viewable for 5 seconds. Similarly, if multiple warning or alarm conditions occur (but no error conditions), each message will cycle through and be viewable for 5 seconds.

Warning, Alarm and Error Messages automatically clear when the issue clears.

## 11.3 Check Function Codes

When the meter or outputs are in a test mode, a check function message appears at the bottom of the Home Screen.

## 11.4 View Alarm and Message Buffer

Up to 30 alarm or warning message codes are buffered on a first-in-first-out basis. To view the buffer, go to **DIAGNOSTICS > HISTORY**.

# 11.5 Warning and Alarm Message Codes

## Failure Codes

Code	Description	Correction
<b>F02 ELECTRONIC ERROR</b>	Multiple watchdog timeouts occurred	Contact factory
<b>F03 ELECTRONIC ERROR</b>	Voltage levels are out of specification	Reboot transmitter; If error repeats, repair or replace transmitter
<b>F10 LOW SIGNAL</b>	Signal strength is below cutoff	Check for empty pipe, transducer spacing and parameter settings
<b>F11 HIGH SIGNAL</b>	Signal strength is oversaturated	Change transducer mounting for more paths or enable shunt resistor
<b>F20 RTD #1 ERROR</b>	Unable to detect RTD #1	Check wiring to RTD #1 connector
<b>F21 RTD #2 ERROR</b>	Unable to detect RTD #2	Check wiring to RTD #2 connector

## Check Function Codes

Code	Description	Correction
<b>C01 CURRENT TEST</b>	Current output is in test mode	Change Current Output from Test Mode
<b>C10 OUTPUT #1 FREQUENCY TEST</b>	Output #1 is in frequency test mode	Change Output #1 from Test Mode
<b>C11 OUTPUT #1 PULSE TEST</b>	Output #1 is in pulse test mode	Change Output #1 from Test Mode
<b>C12 OUTPUT #1 SWITCH TEST</b>	Output #1 is forced on or off	Change Output #1 from Test Mode
<b>C20 OUTPUT #2 FREQUENCY TEST</b>	Output #2 is in frequency test mode	Change Output #2 from Test Mode
<b>C21 OUTPUT #2 PULSE TEST</b>	Output #2 is in pulse test mode	Change Output #2 from Test Mode
<b>C22 OUTPUT #2 SWITCH TEST</b>	Output #2 is forced on or off	Change Output #2 from Test Mode
<b>C30 OUTPUT #3 FREQUENCY TEST</b>	Output #3 is in frequency test mode	Change Output #3 from Test Mode
<b>C31 OUTPUT #3 PULSE TEST</b>	Output #3 is in pulse test mode	Change Output #3 from Test Mode
<b>C32 OUTPUT #3 SWITCH TEST</b>	Output #3 is forced on or off	Change Output #3 from Test Mode
<b>C41 AUX #1 PULSE TEST</b>	Aux Output #1 is in pulse test mode	Change Aux Output #1 from Test Mode
<b>C42 AUX #1 SWITCH TEST</b>	Aux Output #1 is forced on or off	Change Aux Output #1 from Test Mode
<b>C51 AUX #2 PULSE TEST</b>	Aux Output #2 is in pulse test mode	Change Aux Output #2 from Test Mode
<b>C52 AUX #2 SWITCH TEST</b>	Aux Output #2 is forced on or off	Change Aux Output #2 from Test Mode
<b>C60 SIMULATION MODE</b>	Meter is running flow simulation	Deactivate Simulation Mode

## Out-of-Specification Codes

Code	Description	Correction
<b>S01 ELECTRONIC WARNING</b>	Fault detected and meter rebooted	Contact factory, update firmware, or repair or replace transmitter
<b>S02 DEFAULT FAILED</b>	Reset to factory defaults failed	Check calibration If it does not match the calibration settings on the transducer serial tag, enter field calibration settings Return to the Home Screen and continue to operate (if the reset to factory defaults is through the transmitter)
<b>S03 LANGUAGE FILE CORRUPT</b>	English only	Update firmware
<b>S10 mA TOO HIGH</b>	Flow or energy rate higher than flow rate at 20 mA output	Check the scaling of the Current #1 output
<b>S11 mA TOO HIGH</b>	Flow or energy rate higher than 20 mA	Check the scaling of the Current #2 output
<b>S19 mA SUPPLY VOLTAGE ERR</b>	Supply voltage out of range for 4-20 mA outputs	Check wiring
<b>S20 FREQ HIGH</b>	Value higher than max frequency output	Check the scaling of the frequency on Output #1
<b>S21 FREQ HIGH</b>	Value higher than max frequency output	Check the scaling of the frequency on Output #2
<b>S22 FREQ HIGH</b>	Value higher than max frequency output	Check the scaling of the frequency on Output #3
<b>S30 PULSE HIGH</b>	Pulse output is too fast for the pulse width	Check the scaling factor, units and pulse width of the pulse on Output #1
<b>S31 PULSE HIGH</b>	Pulse output is too fast for the pulse width	Check the scaling factor, units and pulse width of the pulse on Output #2
<b>S32 PULSE HIGH</b>	Pulse output is too fast for the pulse width	Check the scaling factor, units and pulse width of the pulse on Output 3
<b>S33 PULSE HIGH</b>	Pulse output is too fast for the pulse width	Check the scaling factor, units and pulse width of the pulse on Aux Output #1 dry contact
<b>S34 PULSE HIGH</b>	Pulse output is too fast for the pulse width	Check the scaling factor, units and pulse width of the pulse on Aux Output #2 dry contact
<b>S40 HIGH FLOW</b>	Flow rate is above high flow alarm setting	Check flow rate and Set High setting for Output #1
<b>S41 HIGH FLOW</b>	Flow rate is above high flow alarm setting	Check flow rate and Set High setting for Output #2
<b>S42 HIGH FLOW</b>	Flow rate is above high flow alarm setting	Check flow rate and Set High setting for Output #3



<b>Code</b>	<b>Description</b>	<b>Correction</b>
<b>S43 HIGH FLOW</b>	Flow rate is above high flow alarm setting	Check flow rate and Set High setting for Aux Output #1
<b>S44 HIGH FLOW</b>	Flow rate is above high flow alarm setting	Check flow rate and Set High setting for Aux Output #2
<b>S45 LOW FLOW</b>	Flow rate is below low flow alarm setting	Check flow rate and Set Low setting for Output #1
<b>S46 LOW FLOW</b>	Flow rate is below low flow alarm setting	Check flow rate and Set Low setting for Output #2
<b>S47 LOW FLOW</b>	Flow rate is below low flow alarm setting	Check flow rate and Set Low setting for Output #3
<b>S48 LOW FLOW</b>	Flow rate is below low flow alarm setting	Check flow rate and Set Low setting for Aux Output #1
<b>S49 LOW FLOW</b>	Flow rate is below low flow alarm setting	Check flow rate and Set Low setting for Aux Output #2
<b>S50 TOTAL OVERFLOW</b>	Accumulated flow total is greater than viewable digits	Check the totalizer units or reset the flow total to clear the overflow counter
<b>S60 COMM TIMEOUT</b>	Modbus master or BACnet device communication packet	Check master device poll rate and offline status Check wiring and termination resistor setting
<b>S61 MODULE TIMEOUT</b>	Network timeout	Check communication settings and wiring
<b>S62 DISCONNECTED</b>	Bluetooth connection timed out	—
<b>S63 BLUETOOTH FAIL</b>	Unable to initialize Bluetooth	Update firmware If error repeats, repair or replace transmitter
<b>S64 MODULE FAILED</b>	Unable to initialize module	Reseat module and reboot transmitter If error repeats, replace module
<b>S65 MODULE MISMATCH</b>	Module installed does not match settings	Replace module with correct module Check card type settings
<b>S67 DATA LOG ERROR</b>	microSD card is missing or full	Check microSD card If data logging is not required, disable data logging
<b>S70 TEMP #1 LOW</b>	Temp #1 is below low alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #1
<b>S71 TEMP #1 LOW</b>	Temp #1 is below low alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #2
<b>S72 TEMP #1 LOW</b>	Temp #1 is below low alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #3
<b>S73 TEMP #2 LOW</b>	Temp #1 is below low alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Aux Output #1
<b>S74 TEMP #2 LOW</b>	Temp #1 is below low alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Aux Output #2

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<b>Code</b>	<b>Description</b>	<b>Correction</b>
<b>S75 TEMP #1 HIGH</b>	Temp #1 is above high alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #1
<b>S76 TEMP #1 HIGH</b>	Temp #1 is above high alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #2
<b>S77 TEMP #1 HIGH</b>	Temp #1 is above high alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Output #3
<b>S78 TEMP #1 HIGH</b>	Temp #1 is above high alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Aux Output #1
<b>S79 TEMP #1 HIGH</b>	Temp #1 is above high alarm setting	Check fluid temperature and RTD #1 Check alarm settings for Aux Output #2
<b>S80 HIGH ENERGY RATE</b>	Flow rate is above high flow alarm setting	Check energy flow rate and Set High setting for Output #1
<b>S81 HIGH ENERGY RATE</b>	Flow rate is above high flow alarm setting	Check energy flow rate and Set High setting for Output #2
<b>S82 HIGH ENERGY RATE</b>	Flow rate is above high flow alarm setting	Check energy flow rate and Set High setting for Output #3
<b>S83 HIGH ENERGY RATE</b>	Flow rate is above high flow alarm setting	Check energy flow rate and Set High setting for Aux Output #1
<b>S84 HIGH ENERGY RATE</b>	Flow rate is above high flow alarm setting	Check energy flow rate and Set High setting for Aux Output #2
<b>S85 LOW ENERGY RATE</b>	Flow rate is above low flow alarm setting	Check energy flow rate and Set Low setting for Output #1
<b>S86 LOW ENERGY RATE</b>	Flow rate is above low flow alarm setting	Check energy flow rate and Set Low setting for Output #2
<b>S87 LOW ENERGY RATE</b>	Flow rate is above low flow alarm setting	Check energy flow rate and Set Low setting for Output #3
<b>S88 LOW ENERGY RATE</b>	Flow rate is above low flow alarm setting	Check energy flow rate and Set Low setting for Aux Output #1
<b>S89 LOW ENERGY RATE</b>	Flow rate is above low flow alarm setting	Check energy flow rate and Set Low setting for Aux Output #2
<b>S90 TEMP #2 LOW</b>	Temp #2 is below low alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #1
<b>S91 TEMP #2 LOW</b>	Temp #2 is below low alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #2
<b>S92 TEMP #2 LOW</b>	Temp #2 is below low alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #3
<b>S93 TEMP #2 LOW</b>	Temp #2 is below low alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Aux Output #1

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Code	Description	Correction
<b>S94 TEMP #2 LOW</b>	Temp #2 is below low alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Aux Output #2
<b>S95 TEMP #2 HIGH</b>	Temp #2 is above high alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #1
<b>S96 TEMP #2 HIGH</b>	Temp #2 is above high alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #2
<b>S97 TEMP #2 HIGH</b>	Temp #2 is above high alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Output #3
<b>S98 TEMP #2 HIGH</b>	Temp #2 is above high alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Aux Output #1
<b>S99 TEMP #2 HIGH</b>	Temp #2 is above high alarm setting	Check fluid temperature and RTD #2 Check alarm settings for Aux Output #2

### Informational Events Codes

Information events are only displayed in the ALARM HISTORY and not on the Home Screen

Code	Description
<b>I01 POWER ON</b>	Power on or rebooted
<b>I11 ZERO</b>	Meter zeroed
<b>I12 FACTORY CALIBRATION</b>	Calibration changed from Field to Factory
<b>I13 FIELD CALIBRATION</b>	Calibration changed from Factory to Field
<b>I21 FIRMWARE CHANGED</b>	Firmware updated
<b>I31 FLOW TOTAL RESET</b>	Flow total reset to zero
<b>I41 NO SD CARD</b>	MicroSD card not installed

## 11.6 Symptoms

Symptom: Transmitter does not power up.	
<b>Possible Causes</b>	No power or inadequate power
	Blown fuse (AC Model only)
	Display ribbon cable not seated properly
<b>Recommended Action</b>	Measure voltage at the power terminals and check that the voltage matches the labels by the power terminals
	Check the fuse near the power terminals If fuse is blown, verify the voltage and polarity is correct and reset the fuse
	Inspect ribbon cable connections LED's on power board will light up with no LCD display
	Replace the transmitter if the above actions do not resolve the issue
Symptom: Flow reading appears to be incorrect.	
<b>Possible Causes</b>	Incorrect positioning of transducers
	Poor contact between transducers and pipe
	Poor placement of transducers
	Low signal strength
	Process loop issues
	Incorrect pipe settings
	Meter not calibrated
Display not set up correctly	
<b>Recommended Action</b>	Refer to the Transducer Mounting Configuration section for details on proper installation
	<b>At the transducer:</b>
	Verify that the spacing of the transducers is set correctly On most transducers, a scribe mark on the side of the transducers indicates the point of measurement—NOT from the end points of the transducers
	Verify that the transducers are aligned correctly For Z-Mount, verify the transducers are 180° From each other
	Make sure there is a good contact between the transducers and pipe and a thin coat of acoustic coupling is applied For integral mount, check for over-tightening of the transducers
	<b>Process loop and general location:</b>
	Make sure the transducers are on the sides of the pipe and NOT on the top of the pipe
	Check that the transducers are NOT located at the highest point in the loop where air may accumulate
	Check that the transducers are NOT on a downward flowing pipe unless adequate downstream head pressure is present to overcome partial filling or cavitation
	Check that the transducers have adequate straight pipe upstream and downstream
Check process loop for entrained air or particulates which will impact the flow readings	
Pipes may develop scale, product build-up or corrosion over time As a result, the effective wall thickness may be different than a new pipe and wall thickness or liner parameters may need to be adjusted	
<b>At the transmitter:</b>	
Verify that pipe parameters match the installation	

### UTM20 Series Ultrasonic Transit-time Flowmeters

<b>Symptom: Unstable flow.</b>	
<b>Possible Causes</b>	Installation issues
	Flow instability
	Transducer mounting is loose
	Transducers are moved
<b>Recommended Action</b>	Incorrect flow settings
	Check process loop for variations of entrained air which will impact the flow
	Check for pump induced flow instability
	Check that the transducers are secure and are in area where the transducers will not be inadvertently bumped or disturbed
	Check low flow cutoff, minimum flow or maximum flow settings
<b>Symptom: Flow readout is opposite of the flow direction.</b>	
<b>Possible Causes</b>	Integral mount transmitter is mounted in reverse flow direction so display is properly oriented
	Up and down transducers wiring is reversed
	Flow direction parameter is reversed
<b>Recommended Action</b>	Change the transducer flow direction parameter
	Rewire the up and down transducers to the transmitter
<b>Symptoms: Current, frequency or pulse outputs do not match the readings.</b>	
<b>Possible Causes</b>	Incorrect parameter settings
	Wiring or control system configuration issues
<b>Recommended Action</b>	Verify that the parameters for the output are set properly

# 12. Replacement Procedures

## **⚠ WARNING**

**Disconnect power before opening the enclosure**

### **Tools Required**

- A Phillips #2 screwdriver
- A flat blade screwdriver
- Tweezers for electronics
- A workbench that prevents ESD damage to the electronics

## **⚠ CAUTION**

**Contains parts and assemblies susceptible to damage by electrostatic discharge (esd). Before picking up an esd-sensitive electronic component, discharge yourself by touching a grounded bare metal surface or approved anti-static mat.**



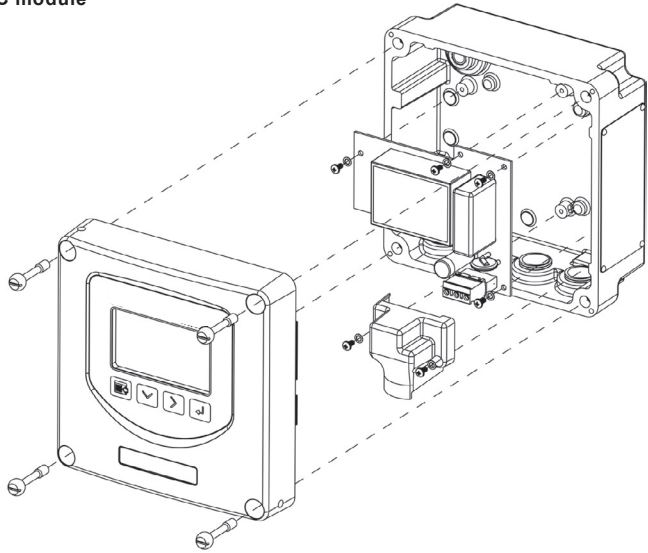
**Observe precautions for handling electrostatic-sensitive devices.**

## **12.1 Replacing an AC Module**

1. Turn off the power.
2. Open the enclosure.
3. Unplug the DC power wire connector from the terminal block on the main board.
4. Remove (2) M3 pan head phillips screws that secure the cover over the AC power terminal block.
5. Unplug the wire connector from the terminal block on the AC module.
6. Remove the remaining (4) M3 pan head phillips screws and lock washers that secure the AC module to the enclosure base.
7. Remove the AC module.

Installation is in the reverse order.

**Fig. 51 Replacing an AC module**

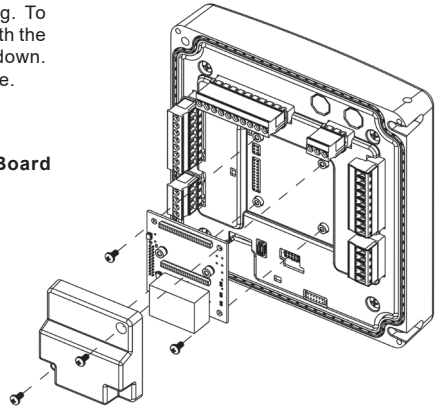


## 12.2 Replacing the Communication or Dry Contact Board

1. Turn off the power.
2. Open the enclosure.
3. Disconnect the wires from the communication board.
4. Remove (2) M3 pan head phillips screws that secure the cover over the communication board.
5. Remove the cover.
6. Remove the remaining (2) M3 pan head phillips screws that secure the communications board.
7. Lift the communications board straight out to unplug from the main board.

Installation is in reverse order, noting the following. To install a new communications board, align the pins with the header on the main board and gently press straight down. Do not misalign the pins. Do not use excessive force.

**Fig. 52**  
**Replacing the Communication or Dry Contact Board**



## 12.3 Replacing the Main Board

1. Turn off the power.
2. Open the enclosure.
3. Remove the terminal blocks from the header on the main board.
4. If a communications board is present, remove it.
5. Remove the (4) M4 pan head phillips screws that secure the main board and shield.
6. Lift the shield off the main board.
7. Gently pull the main board straight out to disengage it from the display header and remove it from the enclosure lid.

Installation is in reverse order, noting the following. To install a new main board, align the pins on the display header with the socket on the main board and gently press straight down. Be careful not to misalign the pins. Do not use excessive force.

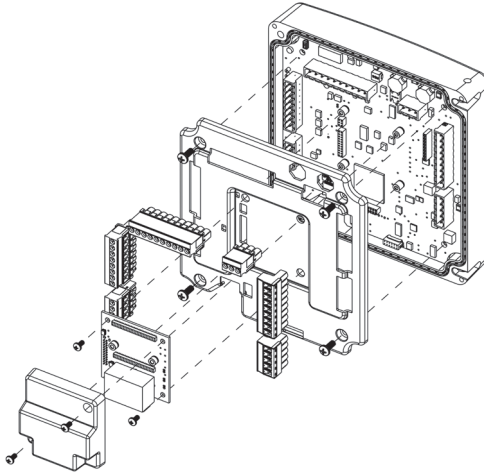


Fig. 53 Replacing the Communication or Dry Contact Board

## 12.4 Firmware Update

Firmware can be updated using SoloCUE Flow Device Manager software. Parameter and calibration settings will not be overwritten unless there is a conflict with the new parameters. Back up the device configuration prior to updating the firmware. See "UTM20 Firmware Update" (available at [www.badgermeter.com](http://www.badgermeter.com)) for more information.



# 13. Specifications

## 13.1 System

<b>Liquid Types</b>	Most clean liquids or liquids containing small amounts of suspended solids or gas bubbles	
<b>Flow Accuracy</b>	Medium and Large Pipes (RZ, NZ, WZ, HZ, LZ, YZ, JZ, KZ)	$\pm 0.5\% \pm 0.0049$ ft/s (0.015 m/s)
	Small Pipes (CA-CT, UZ)	1" (25 mm) and larger = $\pm 1\% \pm 0.03$ ft/s (0.009 m/s) $\frac{3}{4}$ " (20 mm) and smaller = $\pm 1\%$ of full scale
<b>Repeatability</b>	0.2% above 1.5 ft/s	
<b>Velocity</b>	Medium and Large Pipes	Up to 40 ft/s, depending on pipe and fluid
	Small Pipes	Up to 20 ft/s, depending on pipe and fluid
<b>Straight Run Requirements</b>	10 diameters upstream, 5 diameters downstream from single elbow	
<b>Certification and Compliance</b>	<b>General Safety (all models):</b> cCSAus, CE, Pollution Degree 2, CE compliance to Low Voltage Directive, 2014/35/EU	
	<b>U.S./Canada Hazardous Location transmitter and transducers: Transmitter and transducers (certification option B):</b> cCSAus Class I Division 2 Groups ABCD T4 Requires flexible conduit Not available with UZ, HZ or JZ and KZ (Easy Rail) transducers, Auxiliary Dry Contact card or units with AquaCUE/BEACON endpoints	
	<b>Transmitter (certification option R):</b> cCSAus Ex ec ic nC IIC T4 Gc; Ex tc IIIB T100 °C Dc; Class I, Zone 2, AEx ec ic nC IIC T4 Gc; Zone 22, AEx tc IIIB T100 °C Dc; Class II, Division 2, Groups FG; Class III Not available with Auxiliary Dry Contact card or units with AquaCUE/BEACON endpoints	
	<b>Transducers LZ, NZ and RZ (certification option R):</b> cCSAus Ex ec IIC T6 Gc; Ex tc IIIB T60 °C Dc; Class I, Zone 2, AEx ec IIC T6 Gc; Zone 22, AEx tc IIIB T60 °C Dc; Class II, Division 2, Groups FG; Class III Requires flexible conduit Not available with CA-CT, UZ, HZ or JZ and KZ (Easy Rail) transducers	
	<b>ATEX Hazardous Location:</b> Transmitter (certification option V): II 3 G D Ex ec ic nC IIC T4 Gc, Ex tc IIIB T100 °C Dc; Tamb: -25 to 60 °C JZ (DTTJ), KZ (DTTK), LZ (DTTL), NZ (DTTN) and RZ (DTTR) Transducers: II 3 G D Ex ec IIC T6 Gc; Ex tc IIIB T60 °C Dc; Tamb: -25 to 60 °C Not available with UZ, CA to CT, or HZ transducers; flexible conduit, Auxiliary Dry Contact card or AquaCUE/BEACON endpoints	
<b>IECEx Hazardous Location:</b> Transmitter (certification option V): Ex ec nC ic IIC T4 Gc; Ex tc IIIC T100 °C Dc; Tamb: -25 °C to 60 °C JZ, KZ, LZ, NZ and RZ Transducers: Ex ec IIC T6 Gc; Ex tc IIIB T60 °C Dc; Tamb: -25 to 60 °C Not available with UZ, CA to CT, or HZ transducers; flexible conduit, Auxiliary Dry Contact card or AquaCUE/BEACON endpoints		

## 13.2 Transmitter

<b>Power Options</b>	24V DC/AC	9 to 28V DC @ 8 W max or 20 to 26 AC 47 to 63 Hz @ 0.5 A max , 2 Amp slow-blow fuse, not field replaceable
	Mains AC	85 to 264V AC 47 to 63 Hz @ 24VA max 1 Amp slow-blow fuse, manually field replaceable Over-Voltage Rating Category II (CAT II)
<b>Display</b>	Options	Display with keypad or no display/keypad
	Keypad	4-button navigation, keypad with tactile feedback; polyester film
	Display	128 × 64 pixel LED backlit graphical display; adjustable brightness and timeout; polycarbonate window
	Flow rate/total	8-digit
<b>Enclosure</b>	NEMA Type 4X, IP67	
<b>Construction</b>	Aluminum construction; painted; wall, panel or pipe mounting; stainless steel fasteners and mounting hardware; EPDM gasket	
	Conduit Holes	(4) ½" NPT, M20 × 1.5 or 1/2 BSPP; cable glands available for NPT and M20
<b>Environmental Ratings</b>	Pollution Degree	2
	Altitude Restriction	Up to 2000 m (6561 ft)
	Ambient Temperature Range	-4 to 140 °F (-20 to 60 °C)
	Storage Temperature Range	-40 to 176 °F (-40 to 80 °C)
	Humidity	0 to 85%, non-condensing
<b>Configuration</b>	Via optional keypad or SoloCUE configuration software; SoloCUE available on DVD or download	
<b>Units (Field-Selectable)</b>	Velocity	feet/second, meters/second
	Volumetric total	US Gallons, Million Gallons, Imperial Gallons, Million Imperial Gallons, Acre-Feet, Liters, Hectoliters, Cubic Meters, Cubic Feet, Oil Barrels (42 gallons), Fluid Barrels (31.5 gallons), Imperial Fluid Barrels (36 imperial gallons), Pounds (Kilograms) and custom units
	Flow rate	Acre Feet/Day, Liters/Second, Liters/Minute, Liters/Hour, Cubic Meters/Second, Cubic Meters/Minute, Cubic Meters/Hour, Cubic Feet/Minute, Cubic Feet/Minute, Cubic Feet/Hour, Gallons/Second, Gallons/Minute, Gallons/Hour, Million Gallons/Day, Imperial Gallons/Second, Imperial Gallons/Minute, Imperial Gallons/Hour, Million Imperial Gallons/Day, Oil Barrels/Day, Fluid Barrels/Day, Imperial Fluid Barrels/Day and custom units
	Energy total (energy meters)	British Thermal Unit (Btu), Thousand Btu, Millions Btu, Kilocalories, Mega calories, Kilowatt-hour, Megawatt hour, Kilojoules, Mega joules, Ton-hour (Refrigeration)
	Heat/cooling rate (energy meters)	Btu/hour, Thousand Btu/hour, Millions Btu/hour, Ton (Refrigeration), Watts, Kilowatts, Megawatts, Kilojoules/hour, Mega joules/hour, Kilocalories/hour, Mega calories/hour
	Temperature (energy meters)	Fahrenheit, Celcius, Kelvin

### UTM20 Series Ultrasonic Transit-time Flowmeters

		Flow Meter	Energy Meter	
<b>Inputs and Outputs</b>	0/4 to 20 mA output	One 16-bit, isolated, max 800 Ohms, internal or external power	Two 16-bit, isolated, max 800 Ohms, internal or external power	
	Digital input	One 5 to 30V DC, isolated, externally or internally sourced, reset totalizer or alarm output		
	Digital output	Two selectable pulse, alarm, flow direction, sink isolated open collector, 5 to 30V DC, max 50 mA externally or internally sourced, leakage current 1uA max	Three selectable pulse, frequency, alarm, flow direction, isolated open collector, 5 to 30V DC, externally or internally sourced, leakage current 1uA max	
		Frequency output: 50% duty cycle, 63 to 10k Hz maximum frequency		
		Pulse (totalizer) output: 5 kHz max output, open collector, pulse width 5 to 500 ms programmable		
RTD (energy only)	None	Two 2-wire, 3-wire or 4-wire Pt100/Pt1000 RTD 12-bit inputs; Range of -40 to 200 °C; Clamp-on resistor kits available		
<b>Ports</b>	Programming	USB 2.0 mini B connector for connection to a device with SoloCUE configuration software		
	EIA-485	Modbus RTU command set or BACnet MS/TP; Baud rates 9600, 14400, 19200, 38400, 57600, 76800, 115k; terminating resistor selectable		
	Ethernet	Optional 10/100 Base T RJ45, communication via Modbus TCP/IP or BACnet/IP		
	AquaCUE/BEACON	Connectivity to AquaCUE/BEACON endpoint (LTE cellular)		
<b>Data Logging</b>	Number of points	Up to 8 parameters per record Selectable 1 second to 1 day Transfer logs via memory card		
	Real Time Clock	Backed up with a super capacitor, minimum of 32 days of data retention without power; Requires no servicing		
	MicroSD card slot	8 GB card, included with transmitter		
<b>Alarms</b>	Records 150 previous alarms, warnings or errors			
<b>Languages</b>	English, French, German, Italian, Spanish			
<b>Security</b>	Four levels: Read-only, Operator, Service and Admin; 6-digit passcode number; selectable auto logout			

UTM20 Series Ultrasonic Transit-time Flowmeters

### 13.3 Transducers

Model	Construction	Cable Length Max.	Pipe/Tubing Sizes <sup>1</sup>	Flow Rate Max. GPM (LPM)	Pipe/Tubing Materials
<b>CA-CT<sup>5</sup> fixed small pipe</b>	CPVC, Ultem®, Nylon cord grip, PVC cable jacket; -40 to 194 °F	100 ft	0.5 to 2"	190	See <sup>2</sup>
<b>UZ adjustable small pipe</b>	CPVC, Ultem, and anodized aluminum track system; Nickel-plated brass connector with Teflon insulation; PVC cable jacket, -40 to 194 °F (-40 to 90 °C)	100 ft (30 m)	0.5 to 2" (12 to 50 mm)	190 (720)	
<b>NZ (IP67) standard pipe</b>	PVC, Ultem®, Nylon cord grip, PVC cable jacket; -40 to 194 °F (-40 to 90 °C)	300 ft (90 m)	2.5 to 12" (DN65 to DN300)	4000 (15,000)	
<b>RZ (IP54) standard pipe</b>	PBT glass filled, Ultem®, Nylon cord grip; PVC cable jacket; -40 to 250 °F (-40 to 121 °C)	300 ft (90 m)	2.5 to 12" (DN65 to DN300)	4000 (15,000)	
<b>JZ, KZ (IP54) standard pipe, integrated rail</b>	PBT glass filled, Ultem, Nylon cord grip; PVC cable jacket; -40 to 250 °F (-40 to 121 °C)	300 ft (90 m)	2.5 to 6 in (DN65 to DN150) 2.5 to 12" (DN65 to DN300)	4000 (15,000)	
<b>WZ (IP68) standard pipe, submersible</b>	CPVC, Ultem, Nylon cord grip; Polyethylene cable jacket; -40 to 194 °F (-40 to 90 °C)	300 ft (90 m)	2.5 to 12" (DN65 to DN300)	4000 (15,000)	
<b>HZ high temperature</b>	PTFE, Vespel, Nickel-plated brass cord grip; FEP cable jacket; -40 to 350 °F (-40 to 176 °C)	300 ft (90 m)	2.5 to 12" (DN65 to DN300)	4000 (15,000)	
<b>LZ (IP67) large pipe</b>	CPVC, Ultem, Nylon cord grip PVC cable jacket; -40 to 194 °F (-40 to 90 °C)	300 ft (90 m)	8 to 48 in (DN200 to DN1200) <sup>3, 4</sup>	33,000 (125,000)	
<b>YZ (IP68) large pipe, submersible</b>	CPVC, Ultem, Nylon cord grip; Polyethylene cable jacket; -40 to 194 °F (-40 to 90 °C)	300 ft (90 m)	8 to 48 in (DN200 to DN1200) <sup>3, 4</sup>	33,000 (125,000)	

<sup>1</sup> Recommendations based on unlined, new pipes with water. Recommended pipe or tubing sizes vary with pipe conditions and fluid.

<sup>2</sup> PVC, CPVC, HDPE, PTFE, PDVF, stainless steel, ductile iron, aluminum, brass, naval, carbon steel, copper.

<sup>3</sup> Large pipe transducers are recommended for 8 to 12" pipes if normal velocity is expected to be greater than 12 ft/s (3.6 m/s).

<sup>4</sup> Consult factory for larger pipe sizes.

<sup>5</sup> Not for metric pipes.

## 13.4 RTD Kits

Part Number	Description	Installation	RTD Type	Construction	Temperature Range
76290	RTD pair; 15 ft (4.5 m) cable	Pipe clamp, surface mount, IP54	Pt 1000, Class A $\pm (0.15 + 0.002 \cdot t)$ with t as temperature °C	Aluminum body, silicone cable jacket	-58 to 356 °F (-50 to 180 °C)
76291	RTD pair; 50 ft (15 m) cable				
76292	RTD pair; 100 ft (30 m) cable				

## 13.5 SoloCUE Flow Device Manager Software

The flow meter may be programmed through the keypad or with SoloCUE software. If the meter is ordered without a display/ keypad, the flow meter must be programmed with SoloCUE software. The software is used to configure, calibrate and communicate with UTM20 meters with English, French, German, Italian and Spanish menus. Additionally, it has numerous troubleshooting tools to make diagnosing and correcting installation problems easier.

<b>SoloCUE</b>	Used to configure, calibrate and troubleshoot flow meters and control valves; Software is compatible with Windows 7, 8, 10	
<b>USB Cable</b>	RC820648	USB 2.0 mini B connector to A connector, shielded

# 14. Part Number Construction

## 14.1 UTM20 Flow Meters for Pipes 2". and Smaller

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	DQ
<b>Certification</b>	General Area US/Canada, CE	G
<b>Transducer Type <sup>1</sup></b>	½" ANSI Pipe	CA
	¾" ANSI Pipe	CB
	1" ANSI Pipe	CC
	1¼" ANSI Pipe	CD
	1½" ANSI Pipe	CE
	2" ANSI Pipe	CF
	½" Copper Tube	CG
	¾" Copper Tube	CH
	1" Copper Tube	CT
	1¼" Copper Tube	CJ
	1½" Copper Tube	CK
	2" Copper Tube	CL
	Small pipe, universal, DTTSU (not available with conduit)	UZ
<b>Transmitter Type</b>	110/220V AC Remote Mounted	R
	24V DC/AC Remote Mounted	B
<b>Display</b>	Display and Keypad	S
	No Display/Keypad	W
<b>Remote Cable Length</b>	15 feet (4.5 m)	AC
	30 feet (9 m)	AF
	50 feet (15 m)	AK
	75 feet (23 m)	AR
	100 feet (30 m)	BW
<b>Conduit Type and Length (Conduit length is less than or equal to cable length)</b>	None	WW
	5 feet (1.5 m)	AA
	15 feet (4.5 m)	AC
	30 feet (9 m)	AF
	50 feet (15 m)	AK
	75 feet (23 m)	AR
	100 feet (30 m)	BW

UTM20 Series Ultrasonic Transit-time Flowmeters

<b>Hardware</b>	½" NPT Threads, Poly cable glands	S
	½" NPT Threads, Nickel Plated Brass cable glands	T
	½" NPT Threads, no cable glands	N
	M20 Threads, Poly cable glands	C
	M20 Threads, Nickel Plated Brass cable glands	D
	M20 Threads, no cable glands	A
<b>Endpoint Wiring Method</b>	None	XX
<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	S
	Standard Output plus Modbus TCP Ethernet	T
	Standard Output plus BACnet/IP Ethernet	V
	Standard Output plus Modbus TCP Ethernet Standard Output plus Aux Output	9
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	G
<b>Testing &amp; Tagging</b>	Factory Calibrated	F
	Factory Calibrated/Stainless Steel Tag	S

<sup>1</sup> Stainless steel tube ½" to 2". options are available.

### Part number sequence

DQ	-	G	-	-	-	-	-	-	-	XX	-	-	-
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## 14.2 UTM20 Flow Meters for Pipes 2" and Smaller for Class I, Div 2 Hazardous Locations

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DQ</b>
<b>Certification</b>	Hazardous Location, Class I, Division 2	<b>B</b>
<b>Transducer Type 1</b>	½" ANSI Pipe	<b>CA</b>
	¾" ANSI Pipe	<b>CB</b>
	1" ANSI Pipe	<b>CC</b>
	1¼" ANSI Pipe	<b>CD</b>
	1½" ANSI Pipe	<b>CE</b>
	2" ANSI Pipe	<b>CF</b>
	½" Copper Tube	<b>CG</b>
	¾" Copper Tube	<b>CH</b>
	1" Copper Tube	<b>CT</b>
	1¼" Copper Tube	<b>CJ</b>
1½" Copper Tube	<b>CK</b>	
2" Copper Tube	<b>CL</b>	
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Display and Keypad	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable/Conduit Length 2</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
<b>Hardware</b>	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
	M20 Threads, Poly cable glands	<b>C</b>
	M20 Threads, Nickel Plated Brass cable glands	<b>D</b>
	M20 Threads, no cable glands	<b>A</b>
<b>Endpoint Wiring Method</b>	None	<b>XX</b>



<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus BACnet/IP Ethernet	<b>V</b>
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated	<b>F</b>
	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup>Stainless steel tube ½" to 2". options are available.

<sup>2</sup>For hazardous location units, Remote Cable and Conduit Length codes must match

### Part number sequence

DQ	-	B	-	-	-	-	-	-	-	XX	-	-	-
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## 14.3 UTM20 Flow Meters for Pipes 2.5 in. and Larger

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DQ</b>
<b>Certification</b>	General Area US/Canada, CE	<b>G</b>
<b>Transducer Type</b>	Medium pipe, DTTR, 2.5 in. (65 mm) or larger	<b>RZ</b>
	Medium pipe, submersible DTTN, 2.5 in. (65 mm) or larger 1	<b>WZ</b>
	2.5 to 6" (6"5 to 150 mm) Easy Rail (not available with conduit)	<b>JZ</b>
	2.5 to 12" (65 to 300 mm) Easy Rail (not available with conduit)	<b>KZ</b>
	Medium pipe, high temperature (not available with conduit)	<b>HZ</b>
	Large pipe, DTTL, 8 in. (200 mm) or larger	<b>LZ</b>
	Large pipe, submersible DTTL, 8 in. (200 mm) or larger 1	<b>YZ</b>
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Display and Keypad	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable Length</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
	300 feet (90 m)	<b>EW</b>
	350 feet (107 m) (DTTL "LZ" and "YZ" only)	<b>EK</b>
	400 feet (122 m) (DTTL "LZ" and "YZ" only)	<b>FW</b>
	450 feet (137) (DTTL "LZ" and "YZ" only)	<b>FK</b>
	500 feet (152 m) (DTTL "LZ" and "YZ" only)	<b>GW</b>
550 feet (168) (DTTL "LZ" and "YZ" only)	<b>GK</b>	
600 feet (183 m) (DTTL "LZ" and "YZ" only)	<b>HW</b>	

<b>Conduit Type and Length (Conduit length is less than or equal to cable length)</b>	None	<b>WW</b>
	5 feet (1.5 m)	<b>AA</b>
	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
300 feet (90 m)	<b>EW</b>	
<b>Hardware</b>	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
	M20 Threads, Poly cable glands	<b>C</b>
	M20 Threads, Nickel Plated Brass cable glands	<b>D</b>
	M20 Threads, no cable glands	<b>A</b>
<b>Endpoint Wiring Method</b>	None	<b>XX</b>
<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus BACnet/IP Ethernet	<b>V</b>
	Standard Output plus Aux Output	<b>9</b>
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated	<b>F</b>
	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup>Stainless steel tube ½" to 2". options are available.

<sup>2</sup>For hazardous location units, Remote Cable and Conduit Length codes must match

### Part number sequence

DQ	G	-	-	-	-	-	-	XX	-	-	-
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## 14.4 UTM20 Flow Meters for Pipes 2.5 in. and Larger for Class I, Div 2 Hazardous Locations

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DQ</b>
<b>Certification</b>	Hazardous Location, Class I, Division 2	<b>BR</b>
<b>Transducer Type</b>	Medium pipe, DTTR, 2.5 in. (65 mm) or larger	<b>RZ</b>
	Medium pipe, submersible DTTN, 2.5 in. (65 mm) or larger 1	<b>WZ</b>
	Large pipe, DTTL, 8 in. (200 mm) or larger	<b>LZ</b>
	Large pipe, submersible DTTL, 8 in. (200 mm) or larger 1	<b>YZ</b>
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Standard	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable/Conduit Length</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
<b>Hardware</b>	300 feet (90 m)	<b>EW</b>
	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
	M20 Threads, Poly cable glands	<b>C</b>
	M20 Threads, Nickel Plated Brass cable glands	<b>D</b>
<b>Endpoint Wiring Method</b>	M20 Threads, no cable glands	<b>A</b>
	None	<b>XX</b>

<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus BACnet/IP Ethernet	<b>V</b>
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated	<b>F</b>
	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup>Stainless steel tube ½" to 2". options are available.

<sup>2</sup>For hazardous location units, Remote Cable and Conduit Length codes must match

### Part number sequence

DQ	-	-	-	-	-	XX	-	-	-
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## 14.5 UTM20 Flow Meters for Pipes Larger than 2". for ATEX/EICEx Hazardous Locations

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DQ</b>
<b>Certification</b>	Hazardous Location, ATEX, IECEx	<b>V</b>
<b>Transducer Type</b>	Medium pipe, DTTR, 2.5 in. (65 mm) or larger	<b>RZ</b>
	Medium pipe, submersible DTTN, 2.5 in. (65 mm) or larger 1	<b>WZ</b>
	2.5 to 6" (65 to 150 mm) Easy Rail (not available with conduit)	<b>JZ</b>
	2.5 to 12" (65 to 300 mm) Easy Rail (not available with conduit)	<b>KZ</b>
	Large pipe, DTTL, 8 in. (200 mm) or larger	<b>LZ</b>
	Large pipe, submersible DTTL, 8 in. (200 mm) or larger 1	<b>YZ</b>
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Display and Keypad	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable Length</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
<b>Conduit Type and Length (Conduit length is less than or equal to cable length)</b>	None	<b>WW</b>
<b>Hardware</b>	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
	M20 Threads, Poly cable glands	<b>C</b>
	M20 Threads, Nickel Plated Brass cable glands	<b>D</b>
	M20 Threads, no cable glands	<b>A</b>
<b>Endpoint Wiring Method</b>	None	<b>XX</b>
<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus BACnet/IP Ethernet	<b>V</b>

### UTM20 Series Ultrasonic Transit-time Flowmeters

<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
	Factory Calibrated	<b>F</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup> Submersible transducer cables use two conduit openings. **Note:** Check for availability.

**Part number sequence**

DQ	-	-	-	-	-	-	XX	-	-	-
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## 14.6 UTM20 Energy Meters for Pipes 2" and Smaller

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DR</b>
<b>Certification</b>	General Area US/Canada, CE	<b>G</b>
<b>Transducer Type 1</b>	½" ANSI Pipe	<b>CA</b>
	¾" ANSI Pipe	<b>CB</b>
	1" ANSI Pipe	<b>CC</b>
	1¼" ANSI Pipe	<b>CD</b>
	1½" ANSI Pipe	<b>CE</b>
	2" ANSI Pipe	<b>CF</b>
	½" Copper Tube	<b>CG</b>
	¾" Copper Tube	<b>CH</b>
	1" Copper Tube	<b>CT</b>
	1¼" Copper Tube	<b>CJ</b>
	1½" Copper Tube	<b>CK</b>
	2" Copper Tube	<b>CL</b>
	Small pipe, universal, DTTSU (not available with conduit)	<b>UZ</b>
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Display and Keypad	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable Length</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
<b>Conduit Type and Length (Conduit length is less than or equal to cable length)</b>	None	<b>WW</b>
	5 feet (1.5 m)	<b>AA</b>
	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
<b>RTD Type</b>	Surface, Commercial	<b>C</b>
	None (user provided)	<b>X</b>

### UTM20 Series Ultrasonic Transit-time Flowmeters



<b>RTD Length</b>	15 feet	<b>AC</b>
	50 feet	<b>AK</b>
	100 feet	<b>BW</b>
	None (user provided)	<b>WW</b>
<b>Hardware</b>	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
<b>Endpoint Wiring Method</b>	None	<b>XX</b>
<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus BACnet/IP Ethernet	<b>V</b>
	Standard Output plus Auxiliary Dry Contact Output	<b>9</b>
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
<b>Units of Measure Energy Totalizer/Rate</b>	Kilowatt-hour/Watt (field selectable, additional options available)	<b>R</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated	<b>F</b>
	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup> Stainless steel tube ½" to 2". options are available.

### Part number sequence

<b>DR</b>	<b>G</b>	-	-	-	-	-	-	-	-	<b>XX</b>	-	-	-	-
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## 14.7 UTM20 Energy Meters for Pipes 2.5 in. and Larger

<b>Model</b>	UTM20 Ultrasonic Clamp-On Meter	<b>DR</b>
<b>Certification</b>	General Area US/Canada, CE	<b>G</b>
<b>Transducer Type</b>	Medium pipe, DTTR, 2.5 in. (65 mm) or larger	<b>RZ</b>
	Medium pipe, submersible DTTN, 2.5 in. (65 mm) or larger 1	<b>WZ</b>
	2.5 to 6" (65 to 150 mm) Easy Rail (not available with conduit)	<b>JZ</b>
	2.5 to 12" (65 to 300 mm) Easy Rail (not available with conduit)	<b>KZ</b>
	Medium pipe, high temperature (not available with conduit)	<b>HZ</b>
	Large pipe, DTTL, 8 in. (200 mm) or larger	<b>LZ</b>
	Large pipe, submersible DTTL, 8 in. (200 mm) or larger 1	<b>YZ</b>
<b>Transmitter Type</b>	110/220V AC Remote Mounted	<b>R</b>
	24 VDC/AC Remote Mounted	<b>B</b>
<b>Display</b>	Standard	<b>S</b>
	No Display/Keypad	<b>W</b>
<b>Remote Cable Length 2</b>	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
	300 feet (90 m)	<b>EW</b>
<b>Conduit Type and Length (Conduit length is less than or equal to cable length)</b>	None	<b>WW</b>
	5 feet (1.5 m)	<b>AA</b>
	15 feet (4.5 m)	<b>AC</b>
	30 feet (9 m)	<b>AF</b>
	50 feet (15 m)	<b>AK</b>
	75 feet (23 m)	<b>AR</b>
	100 feet (30 m)	<b>BW</b>
	150 feet (46 m)	<b>BK</b>
	200 feet (61 m)	<b>DW</b>
	250 feet (76 m)	<b>DK</b>
300 feet (90 m)	<b>EW</b>	

<b>RTD Type</b>	Surface, Commercial	<b>C</b>
	None (user provided)	<b>X</b>
<b>RTD Length</b>	15 feet (4.5 m)	<b>AC</b>
	50 feet (15 m)	<b>AK</b>
	100 feet (30 m)	<b>BW</b>
	None (user provided)	<b>WW</b>
<b>Hardware</b>	½" NPT Threads, Poly cable glands	<b>S</b>
	½" NPT Threads, Nickel Plated Brass cable glands	<b>T</b>
	½" NPT Threads, no cable glands	<b>N</b>
	M20 Threads, Poly cable glands	<b>C</b>
	M20 Threads, Nickel Plated Brass cable glands	<b>D</b>
	M20 Threads, no cable glands	<b>A</b>
<b>Endpoint Wiring Method</b>	None	<b>XX</b>
<b>Communication/Output</b>	Standard Output (Modbus RTU or BACnet MS/TP field selectable)	<b>S</b>
	Standard Output plus Modbus TCP Ethernet	<b>T</b>
	Standard Output plus Aux Output	<b>9</b>
<b>Units of Measure Totalizer/Flow Rate</b>	Gallons/gallons per minute (field selectable, additional options available)	<b>G</b>
<b>Units of Measure Energy Totalizer/Rate</b>	Kilowatt-hour/Kilowatt (field selectable, additional options available)	<b>R</b>
<b>Testing &amp; Tagging</b>	Factory Calibrated	<b>F</b>
	Factory Calibrated/Stainless Steel Tag	<b>S</b>

<sup>1</sup>Contact factory for DTTL cable lengths longer than 300 ft.  
<sup>2</sup>Submersible transducer cables use two conduit openings.

**Part number sequence**

<b>DR</b>	<b>G</b>	-	-	-	-	-	-	-	<b>XX</b>	-	-	-	-
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# 15. North American Pipe Schedules

**Table 8: Cast iron pipe, standard classes, 3 to 10 inch**

Size in.	Class in.	A	B	C	D	E	F	G	H				
3	OD	3.80	3.96	3.96	3.96								
	Wall	0.39	0.42	0.45	0.48								
	ID	3.02	3.12	3.06	3.00								
4	OD	4.80	5.00	5.00	5.00								
	Wall	0.42	0.45	0.48	0.52								
	ID	3.96	4.10	4.04	3.96								
6	OD	6.90	7.10	7.10	7.10					7.22	7.22	7.38	7.38
	Wall	0.44	0.48	0.51	0.55					0.58	0.61	0.65	0.69
	ID	6.02	6.14	6.08	6.00					6.06	6.00	6.08	6.00
8	OD	9.05	9.05	9.30	9.30	9.42	9.42	9.60	9.60				
	Wall	0.46	0.51	0.56	0.60	0.66	0.66	0.75	0.80				
	ID	8.13	8.03	8.18	8.10	8.10	8.10	8.10	8.00				
10	OD	11.10	11.10	11.40	11.40	11.60	11.60	11.84	11.84				
	Wall	0.50	0.57	0.62	0.68	0.74	0.80	0.86	0.92				
	ID	10.10	9.96	10.16	10.04	10.12	10.00	10.12	10.00				

**Table 9: Steel, stainless steel, PVC pipe, standard classes**

NPS	OD	SCH 60		X STG.		SCH 80		SCH 100		SCH 120/140		SCH 180					
in.	in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.				
1	1.315			0.957	0.179	0.957	0.179					0.815	0.250				
1.25	1.660			1.278	0.191	1.278	0.191					1.160	0.250				
1.5	1.900			1.500	0.200	1.500	0.200					1.338	0.281				
2	2.375			1.939	0.218	1.939	0.218					1.687	0.344				
2.5	2.875			2.323	0.276	2.323	0.276					2.125	0.375				
3	3.500			2.900	0.300	2.900	0.300					2.624	0.438				
3.5	4.000			3.364	0.318	3.364	0.318										
4	4.500			3.826	0.337	3.826	0.337							3.624	0.438	3.438	0.531
5	5.563			4.813	0.375	4.813	0.375							4.563	0.500	4.313	0.625
6	6.625			5.761	0.432	5.761	0.432							5.501	0.562	5.187	0.719
8	8.625	7.813	0.406	7.625	0.500	7.625	0.500	7.437	0.594	7.178	0.719	6.183	1.221				
10	10.75	9.750	0.500	9.75	0.500	9.562	0.594	9.312	0.719	9.062	0.844	8.500	1.125				

**Table 10: Steel, stainless steel, PVC pipe, standard classes (continued)**

NPS	OD	SCH 5		SCH 10 (Lt Wall)		SCH 20		SCH 30		STD		SCH 40	
		in.	in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.	ID in.	Wall in.
1	1.315	1.185	0.065	1.097	0.109	-	-	-	-	1.049	-	1.049	0.133
1.25	1.660	1.53	0.065	1.442	0.109					1.380		1.380	0.140
1.5	1.900	1.77	0.065	1.682	0.109					1.610		1.610	0.145
2	2.375	2.245	0.065	2.157	0.109					2.067		2.067	0.154
2.5	2.875	2.709	0.083	2.635	0.120					2.469		2.469	0.203
3	3.500	3.334	0.083	3.260	0.120					3.068		3.068	0.216
3.5	4.000	3.834	0.083	3.760	0.120					3.548		3.548	0.226
4	4.500	4.334	0.083	4.260	0.120					4.026	0.237	4.026	0.237
5	5.563	5.345	0.109	5.295	0.134					5.047	0.258	5.047	0.258
6	6.625	6.407	0.109	6.357	0.134					6.065	0.280	6.065	0.280
8	8.625	8.407	0.109	8.329	0.148	8.125	0.250	8.071	0.277	7.981	0.322	7.981	0.322
10	10.75	10.482	0.134	10.42	0.165	10.25	0.250	10.13	0.310	10.02	0.365	10.02	0.365

**Table 11: Copper tubing, copper and brass pipe, aluminum**

Nominal Diameter in.		Copper Tubing in.			Copper & Brass Pipe in.	Alum. in.
		Type				
		K	L	M		
0.5	OD	0.625	0.625	0.625	0.840	-
	Wall	0.049	0.040	0.028	0.108	
	ID	0.527	0.545	0.569	0.625	
0.625	OD	0.750	0.750	0.750	-	
	Wall	0.049	0.042	0.030		
	ID	0.652	0.666	0.690		
0.75	OD	0.875	0.875	0.875	1.050	
	Wall	0.065	0.045	0.032	0.114	
	ID	0.745	0.785	0.811	0.822	
1	OD	1.125	1.125	1.125	1.315	
	Wall	0.065	0.050	0.035	0.127	
	ID	0.995	1.025	1.055	1.062	
1.25	OD	1.375	1.375	1.375	1.660	
	Wall	0.065	0.055	0.042	0.146	
	ID	1.245	1.265	1.291	1.368	
1.5	OD	1.625	1.625	1.625	1.900	
	Wall	0.072	0.060	0.049	0.150	
	ID	1.481	1.505	1.527	1.600	
2	OD	2.125	2.125	2.125	2.375	
	Wall	0.083	0.070	0.058	0.157	
	ID	1.959	1.985	2.009	2.062	
2.5	OD	2.625	2.625	2.625	2.875	2.500
	Wall	0.095	0.080	0.065	0.188	0.050
	ID	2.435	2.465	2.495	2.500	2.400
3	OD	3.125	3.125	3.125	3.500	3.000
	Wall	0.109	0.090	0.072	0.219	0.050
	ID	2.907	2.945	2.981	3.062	2.900

**Table 11: Copper tubing, copper and brass pipe, aluminum (continued)**

Nominal Diameter in.		Copper Tubing in.			Copper & Brass Pipe in.	Alum. in.
		Type				
		K	L	M		
3-1/2	OD	3.625	3.625	3.625	4.000	-
	Wall	0.120	0.100	0.083	0.250	
	ID	3.385	3.425	3.459	3.500	
4	OD	4.125	4.125	4.125	4.500	4.000
	Wall	0.134	0.110	0.095	0.095	0.250
	ID	3.857	3.905	3.935	3.935	4.000
4-1/2	OD	-				5.000
	Wall					0.250
	ID					4.500
5	OD	5.125	5.125	5.125	5.563	5.000
	Wall	0.160	0.125	0.109	0.250	0.063
	ID	4.805	4.875	4.907	5.063	4.874
6	OD	6.125	6.125	6.125	6.625	6.000
	Wall	0.192	0.140	0.122	0.250	0.063
	ID	5.741	5.845	5.881	6.125	5.874
7	OD	-			7.625	7.000
	Wall				0.282	0.078
	ID				7.062	6.844
8	OD	8.125	8.125	8.125	8.625	8.000
	Wall	0.271	0.200	0.170	0.313	0.094
	ID	7.583	7.725	7.785	8.000	7.812
10	OD	10.125	10.125	10.125	10.000	-
	Wall	0.338	0.250	0.212	0.094	
	ID	9.449	9.625	9.701	9.812	

