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## SUPPORTED FEATURES

TFX-5000 meters include an EIA-485 port that is selectable for Modbus RTU or BACnet MS/TP protocol. The meter can be wired on a single daisy chain network and be queried for flow rate and totalizer readings along with diagnostic and other information.

For further information on the proper installation of the transmitter, see the TFX-5000 user manual.

EIA-485 port on the TFX-5000 automatically detects which lines are A and B for transmitting and receiving. The hardware automatically corrects for the RS485 negative and positive connections being swapped.

## WIRING

### RS485 Output

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

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

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

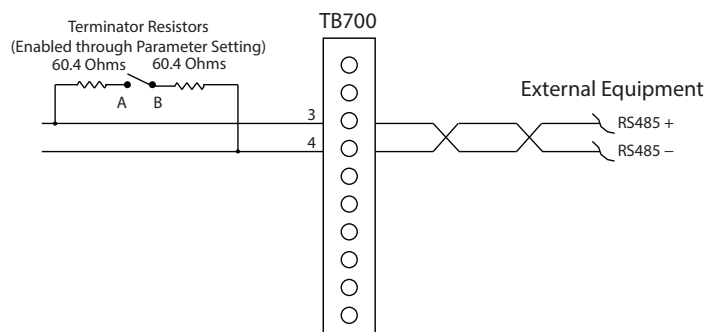


Figure 1: Typical RS485 interface

## COMMUNICATION SETTINGS

To set up the meter for Modbus RTU:

1. Go to Main Menu > System Setup > Communications menu.
2. Select Modbus RTU.
3. Set the address (1...127).
4. Check that the baud rate, parity, stop bits and word order (endian) match the master device.
5. Enable the terminating resistor if the meter is the last device in the network. TFX-5000 meters have a built-in resistor that can be selected through the communication setting.
6. Select the master timeout. TFX-5000 meters can display a warning when the master device does not send a packet within the specified time. Setting the master timeout to 0 disables the warning.
7. Select which parameters the master device can write to:
  - a. All coil outputs and read/write holding registers
  - b. Coil outputs only (resets)
  - c. None (read only).

## REGISTERS/STARTING ADDRESS

It is important to know whether the master device uses starting addresses or registers/coils as these numbers are offset by 1. For example, holding output coil 00001 is starting address 00 (hex).

### Function Codes

TFX-5000 transmitters support the following function codes, as applicable:

- 01 (0x01 hex) Read Coils
- 03 (0x03 hex) Read Holding Registers
- 04 (0x04 hex) Read Input Registers
- 05 (0x05 hex) Write Single Coil
- 06 (0x06 hex) Write Single Register
- 16 (0x10 hex) Write Multiple Registers

### Word Order/Endian

Each Modbus holding register represents a 16-bit integer value (2 bytes). The official Modbus standard defines Modbus as a 'big-endian' protocol where the most significant byte of a 16-bit value is sent before the least significant byte. For example, the 16-bit hex value of '1234' is transferred as '12'34'.

Beyond 16-bit values, the protocol itself does not specify how 32-bit (or larger) numbers that span over multiple registers should be handled. It is very common to transfer 32-bit values as pairs of two consecutive 16-bit registers in little-endian word order. For example, the 32-bit hex value of '12345678' is transferred as '56'78'12'34'. The register bytes are still sent in big-endian order per the Modbus protocol, but the 16-bit registers are sent in little-endian order. Alternatively, some devices store and transfer the Modbus registers in big-endian word order. For example, the 32-bit hex value of '12345678' is transferred as '12'34'56'78'.

As long as the transferring and receiving device transmit the data in the same manner, it does not matter in which order the words are sent. The word order is selectable in the TFX-5000 meter. This option is useful in applications where the Modbus master cannot be configured for endianness.

# MODBUS REGISTERS AND COILS

## Flow Meter Registers

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>READINGS</b>					
Flow Rate on Screen	Flow rate displayed on home screen. Unit is based on selection for home screen.	R	40001-40002	40601-40602	41201-41204
Velocity on Screen	Fluid velocity displayed on home screen. Unit is based on selection for home screen.	R	40003-40004	40603-40604	41205-41208
Delta Time Filtered (ns)	Time of flight difference between upstream and downstream used to calculate the flow rate. Units are nanoseconds.	R	40005-40006	40605-40606	41209-41212
Flow Rate (gal/min)	Flow rate in gallons/minute.	R	40201-40202	40801-40802	41401-41404
Velocity (ft/sec)	Fluid velocity in feet/second.	R	40203-40204	40803-40804	41405-41408
Flow Rate (l/min)	Flow rate in liters/minute.	R	40401-40402	41001-41002	41601-41604
Velocity (m/sec)	Fluid velocity in meters/second.	R	40403-40404	41003-41004	41605-41608
<b>TOTALS</b>					
Net Flow Totalizer (home screen units)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow. Unit is based on selection for home screen.	R	42001-42002	42301-42302	42601-42604
Positive Flow Totalizer (home screen units)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total. Unit is based on selection for home screen.	R	42003-42004	42303-42304	42605-42608
Negative Flow Totalizer (home screen units)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total. Unit is based on selection for home screen.	R	42005-42006	42305-42306	42609-42612
Gross Flow Totalizer (home screen units)	Total volume of forward and reverse flow. Unit is based on selection for home screen.	R	42007-42008	42307-42308	42613-42615
Flow Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42009-42010	—	—
Flow Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42011-42012	—	—
Flow Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42013-42014	—	—
Flow Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42015-42016	—	—
Net Flow Totalizer (gal)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	42101-42102	42401-42402	42701-42704
Positive Flow Totalizer (gal)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	42103-42104	42403-42404	42705-42708
Negative Flow Totalizer (gal)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	42105-42106	42405-42406	42709-42712
Gross Flow Totalizer (gal)	Total volume of forward and reverse flow.	R	42107-42108	42407-42408	42713-42716
Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42109-42110	—	—
Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42111-42112	—	—
Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42113-42114	—	—
Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42115-42116	—	—
Net Flow Totalizer (liters)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	42201-42202	42501-42502	42801-42804
Positive Flow Totalizer (liters)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	42203-42204	42503-42504	42805-42808
Negative Flow Totalizer (liters)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	42205-42206	42505-42506	42809-42812
Gross Flow Totalizer (liters)	Total volume of forward and reverse flow.	R	42207-42208	42507-42508	42813-42816

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>TOTALS (continued)</b>					
Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42209-42210	—	—
Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42211-42212	—	—
Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42213-42214	—	—
Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42215-42216	—	—
<b>HOME SCREEN UNITS</b>					
Flow Rate Units	Flow rate units on home screen as defined in parameter settings.	R	43001	—	—
Flow Rate Decimal	Number of digits after the decimal of flow rate on home screen. Use with long integer format.	R	43002	—	—
Velocity Units	Velocity units on home screen as defined in parameter settings.	R	43003	—	—
Flow Total Units	Total volume units on home screen as defined in parameter settings.	R	43004	—	—
Flow Total Decimal	Number of digits after the decimal of flow total on home screen. Use with long integer format.	R	43005	—	—
<b>SETUP</b>					
Low Flow Cutoff	Setting to display flow rate as zero & stop totalizing when flow rate goes below this value.	R/W	—	44001-44002	—
Low Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes below this value and trigger a low signal error message.	R/W	44003	—	—
High Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes above this value and trigger an oversaturate error message.	R/W	44004	—	—
<b>DIAGNOSTICS ALARMS</b>					
Active Failed Conditions	Message code corresponds to the bit (for example, F02 is bit 02).	R	45001-45007	—	—
Active Out of Specification Conditions	Message code corresponds to the bit (for example, S02 is bit 02).	R	45008-45014	—	—
Active Check Function Conditions	Message code corresponds to the bit (for example, C02 is bit 02).	R	45015-45021	—	—
Alarm History	Individual registers per buffer.	R	45033-45288 Array of 100 single registers	—	—
<b>DIAGNOSTICS</b>					
Signal Strength	Indicates the strength of the ultrasonic signal.	R	45501	—	—
Current Output #1 Source	Parameter assigned to Current Output #1. <sup>1</sup>	R	45601	—	—
Current Output #1	Current in mA of Current Output #1.	R	—	45602-45603	—
Output #1 Mode	Operation mode of Digital Output #1. <sup>1</sup>	R	45701	—	—
Output #1 Source	Parameter assigned to Digital Output #1. <sup>1</sup>	R	45702	—	—
Output #1 Status	Status of Digital Output #1. <sup>1</sup>	R	45703	—	—
Output #2 Mode	Operation mode of Digital Output #2. <sup>1</sup>	R	45704	—	—
Output #2 Source	Parameter assigned to Digital Output #2. <sup>1</sup>	R	45705	—	—
Output #2 Status	Status of Digital Output #2. <sup>1</sup>	R	45706	—	—
Aux Output Mode	Operation mode of Auxiliary Output. <sup>1,2</sup>	R	45801	—	—
Aux Output Source	Parameter assigned to Auxiliary Output. <sup>1,2</sup>	R	45802	—	—
Aux Output Status	Status of Digital Auxiliary. <sup>1,2</sup>	R	45803	—	—
Input Mode	Operation mode of Digital Input. <sup>1</sup>	R	45901	—	—
Input Active State	Indicates the voltage level to make the input active. <sup>1</sup>	R	45902	—	—
Input Status	Status of Digital Input. <sup>1</sup>	R	45903	—	—

<sup>1</sup> See “Enumerations” on page 12.<sup>2</sup> Use only if auxiliary output card is installed.

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>COMMUNICATION</b>					
Modbus Access	Modbus Access Type.	R	46001	—	—
Modbus Active Timeout	Defines the maximum time that master will poll the meter. If the meter does not see any communication from the master in the time specified, a message will trigger.	R/W	46002	—	—
Termination Resistor	Selection to enable or disable the internal termination resistor (RS485 devices only).	R/W	46003	—	—
<b>IDENTIFICATION</b>					
Tag Identification	String setting to identify the meter.	R	47001	—	—
Part Number	Part number of the meter. (String)	R	47065	—	—
Serial Number	Serial number of the meter. (String)	R	47129	—	—
Firmware Version	Firmware version of the meter. (String)	R	47193	—	—
Calibration Date	Date the meter was last calibrated at factory. (String)	R	47257	—	—
Date Code	Date the meter was manufactured. (String)	R	47321	—	—

## Coils

Descriptive Name	Description	Network Access	Coil
<b>ACTIONS</b>			
Reset Totalizers	Resets all flow totals in meter to zero. <sup>1</sup>	W	00001
Unlatch Alarms	Unlatches outputs in alarm latched state. <sup>1</sup>	W	00002
Clear Alarm History	Clears all errors, alarms and event codes from alarm history. <sup>1</sup>	W	00003
Reboot Device	Reboots the meter. <sup>1</sup>	W	00004

<sup>1</sup> See *"Enumerations"* on page 12.

## Energy Meter Registers

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>READINGS</b>					
Flow Rate on Screen	Flow rate displayed on home screen. Unit is based on selection for home screen.	R	40001-40002	40601-40602	41201-41204
Velocity on Screen	Fluid velocity displayed on home screen. Unit is based on selection for home screen.	R	40003-40004	40603-40604	41205-41208
Delta Time Filtered (ns)	Time of flight difference between upstream and downstream used to calculate the flow rate. Units are nanoseconds.	R	40005-40006	40605-40608	41209-41216
Energy/BTU Rate	Energy rate displayed on home screen. Unit is based on selection for home screen.	R	40009-40010	40609-40610	41217-41218
Temperature #1	Temperature #1 displayed on home screen. Unit is based on selection for home screen.	R	40011-40012	40611-40612	—
Temperature #2	Temperature #2 displayed on home screen. Unit is based on selection for home screen.	R	40013-40014	40613-40614	—
Delta Temperature	Delta temperature displayed on home screen. Order of operation and unit is based on selection for home screen.	R	40015-40016	40615-40616	—
Flow Rate (gal/min)	Flow rate in gallons/minute.	R	40201-40202	40801-40802	41401-41404
Velocity (ft/sec)	Fluid velocity in feet/second.	R	40203-40204	40803-40804	41405-41408
Energy Rate (kBTU)	Energy rate in kBTU.	R	40205-40306	40805-40806	41409-41412
Flow Rate (l/min)	Flow rate in liters/minute.	R	40401-40402	41001-41002	41601-41604
Velocity (m/sec)	Fluid velocity in meters/second.	R	40403-40404	41003-41004	41605-41608
Energy Rate (kWH)	Energy rate in kWH.	R	40405-40406	41005-41006	41609-41612
<b>TOTALS</b>					
Net Flow Totalizer (home screen units)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow. Unit is based on selection for home screen.	R	42001-42002	42301-42302	42601-42604
Positive Flow Totalizer (home screen units)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total. Unit is based on selection for home screen.	R	42003-42004	42303-42304	42605-42608
Negative Flow Totalizer (home screen units)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total. Unit is based on selection for home screen.	R	42005-42006	42305-42306	42609-42612
Gross Flow Totalizer (home screen units)	Total volume of forward and reverse flow. Unit is based on selection for home screen.	R	42007-42008	42307-42308	42613-42616
Flow Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42009-42010	—	—
Flow Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42011-42012	—	—
Flow Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42013-42014	—	—
Flow Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42015-42016	—	—
Energy/BTU Net Total (home screen units)	Total energy as positive energy rate minus negative energy rate. A negative total results when reverse flow is greater than positive energy rate. Unit is based on selection for home screen.	R	42017-42018	42317-42318	42633-42636
Energy/BTU Positive Total (home screen units)	Total energy of flow in forward direction, such as heating. Negative energy rate is not accounted for in the total. Unit is based on selection for home screen.	R	42019-42020	42319-42320	42637-42640
Energy/BTU Negative Total (home screen units)	Total energy of flow in reverse direction, such as cooling. Positive energy rate is not accounted for in the total. Unit is based on selection for home screen.	R	42021-42022	42321-42322	42641-42644
Energy/BTU Gross Total (home screen units)	Total energy of forward and negative energy rate (all energy to heat and cool). Unit is based on selection for home screen.	R	42023-42024	42323-42324	42645-42648
Energy/BTU Totalizer Overflow Counter (Net)	Number of times the net energy total overruns.	R	42025-42026	—	—
Energy/BTU Totalizer Overflow Counter (Positive)	Number of times the positive energy total overruns.	R	42027-42028	—	—
Energy/BTU Totalizer Overflow Counter (Negative)	Number of times the negative energy total overruns.	R	42029-42030	—	—



Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>TOTALS (continued)</b>					
Energy/BTU Totalizer Overflow Counter (Gross)	Number of times the gross energy total overruns.	R	42031-42032	—	—
Net Flow Totalizer (gal)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	42101-42102	42401-42402	42701-42704
Positive Flow Totalizer (gal)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	42103-42104	42403-42404	42705-42708
Negative Flow Totalizer (gal)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	42105-42106	42405-42406	42709-42712
Gross Flow Totalizer (gal)	Total volume of forward and reverse flow.	R	42107-42108	42407-42408	42713-42716
Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42109-42110	—	—
Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42111-42112	—	—
Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42113-42114	—	—
Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42115-42116	—	—
Energy/BTU Net Total (kBTU)	Total energy as positive energy rate minus negative energy rate. A negative total results when reverse flow is greater than positive energy rate.	R	42117-42118	42417-42418	42733-42736
Energy/BTU Positive Total (kBTU)	Total energy of flow in forward direction, such as heating. Negative energy rate is not accounted for in the total.	R	42119-42120	42419-42420	42737-42740
Energy/BTU Negative Total (kBTU)	Total energy of flow in reverse direction, such as cooling. Positive energy rate is not accounted for in the total.	R	42121-42122	42421-42422	42741-42744
Energy/BTU Gross Total (kBTU)	Total energy of forward and negative energy rate (all energy to heat and cool).	R	42123-42124	42423-42424	42745-42748
Net kBTU Totalizer Overflow Counter	Number of times the net energy total overruns.	R	42125-42126	—	—
Positive kBTU Totalizer Overflow Counter	Number of times the positive energy total overruns.	R	42127-42128	—	—
Negative kBTU Totalizer Overflow Counter	Number of times the negative energy total overruns.	R	42129-42130	—	—
Gross kBTU Totalizer Overflow Counter	Number of times the gross energy total overruns.	R	42131-42132	—	—
Net Flow Totalizer (liters)	Total volume as forward flow minus reverse flow. A negative total results when reverse flow is greater than forward flow.	R	42201-42202	42501-42502	42801-42804
Positive Flow Totalizer (liters)	Total volume of flow in forward direction. Reverse flow is not accounted for in the total.	R	42203-42204	42503-42504	42805-42808
Negative Flow Totalizer (liters)	Total volume of flow in reverse direction. Forward flow is not accounted for in the total.	R	42205-42206	42505-42506	42809-42812
Gross Flow Totalizer (liters)	Total volume of forward and reverse flow.	R	42207-42208	42507-42508	42813-42816
Totalizer Overflow Counter (Net)	Number of times the net flow total overruns.	R	42209-42210	—	—
Totalizer Overflow Counter (Positive)	Number of times the positive flow total overruns.	R	42211-42212	—	—
Totalizer Overflow Counter (Negative)	Number of times the negative flow total overruns.	R	42213-42214	—	—
Totalizer Overflow Counter (Gross)	Number of times the gross flow total overruns.	R	42215-42216	—	—
Energy Net Total (kWh)	Total energy as positive energy rate minus negative energy rate. A negative total results when reverse flow is greater than positive energy rate.	R	42217-42218	42517-42518	42833-42836
Energy Positive Total (kWh)	Total energy of flow in forward direction, such as heating. Negative energy rate is not accounted for in the total.	R	42219-42220	42519-42520	42837-42840
Energy Negative Total (kWh)	Total energy of flow in reverse direction, such as cooling. Positive energy rate is not accounted for in the total.	R	42221-42222	42521-42522	42841-42844
Energy Gross Total (kWh)	Total energy of forward and negative energy rate (all energy to heat and cool).	R	42223-42224	42523-42524	42845-42848

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>TOTALS (continued)</b>					
Net kWh Totalizer Overflow Counter	Number of times the net energy total overruns.	R	42225-42226	—	—
Positive kWh Totalizer Overflow Counter	Number of times the positive energy total overruns.	R	42227-42228	—	—
Negative kWh Totalizer Overflow Counter	Number of times the negative energy total overruns.	R	42229-42230	—	—
Gross kWh Totalizer Overflow Counter	Number of times the gross energy total overruns.	R	42231-42232	—	—
<b>HOME SCREEN UNITS</b>					
Flow Rate Units	Flow rate units on home screen as defined in parameter settings. <sup>1</sup>	R	43001	—	—
Flow Rate Decimal	Number of digits after the decimal of flow rate on home screen. Use with long integer format.	R	43002	—	—
Velocity Units	Velocity units on home screen as defined in parameter settings. <sup>1</sup>	R	43003	—	—
Flow Total Units	Total volume units on home screen as defined in parameter settings. <sup>1</sup>	R	43004	—	—
Flow Total Decimal	Number of digits after the decimal of flow total on home screen. Use with long integer format.	R	43005	—	—
Energy Rate Units	Energy rate units on home screen as defined in parameter settings. <sup>1</sup>	R	43006	—	—
Energy Rate Decimal	Number of digits after the decimal of energy rate on home screen. Use with long integer format.	R	43007	—	—
Temperature Units	Temperature units on home screen as defined in parameter settings. <sup>1</sup>	R	43008	—	—
Energy Total Units	Energy total units on home screen as defined in parameter settings. <sup>1</sup>	R	43009	—	—
Energy Total Decimal	Number of digits after the decimal of energy total on home screen. Use with long integer format.	R	43010	—	—
<b>SETUP</b>					
Low Flow Cutoff	Setting to display flow rate as zero & stop totalizing when flow rate goes below this value.	R/W	—	44001	—
Low Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes below this value and trigger a low signal error message.	R/W	44003	—	—
High Signal Cutoff	Setting to display flow rate as zero & stop totalizing when signal strength goes above this value and trigger an oversaturate error message.	R/W	44004	—	—
<b>DIAGNOSTICS ALARMS</b>					
Active Failed Conditions	Message code corresponds to the bit (for example, F02 is bit 02).	R	45001-45007	—	—
Active Out of Specification Conditions	Message code corresponds to the bit (for example, S02 is bit 02).	R	45008-45014	—	—
Active Check Function Conditions	Message code corresponds to the bit (for example, C02 is bit 02).	R	45015-45021	—	—
Alarm History	Individual registers per buffer.	R	45033 Array of 100 single registers	—	—

<sup>1</sup> See “Enumerations” on page 12.

Descriptive Name	Description	Network Access	Integer and Long Integer	Single Precision 32-bit floating point	Double Precision 64-bit floating point
<b>DIAGNOSTICS</b>					
Signal Strength	Indicates the strength of the ultrasonic signal.	R	45501	—	—
Current Output #1 Source	Parameter assigned to Current Output #1. <sup>1</sup>	R	45601	—	—
Current Output #1	Current in mA of Current Output #1.	R	—	45602-45603	—
Current Output #2 Source	Parameter assigned to Current Output #2. <sup>1</sup>	R	45604	—	—
Current Output #2	Current in mA of Current Output #2.	R	—	45605-45606	—
Current Output #3 Source	Parameter assigned to Current Output #3.	R	45607	—	—
Current Output #3	Current in mA of Current Output #3. <sup>1</sup>	R	—	45608-45609	—
Output #1 Mode	Operation mode of Digital Output #1. <sup>1</sup>	R	45701	—	—
Output #1 Source	Parameter assigned to Digital Output #1. <sup>1</sup>	R	45702	—	—
Output #1 Status	Status of Digital Output #1. <sup>1</sup>	R	45703	—	—
Output #2 Mode	Operation mode of Digital Output #2. <sup>1</sup>	R	45704	—	—
Output #2 Source	Parameter assigned to Digital Output #2. <sup>1</sup>	R	45705	—	—
Output #2 Status	Status of Digital Output #2. <sup>1</sup>	R	45706	—	—
Output #3 Mode	Operation mode of Digital Output #3. <sup>1</sup>	R	45707	—	—
Output #3 Source	Parameter assigned to Digital Output #3. <sup>1</sup>	R	45708	—	—
Output #3 Status	Status of Digital Output #3. <sup>1</sup>	R	45709	—	—
Aux Output #1 Mode	Operation mode of Auxiliary Output #1. <sup>1,2</sup>	R	45710	—	—
Aux Output #1 Source	Parameter assigned to Auxiliary Output #1. <sup>1,2</sup>	R	45711	—	—
Aux Output #1 Status	Status of Digital Auxiliary #1. <sup>1,2</sup>	R	45712	—	—
Aux Output #2 Mode	Operation mode of Auxiliary Output #2. <sup>1,2</sup>	R	45713	—	—
Aux Output #2 Source	Parameter assigned to Auxiliary Output #2. <sup>1,2</sup>	R	45714	—	—
Aux Output #2 Status	Status of Digital Auxiliary #2. <sup>1,2</sup>	R	45715	—	—
Input Mode	Operation mode of Digital Input. <sup>1</sup>	R	45901	—	—
Input Active State	Indicates the voltage level to make the input active. <sup>1</sup>	R	45902	—	—
Input Status	Status of Digital Input. <sup>1</sup>	R	45903	—	—
<b>COMMUNICATION</b>					
Modbus Access	Modbus Access Type.	R	46001	—	—
Modbus Active Timeout	Defines the maximum time that master will poll the meter. If the meter does not see any communication from the master in the time specified, a message will trigger.	R/W	46002	—	—
Termination Resistor	Selection to enable or disable the internal termination resistor (RS485 devices only). <sup>1</sup>	R/W	46003	—	—
<b>IDENTIFICATION</b>					
Tag Identification	String setting to identify the meter. (String)	R	47001	—	—
Part Number	Part number of the meter. (String)	R	47065	—	—
Serial Number	Serial number of the meter. (String)	R	47129	—	—
Firmware Version	Firmware version of the meter. (String)	R	47193	—	—
Calibration Date	Date the meter was last calibrated at factory. (String)	R	47257	—	—
Date Code	Date the meter was manufactured. (String)	R	47321	—	—

<sup>1</sup> See “Enumerations” on page 12.

<sup>2</sup> Use only if auxiliary output card is installed.

## Coils

Descriptive Name	Description	Network Access	Coil
<b>ACTIONS</b>			
Reset Totalizers	Resets all flow totals in meter to zero. <sup>1</sup>	W	00001
Unlatch Alarms	Unlatches outputs in alarm latched state. <sup>1</sup>	W	00002
Clear Alarm History	Clears all errors, alarms and event codes from alarm history. <sup>1</sup>	W	00003
Reboot Device	Reboots the meter. <sup>1</sup>	W	00004

<sup>1</sup> See “Enumerations” on page 12.

## ENUMERATIONS

Parameter	Enumeration	Value
<b>UNITS OF MEASURE</b>		
Flow Rate Units	Liters per second	0
	Liters per minute	1
	Liters per hour	2
	Cubic meters per second	3
	Cubic meters per minute	4
	Cubic meters per hour	5
	Cubic feet per second	6
	Cubic feet per minute	7
	Cubic feet per hour	8
	Gallons per second	9
	Gallons per minute	10
	Gallons per hour	11
	Mega gallons per day	12
	United Kingdom gallons per second	13
	United Kingdom gallons per minute	14
	United Kingdom gallons per hour	15
	Barrels per minute	18
	Mega United Kingdom gallons per day	19
	Barrels per day	20
	Acre feet per day	21
	Fluid barrels per day	22
	Imperial barrels per day	23
	Custom flow rate	24
Velocity Units	Meters per second	0
	Feet per hour	11
Flow Total Units	Liters	0
	Hectoliters	1
	Cubic meters	2
	Cubic feet	3
	Gallons	4
	Mega gallons	5
	United Kingdom gallons	6
	Acre feet	9
	Oil barrel	10
	Mega United Kingdom gallons	11
	Liquid barrel	12
	Feet	13
	Meters	14
	Kilograms	15
	Custom	16
Energy Rate Units	Custom	0
	Watts	1 - W
	Kilowatts	2 - kW
	Mega Watts	3 - mW
	British thermal units per hour	4 - btu/h
	Thousand British thermal units per hour	5 - kbtu/h
	Million British thermal units per hour	6 - mbtu/h
	KiloJoule per hour	7 - kJ/h
	Mega Joule per hour	8 - MJ/h
	Kilocalorie per hour	9 - kcal/h
Temperature Units	Degrees Celsius	0
	Degrees Fahrenheit	1
	Degrees Kelvin	2
Energy Total Units	Custom	0
	British thermal units	1
	Thousand British thermal units	2
	Million British thermal units	4
	Ton	5
	KiloJoule	6
	Mega Joule	7
	Kilowatt hours	8
	Mega kilowatt hours	9
	Thousand calories	10
	Mega calories	11

Parameter	Enumeration	Value
<b>INPUTS/OUTPUTS</b>		
Current Output Source	Disabled	0
	Flow rate	1
	Velocity	2
	Signal strength	3
	Temperature 1 (Energy models only)	4
	Temperature 2 (Energy models only)	5
	Energy rate (Energy models only)	6
	Test mode	7
Digital Output Mode	Disabled	0
	Frequency	1
	Pulse totalizer	2
	Direction status	3
	Mode alarm	4
Digital Output Source	Disabled	0
	Flow rate	1
	Velocity	2
	Test mode	3
Digital Output Status	Energy rate (Energy models only)	4
	Off	0
	On	1
	Frequency	2
	Pulse	3
Aux Output Mode	Disabled	4
	Disabled	0
	Pulse totalizer	2
	Direction status	3
Aux Output Source	Mode alarm	4
	Disabled	0
	Flow rate	1
	Velocity	2
Aux Output Status	Test mode	3
	Energy rate (Energy models only)	4
	Off	0
	On	1
Input Mode	Pulse	3
	Disabled	4
	Disabled	0
	Reset flow total	1
Input Active State	Unlatch alarm	2
	Active high	0
Input Status	Active low	1
	Inactive	0
	Active	1
<b>COMMUNICATION</b>		
Termination Resistor	Disabled	0
	Enabled	1
<b>ACTIONS</b>		
Reset Totalizers	Disabled	0
	Enabled	1
Unlatch Alarms	Disabled	0
	Enabled	1
Clear Alarm History	Disabled	0
	Enabled	1
Reboot Device	Disabled	0
	Enabled	1

## WARNING AND ALARM MESSAGE CODES

### Failure Codes

**NOTE:** F01 indicates that the bootloader could not start the firmware application, so it is not possible to record this failure in the alarm history.

Code	Description
F02 ELECTRONIC ERROR	Multiple watchdog timeouts occurred.
F03 ELECTRONIC ERROR	Voltage levels are out of specification.
F10 LOW SIGNAL	Signal strength is below cutoff.
F11 HIGH SIGNAL	Signal strength is oversaturated.
F20 RTD #1 ERROR	Unable to detect RTD #1.
F21 RTD #2 ERROR	Unable to detect RTD #2.

### Check Function Codes

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

## Out-of-Specification Codes

Code	Description	Correction
S01 ELECTRONIC WARNING	Fault detected and meter rebooted.	Contact factory, update firmware, or repair or replace transmitter.
S02 DEFAULT FAILED	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 <i>Home Screen</i> and continue to operate (if the reset to factory defaults is through the transmitter).
S03 LANGUAGE FILE CORRUPT	English only.	Update firmware.
S10 mA TOO HIGH	Flow or energy rate higher than flow rate at 20 mA output.	Check the scaling of the Current #1 output.
S11 mA TOO HIGH	Flow or energy rate higher than 20 mA.	Check the scaling of the Current #2 output.
S12 mA TOO HIGH	Flow or energy rate higher than 20 mA.	Check the scaling of the HART output.
S19 mA SUPPLY VOLTAGE ERR	Supply voltage out of range for 4-20 mA outputs.	Check wiring.
S20 FREQ HIGH	Value higher than max. frequency output.	Check the scaling of the frequency on Output #1.
S21 FREQ HIGH	Value higher than max. frequency output.	Check the scaling of the frequency on Output #2.
S22 FREQ HIGH	Value higher than max. frequency output.	Check the scaling of the frequency on Output #3.
S30 PULSE HIGH	Pulse output is too fast for the pulse width.	Check the scaling factor, units and pulse width of the pulse on Output #1.
S31 PULSE HIGH	Pulse output is too fast for the pulse width.	Check the scaling factor, units and pulse width of the pulse on Output #2.
S32 PULSE HIGH	Pulse output is too fast for the pulse width.	Check the scaling factor, units and pulse width of the pulse on Output #3.
S33 PULSE HIGH	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.
S34 PULSE HIGH	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.
S40 HIGH FLOW	Flow rate is above high flow alarm setting.	Check flow rate and Set High setting for Output #1.
S41 HIGH FLOW	Flow rate is above high flow alarm setting.	Check flow rate and Set High setting for Output #2.
S42 HIGH FLOW	Flow rate is above high flow alarm setting.	Check flow rate and Set High setting for Output #3.
S43 HIGH FLOW	Flow rate is above high flow alarm setting.	Check flow rate and Set High setting for Aux Output #1.
S44 HIGH FLOW	Flow rate is above high flow alarm setting.	Check flow rate and Set High setting for Aux Output #2.
S45 LOW FLOW	Flow rate is below low flow alarm setting.	Check flow rate and Set Low setting for Output #1.
S46 LOW FLOW	Flow rate is below low flow alarm setting.	Check flow rate and Set Low setting for Output #2.
S47 LOW FLOW	Flow rate is below low flow alarm setting.	Check flow rate and Set Low setting for Output #3.
S48 LOW FLOW	Flow rate is below low flow alarm setting.	Check flow rate and Set Low setting for Aux Output #1.
S49 LOW FLOW	Flow rate is below low flow alarm setting.	Check flow rate and Set Low setting for Aux Output #2.
S50 TOTAL OVERFLOW	Accumulated flow total is greater than viewable digits.	Check the totalizer units or reset the flow total to clear the overflow counter.
S60 COMM TIMEOUT	Modbus master or BACnet device communication packet.	Check master device poll rate and offline status. Check wiring and termination resistor setting.
S61 MODULE TIMEOUT	Network timeout.	Check communication settings and wiring.
S62 DISCONNECTED	Bluetooth connection timed out.	—
S63 BLUETOOTH FAIL	Unable to initialize Bluetooth.	Update firmware. If error repeats, repair or replace transmitter.
S64 MODULE FAILED	Unable to initialize module.	Reseat module and reboot transmitter. If error repeats, replace module.
S65 MODULE MISMATCH	Module installed does not match settings.	Replace module with correct module. Check card type settings.
S67 DATA LOG ERROR	SD micro card is missing or full.	Check SD micro card. If data logging is not required, disable data logging.
S70 TEMP #1 LOW	Temp. #1 is below low alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #1.
S71 TEMP #1 LOW	Temp. #1 is below low alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #2.
S72 TEMP #1 LOW	Temp. #1 is below low alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #3.
S73 TEMP #2 LOW	Temp. #1 is below low alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Aux Output #1.
S74 TEMP #2 LOW	Temp. #1 is below low alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Aux Output #2.
S75 TEMP #1 HIGH	Temp. #1 is above high alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #1.
S76 TEMP #1 HIGH	Temp. #1 is above high alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #2.
S77 TEMP #1 HIGH	Temp. #1 is above high alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Output #3.
S78 TEMP #1 HIGH	Temp. #1 is above high alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Aux Output #1.
S79 TEMP #1 HIGH	Temp. #1 is above high alarm setting.	Check fluid temperature and RTD #1. Check alarm settings for Aux Output #2.
S80 HIGH ENERGY RATE	Flow rate is above high flow alarm setting.	Check energy flow rate and Set High setting for Output #1.
S81 HIGH ENERGY RATE	Flow rate is above high flow alarm setting.	Check energy flow rate and Set High setting for Output #2.
S82 HIGH ENERGY RATE	Flow rate is above high flow alarm setting.	Check energy flow rate and Set High setting for Output #3.
S83 HIGH ENERGY RATE	Flow rate is above high flow alarm setting.	Check energy flow rate and Set High setting for Aux Output #1.
S84 HIGH ENERGY RATE	Flow rate is above high flow alarm setting.	Check energy flow rate and Set High setting for Aux Output #2.
S85 LOW ENERGY RATE	Flow rate is above low flow alarm setting.	Check energy flow rate and Set Low setting for Output #1.
S86 LOW ENERGY RATE	Flow rate is above low flow alarm setting.	Check energy flow rate and Set Low setting for Output #2.
S87 LOW ENERGY RATE	Flow rate is above low flow alarm setting.	Check energy flow rate and Set Low setting for Output #3.
S88 LOW ENERGY RATE	Flow rate is above low flow alarm setting.	Check energy flow rate and Set Low setting for Aux Output #1.
S89 LOW ENERGY RATE	Flow rate is above low flow alarm setting.	Check energy flow rate and Set Low setting for Aux Output #2.
S90 TEMP #2 LOW	Temp. #2 is below low alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #1.
S91 TEMP #2 LOW	Temp. #2 is below low alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #2.
S92 TEMP #2 LOW	Temp. #2 is below low alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #3.

Code	Description	Correction
S93 TEMP #2 LOW	Temp. #2 is below low alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Aux Output #1.
S94 TEMP #2 LOW	Temp. #2 is below low alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Aux Output #2.
S95 TEMP #2 HIGH	Temp. #2 is above high alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #1.
S96 TEMP #2 HIGH	Temp. #2 is above high alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #2.
S97 TEMP #2 HIGH	Temp. #2 is above high alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Output #3.
S98 TEMP #2 HIGH	Temp. #2 is above high alarm setting.	Check fluid temperature and RTD #2. Check alarm settings for Aux Output #1.
S99 TEMP #2 HIGH	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*.

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



## TROUBLESHOOTING

Code	Description	Recommended Action
S60 MODBUS TIMEOUT Modbus master device communication packet.	Check master device poll rate and offline status.	Check the recommended actions listed for no communication symptom. If the master device communicates less frequently, change the Master Timeout to a larger time period.

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

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