

# TRICON<sup>®</sup>/E/E2/E3 Transmitter Installation and Maintenance Guide



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### TRICON/E/E2/E3 INSTALLATION AND MAINTENANCE GUIDE

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## CHAPTER 1 OVERVIEW

The TRICON® transmitter provides an electronic interface to Neptune water meters, enabling customers to monitor their water usage and control various processes based on that usage. The TRICON transmitter is available in two styles: Digital Pulse and Analog 4-20mA.

### TRANSMITTER STYLES

#### Digital Pulse

The original Digital Pulse model is a 3-terminal transmitter which outputs electrical pulses at a rate corresponding to the rate of flow through the meter. It requires 12-24VDC operating power and is intended for use in applications requiring only a digital signal.

The TRICON/E2 and TRICON/E<sup>®</sup>3 Digital Pulse models are 5-terminal transmitters which have the same features as the original Digital Pulse model plus two additional terminals (High Resolution Output and Count Direction) for connection to a high-speed, bi-directional counter. It requires 12-24VDC operating power, and is intended for use in applications requiring a high resolution digital signal.

#### Analog 4-20mA

The Analog 4-20mA model is a 5-terminal transmitter which has the same features as the original Digital Pulse model, plus two additional terminals for a 4-20mA output that is proportional to the rate of flow through the meter. It requires 24VDC operating power, and is intended for use in applications requiring analog and/or digital signals.

### USAGE

All models are designed to be mounted between the meter maincase and a totalizing register, and they do not affect the normal operation of either the meter or the register. When used with a SmartTrol® controller or other third-party instrumentation equipment, both models allow monitoring and/or controlling complex metering systems. The Digital Pulse model TRICON/E transmitters are produced in only two styles: Disc and Turbine, for use with ALL Neptune disc meters or ALL Neptune turbine meters, respectively. The Analog 4-20mA model TRICON/E transmitters, however, are manufactured specifically for the size and type of meter with which they are to be used. For this reason, special care should be taken to ensure that you have the proper Analog 4-20mA model TRICON/E required for your application. Contact Neptune for technical assistance, if necessary.

### CONTACTING CUSTOMER SUPPORT

If you encounter any problems with the installation or operation of your TRICON, please call Neptune Customer Support at (800) 647-4832.

## CHAPTER 2 INSTALLING THE TRANSMITTER

This chapter is designed to take you through the installation process for the TRICON transmitter.

### TOOLS AND MATERIALS

The following equipment is required for the installation:

- medium, flat-head screwdriver
- wire stripper
- hammer
- small (1/8") diameter punch, or similar tool
- multi-conductor, solid, #22 AWG, copper cable
- Dow Corning® #4, or equivalent compound (optional)

### PREPARATION

Be sure to review the following sections before beginning the installation.

#### Inspection and Storage

Remove the assembly parts from the parts bag and inspect them for any damage. The transmitter arrives partially assembled, with the terminal cover and mounting ring being the only separate parts. Once the inspection is complete, store the cartons in a clean, dry environment. The temperature should remain between -40° and 185°F (-40° and 85°C).

#### Safety and Preliminary Checks

Always follow your local electrical and safety codes, and observe the following guidelines for running wire between your TRICON/E transmitter and the receiving device.

- Avoid installing your TRICON/E instrumentation wiring near sources of electrical noise, such as:
  - contactors, motor starters, and relays
  - radio transmitters and antennas
  - high-voltage power wiring and transformers
- Whenever possible, separate your instrumentation wiring from other wiring by using a separate metal conduit or metal wire tray.
- Use the minimum length of cable required for the installation and cut off any excess. Do not coil excess wire.



For longer runs (1,000' maximum) use #22 AWG shielded twisted pair cable for signal connections, and tie the shield to ground at the receiving device, not at the TRICON/E transmitter.

- When forced to cross other wiring, cross at right angles to minimize noise coupling between wiring.
- Use a dedicated power source, such as a separate circuit breaker or isolation transformer, for all instrumentation equipment to reduce the effects of electrical noise from other equipment on the line.
- Ensure proper earth ground is available and installed in compliance with local electrical codes.

## INSTALLATION

### Wiring the Transmitter

Follow this procedure to wire the transmitter.

- 1 Locate the terminal cover and remove the cover screw.
- 2 Lift the terminal cover from the transmitter.

Refer to Figure 2.1.

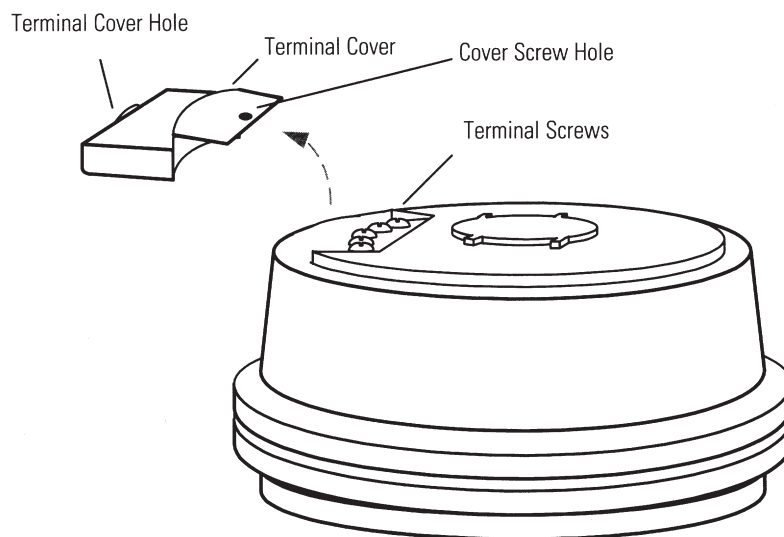


Figure 2.1 Elements of the Transmitter

- 3 Insert the end of the multi-conductor cable through the hole in the terminal cover as shown in Figure 2.2.

Move the cover far enough down the cable to allow you to work with the end that you just inserted.

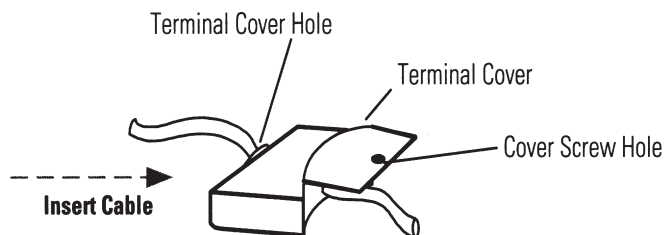


Figure 2.2 Inserting Multi-Conductor Cable

- 4 Strip the outer covering of the cable back approximately 1½" from the inserted end.
- 5 Separate the individual conductors and strip the insulation back approximately ½" from the end of each conductor.
- 6 Using the rounded shaft of the screwdriver, form a hook in the end of each bare copper wire. (See Figure 2.3.)



Figure 2.3 Creating a Hook in the Wire

- 7 Loosen the terminal screws, as shown in Figure 2.4.

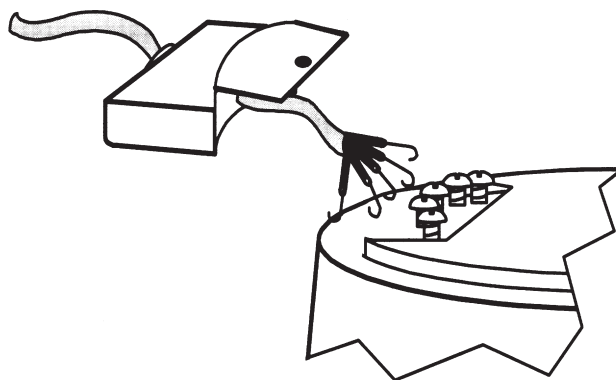


Figure 2.4 Connecting the Conductors to the Terminal Screws

- 8 Position the wire hook of each conductor under the proper terminal screw according to the appropriate wiring diagram.

Refer to Figure 2.5 and Table 2.1 for the wiring diagram.



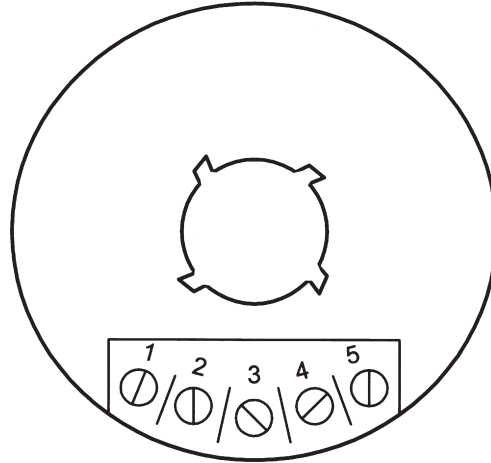


Figure 2.5 TRICON/E/E2/E3 Wiring

Table 2.1 TRICON E/E2/E3 Wiring Codes

PIN #	TRICON/E DIGITAL PULSE (PRIOR TO 1/96)	TRICON/E2 & E3 MODEL DIGITAL PULSE MODEL (AFTER 1/96)	TRICON/E, E2 & TRICON/E3 4-20MA MODELS
1	No Connection	High Resolution Output	4-20mA Source (+) <sup>1</sup>
2	No Connection	Count Direction <sup>2</sup>	4-20mA Return (-)
3	12-24VDC Power In (+)	12-24VDC Power In	24VDC Power In (+)
4	Common Ground (- side)	Common Ground (- side)	Common Ground (- side)
5	Pulse Output	Pulse Output	Pulse Output

<sup>1</sup>The (+) indicates conventional current exiting the TRICON.

<sup>2</sup>This connection is a contact closure to ground and requires DC power to be supplied through a pull-up resistor. Typical pull-up resistor values are 2K per 5 volts of the DC voltage.

- 9 Place each wire hook so that it runs in a clockwise direction around the screw terminal, with no insulation under the screw head.
- 10 Use the tip of the screwdriver to close the hooks around the terminal screws and tighten the screws until snug.



Take care not to overtighten the terminal screws when completing the wiring.

### Testing the Wires

After wiring the transmitter, double-check to ensure it is wired correctly. Apply power to the TRICON transmitter and check the output signals as follows:

- At **No Flow** – there should be no pulses out of the digital output terminal, and a 4mA direct current should be present in the 4-20mA loop.
- At **1/2 Flow** – the pulse rate out of the digital output terminal should be ½ the maximum pulse rate, and a 12mA direct current should be present in the 4-20mA loop.
- At **Maximum Flow** – the pulse rate out of the digital output terminal should be equal to the maximum pulse rate, and a 20mA direct current should be present in the 4-20mA loop.

### Final Assembly

Once testing is complete, the transmitter is ready for the final steps of the assembly process.

- 1 Shut off all power to the TRICON.
- 2 Place a generous amount of Dow Corning #4 on all exposed wire and terminals.
- 3 Fill the inside of the terminal cover with the moisture compound.
- 4 Slide the terminal cover in place over the terminal screws.
- 5 Fasten the terminal cover with the cover screw and tighten until snug.



Take care not to overtighten the cover screw when securing the terminal cover.

- 6 Snap the strain relief fitting over the cable and push it into place in the cable entry hole.
- 7 Wipe away any excess compound.

### Mounting the Transmitter

Once the transmitter has been assembled, it is ready to be mounted. If you are installing a TRICON transmitter on a meter that does not already have a register mounted on it, skip to step 4. If the meter does have a register mounted, begin at step 1.

- 1 Position the small end of the punch on the center of the seal pin at the base of the register.
- 2 Using the hammer, drive the punch through the center of the seal pin. The head of the pin should shear off.

Refer to Figure 2.6 for assistance with the following steps.

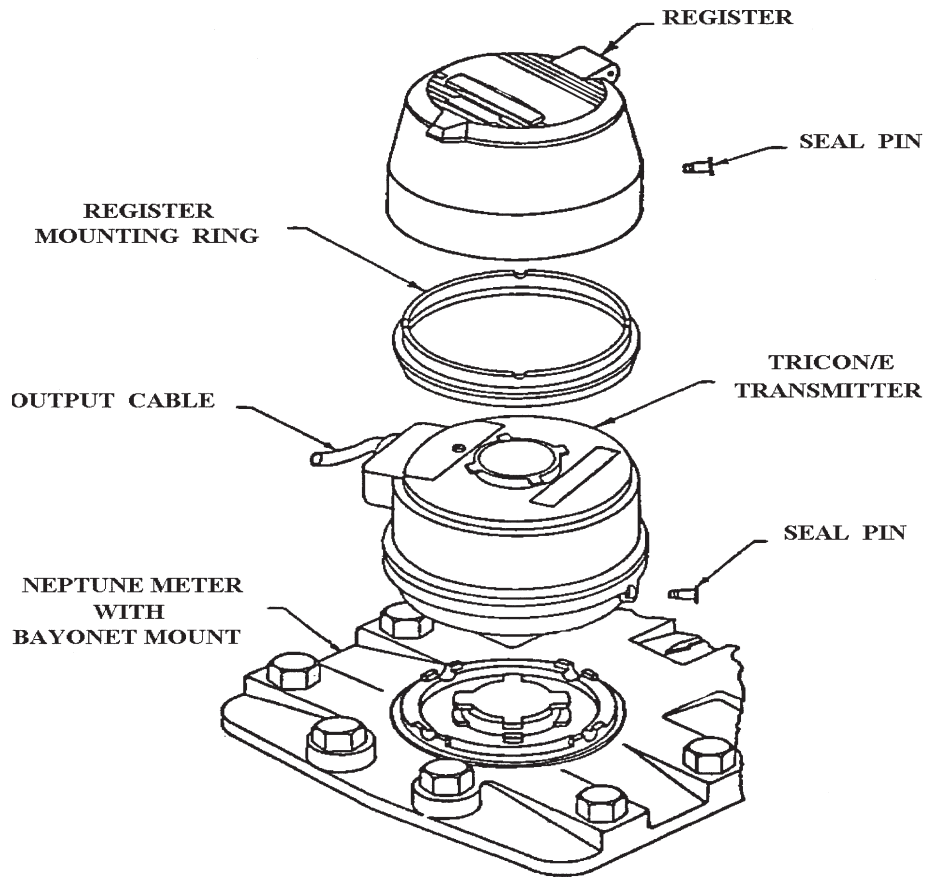


Figure 2.6 Mounting the TRICON Transmitter

- 3 Twist the register approximately  $\frac{1}{4}$  turn counter-clockwise and remove it from the meter.
- 4 Position the TRICON transmitter on the meter and twist it clockwise until it locks into place.
- 5 Place the register mounting ring on top of the TRICON transmitter with the four rounded grooves facing upward.
- 6 Align the notch in the base of the register mounting ring with the terminal cover of the TRICON and snap the ring into place.

When properly oriented, the register mounting ring should sit flush on top of the TRICON transmitter.

- 7 Position the register on top of the TRICON transmitter and register mounting ring, and twist it clockwise until it locks into place.
- 8 Drive the new seal pins into the register base and TRICON base to secure the installation and prevent tampering.

### CHAPTER 3 SPECIFICATIONS AND PERFORMANCE DATA

This chapter will provide you with the electrical specifications and the performance data for the models of the TRICON transmitter.

#### ENVIRONMENTAL CONDITIONS

Operating Temperature	32° to 158°F (0° to 70°C)
Storage Temperature	-40° to 185°F (-40° to 85°C)
Operating Humidity	0 to 95% RH, non-condensing

#### ELECTRICAL SPECIFICATIONS (TRICON/E3 MODELS)

**Table 3.1 Pulse Outputs (over 0-70°C operating temperature)**

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNITS
V <sub>ol</sub>	Low Digital Pulse Output Voltage	—	0.4	—	V
V <sub>oh</sub>	High Digital Pulse Output Voltage	8.5	V <sub>DCIN</sub> -1.0V	12	V
I <sub>ol</sub>	Current @ V <sub>ol</sub>	—	-10	—	mA
I <sub>oh</sub>	Current @ V <sub>oh</sub>	—	+10	—	mA
t <sub>r</sub> l-h <sup>1</sup>	Output Rise Time	—	—	2	uS
t <sub>f</sub> h-l <sup>1</sup>	Output Fall Time	—	—	2	uS

<sup>1</sup>Measured with R<sub>L</sub>=2.4KΩ and C<sub>L</sub>=50pF.

**Table 3.2 4-20mA Model (over 0-50°C operating temperature)**

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNITS
V <sub>cc</sub>	Power Supply Voltage	22.5	—	26.5	V
I <sub>S</sub>	Power Supply Current	20	—	80	mA
R <sub>L</sub>	Loop Resistance	0	—	600	Ω
Gain	Scaling Accuracy	—	—	0.5	%FS
Zero	Offset Accuracy	—	—	0.2	%FS
V <sub>ol</sub>	Low Digital Pulse Output Voltage	—	0.4	—	V
V <sub>oh</sub>	High Digital Pulse Output Voltage	8.5	—	12	V
I <sub>ol</sub>	Current @ V <sub>ol</sub>	—	-10	—	mA
I <sub>oh</sub>	Current @ V <sub>oh</sub>	—	10	—	mA
*t <sub>r</sub> l-h <sup>1</sup>	Output Rise Time	—	—	2	uS
*t <sub>f</sub> h-l	Output Fall Time	—	—	2	uS

<sup>1</sup>Measured with R<sub>L</sub>=2.4KΩ and C<sub>L</sub>=50pF

**Table 3.3 HF and UP/DN Models (over 0-70°C operating temperature )**

PARAMETER	DESCRIPTION	MINIMUM	TYPICAL	MAXIMUM	UNITS
V <sub>cc</sub>	Power Supply Voltage	11.5	—	26.5	V
I <sub>S</sub>	Power Supply Current	20	—	50	mA
V <sub>ol</sub>	Low Digital Pulse Output Voltage	0	—	—	V
V <sub>oh</sub>	High Digital Pulse Output Voltage	—	24	26.5	V
I <sub>ol</sub>	Current @ V <sub>ol</sub>	-1.0	—	—	A
I <sub>oh</sub>	Current @ V <sub>oh</sub>	—	0.04	+1.0 W/V <sub>oh</sub>	A
t <sub>r</sub> l-h <sup>1</sup>	Output Rise Time	—	—	2	μS
t <sub>f</sub> h-l	Output Fall Time	—	—	2	μS

<sup>1</sup>Measured with R<sub>L</sub>=2.4KΩ and C<sub>L</sub>=50pF.

**Table 3.4 All Models Absolute Limits<sup>1</sup>**

PARAMETER	DESCRIPTION	MINIMUM	MAXIMUM	UNITS
T (op)	Operating Temperature	0	85	°C
T (stg)	Storage Temperature	-40	85	°C
V <sub>cc</sub>	Power Supply Voltage	-30	30	V
R <sub>L</sub>	Output Load (pulse output)	1200	—	KΩ
I <sub>out</sub>	Output Current (pulse output)	—	10	mA

<sup>1</sup>These limits **cannot** be exceeded without possible damage.

## PERFORMANCE DATA

**Table 3.5 T-10 Disc Meters**

METER SIZE (in)	MAXIMUM FLOW RATE (gpm)	MAXIMUM CONTINUOUS FLOW RATE (gpm)	MINIMUM FLOW RATE (gpm)	NUMBER OF PULSES PER GALLON <sup>1</sup>	PULSE OUTPUT @ MAXIMUM FLOW RATE (Hz) <sup>1</sup>	FLOW RANGE OF 4-20MA OUTPUT (gpm)
5/8	20	10	1/4	578.10	192.70	0–20
3/4	30	15	1/2	322.60	161.30	0–30
1	50	25	3/4	150.80	125.67	0–50
1 1/2	100	50	1 1/2	67.57	112.62	0–100
2	160	80	2	37.30	100.00	0–160

<sup>1</sup>For the **High Resolution Output** of TRICON/E2 transmitters, multiply these values by **36**, and for the TRICON/E3, multiply by **40**.

Table 3.6 T-8 Disc Meters

METER SIZE (in)	MAXIMUM FLOW RATE (gpm)	MAXIMUM CONTINUOUS FLOW RATE (gpm)	MINIMUM FLOW RATE (gpm)	NUMBER OF PULSES PER GALLON <sup>1</sup>	PULSE OUTPUT @ MAXIMUM FLOW RATE (Hz) <sup>1</sup>	FLOW RANGE OF 4-20mA OUTPUT (gpm)
5/8	20	10	1/4	473.60	157.87	0–24.41 <sup>2</sup>
3/4	30	15	1/2	329.14	164.57	0–29.40
1	50	25	3/4	126.55	105.46	0–59.58 <sup>2</sup>
1 1/2	100	50	1 1/2	47.86	79.77	0–141.18 <sup>2</sup>
2	160	80	2	25.60	68.27	0–234.37 <sup>2</sup>

<sup>1</sup>For the **High Resolution Output** of TRICON/E2 transmitters, multiply these values by **36**, and for the TRICON/E3, multiply by **40**.

<sup>2</sup>T-8 disc meters are no longer manufactured. Therefore, all TRICON/E transmitters manufactured for disc meters are the T-10 type. In most cases, the newer T-10 meter chamber is smaller than its corresponding T-8 meter chamber, which results in the TRICON/E having a theoretical “Flow Rate at 20mA Output” that is greater than the Maximum Flow Rate allowed for the meter. This means that the T-10 type TRICON/E running on a T-8 meter will never actually reach the 20mA output level during normal operation. The calculated flow rate required to produce a 20mA output is provided as a reference for use in calibrating the 4-20mA receiving instrument.

Table 3.7 Trident® Turbine (TT) Meters

METER SIZE (in)	MAXIMUM CONTINUOUS FLOW RATE (gpm)	MINIMUM FLOW RATE (gpm)	NUMBER OF PULSES PER GALLON <sup>1</sup>	PULSE OUTPUT @ MAXIMUM FLOW RATE (Hz) <sup>1</sup>	FLOW RANGE OF 4-20mA OUTPUT (gpm)
2	200	3	4.6080	15.36	0 – 200
3	450	5	2.8900	21.68	0 – 450
4	1,000	10	1.5900	26.50	0 – 1,000
6	2,000	20	0.4640	15.47	0 – 2,000
8 (through S/N 31918014)	3,500	35	0.2493	14.54	0 – 3,500
8 (from S/N 31918274)	3,500	35	0.2253	13.14	0 – 3,873
10 (through S/N 31919282)	5,500	50	0.1600	14.67	0 – 5,500
10 (from S/N 31919300)	5,500	50	0.1472	13.49	0 – 5,981

<sup>1</sup>For the **High Resolution Output** of the TRICON/E2 transmitters, multiply these values by **9** and for the TRICON/E3, multiply these values by **10**.

Table 3.8 High Performance Turbine (HPT) Meters

METER SIZE (in)	MAXIMUM CONTINUOUS FLOW RATE (gpm)	MINIMUM FLOW RATE (gpm)	NUMBER OF PULSES PER GALLON <sup>1</sup>	PULSE OUTPUT @ MAXIMUM FLOW RATE (Hz) <sup>1</sup>	FLOW RANGE OF 4-20mA OUTPUT (gpm)
1 1/2	160	4	6.09500	16.25	0 – 160
2	200	4	6.09500	20.32	0 – 200
3	450	5	11.20000	84.00	0 – 450
4	1,200	10	7.55600	151.10	0 – 1,200
6	2,500	20	0.72730	30.30	0 – 3,000
8	4,000	35	0.75560	50.37	0 – 4,000
10	6,500	50	0.75560	81.86	0 – 6,500
12	8,000	120	0.75560	100.75	0 – 8,000
16	13,500	200	0.07556	17.00	0 – 13,500
20	22,000	300	0.07556	27.71	0 – 22,000

<sup>1</sup>For the **High Resolution Output** of the TRICON/E2 transmitters, multiply these values by **9** and for the TRICON/E3, multiply these values by **10**.

**Table 3.9 Compound Meters**

Compound Meter <sup>1</sup> Size and Type	Turbine Element	Disc Element
3" TRU/FLO	3" TT	5/8" T-10
4" TRU/FLO	4" TT	3/4" T-10
6" TRU/FLO	6" TT	1" T-10
2" HP TRU/FLO	2" HPT	5/8" T-10
4" PROTECTUS III	4" TT	1" T-10
6" PROTECTUS III	6" TT	1 1/2" T-10
8" PROTECTUS III	8" TT	2" T-10
10" PROTECTUS III	10" TT	2" T-10
4" HP PROTECTUS III	2	1" T-10
6" HP PROTECTUS III	2	1 1/2" T-10
8" HP PROTECTUS III	2	2" T-10
10" HP PROTECTUS III	2	2" T-10

<sup>1</sup>For TRICON/E Performance Specifications of Compound Meters, refer to the specification information of each respective meter element.

<sup>2</sup>Refer to Table 3.10 for the performance specifications of the 4", 6", 8", and 10" HP PROTECTUS III Turbine Elements.

**Table 3.10 4", 6", 8", and 10" HP PROTECTUS III Turbine Elements Performance Specifications<sup>2</sup>**

METER SIZE (in)	MAXIMUM CONTINUOUS FLOW RATE (gpm)	NUMBER OF PULSES PER GALLON <sup>1</sup>	PULSE OUTPUT @ MAXIMUM FLOW RATE (Hz) <sup>1</sup>	FLOW RANGE OF 4-20MA OUTPUT (gpm)
4	1,200	7.5560	151.2	0 – 1,200
6	2,500	0.7556	37.78	0 – 2,888
8	4,000	0.6095	40.63	0 – 4,959
10	6,500	0.5333	57.78	0 – 9,209

<sup>1</sup>For the **High Resolution Output** of the TRICON/E2 transmitters, multiply these values by **9** and for the TRICON/E3, multiply these values by **10**.

<sup>2</sup>Note: This table is based on mounting HPT TRICON/E3 on the same size HP PROTECTUS III Turbine Element.

## CHAPTER 4 MAINTENANCE

If you find that your TRICON system is not operating as expected when installed, use the following guidelines to try to determine the source of the problem.

### TROUBLESHOOTING

If the TRICON appears to be operating, but electronic flow indication does not agree with mechanical register indication, try the following:

- Verify that the TRICON and register match the meter size and type.  
If not, replace the TRICON and/or the register with the appropriate type to match the meter.
- Verify that the register turns smoothly when installed on the TRICON.  
If not, replace the register or have it repaired to correct problems with excessive torque.
- Verify that the TRICON is wired and powered properly.  
If not, correct the wiring/power problem.
- Verify compatibility and proper calibration of equipment to which the TRICON is connected.



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