

Universal Pulse Transmitter

Bulletin SS01105 Issue/Rev. 0.8 (1/18)

Smith Meter® Transmitter

The Smith Meter® Model Universal Pulse Transmitter (UPT) is an infrared, quad-channel, high-resolution pulse generator driven by the output shaft of a positive displacement meter. It provides high-integrity pulse transmission and verification of signal and power for custody transfer measurement applications.

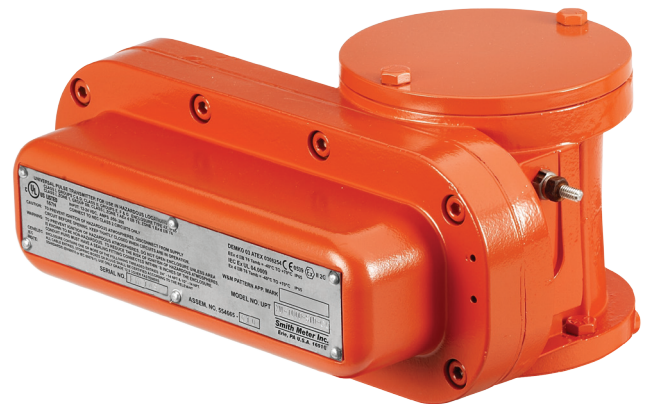
Features

- **Dual-Pulse (Quadrature) Output** for signal integrity checking and direction sensing.
- **Complementary Pulse Output** for power check.
- **Verification Pulse (Pulse per Revolution)** for independently checking signal transmission.
- **Explosion-Proof** Approved by UL, C-UL, ATEX, and IECEx.
- **Weather-Tight** – conforms to NEMA 4 requirements.

Principle of Operation

The UPT Transmitter incorporates a state-of-the-art infrared emitter coupled through a rotating disk to a receiver array. This guarantees pulse tracking capability as the infrared emitter ages. The array detects the passage of slots on the disk, supplying the information to an application-specific integrated circuit board that converts them, by means of the self-contained electronic circuitry, into positive square wave output signals. Circuit design is such that the high-resolution pulse signals generated are approximately 90 degrees electrically out of phase. The pulse trains are compatible with all Smith Meter electronics.

As a normal function of the array, a verification pulse output is generated to provide one pulse per revolution of the input shaft.



Applications

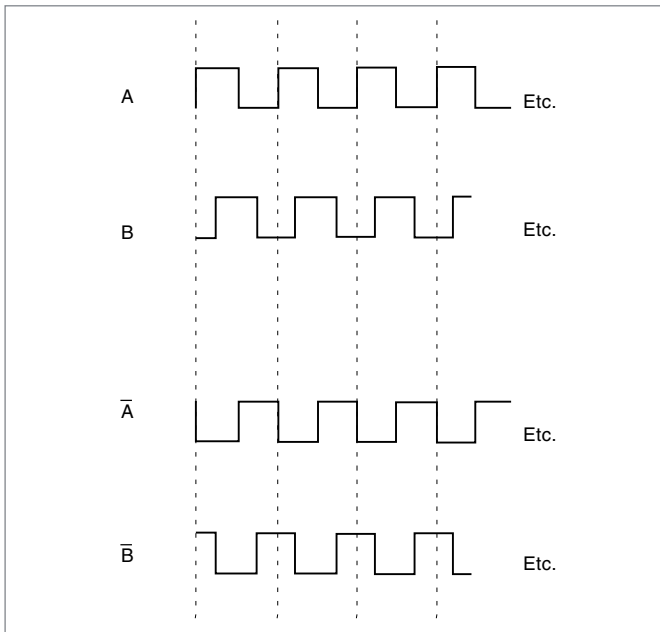
Quadrature

The Model UPT Transmitter provides a high-resolution pulse output whose integrity can be checked for pulse transmission errors resulting from induced noise, loss of transmitter power, malfunctioning transmitter, faulty transmission cable, etc. This is accomplished by interfacing the transmitted signals with a pulse sequence comparator device. Flow direction can also be detected with the appropriate instrumentation.

With the transmitter shaft turning in the counter-clockwise direction, the two pulse channels (A and B) are compared for a constant pulse stream...ABABAB... Each time the sequence is broken, and “AA” or “BB” occurs, an error signal is registered in the error signal circuitry. If the number of pulse transmission errors reaches a user-selected quantity, typically between 0 and 100, alarm functions built into the comparator device will be actuated when used with appropriate receiving equipment.

Complementary Pulse Output

The dual (\bar{A} and \bar{B}) complementary pulse output provides a check to compatible instrumentation for “power off” conditions. With electrical power to the UPT Transmitter, the “logic on” voltage and frequency of \bar{A} and \bar{B} will be a mirrored image of A and B, respectively, as shown in Figure 1 (Channel A is 180 electrical degrees out of phase with Channel \bar{A}). If power is interrupted to the transmitter, the “logic on” voltage of A, \bar{A} , B, and \bar{B} will be 0 VDC.



Phasing: Outputs A and \bar{A} 180 degrees ($\pm 0.1\%$) out of phase; B and \bar{B} 180 degrees ($\pm 0.1\%$) out of phase; verification pulse occurs on leading edge of the A pulse.

Quadrature separation between Outputs A and B (similarly A and \bar{B}) 90 electrical degrees ± 40 electrical degrees.

Verification Pulse

Type: Push-Pull driver (current sink or current source, 20 mA/channel maximum).

Sourcing: Output voltage equal to input voltage minus a 2-volt (maximum) drop.

Sinking Voltage: Output voltage to within 0.5 volt of circuit common.

Pulse Width: ≥ 47 milliseconds minimum at 300 RPM.

Note: Pulse width is inversely proportional to rotational rate.

Mechanical Characteristics

Operating Speed: 0-300 rpm (input revolutions).

Typical Running Torque: 14 inch oz.

Operating Temperature Range: -40°F to 158°F (-40°C to 70°C).

Approvals

North America UL/CUL

Class I, Division 1, Groups C & D; Class II, Groups E, F, and G; UNL-UL Enclosure 4X, CNL-CSA Enclosure 4.

Class I, Zone 1, Exd IIB, IP65.

UL/CUL File E23545.

European Union ATEX Directive

Ex db IIB Gb T6, IP65.

International IECEx

Ex db IIB Gb T6, IP65.

IECEx UL 04.0009X

Ordering Information

The UPT Transmitter models available offer a variety of pulse rates (number of pulses per unit volume). It is important to select the proper model transmitter which, when mated with the particular driving meter, will provide the desired number of pulses per unit volume.

Pulse output per metered volume for the various transmitter models and various gearing can be determined from Table 1.

Specifications

Electrical Characteristics	
Input Power:	Voltage: +12 VDC to +24 VDC
Current:	50 mA typical @ 12 or 24 VDC 150 mA typical @ 24 VDC into an 820 Ω load.
Output Characteristics:	Logic On Voltage, V

Transmission Distance*	
Distance	Wire/Size
Up to 2,000 ft. (610 meters)	#20 } Multiple conductor insulated shielded cable
Output Characteristics:	

* For distances greater than listed above, contact factory and advise:
 - Type of instrument and if capacitive coupled.
 - Output frequency at maximum flow rate - pulses/second (Hz).
 - Transmission length.

Pulse Outputs

Type: Push-pull driver (current sink or current source, 20 mA / channel max).

Sourcing: Output voltage equal to input voltage minus a 2-volt (maximum) drop.

Sinking: Output voltage to within 0.5 volt of circuit common.

Duty Cycle: 50/50 nominal (may vary to 60/40 with temperature).

Modeling

UPT — XU — 1000 — STD — 01	
Type	Input Coupling⁵
UPT - Universal Pulse Transmitter	00 - S1 (E3 Through H8, E3-S3, S5) ⁷ 01 - S3 and S5 (C2, F4 Through H8) ⁷ 02 - S6 and S7 (C2 Through M16) 03 - S1, S3, and S5 (JA/JB10, K12, and M16) 04 - C2-S1 and SC-13 Gallons 05 - C2-S1 and SC-13 Dekalitres 06 - SD Meters and T-40 Gallons 07 - SD Meters and T-40 Dekalitres
Housing	Trim Package
XU - Explosion-Proof, UL/CUL, ATEX and IECEx	STD - Standard
High-Frequency Pulse Resolution⁴	
1000 - 1,000 Pulses 500 - 500 Pulses 250 - 250 Pulses 200 - 200 Pulses 100 - 100 Pulses	

Table 1

Transmitter Models / Available Pulses per Volume Unit ⁶					
Meter Gearing	UPT-1000	UPT-500	UPT-250	UPT-200	UPT-100
1:1 Gallons	1,000 pulses/gal	500 pulses/gal	250 pulses/gal	200 pulses/gal	100 pulses/gal
5:1 Gallons ¹	200 pulses/gal	100 pulses/gal	50 pulses/gal	40 pulses/gal	20 pulses/gal
1:1 Barrels	1,000 pulses/bbl	500 pulses/bbl	250 pulses/bbl	200 pulses/bbl	100 pulses/bbl
1:1 Dekalitres	1,000 pulses/dek	500 pulses/dek	250 pulses/dek	200 pulses/dek	100 pulses/dek
5:1 Dekalitres	200 pulses/dek	100 pulses/dek	50 pulses/dek	N/A	N/A
10:1 Dekalitres	100 pulses/dek	50 pulses/dek	N/A	N/A	N/A

1 U.S. Gallons unless specified Imperial Gallons.

4 Pulses per revolution of input shaft.

5 This coupling mates with output of meters listed.

6 Nominal pulses per volume are based on meter with 100% gearing.

7 The 00 coupling is required for F4-S1 models pre-2008 (see parts list). The 01 coupling is required for F4-S1 models 2008-present.

Chart A

Meter Size	Pressure Rating	Gearing	UPT Input Coupling
⁸ C2, E3, F4, G6, H8	S1	All	014356-002
E3, F4, G6	A1	All	014356-002
F4, G6	V1	All	014356-002
E3	S3, S5	All	014356-002
⁹ C2, F4, G6, H8	S1, S3, S5	All	003821-002
E3, F4, G6	A3	All	003821-002
C2, E3, F4, G6, H8	S6, S7	All	005969-002
JA10, JB10, K12, M16	S3, S5, S6, S7	All	005969-002
Meter Size	Pressure Rating	Gearing	UPT Input Gear
SC-13	N/A	100% USG	514580-002
SC-13	N/A	100% DEK	538185-002
T-11, I-75	N/A	100% USG	501477-002
T-11, I-75	N/A	100% DEK	070269-002
T-20, I-150	N/A	100% USG	008970-002
T-40, SD-30, SD-3, SD-3-NF	N/A	100% USG	539401-002
T-40, SD-30, SD-3, SD-3-NF	N/A	100% DEK	500478-002

Special Application with Manual Calibrator

For meters equipped with a manual calibrator, disregard input coupling. Instead of a coupling, provide UPT Adaptor Kit 529288-011.

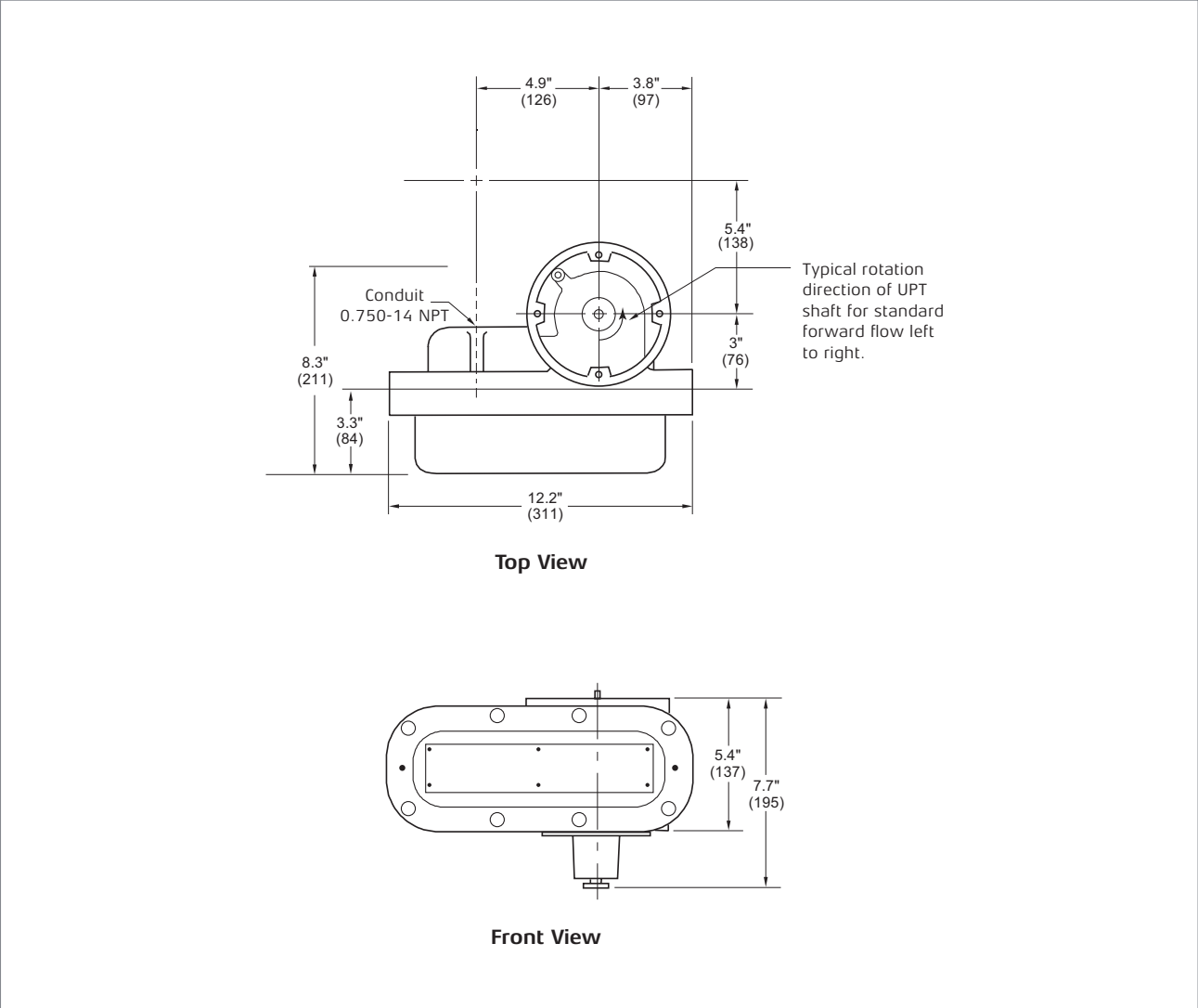
⁸ For F4-S1 meters manufactured prior to 2008.

⁹ For F4-S1 meters manufactured 2008-present, also reference F4-S1 parts list P001006.

Dimensions

Inches (Millimeters)

Note: Dimensions – inches to the nearest tenth (millimeters to the nearest whole mm), each independently dimensioned from respective engineering drawings.



Weight

Standard Version: 15.5 lb.

Revisions included in SS01105 Issue/Rev. 0.8 (1/18):

Electrical safety section has been updated.

The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

Contact information is subject to change. For the most current contact information, visit our website at www.fmctechnologies.com/measurementsolutions and click on the "Contact Us" link in the left-hand column.