**­­­­­­SECTION 40 71 66**

**ULTRASONIC TRANSIT TIME CLAMP-ON FLOW MEASURING SYSTEM**

***PART 1-GENERAL***

**1.01 SUMMARY**

1. Ultrasonic clamp-on flow measurement system designed for non-intrusive external to pipe measurement of water and wastewater media. The system shall utilize a transit time ultrasonic principle of measurement mounted on the customer pipe from which the volume flow rate can be derived. The two-sensor set version shall maintain specified accuracy even when mounted 2xDN pipe diameters before or after specified obstructions. The ultrasonic flow meter will be suitable for flow velocities from 0 - 33 fps.

**1.02 SUBMITTALS**

1. Furnish complete Product Data, Test Reports, Operating Manuals, Record Drawings, Manufacturer’s Certifications, Manufacturer’s Field Reports
2. Product Data:
   1. Dimensional Drawings.
   2. Materials of Construction.
   3. Measurement accuracy.
   4. Range and range ability.
   5. Enclosure Rating.
   6. Classification Rating.
   7. Power:
      1. Voltage.
      2. Wattage.
   8. Output options.

**1.03 QUALITY ASSURANCE**

1. Manufacture instruments facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.

**1.04 DELIVERY, STORAGE AND HANDLING**

1. Store all instruments in a dedicated structure with space conditioning to meet the recommended storage requirements provided by the Manufacturer.
2. Any instruments that are not stored in strict conformance with the Manufacturer’s recommendation shall be replaced.

**1.05 PROJECT OR SITE CONDITIONS**

1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, process and ambient temperature, and humidity conditions.

**1.06 WARRANTY**

1. The ultrasonic clamp on system shall have standard one year warranty from date of shipment and if the meter is commissioned by a factory certified technician, the warranty is extended to three years from the date of shipment.

**1.07 MAINTENANCE**

A. Provide all parts, materials, fluids, etc. necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

1. The ultrasonic transducers may require to be re-coupled to the pipe with new acoustic gel every 12 to 24 month depending on the installation condition.

**1.08 LIFECYCLE MANAGEMENT**

A. Instrument documentation, like original calibration certificates, manuals and product status information shall be accessed via a web enabled system with a license. The instrument-specific information shall be accessed via its serial number. When services are provided by an authorized service provider the services information like subsequent field calibrations shall be archived and accessible via this web enabled system.

***PART 2 -PRODUCTS***

**2.01 MANUFACTURER**

1. Endress+Hauser- Proline Prosonic Flow P 500

**2.02 MANUFACTURED UNITS**

A. The flow measuring system shall consist of: a clamp-on sensor pair(s), sensor holders, sensor cables, transmitter, transducer coupling pads, mounting clamps/straps, installation aids.

1. The flow measuring system with two sensor sets shall be capable of measuring within the specified accuracy with a minimum of 2xDN pipe diameters upstream or downstream of specified obstructions (Flow Disturbance Compensation, FlowDC)

2. The flow measuring system shall have an easy, safe and menu-guided ultrasonic sensor mounting procedure to ensure precise measuring results.

3. The flow measuring system shall support remote configuration.

4. Ultrasonic coupling gel shall not be required due to transducer coupling pads.

B. The sensors shall be selectable for pipe diameters in the range of 1/2” to 160” (DN 15 to 4000) and meet the appropriate process temperature range.

1. The sensors shall be rated NEMA 6P suitable for submergence.

2. The sensors shall be suitable for composite, metal, plastic, lined or unlined pipes.

3. The sensors shall utilize an integral spring mechanism to maintain correct contact pressure with the mating pipe surface during operation.

1. The sensors shall locate mechanically and lock within the sensor holder to preclude incorrect sensor orientation during installation or accidental dislocation due to vibration during operational service.
2. The sensor positioning on the pipe shall be prescribed by the transmitter via the HMI display and communications protocol (where employed)

6. The transmitter primary output shall be specified, as:

4-20mA HART, or

Modbus RS485, or

And up to 2 secondary configurable analog I/O slots (freely programmable to 4-20mA in/output, 0-10 kHz pulse/frequency, or status input)

C. The transmitter shall be a three-stage microprocessor controller mounted remotely as specified in the instrument schedule. The transmitter shall operate on AC (100 to 240V) or DC (24 V) via a dedicated or universal power supply as specified. The transmitter housing will carry a NEMA 4X rating and shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments.

1. The transmitter shall allow local or remote programming that can be operated via an optical display or WLAN connection without opening the compartment.

2. The transmitter display shall indicate simultaneous flow rate and total flow with three Totalizers (eg. forward, reverse and net total) and user-selectable engineering units, readout of diagnostic remedy messages, and support at least 19 standard languages.

3 The transmitter shall safeguard against entering of invalid data for the particular meter size and all programming parameters shall be access-code protected and retained in the embedded HistoROM.

4. The transmitter primary output shall be specified, as:

4-20mA HART, or

Modbus RS485, or

And up to 2 secondary configurable analog I/O slots (freely programmable to 4-20mA in/output, 0-10 kHz pulse/frequency, or status input)

5. The transmitter output(s) shall be integral to the ultrasonic flowmeter transmitter electronics; using an external third party signal converter is unacceptable.

6. The transmitter output selected must be supported by Add-on Instructions (AOI), faceplates, device drivers, instructions and pre-engineered code.

7. The transmitter shall internally retain all setup parameters, calibration parameters and accumulated measurements in non-volatile memory in the event of power failure.

8. The transmitter shall be protected against voltage spikes from the power source with internal transient protection.

9. The transmitter and sensor must support an onboard, ISO traceable means of attested in-situ verification utilizing redundant references to validate measurement quality over the lifespan.

10. The transmitter shall provide access to service and monitoring parameters designed to identify transient or permanent process influences.

11. The transmitter shall provide lock-out from vandalism or programming changes of K-factor and zero point when used for fiscal measurement as specified.

12. The transmitter shall support commissioning and maintenance options via a service interface for operation via an internal web server, accessible via a standard RJ-45 cable.

13. The transmitter shall include a wireless local area network (WLAN) option built into the device display with an operating range of up to 16 feet. The WLAN shall permit unique SSID programming, four encryption levels and activation/deactivation of the function at the owner preference.

**2.03 SOURCE QUALITY CONTROL**

1. Each flow measuring system shall be verified at a facility traceable to the National Institute of Standards and Technology (NIST) accredited to ISO 17025.
2. The flow measuring system maximum measured error under factory reference conditions shall be ± 0.5% of reading at any flow velocity greater than 1 ft/sec to the stated maximum.
3. When installed in the field, measurement error becomes a function of additional sources of uncertainty; the additional error should typically not exceed ± 1.5% of reading giving an overall error of ± 2%.
4. The technique of sensor and transmitter verification must be by a traceable method per NIST or ISO.
5. Provide complete documentation covering the traceability of all calibration instruments.
6. Provide ISA data sheet ISA-TR20.00.01. Use the latest revision of form 20F2321. Complete the form with all known data, and dash out the inapplicable fields. Incomplete data sheets submitted will be result in a rejected submittal.

**2.04 ACCESSORIES**

* + 1. Stainless steel tag - labeled to match the Contract Documents.
    2. Provide sun shield for outdoor installations.

D. During mounting and commissioning a clamp-on measuring point, information on the liquid and piping is needed. If liquid or pipe data is not already programmed, additional accessories may be needed.

**2.05 SAFETY**

A. All electrical equipment shall meet the requirements of ANSI/NFPA 70, NATIONAL ELECTRIC CODE, latest edition.

B. All devices shall be certified for use in hazardous areas as: FM non-incendive for Class I, Division 2, or Class I, Division 1 XP, Group A-D services

C. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment.

D. Electrical equipment housing shall conform to NEMA 4X classification.

E. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as FM, UL, ETL, CSA, etc. for the specified electrical area classification.

***PART 3-EXECUTION***

3.01 EXAMINATION

1. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process condition.
2. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

3.02 INSTALLATION

1. As shown on installation details and mechanical Drawings.
2. As recommended by the manufacturer’s installation and operation manual.
3. Specific attention should be given to the following technical requirements:
   * 1. Observe undisturbed straight run diameters before and after the point of measurement greater than or equal to 15D inlet and 3D outlet; install well clear of fittings, throttling valves, tees or elbows.
     2. Ultrasonic sensors mounted on horizontal piping should be oriented at ± 30 degrees from the top (0°) or bottom (180°) position on the pipe circumference to ensure measuring accuracy.

3.03 FIELD QUALITY CONTROL

1. Demonstrate the performance of all instruments to the ENGINEER before commissioning.
2. ENGINEER to witness all instrument electronic calibration and flow verification in the field.
3. Each instrument shall be tested before commissioning and the ENGINEER shall witness the response in the PLC control system and associated registers.
   * + 1. The manufacturer shall offer an FDT based and FDT Group certified FDT frame tool capable of supporting HART, Profibus and Foundation fieldbus protocols.
       2. Each instrument shall be supported with a device type manager (DTM) allowing direct integration in the PLC
       3. Each instrument shall be capable of operational configuration directly through the PLC
       4. Each instrument shall provide direct control of totalizer reset functions through the PLC
4. Manufacturer’s Field Services:
5. Manufacturer’s representative shall verify installation of all installed sensors and transmitters.
6. Notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
7. Manufacturer’s representative shall perform an electronic

verification at the time of installation in respect of the transmitter, with simulated flow values, to confirm correct operation.

3.04 ADJUSTING

1. Verify factory set up of all instruments in accordance with the Manufacturer’s instructions.

3.05 PROTECTION

1. All instruments shall be fully protected after installation and before commissioning. Replace any instruments damaged before commissioning:
   * + 1. The ENGINEER shall be the sole party responsible for determining the corrective measures.