**SECTION 40 71 66**

**ULTRASONIC GAS FLOW MEASURING SYSTEM**

***PART 1 – GENERAL***

**1.01 SUMMARY**

A. Provide an ultrasonic flow meter for a wide range of gas applications to provide reliable flow measurement, even with wet gas and changing gas properties and compositions. The meter shall use a transit time ultrasound signal to measure the volume flow and generate a real time fraction measurement of methane in wet conditions.

**1.02 SUBMITTALS**

1. Furnish complete Product Data, Operating Manuals, Manufacturer’s Certifications, Sample Calibration sheets, and (where available and appropriate) Manufacturer’s Field Reports and Test Reports.
2. Product Data:
   1. Dimensional Drawings.
   2. Materials of Construction:
      1. Metering Tube.
      2. Integral Flanges.
      3. Integral Transmitter.
   3. Measurement accuracy.
   4. Range and range ability.
   5. Enclosure Rating.
   6. Classification Rating.
   7. Calibration certificates.
   8. Power:
      1. Voltage.
      2. Wattage.
   9. Output options.

**1.03 QUALITY ASSURANCE**

1. Manufacturer instruments facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.
2. The ultrasonic flow sensor will be flow calibrated against an accredited ISO-17025 flow test stand on gas with certified accuracy traceable to NIST.

**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 pressure, and humidity conditions.

**1.06 WARRANTY**

1. The meter 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, necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

**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***

* 1. **MANUFACTURER**

1. Endress+Hauser - Proline Prosonic G 300) or G 500

**2.02 MANUFACTURED UNITS**

A. The ultrasonic flow meter sizes 1”-12” shall consist of a single transmitter mounted either integral (G 300) or remote (G 500) to the sensor meter body.

B. The sensor shall contain either a single pair (1”) of ultrasonic measuring transducers, or two pairs (2-12”) configured in a two-chord arrangement.

C. The ultrasonic transducers shall be manufactured with Titanium Gr. 2.

D. The sensor meter body shall be constructed of 316L with 316L fully-welded ASME B16.5 Class 150, 300, or 600 flanges.

E. The sensor meter body shall have an optional integrated temperature measurement or integrated temperature and pressure measurement.

F. The sensor shall be suitable for process temperature between -58 to +302F. With optional pressure cell the temperature range is -58 to 212F

G. The four-wire transmitter (integral or remote) shall sequentially drive the measuring transducers to both transmit and receive the ultrasonic signal.

H. The transmitter electronics and software shall evaluate and condition the sensor signals and convert them into measurement variables. The variables shall include volume flow, corrected volume, and mass flow. An optional Advanced Gas Analysis package is available and can provide additional variables such as corrected methane volume, energy flow, methane fraction, calorific value, density, and dynamic viscosity, and Wobbe index.

I. The transmitter shall be a three-stage microprocessor controller mounted integrally 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 (G 300) or 3 (G 500) 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 ACCESSORIES**

A. No additional accessories are needed for commissioning or normal operation.

**2.04 SOURCE QUALITY CONTROL & CALIBRATION**

1. Ultrasonic flow meters shall be factory flow calibrated against an ISO-17025 accredited test stand per “General Requirements for the Competence of Testing and Calibration Laboratories” with certified accuracy traceable to NIST
2. Evidence of accreditation must originate from a national verification agency such as A2LA.

C. Each meter shall ship with a certified calibration report exceeding stated standard accuracy of 1.0% of rate; an optional calibration accuracy of 0.5% of rate. Turndown for either calibration shall be 133:1.

D. 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.

E. Provide complete documentation covering the traceability of all calibrated instruments.

**2.05 SAFETY**

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

1. All devices shall be certified for use in hazardous areas to Class I, Division 1, Groups A-D; both intrinsically safe (Ex-i) and flameproof (Ex-d) methods should be available. The unit shall have the following approvals: ATEX, IECEx, cCSAus, INMETRO, and NEPSI.
2. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment. Devices with intrinsically safe ratings will normally be acceptable with vendor’s approval.
3. Electrical equipment housing shall conform to NEMA 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.

F. Electrical equipment specified as intrinsically safe shall qualify as “simple apparatus” or NTRL approved intrinsically safe equipment per ANSI/ISA-RP12.6 “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations”, latest edition.

***PART 3 –EXECUTION***

3.01 EXAMINATION

1. Examine the complete set of plans, the expected process gas composition, 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 in manufacturer’s Technical Information, Operating Instructions 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 or special requirements within the piping system:
   * + 1. Provide proper, undisturbed straight run diameters before (20D or 10D) and after (3D) the measurement location depending on the number of acoustic paths used (1 or 2 acoustic paths)

3.03 FIELD QUALITY CONTROL

1. Verify the correct function of all instruments during commissioning through key functional diagnostic.
2. Each instrument shall be tested before commissioning to ensure interoperability in the PLC control system and associated registers.
3. Manufacturer’s Field Services:
4. Manufacturers’ representative shall verify installation of all installed flow tubes and transmitters.
5. Notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.

3.04 ADJUSTING

1. Verify factory electronic calibration (including all I/O) 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.