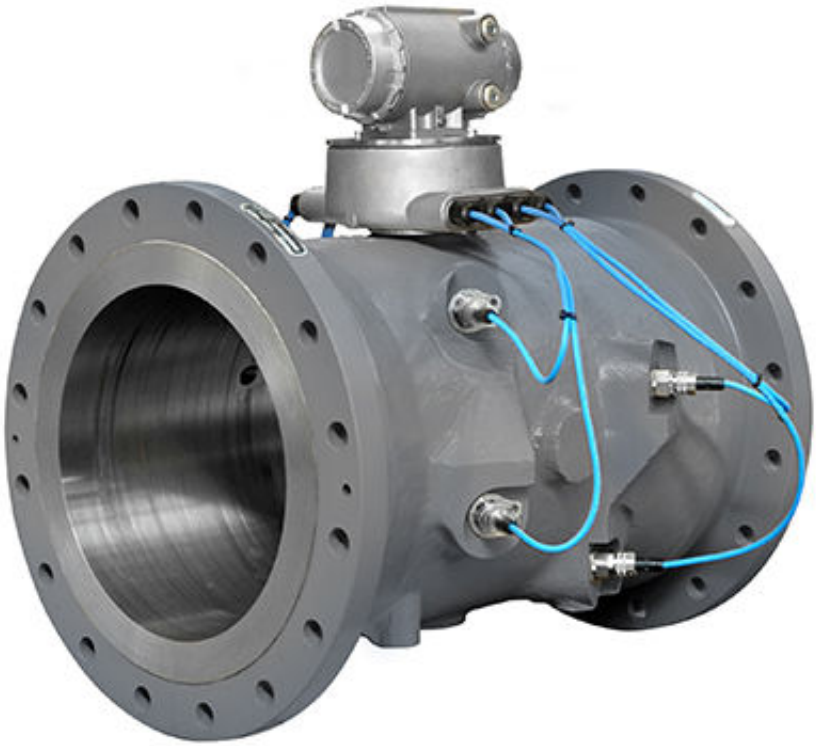
Installation manual
00825-0100-3814, Rev AC
January 2024

Rosemount™ 3814 Liquid Ultrasonic Flow Meter



ROSEMOUNT™

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Safety and approval information

This Rosemount product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EU Declaration of Conformity for directives that apply to this product. The EU Declaration of Conformity, with all applicable European directives, and the complete ATEX installation drawings and instructions are available on the Internet at Emerson.com or through your local Emerson support center.

Information affixed to equipment that complies with the Pressure Equipment Directive can be found on the Internet at Emerson.com.

For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Other information

Full product specifications can be found in the product data sheet. Troubleshooting information can be found in the maintenance and troubleshooting manual.

Product data sheets and manuals are available on the Emerson website at Emerson.com.

Return policy

Follow Emerson procedures when returning equipment.

These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Emerson employees. Emerson will not accept your returned equipment if you fail to follow Emerson procedures. Return procedures and forms are available on our website at Emerson.com or by phoning the Emerson Customer Service department.

Emerson Flow customer service

- Worldwide: flow.support@emerson.com
- Asia-Pacific: APflow.support@emerson.com

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1 Introduction

1.1 General overview of Rosemount Liquid Ultrasonic Flow Meter

Rosemount 3814 Liquid Ultrasonic Meters have various configurations that meet a broad range of customer requirements. Each meter comes fully assembled from Emerson, and all parts and assemblies are tested prior to shipment.

Refer to the following documents for additional details:

- 00825-0300-3810 HART® Field Device Specification Guide Liquid Ultrasonic Meter
- 00809-0100-3814 Rosemount 3810 Liquid Ultrasonic Meter Maintenance and Troubleshooting Manual

Computer simulations of various velocity profiles demonstrate that four measurement paths provide an optimum solution for measuring asymmetric flow. The Rosemount 3814 Liquid Ultrasonic Meter utilizes four cross-bore, parallel-plane measurement paths to offer a high degree of accuracy, repeatability, and superior low-flow capabilities without the compromises associated with conventional technologies. These features make the Rosemount 3814 Liquid Ultrasonic Meter the best choice for custody transfer applications.

The Rosemount 3814 Liquid Ultrasonic Meter technology can be applied to custody transfer flow measurement applications as shown in Typical applications.

1.2 Typical applications

- Custody transfer measurement
- Allocation measurement
- High viscosity, low Reynolds Number applications (where *Re* ≤5000)
- Check metering
- Leak detection
- Line balancing
- Batch control
- Loading and off loading
- Offshore
  - Floating Production, Storage and Offshore Loading (FPSO)
  - Offshore Platforms
  - Barges
- Pipelines
  - Crude Oil pipelines
  - Refined product pipelines
- Terminals
  - Loading and off-loading (Ship, barge, truck, railcar, etc.)
  - Tank Farms

— Cavern Storage

1.3 Features and benefits of this product

- Explosion-proof transmitter electronics enclosure with CPU Module, Power Supply, Intrinsic Safety Barrier Module and Backplane board
- Intrinsically safe Transducer electronics enclosure with the Acquisition Module
- HART® and AMS Suite: Intelligent Device Manager communications for PlantWeb architecture
- Reduce unaccounted measurement
- Increase energy savings
- Replaceable transducers while under pressure
- Extensive self diagnostics
- Immediate alarm reporting
- Auto-detected ASCII/RTU Modbus® communications protocol
- Interchangeable electronics modules
- Internet-ready communications
- Ethernet access
- Modbus TCP/IP
- On-board LED status indicators
- Analog pressure and temperature inputs
- MeterLink (a Windows™-based interface software)
- Local Display (optional)
- Glass endcap (for local display installations)

For other features and benefits refer to the product datasheet at: Emerson.com/Automation.

1.4 Acronyms, abbreviations, and definitions

Table 1-1: Acronyms, abbreviations and definitions

Acronym or abbreviation	Definition
°	Degree (angle)
°C	Degrees Celsius (temperature unit)
°F	Degrees Fahrenheit (temperature unit)
ADC	Analog-to-digital converter
AI	Analog input
AMS® Suite Device Manager	Asset Management Software - Device Manager
AO	Analog output

Table 1-1: Acronyms, abbreviations and definitions *(continued)*

Acronym or abbreviation	Definition
ASCII MODBUS	A Modbus protocol message framing format in which American Standard Code for Information Interchange (ASCII) characters are used to delineate the beginning and end of the frame.
boolean	A type of data point that can only take on values of TRUE or FALSE (generally TRUE is represented by a value of 1, FALSE is represented by a value of 0)
bps	Bits per second (baud rate)
cPoise	Centipoise (viscosity unit)
CPU	Central Processing Unit
CTS	Clear-to-Send (CTS); the RS-232C handshaking signal input to a transmitter indicating that it is okay to transmit data – i.e., the corresponding receiver is ready to receive data. Generally, the Request-to-Send (RTS) output from a receiver is input to the CTS input of a transmitter.
DAC	Digital-to-Analog Converter
MeterLink™	Ultrasonic Meter interface software
DI	Digital Input
DO	Digital Output
DHCP	Dynamic Host Configuration Protocol
dm	Decimeter (10^{-1} meters, length unit)
ECC	Error Correction Code
EEPROM	Electrically-Erasable, Programmable Read-Only Memory
Flash	Non-volatile, programmable read-only memory
FODO	Output that is user configurable as either a frequency or digital output
HART® Communication Protocol	Highway Addressable Remote Transducer communications protocol
hr	hour (time unit)
Hz	Hertz (cycles per second, frequency unit)
I/O	Input/Output
IS	Intrinsically Safe
K	Kelvin (temperature unit)
kHz	Kilohertz (103 cycles per second, frequency unit)
LAN	Local Area Network
LED	Light-emitting diode
m	Meter (length unit)
m^3/d	Cubic meters per day (volumetric flow rate)
m^3/h	Cubic meters per hour (volumetric flow rate)

Table 1-1: Acronyms, abbreviations and definitions *(continued)*

Acronym or abbreviation	Definition
m^3/s	Cubic meters per second (volumetric flow rate)
mA	Milliamp (current unit)
MAC Address	Media Access Control (Ethernet Hardware Address -EHA)
microinch (µinch)	Microinch (10^{-6} in)
micron	Micrometer (10^{-6} m)
MMU	Memory Management Unit
MPa	Megapascal (equivalent to 10^6 Pascal) (pressure unit)
N/A	Not Applicable
Nm^3/h	Normal cubic meters per hour
NOVRAM	Non-volatile Random Access Memory
Pa	Pascal, equivalent to 1 newton per square meter (pressure unit)
Pa·s	Pascal Second (viscosity unit)
PC	Personal Computer
PFC	Peripheral field connection (board)
P/N	Part number
PS	Power supply (board)
psi	Pounds per square inch (pressure unit)
psia	Pounds per square inch absolute (pressure unit)
psig	Pounds per square inch gage (pressure unit)
R	Radius
rad	Radian (angle)
RAM	Random Access Memory
RTS	Request-to-Send; the RS-232C handshaking signal output by a receiver when it is ready to receive data
RTU MODBUS	A Modbus protocol framing format in which elapsed time between received characters is used to separate messages. RTU stands for Remote Terminal Unit.
s	Second (time unit, metric)
SDRAM	Synchronous Dynamic Random Access Memory
sec	Second (time unit, U.S. customary)
TCP/IP	Transmission Control Protocol/Internet Protocol
time_t	Seconds since Epoch (00:00:00 UTC Jan. 1, 1970) (time unit)
UDP	User Datagram Protocol

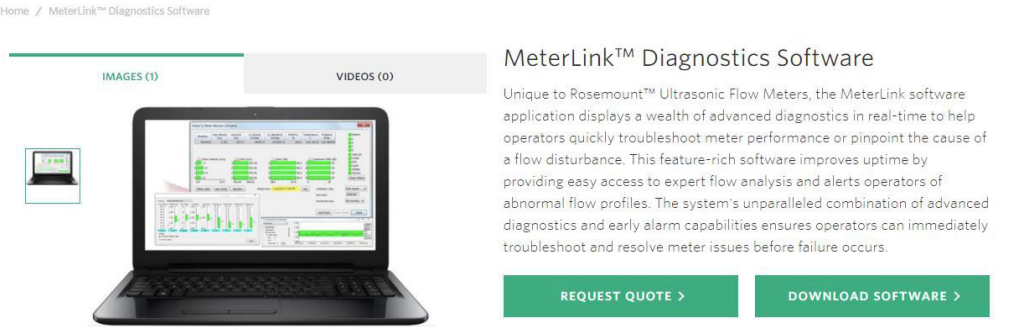
Table 1-1: Acronyms, abbreviations and definitions *(continued)*

Acronym or abbreviation	Definition
U.L.	Underwriters Laboratories, Inc. - product safety testing and certification organization
V	Volts (electric potential unit)
W	Watts (power unit)

1.5 MeterLink™ software

MeterLink™ software has robust features for setting communications parameters, calibrating your meter, collecting logs and reports and monitoring the meter health and alarm statuses. MeterLink may be downloaded at no charge from: Emerson.com/Meterlink.

Figure 1-1: MeterLink download and registration



Select the MeterLink software and firmware bundle appropriate for your meter. Complete the Online registration form and you will receive a confirmation email with a hyperlink directing you to the download site.

NOTICE

After the download, follow the instructions in the Readme file. Do not attempt to unzip the zipped firmware file. MeterLink unzips the compressed file using the **Tools** → **Program Download** utility.

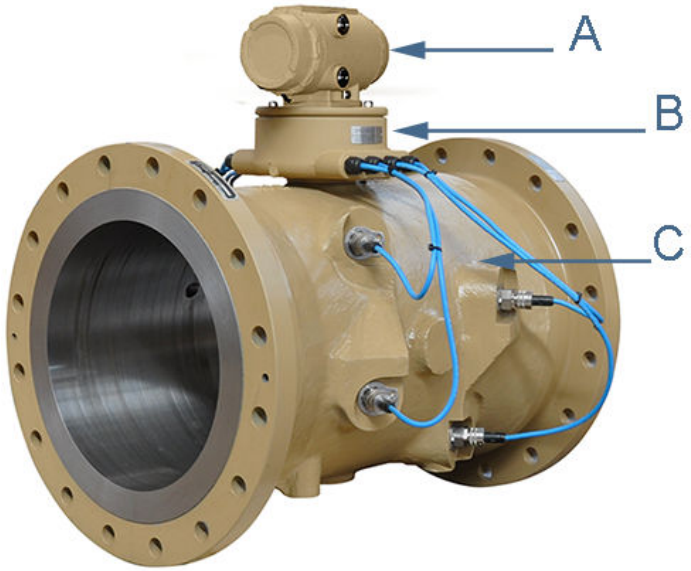
Refer to the MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual (00809-0100-7630) for installation instructions and to setup initial communications. You may download the manual here: Emerson.com/Meterlink.

1.6 Rosemount 3814 Liquid Ultrasonic Flow meter design

The Rosemount 3814 Liquid Ultrasonic Flow Meter is a four-path (eight transducers) in-line meter designed to measure the difference in signal transit time with and against the flow across one or more measurement path(s). A signal transmitted in the flow direction travels faster than one transmitted against the flow direction. Each measurement path is defined by a transducer pair in which each transducer alternately acts as transmitter and receiver.

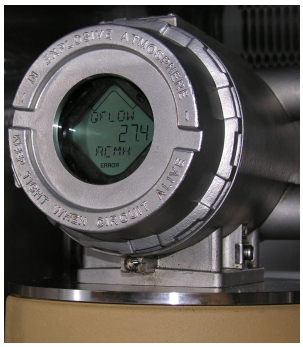
The meter uses transit time measurements and transducer location information to calculate the mean velocity. Computer simulations of various velocity profiles demonstrate that multiple measurement paths provide an optimum solution for measuring asymmetric flow. The Rosemount 3814 Liquid Ultrasonic Flow Meter utilizes four cross-bore, parallel-plane measurement paths, offers a high degree of repeatability, bi-directional measurement and superior low-flow capabilities without the compromises associated with conventional technologies.

Figure 1-2: Rosemount 3814 Liquid Ultrasonic Flow Meter Design



A. *Transmitter electronics enclosure (explosion-proof) Optional - Local Display with glass endcap (Figure 1-3)*
B. *Base electronics enclosure (intrinsically safe)*
C. *Meter body with transducer assemblies (LT-031, LT-03, LT-04, LT-05, LT-08, or LT-09) (intrinsically safe)*

Figure 1-3: Transmitter electronics enclosure with optional local display and glass endcap



The Rosemount 3814 Liquid Ultrasonic Flow Meter is a four-path (eight transducers) in-line meter designed to measure the difference in signal transit time with and against the flow across one or more measurement path(s). A signal transmitted in the flow direction travels faster than one transmitted against the flow direction. Each measurement path is

defined by a transducer pair in which each transducer alternately acts as transmitter and receiver. The meter uses transit time measurements and transducer location information to calculate the mean velocity.

Computer simulations of various velocity profiles demonstrate that multiple measurement paths provide an optimum solution for measuring asymmetric flow. The Rosemount 3814 Liquid Ultrasonic Flow Meter utilizes four cross-bore, parallel-plane measurement paths, offers a high degree of repeatability, bi-directional measurement and superior flow capabilities for custody transfer without the compromises associated with conventional technologies.

The Rosemount 3814 Liquid Ultrasonic Flow Meter's U.L. safety listing is accomplished through the combination of an explosion-proof Transmitter Electronics Enclosure that houses the CPU Module, Power Supply board, I.S. Barrier board, Backplane board and optional LCD Display board.

Important
The optional LCD Display requires firmware v1.04 or later and Uboot version, April 25, 2022.

The Base Electronics Enclosure is intrinsically safe and houses the Acquisition Module, the acquisition cable and wiring. The Intrinsically safe transducers and cable assemblies are designed for Class 1, Division 1, Groups C and D areas without need of further protection when installed in accordance with the field wiring diagram (refer to Rosemount drawing DMC-004936).

The Rosemount 3814 Liquid Ultrasonic Flow Meter's U.L. safety listing is accomplished through the combination of an explosion-proof Transmitter Electronics Enclosure that houses the CPU Module, the Base Electronics Enclosure that houses the Acquisition Module with intrinsically safe transducers and cable assemblies designed for Class 1, Division 1, Groups C and D areas without need of further protection when installed in accordance with the field wiring diagram (refer to Rosemount drawing DMC-004936, see Engineering Drawings and Safety conditions).

1.7 Meter specifications

⚠ CAUTION

FLUID CONTENTS MAY BE HAZARDOUS
The meter must be fully depressurized and drained before attempting to remove the transducer housing. If fluid begins to leak from the transducer housing, immediately reinstall it.

Failure to comply may cause serious injury or equipment damage.

⚠ CAUTION

ESCAPING FLUIDS HAZARD
The purchaser of the meter is responsible for the selection of Rosemount components/ seals and materials compatible with the chemical properties of the measurement fluid.

Failure to select suitable meter components/seals may cause escaping fluids, resulting in injury or equipment damage.

Consult your Emerson Flow service representative to ensure you purchase the correct components and seals for your application.

Specifications for Rosemount 3814 Liquid Ultrasonic Flow Meters are below:

Table 1-2: Meter specifications

Liquid Meter specifications	
Meter type	Number of paths: • Four-path (eight transducer) chordal design
Ultrasonic type	• Transit-time based measurement • Spool piece with integral mount transducers
Enclosure materials	• ASTM B26 Gr A356.0 T6 Aluminum — Chromate conversion coated with a polyurethane enamel • ASTM A351 Gr CF8M Stainless Steel — Passivated
Meter Performance	
Linearity	• ± 0.15 percent of measured value over a 10:1 turndown • ± 0.20 percent of measured value over a 20:1 turndown
Uncertainty of Meter Factor	< ± 0.027 percent (API MPMS, Chapter 5, Section 8, Table B-1)
Velocity range	• 2.0 fps (0.6 m/s) to 40.0 fps (12.2 m/s) (nominal) 48 fps (14.3 m/s) (over-range)
Upper Viscosity Limit	• 150 centipoise (Transducers LT-01, LT-03, LT-08, LT-09) • 1000 centipoise (Transducers LT-04, LT-05)

Table 1-2: Meter specifications *(continued)*

Liquid Meter specifications	
Body and Flange Pressure rating range	U.S. Customary Units - Meter sizes 4 in. to 24 in. (Raised face, RTJ or Companion) • Line sizes: — 4 in. (DN 100) — 6 in. (DN 150) — 8 in. (DN 200) — 10 in. (DN 250) — 12 in. (DN 300) — 16 in. (DN 400) — 18 in. (DN 450) — 20 in. (DN 500) — 24 in. (DN 600) • ANSI pressure classes (per ANSI B16.5): — 150 ANSI / PN 20 — 300 ANSI / PN 50 — 600 ANSI / PN 100 — 900 ANSI / PN 150 — 1500 ANSI/PN 200 • Body and flange material and temperature ratings: — Carbon Steel body and Flanges: -49 °F to 302 °F (-45 °C to 150 °C) — 316 Stainless steel body and flanges: 58 °F to 302 °F (-50 °C to 150 °C) — 316L Stainless steel body and flanges: 58 °F to 302 °F (-50 °C to 150 °C) — Carbon Steel body and flanges: 58 °F to 302 °F (-50 °C to 150 °C) • Maximum Pressures — Dependent on operating temperature • Minimum Pressures — 0 psig 0 barg Meter bore • Schedule 20, 30, 40, 80, 120, 160, LW, XS, XXS and Standard
Flange types	• Raised face or RTJ
Specific Gravity	• 0.35 to 1.50
Accuracy Limits	• Accuracy limits typically are: — ±0.20 percent without a flow calibration

Table 1-2: Meter specifications *(continued)*

Liquid Meter specifications	
Power	Meter • 10.4 Vdc to 36 Vdc • 11 W typical power consumption
Temperature flameproof Transmitter Electronic Enclosure and Base Electronics Enclosure	Serial cable • Belden #9940 or equivalent (22 gauge) — Capacitance (pF/m) 121.397 (conductor to conductor) — Capacitance (pF/m) 219.827 (conductor to other conductor and shield) — Resistance (Dc) Dcr @ 68 °F (20 °C) (Ohm/km) 48.2307 Nominal Outer shield resistance - DCR @ 68 °F (20 °C) (Ohm/km) 16.405 — Operating voltage - 300 V RMS (UL AWM Style 2464) — Current 2.4 Amps per conductor @ 77 °F (25 °C) (recommended) Ethernet cable • Cat-5 Standard 100Mbps Frequency (see Table 3-1) • 22 AWG wire characteristics are as follows: — Capacitance = 20 pF/ft or 20 nF/1000 ft (between two wires) — Resistance = 0.0168 Ohms/ft or 16.8 Ohms/1000 ft — Pull-up voltage is 24 Vdc
Transducers	• LT-01, LT-03 — Operating Temperature Range -58 °F to +212 °F (-50 °C to 100 °C) • LT-04, LT-05, LT-08, LT-09 — Operating Temperature Range -58 °F to +302 °F (-50 °C to +150 °C) **Note** The process temperature must not exceed the operating temperature range of the transducers. **Note** The ultrasonic transducers are not intended for use across boundary walls of different hazardous area classifications. The transmitter electronics cannot be remote mounted from a Division 1 classification to a Division 2 area to meet an area classification.
Communications specifications	
Connectivity protocols	One serial RS-232/RS-485 ports (115 kbps baud rate) (Modbus RTU/ASCII) • (1) Serial Port A (RS-232/RS-485 Full Duplex/ RS-485 Half Duplex)

Table 1-2: Meter specifications *(continued)*

Liquid Meter specifications	
	One Ethernet Port (TCP/IP) 100 BaseT • Up to 10 Mbps • Modbus TCP
Device compatibility	FloBoss 103, FloBoss S600 flow computer, ROC 107
Digital, analog, and frequency inputs	
Digital Input(s) (Selectable)	(1) Single polarity (for flow calibration gating - contact closure) • Single input for starting and stopping • Four pulse configurations available
Analog Input(s)	(2) 4-20 mA • AI-1 Temperature • AI-2 Pressure **Note** The analog-to-digital conversion accuracy is within ±0.05 percent of full scale over the operating temperature range. **Note** AI-1 and AI-2 are electronically isolated and operate in sink mode. The input contains a series resistance so HART® Communicators can be connected to configure sensors. A 24 Volt Dc power supply is available to provide power to the sensors.

Table 1-2: Meter specifications *(continued)*

Liquid Meter specifications	
Digital, analog, and frequency outputs	
Frequency/Digital Output(s)	The meter has user-configurable selections for either a Frequency Output or Digital Output (FODO) status. (Also Frequency/Digital outputs). Frequency/Digital Outputs • FODO1 (eight possible output configurations) • FODO2 (eight possible output configurations) • FODO3 (eight possible output configurations) • FODO4 (eight possible output configurations) • FODO5 (eight possible output configurations) • FODO6 (eight possible output configurations) Frequency or Digital Output parameter pairs (Frequency/Digital outputs) Frequency or Digital Outputs (FODO 1, FODO2, FODO3, FODO4, FODO5, FODO6) source selections. • (FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B) Mode options: • Open Collector (requires external excitation supply voltage and pull-up resistor) • TTL (internally powered by the meter 0-5 Vdc signal) Channel B Phase options: • Lag forward, Lead reverse (Phase B lags Phase A while reporting forward flow, leads Phase A while reporting reverse flow) • Lead forward, Lag reverse (Phase B leads Phase A while reporting forward flow, lags Phase A while reporting reverse flow) Phase A and Phase B output (based on flow direction) • Reverse flow - output only reports flow in the reverse direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A. • Forward flow - output only reports flow in the forward direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A. • Absolute - output reports flow in both directions. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A. • Bidirectional - output reports flow on Phase A only in the forward direction and on Phase B only in the reverse direction.

Table 1-2: Meter specifications *(continued)*

Liquid Meter specifications	
	Maximum frequency for the frequency outputs • 1000 Hz • 5000 Hz
Analog Output(s)	• (1) 4-20 mA independently configurable analog output (HART) • (1) 4-20 mA independently configurable analog output (conventional) The analog output zero scale offset error is within ±0.1 percent of full scale and gain error is within ±0.2 percent of full scale. The total output drift is within ±50 ppm of full scale per °C.

1.8 Pre-installation considerations

- Pipeline equipment code compliance, ANSI, ASME, etc.
- Proper inlet/outlet meter tube piping for reasonable stable flow to the settling chamber (first meter tube spool upstream of the meter).
- Electrical safety compliance; UL, ULC, ATEX, IECEx etc.
- Civil and structural good practices compliance
- Contractual agreements or governmental compliance (or both)
- In-situ performance test procedures
- In-situ meter calibration
- Field tested advanced meter health and flow dynamics diagnostics
- Data collection and retention procedures

1.9 Safety conditions

Rosemount 3810 Series Liquid Ultrasonic Meters are approved to the ATEX Directive 94/9/EC.

Refer to the 3810 Series Systems Wiring Diagram, Sheet 3 (DMC-004936) for the certification tag (see Engineering Drawings).

Rosemount 3810 Series Liquid Ultrasonic Meters are INMETRO certified. Refer to the 3810 Series Liquid Ultrasonic Flow Meter Tag, INMETRO Certification drawing DMC-006173.

Certificate number: NCC 11.0163 X

Marking: --Ex d ia IIB T4 Gb IP66 W

Electrical parameters: Refer to Meter specifications, Table 1-2

Special conditions for safe use

- Explosion proof joint dimensions are compliant with the Brazilian Association of technical standard: ABNT NBR IEC 60079-1, Table 3.

- The enclosure for the explosion proof transmitter and intrinsically safe barrier must be remote mounted (refer to Meter specifications, Table 1-2) if the operating temperature exceeds 140 °F (60 °C) (refer to Meter specifications, Table 1-2)
- Cable length (refer to Meter specifications, Table 1-2)

⚠ WARNING

EXPLOSION OR FIRE HAZARD
Read and follow the instructions below:

- Conduit runs must have a sealing fitting within 18 in. (457 mm) of the enclosure to reduce the risk of an explosion or a fire.
- During operation, keep covers tightly closed. DO NOT open the transmitter electronics enclosures when an explosive atmosphere may be present.
- During equipment maintenance, disconnect power before opening the transmitter electronics enclosures. Before replacing, clean cover joints.
- DO NOT substitute meter components. Substituting components may compromise the intrinsic safety of the device.

Failure to follow these safety instructions can result in severe injury to personnel or cause damage to the equipment.

1.10 Certifications and approvals

Rosemount 3814 Liquid Ultrasonic Flow Meters have electrical, metrology, intrinsic safety and Pressure Equipment Directive certifications and approvals by the agencies listed below. Refer to the nameplate tag on the meter body, the wiring diagram (DMC-004936) in Engineering Drawings and observe all safety precautions. Rosemount 3810 Series Liquid Ultrasonic Flow Meters operate within the pressure and temperature range of the device (also see Meter specifications).

Standards

- US
- Canada
- Europe
  - Explosive Atmospheres (ATEX)
  - International Electro-technical Commission (IECEx)
  - Pressure Equipment Directive (PED via BSI)
  - Electromagnetic Compatibility (EMC)
  - International Organization of Legal Metrology (OIML)

Approval Agencies

- UL
- ULC
- DEMKO
- INMETRO
- NEPSI

- GOSTR

Important
Please consult Emerson for a complete metrology approvals list.

1.11 FCC compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTICE

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.12 References

1	Gould Modbus Protocol Reference Guide, Rev. B, PI-MBUS-300
2	API MPMS Chapter 5.8, Section 8-Measurement of Liquid Hydrocarbons by Ultrasonic Flow Meters Using Transit Time Technology, Edition: 2nd American Petroleum Institute / 01-Nov- 2011
3	API MPMS Chapter 4.2, Displacement Provers, 3rd Edition | September 2003 | Reaffirmed: March 2011
4	API MPMS Chapter 12.2, Calculation of Petroleum Quantities Using Dynamic Measurement Methods And Volumetric Correction Factors, 2nd Edition | May 1995 | Reaffirmed: February 2009

2 Mechanical Installation

2.1 Meter piping, lifting and mounting

Refer to the following sections for piping recommendations, lifting with hoist rings and slings, mounting in cooled pipelines and safety warnings and precautions.

⚠ WARNING

CUTTING HAZARD
Sharp edges may be present on the meter.

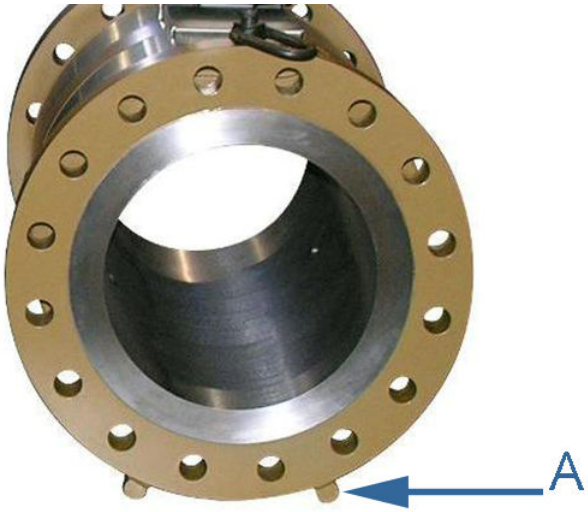
Wear appropriate personal protective equipment when working on the meter.

Failure to comply can cause serious injury to personnel.

⚠ WARNING

CRUSHING HAZARD
Do not remove flange stabilizers.

Failure to comply can cause serious injury or equipment damage.



A. Flange stabilizers

⚠ CAUTION

SURFACE TEMPERATURE HAZARD
Meter body and piping may be extremely hot or cold.

Wear appropriate personal protective equipment when coming in contact with the meter.

Failure to comply may result in injury.

⚠ CAUTION

TRIPPING HAZARD
Clear all obstacles or obstructions from the work area when transporting, installing or removing the meter.

Failure to comply may cause injury to personnel.

⚠ CAUTION

TRANSPORTATION HAZARD
When moving the meter, do not insert the forks of a forklift into the bore.

Inserting the forks may cause the meter to become unstable, resulting in injury to personnel or damage to the bore and sealing face.

2.2 Meter components

Rosemount 3810 Series Ultrasonic Flow Meters are assembled, configured, and tested at the factory. The meter components include the Transmitter Electronics Enclosure, the Base Electronics.

Enclosure and the Meter Body with transducer assemblies.

⚠ WARNING

FLUID CONTENTS MAY BE UNDER PRESSURE

When the meter is under pressure, DO NOT attempt to remove or adjust the transducer housing.

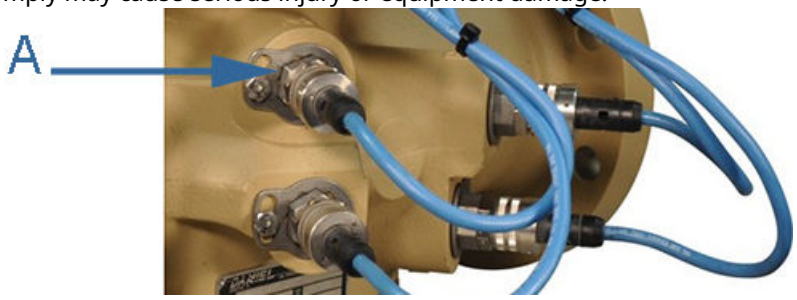
Attempting to do so may release pressurized fluid, resulting in serious injury or equipment damage

⚠ WARNING

FLUID CONTENTS MAY BE HAZARDOUS

The meter must be fully depressurized and drained before attempting to remove the transducer housing. If fluid begins to leak from the transducer housing, immediately reinstall it.

Failure to comply may cause serious injury or equipment damage.



1. Transducer housing

⚠ WARNING

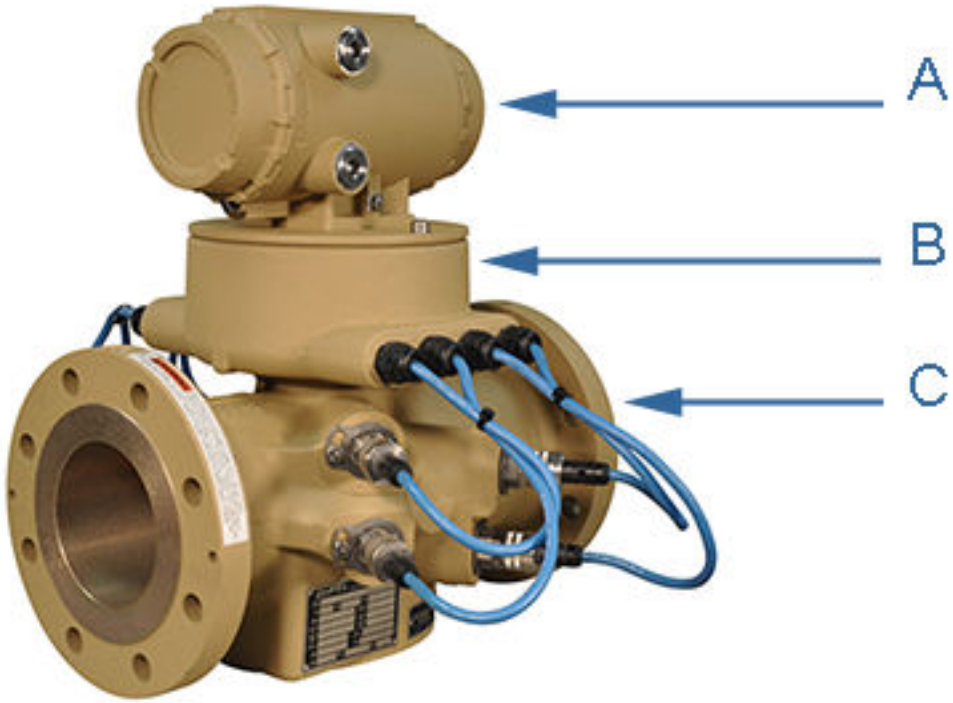
EXPLOSION OR FIRE HAZARD

Conduit runs must have a sealing fitting within 50 mm (2 inches) of the enclosure to reduce the risk of an explosion or a fire.

- During operation, keep covers tight.
- During equipment maintenance, disconnect power before opening transmitter or base electronics. Clean cover joints before replacing.
- DO NOT substitute meter components. Component substituting may compromise the intrinsic safety.

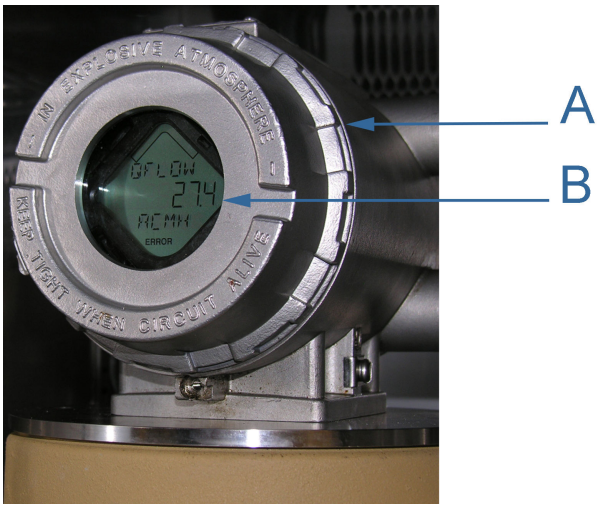
Failure to do so may result in severe injury to personnel or cause damage to the equipment.

Figure 2-1: Rosemount 3814 Liquid Ultrasonic Flow Meter assembly



A. Explosion-proof transmitter enclosure (CPU Module, Power Supply, I.S. Barrier Board and Backplane Board, Optional: glass endcap for Local Display)
B. Intrinsically-safe base enclosure includes Acquisition Module
C. Meter body transducer assemblies and cables

Figure 2-2: Transmitter electronics enclosure with optional local display and glass endcap



A. Transmitter electronics enclosure with glass endcap
B. Local display

2.3 Piping recommendations

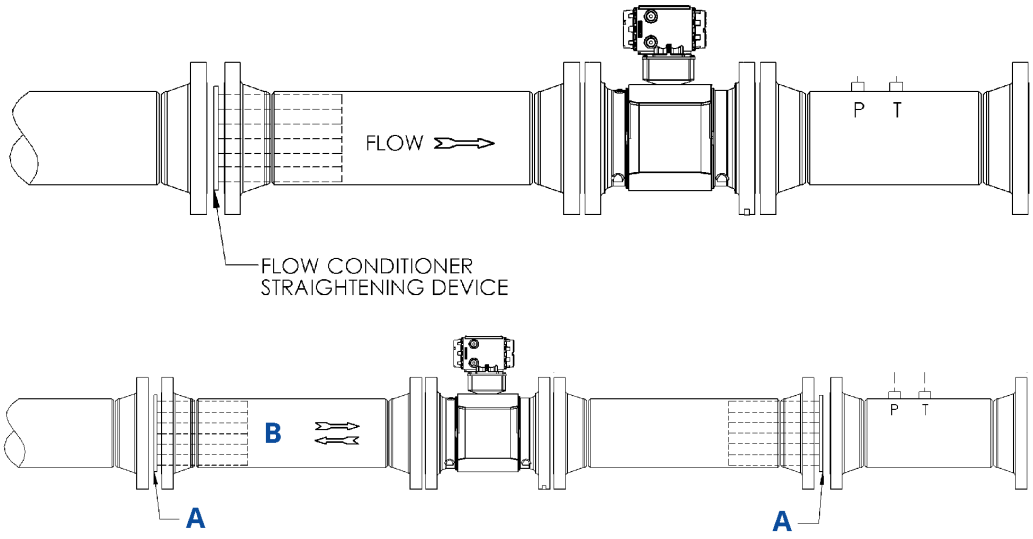
⚠ WARNING

BURST HAZARD

Before pipeline cleaning and maintenance (“pigging operations”), remove straightening vanes or flow conditioners.

Failure to comply may cause excessive pressure in the meter system, resulting in death, serious injury or equipment damage.

3814 Ultrasonic Flow Meter with flow conditioner for unidirectional flow



Flow conditioning is recommended for best measurement results:

- Honed or un-honed meter tube(s)
- Flow direction (unidirectional or bidirectional)
- Correct meter size selection - too low may cause poor flow stability (thermal convection or too fast may cause erosion problems and resonance, cracks or failure of probes or thermowells (approximately 0.6 to 12 m/sec or 2 to 40 ft./sec).
- Space availability for meter lengths (to allow inlet piping customization)
- Concentric alignment pins or flange concentricity technique considerations

NOTICE

For optimal flow measurement conditions, Emerson suggests the piping configurations in Figure 2-3 and Figure 2-4. Regardless of the configuration selected, the user agrees to accept full responsibility for the site piping design and installation.

Figure 2-3: Piping recommendations unidirectional flow

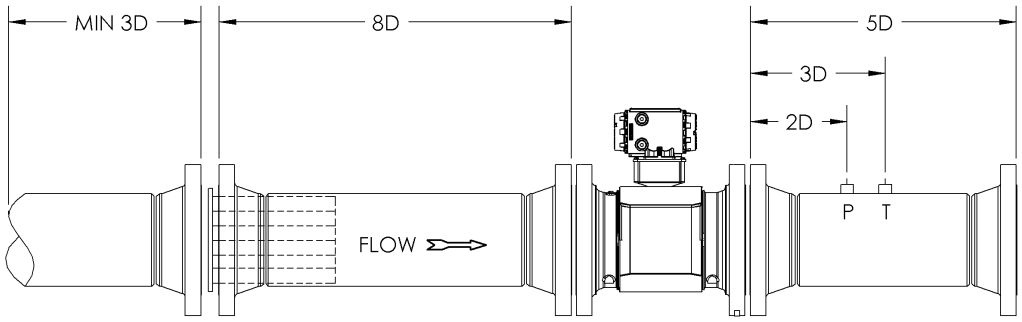
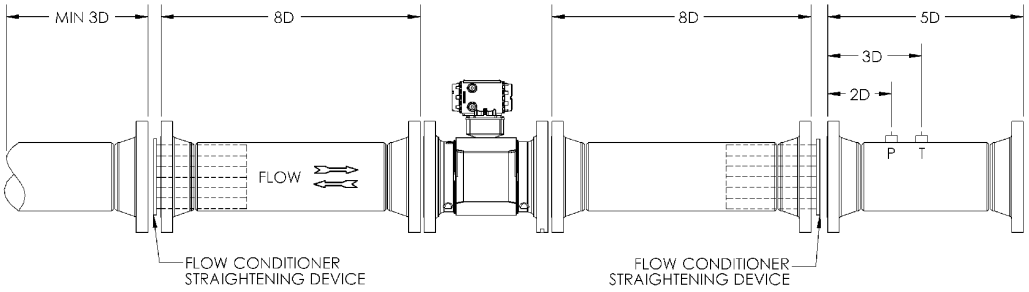


Figure 2-4: Piping recommendations bidirectional flow



All pipe lengths are minimum:

- D = Nominal pipe size in in. (i.e. 6 in. pipe size; 10 D = 48 in.)
- P = Pressure measurement location
- T = Temperature measurement location

Refer to the ultrasonic meter product data sheet for piping information. The Liquid Ultrasonic Flow Meter Datasheet may be downloaded from the Emerson website: Emerson.com/Automation.

NOTICE

To access the product datasheet, from the Emerson.com/Automation link:

1. Open Emerson.com/Automation.
2. Click the **Documentation** tab.
3. Expand the **Data Sheets - Bulletins - Catalogs** tab.
4. Select the **Product Data Sheet**.

Meter tube dimensions with tube bundle or profiler plate for uni-directional and bi-directional flow, the minimum straight pipe length is as follows:

Table 2-1: Piping recommendation for uni-directional or bi-directional flow

Uni-Directional Flow	Bi-Directional Flow
8D upstream (with a flow conditioner)	8D upstream (with a flow conditioner)

Table 2-1: Piping recommendation for uni-directional or bi-directional flow *(continued)*

Uni-Directional Flow	Bi-Directional Flow
8D upstream (no flow conditioner)	8D upstream (no flow conditioner)
5D downstream	8D downstream

- The bore of the mating piping should be within 1 percent of the meter inside diameter.
- The meter is provided with dowel pins to align the meter body bore with the bore of the mating piping.
- The Rosemount Liquid Ultrasonic Flow Meter should be mounted in horizontal piping with the chord paths horizontal

⚠ CAUTION

FAULTY METER INSTALLATION
Correctly install the equipment. If meter bodies are mounted or oriented differently than specified above, debris may collect in the transducer ports.

Failure to comply may cause equipment damage or adversely affect the transducer signals.

- Normally, the meter body is installed so that the electronics assembly is on the top of the meter. If there is insufficient space above the piping for this arrangement, the meter can be ordered with extra long transducer cables for remote mounting or the meter housing can be installed with the electronics assembly on the bottom.
- The mating piping should include temperature and pressure measurement connections located a minimum of two nominal pipe diameters length down stream of the meter, or per API MPMS 5.8.
- Piping requirements for field calibration of high viscosity, low Reynolds Number applications is comprised of the upstream pipe section, CPA (Canadian Pipeline Associates) flow conditioning plate, Venturi reducer section, ultrasonic meter and downstream pipe section.

2.3.1 High Viscosity piping requirements

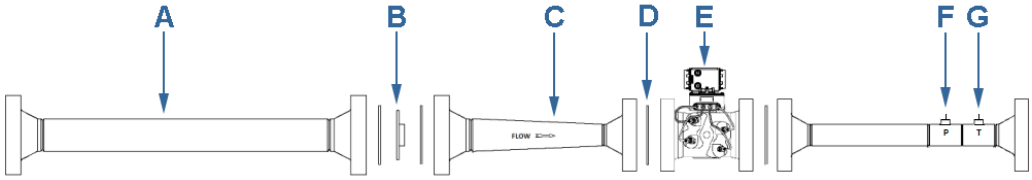
The piping requirements for High Viscosity meter applications are shown in Figure 2-5.

⚠ CAUTION

HIGH VISCOSITY FLOW MEASUREMENT METER RECALIBRATION
In high viscosity meter applications, if the connection between the upstream meter flange (Figure 2-5, Item D) and the Venturi reducer (Figure 2-5, Item C) is disassembled or disturbed for any reason, the meter will need to be recalibrated in accordance with Emerson recommendations. Alignment of this flange joint is critical in the performance of the meter. It is recommended to consult Emerson Customer Support for assistance when re-aligning this joint.

Failure to recalibrate the meter and correctly reinstall the flanged joint will result in faulty flow measurement.

Figure 2-5: High Viscosity meter tube and Venturi piping recommendations



A. Meter tube

B. Flow conditioner and flange gaskets

C. Venturi conical reducer

D. Upstream meter flange

E. 3810 Series Liquid Ultrasonic Flow Meter

F. Pressure tap

G. Temperature tap

Sunshields, to be provided by the customer, may be required to prevent exceeding the ambient operating temperature range when the meter is mounted in a location with extremely hot climates.

⚠ CAUTION

SUNSHIELD PROTECTION
Install a sunshield to prevent prolonged exposure to direct sunlight in extreme climates.

Failure to shield the meter may result in exceeding the process temperature range and damage transmitter electronics.

2.4 Meter safety for hoist rings and lifting slings

A Rosemount Liquid Ultrasonic Flow Meter can be safely lifted and maneuvered into and out of a meter run for installation or service by obeying the following instructions.

⚠ WARNING

FALLING AND CRUSHING HAZARD
Lifting a Rosemount Ultrasonic Meter with Other Equipment

The following lifting instructions are for installation and removal of the Rosemount Liquid Ultrasonic Meter ONLY. The instructions below do not address lifting the Rosemount Ultrasonic Meter while it is attached, bolted, or welded to meter tubes, piping, or other fittings.

The operator must refer to their company's hoisting and rigging standards, or the "DOE-STD-1090-2004 Hoisting and Rigging" standard if such company standards do not exist, for lifting and maneuvering any assembled meter tube and associated piping.

Using these instructions to maneuver the Rosemount Ultrasonic Meter while it is still attached, bolted, or welded to a meter tube, piping, or other fitting can result in death, serious injury or equipment damage.

⚠ WARNING

CRUSHING HAZARD
During meter installation or removal, always place the unit on a stable platform or surface that supports its assembled weight. Provide support for the dual transmitter electronics assemblies during installation and removal.

Failure to comply can cause the meter to roll and the electrical wiring conduit connections to be severed, resulting in serious injury or equipment damage.

NOTICE

Prior to lifting the unit, refer to the Rosemount 3814 Liquid Ultrasonic Flow Meter nameplate or outline dimensional (general arrangement) drawing for the assembled weight.

When lifting a Rosemount Ultrasonic Meter by itself, Emerson recommends two methods. These methods are:

- Using appropriately rated Safety Engineered Swivel Hoist Rings installed in the Rosemount Ultrasonic Meter end flanges.
- Using appropriately rated lifting slings positioned at designated areas of the Rosemount Ultrasonic Meter.

Both methods must be used in conjunction with all appropriate company hoisting and rigging standards or the DOE-STD-1090-2004 HOISTING AND RIGGING standard if such company standards do not exist. Refer to the following sections for more information on these two methods.

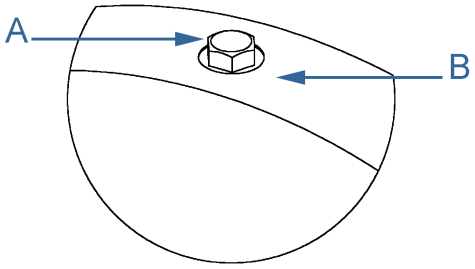
2.4.1 Use of appropriate safety engineered swivel hoist rings in meter end flanges

Rosemount Ultrasonic Meters come equipped with a tapped hole located on the top of each meter body end flange. A flat machined surface surrounds each tapped hole (see Figure 2-6). This feature provides complete surface contact ONLY between the meter flange and an OSHA compliant Safety Engineered Swivel Hoist Ring as shown in Figure 2-7.

Operators SHALL NOT use Eye Bolts (see Figure 2-7) in the Rosemount 3814 Liquid Ultrasonic Meter flange tapped holes to aid in lifting or maneuvering the unit.

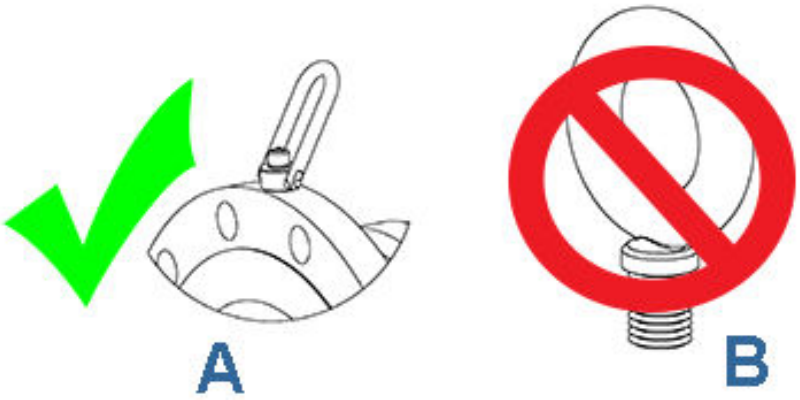
Operators SHALL NOT use other Hoist Rings that do not fully seat flush with the counter bore on the top of the meter flanges.

Figure 2-6: Meter end flange with tapped flat-counterbore hole for hoist ring



A. Plug bolt
B. Flat counterbore surface

Figure 2-7: Safety approved hoist ring and non-compliant eye bolt



A. Safety engineered swivel hoist ring
B. Eye bolt

Safety precautions using safety engineered swivel hoist rings

Read and follow the Safety Precautions listed below:

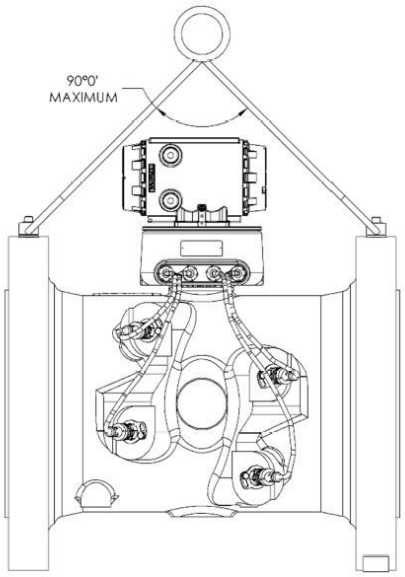
Procedure

1. Meters must only be lifted by personnel properly trained in the safe practices of rigging and lifting.
2. Remove the plug bolts installed in the tapped holes on the top of the flanges. Do not discard the bolts as they must be reinstalled once the lifting operation is complete to prevent corrosion of the tapped holes.
3. Ensure the tapped holes on the meter are clean and free of debris before installing the hoist rings.
4. Use only the safety engineered swivel hoist rings that are rated for lifting the meter. Do not use any other type of hoist rings with the same screw size or heavy duty hoist rings. The meter tapping and counter bore size are suitable only for the hoist rings specified by Emerson.
5. When installing a hoist ring, make sure the base surface of the hoist ring fully contacts the machined flat surface of the tapped hole. If the two surfaces do not

come in contact then the hoist ring will not hold its full rated load. Torque the hoist ring attachment bolts to the limit indicated on the hoist rings.

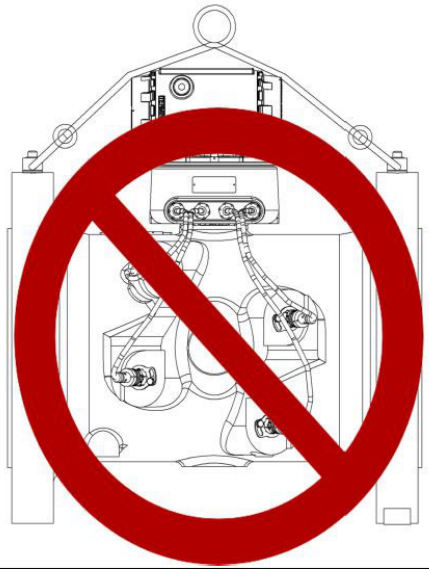
6. After installation of the hoist rings, always check that the ring rotates and pivots freely in all directions.
7. NEVER attempt to lift the meter using only one hoist ring.
8. Always use separate slings to each hoist ring. NEVER reeve one sling through both hoist rings. The slings must be of equal length. Each sling must have a load rating that equals or exceeds the hoist ring load rating. The angle between the two slings going to the hoist rings must never exceed 90 degrees or the load rating of the hoist rings will be exceeded.

Figure 2-8: 90 Degree angle between slings



9. NEVER allow the slings to contact the electronics enclosure. Damage to the enclosure may occur. Use a spreader bar with the slings to prevent contact with the electronics enclosure and the base enclosure (see Figure 2-10). If the slings do come in contact with the electronic enclosure then remove the two bolts holding the enclosure to its base and temporarily remove the head from the meter during the lifting operation. You will need to unplug the cable from J3 on the Acquisition Module. Two screws hold this cable in place. Once the lifting operation is complete, reattach and secure the electronics cable to J3 on the Acquisition Module, return the electronics enclosure to its original position, replace the bolts, and secure the enclosure in place. Lifting the meter with the upper enclosure installed but without the bolts installed, may cause the electronics to fall and cause personal injury or equipment damage.

Figure 2-9: Incorrect sling attachment



10. NEVER apply shock loads to the meter. Always lift the meter gradually. If shock loading ever occurs, the hoist ring must be inspected per manufacturer's recommendations prior to be placed in any further service. If a proper inspection cannot be performed, discard the hoist ring.
11. NEVER lift with any device, such as hooks, chains, or cables that could create side pulls that could damage the ring of the hoist ring.
12. NEVER lift more than the ultrasonic meter assembly including electronics and transducers with the hoist rings. The only exception is that it is safe to lift the meter with one ASME B16.5 or ASME B16.47 blind flange bolted to each end flange of the meter. NEVER use the hoist rings on the meter to lift other components such as meter tubes, piping or fittings attached to the meter. Doing so will exceed the load rating of the hoist rings.
13. Remove the hoist rings from the meter after lifting is completed and store them in an appropriate case or container per their manufacturer's recommendation.
14. Apply heavy lubricant or anti-seize to the threads of the plug bolts and reinstall the plug bolts to keep the tapped holes free of debris and to prevent corrosion.

Obtain safety engineered swivel hoist rings

A list of approved manufacturers of safety engineered hoist rings is below:

- American Drill Bushing
- Carr Lane

Select an approved supplier from the list below. These vendors can supply the safety engineered hoist rings. This is not intended to be a complete list.

- Fastenal
- Reid Supply

The appropriate hoist rings can also be purchased directly from Emerson. The following table provides part number for reference:

Table 2-2: Hoist ring part number lookup table

Rosemount Part number(1)	Hoist ring thread size & load rating(1)	American Drill Bushing Co. P/N(1)	Carr Lane Manufacturing Co. P/N(1)
1-504-90-091	3/8 in.-16UNC, 1000 lb.	23053	CL-1000-SHR-1
1-504-90-092	½ in.-13UNC, 2500 lb.	23301	CL-23301-SHR-1
1-504-90-093	¾ in. -10UNC, 5000 lb.	23007	CL-5000-SHR-1
1-504-90-094	1 in. -8UNC, 10000 lb.	23105	CL-10000-SHR-1
1-504-90-095	1.5 in. -6UNC, 24000 lb.	23202	CL-24000-SHR-1

(1) The part numbers include only one hoist ring. Two hoist rings are required per meter.

Size needed for engineered swivel hoist ring

To determine the size of the hoist rings required for your meter, use the table below for the 3814 Liquid Ultrasonic Meter. The part number shown in Table 2-3 is appropriately rated for the ANSI rating of your meter.

Table 2-3: Hoist ring lookup table for Rosemount 3814 Liquid Ultrasonic Flow Meters

ANSI 300	ANSI 600	ANSI 900	ANSI 1500	Part Number
4 in. - 10 in. (101.6 mm - 254 mm)	4 in. - 8 in. (101.6 mm - 203.2 mm)	4 in. - 8 in. (101.6 mm - 203.2 mm)	4 in. - 6 in. (101.6 mm - 152.4 mm)	1-504-90-091
12 in. - 18 in. (304.8 mm - 457.2 in.)	10 in. - 16 in.(254 mm - 406 mm)	10 in. - 12 in. (254 mm - 304.8 mm)	8 in. - 10 in. (101.6 mm - 254 mm)	1-504-90-092
20 in. - 24 in. (508 mm - 609.6 mm)	18 in. - 20 in. (304.8 mm - 508 mm)	16 in. - 20 in. (406 mm - 508 mm)	12 in. (304.8 mm)	1-504-90-093
30 in. - 36 in. (762 mm - 914.4 mm)	24 in. - 30 in. (609.6 mm - 762 mm)	24 in. (609.6 mm)	16 in. - 20 in. (406 mm - 508 mm)	1-504-90-094
-	36 in. (914.4 mm)	30 in. - 36 in. (762 mm - 914.4 mm)	24 in. - 36 in. (609.6 mm - 914.4 mm)	1-504-90-095

Note
4” to 6” 45 degree meters and 8” to 36” 60 degree meters

2.4.2 Use of appropriately rated lifting slings

The following instructions are intended to provide general guidelines for proper lifting slings of the Rosemount 3814 Ultrasonic Meter by itself. These instructions are intended to be followed in addition to your company's standards or the DOE-STD-1090-2004 Hoisting and Rigging standard if such company standards do not exist.

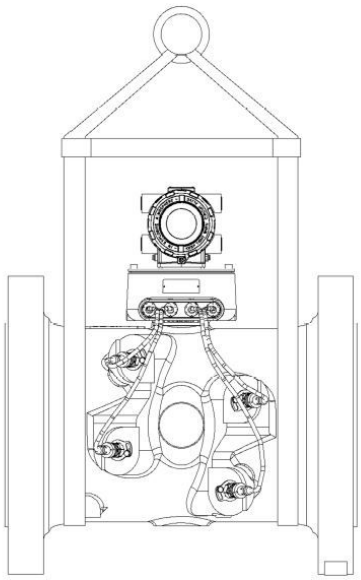
Safety precautions using appropriate rated lifting slings

Procedure

1. Meters must only be lifted by personnel properly trained in the safe practices of rigging and lifting.

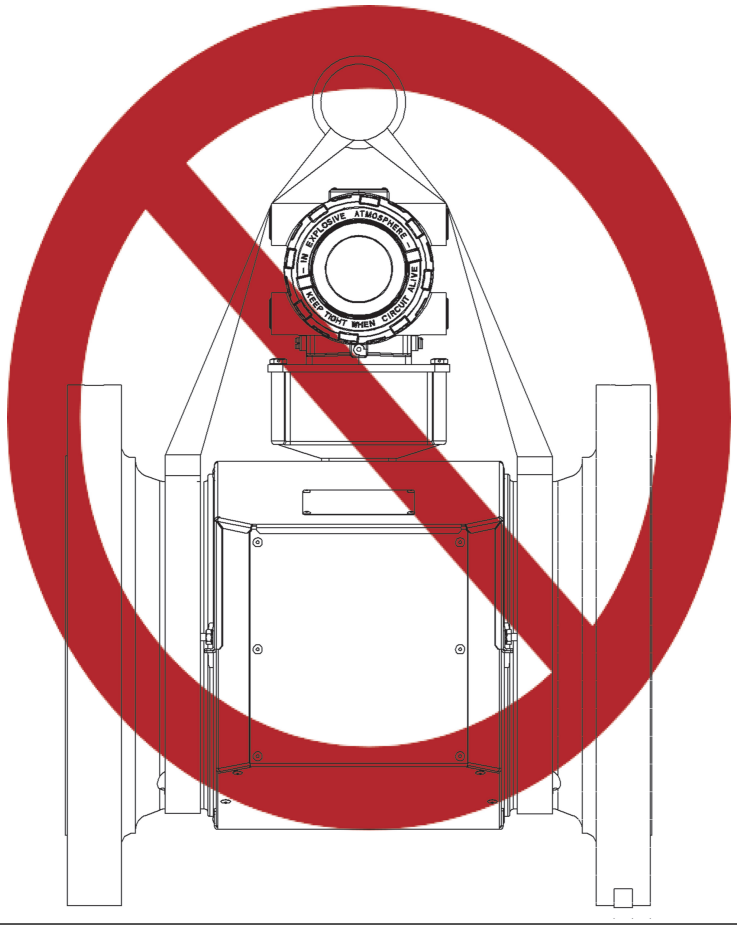
2. NEVER attempt to lift the meter by wrapping slings around the electronics enclosure.
3. NEVER attempt to lift the meter using only one sling around the meter. Always use two slings wrapped around each end of the body as shown below. A choker style sling is recommended.

Figure 2-10: Correct sling attachment



4. Visually inspect the slings prior to use for any signs of abrasion or other damage. Refer to the sling manufacturer's procedures for proper inspection of the particular sling you are using.
5. Only use slings with ratings that exceed the weight to be lifted. Reference your company's standards for safety factors that must be included when calculating the load rating.
6. NEVER allow the slings to contact the electronics enclosure or the transducer cabling. Damage to the meter may occur. If the slings do come in contact with the electronics enclosure, then remove the two bolts holding the enclosure to its base and temporarily remove the head from the meter during the lifting operation (remove the two bolts holding the enclosure to its base and unplug the cable from the Acquisition Module. Two screws hold this cable in place.) Use a spreader-bar on the sling to prevent contact with the electronics. Once the lifting operation is complete, reattach and secure the electronics cable to J3 on the Acquisition Module, return the electronics enclosure to its original position, replace the bolts, and secure the enclosure in place. Lifting the meter with the upper enclosure installed but with out the bolts installed, may cause the electronics to fall and cause personal injury or electronics damage.

Figure 2-11: Incorrect sling attachment



7. NEVER apply shock loads to the meter. Always lift the meter gradually. If shock loading ever occurs, the slings must be inspected per manufacturer's procedures prior to being placed in any further service.

2.5 Mounting requirements in heated or cooled pipelines

The ambient operating temperature of the Rosemount 3814 Liquid Ultrasonic Flow Meter electronics (i.e. Flameproof enclosure and Intrinsically safe base enclosure) is -40°F (-40°C) to 140°F (60°C). If the meter is installed into a pipeline which is heated or cooled outside this temperature range it is necessary to remove the electronics housing from the meter body (i.e. Spool piece acting as process fluid conduit) and mount it next to the meter body on a pipe stand or other rigid structure.

Extended length transducer cables (P/N 1-360-01-601, 15 ft. long) shall be used to connect the Rosemount 3814 Liquid Ultrasonic Flow Meter electronics to the transducers installed in the meter body. The process temperature must also not exceed the operating temperature range of the transducers. LT-01 and LT-03 transducers have an operating range from -58 °F (-50 °C) to 212 °F (100 °C).

For process fluid temperatures up to 150°C, the high temperature extended length transducer cables (P/N 1-360-01-800) shall be used to connect the Rosemount 3814 Liquid Ultrasonic Flow Meter electronics to the transducers installed in the meter body. The process temperature for LT-04, LT-05, LT-08 and LT-09 transducers must also not exceed the operating temperature range of the transducers -58 °F (-50 °C) to 302 °F (150 °C).

⚠ CAUTION

SURFACE TEMPERATURE HAZARD

The meter body and piping may be extremely hot or cold. Wear appropriate personal protective equipment when coming in contact with the meter.

Failure to comply may result in injury.

3 Electrical Installation

3.1 Cable length TTL mode

When the “TTL” mode is selected, the maximum cable length is 2,000 ft.

3.2 Cable length Open Collector mode

For the “open collector” mode, the maximum cable length depends on the cable parameters, pull-up resistance used, the maximum frequency to output, and frequency input parameters being driven. The following table provides estimated cable lengths for different pull-up resistor values and different Max Frequency settings in the meter using the following cable parameters. The table also provides an estimated cable voltage drop which indicates how much voltage will be across the cabling and effectively indicates to what voltage level the frequency input can be pulled down to by the frequency output.

If the voltage drop is higher than the voltage required for the frequency input to see a low state, then the configuration will most likely not work for your system. Performance of frequency outputs will vary from this table with setup and frequency input being driven.

Table 3-1: Configurations for open collector frequency outputs

Cable	**Cable resistance**	**Cable**	**Pull-up resistance**	**Total**	**Maximum frequency**	**Sink**	**Cable voltage drop**
Length	(2 Conductors)	Capacitance	Resistance	Resistance	Frequency	Current	(2 Conductors)
(x1000 ft.)	Ω	nF	Ω	Ω	(Hz)	(A)	Vdc
0.5	16.8	10.00	1000	1016.8	5000	0.024	0.397
1	33.6	20.00	1000	1033.6	1000	0.023	0.780
2	67.2	40.00	1000	1067.2	1000	0.022	1.511
4	134.4	80.00	1000	1134.4	1000	0.021	2.843
0.5	16.8	10.00	500	516.8	5000	0.046	0.780
1	33.6	20.00	500	533.6	5000	0.045	1.511
1.7	57.12	34.00	500	557.12	5000	0.043	2.461
6.5	218.4	130.00	500	718.4	1000	0.033	7.296

The 22 AWG wire characteristics are as follows:

- Capacitance = 20 pF/ft. or 20 nF/1000 ft. (between two wires)
- Resistance = 0.0168 Ohms/ft. or 16.8 Ohms/1000 ft.
- Pull-up voltage is 24 Vdc

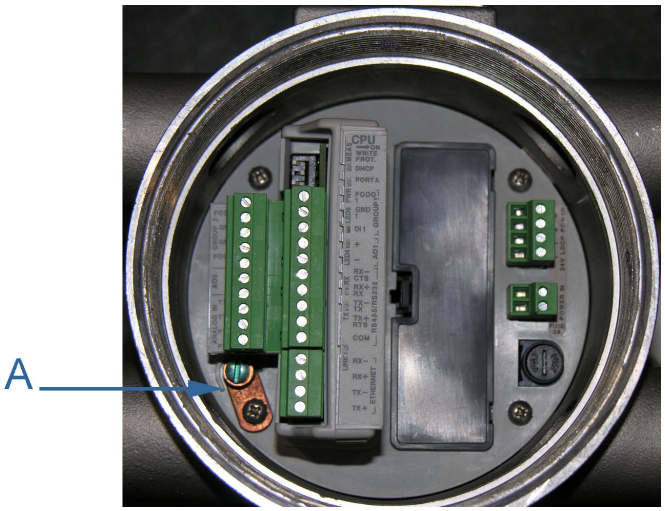
3.3 Grounding meter electronics

Rosemount 3814 Liquid Ultrasonic Flow Meter electronics should be internally grounded for intrinsically safe operations. Connect a wire to the chassis ground lug installed inside the Transmitter Electronics Enclosure as the primary ground.

NOTICE

The internal grounding terminal shall be used as the primary equipment ground. The external terminal is only a supplemental bonding connection where local authorities permit or require such a connection.

Figure 3-1: Internal Transmitter Electronics Enclosure chassis ground



A. Transmitter Electronics Enclosure internal ground lug

Figure 3-2: External ground lug

A. External ground lug

3.4 Conduit seals

Rosemount 3814 Liquid Ultrasonic Meters require conduit seals for installations in hazardous environments. Adhere to safety instructions to protect personnel and equipment.

⚠ WARNING

HAZARDOUS VOLTAGE INSIDE
Do not open the Transmitter Electronics Enclosure when an explosive gas atmosphere is present. Disconnect equipment from supply circuit before opening.

Failure to remove power may result in death or serious injury.

⚠ WARNING

EXPLOSION HAZARD
Substitution of components may impair intrinsic safety. Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

Failure to comply may result in death or serious injury.

3.4.1 Startup for systems using explosion-proof conduit

Procedure

1. Assemble conduit to the Transmitter Electronics Enclosure. A conduit seal is required within 18 in. (457 mm) of the enclosure.
2. Ensure all power to field wiring is turned **OFF**.

   ⚠ WARNING

   HAZARDOUS VOLTAGE INSIDE
   Do not open in flammable gas area. Disconnect all power to the meter.

   Failure to comply can result in death or serious injury.

3. Remove the end cap nearest the conduit entry to gain access to the transmitter electronics.
4. Pull the wires.
5. Complete the field connection wiring according to the system wiring diagram (see Engineering Drawings).
6. Apply electrical power to the system to ensure the field connections are working correctly. Allow the system to run for the time specified by the customer (usually one week) and an electrician have fully tested the connections. After the Acceptance Test is witnessed and approved, seal the conduit.
7. Power down the system and apply the sealing compound to the conduit and allow to set in accordance with manufacturer specifications.
8. If required, install the security latches and wire seals on the Transmitter Electronics Enclosure end caps (see Sealing the Transmitter Electronics Enclosure and see Figure 3-9).
9. If required, install the wire seals through the socket head bolts on the Base Enclosure (see Sealing the Transmitter Electronics Enclosure).
10. Connect electrical power to the system.

11. Set or configure the meter using MeterLink. For additional installation information refer to the system wiring diagram (see Engineering Drawings), *MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (00809-0100-7630). Use the MeterLink Field Setup Wizard to complete the configuration. Also see, Field Setup Wizard using MeterLink in this manual.

3.4.2 Startup for systems using flame-proof cable

⚠ WARNING

HAZARDOUS VOLTAGE INSIDE
Do not open the Transmitter Electronics Enclosure when an explosive gas atmosphere is present. Disconnect equipment from supply circuit before opening.

Failure to remove power may result in death or serious injury.

Procedure

1. Check to make certain that all field wiring power is turned **OFF**.
2. Remove the end cap nearest the cable entries to gain access to the transmitter electronics.
3. Install the cable and cable gland.
4. Complete the field connection wiring.
5. Connect a flow computer to the communications line on the Rosemount 3814 Liquid Ultrasonic Flow Meter.
6. Apply electrical power to the system to ensure the field connections are working correctly. Allow the system to run for the time specified by the customer (usually one week) and an electrician have fully tested the connections. After the Acceptance Test is witnessed and approved, seal the conduit.
7. Connect electrical power to the system.
8. If required, install the security latches and wire seals on the Transmitter Electronics Enclosure end caps .
9. Install the wire seals on the Base Enclosure hex head bolts and on the Shroud covering the meter body (see Base enclosure security seals).
10. Ensure the safety latches are installed on the Transmitter Electronics Enclosure.
11. Set or configure the software using MeterLink. For additional installation information, refer to the system wiring diagram (see Engineering Drawings), *MeterLink Software for Gas and Liquid Quick Start Manual* (00809-0100-7630). Use the MeterLink Field Setup Wizard to complete the meter configuration. Also see, Field Setup Wizard using MeterLink in this manual.

3.5 Wiring and I/O

MeterLink™ uses the TCP/IP protocol to communicate with the 960-24™ MSTS electronics instead of Modbus ASCII or RTU. The TCP/IP protocol only works across either Ethernet, RS-485 full duplex (i.e., four-wire), or RS-232. MeterLink can communicate with multiple meters if they are multi-dropped using four-wire full duplex RS-485 mode. The meter electronics is HART® capable and provides communication flexibility with Rosemount 3814 Liquid Ultrasonic Flow Meters.

The HART® output provides communication with other field devices (e.g., AMS Trex, Field Communicator and AMS Device Manager Software) and ultimately, communicates key diagnostic information through PlantWeb™ architecture.

NOTICE

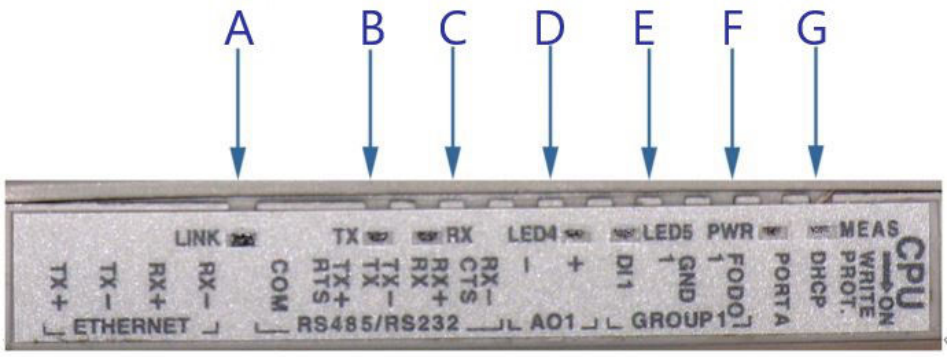
If not using Ethernet, a full duplex serial connection is necessary for MeterLink to communicate with a Rosemount 3814 Liquid Ultrasonic Meter.

The Rosemount 3810 Series Ultrasonic Flow Meter electronics auto-detects the protocol used and automatically switches between TCP/IP, Modbus ASCII, and Modbus RTU so it is not necessary to make any meter configuration changes to change the protocol.

3.5.1 CPU Module labeling and LED indicators

The meter's metrology mode and the status of the data transfer from the Acquisition Module to the CPU Module is indicated via Light-Emitting Diode (LED) status indicators. The Write PROT. switch prevents overwriting the meter's configuration.

Figure 3-3: CPU Module labeling and LED indicators



A. Link (Eth1 Link) - User Ethernet connection
B. TX (RS-485/RS-232) - Transmitting data
C. RX (RS-485/RS-232) - Receiving data
D. LED 4 - Not used
E. LED 5 - Not used
F. Power
G. Acquisition/Measurement mode

Table 3-2: CPU Module labeling and LED functions

CPU Module labeling and LED functions	Function	Switch position indicator or LED
WRITE PROT.	• Write-protect mode - With switch in the **ON** position (default setting) protects configuration and firmware overwrites. • To write configuration changes or download firmware to the meter, change the switch to the **OFF** position.	Switch position • **ON** - (Default setting) Enables write-protection of the configuration and firmware • **OFF** - Enables writing configuration changes or downloading firmware

Table 3-2: CPU Module labeling and LED functions *(continued)*

CPU Module labeling and LED functions	Function	Switch position indicator or LED
DHCP	• Dynamic Host Protocol Server - Enables you to communicate with a Rosemount meter that is not connected to a network. • When the CPU Module switch is in the **ON** position, the meter is enabled to act as a DHCP server for a single DHCP client connected to the Ethernet port using a crossover cable. **Note** This should be used for peer to peer connections only. • When the connection is made, select to use the Meter Name in the meter instead of the Meter Directory Name in order to keep all log files and configurations separate from each meter.	Switch position • **ON** - The meter is enabled to act as a DHCP server for a single DHCP client • **OFF** - Disables the DHCP server
PORT A	• PORT A override - RS-232 serves as an override during meter commissioning to establish communications and in the event the user cannot communicate with the meter due to an inadvertent communication configuration change. The override period is for two minutes. • Supports: — Auto-detected ASCII (Start bit 1, Data Bit 7, Parity Odd/Even, Stop Bit 1) — RTU (Start Bit 1, Data Bit 8, Parity none, Stop Bit 1). — Modbus protocols • RS-232 Baud rate = 19,200 • Modbus ID = 32	Switch position • **ON** - Enables RS-232 PORT A override • **OFF** - (Default setting) Disables RS-232 PORT A
MEAS	System color indicates metrology mode • Acquisition mode • Measurement mode	LED status • Red flashing LED • Solid red the Acquisition Module not communicating with the CPU Module • Green flashing LED
PWR	• 3.3 V Power Indicator	• Solid green
LED 4	• Not used	-
LED 5	• Not used	-

Table 3-2: CPU Module labeling and LED functions *(continued)*

CPU Module labeling and LED functions	Function	Switch position indicator or LED
RX	• RX signal (Port A for RS485 or RS232 communication) receiving data	• Flashing green (when receiving data)
TX	• TX signal (Port A for RS485 or RS232 communication) transmitting data	• Flashing green (when transmitting data)
LINK	• ETH1Link user Ethernet connection	• Solid green

Ethernet communications

The Ethernet port IP address, subnet mask, and gateway address are software-configurable. In addition, a meter can be configured to act as a DHCP (Dynamic Host Configuration Protocol) server to assign an IP address to a PC or laptop running MeterLink™. The DHCP server facility is not intended to act as a general purpose DHCP server for a wider network. To this end, no user control is provided over the class or range of IP addresses the unit provides. A standard twisted pair (Cat-5) cable should be used for Ethernet wiring.

It is strongly recommended that the meter be configured using an independent (off-network) single host. After configuration of the Rosemount 3814 Liquid Ultrasonic Flow Meter, the DHCP option must be turned off if used on a LAN/WAN.

⚠ CAUTION

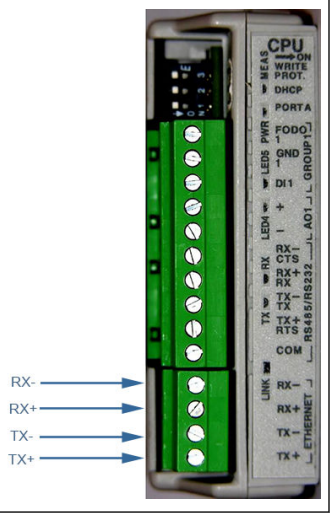
RESTRICT ETHERNET AND SERIAL CONNECTIVITY USAGE
User is responsible for ensuring that physical access and Ethernet or electronic access to the Rosemount 3814 Liquid Ultrasonic Flow Meter is appropriately controlled and any necessary security precautions, such as, establishing a firewall, setting password permissions and/or implementing security levels.

Failure to restrict Ethernet and communication access to the Rosemount 3814 Liquid Ultrasonic Flow Meter can result in, among other things, unauthorized access, system corruption, and/or data loss.

Use ethernet cable (P/N 1-360-01-596) to connect the PC to the meter.

Table 3-3: Ethernet cable to PC communication

Ethernet communication	
Wire color	CPU
White w/ Orange Stripe	TX+
Orange w/ White Stripe	TX -
White w/ Green Stripe	RX+
Green w/ White Stripe	RX -



A DIN 41612 48-pin connector is the interface from the CPU Module to the CPU Module to the Field Connection Board (male end located on the back of the Field Connection Board).

Serial connections

Use serial cable (P/N 3-2500-401) to connect to a PC running MeterLink™. The cable is designed for RS-232 communications which is the serial Port A default configuration (see Engineering Drawings field wiring diagram, Drawing DMC-004936). The DB-9 end of the cable plugs directly into the PC running MeterLink. The three wires on the other end of the cable connect to the CPU Module. The RED wire goes to RX, the WHITE wire goes to TX, and the BLACK wire goes to COM for the RS-485/RS-232 terminals (Table 3-4 for Port A wiring).

When Belden wire No. 9940 or equivalent is used, the maximum cable length for RS-232 communications at 9600 bps is 88.3 meters (250 ft.) and the maximum cable length for RS-485 communication at 57600 bps is 600 meters (1970 ft.).

Port A supports a special override mode which forces the port to use known communication values (19200 baud, address 32, RS-232). Note that the protocol is auto-detected. This mode is expected to be used during meter commissioning (to establish initial communication) and in the event that the user cannot communicate with the meter (possibly due to an inadvertent communication configuration change). Alternately, when using MeterLink with an Ethernet port, use Ethernet cable (P/N 1-360-01-596) to connect the PC.

Table 3-4: Serial Port A parameters

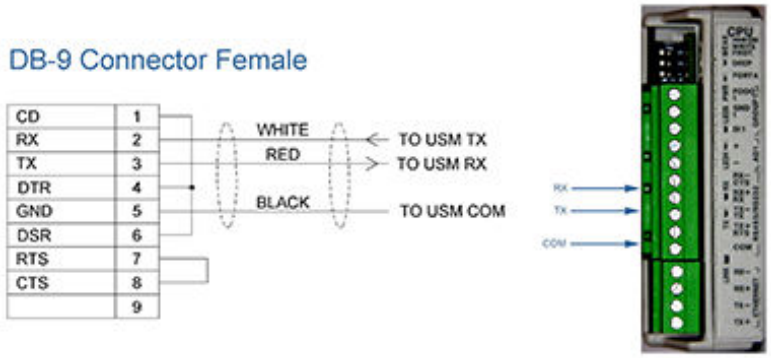
Port/Communication	Description	Common features
Port A (Standard) • RS-232 • RS-485 Half Duplex • RS-485 Full Duplex	• Typically used for general communications with a flow computer, RTU (Modbus slave) and radios. • Special override mode to force port configuration to known settings. • Supports RTS/CTS handshaking with software-configurable RTS on/off delay times. • Factory default is RS-232, Address 32, 19200 baud.	Communications via MeterLink using RS-232 or RS-485 Full Duplex • Software configurable Modbus Address (1-247) • Auto-detects TCP/IP and ASCII or RTU Protocol — ASCII Protocol: Start Bits = 1, Data Bits=7(1) — Parity: odd or even 1, Stop Bits = 1(1) — Baud Rates: 1200, 2400, 9600, 19200, 38400, 57600, 115000 bps — RTU Protocol: Start Bits = 1, Data Bits = 8(1) — Parity: none, Stop Bits = 1(1) — Baud Rates: 1200, 2400, 9600,19200, 38400, 57600, 115000 bps
Ethernet	• Preferred port for diagnostic communication via MeterLink • 10 Mbps/100 Mbps	• Modbus TCP/IP

(1) Denotes auto-detected protocols.

NOTICE

If not using Ethernet, a full duplex serial connection is necessary for MeterLink to communicate with a Rosemount 3814 Liquid Ultrasonic Meter.

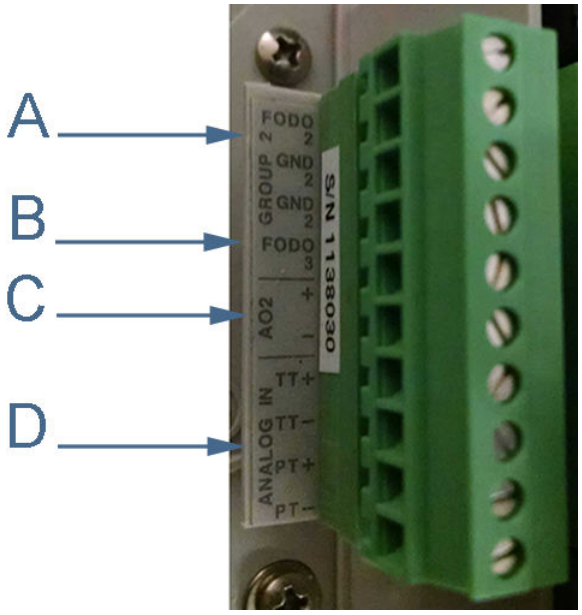
Figure 3-4: PC to meter serial connection wiring



3.6 Rosemount Ultrasonic Meters I/O connections

The 960-24™ MSTS provides I/O connections on the CPU Module.

Figure 3-5: CPU Module I/O connections



A. Frequency/Digital Output 2
B. Frequency/Digital Output 3
C. Analog Output 2 - 4-20 mA output
D. Analog Input - HART® temperature and pressure connections

3.6.1 Frequency/Digital outputs

The meter has three user-configurable selections for configuring either a Frequency output or Digital output (FODO).

- FODO1 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO2 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO3 (eight possible parameter configurations) [Type 2] [Type 4]
- FODO4 (eight possible parameter configurations) [Type 4]
- FODO5 (eight possible parameter configurations) [Type 4]
- FODO6 (eight possible parameter configurations) [Type 4]

Frequency or Digital Outputs (FODO 1, FODO 6) source - Group 1

- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- Frequency output 1A is the A Phase of Frequency output 1 content (Uncorrected volume flow rate, Profile factor)
- Frequency output 1B is the B Phase of Frequency output 1 Electrical installation
- Frequency output 2A is based on frequency content (Actual - Uncorrected Flow Rate)
- Frequency output 2B is based on frequency content and Frequency 2B Phase

- Digital output 1A is based on Digital output1A content (Frequency Output 1Validity and Flow Direction)
- Digital output 1B is based on Digital output1B content (Frequency Output 1 Validity and Flow Direction)
- Digital output 2A is based on Digital output 2A content (Frequency Output 2 Validity and Flow Direction)

Frequency or Digital Outputs (FODO 2, FODO 3, FODO 4, FODO5) source - Group 2

- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- Frequency output 1A is the A Phase of Frequency output 1 content (Uncorrected volume flow rate, Profile factor)
- Frequency output 1B is the B Phase of Frequency output 1
- Frequency output 2A is the A Phase of Frequency output 2 content (Uncorrected volume flow rate, Profile factor)
- Frequency output 2B is the B Phase of Frequency output 2 content
- Digital output 1A is based on Digital output1A content (Frequency Output 1Validity and Flow Direction)
- Digital output 1B is based on Digital output1B content (Frequency Output 1 Validity and Flow Direction)
- Digital output 2A is based on Digital output 2A content (Frequency Output 2 Validity and Flow Direction)
- Digital output 2B is based on Digital output 2B content (Frequency Output 2 Validity and Flow Direction)

Mode options

- Open Collector (requires external excitation supply voltage and pull-up resistor)
- TTL (internally powered by the meter 0-5 VDC signal)

Channel B Phase options

- Lag forward, Lead reverse (Phase B lags Phase A while reporting forward flow, leads Phase A while reporting reverse flow)
- Lead forward, Lag reverse (Phase B leads Phase A while reporting forward flow, lags Phase A while reporting reverse flow)

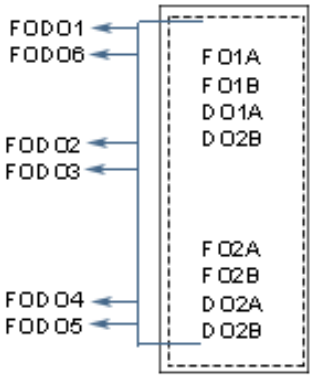
Phase A and Phase B output (based on flow direction)

- Reverse flow - output only reports flow in the reverse direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Forward flow - output only reports flow in the forward direction. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Absolute - output reports flow in both directions. For frequency outputs, Phase B of the output is 90 degrees out of phase with Phase A.
- Bi-directional - output reports flow on Phase A only in the forward direction and on Phase B only in the reverse direction.

Maximum frequency for the frequency outputs

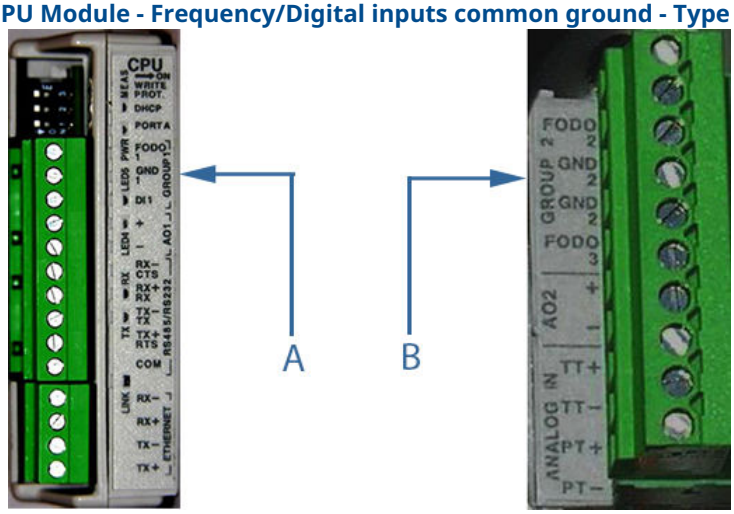
- 1000 Hz
- 5000 Hz

Table 3-5: Frequency/Digital Outputs possible configurations

Frequency/Digital output		Source configuration
Frequency /Digital Output 1 Frequency /Digital Output 2 Frequency /Digital Output 3 Frequency /Digital Output4 Frequency /Digital Output 5 Frequency /Digital Output 6	• Frequency output 1A • Frequency output 1B • Digital output 1A • Digital output 1B • Frequency output 2A • Frequency output 2B • Digital output 2A • Digital output 2B	

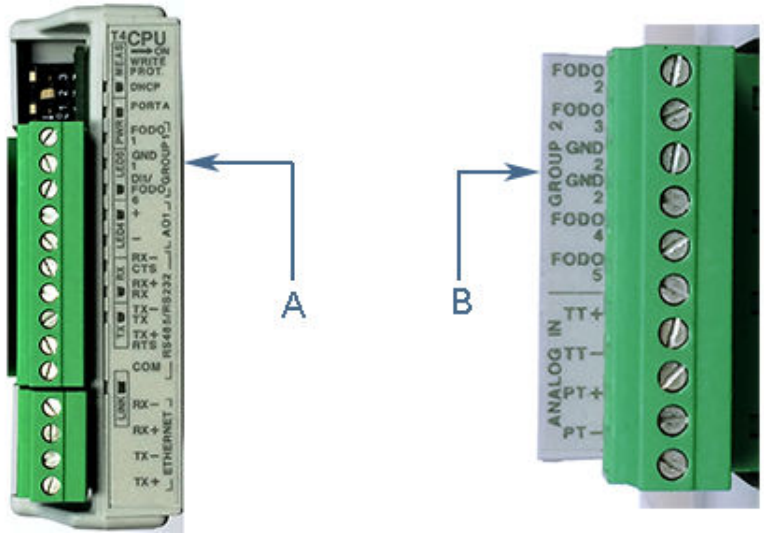
Output for FODO1 and Digital Output1 (Group 1 on the CPU Module) share a common ground and have 50 V isolation. FODO2 and FODO3 (Group 2 on the CPU Module) share a common ground and have 50 V isolation. This allows an output to be connected to a different flow computer. The outputs are opto-isolated from the CPU Module and have a withstand voltage of at least 500 V rms dielectric.

Figure 3-6: CPU Module - Frequency/Digital inputs common ground - Type 2



A. FODO1 and Digital input1 - Shared common ground (Group 1)
B. FODO2 and FODO3 - Shared common ground (Group 2)

Figure 3-7: CPU Module - Frequency/Digital outputs common ground - Type 4



A. FODO1 and DI1/FODO6 - Shared common ground - Type 4 CPU Module (Group 1)

B. FODO2, FODO3, FODO4 and FODO5 - Shared common ground - Type 4 CPU Module (Group 2)

3.6.2 Analog input settings

The The 960-24 MSTS has the capability to sample analog temperature (Analog Input 1) and pressure (Analog Input 2) with 4-20 mA signals. These analog input signals are configured to sink. The two independent analog input circuits are configured for conventional 4-20 mA service. Also, 24 VDC isolated power supply connection is provided for an external power source. Refer to the Field wiring diagram DMC-004936 in Engineering Drawings.

3.6.3 Analog output settings

The 960-24™ MSTS provides two 4-20 mA analog output signals that are software configurable for either sink or source current (see Engineering Drawings, drawing DMC-004936).

Full HART® functionality is provided so that any commercially available HART® transmitter which meets the specifications of the HART® Communications Foundation can be connected to the Rosemount 3814 Liquid Ultrasonic Flow Meter.

Analog Output 2 (AO2) is user-configurable as a conventional 4-20 mA output.

3.6.4 Digital input

The 960-24™ MSTS provides one digital input that can be used as a general purpose input or used for synchronizing calibration (for flow calibration gating-contact closure). The meter records the volume seen between switch closures. The polarity of the input is configured as normal or inverted polarity.

- Polarity is determined by the **IsDI1ForCalActiveLow** and the gating edge is determined by the **IsDI1ForCalStateGated** (calibrate edge gated or calibrate state gated).
- Calibration is started via an inactive>active state change.

The digital input must be configured via the MeterLink **Tools** → **Edit/Compare Configuration** page.

3.6.5 DHCP server switch settings

The meter can be configured to act as a DHCP server. The DHCP server is enabled/disabled via CPU Module DHCP switch as follows:

Table 3-6: DHCP server switch settings

CPU Module switch	DHCP server disabled	DHCP server enabled
DHCP	OFF	ON

3.6.6 Configuration protect switch settings

The meter's configuration parameters and firmware can be protected against changes via CPU Module Write PROT. switch as follows:

Table 3-7: Configuration protect switch settings

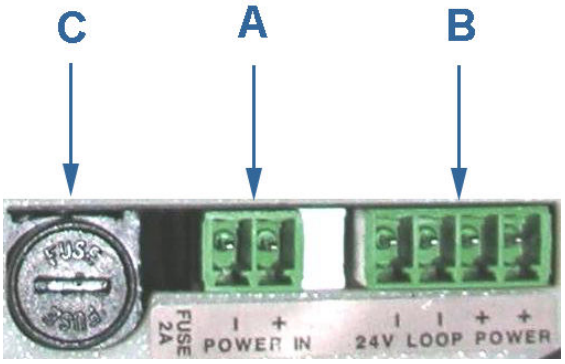
CPU Module switch	Configuration protected	Configuration unprotected
WRITE PROT.	ON (default)	OFF

A complete list of write-protected parameters is in Engineering Drawings.

3.6.7 External power source connection and fuse

Located inside the Transmitter Electronics Enclosure is a connector for a user-provided external power source, a 2 Ampere fuse and a 24 V loop power connection for ultrasonic meter analog outputs, generator temperature or pressure transmitter devices. The current is limited to 88 mA.

Figure 3-8: CPU Module power source connections



A. Power In connector (main power)
B. 24 V Loop power
C. 2 Ampere fuse (used for the main power input)

3.7 Security seal installation

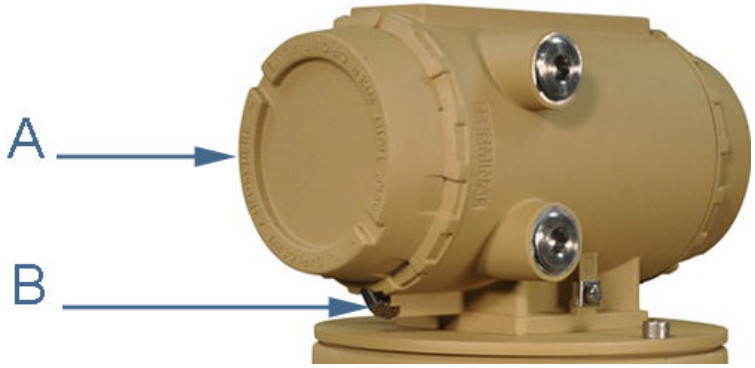
Security seals protect the integrity of the meter metrology and prevent tampering with transducer assemblies. The following sections detail how to properly seal the Rosemount 3814 Liquid Ultrasonic Flow Meter after commissioning. The security seal wires are commercially available.

Be sure to set the **WRITE PROT**. switch on the CPU Module to the **ON** position prior to sealing the enclosure.

3.7.1 Sealing the Transmitter Electronics Enclosure

Use the following instructions to install the security seal wires on the Transmitter Electronics Enclosures.

Figure 3-9: Transmitter electronic enclosure security latch

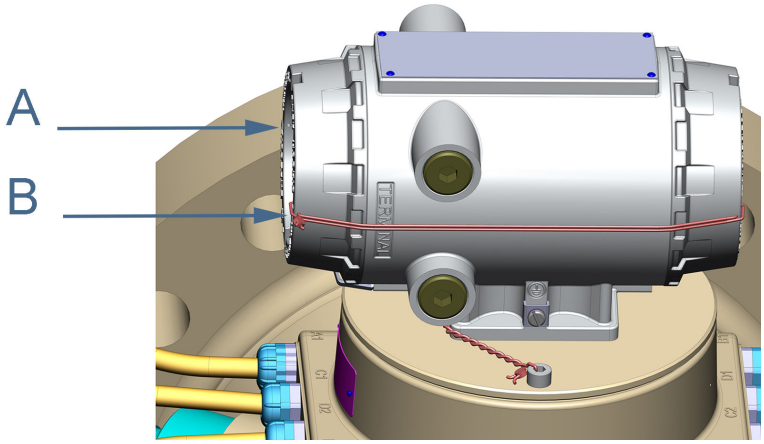


A. Transmitter Electronics Enclosure endcap
B. Security latch

Procedure

1. Rotate the end cap clockwise fully closing and compressing the end cap seal. Install the Security latch using a 3mm Allen wrench.
2. Install the security seal wire into and through one of the two holes in the end cap. Choose holes that minimize counterclockwise rotation of the end cap when the security wire is taut (maximum wire diameter is .078 inch; 2.0 mm).

Figure 3-10: Transmitter Electronics Enclosure security seal installation



A. Transmitter Electronics Enclosure endcap
B. Security wire seals

3. Adjust the security wire, removing all slack and thread into the lead seal.
4. Cut wire ends to remove excess wire.

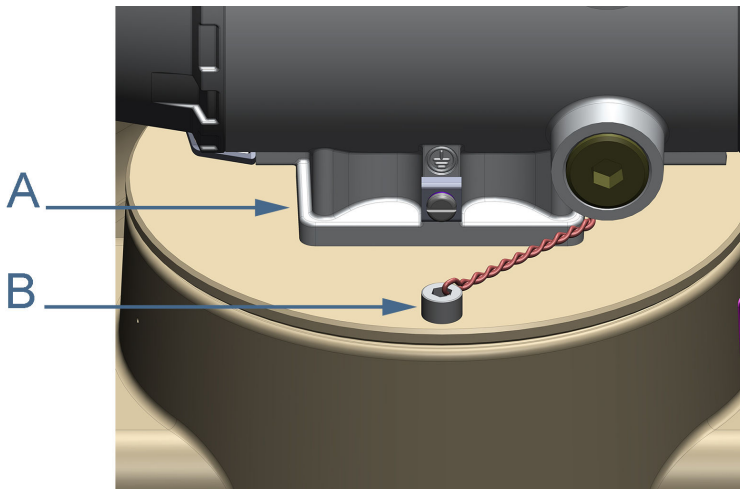
3.7.2 Base enclosure security seals

Use the following instructions to install the security seal wire on the Base Enclosure.

Procedure

1. Install security wire seal into and through two of the four the holes in the socket head screws on the Base Enclosure cover (maximum wire diameter 0.078 inch; 2.0 mm).

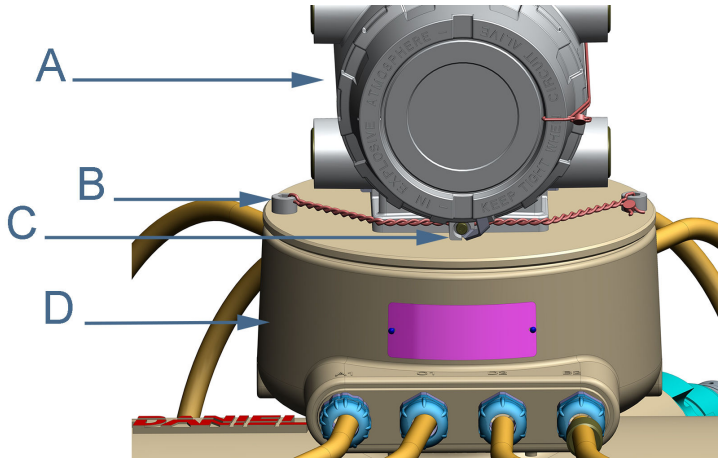
Figure 3-11: Base Enclosure security seals



A. Base enclosure
B. Security wire seals

2. Position the wire to prevent counterclockwise rotation of the screws when the seal wire is taut.
3. Feed the security wire beneath the Transmitter Electronics Enclosure and through the adjacent socket head screw. Twist the wire, removing all slack and seal.

Figure 3-12: Base Enclosure security seals



A. Transmitter Electronics Enclosure

B. Security wire seals

C. Transmitter Electronics endcap security latch

D. Base Enclosure

4. Cut wire ends to remove excess wire.

   This completes Base Enclosure security seal installation procedure.

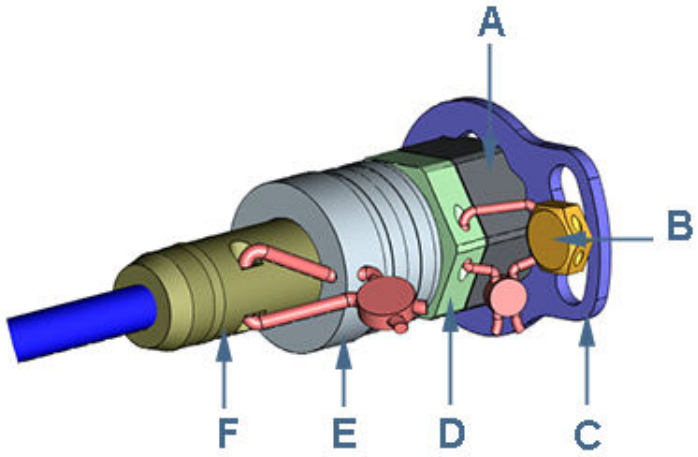
3.7.3 Transducer assembly security seal

Use the following instructions and Figure 3-13 to install the security seal wire on the transducer assembly.

Procedure

1. For each Transducer Assembly, install a security seal wire into and through one of the two holes of the Locking Ring bolt (Item C) and through one of the two holes in the Transducer Retainer (Item D). Choose holes that minimize counterclockwise rotation of the Locking Ring bolt and the Transducer Retainer when security wire is taut (maximum wire diameter: 0.06 in.; 1.5 mm).
2. For each Transducer Assembly, insert a security seal wire into one of the two holes in the transducer cable connector (Item F) and feed through one of the two holes in the transducer cable nut (item E).
3. Adjust the security wire, removing all slack and thread into the lead seal.
4. Cut wire ends to remove excess wire.

Figure 3-13: Transducer assembly security wire seals



A. Transducer Housing
B. Transducer Housing Locking Ring Screw
C. Transducer Housing Locking Ring Bolt
D. Transducer Retainer
E. Transducer cable nut
F. Transducer cable connector

3.8 Sealing the unit

The unit should be properly sealed with a sealing compound after electrical connections have been tested according to the customer's Best Practices schedule. Some areas require a witnessed Acceptance Test for the installed system and require that the meter run for a predetermined length of time (approximately one to two weeks) before the unit is sealed. This allows time to verify all electrical connections are correct, that the meter is accurately measuring flow and that the meter meets the customer's installation requirements. See Startup for systems using explosion-proof conduit and Startup for systems using flame-proof cable.

4 Configuration

After the mechanical and electrical installation is complete and connectivity is established, use the *MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (00809-0100-7630) to setup initial communications with the meter.

4.1 Set up MeterLink

Procedure

1. Follow the instructions in the *MeterLink™ Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (00809-0100-7630) to setup software communications with the meter.
2. Select **File** → **Program Settings** and customize the user-preferences (for example, User name, Company name, display units, Liquid Meter volume units, and other interface settings).
3. Connect to your meter. If your meter is not shown in the list, select **Edit Meter Directory** and setup the connections properties.

4.1.1 Field Setup Wizard using MeterLink

Procedure

1. Use the **Field Setup Wizard-Startup** and select the checkboxes that allow proper configuration for your meter (Temperature, Pressure, Meter Corrections, and Meter Outputs).

   Selections on this page will affect other configuration selections. Select **Next** to continue to General setup.

2. Use **General setup** to configure the meter's system units (U.S Customary or Metric units) volume units, flow rate time, low flow cutoff, contract hour and enable reverse flow.

   Select **Next** to continue to Frequency Outputs.

   Note
   The Meter's Units system configured on the General Page affect the units for the optional Local Display items.

3. Set the Frequency/Digital Outputs Sources for either a frequency output or a digital status. Select the Source for each Frequency/Digital output and select the desired drive Mode. The Mode options are Open Collector which requires an external excitation voltage and pull-up resistor or TTL mode which outputs a 0-5 Vdc signal.

   Note
   Frequency outputs 1 and Digital outputs 1 are paired together meaning the Digital outputs 1 will report the status for the parameter for Frequency outputs 1. Similarly, Frequency outputs 2 and Digital outputs 2 are paired together. Additionally, each Frequency output has an A and B output phase.

4. Configure Frequency output 1 and Frequency output 2 content (Rosemount Liquid Ultrasonic Meters content is Uncorrected flow rate), flow direction, Channel B phase, maximum frequency output (Hertz) and Full scale volumetric flow rate.

   Select **Next** to continue to Meter Digital Outputs.

5. Select the Meter Digital Output parameters for Digital output 1A, Digital output 1B, Digital output 2A and Digital output 2B based on Frequency validity or flow direction..

   if the output of the ultrasonic meter is reversed from what a flow computer is expecting, select Inverted Operation. This changes the digital output from a HIGH for a TRUE condition to output a LOW for a TRUE condition. Select **Next** to continue to Current Outputs.

6. Current Outputs are based on Uncorrected (Actual) flow rate content, flow direction (Forward, Reverse or Absolute) and Full scale volumetric flow rate used with output (20mA maximum). Alarm action parameters determines the state the output will drive during an alarm condition (High 20mA, Low - 4 mA, Hold last value, Very low - 3.5, Very high 20.5 mA or None).

   Select **Next** to continue to HART® Output(s).

7. HART® Output parameters include four Dynamic process variables (Primary, Secondary, Third and Fourth variable. The Primary variable is set to match the Content set for Current output 1. If a second current output is available, the Secondary variable is set to match the Content set for Current output 1) Identification and HART® units (volume units, Flow rate time units, Velocity units, Pressure and Temperature units).

   Click **Next** to continue to the Temperature and Pressure page.

8. Set the temperature and pressure scaling for analog inputs, enter fixed values, and set alarm limits for both. The alarm limit selections are hold last output value or use fixed value.

   - Live temperature selections include minimum and maximum inputs or fixed temperature.
   - Live pressure selections include minimum and maximum inputs, gage (atmospheric pressure), absolute, or fixed pressure. Click **Next** to continue to the Local Display page, if View local display setup was selected on the Startup page.

4.1.2 Display items

The valid labels, descriptions and units for the display items are shown below:

Table 4-1: Local display labels, descriptions and valid units

Local Display labels, descriptions and units	
QFLOW — Uncorrected volume flow rate	
	• BBL – Barrels • GAL – Gallons • L – Liters • CM – Cubic Meters • MCM – Thousand Cubic Meters
TDYVL — Current day's forward uncorrected volume	

Table 4-1: Local display labels, descriptions and valid units *(continued)*

Local Display labels, descriptions and units	
	• +BBL – Barrels • +GAL – Gallons • +L – Liters • +CM – Cubic Meters • +MCM – Thousand Cubic Meters
TDYVL — Current day's reverse uncorrected volume	
	• -BBL – Barrels • -GAL – Gallons • -L – Liters • -CM – Cubic Meters • -MCM – Thousand Cubic Meters
YSTVL — Previous day's forward uncorrected volume	
	• +BBL – Barrels • +GAL – Gallons • +L –Liters • +CM – Cubic Meters • +MCM – Thousand Cubic Meters
YSTVL — Previous day's reverse uncorrected volume	
	• -BBL – Barrels • -GAL – Gallons • -L – Liters • -CM – Cubic Meters • -MCM – Thousand Cubic Meters
TOTVL — Forward uncorrected volume	
	• +BBL – Barrels • +GAL – Gallons • +L – Liters • +CM – Cubic Meters • +MCM – Thousand Cubic Meters
TOTVL — Reverse uncorrected volume	
	• -BBL – Barrels • -GAL – Gallons • -L – Liters • -CM – Cubic Meters • -MCM – Thousand Cubic Meters
VEL — Average flow velocity	

Table 4-1: Local display labels, descriptions and valid units *(continued)*

Local Display labels, descriptions and units	
	• Ft/S – Feet per second • M/S – Meters per second
SOS — Average sound velocity	
	• Ft/S – Feet per second • M/S – Meters per second
TEMP — Flow-condition temperature	
	• DEGF – Degrees Fahrenheit • DEGC – Degrees Celsius
PRESS — Flow-condition pressure	
	• PSI – Pound per square inch • MPA – Megapascals
FRQ1A — Frequency channel 1A	
	• HZ – Hertz
FRQ1B — Frequency channel 1B	
	• HZ – Hertz
KFCT1 — Frequency 1 K-factor	
	• BBL – Barrels • GAL – Gallons • L – Liters • CM – Cubic Meters • MCM – Thousand Cubic Meters
FRQ2A — Frequency channel 2A	
	• HZ – Hertz
FRQ2B — Frequency channel 2B	
	• HZ – Hertz
KFCT2 — Frequency 2 K-factor	
	• BBL – Barrels • GAL – Gallons • L – Liters • CM – Cubic Meters • MCM – Thousand Cubic Meters
AO1 — Analog Output 1 current	
	• MA – Milliamperes
AO2 — Analog Output 2 current	

Table 4-1: Local display labels, descriptions and valid units *(continued)*

Local Display labels, descriptions and units	
	• MA – Milliamperes

Note
When connected to a meter with the optional local display, reverse flow direction is indicated with a minus sign (negative) before the value(s) shown on the display.

4.1.3 Display units

The Meter volume units displayed are either U.S. Customary or Metric. To modify the Display Units, configure the Meter units system in the **Field Setup Wizard → General Page.**

- U.S. Customary volume unit selections are:
  - Barrels
  - Gallons
- Metric volume unit selections are:
  - Cubic meters
  - Cubic liters
- Display units preceded by a plus or minus sign indicate forward and reverse flow direction.
- The Local Display Flow rate time units are modifiable by selecting the drop-down arrow and clicking the time unit in the list box.
- Valid flow rate time units selections are:
  - second
  - minute
  - hour
  - day

4.1.4 Scroll delay

The Scroll Delay is the time interval for the selected display items to be shown on the Local Display. The default scroll delay setting is five seconds. Click the spin box up or down arrow to increase or decrease the length of time an item displays.

Procedure

1. Select **Finish** to write the configuration settings to the meter.
2. Save the meter configuration file, collect a Maintenance log and Waveforms to document the “As Left” settings.

4.2 Using AMS Device Manager to configure the meter

This procedure assumes you have AMS Device Manager installed on the host computer and have downloaded the latest Rosemount Liquid Ultrasonic Meter Device Description (DD).

If not installed, click the link below to download the AMS device installation tool kit:

Emerson.com/SoftwareDownloadsDrivers

4.2.1 Installing AMS Device Description

Procedure

1. Use the link above to search for the Device Description (DD) for your Rosemount 3810 Series Liquid Ultrasonic Flow Meter.
2. Use the drop-down menu and select **Emerson - Rosemount**.
3. Next, select the Device, **Liquid 3810 Series**, from the drop-down menu.
4. Choose the Device Revision1, from the drop-down menu.
5. Next, select HART® from the Communication Protocol menu.
6. Select **AMS Device Manager** for the Host System.
7. Select the **Host System Revision 14.5**.
8. Verify your search parameters are correct, as shown below:

Figure 4-1: AMS Device Description search result

9. Click **Search Now**.
10. Click the Rosemount Industries Liquid 3810 Series Rev 1 hyperlink. The file download dialog displays. Click the **Save** button to save the files to your host system. You may use the default download location or change the directory.

Figure 4-2: AMS file download

11. Click the **Save** button to complete the file download.
12. Click **Open** or **Open Folder** to view the downloaded files.
13. Establish power to the meter and wiring to Analog Input 1 for HART® communication.
14. Start the AMS Device Manager using a laptop or PC.
15. Enter login credentials and click **OK** to launch the application.
16. Click the **Configure** tab, and then select one:
    - Guided Setup
    - Manual Setup
    - Alert Setup

Figure 4-3: AMS Device Manager

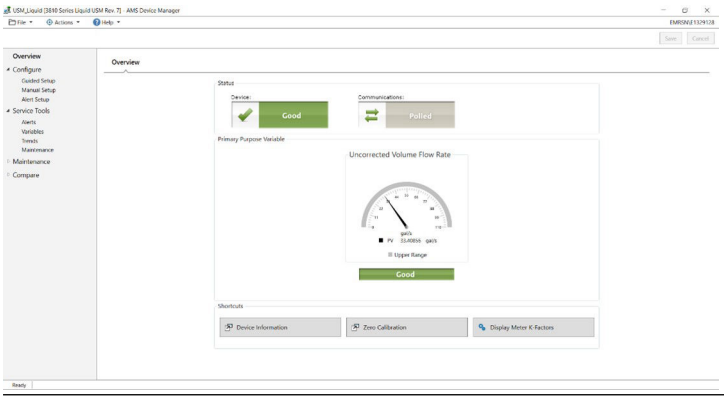
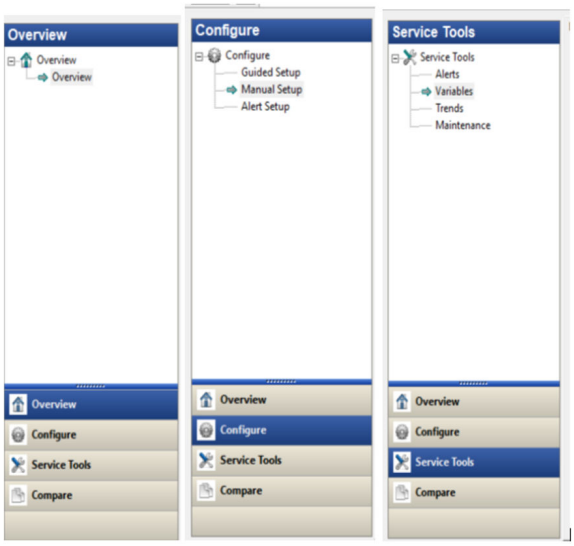


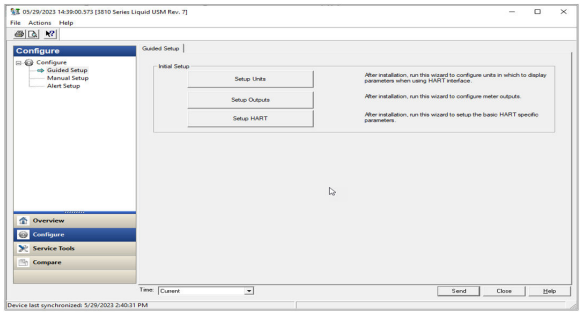
Figure 4-4: AMS Device Manager - Overview



4.2.2 AMS Device Manager - Guided Setup

The Guided setup wizard provides configuration parameter settings for the meter. The Guided Setup is a subset of the Manual Setup parameters.

Figure 4-5: AMS Device Manager - Guided Setup



Note
Before writing configuration changes to your meter, make sure you have saved the Configuration file and Maintenance log.

Procedure

1. Disable the Write Protect switch in the CPU Module to write any of the following configuration parameters to your meter.
2. Click the **Setup Units** tab to configure the system units (U.S. Customary or Metric units), Volume units, Flow rate time units, Velocity units, Pressure units and Temperature units. Click **Apply** to write the parameters to the meter.
3. Click the **Setup Outputs** tab to configure the Device Variables Mapping, Units, Frequency/Digital outputs, Frequency and Digital Outputs 1 and 2, Analog outputs, Digital Input, Pressure and Temperature.
    a. ***Analog output 1 (HART)*** - Content (Primary Variable) displays Uncorrected Flow Rate and is a read-only attribute. Configure Direction (flow), Lower Range value, Upper range value and Alarm Action and view the HART® Parameters Tag, Date, Descriptor, Message, Final Assembly Number Poll Address, Number of Response Preambles.
    b. ***Analog Output 2*** - Content (Secondary Variable) displays Uncorrected Flow Rate and has a read-only attribute. Configure Direction (flow), Lower Range value, Upper range value and Alarm Action. Map the Third and Four variables using the Manual Setup wizard. Selections include Uncorrected Volume Flow Rate, Average flow velocity, Average sound velocity, Pressure, and Temperature.
4. After all of the data shown below is entered, click **Apply** to write the parameters to the meter.
    a) Click the **Frequency/Digital Outputs** tab to configure Frequency/Digital Output 1, 2 and 3 Source and drive Mode. Select the Source for each Frequency/Digital output and select the desired drive Mode. The Mode options are Open Collector which requires an external excitation voltage and pull-up resistor or TTL mode which outputs a 0-5 Vdc signal (each Frequency output has an A and B output phase).

    Note
    If changes are made to any Source variable on this page, apply the changes and navigate to the **Guided Setup** page. Navigate back to the **Manual Setup** for the changes to be reflected in other Manual Setup pages.

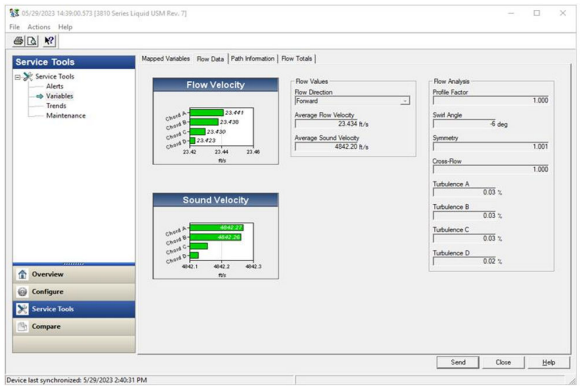
    b) Click the **Frequency and Digital Output 1** tab to configure the Content, (flow) Direction, Channel B Phase frequency output, Lag forward, Lead Reverse or

Lead Forward, Lag Reverse (Phase B lags Phase A while reporting forward flow and lead Phase A while reporting reverse flow or the opposite), Digital Output 1 Channel A Content and Polarity, Channel B Content and Polarity, Maximum Frequency, and Lower and Upper Range Units of Measure.

c) Click the **Frequency and Digital Output 2** tab and repeat Step 3 to configure Frequency and Digital Output 2 parameters.

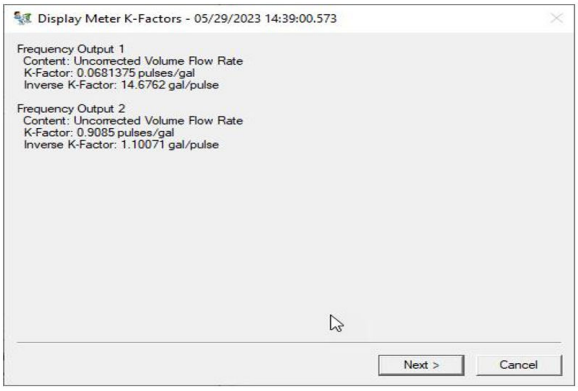
5. Click **Setup HART** to configure the HART® parameters (tag, date, descriptor, message text, Final Assembly number, Poll address and number of response preambles are displayed). After all of the data is entered, click **Apply** to write the parameters to the meter.
6. On the **Overview** page, click **Alert Setup** and select the **Flow Analysis** tab and enable Reverse Flow. Click the **OK** button to return to the **Overview** page.
7. On the **Overview** page, click the **Service Tools** tab and select the **Variables** tab. The Flow Data, Path Information, Flow Totals, and All Variables data is populated after you are connected to the meter.
   a) Click the **Flow Data** tab and view the Flow Direction (Forward or Reverse), Average Flow and Average Sound Velocities values.
   b) Click the **Path Information** tab and view the Chord performance, Gain, SNR (Signal to Noise Ratio) Signal strength (mV), and Noise (mV).
   c) Click the **Flow Totals** tab to view the volume totals (forward and reverse uncorrected volume).
   d) Click the **All Variables** tab to view a graphical display of the Primary, Secondary, Third and Fourth Variables.

Figure 4-6: AMS Device Manager - Service Tools All Variables status indicators



8. Click **OK** to return to the Overview page.
9. Enable the Write Protect switch on the CPU Module to protect the meter's configuration.
10. From the **Overview** window, click **Display Meter K-Factors**. K-Factors are a read-only values calculated from the Full scale volumetric flow rate used with frequency outputs and the Maximum frequency for frequency output.

Figure 4-7: Display Meter K-Factors

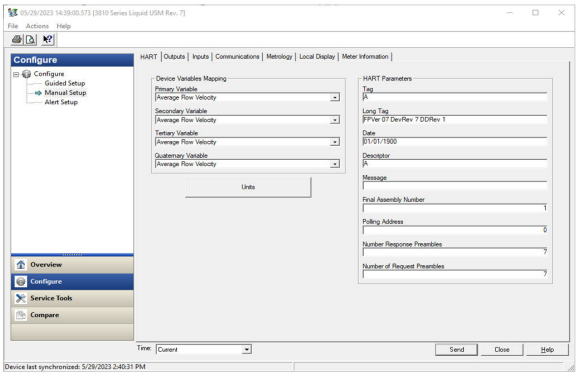


11. Click **Next** to return to the **Device Manager Overview** page.

4.2.3 AMS Device Manager - Manual Setup

Use the Manual Setup wizard to configure the meter's parameters. See Figure 4-3 and Figure 4-4 and from the AMS Device Manager Configure menu, click **Manual Setup**.

Figure 4-8: AMS Device Manager - Configure Manual Setup



Procedure

1. If installed, remove security wires from the endcap and the Bracket/Cover hex head bolts that secures the Base Enclosure.
2. Disable the Write Protect switch in the CPU Module to write any of the following configuration parameters to your meter.
3. Click the **HART** tab. The Primary and Secondary variables are read-only and are configured for Uncorrected Flow Rate. The Third and Fourth variable configuration choices include Pressure and Temperature.
4. Click the **Units** button in **HART** tab (see AMS Device Manager - Guided Setup, Step 1).
5. Click the **Analog Output 1** button in **Outputs** tab (see AMS Device Manager - Guided Setup, Step 3a).
6. Click the **Analog Output 2** button in **Outputs** tab. Follow the configuration instructions in the AMS Device Manager - Guided Setup, Step 3b. The read-only Secondary variable Content, Uncorrected Flow Rate, displays. Use the drop-down arrow and select the (flow) Direction - Forward or Reverse. Enter a Lower and Upper

Range limit. Set the Alarm Action parameters. Click **Apply**, after you enter the data to write the parameters to the meter.

7. Click the **Frequency/Digital Outputs** button in **Outputs** tab. Follow the configuration instructions in the AMS Device Manager - Guided Setup, Step 4a).

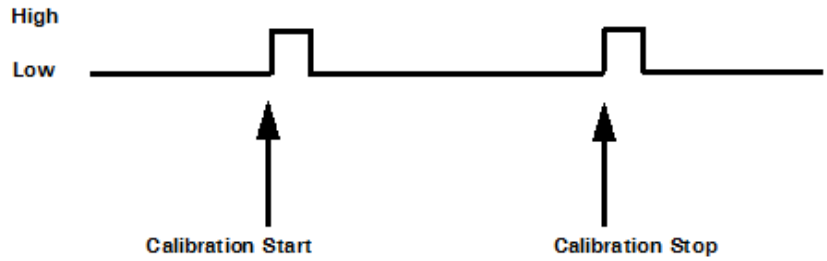
Note
If changes are made to any Source variable on this page, apply the changes and navigate to the **Guided Setup** page. Navigate back to the **Manual Setup** for the changes to be reflected in other **Manual Setup** pages.

   a) Click **Apply**, after you enter the data to write the parameters to the meter.

8. Click the **Frequency and Digital Output 2** tab. Follow the instructions in the AMS Device Manager - Guided Setup, Step 4c to configure the Frequency and Digital Output 2 parameters. Click **Apply**, after you enter the data to write the parameters to the meter.
9. Click the **Analog Input 1 (Temperature)** button in the **Inputs** tab. Configure the input parameters including: Source (Live Analog or Fixed), Min and Max input limits corresponding to 4 mA and 20 mA respectively and the Low and High alarm limits. Click **Apply**, after you enter the data to write the parameters to the meter.
10. Click the **Analog Input 2 (Pressure)** button in the **Inputs** tab. Configure the input parameters including: Source (Live Analog or Fixed), Min and Max input limits corresponding to 4 mA and 20 mA respectively and the Low and High alarm limits. Select either **Gage** or **Absolute** for the type of pressure reading desired. If a live pressure transmitter is connected, select the type of reading the transmitter outputs. If **Absolute** is selected, you must also enter the Atmospheric pressure. Click **Apply**, after you enter the data to write the parameters to the meter.
11. Click the **Digital Input** button in the **Inputs** tab. The default Digital Input 1 polarity is set to Normal for general purpose or set to Inverted when used for calibration. Click **Apply**, after you choose the calibration data to write the parameters to the meter.
    a. Calibration Polarity configuration parameter selections are:
       - Digital Input 1 Calibrate Active High
       - Digital Input 1 Calibrate Active Low

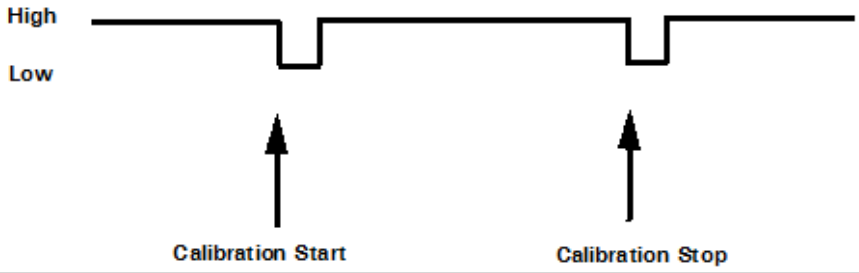
    b. Calibration Gating configuration parameter selections are:
       - Edge gated, active high

Figure 4-9: Gating configuration parameter Edge gated, active high



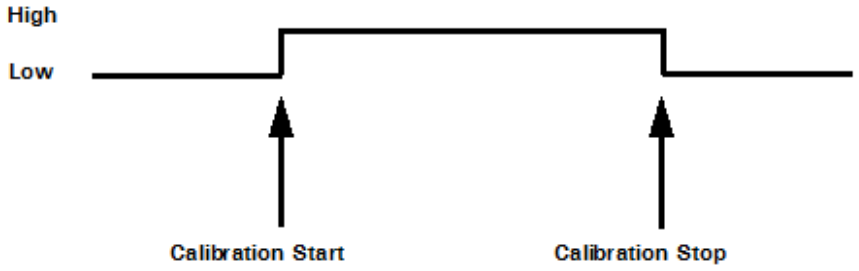
       - Edge gated, active low

Figure 4-10: Gating configuration parameter Edge gated, active low



- State gated, active high

Figure 4-11: Gating configuration parameter State gated, active high

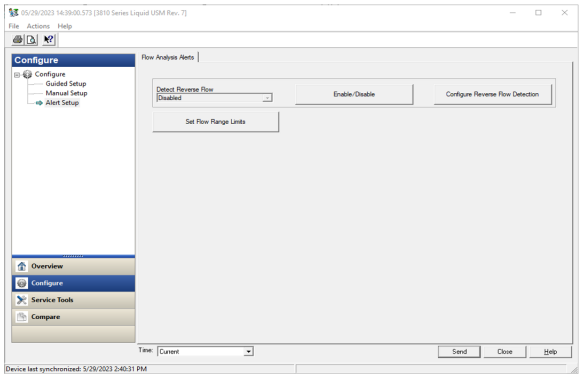


- State gated, active low

Figure 4-12: Gating configuration parameter State gated, active low

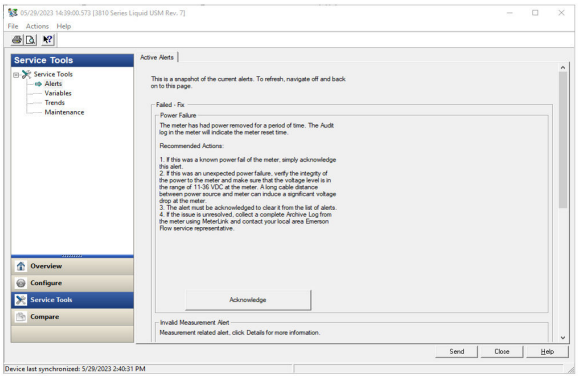
12. Click the **Alert Setup** tab (from the main Configuration page).

Figure 4-13: Configure Flow Analysis Alert



13. Click the **Flow Analysis Alerts** tab to select Configure Reverse Flow Detection, if desired. The default setting is **Disabled**. Click the **Disabled** button to send the feature command to the meter. Check for a response error. If no error response is received, click the **Enable** button.
    a) Enter the minimum reverse flow velocity above which to accumulate flow in the reverse direction for this alert. Enter a positive value for the Reverse Flow Zero Cutoff. Click the **Next** button to write the values to the meter. Check for an error response. If no error response is received, click the **Next** button. The Detect Reverse Flow enabled page displays. Click the **Next** button to display Detect Reverse Flow disabled.
    b) If an error message is returned, click the **Next** button to display the Method Complete page.
    c) Click the **Set Flow Range Limits** button and enter a positive value for the Flow Analysis Lower Velocity Range and the Upper Velocity Range Limits. When the velocity is outside of the limit parameters, an alert is triggered. Click the **Next** button to display the Method Complete page.
14. Click the **Service Tools** tab to access the device alerts, variables, trends and maintenance statuses or to edit the configuration parameters.
    a) Click the **Service Tools** → **Alerts** tab. If an alert condition exists, the alert type and description displays. Recommended actions are listed to assist you in a resolution. After you resolve the alert condition, click the **Acknowledge** button to clear the alert. Click **Apply** to write the changes to the meter. If no alert condition is active, click **OK** to close the device window.

Figure 4-14: AMS Device Manager - Service Tools Alerts

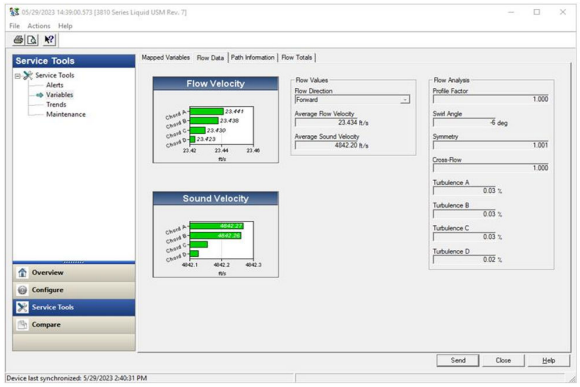


b) If you change the device configuration, a confirmation dialog displays and prompts you to write the changes to the meter. Click **Yes** to write the changes to the meter or click **No** to cancel pending changes.

Figure 4-15: Configuration changes dialog

c) Click the **Service Tools** → **Variables** tab. The Variables page displays tabs for the device's Flow Data, Path Information, Flow Totals, and All Variables.

Figure 4-16: AMS Device Manager - Service Tools



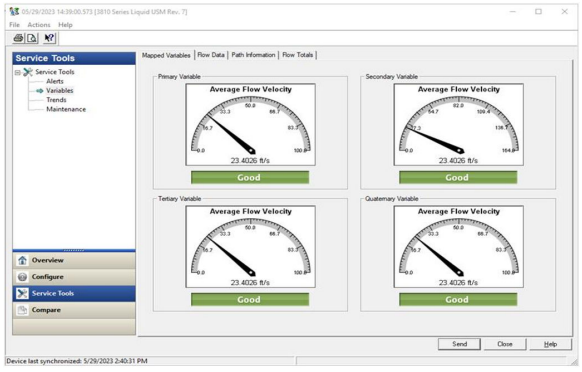
d) The **Service Tools** → **Flow Data** page includes charts for flow and sound velocities. The flow values (flow direction, average flow velocity and average sound velocity) parameters are displayed for the connected device.

e) Click **Service Tools** → **Variables** → **Path Information** tab to view the device's chord performance (percent), Gain (dB), SNR (dB), Signal (mV) and Noise (mV).

f) Click **Service Tools** → **Variables** → **Flow Totals** to view the volume totals (Forward and reverse Uncorrected Volume) parameters for the connected device.

g) Click **Service Tools** → **Variables** → **All Variables** tab to view Primary, Secondary, Third and Fourth Variable parameter status.

Figure 4-17: AMS Device Manager - Service Tools All Variables status indicators

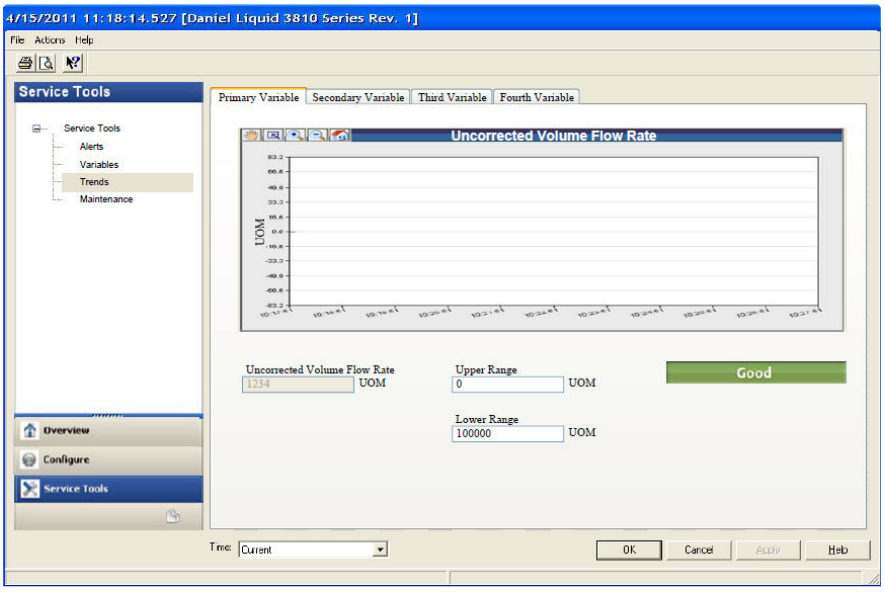


Gauges display each variable's status as good or bad. If a status is bad refer to the Service Tools Alerts page for recommended actions to resolve the alert condition. Also refer to the Field Device Specification manual (00825-0300-3810) for Commands 48 and 140 details.

Important
Alerts are triggered for Command 48 Additional device status and Command 140 detailed status information. Alerts are grouped as Failed - Fix Now, Maintenance - Fix Soon and Advisory according to the severity level; 1-6. Severity 1 is the highest and 6 is the lowest level.

h) Click the **Service Tools** → **Trends** tab to display the device variables (uncorrected volume flow rate, pressure and temperature) trends.

Figure 4-18: AMS Device Manager - Service Tools Trends



Primary and Secondary variables display real-time uncorrected volume flow rate trends. The third and fourth variables charts display trends for temperature and pressure.

15. Click the **Service Tools** → **Routine Maintenance** tab. Click **Analog Output 1 Trim** to perform a digital to analog trim adjustment of the first milliampere output. The 4 mA and 20 mA output current values should equal the plant's standard values.
    a) Click **Yes** to confirm the configuration changes. Repeat this step to trim Analog Output 2 current.
    b) Click **Apply** to write the output trim values to the meter.
    c) Click **OK** to navigate back to the Service Tools page.
16. Click the **Service Tools** → **Zero Calibration** tab. See AMS Device Manager - Guided Setup: Step 7 to configure the zero flow parameters.
17. After you have changed and written the configuration changes to the meter do the following:
    a) Enable the Write Protect switch on the CPU Module to protect the meter's configuration.
    b) Replace the end cap and if required, apply security seals through the endcap holes and through the hex head bolts that secure the Bracket/Cover to the Base enclosure.

Note
The next time you connect to the device using MeterLink, the Monitor page will display a Meter status alarm that the configuration has changed and remains latched until acknowledged. Click **Ack** (acknowledge) to clear the alarm.

4.3 Using a Field Communicator to configure the meter

Important
Follow all guidelines and precautions described in the Field Communicator User Manual and in the 3814 Liquid Ultrasonic Flow Meter documentation when working in a hazardous area.

Prerequisites

- Emerson Field Communicator software, license, installation guide and user manual available on the One Emerson website: Emerson.com/FieldCommunicators
- Rosemount HART® Device Description (HART DD) installed for the meter
- Network configured for a Field Communicator
- System wiring diagram drawing number DMC-004936 (see Engineering Drawings)
- Power supply

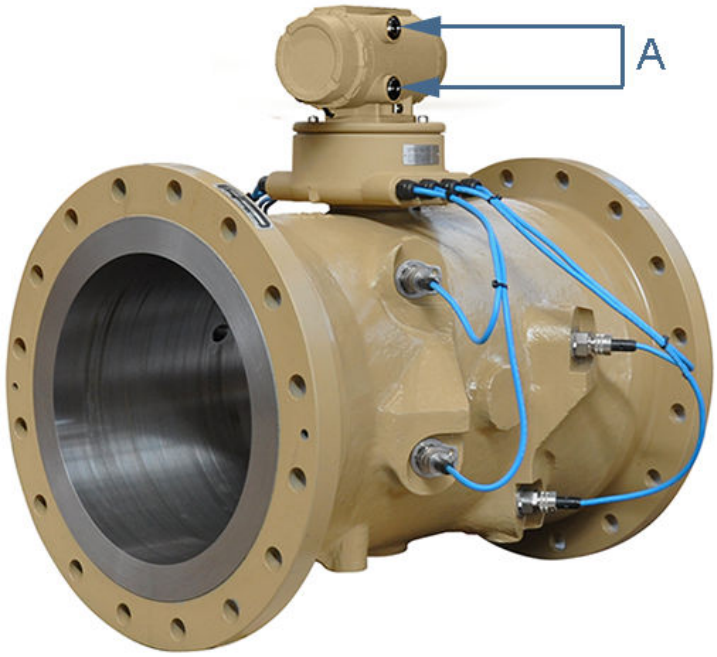
Procedure

1. Remove electrical power to the meter. If installed, remove the end cap security latches and seals and then, remove the end cap.
2. Refer to the Field Communicator Users Manual wiring diagrams and commissioning instructions provided with your handheld device. Register the product to activate the end user license.
3. Fully charge the Field Communicator battery prior to use.

   Important
   Do not change the battery in a hazardous area environment. The power supply is not intrinsically safe.

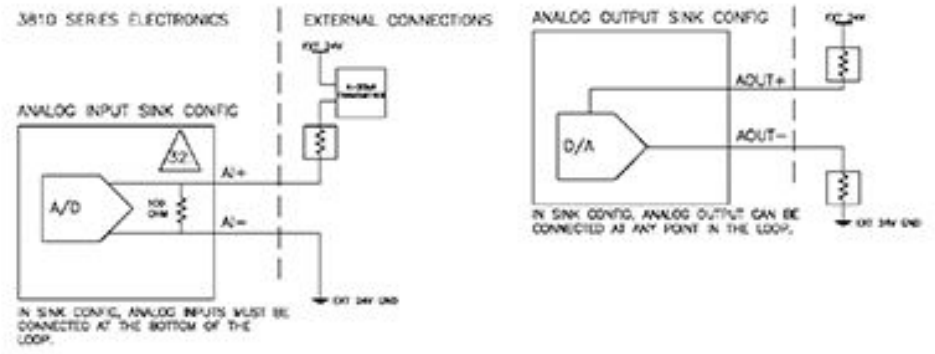
4. On the meter, run the wires through the field wiring conduit and into the transmitter electronics enclosure.

Figure 4-19: 3814 transmitter field wiring conduit entries



5. Wire Analog Input 1 (AI1) and Analog Output 1 (AO1) as shown in Figure 4-20.

Figure 4-20: Field Communicator wiring diagram for the Meter



6. Use the leads provided with the Field Communicator to connect to your device.
7. Press and hold the **Power** button on the Field Communicator until the green light blinks.
8. Use the touch screen on the Field Communicator, the keypad or use the stylus to navigate through the device menus.
9. Refer to the Menu tree in Section D.1.1 of the Rosemount HART Field Device Specification manual (00825-0300-3810) for the device fast key sequences. Included in the menu tree are:
   - Diagram Page 1 - 3810 Series Root Menu; Overview, **Configure** → **Manual Setup**
   - Diagram Page 2 - **Configure** → **Manual Setup** (continued) and **Alerts Setup**

- Diagram Page 3 - **Service Tools** → **Alerts** and Variables
- Diagram Page 4 - **Service Tools** → **Variables** (continued), **Service Tools** → **Trends**, and **Service Tools** → **Maintenance**

10. If you encounter problems, refer to the contact information on the back cover of this manual or the contacts included in the Field Communicator Users Manual.

4.4 Security seals for the meter

For the integrity of the meter metrology and to prevent tampering with the transmitter electronics and transducer assemblies, attach security latches on the end caps and install security wires on the Transmitter Electronics Enclosure end caps, the Bracket/Cover cap head screws. See Sealing the Transmitter Electronics Enclosure and Base enclosure security seals.

Seal the conduit ports with sealing compound according to the customer's requirements (e.g., after approximately one to two weeks of run time). Also, see Conduit seals.

4.5 Configure users and network security

Starting with Rosemount 3810 Series Firmware v1.60, the meter must authenticate any user making a connection to the meter using MeterLink. MeterLink will prompt for a username and password that will be authenticated by the meter before a successful connection is established. While the default password is unique to each meter, it is highly recommended to be changed at meter startup. For added security, the default username, administrator, can be changed as well. See Manage Users in the *Rosemount 3810 Series Liquid Ultrasonic Flow Meters: Operations Manual* (00809-0200-3810) for more details on setting up users, user types and passwords using the **Meter** → **Manage Users** dialog box in MeterLink.

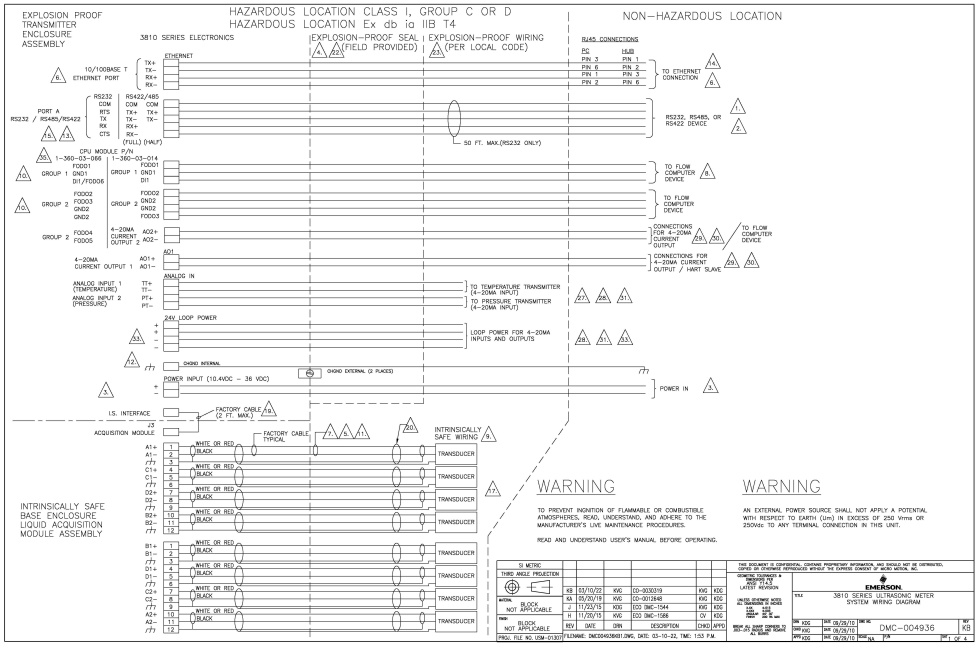
If the Rosemount 3810 Series Electronics will be connected to a network, please read the security recommendations found in Cybersecurity and network communications in the *Rosemount 3810 Series Liquid Ultrasonic Flow Meters: Operations Manual* (00809-0200-3810).

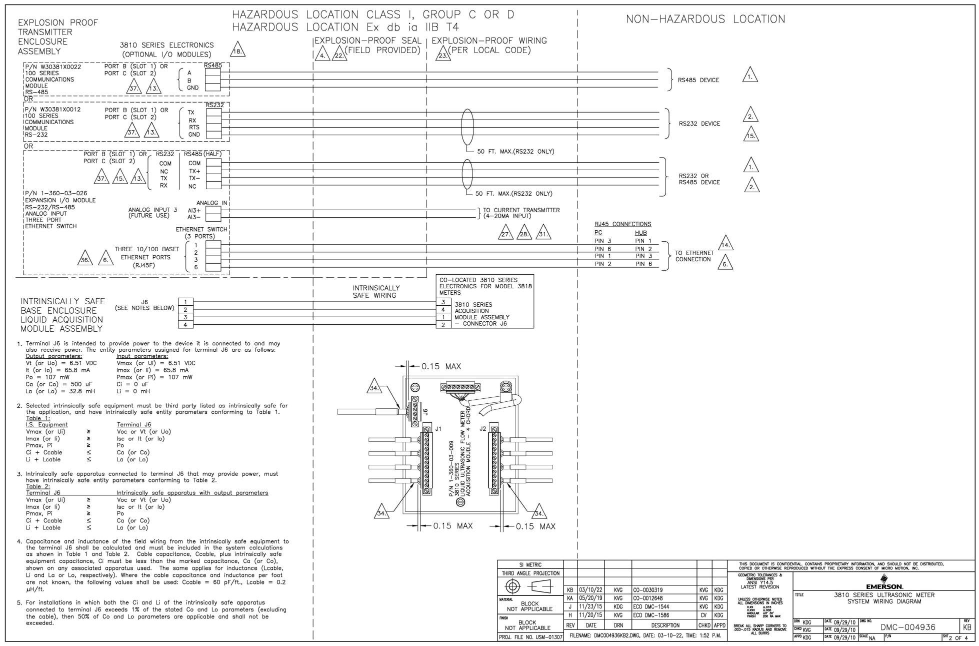
A Engineering Drawings

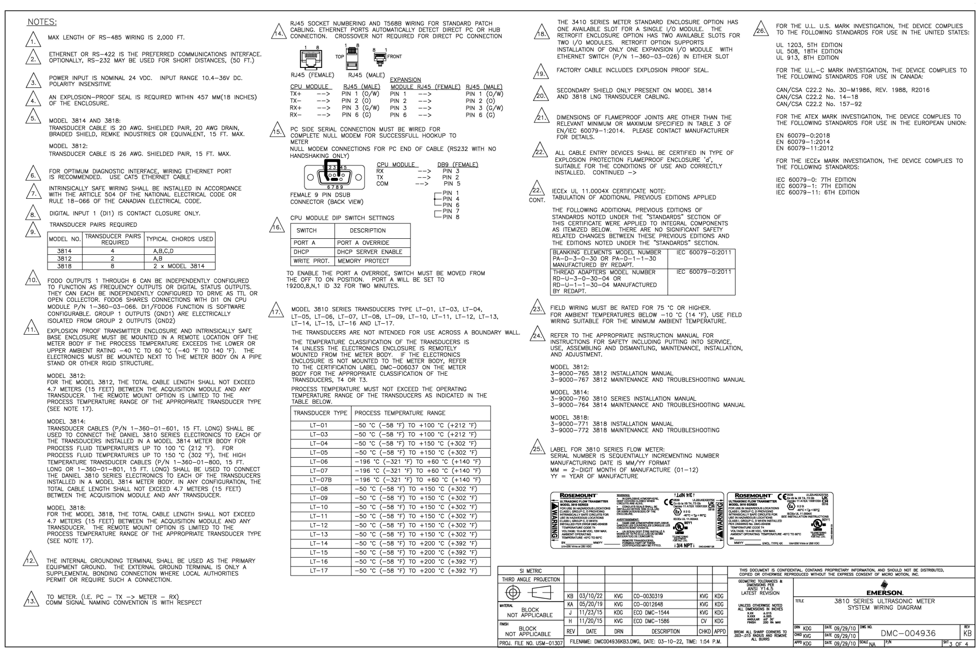
A.1 Rosemount 3814 Liquid Ultrasonic Flow Meter drawings

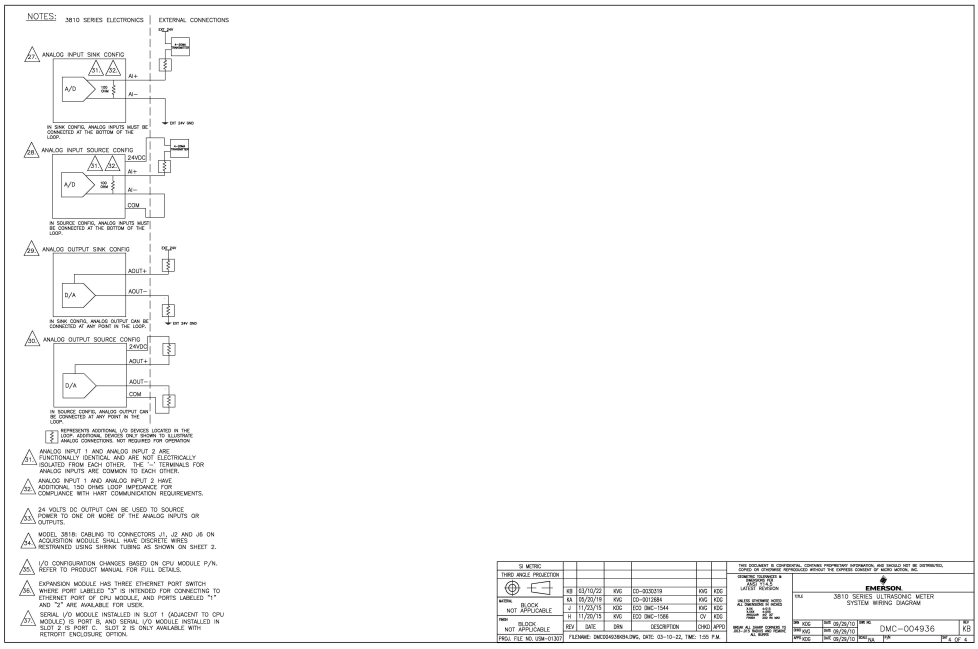
This appendix contains the following engineering drawing(s) for the ultrasonic meter:

DMC-004936	3810 Series Ultrasonic Meter System Wiring Diagram




HAZARDOUS LOCATION CLASS I, GROUP C OR D
HAZARDOUS LOCATION Ex db ia IIB T4
NON-HAZARDOUS LOCATION
EXPLOSION PROOF TRANSMITTER ENCLOSURE ASSEMBLY
EXPLOSION-PROOF SEAL (FIELD PROVIDED)
EXPLOSION-PROOF WIRING (PER LOCAL CODE)
INTRINSICALLY SAFE BASE ENCLOSURE LIQUID ACQUISITION MODULE ASSEMBLY
0.15 MAX
EMERSON.
3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DMC-004936


NOTES:
EMERSON.
3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DMC-004936


NOTES:
3810 SERIES ELECTRONICS
EXTERNAL CONNECTIONS
ANALOG INPUT SINK CONFIG
A/D
A1+
A1–
EXT 24V GND
IN SINK CONFIG, ANALOG INPUTS MUST BE CONNECTED AT THE BOTTOM OF THE LOOP.
ANALOG INPUT SOURCE CONFIG
24VDC
COM
IN SOURCE CONFIG, ANALOG INPUTS MUST BE CONNECTED AT THE BOTTOM OF THE LOOP.
ANALOG OUTPUT SINK CONFIG
D/A
AOUT+
AOUT–
IN SINK CONFIG, ANALOG OUTPUT CAN BE CONNECTED AT ANY POINT IN THE LOOP.
ANALOG OUTPUT SOURCE CONFIG
IN SOURCE CONFIG, ANALOG OUTPUT CAN BE CONNECTED AT ANY POINT IN THE LOOP.
REPRESENTS ADDITIONAL I/O DEVICES LOCATED IN THE LOOP. ADDITIONAL DEVICES ONLY SHOWN TO ILLUSTRATE ANALOG CONNECTIONS. NOT REQUIRED FOR OPERATION
ANALOG INPUT 1 AND ANALOG INPUT 2 ARE FUNCTIONALLY IDENTICAL AND ARE NOT ELECTRICALLY ISOLATED FROM EACH OTHER. THE '–' TERMINALS FOR ANALOG INPUTS ARE COMMON TO EACH OTHER.
ANALOG INPUT 1 AND ANALOG INPUT 2 HAVE ADDITIONAL 12Ω OHMIC LOOP IMPEDANCE FOR COMPLIANCE WITH HART COMMUNICATION REQUIREMENTS.
24 VOLTS DC OUTPUT CAN BE USED TO SOURCE POWER TO ONE OR MORE OF THE ANALOG INPUTS OR OUTPUTS.
MODEL 3810: CABLING TO CONNECTORS J1, J2 AND J6 ON ACQUISITION MODULE SHALL HAVE DISCRETE WIRES RESTRAINED USING SHRINK TUBING AS SHOWN ON SHEET 2.
I/O CONFIGURATION CHANGES BASED ON CPU MODULE P/N. REFER TO PRODUCT MANUAL FOR FULL DETAILS.
EXPANSION MODULE HAS THREE ETHERNET PORT SWITCH WHERE PORT LABELED "3" IS INTENDED FOR CONNECTING TO ETHERNET PORT OF CPU MODULE, AND PORTS LABELED "1" AND "2" ARE AVAILABLE FOR USER.
SERIAL I/O MODULE INSTALLED IN SLOT 1 (ADJACENT TO CPU MODULE) IS PORT B, AND SERIAL I/O MODULE INSTALLED IN SLOT 2 IS PORT C. SLOT 2 IS ONLY AVAILABLE WITH RETROFIT ENCLOSURE OPTION.
IS METRIC
THIRD ANGLE PROJECTION
MATERIAL
BLOCK NOT APPLICABLE
FINISH
BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307
FILENAME: DMC004026B04.DWG, DATE: 03-10-22, TIME: 1:55 P.M.
REV
DATE
DRN
DESCRIPTION
CHKD
APPD
KB 03/10/22 KWJ CO-0030319 KWJ KDG
KA 05/30/19 KWJ CO-0012684 KWJ KDG
J 11/23/15 KDG ECO DMC-1544 KWJ KDG
H 11/26/13 KWJ ECO DMC-1586 CY KDG
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
EMERSON.
TITLE
3810 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM
DRN KDG DATE 05/29/10
CHK KDG DATE 05/29/10
APP KDG DATE 05/29/10
DMC-004936
REV KB
SIZE A
FSCM NO.
SHEET 4 OF 4

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Version 2, June 1991

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Version 3, 29 June 2007

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