Installation Manual
Part Number 3-9000-759Revision D
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Daniel™ 3410 Series Gas Ultrasonic Flow Meters

3414 Gas Ultrasonic Flow Meter

3411 and 3412 Gas Ultrasonic Flow Meters

DANIEL™

EMERSON.
Process Management

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Return Material Authorization (RMA)
A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason. Download the RMA form from the Support Services web page by selecting the link below. www2.emersonprocess.com/EN-US/BRANDS/DANIEL/SUPPORT-SERVICES/Pages/Support-Services.aspx?

Signal words and symbols

Pay special attention to the following signal words, safety alert symbols and statements:

 Safety alert symbol

This is a safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Important

Important is a statement the user needs to know and consider.

Tip

Tip provides information or suggestions for improved efficiency or best results.

Note

Note is a “general by-the-way” content not essential to the main flow of information.

Important safety instructions

Daniel Measurement and Control, Inc. (Daniel) designs, manufactures and tests products to function within specific conditions. Because these products are sophisticated technical instruments, it is important that the owner and operation personnel strictly adhere both to the information printed on the product and to all instructions provided in this manual prior to installation, operation, and maintenance.

Daniel also urges you to integrate this manual into your training and safety program.

BE SURE ALL PERSONNEL READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND ALL NOTICES AND PRODUCT WARNINGS.

⚠WARNING

Installing, operating or maintaining a Daniel product improperly could lead to serious injury or death from explosion or exposure to dangerous substances. To reduce this risk:

- Comply with all information on the product, in this manual, and in any local and national codes that apply to the product.
- Do not allow untrained personnel to work with this product.
- Use Daniel parts and work procedures specified in this manual.

Product owners (Purchasers):

- Use the correct product for the environment and pressures present. See technical data or product specifications for limitations. If you are unsure, discuss your needs with your Daniel representative.
- Inform and train all personnel in the proper installation, operation, and maintenance of this product.
- To ensure safe and proper performance, only informed and trained personnel should install, operate, repair and maintain this product.
- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:

  http://www.daniel.com

- Save this instruction manual for future reference.
- If you resell or transfer this product, it is your responsibility to forward this instruction manual along with the product to the new owner or transferee.
- ALWAYS READ AND FOLLOW THE INSTALLATION, OPERATIONS, MAINTENANCE AND TROUBLESHOOTING MANUALS AND ALL PRODUCT WARNINGS AND INSTRUCTIONS.
- Do not use this equipment for any purpose other than its intended service. This may result in property damage and/or serious personal injury or death.

Product Operation Personnel:

- To prevent personal injury, personnel must follow all instructions of this manual prior to and during operation of the product.
- Follow all warnings, cautions, and notices marked on, and supplied with, this product.
- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:

  http://www.daniel.com

- Read and understand all instructions and operating procedures for this product.
- If you do not understand an instruction, or do not feel comfortable following the instructions, contact your Daniel representative for clarification or assistance.
- Install this product as specified in the INSTALLATION section of this manual per applicable local and national codes.
- Follow all instructions during the installation, operation, and maintenance of this product.
- Connect the product to the appropriate pressure and electrical sources when and where applicable.
- Ensure that all connections to pressure and electrical sources are secure prior to and during equipment operation.
- Use only replacement parts specified by Daniel. Unauthorized parts and procedures can affect this product's performance, safety, and invalidate the warranty. “Look-a-like” substitutions may result in deadly fire, explosion, release of toxic substances or improper operation.
- Save this instruction manual for future reference.

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PRODUCT NAMES USED HEREIN ARE FOR MANUFACTURER OR SUPPLIER IDENTIFICATION ONLY AND MAY BE TRADEMARKS/REGISTERED TRADEMARKS OF THESE COMPANIES

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1. LIMITED WARRANTY: Subject to the limitations contained in Section 2 herein, Daniel Measurement & Control, Inc. (“Daniel”) warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Daniel, and that the Goods manufactured by Daniel will be free from defects in materials or workmanship under normal use and care and Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Daniel, whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Daniel from a third party for resale to Buyer ("Resale Products”) shall carry only the warranty extended by the original manufacturer. Buyer agrees that Daniel has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Daniel thereof in writing during the applicable warranty period, Daniel shall, at its option, correct any errors that are found by Daniel in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Daniel to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Daniel are not covered by this limited warranty, and shall be at Buyer's expense. Daniel shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Daniel. All costs of dismantling, reinstallation and freight and the time and expenses of Daniel's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Daniel. Goods repaired and parts replaced by Daniel during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Daniel and can be amended only in a writing signed by Daniel. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES. Buyer acknowledges and agrees that corrosion or erosion of materials is not covered by this warranty.

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Section 1: Introduction

Daniel 3410 Series Ultrasonic Gas Flow Meters have various configurations that meet a broad range of customer requirements. Each meter comes fully assembled from Daniel™ Measurement and Control, Inc.

Refer to the following documents for additional details:

- P/N 3-9000-763 Daniel MeterLink Software for Gas and Liquid Ultrasonic Flow Meters Quick Start Manual
- P/N 3-9000-761 HART® Field Device Specification Manual
- P/N 3-9000-769 Daniel 3410 Series Ultrasonic Gas Flow Meter Maintenance and Troubleshooting Manual

Daniel 3414 Gas Ultrasonic Flow Meter technology provides custody transfer gas measurement with the 3414 Model four-path (eight transducers) chordal design.

Model 3412 dual-path (four transducers) chordal design and Model 3411 single-path (two transducers) chordal design provides check metering, pipeline balance, storage measurement, production, or wet gas applications.

See Section 1.2 for advantages of Daniel 3410 Series Ultrasonic Gas Flow Meters.

1.1 Typical applications

Daniel 3410 Series Ultrasonic Gas Flow Meters have various configurations that meet a broad range of customer requirements. Each meter comes fully assembled from Daniel. The technology can be applied to custody transfer, allocation measurement, and check metering applications such as:

- Custody transfer
- Power plants
- Large industrial users
- Production
- Underground storage sites
- Offshore
- Allocation measurement

1.2 Features and benefits

- Proven long term stability
- Field proven reliability
- No line obstruction
- No pressure loss
- No moving parts
- Low maintenance
- Bi-directional measurement
- Extractable transducers
- Extensive self diagnostics
- Immediate alarm reporting
- Continuous Flow Analysis
  - Abnormal profile
  - Blockage
  - Internal bore buildup
  - Liquids present in the gas meter
  - Reverse Flow
  - Speed of Sound comparison error
- Auto-detected ASCII/RTU Modbus communications protocol
- Low power consumption
- Sophisticated noise reduction
- Internet-ready communications
- Ethernet access
- On-board LED status indicators
- Analog pressure and temperature inputs
- Communication via Emerson's AMS™ Device Manager and Field Communicator
- API Chapter 21 compliant event and data logging (gas meters)
- Daniel MeterLink (a Windows®-based interface software)
- Local Display (optional)

For other features and benefits refer to the product datasheet:

http://www2.emersonprocess.com/EN-US/BRANDS/DANIEL/FLOW/Pages/Flow.aspx

1.3 Acronyms, abbreviations and definitions

Table 1-1 Daniel 3410 Series Gas Ultrasonic Meter 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® Device Manager	Asset Management Software - Device Manager
AO	Analog Output
ASCII MODBUS	A Modbus protocol message framing format in which ASCII characters are used to delineate the beginning and end of the frame. ASCII stands for American Standard Code for Information Interchange.
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; 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 Clear-to-Send (CTS) input of a transmitter.
DAC	Digital-to-Analog Converter
Daniel MeterLink™	Daniel 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

Table 1-1 Daniel 3410 Series Gas Ultrasonic Meter acronyms, abbreviations and definitions

Acronym or abbreviation	Definition
IS	Intrinsically Safe
K	Kelvin (temperature unit)
kHz	kilohertz (10^3 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)
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 of meter
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.

Table 1-1 Daniel 3410 Series Gas Ultrasonic Meter acronyms, abbreviations and definitions

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

1.4 Daniel MeterLink software

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

http://www.daniel.com/um2.htm

Figure 1-1 Daniel MeterLink download and registration

Procedure

1. From the right panel under Quick Links, click the **MeterLink Registration and Download** link.
2. Click the **Order Now** button to complete the Online registration form.
3. Click **Next** to go to the order confirmation page.
4. Click **Complete Order**.
   You will receive a conformation e-mail with a hyperlink directing you to the download site. Click the link provided.
5. Click **Save.**

Refer to the *Daniel MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (P/N 3-9000-763) for installation instructions and setup for initial communications. You may download the manual from the Daniel MeterLink web page:

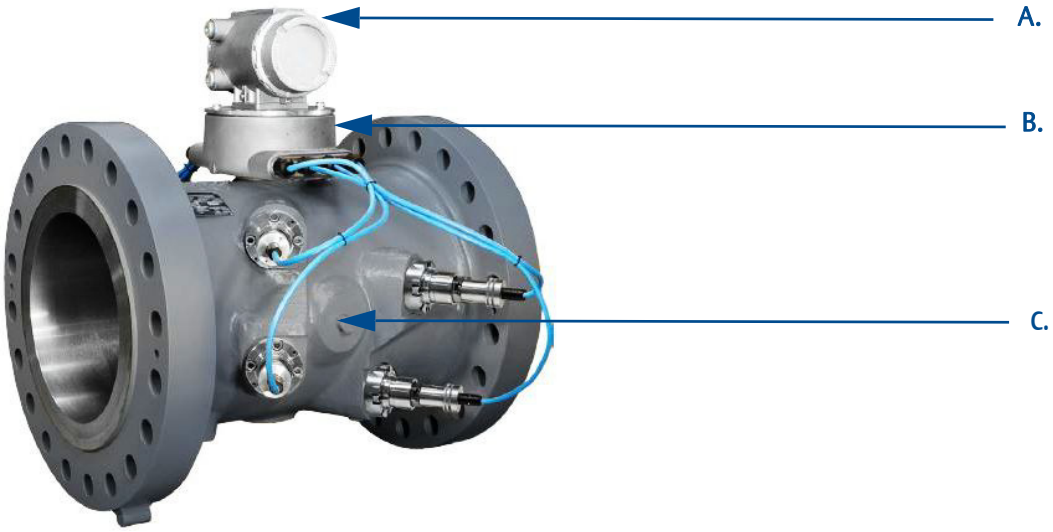
http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/MeterLink.aspx

1.5 Daniel 3410 Series meter design

Daniel 3410 Series Gas Ultrasonic Flow Meters are designed to accurately measure products in applications where reliable performance is critical, by measuring 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.**Daniel 3414** Gas Ultrasonic Flow meters utilize four cross-bore, parallel-plane measurement paths that offer a high degree of accuracy, repeatability, bi-directional measurement and superior low-flow capabilities without the compromises associated with conventional technologies. These features make the Daniel 3414 the best choice for custody transfer applications.

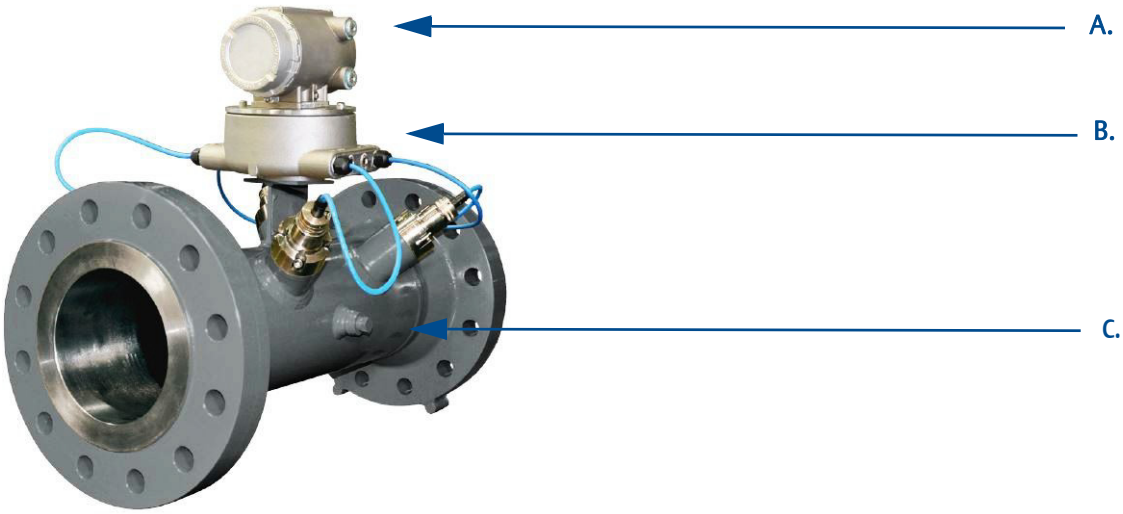
Figure 1-2 Daniel 3414 Gas Ultrasonic Flow Meter design



A. Transmitter electronics enclosure (explosion-proof) Optional - Local Display with glass endcap (Figure 1-4)
B. Base electronics enclosure (intrinsically safe)
C. Meter body with transducer assemblies (T-11, T-12, T-21 or T-22) (intrinsically safe)

Daniel 3412 Gas Ultrasonic Flow meters utilize two-path in-line (four transducers) measurement paths and are designed to measure the difference in signal transit time with and against the flow across one or more measurement path(s). The two paths are configured at right angles to one another in a "bulls-eye" arrangement.

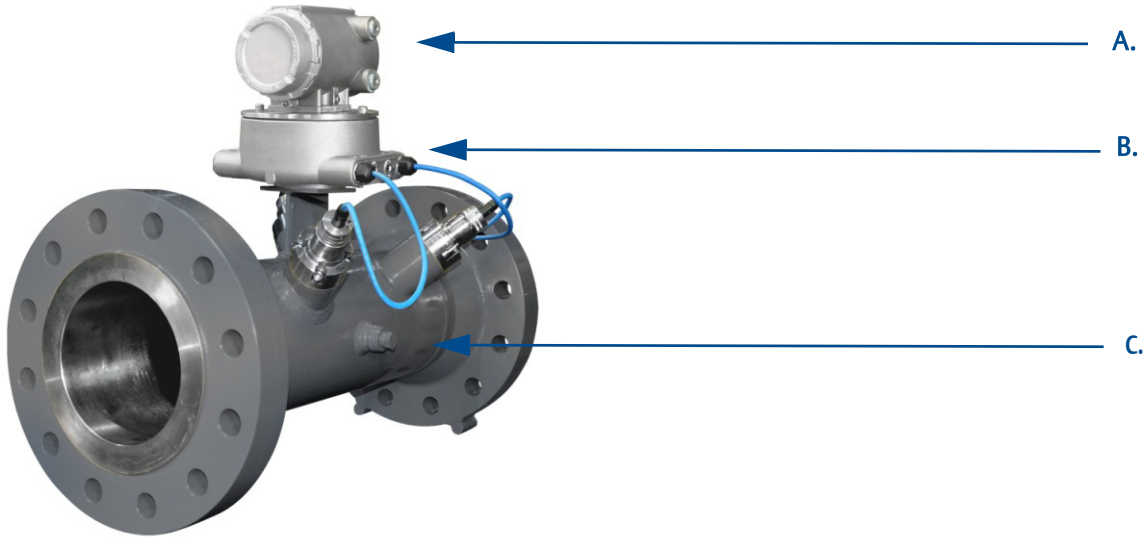
Figure 1-3 Daniel 3412 Gas Ultrasonic Flow Meter design



A. Transmitter electronics enclosure (explosion-proof) Optional - Local Display with glass endcap (Figure 1-4)
B. Base electronics enclosure (intrinsically safe)
C. Meter body with transducer assemblies (T-11, T-12, T-21 or T-22) (intrinsically safe)

Daniel 3411 Gas Ultrasonic Flow meters are single-path (two transducer) Gas Ultrasonic Flow Meter and is referred to as a bounce-path (as the signal is bounced off the meter body) or a centerline path (as it goes through the centerline of the meter body) meter. The bounce-path method simplifies construction of the meter and makes the meter less susceptible to interference from pipeline liquids.

Figure 1-4 Daniel 3411 Gas Ultrasonic Flow Meter design



A. Transmitter electronics enclosure (explosion-proof) Optional - Local Display with glass endcap (Figure 1-4)
B. Base electronics enclosure (intrinsically safe)
C. Meter body with transducer assemblies (T-11, T-12, T-21 or T-22) (intrinsically safe)

The Daniel Gas Ultrasonic Flow Meter design is available with an optional glass endcap and a local display.

Figure 1-5 Transmitter electronics enclosure with local display and glass endcap

All Daniel 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.

Note: The optional LCD Display requires firmware v1.04 or later and Uboot version, January 31, 2013.

The Base Electronics Enclosure that houses the Acquisition Module. 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 Daniel drawing DMC - 005324 (see Appendix A).

1.6 Meter specifications

⚠WARNING

CONTENTS MAY BE UNDER PRESSURE

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

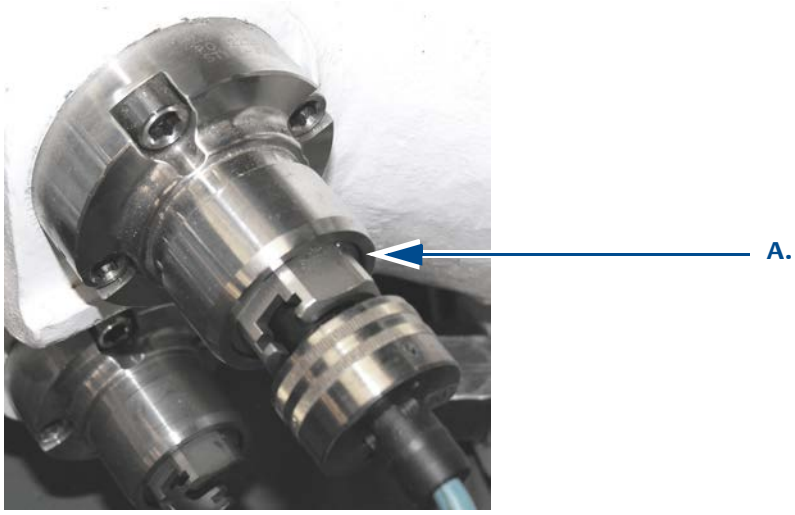
Attempting to do so may release pressurized gases, resulting in serious injury or equipment damage

⚠WARNING

CONTENTS MAY BE HAZARDOUS

The meter must be fully depressurized and drained before attempting to remove the transducer holder. If gas or fluid begins to leak from the transducer holder, stop immediately and reinstall the holder.

Failure to do so may cause serious injury or equipment damage.



A. Transducer holder

⚠CAUTION

ESCAPING GASES OR LIQUIDS HAZARD

The purchaser of the meter is responsible for the selection of Daniel components/seals and materials compatible with the chemical properties of gas flow measurement.

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

Consult your Daniel Sales and Service representative to ensure you purchase the correct components and seals for your application.

Specifications for Daniel 3410 Series Gas Ultrasonic Flow Meters are below:

Table 1-2 Meter specifications

Daniel 3411, 3412 and 3414 meter specifications	
Meter type	Number of paths • 3411 Daniel single path (two transducer) or center-line (bounce) design • 3412 Daniel two path (four transducer) center-line (bounce) design • 3414 Daniel 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 – 100% conversion coated and exterior coated with a polyurethane enamel • ASTM A351 Gr CF8M Stainless Steel – Passivated
	Optional Local Display with a glass endcap on transmitter enclosure
Meter Performance	
Linearity	• Model 3414 Four-path meter chordal design – ± 0.3% of measured value over a 100:1 turndown 3-100 ft/s; 0.3 to 30 m/s) including lab uncertainty – Flow calibrated accuracy is ± 0.1% of reading relative to lab over entire flow calibration range (Q_{min} - Q_{max}) • Model(s) 3411 single-path or 3412 two-path – Flow calibrated accuracy is ± 0.5% of reading relative to lab[1] – Accuracy is typically ±1.5% of actual volume flow[1](without flow calibration)
1. Does not take into consideration changes in wall roughness and installation effects.	
Repeatability	• ±0.05% of reading in the specified velocity range from 5% to 100% (Q_{max})
Velocity range	• 100 ft/s (30 m/s) with over-range) • 125 fps (38 m/s) on some line sizes • Meter meets or exceeds AGA9 (2007) performance specifications
Body and Flange Sizes and Pressure rating range	U.S. Customary Units - Meter sizes 4, 6, 8, 10, 12, 16, 18, 20, 24, 30, and 36 (inches) • ANSI pressure classes 300, 600, 900 and 1500 (per ANSI B16.5) • Carbon Steel • 316 Stainless Steel Metric Units - Meter sizes DN - 100, 150, 200, 250, 300, 400, 450, 500, 600, 700, 750, 900 • PN 50, 100, 150, 200 • Carbon Steel • 316 Stainless Steel Maximum Pressures • Dependent on operating temperature Meter bore • Schedule 20, 30, 40, 60, 80, 100, 120, 140, 160, STD, XS, LW

Table 1-3 Performance specifications

Meter size	4” to 24”	30”	36”
Qmin(ft/s)	2	2	2
Qt (ft/s)	10	8.5	7.5
Qmax (ft/s)	100	85	75

Table 1-2 Meter specifications

Meter Performance	
Flange types	ANSI classes - 300, 600, 900 and 1500 (per ANSI B16.5)
Specific Gravity	0.35 to 1.50
Accuracy Limits	Model 3414 accuracy limits (AGA 9 compliant) are: • ± 1% without a flow calibration (10" and smaller line sizes) • ± 0.7% without a flow calibration (for 12" and larger line sizes) • ±0.1% with a flow calibration Model(s) 3411 and 3412 accuracy limits are: • ± 1.5% without a flow calibration
Minimum operating pressure	100 psig (7 bar)
Electronic specifications	
Power	Meter • 10.4 VDC to 36 VDC • 11 W power consumption (15 W maximum) \

Table 1-2 Meter specifications

Electronic specifications (Continued)

Transducer, mounts and holders

Table 1-4 Transducer specifications

Transducer type	Temperature range	Mount and holder type
T-11	-20 °C to +100 °C (-4 °F to 212 °F)	Standard mounts/Holders, NBR O-ring Inconel mounts/316L Holders, NBR O-ring Inconel Mounts/Inconel Holders/FKM O-ring
T-12	-20 °C to +100 °C (-4 °F to 212 °F)	Standard mounts/Holders, NBR O-ring Inconel mounts/316L Holders, NBR O-ring Inconel Mounts/Inconel Holders/FKM O-ring
T-21[1]	-20 °C to +100 °C (-4 °F to 212 °F)	Standard mounts/Holders, NBR O-ring Inconel mounts/316L Holders, NBR O-ring Inconel Mounts/Inconel Holders/FKM O-ring
T-22[2]	-50 °C to +100 °C (-58°F to 212 °F)	Standard mounts/Holders, NBR O-ring Inconel mounts/316L Holders, NBR O-ring Inconel Mounts/Inconel Holders/FKM O-ring

1. T-21 transducers use W-01 transformers
2. T-22 transducers use W-02 transformers

Note: The process temperature must not exceed the operating temperature range of the transducers.

Note: T-11 and T-21 transducers are designed for 12 inch and larger meters. T-12 and T-22 transducers are designed for 4" through 10 meters.

Note: T-11 and T-21 transducers are used for all meter sizes for Models 3411 and 3412.

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 Division 1 classification to a Division 2 area to meet an area classification.

Table 1-2 Meter specifications

Communications specifications	
Connectivity protocols	One serial RS-232/RS-485 port (115 kbps baud rate) (Modbus RTU/ASCII) • (1) Serial Port A (RS-232/RS-485 Full Duplex/RS-485 Half Duplex)
	One Ethernet Port (TCP/IP) 100 Base • Up to 10 Mbps (internal connection) 100Mbps (external connection) • Modbus TCP, TCP/IP
Device compatibility	Daniel Ultrasonic flow meters are compatible with nearly every commercially available flow computer. Examples: FloBoss 103, FloBoss S600 flow computer, ROC 107,
Digital, analog, and frequency inputs	
Digital Input(s) (Selectable)	(1) Single polarity – 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% 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 output is available to provide power to the sensors.

Table 1-2 Meter specifications

Digital, analog, and frequency outputs	
Frequency/Digital Output(s)	The meter has user-configurable selections for either a frequency output or digital status (FODO) (Also see Section 3.6.1). (3) Frequency/Digital Outputs • FODO1 (four possible output configurations) • FODO2(eight possible output configurations) • FODO3(eight possible output configurations) Frequency or Digital Output parameter pairs (see Section 3.6.1) Frequency or Digital Outputs (FODO 1) source selections: • (FO1A, DO1A, FO1B, DO1B) Frequency or Digital Outputs (FODO 2) source selections • (FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B) Frequency or Digital Outputs (FODO 3) 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. Maximum frequency for the frequency outputs • 1000Hz • 5000Hz
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% of full scale and gain error is within ±0.2% of full scale. The total output drift is within ±50 ppm of full scale per °C.

1.7 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, CSA, ATEX, IECEx etc.
- Civil and structural good practices compliance
- Contractual agreements or governmental compliance (or both)
- In-situ performance test procedures
- Field tested meter health check and flow dynamics diagnostics
- Data collection and retention procedures

1.8 Safety

The Daniel 3410 Series Gas Ultrasonic Flow Meter is suitable for use in U.L. Class 1, Division 1, Group C and D hazardous locations.

NOTICE

An “X” signifies the user should contact Daniel Measurement and Control, Inc. for information on the dimensions of the flameproof joints.

Refer to the 3410 Series Systems Wiring Diagram, Sheet 3 (P/N DMC -005324) for the certification tag (see Appendix A).

Daniel 3410 Series Liquid Ultrasonic Meters are INMETRO certified. Refer to the 3410 Series Liquid Ultrasonic Flow Meter Tag, INMETRO Certification drawing DMC - 006224.

Certificate number: NCC 11.0163 X
Marking: --Ex d ia IIB T4 Gb IP66 W
Electrical parameters: Refer to Section 1.6, Table 1-1

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 Section 1.6, Table 1-2) if the operating temperature exceeds 1 40 °F (60 °C) (refer to Section 1.6, Table 1-2)
- Cable length (refer to Section 1.6, Table 1-2)

⚠WARNING

EXPLOSION OR FIRE HAZARD

Conduit runs must have a sealing fitting within 18 inches (457 mm) 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.

1.9 Daniel 3410 Series Certifications and Approvals

Daniel 3410 Series Gas 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 (P/N DMC - 005324) in Appendix A and observe all safety precautions. Daniel 3410 Series Gas Ultrasonic Flow Meters operate within the pressure and temperature range of the device (also see Section 1.6 for meter specifications). Daniel 3410 Series Gas Ultrasonic Flow Meters are approved to the ATEX Directive 94/9/EC.

Standards

- US
- Canada
- Europe
  - Explosive Atmospheres (ATEX)
  - International Electrotechnical 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 Daniel Customer Service for the complete metrology approvals list.

1.10 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.

1.11 References

[1] *Gould Modbus Protocol Reference Guide*, Rev. B, PI-MBUS-300

[2] Measurement of Fuel Gas By Turbine Meters, American Gas Association, Transmission Measurement Committee Report No. 7, Second Revision, April 1996 (also referred to as AGA7)

[3] Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases, American Gas Association, Transmission Measurement Committee Report No. 8, Second Edition, Second Printing, July 1994 (also referred to as AGA8)

[4] Speed of Sound in Natural Gas and Other Related Hydrocarbon Gasses, Report 10, First Edition, May 2003 (also referred to as AGA10)

[5] Manual of Petroleum Measurement Standards, Chapter 21 – Flow Measurement Using Electronic Metering Systems, Section 1 – Electronic Gas Measurement, American Gas Association and American Petroleum Institute, First Edition, September 1993

[6] AGA Report No. 9, Measurement of Gas by Multipath Ultrasonic Meters, Second Edition (April 2007)

Section 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 heated or cooled pipelines and safety warnings and precautions.

⚠ 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 do so may result in injury.

⚠ WARNING

CUTTING HAZARD

Sharp edges may be present on the meter.

Wear appropriate personal protective equipment when working on the meter. Failure to do so may cause serious injury.

⚠ 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 or damage to the bore and sealing face.

⚠ CAUTION

TRIPPING HAZARD

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

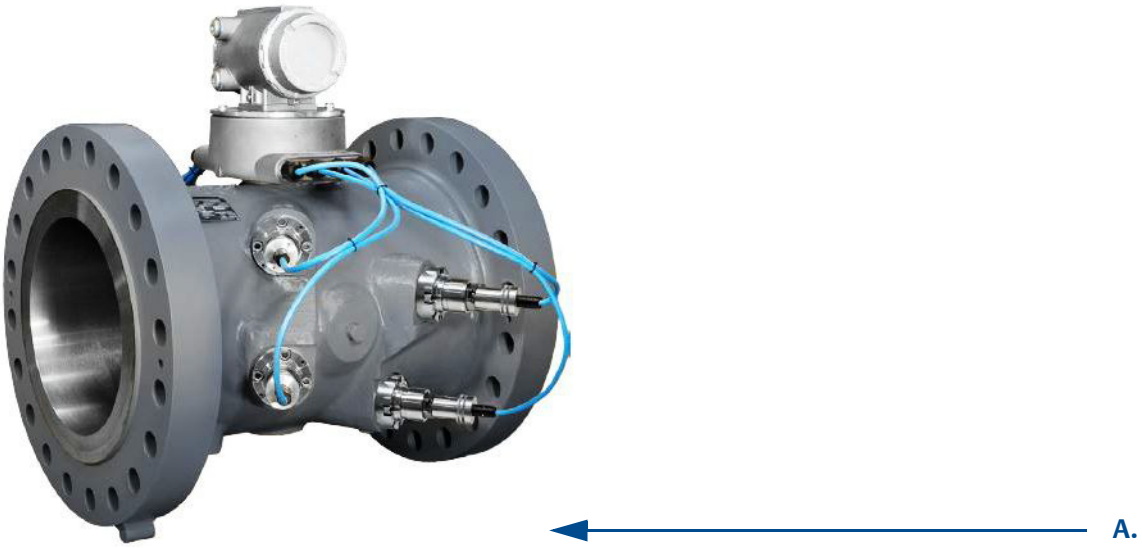
Failure to clear the work area may cause injury to personnel.

⚠WARNING

CRUSHING HAZARD

Do not remove flange stabilizers.

Attempting to do so may allow the meter to roll, resulting in serious injury or equipment damage.



A. Flange stabilizers

⚠CAUTION

ESCAPING GASES OR LIQUIDS HAZARD

The purchaser of the meter is responsible for the selection of Daniel components/seals and materials compatible with the chemical properties of gas flow measurement.

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

Consult your Daniel Sales and Service representative to ensure you purchase the correct components and seals for your application.

2.2 Meter components

Daniel 3410 Series Gas 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. [1]

⚠WARNING

CONTENTS MAY BE UNDER PRESSURE

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

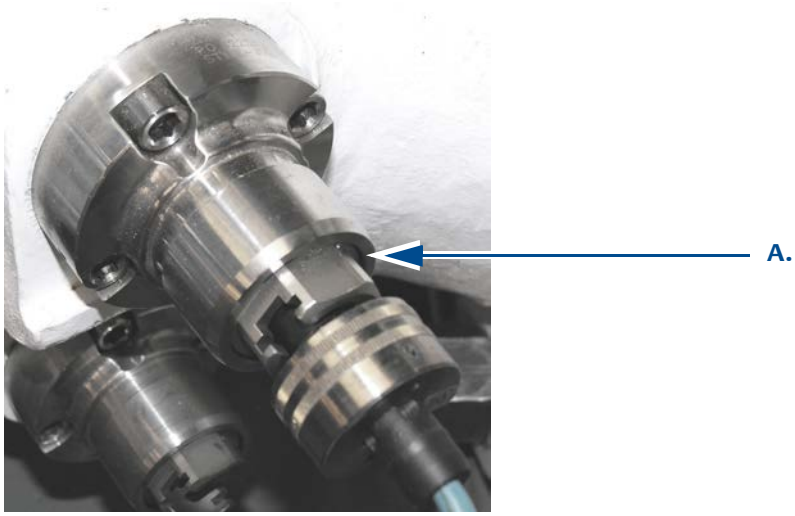
Attempting to do so may release pressurized gases, resulting in serious injury or equipment damage

⚠WARNING

CONTENTS MAY BE HAZARDOUS

The meter must be fully depressurized and drained before attempting to remove the transducer holder. If gas or fluid begins to leak from the transducer holder, stop immediately and reinstall the holder.

Failure to do so may cause serious injury or equipment damage.



A. Transducer holder

1. Refer to the 3-9000-744 Split Clamp Extractor Tool Operation Manual to remove the transducer holders while the meter is pressurized.

⚠WARNING

EXPLOSION OR FIRE HAZARD

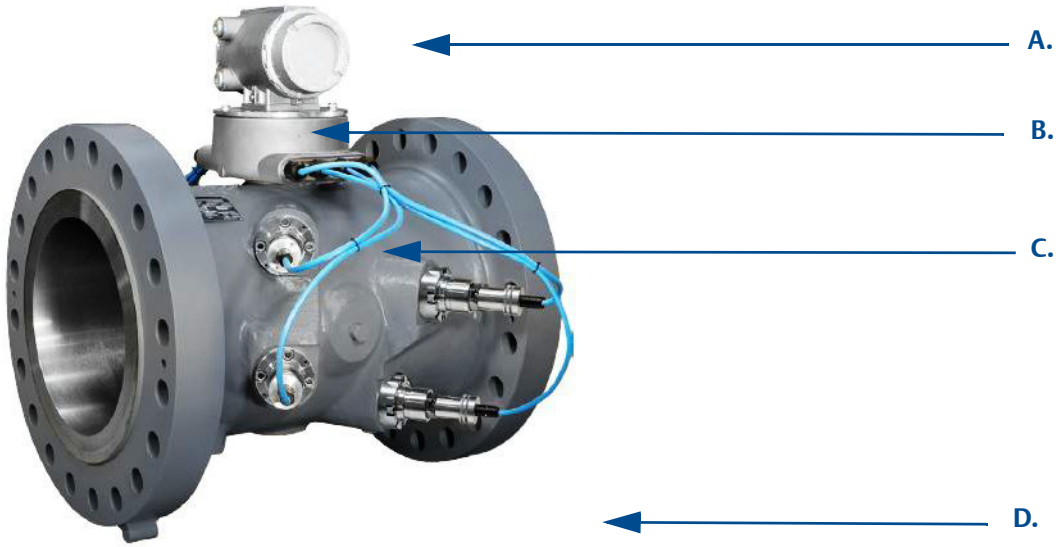
Conduit runs must have a sealing fitting within 18 inches (457 mm) of the enclosure to reduce the risk of an explosion or a fire.

- **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.

The 3414 four path ultrasonic meter components are shown below.

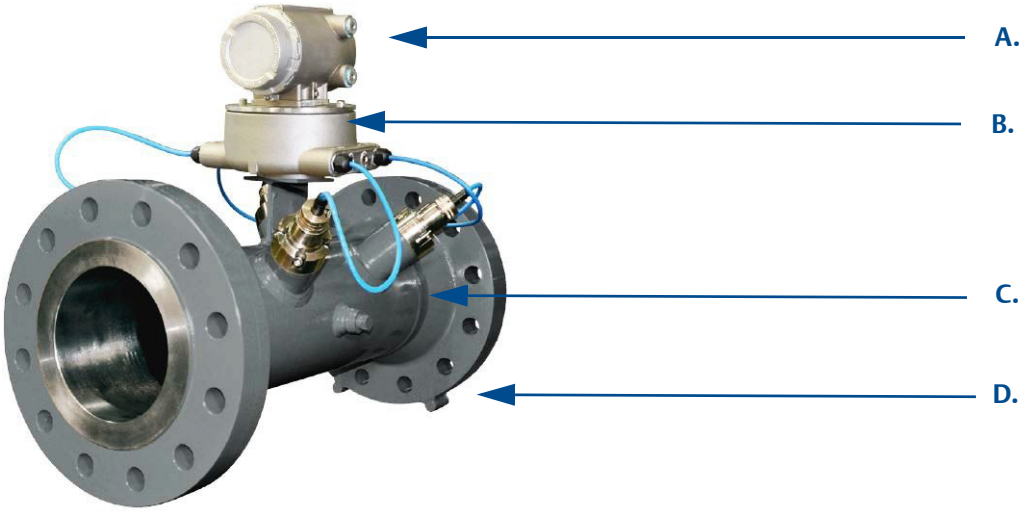
Figure 2-1 Daniel 3414 Flow Meter assembly



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

The 3412 dual path ultrasonic meter components are shown below.

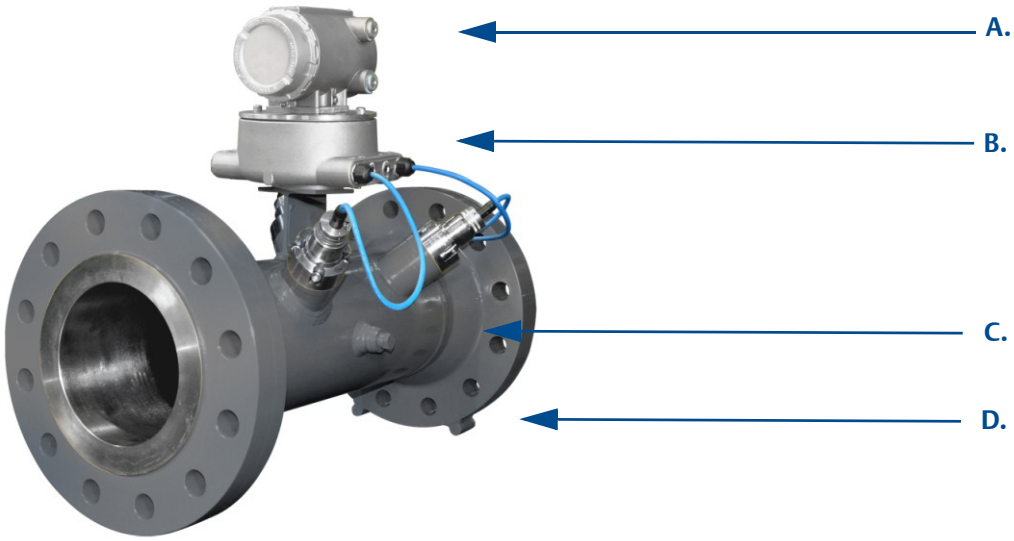
Figure 2-2 Daniel 3412 Flow Meter assembly



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

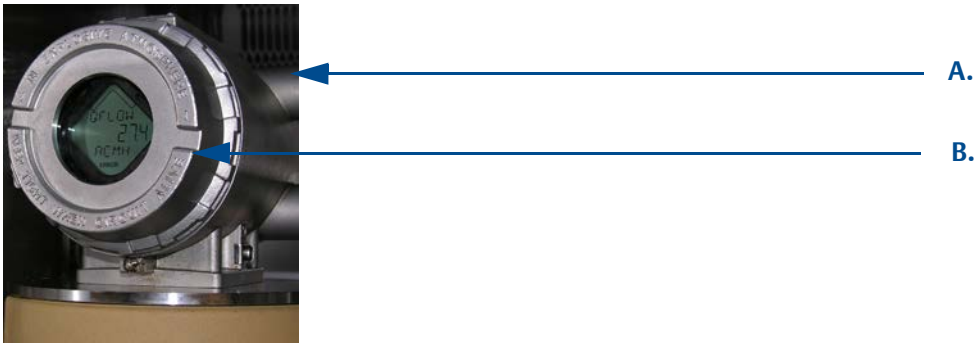
The 3411 single path ultrasonic meter components are shown below.

Figure 2-3 Daniel 3411 Flow Meter assembly



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

Figure 2-4 Transmitter electronics enclosure with optional local display and glass endcap



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

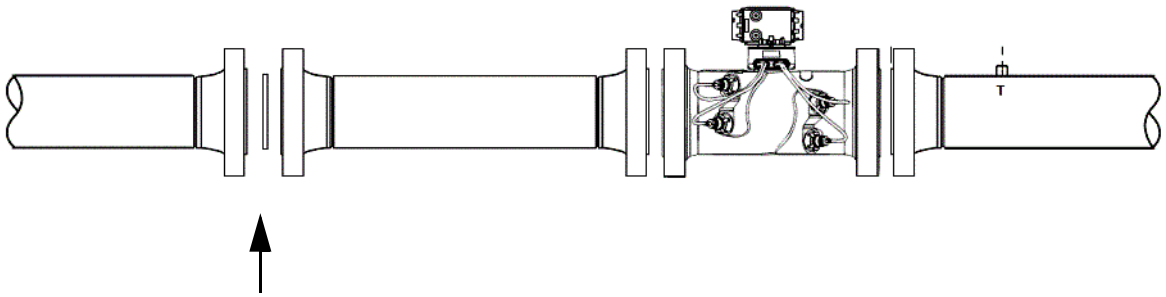
2.3 Piping recommendations

⚠WARNING

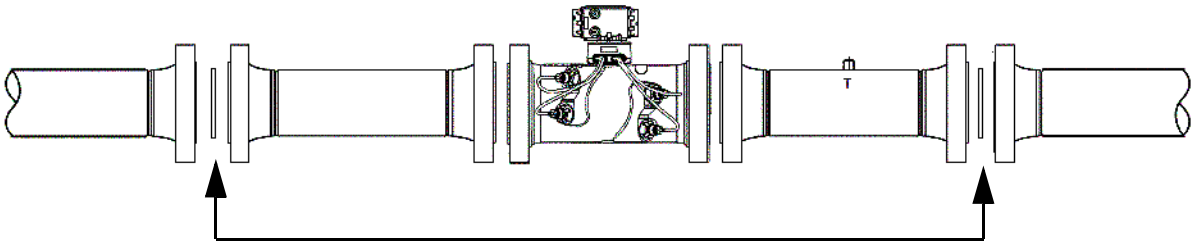
BURST HAZARD

Before pipeline cleaning and maintenance ("pigging operations"), remove straightening vanes or flow conditioners. Failure to do so may cause excessive pressure in the meter system, resulting in serious injury/ death or equipment damage.

3410 Series Gas Ultrasonic Flow Meter with flow conditioner for uni-directional flow



3410 Series Gas Ultrasonic Flow Meter with flow conditioner for bi-directional flow



Sunshields, provided by the customer, may be required to prevent exceeding the process fluid temperature 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.

NOTICE

For optimal flow measurement conditions, Daniel suggests the piping configurations below. Regardless of the configuration selected, the user agrees to accept full responsibility for the site piping design and installation.

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 0.3 to 30 m/sec or 1 to 100 ft/sec).
- Space availability for meter lengths (to allow inlet piping customization)
- Concentric alignment pins or flange concentricity technique considerations

IMPORTANT

The bore of the mating piping should be within 1% of the meter inside diameter.

Figure 2-5 Piping recommendations uni-directional without flow conditioner

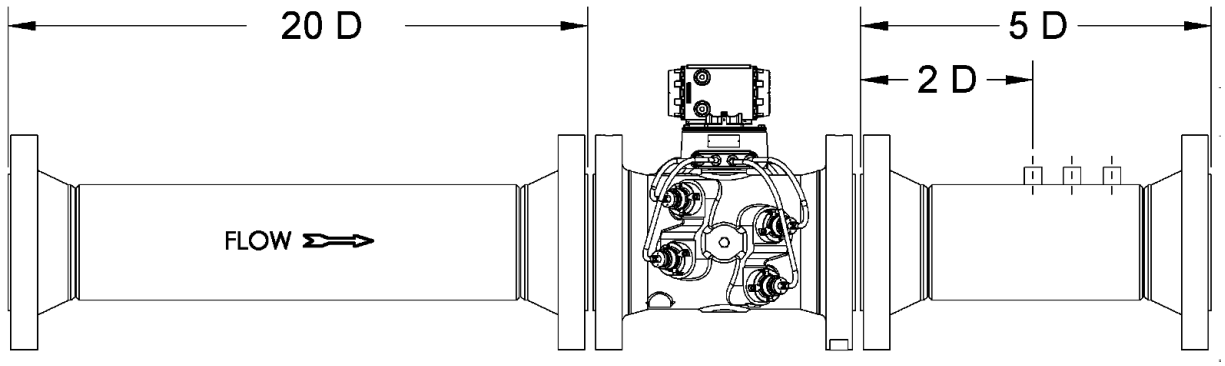


Figure 2-6 Piping recommendations Uni-directional with flow conditioner

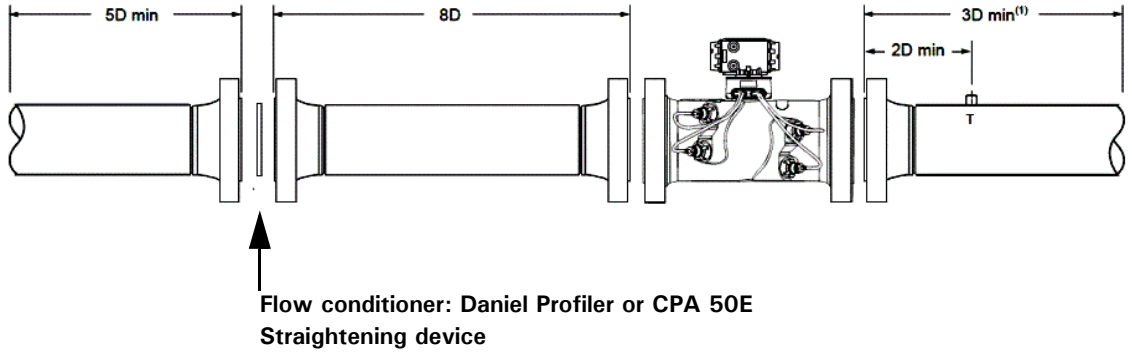
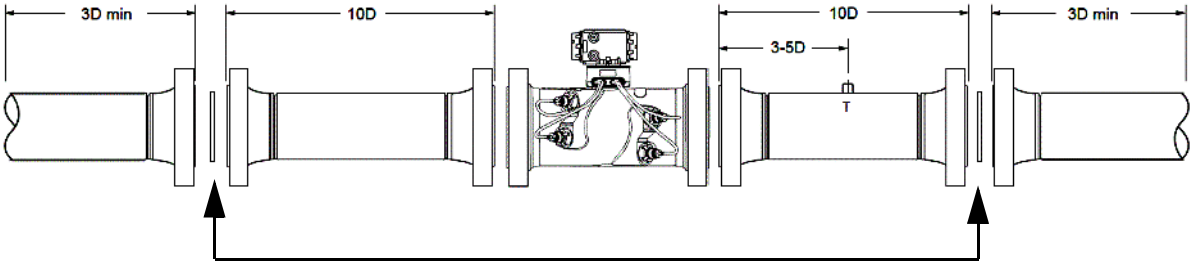


Figure 2-7 Piping recommendations Bi-directional flow with flow conditioner



All pipe lengths are minimum:

- D = Nominal pipe size in inches (i.e. 6” pipe size; 10 D = 60 in)
- P = Pressure measurement location
- T = Temperature measurement location

http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/Ultrasonic-Series-3400.aspx

NOTICE

To access the product datasheet from the Daniel products page (above link), select the Daniel Gas Ultrasonic Flow Meter link, click the Documentation tab, expand the Data Sheets - Bulletins - Catalogs tab, then select the Data Sheet.

- The meter is provided with dowel pins to align the meter body bore with the bore of the mating piping.

- Daniel 3410 Series Ultrasonic Gas Flow Meters 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 or gas may collect in the transducer ports which could adversely affect the transducer signals, or cause equipment damage.

- 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 measurement connections located a minimum of three nominal pipe diameters length down stream of the meter, or per AGA Report No. 9.

2.4 Meter safety for hoist rings and lifting slings

A Daniel Gas 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

DANGER TO PERSONNEL AND EQUIPMENT

Lifting a Daniel Ultrasonic Meter with other equipment

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

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

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.

⚠WARNING

CRUSHING HAZARD

During meter installation or removal, always place the unit on a stable platform or surface that supports its assembled weight.

Failure to do so could allow the meter to roll, resulting in serious injury or equipment damage.

NOTICE

Prior to lifting the unit, refer to the Daniel 3414, 3412, or 3411 Gas Ultrasonic Flow Meter nameplate or outline dimensional (general arrangement) drawing for the assembled weight.

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

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

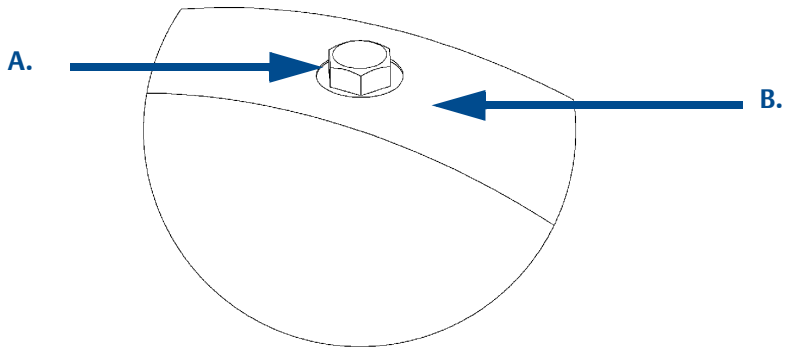
2.4.1 Use of appropriate safety engineered swivel hoist rings in meter end flanges

Daniel 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. This feature provides complete surface contact ONLY between the meter flange and an OSHA compliant Safety Engineered Swivel Hoist Ring as shown in Figure 2-9.

Operators SHALL NOT use Eye Bolts (see Figure 2-9) in the Daniel 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.

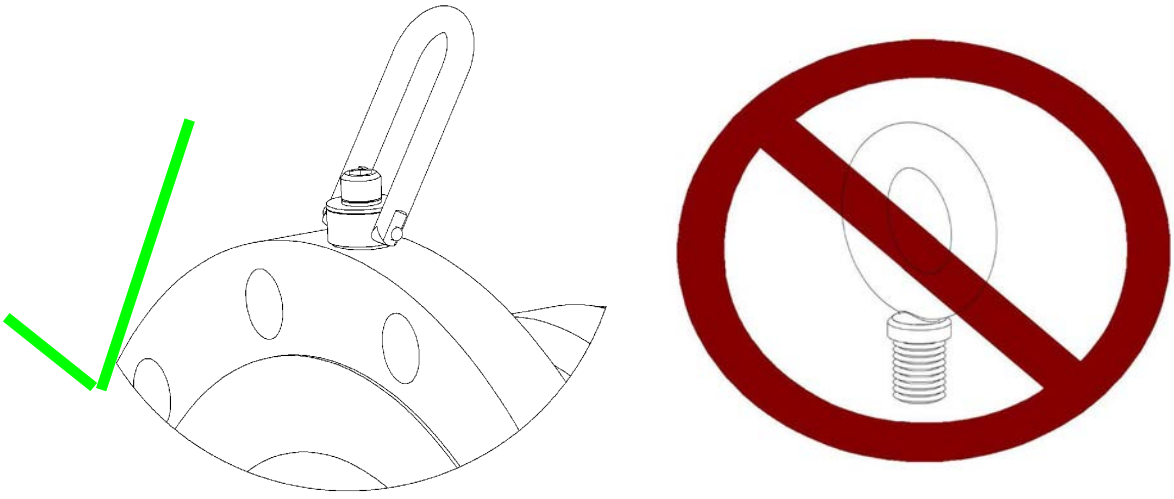
Figure 2-8 Meter end flange with tapped flat-counterbore hole for hoist ring



A. Plug Bolt

B. Flat Counterbore Surface

Figure 2-9 Safety approved hoist ring and non-compliant eye bolt



Safety engineered swivel hoist ring

Eye bolt

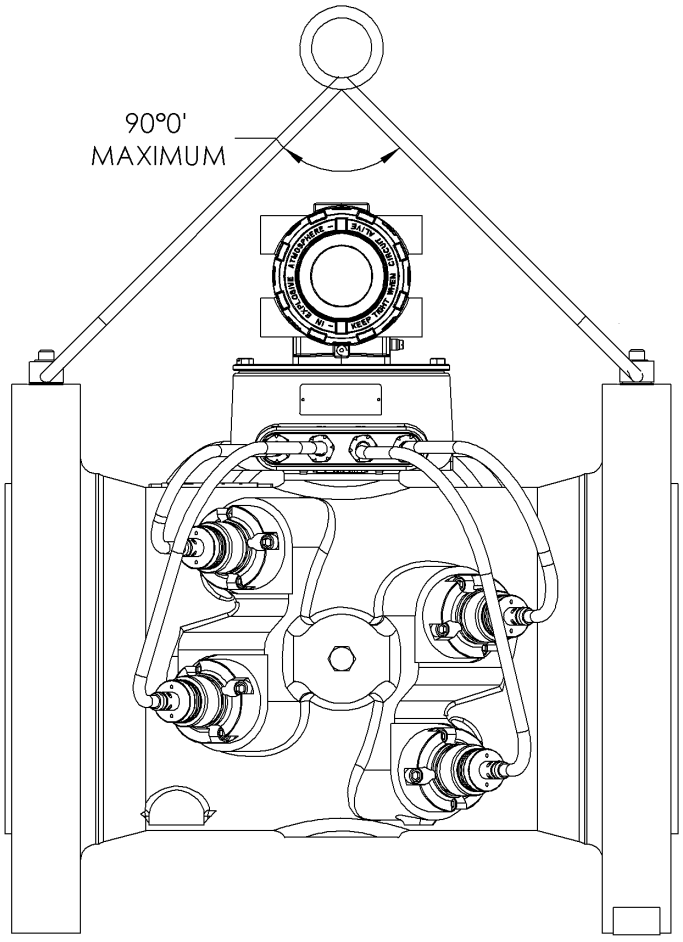
Safety precautions using safety engineered swivel hoist rings

Read and follow the Safety Precautions listed below:

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. Make sure 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 Daniel.
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 2-10 90 Degree angle between slings

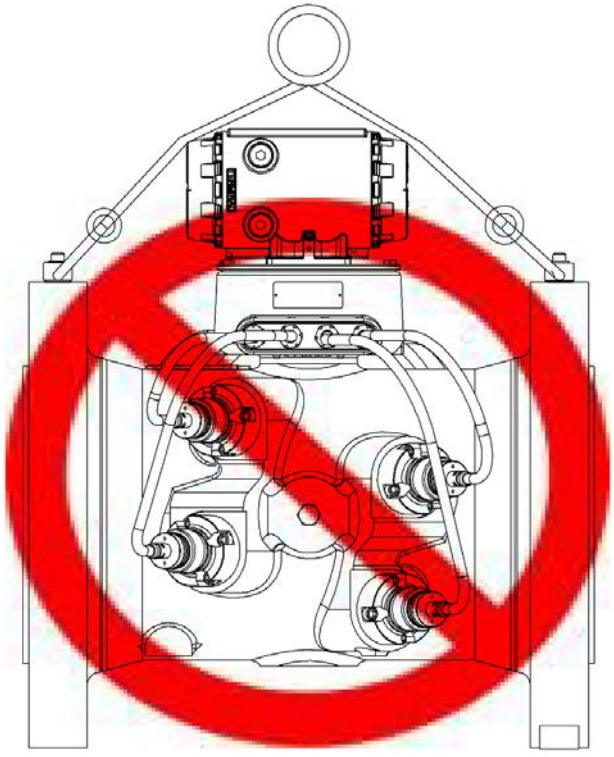


9. NEVER allow the slings to contact the electronics enclosure. Damage to the enclosure may occur. Use a spreader bar with the slings to prevent contact with the electronics enclosure and the base enclosure (see Figure 2-12). If the slings do come in contact with the electronic enclosure then remove 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 2-11 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 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 that safe is 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.

How to obtain safety engineered swivel hoist rings

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

- American Drill Bushing Company(www.americandrillbushing.com)
- Carr Lane Manufacturing Company (www.carrlane.com)

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 (www.fastenal.com)
- Reid Tools (www.reidtool.com)

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

Table 2-1 Hoist ring part number lookup table

Daniel 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”-16UNC, 1000 lb.	23053	CL-1000-SHR-1
1-504-90-092	1/2”-13UNC, 2500 lb	23301	CL-23301-SHR-1
1-504-90-093	3/4”-10UNC, 5000 lb.	23007	CL-5000-SHR-1
1-504-90-094	1”-8UNC, 10000 lb.	23105	CL-10000-SHR-1
1-504-90-095	1-1/2”-6UNC, 24000 lb.	23202	CL-24000-SHR-1

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

What size safety engineered swivel hoist ring do you need?

To determine the size of the hoist rings required for your meter, use the appropriate table below. Look down the column that matches the ANSI rating of your meter. Find the row that contains your meter size. Follow the row to the end to find the appropriate hoist ring part number.

Table 2-2 Hoist Ring Lookup Table for Daniel 3414 Gas Meters[1]

ANSI 300	ANSI 600	ANSI 900	ANSI 1500	Daniel Part Number
4” to 10”	4” to 8”	4” to 8”	4” to 6”	1-504-90-091
12” to 18”	10” to 16”	10” to 12”	8” to 10”	1-504-90-092
20” to 24”	18” to 20”	16” to 20”	12”	1-504-90-093
30” to 36”	24” to 30”	24”	16” to 20”	1-504-90-094
	36”	30" to 36”	24" to 36”	1-504-90-095

1. *4” to 6” 45 degree meters and 8” to 36” 60 degree meters.*

Table 2-3 Hoist Ring Lookup Table for Daniel 3411 or 3412 Gas Meters

ANSI 300	ANSI 600	ANSI 900	ANSI 1500	Daniel Part Number
4” to 10”	4” to 8”	4” to 8”	4” to 6”	1-504-90-091
12” to 18”	10” to 16”	10” to 12”	8” to 10”	1-504-90-092
20” to 24”	18” to 20”	16” to 20”	12”	1-504-90-093
30” to 36”	24” to 30”	24”	16” to 20”	1-504-90-094
	36”	30" to 36”	24" to 36”	1-504-90-095

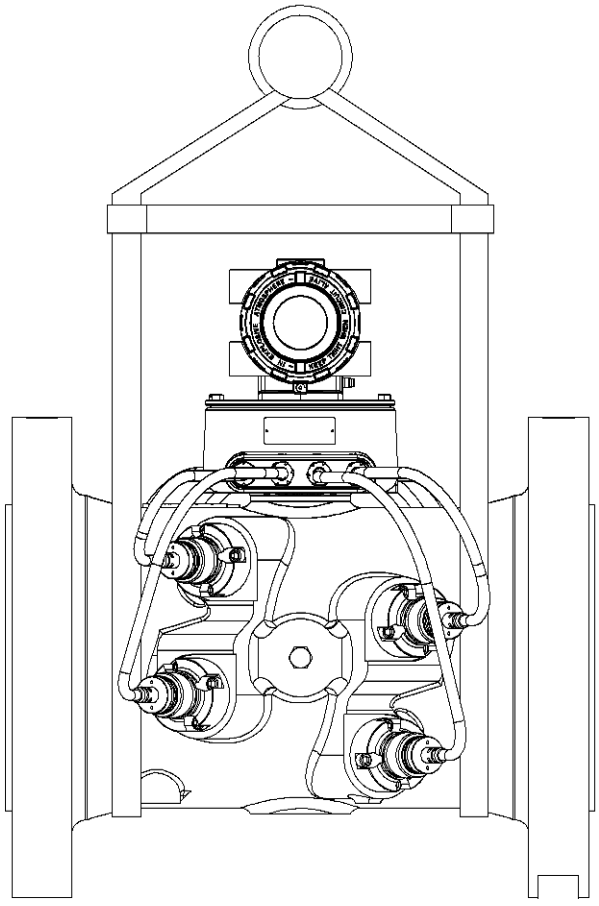
2.4.2 Appropriately rated lifting slings

The following instructions are intended to provide general guidelines for using proper lifting slings when lifting a Daniel 3410 Series Gas Ultrasonic Flow 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

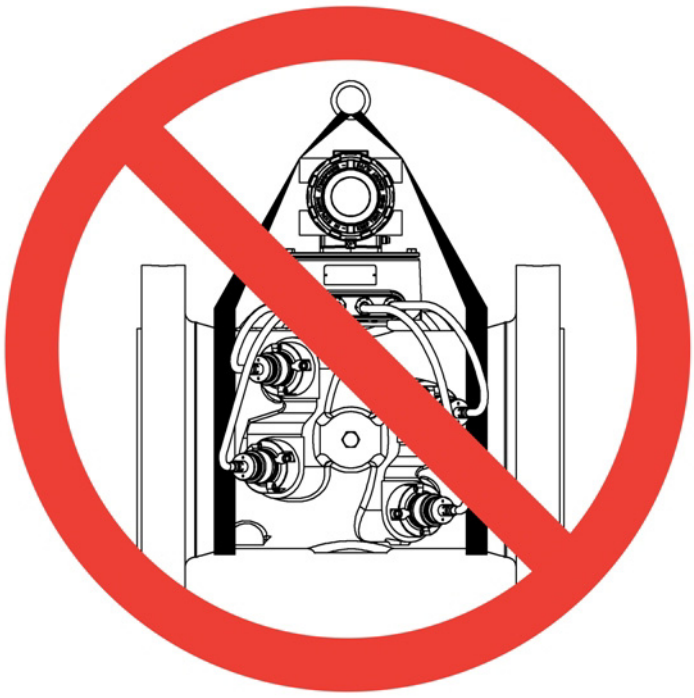
1. Meters must only be lifted by personnel properly trained in the safe practices of rigging and lifting.
2. NEVER attempt to lift the meter by wrapping slings around the electronics enclosure.
3. NEVER attempt to lift the meter using only one sling around the meter. Always use two slings wrapped around each end of the body as shown below. A choker style sling is recommended.

Figure 2-12 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 slings to prevent contact with the electronics.
7. 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 2-13 Incorrect sling attachment



8. 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 Daniel 3410 Series Gas 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 2-3-3400-194, 15 ft. long) shall be used to connect the Daniel 3410 Series Gas 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. T-11, T-12 and T-21 transducers have an operating range from -4 °F (-20 °C) to 212 °F (+100 °C). T-22 transducers have an operating range from -58 °F (-50 °C) to 212 °F (+100 °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 do so may result in injury.

Section 3: Electrical installation

3.1 Cable length TTL mode

The maximum cable length is 2000 feet when the Digital Output "TTL" mode is selected.

3.2 Cable length Open Collector mode

For the Digital Output "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)
(x1000ft)	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:

- 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 = 24 VDC

3.3 Grounding meter electronics housing

The 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. A secondary ground is located outside of the Transmitter Electronics Enclosure (see Figure 3-2).

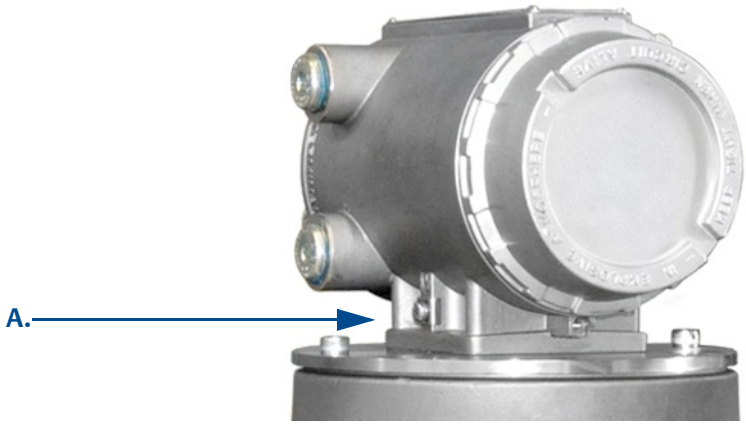
NOTICE

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. DO NOT connect digital grounds to the ground lugs.

Figure 3-1 Internal Transmitter Electronics Enclosure chassis ground

A. Transmitter Electronics Enclosure ground lug

Figure 3-2 External ground lug



A. External ground lug

3.4 Conduit seals

Conduit seals are required for meter installations in hazardous environments. Adhere to safety instructions to protect personnel and equipment.

⚠WARNING

EXPLOSION HAZARD

To reduce the risk of an explosion or fire, conduit runs must have a sealing fitting connected within 457.2 mm (18 inches) of the enclosure. Substitution of components may impair intrinsic safety of the meter.

Failure to keep covers tight during operation may result in serious injury or death.

⚠WARNING

EXPLOSION HAZARD

Substitution of components may impair the intrinsic safety and cause ignition of flammable or combustible atmospheres. Disconnect power before servicing.

Failure to remove power and use Daniel approved components may cause serious injury.

3.4.1 Startup for systems using explosion-proof conduit

1. Assemble conduit to the Transmitter Electronics Enclosure. A conduit seal fitting is required within 18 inches (457 mm) of the enclosure.
2. Check to make certain that all power to field wiring is turned OFF.

⚠WARNING

HAZARDOUS VOLTAGE INSIDE

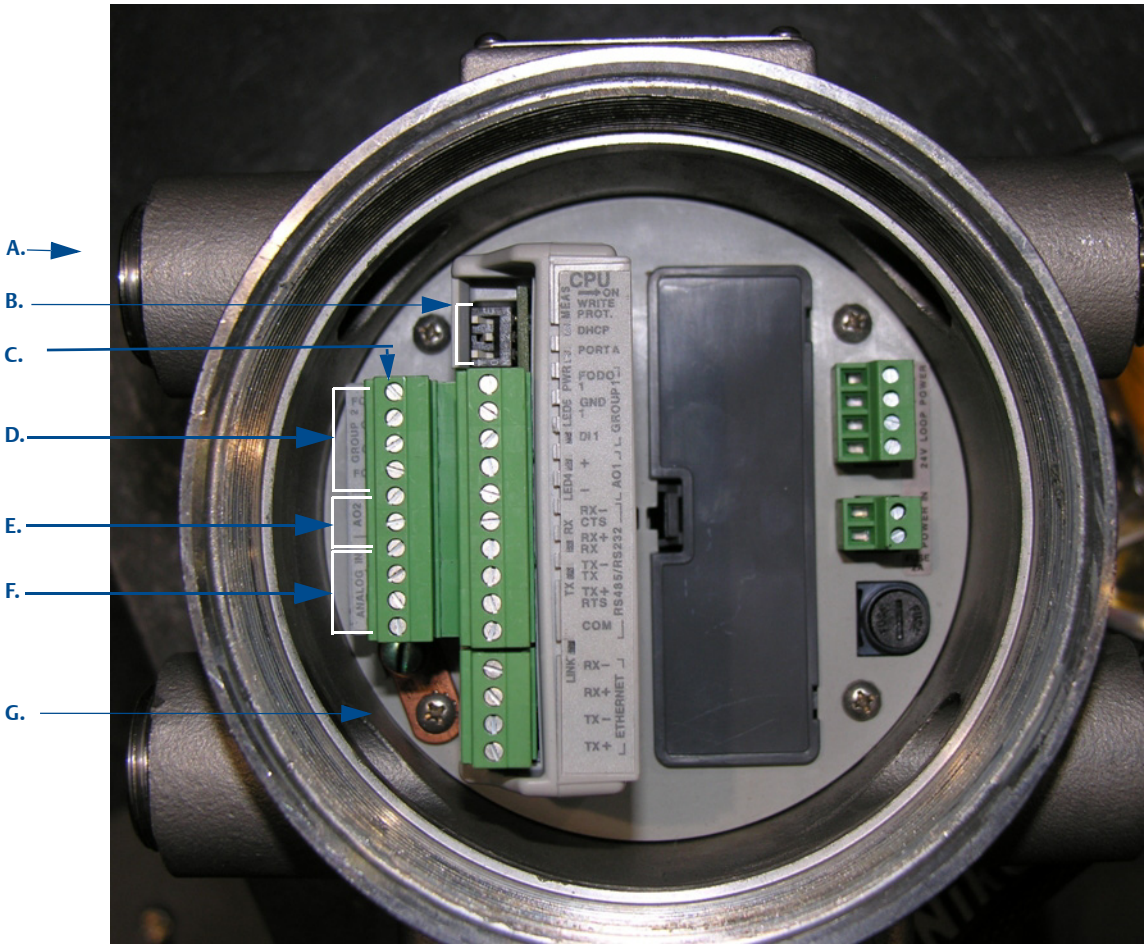
Do not open the Transmitter Electronics Enclosure when an explosive gas atmosphere is present. Disconnect equipment from supply circuit before opening the enclosure.

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

3. Remove the end cap nearest the conduit entry to gain access to the transmitter electronics.
4. Pull the wires into the electronics enclosure.Complete the field connection wiring as shown in see Figure 3-3 and Section 3.5.

5. Complete the field connection wiring and apply electrical power to the system.

Figure 3-3 Electronics field wiring - upper terminal block, switches, ground lug



A. Conduit wiring entry (four entries)

B. Switches:
   1. Port A
   2. DHCP
   3. WRITE PROT.

C. Upper terminal block

D. FODO Group 2
   FODO2
   GND2
   FODO3

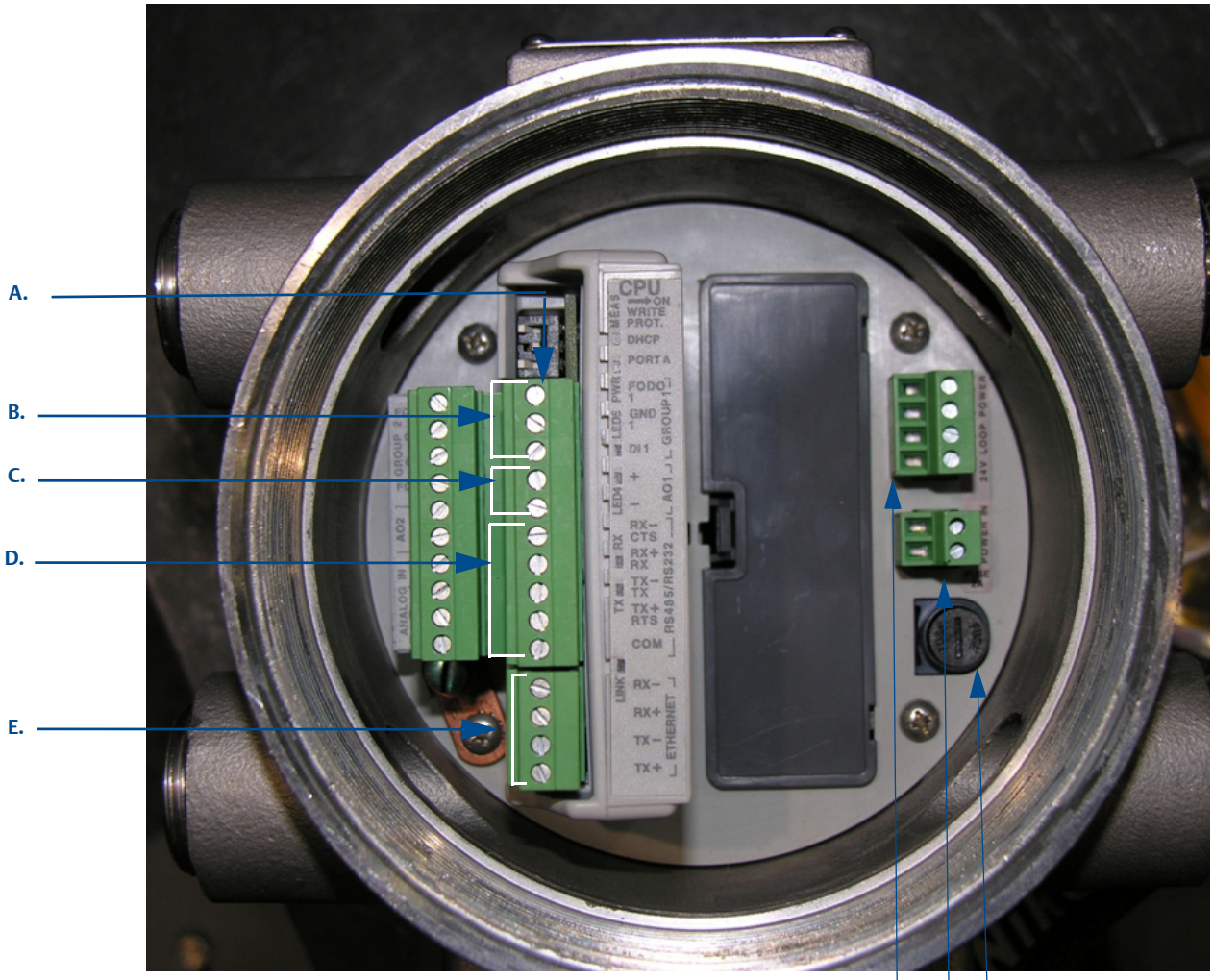
E. Analog Out (Current 4-20mA)
   AO2+
   AO2 -

Upper terminal block (continued)

F. Analog In
   Analog In (AO1)
   Analog Input 1 (Temperature)
   TT+
   TT -
   Analog In (AO2)
   Analog Input 2 (Pressure)
   PT+
   PT -

G. Ground lug

Figure 3-4 Transmitter electronics field wiring lower terminal block



A. Upper terminal block

B. FODO Group 1 connections

- FODO1
- GND1
- DI 1

C. AO1

- AO1+
- AO1 -

D. Serial COMs (RS-232, RS-485)

- RS-232: RTS, TX, RX, CTS
- RS-485: TX+, TX -, RX+, RX - (4-wire Full Duplex)
- RS-485: TX+, TX- (2-wire Half Duplex)

E. Ethernet

- Ethernet (orange and white wire)
- Ethernet (orange wire)
- Ethernet (green and white wire)
- Ethernet (green wire)

F. 24V loop power (4-24mA inputs/outputs)

G. Power In (104VDC - 36VDC)

H. Fuse cover

6. Set or configure the meter operating parameters using Daniel MeterLink. For additional installation information refer to the system wiring diagram (see Appendix A), *Daniel MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (P/N 3-9000-763) and use the Daniel MeterLink Field Setup Wizard to complete the configuration.
7. Verify the field connections are working correctly. Allow the system to run for the time specified by the customer (usually one week) and an electrician has fully tested the connections. After the Acceptance Test is witnessed and approved, seal the conduit.
8. Power down the system and apply the sealing compound to the conduit and allow to set in accordance with manufacturer specifications.
9. If required, install the security latches and wire seals on the Transmitter Electronics Enclosure end caps (see Section 3.7 and Figure 3-11).
10. If required, install the wire seals through the socket head bolts on the Base Enclosure (see Section 3.7, Figure 3-12 and Figure 3-13).
11. Re-apply electrical power to the system.

3.4.2 Startup for systems that use 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 the enclosure.

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

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 and apply electrical power to the system.
5. Set or configure the meter operating parameters using Daniel MeterLink. For additional installation information refer to the system wiring diagram (see Appendix A), *Daniel MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (P/N 3-9000-763) and use the Daniel MeterLink Field Setup Wizard to complete the configuration.
6. Verify the field connections are working correctly. Allow the system to run for the time specified by the customer (usually one week) and an electrician has 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 Section 3.7 and Figure 3-11).
9. If required, install the wire seals through the socket head bolts on the Base Enclosure (see Section 3.7, Figure 3-12 and Figure 3-13).
10. Re-apply electrical power to the system.

3.5 Wiring and I/O

Daniel MeterLink uses the TCP/IP protocol to communicate with the Daniel 3410 Series Ultrasonic Gas Flow Meter electronics instead of Modbus ASCII or RTU. The TCP/IP protocol only works across either Ethernet, RS-485 full duplex (4-wire) or RS-232. Daniel MeterLink can communicate with multiple meters if they are multi-dropped using 4-wire, full duplex RS-485 mode. The meter electronics is HART capable and provides communication flexibility with Daniel 3410 Series Gas Ultrasonic Flow Meters.

Note: Port B for RS-485 full duplex communication is not supported.

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

NOTICE

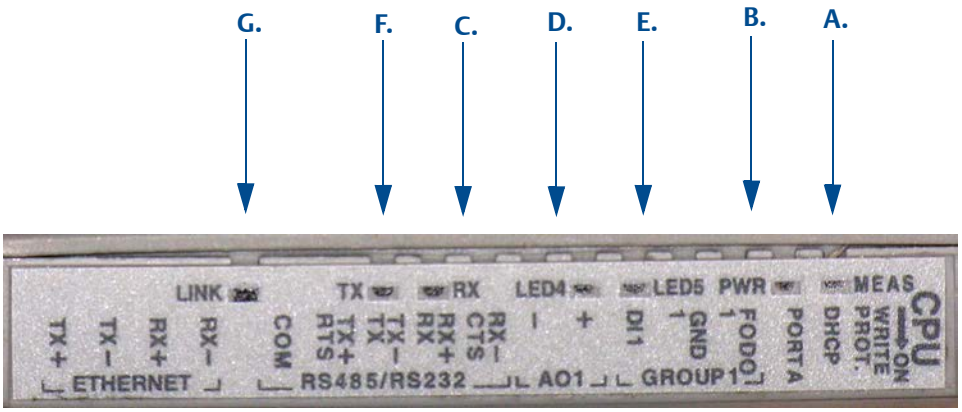
If not using Ethernet, a full duplex serial connection is necessary for Daniel MeterLink to communicate with a Daniel 3410 Series Gas Ultrasonic Meter.

The Daniel 3410 Series Gas 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 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 are indicated via light-emitting diode (LED) status indicators. The WRITE PROT. switch protects the meter's configuration,

Figure 3-5 CPU Module labeling and LED indicators



A. Acquisition/Measurement mode
B. Power
C. RX (RS-485/RS-232) - receiving data
D. LED 4 - not used
E. LED 5 - not used
F. TX (RS-485/RS-232) - transmitting data (RS-485 2-wire use TX+ and TX-)
G. Link (Eth1 Link) - user Ethernet connection

Table 3-2 CPU Module labeling and LED functions

CPU Module label or LED	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
DHCP	• Dynamic Host Protocol Server - enables you to communicate with a Daniel 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. 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 override
MEAS	System color indicates metrology mode • Acquisition mode • Measurement mode	LED status • Red flashing LED • Solid red the Acquisition Module is not communicating with the CPU Module • Green flashing LED
PWR	• 3.3V Power Indicator	• Solid Green
LED 4	• Not used	
LED 5	• Not used	
RX	• RX signal (Port A for RS485 or RS232) communication) receiving data	• Flashing green (when receiving data)
TX	• TX signal (Port A for RS485; 2-wire or 4-wire) 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 Daniel 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 Daniel 3410 Series Gas Ultrasonic Flow Meter, the DHCP option must be turned off if used on a LAN/WAN.

NOTICE

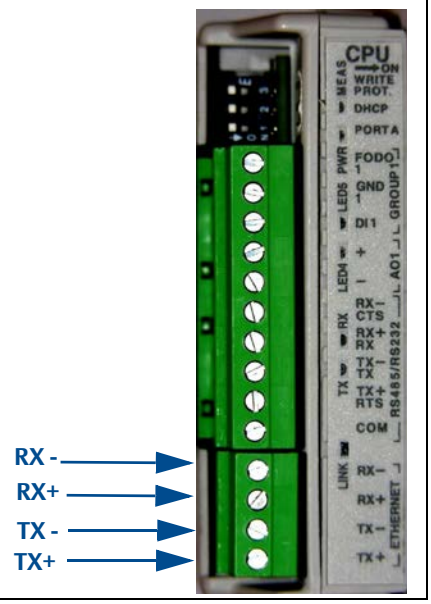
RESTRICTED ETHERNET AND SERIAL CONNECTIVITY USAGE

Failure to restrict Ethernet and communication access to the Daniel 3410 Series Gas Ultrasonic Flow Meter can result in, among other things, unauthorized access, system corruption, and/or data loss.

User is responsible for ensuring that physical access and Ethernet or electronic access to the Daniel 3410 Series Gas Ultrasonic Flow Meter is appropriately controlled and any necessary security precautions are implemented; such as, establishing a firewall, setting password permissions and/or implementing security levels.

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 -



Use ethernet cable, Daniel P/N 3-3400-079, to connect the PC to the meter.

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

Modbus TCP

If the meter firmware supports Modbus TCP slave functionality, the following controls will be available.

Modbus TCP unit identifier: Enter the Modbus TCP unit identifier here. Valid values are 0-255.

Enable alternate Modbus TCP port: The standard TCP port for Modbus TCP is port 502. This port is always enabled in a meter that supports Modbus TCP. By selecting this option, you can also enable Modbus TCP communications on a secondary TCP port specified by Alternate Modbus TCP port.

Alternate Modbus TCP port:

Enter the alternate TCP port number here after selecting Enable alternate modbus TCP port. Valid port numbers are from 1 to 65535. The meter will not allow some port numbers that are either used by the meter or are defined port numbers for other protocols. Daniel MeterLink™ will prompt you if it was not able to write the specified port number to the meter.

Serial connections

Use a serial cable, Daniel P/N 3-2500-401, to connect to a PC running Daniel MeterLink. The cable is designed for RS-232 communications which is the serial Port A default configuration (see Appendix A field wiring diagram, Daniel Drawing DMC - 005324). The DB-9 end of the cable plugs directly into the PC running Daniel MeterLink. The three wires on the other end of the cable connect to the CPU Module RS-485/RS-232 terminals. The RED wire goes to RX, the WHITE wire goes to TX, and the BLACK wire goes to COM (see Table 3-6 for Port A wiring). RS-485, 2-wire connection on Port A, uses TX+ and TX- on the CPU Module and has a ground wire.

When Beldon 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 Daniel MeterLink with an Ethernet port, use Ethernet cable, Daniel P/N 3-3400-079, 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 • RS-485[1] (2-wire communication on Port A.)	• Typically used for general communications with a flow computer, RTU (Modbus slave) and radios. • RS-485 — 2-wire (Half Duplex) connected to TX+ and TX - • 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 Daniel 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 [2] — Parity: odd or even 1, Stop Bits = 1[2] — Baud Rates: 1200, 2400, 9600, 19200, 38400, 57600, 115000 bps — RTU Protocol: Start Bits = 1, Data Bits = 8[2] — Parity: none, Stop Bits = 1[2] — Baud Rates: 1200, 2400, 9600, 19200, 38400, 57600, 115000 bps
Ethernet	• Preferred port for diagnostic communication via Daniel MeterLink • 10 Mbps/100 Mbps	• Modbus TCP/IP, Modbus TCP

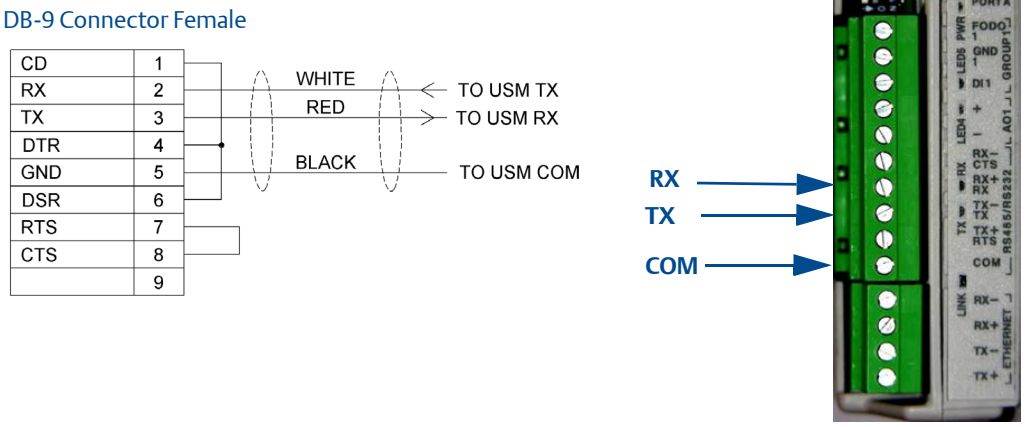
1. *RS-485 2-wire connections use TX+ and TX - on the CPU Module*

2. Denotes auto-detected protocols

NOTICE

If not using Ethernet, a full duplex serial connection is necessary for Daniel MeterLink to communicate with a Daniel 3410 Series Gas Ultrasonic Flow Meter.

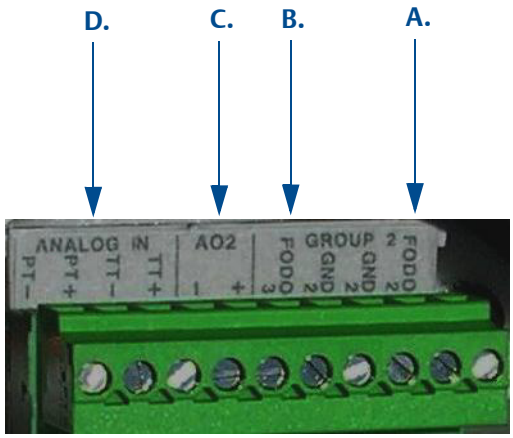
Figure 3-6 PC to meter serial connection wiring



3.6 I/O connections

The Daniel 3410 Series Gas Ultrasonic Flow Meter provides the I/O connections on the CPU Module.

Figure 3-7 CPU Module I/O connections



A. Frequency/Digital Output 2
B. Frequency/Digital Output 3
C. Analog Output 2 - 4-20mA 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 (four possible parameter configurations)
- FODO2 (eight possible parameter configurations)
- FODO3 (eight possible parameter configurations)

Frequency or Digital Outputs (FODO 1) source

- FO1A, DO1A, FO1B, DO1B
- Frequency output 1A is based on frequency content (Actual - Uncorrected Flow Rate)
- Frequency output 1B is based on frequency content and Frequency 1 B Phase
- Digital output 1A is based on Digital output1A content (Frequency1A Validity or Flow Direction)

Frequency or Digital Outputs (FODO 2) source

- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- Frequency output 1A is based on frequency content (Actual - Uncorrected Flow Rate)
- Frequency output 1B is based on frequency content and Frequency 1B Phase
- 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 1Validity and Flow Direction)
- Digital output 1B is based on Digital output1B content (Frequency 1 Validity and Flow Direction)
- Digital output 2A is based on Digital output 2A content (Frequency 2 Validity and Flow Direction)
- Digital output 2B is based on Digital output 2B content (Frequency 2 Validity and Flow Direction)

Frequency or Digital Outputs (FODO 3) source

- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- FO1A, DO1A, FO1B, DO1B, FO2A, DO2A, FO2B, DO2B
- Frequency output 1A is based on frequency content (Actual - Uncorrected Flow Rate)
- Frequency output 1B is based on frequency content and Frequency 1B Phase
- 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 output 1A content (Frequency 1 Validity and Flow Direction)
- Digital output 1B is based on Digital output 1B content (Frequency 1Validity and Flow Direction)
- Digital output 2A is based on Digital output 2A content (Frequency 2 Validity and Flow Direction)
- Digital output 2B is based on Digital output 2B content (Frequency 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)

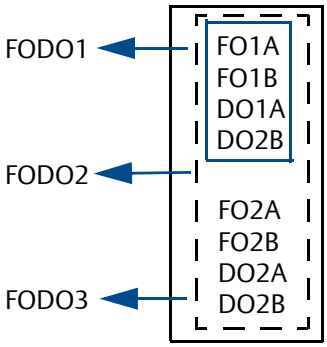
Phase A and Phase B output (based on flow direction)

- 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.
- Bidirectional - 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

- 1000Hz
- 5000Hz

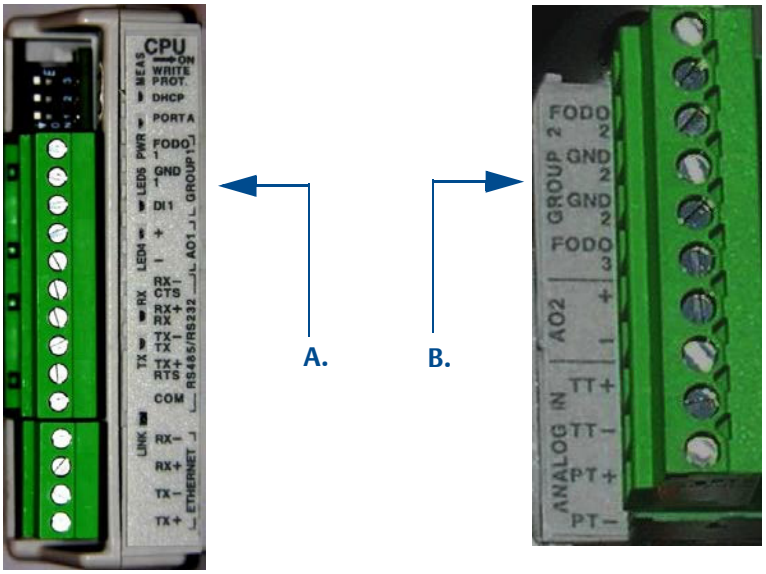
Table 3-5 Frequency/Digital Outputs possible configurations

Frequency/Digital output		Source configuration
Frequency /Digital Output 1[1]	• Frequency output 1A • Frequency output 1B • Digital output 1A • Digital output 1B	
Frequency /Digital Output 2[2] or Frequency /Digital Output 3[2]	• Frequency output 1A • Frequency output 1B • Digital output 1A • Digital output 1B • Frequency output 2A • Frequency output 2B • Digital output 2A • Digital output 2B	

1. *Solid blue line denotes valid selection for Frequency/Digital Output 1.*
2. *Black dashed -line denotes valid selections for Frequency/Digital Output 2 and Frequency/Digital Output 3.*

Output for FODO1 and Digital Output1 (Group 1 on the CPU Module) share a common ground and have 50V isolation. FODO2 and FODO3 (Group 2 on the CPU Module) share a common ground and have 50V 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 500V rms dielectric.

Figure 3-8 CPU Module - Frequency/Digital outputs common ground



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

3.6.2 Analog input settings

The Daniel 3410 Series Gas Ultrasonic Flow Meter 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, 24VDC isolated power supply connection is provided for an external power source. Refer to the Field wiring diagram DMC - 005324 in Appendix A.

3.6.3 Analog output settings

The Daniel 3410 Series Ultrasonic Gas Flow Meter provides two 4-20 mA analog output signals that are software configurable for either sink or source current (see Appendix A DMC - 005324).

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 Daniel® Liquid Ultrasonic Flow Meter.

- Analog Output1 (AO1) is user-configurable as a 4-20mA output and has HART capabilities.
- Analog Output 2 (AO2) is user-configurable as a conventional 4-20 mA output.

3.6.4 Digital Input

The Daniel 3410 Series Gas Ultrasonic Flow Meter provides one digital input that can be used as a general purpose input. The digital input must be configured via the Daniel MeterLink **Tools|Edit/Compare Configuration** screen.

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 Switch 2 → 	OFF	ON

3.6.6 Configuration protect switch settings

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

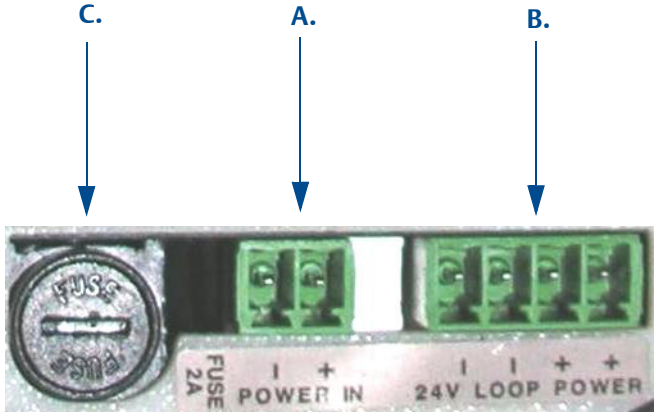
Table 3-7 Configuration protect switch settings

CPU Module switch	Configuration protected	Configuration unprotected
WRITE PROT. Switch 3 → 	**ON** (default setting)	**OFF**

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 Amp fuse and a 24V loop power connection for ultrasonic meter analog outputs, temperature transmitter or pressure transmitter devices. The current is limited to 88mA.

Figure 3-9 CPU Module power source connections



A. Power In connector (main power)
B. 24V LOOP POWER
C. 2 Amp fuse (used for the main power input)

3.7 Security seal installation

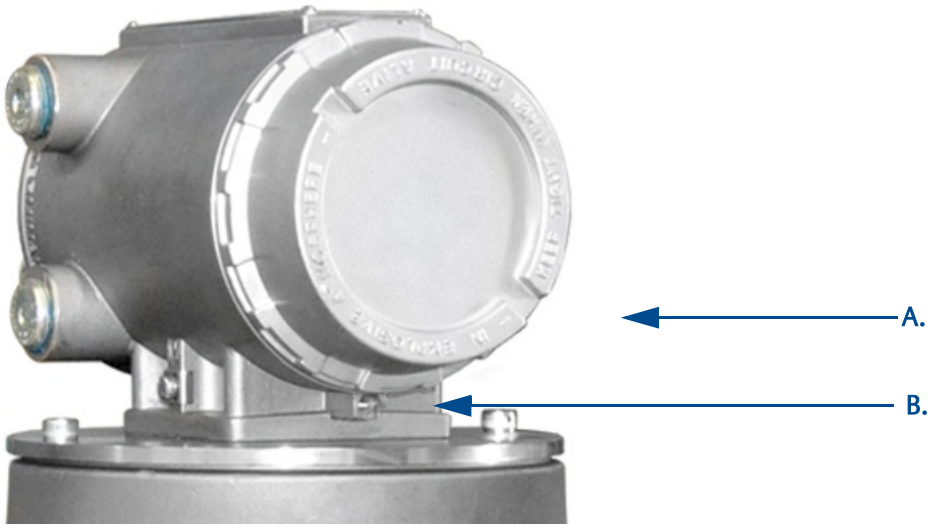
Security seals protect the integrity of the meter metrology and prevent tampering with transducer assemblies. The following sections detail how to properly seal the Daniel 3410 Series Gas Ultrasonic Flow Meter after commissioning. The security seal wires are commercially available.

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

3.7.1 Seal Transmitter Electronics Enclosure

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

Figure 3-10 Transmitter electronics enclosure security latch

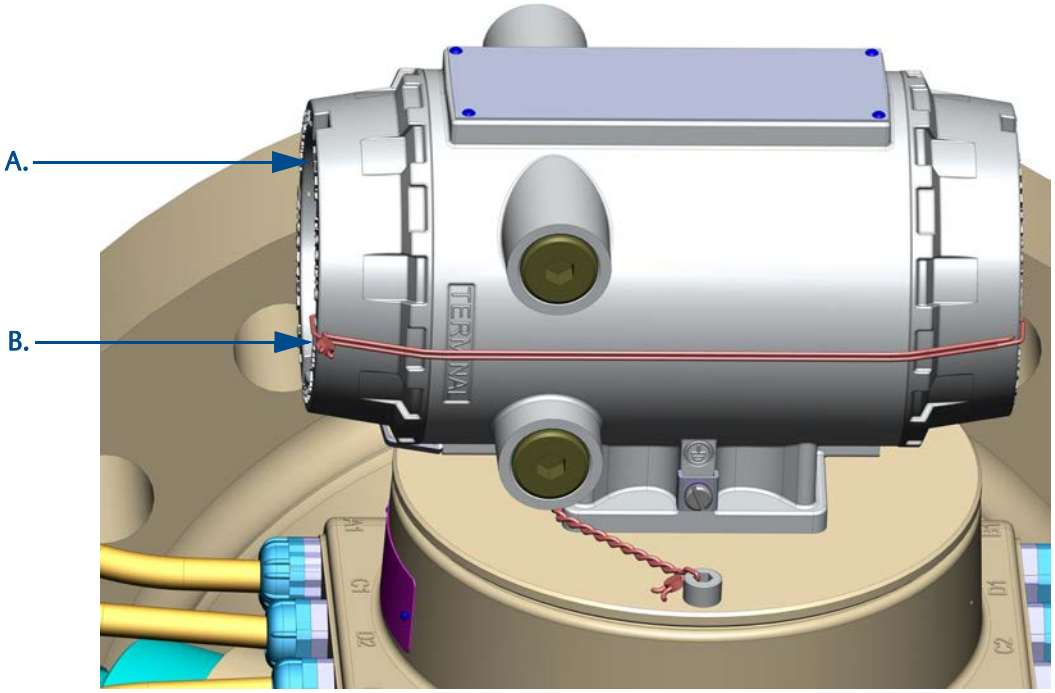


A. Transmitter Electronics Enclosure end cap. Optional glass endcap for Local Display
B. Security latch

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 .078 inch; 2.0mm).

Figure 3-11 Transmitter Electronics Enclosure security seals



A. Transmitter Electronics Enclosure end cap
B. Security wire seals

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

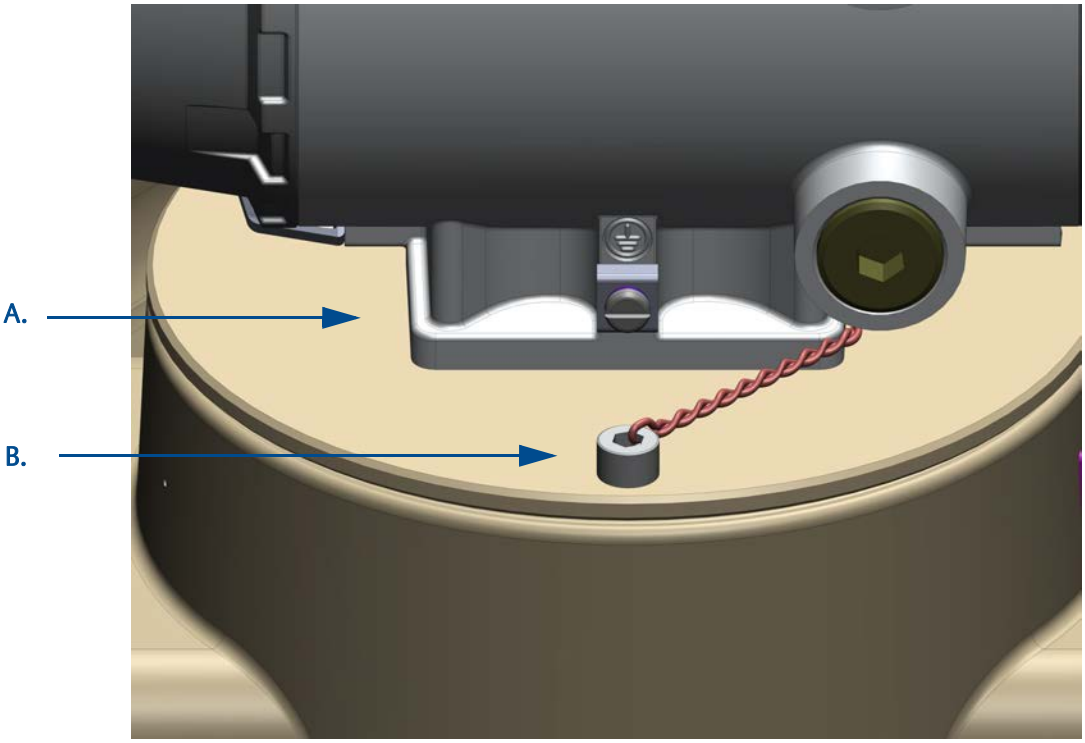
3.7.2 Base Enclosure Security Seals

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

Procedure

1. Install security wire seal into and through the hole in the socket head screw on the Base Enclosure cover (maximum wire diameter .078 inch; 2.0mm).

Figure 3-12 Base Enclosure wire seal installation

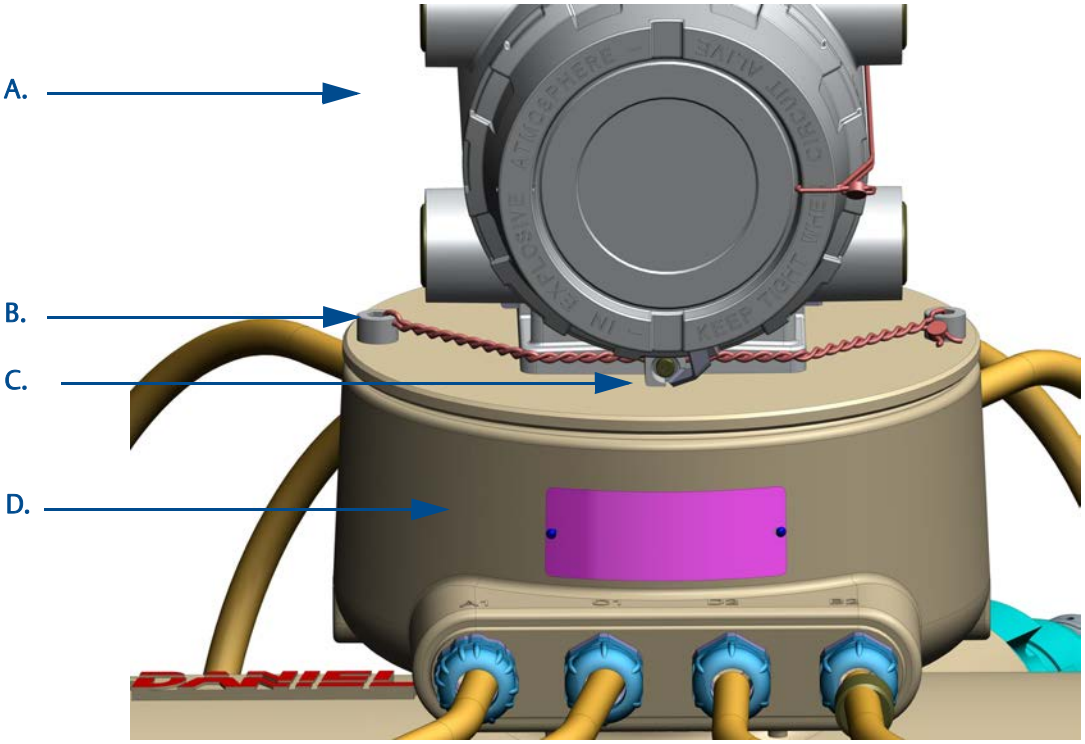


A. Base Enclosure cover
B. Security wire seals

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 3-13 Base Enclosure security seals



A. Transmitter Electronics Enclosure
B. Security wire seals
C. Transmitter Electronics endcap security latch
D. Base Enclosure

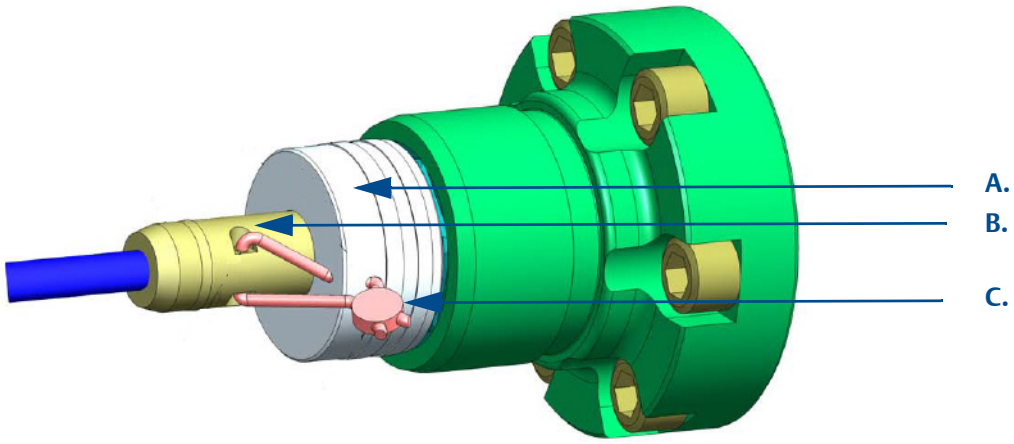
4. Cut wire ends to remove excess wire.

3.7.3 Transducer assembly security seals

Use the following instructions and Figure 3-14 to install the security seal wire on the transducer assembly.

1. Rotate the transducer cable nut (Item A) clockwise, compressing the seal on the transducer cable connector.
2. Insert a security seal wire into one of the two holes in the transducer cable connector (Item B) and feed through one of the two holes in the transducer cable nut (Item A).
   Note: Choose holes that minimize counterclockwise rotation of the transducer cable nut when the security wire (Item C) is taut.
3. Adjust the security wire, removing all slack and thread into the lead seal.
4. Cut wire ends to remove excess wire.

Figure 3-14 Transducer assembly security seal



A. Transducer cable nut
B. Transducer cable connector
C. Security wire seal

3.7.4 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 Section 3.4.1 and Section 3.4.2

Section 4: Configuration

After the mechanical and electrical installation is complete and connectivity is established, use the *Daniel MeterLink Software for Gas and Liquid Ultrasonic Meters Quick Start Manual* (P/N 3-9000-763) to setup software communications with the meter.

4.1 Daniel MeterLink Setup

1. Review the software operating system, hardware and peripheral requirements.
2. Follow the installation instructions for your operating system (Windows® XP, Windows Vista®, Windows® 7 or Windows® 8).
3. Configure a direct connection driver for first time modem configuration for Daniel MeterLink communications.
4. Select the Daniel MeterLink desktop icon and complete the information in the Registration Wizard to keep you informed about updates and technical support. Registration options include:
   - Register by e-mail
   - Register by phone
   - Register later (remind me)
   - Register later using the Help | Resister Program menu (don't remind me)
5. Select **File | Program Settings** and customize the user-preferences (e.g. User name, Company name, display units, Liquid Meter volume units and other interface settings)
6. Connect to your meter. If your meter is not shown in the list, select **Edit Meter Directory** and setup the connections properties.
7. Save the meter configuration file, collect a Maintenance log and Waveforms to document the meter's "As Found" settings.
8. Run the Field Setup Wizard.

4.2 Field Setup Wizard

1. Use the Field Setup Wizard-Startup in Daniel MeterLink and select the checkboxes that allow proper configuration for your meter (Temperature, Pressure, Meter Corrections, Meter Outputs, Gas chromatograph setup, Continuous flow analysis, View local display setup, 4+4 8-path meter combine output and SOS limit percentage). 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 units system (U.S Customary or Metric units) volume units, flow rate time, low flow cutoff, contract hour, enable reverse flow alarm, set meter time and notepad comments. Select **Next** to continue to Frequency/ Digital Outputs page.

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

   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, 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 configure the HART® Output(s) parameters.
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). Select **Next** to continue to the Meter Corrections page.

8. The Meter Corrections page allows you to configure the flow profile, temperature, pressure and linear expansion corrections, pipe outside diameter The Young's Modulus value (ratio of tensile stress to tensile strain) and the Poisson's ratio value (the absolute ratio of the pipe material lateral strain over axial strain) for 3412 and 3411 Gas Ultrasonic Flow meters. Click **Next** to continue to the Temperature and Pressure page.

9. 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 Gas Chromatograph Setup page.

10. Select the settings below to configure a serial port as a Modbus Master to poll a gas chromatograph.

    - Serial Port: select which serial port will be connected to the GC. While the port is configured for communications to a GC, it will not act as a Modbus slave device for communications from Daniel MeterLink™ or a SCADA system.
    - GC protocol: select the protocol for which the GC is configured. The Daniel Gas Ultrasonic meter uses 7 data bits, Even parity, and 1 stop bit for ASCII Modbus and 8 data bits, No parity, and 1 stop bit for RTU Modbus
    - GC baud rate: select the baud rate for which the GC is configured.
    - GC comms address: enter the Modbus ID of the GC.
    - GC stream number: enter the stream number for the gas composition the Daniel Gas Ultrasonic meter will read.
    - GC heating value units: elect the units for which the heating value is configured in the GC.
    - Use which gas composition on GC alarm: select which gas composition the Daniel Gas Ultrasonic meter will use if the GC goes into alarm. If Fixed value is selected, the meter will start using the fixed gas composition stored in the meter. If Last good value is selected, the meter will use the last gas composition collected from the GC before the GC started to report alarms. Click **Next** to continue to the AGA8 page.

11. Configure the properties necessary for the AGA8 calculations. This page is only displayed for Daniel Gas Ultrasonic meters if both temperature and pressure are set to Live or Fixed and Base condition correction is selected on the Startup Page. Configuration parameters include:

    - Calculations performed internally (by the meter) or Externally
    - AGA8 method - Gross Method 1, Gross method 2 or Detail
    - Base temperature and pressure
    - Specific gravity - reference temperature and pressure
    - Volumetric gross heating value and reference temperature
    - Molar density reference temperature and pressure
    - Flow Mass density, flow compressibility and Base compressibility
    - Gas composition inputs - components and mole percent

    Click **Next** to continue to the Continuous Flow Analysis page, if View Continuous Flow Analysis setup was selected on the Startup page.

12. Configure the flow analysis parameters shown below.

    - Set low and high flow limits
    - Enable SOS comparison (requires AGA 8 Detail method)
    - Enable liquid detection and Profile factor limit
    - Enable Blockage. Enter the percent for Symmetry, Cross-flow, Chords A to D turbulence
    - Enable Internal bore buildup

    Click **Next** to continue to the Local display page, if View local display setup was selected on the Startup page.

13. Configure the parameters for the local display. Use the drop-down arrow in the Display Items list box and select or modify the parameters that will be displayed; the Display items, the Display units and the Scroll delay.

Display Items:

The Local Display's labels and descriptions are shown below:

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

Local display labels, descriptions and valid units
QFLOW – Uncorrected volume flow rate • ACF — Actual Cubic Feet • ACM — Actual Cubic Meters • MACF — Thousand Actual Cubic Feet • MACM —Thousand Actual Cubic Meters
TDYVL – Current day's forward uncorrected volume • +ACF — Actual Cubic Feet • +ACM — Actual Cubic Meters • +MACF — Thousand Actual Cubic Feet • +MACM —Thousand Actual Cubic Meters
TDYVL – Current day's reverse uncorrected volume • -ACF — Actual Cubic Feet • -ACM — Actual Cubic Meters • -MACF — Thousand Actual Cubic Feet • -MACM —Thousand Actual Cubic Meters
YSTVL – Previous day's forward uncorrected volume • +ACF — Actual Cubic Feet • +ACM — Actual Cubic Meters • +MACF — Thousand Actual Cubic Feet • +MACM —Thousand Actual Cubic Meters
YSTVL – Previous day's reverse uncorrected volume • -ACF — Actual Cubic Feet • -ACM — Actual Cubic Meters • -MACF — Thousand Actual Cubic Feet
TOTVL – Forward uncorrected volume • +ACF — Actual Cubic Feet • +ACM — Actual Cubic Meters • +MACF — Thousand Actual Cubic Feet • +MACM —Thousand Actual Cubic Meters
TOTVL – Reverse uncorrected volume • -ACF — Actual Cubic Feet • -ACM — Actual Cubic Meters • -MACF — Thousand Actual Cubic Feet • -MACM —Thousand Actual Cubic Meters
QBASE – Corrected volume flow rate • SCF — Standard Cubic Feet • SCM — Standard Cubic Meters • MSCF — Thousand Standard Cubic Feet • MSCM — Thousand Standard Cubic Meters

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

Local display labels, descriptions and valid units
TDYVL – Current days forward corrected volume • +SCF — Standard Cubic Feet • +SCM — Standard Cubic Meters • +MSCF — Thousand Standard Cubic Feet • +MSCM — Thousand Standard Cubic Meters
TDYVL – Current days reverse corrected volume • -SCF — Standard Cubic Feet • -SCM — Standard Cubic Meters • -MSCF — Thousand Standard Cubic Feet • -MSCM — Thousand Standard Cubic Meters
YSTVL – Previous days forward corrected volume • +SCF — Standard Cubic Feet • +SCM — Standard Cubic Meters • +MSCF — Thousand Standard Cubic Feet • +MSCM — Thousand Standard Cubic Meters
YSTVL – Previous days reverse corrected volume • -SCF — Standard Cubic Feet • -SCM — Standard Cubic Meters • -MSCF — Thousand Standard Cubic Feet • -MSCM — Thousand Standard Cubic Meters
TOTVL – Forward corrected volume • +SCF — Standard Cubic Feet • +SCM — Standard Cubic Meters • +MSCF — Thousand Standard Cubic Feet • +MSCM — Thousand Standard Cubic Meters
TOTVL – Reverse corrected volume • -SCF — Standard Cubic Feet • -SCM — Standard Cubic Meters • -MSCF — Thousand Standard Cubic Feet • -MSCM — Thousand Standard Cubic Meters
VEL – Average flow velocity • 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

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

Local display labels, descriptions and valid units
KFCT1 – Frequency 1 K-factor • CF — Cubic Feet • CM —Cubic Meters • MCF — Thousand Cubic Feet • MCM —Thousand Cubic Meters
FRQ2A – Frequency channel 2A • HZ — Hertz
FRQ2B – Frequency channel 2B • HZ — Hertz
KFCT2 – Frequency 2 K-factor • CF — Cubic Feet • CM —Cubic Meters • MCF — Thousand Cubic Feet • MCM —Thousand Cubic Meters
AO1 – Analog Output 1 current • MA — **Milliamperes**
AO2 – Analog Output 2 current • MA — **Milliamperes**

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

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:
  - Cubic feet
  - Thousand cubic feet
- Metric volume unit selections are:
  - Cubic meters
- Display units preceded by a plus or minus sign indicate forward and reverse flow direction, as shown in the table below.\
- 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
  - hour
  - day

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.

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.

4.3 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 Daniel Liquid Ultrasonic Meter Device Description (DD).

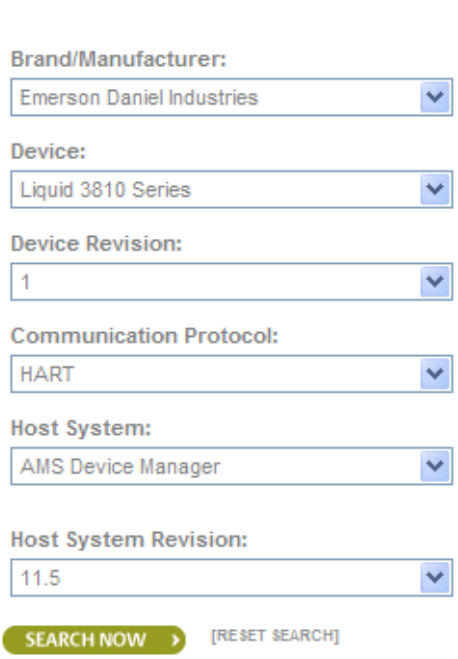
If not installed, click the link below to download the AMS device installation tool kit.

http://www2.emersonprocess.com/en-US/documentation/deviceinstallkits/Pages/deviceinstallkitsearch.aspx

Procedure - installing AMS Device Description

1. Use the link above to search for the Device Description (DD) for your Daniel 3810 Series Liquid Ultrasonic Flow Meter.
2. Use the pull-down menu and select the Brand/Manufacturer - **Emerson Daniel Industries**.
3. Next select the Device, **Liquid 3810 Series** from the pull-down menu.
4. Choose the **Device Revision1**, from the pull-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 11.5**.
8. Verify your search parameters are correct, as shown below.

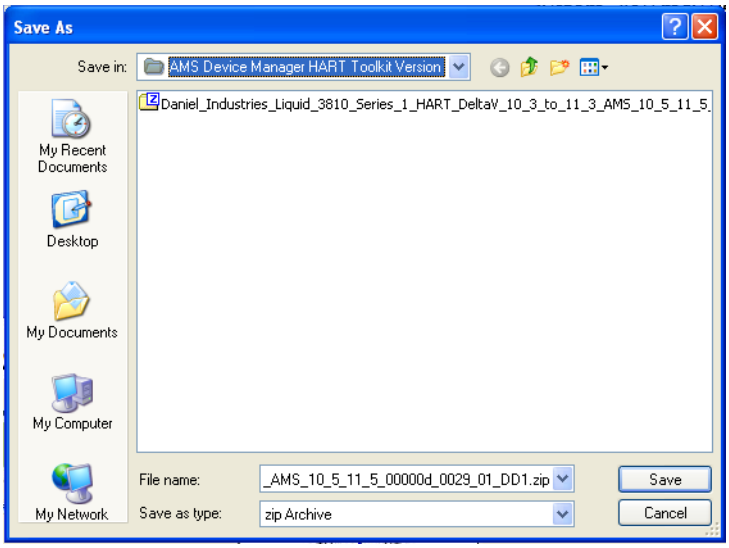
Figure 4-1 AMS Device Description search



9. Click **Search Now**.

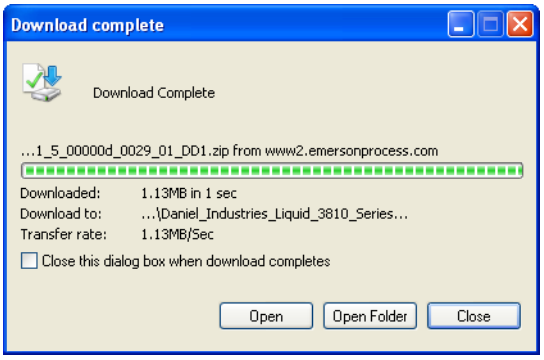
10. Click the **Daniel Industries Liquid 3810 Series Rev 1** hyperlink. The file download dialog displays. Click the **Save** button to save the files to your host system. You may use the default download location or change the directory.

11. **AMS file download options**



12. Click the **Save** button to complete the file download.

Figure 4-2 AMS file download complete



13. Click **Open** or **Open Folder** to view the downloaded files.
14. Establish power to the meter and wiring to Analog Input 1 for HART communication.
15. Start the AMS Device Manager using a laptop or PC.
16. Enter login credentials and click **OK** to launch the application.

17. Click the Configure tab, and then select **Guided Setup**, **Manual Setup** or **Alert Setup**.

Figure 4-3 AMS Device Manager

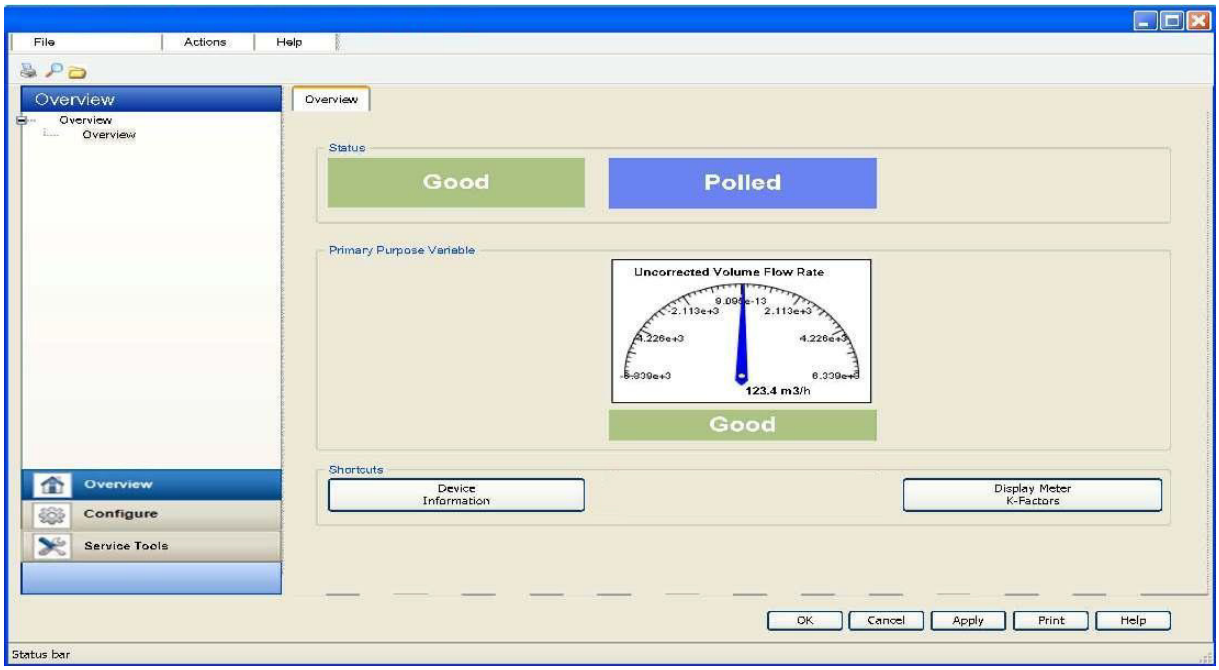
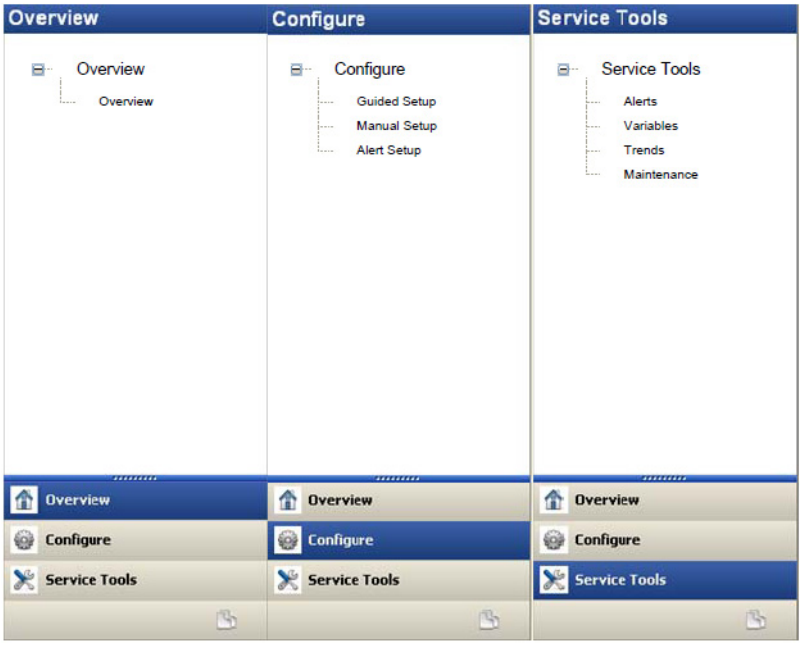


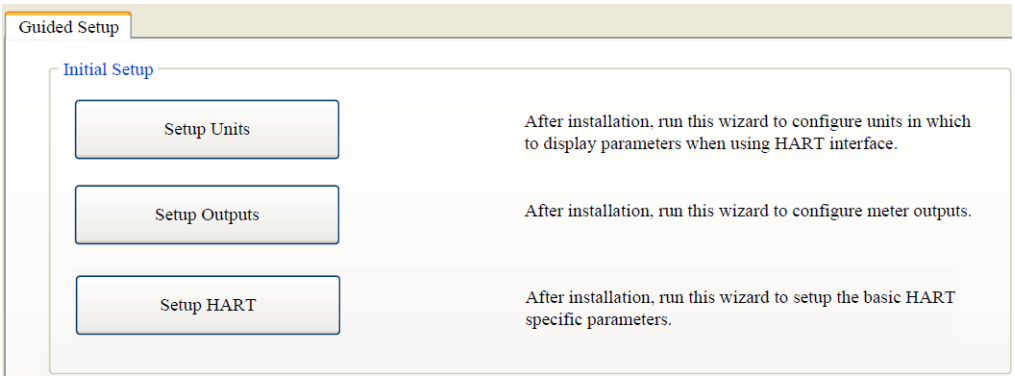
Figure 4-4 AMS Device Manager - Overview



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.

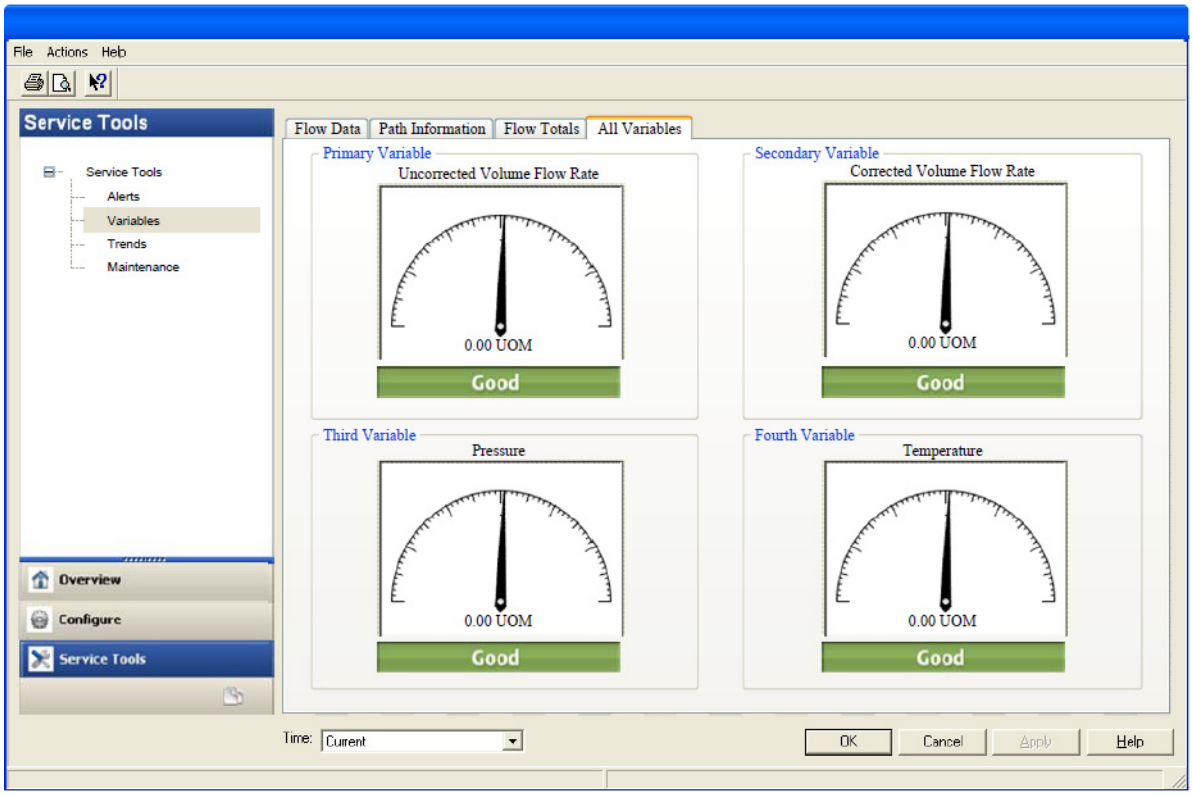
Procedure

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, 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). (**Refresh 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 3b 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).

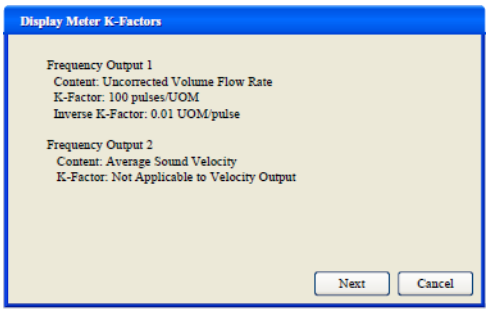
d. Click the **All Variables** tab to view a graphical display of the Primary, Secondary, Third and Fourth Variables.

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

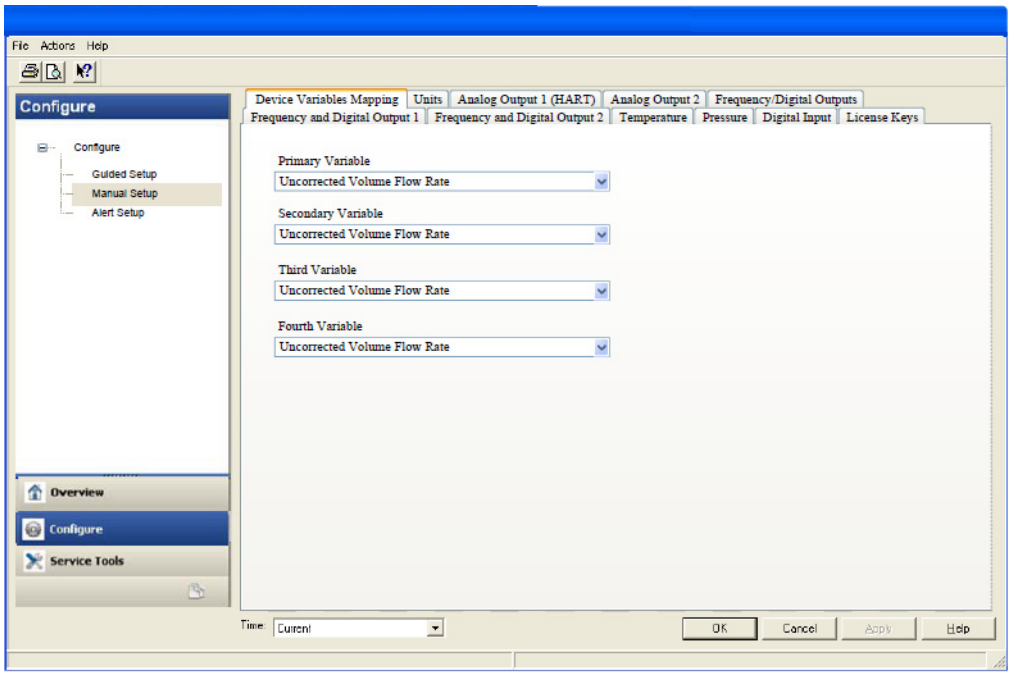


Click **Next** to return to the Device Manager Overview page.

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.

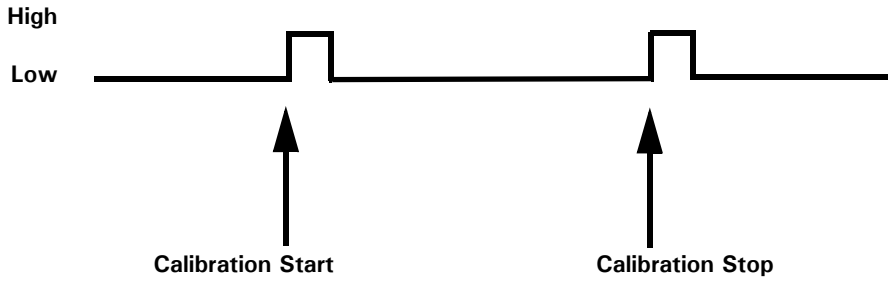
1. Disable the Write Protect switch in the CPU Module to write any of the following configuration parameters to your meter.
2. Click the **Device Variables Mapping** tab. The Primary and Secondary variables are read only and are configured for Uncorrected Flow Rate. The Third and Fourth variable configuration choices include Pressure and Temperature.
3. Click the **Units** tab (see AMS Device Manager - Guided Setup, Step 2).
4. Click the **Analog Output 1 (HART)** tab (see AMS Device Manager - Guided Setup, Step 3).
5. Click the **Analog Output 2** tab. Follow the configuration instructions in the AMS Device Manager - Guided Setup, Step 3. 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.

6. Click the **Frequency/Digital** Outputs tab. Follow the configuration instructions in the AMS Device Manager - Guided Setup, Step 4a.). (**Refresh 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). Click **Apply**, after you enter the data to write the parameters to the meter.
7. Click the **Frequency and Digital Output 1** tab. Follow the configuration instructions in the AMS Device Manager - Guided Setup, Step 4b. 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 **Temperature** 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 **Pressure** 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** 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:

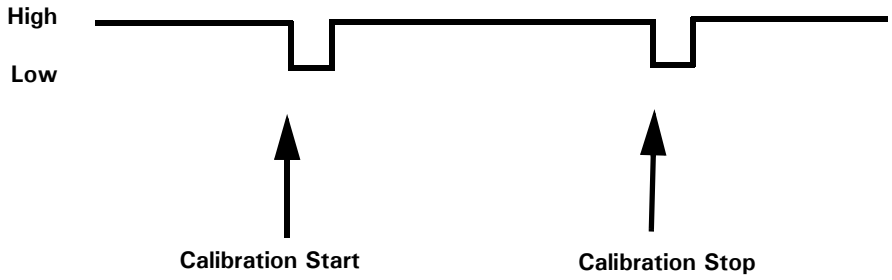
— Edge gated, active high

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



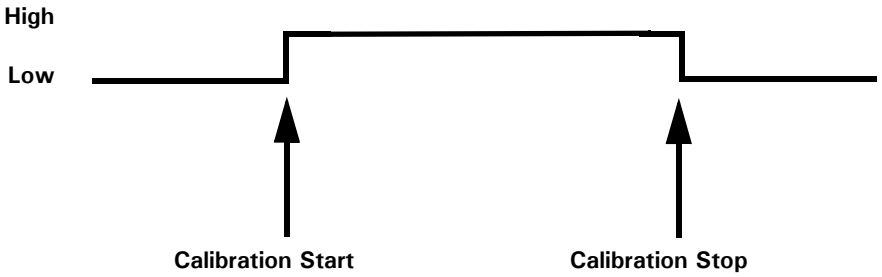
— Edge gated, active low

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



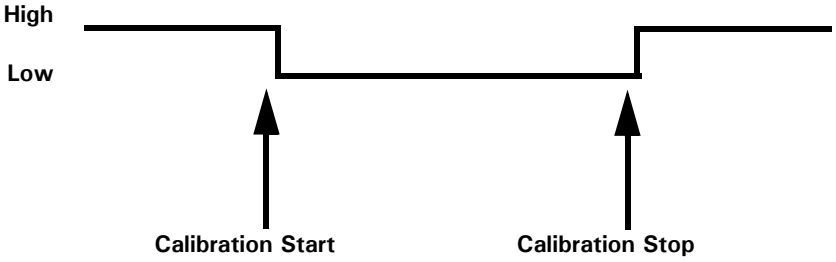
— State gated, active high

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



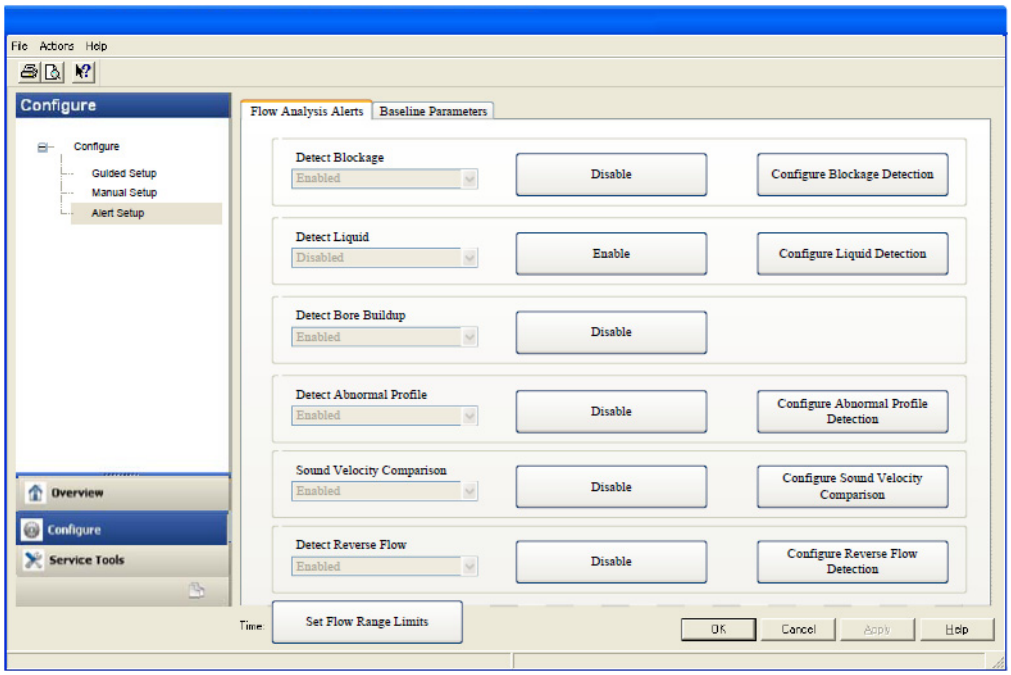
— State gated, active low

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** 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.

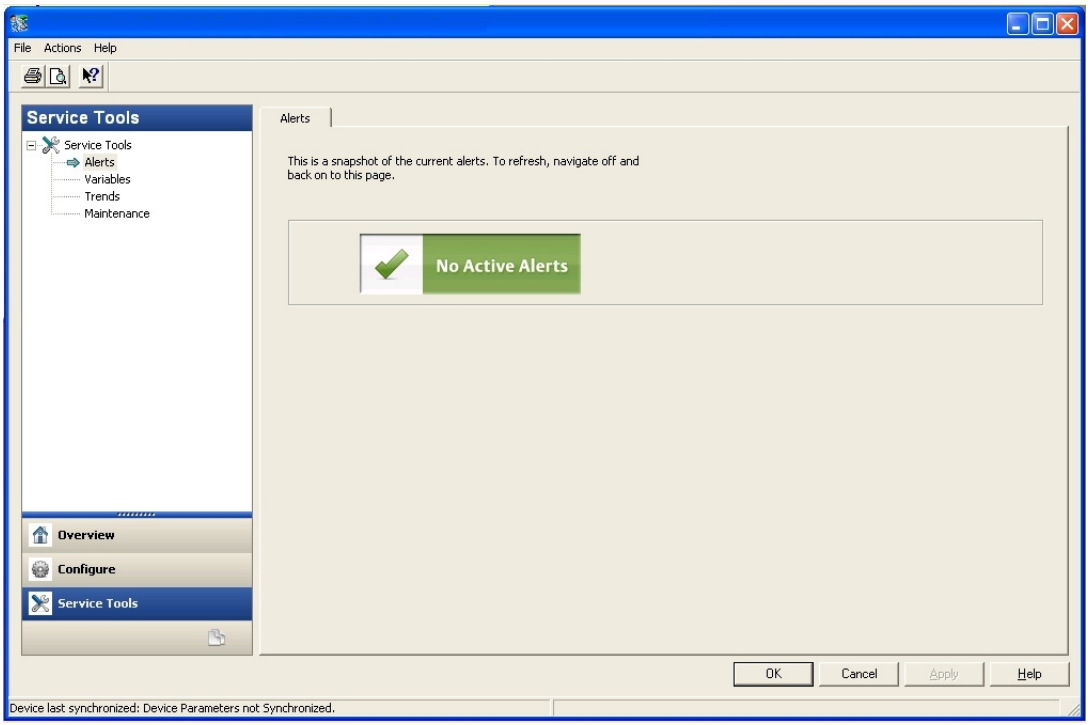
    b. If an error message is returned, click the **Next** button to display the Method Complete page.

    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

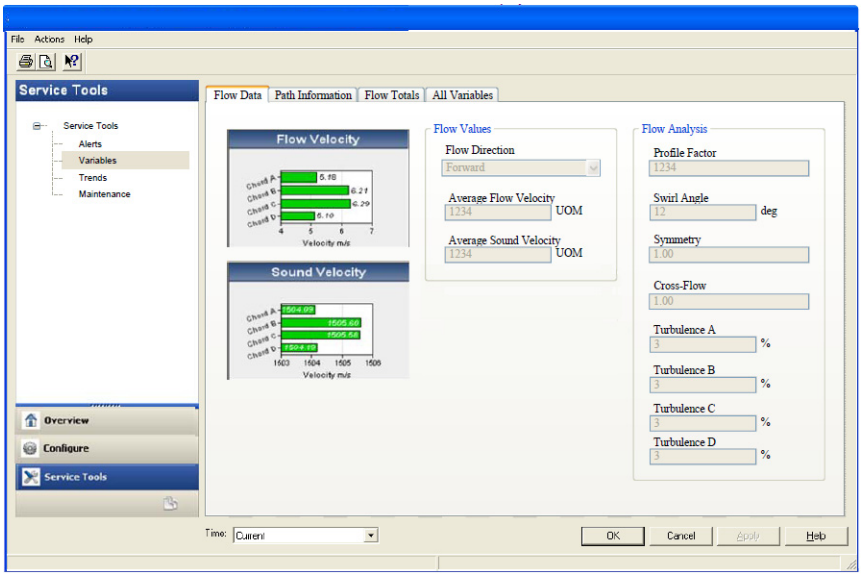


b. If you change the device configuration, a confirmation dialog displays and prompts you to write the changes to the meter. Click **Yes** to write the changes to the meter or click **No** to cancel pending changes.

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



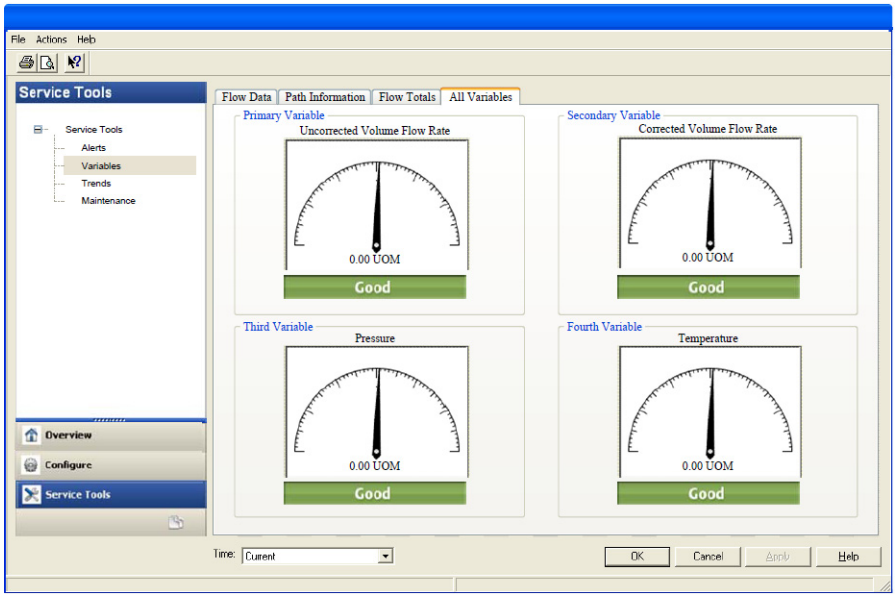
d. The **Service Tools|Flow Data** page includes charts for flow and sound velocities. The flow values (flow direction, average flow velocity and average sound velocity) parameters are displayed for the connected device.

e. Click **Service Tools|Variables|Path Information** tab to view the device's chord performance (%), 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



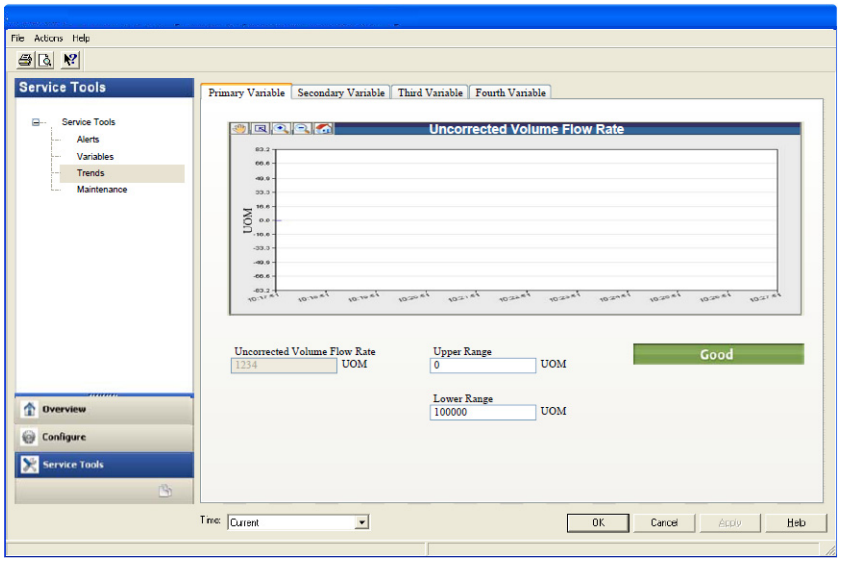
Gauges display each variable's status as good or bad. If a status is bad refer to the Service Tools Alerts page for recommended actions to resolve the alert condition. Also refer to the Field Device Specification manual (P/N 3-9000-762) for Commands 48 and 140 details.

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 displays 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 4mA and 20mA output current values should equal the plant's standard values. Click **Yes** to confirm the configuration changes. Repeat this step to trim Analog Output 2 current. Click **Apply** to write the output trim values to the meter. Click **OK** to navigate back to the Service Tools page.

16. 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 Daniel MeterLink, the Monitor page displays a Meter status alarm that the configuration has changed and remains latched until acknowledged. Click the **Ack** (acknowledge) button to clear the alarm.

4.4 Using a Field Communicator to configure the meter

important

Follow all guidelines and precautions described in the Field Communicator User Manual and in the 3818 LNG Liquid Ultrasonic Flow Meter documentation when working in a hazardous area.

Installation Requirements

- Emerson Field Communicator software, license, installation guide and user manual available on the Emerson Asset Optimization Field Communicator website:

http://www2.emersonprocess.com/en-US/brands/Field-Communicator/Pages/Documentation.aspx

- Daniel HART Device Description (HART DD) installed for the meter
- Network configured for a Field Communicator
- Daniel Field Device Specification Manual (P/N 3-9000-762) available on the Daniel website

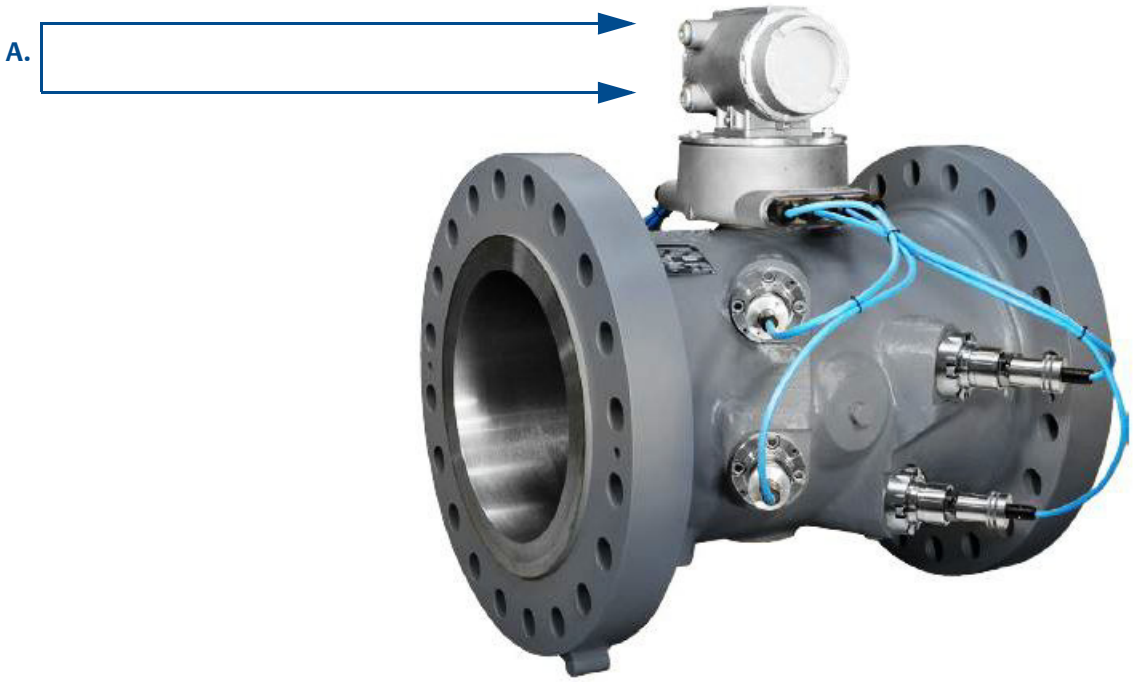
http://www2.emersonprocess.com/en-US/brands/daniel/Flow/ultrasonics/Pages/Ultrasonic.aspx

- System wiring diagram drawing number DMC-005324 (see Appendix A)
- Power supply

Procedure

1. Remove electrical power to the meter. If installed, remove the endcap security latches and seals and then, remove the endcap.
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.

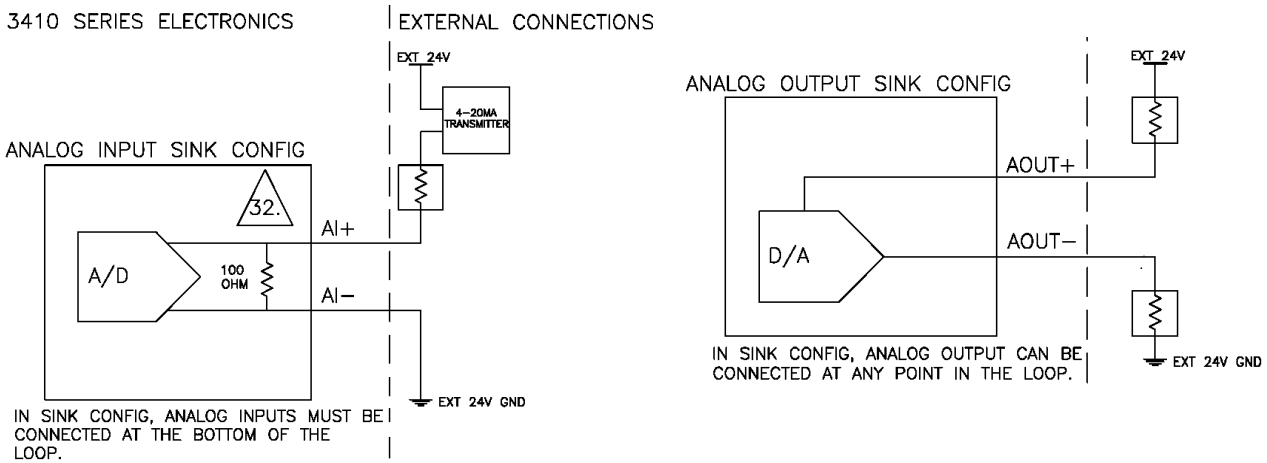
Figure 4-19 3414 transmitter field wiring conduit entries



A. Field wiring conduit entries (4)

5. Wire Analog Input 1 (AI1) and Analog Output 1 (AO1) as shown in Figure 4-20 and Appendix A, drawing DMC-005324.

Figure 4-20 Field Communicator wiring diagram for the 3410 Series electronics



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 Daniel HART Field Device Specification manual (P/N 3-9000-762) for the device fast key sequences. Included in the menu tree are:
   - Diagram Page 1 - 3410 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 User's Manual.

4.5 Security seals for the meter (optional)

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 Section 3.7 and Section 3.7.4.

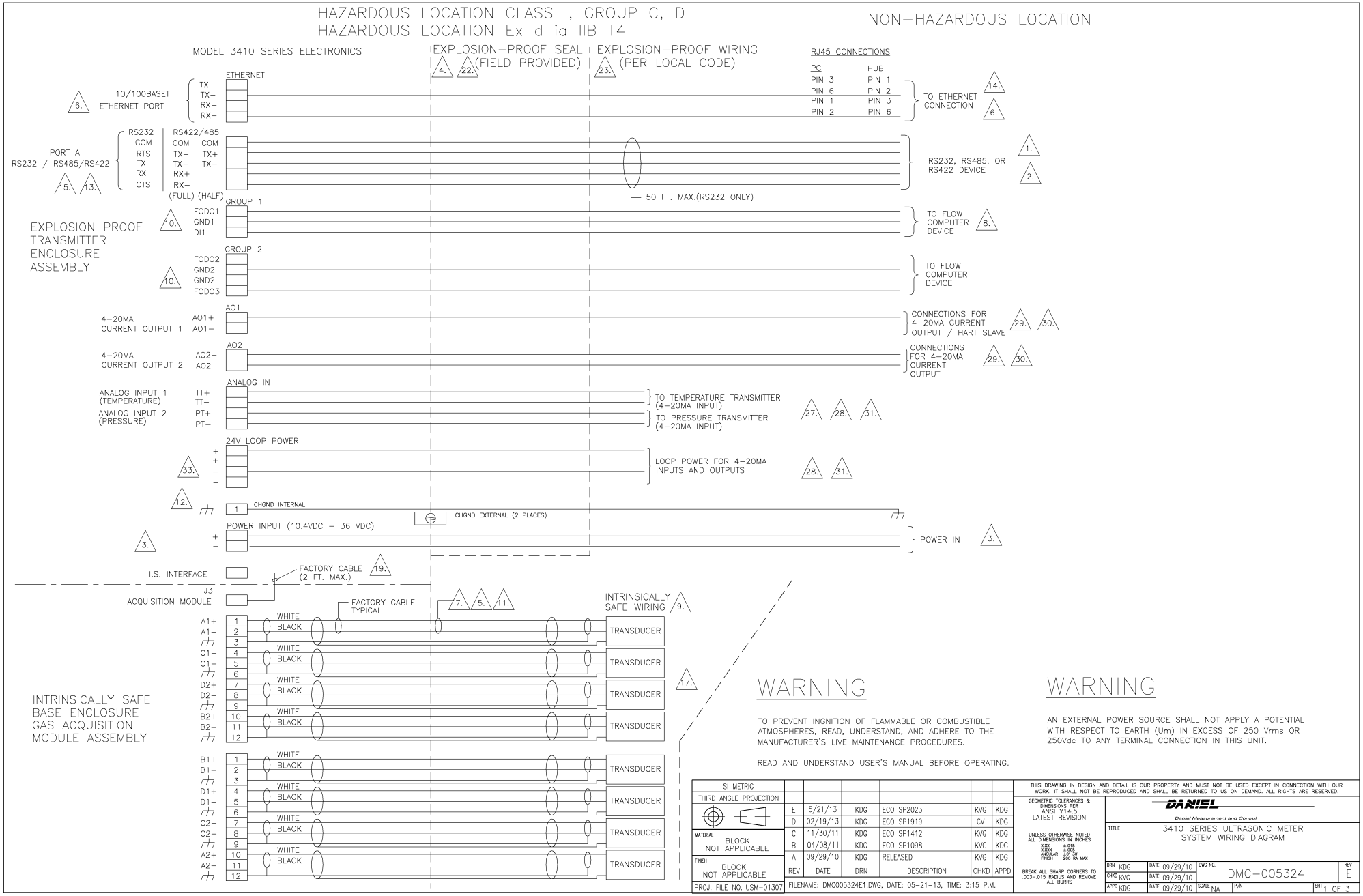
Seal the conduit ports with sealing compound according to the customer's requirements (e.g., after approximately one to two weeks of run time). Also, see Section 3.4.1.

Appendix A: Engineering drawings

A.1 3410 Series engineering drawings

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

DMC-005324 Daniel 3410 Series Ultrasonic Gas Flow Meter System Wiring Diagram



WARNING

TO PREVENT INGNITION OF FLAMMABLE OR COMBUSTIBLE ATMOSPHERES, READ, UNDERSTAND, AND ADHERE TO THE MANUFACTURER'S LIVE MAINTENANCE PROCEDURES.

READ AND UNDERSTAND USER'S MANUAL BEFORE OPERATING.

WARNING

AN EXTERNAL POWER SOURCE SHALL NOT APPLY A POTENTIAL WITH RESPECT TO EARTH (Um) IN EXCESS OF 250 Vrms OR 250Vdc TO ANY TERMINAL CONNECTION IN THIS UNIT.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
E	5/21/13	KDG	ECO SP2023	KVG	KDG
D	02/19/13	KDG	ECO SP1919	CV	KDG
C	11/30/11	KDG	ECO SP1412	KVG	KDG
B	04/08/11	KDG	ECO SP1098	KVG	KDG
A	09/29/10	KDG	RELEASED	KVG	KDG

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BLOCK NOT APPLICABLE
FINISH: BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307
FILENAME: DMC005324E1.DWG, DATE: 05-21-13, TIME: 3:15 P.M.

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

DANIEL
Daniel Measurement and Control

TITLE: 3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM

DRN KDG DATE 09/29/10
CHKD KVG DATE 09/29/10
APPD KDG DATE 09/29/10
DWG NO. DMC-005324
REV E
SCALE NA P/N
SHT 1 OF 3

HAZARDOUS LOCATION CLASS I, GROUP C, D
HAZARDOUS LOCATION Ex d ia IIB T4

NON–HAZARDOUS LOCATION

3410 SERIES ELECTRONICS
(OPTIONAL EXPANSION MODULES) △18.

EXPLOSION–PROOF SEAL
△4. △22. (FIELD PROVIDED)

EXPLOSION–PROOF WIRING
△23. (PER LOCAL CODE)

EXPLOSION PROOF
TRANSMITTER
ENCLOSURE
ASSEMBLY

P/N W30381X0022
100 SERIES
COMMUNICATIONS
MODULE
RS–485

PORT B △13.

RS485
A
B
GND

RS485 DEVICE △1.

OR

P/N W30381X0012
100 SERIES
COMMUNICATIONS
MODULE
RS–232

PORT B △13.

RS232
TX
RX
RTS
GND

RS232 DEVICE △2. △15.

50 FT. MAX.(RS232 ONLY)

INTRINSICALLY SAFE
BASE ENCLOSURE
LIQUID ACQUISITION
MODULE ASSEMBLY

J6
(SEE NOTES BELOW)

1
2
3
4

INTRINSICALLY
SAFE WIRING

CO–LOCATED 3410 SERIES
ELECTRONICS FOR MODEL 3418
METERS

3410 SERIES
ACQUISITION
MODULE ASSEMBLY
– CONNECTOR J6

3
4
1
2

1. Terminal J6 is intended to provide power to the device it is connected to and may also receive power. The entity parameters assigned for terminal J6 are as follows:

Output parameters:	Input parameters:
Vt (or Uo) = 6.51 VDC	Vmax (or Ui) = 6.51 VDC
It (or Io)= 65.8 mA	Imax (or Ii) = 65.8 mA
Po = 107 mW	Pmax (or Pi) = 107 mW
Ca (or Co) = 500 uF	Ci = 0 uF
La (or Lo) = 32.8 mH	Li = 0 mH

2. Selected intrinsically safe equipment must be third party listed as intrinsically safe for the application, and have intrinsically safe entity parameters conforming to Table 1.

Table 1:

I.S. Equipment		Terminal J6
Vmax (or Ui)	≥	Voc or Vt (or Uo)
Imax (or Ii)	≥	Isc or It (or Io)
Pmax, Pi	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

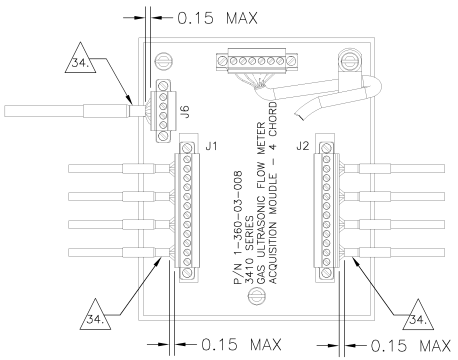
3. Intrinsically safe apparatus connected to terminal J6 that may provide power, must have intrinsically safe entity parameters conforming to Table 2.

Table 2:

Terminal J6		Intrinsically safe apparatus with output parameters
Vmax (or Ui)	≥	Voc or Vt (or Uo)
Imax (or Ii)	≥	Isc or It (or Io)
Pmax, Pi	≥	Po
Ci + Ccable	≤	Ca (or Co)
Li + Lcable	≤	La (or Lo)

4. Capacitance and inductance of the field wiring from the intrinsically safe equipment to the terminal J6 shall be calculated and must be included in the system calculations as shown in Table 1 and Table 2. Cable capacitance, Ccable, plus intrinsically safe equipment capacitance, Ci must be less than the marked capacitance, Ca (or Co), shown on any associated apparatus used. The same applies for inductance (Lcable, Li and La or Lo, respectively). Where the cable capacitance and inductance per foot are not known, the following values shall be used: Ccable = 60 pF/ft., Lcable = 0.2 µH/ft.

5. For installations in which both the Ci and Li of the intrinsically safe apparatus connected to terminal J6 exceeds 1% of the stated Co and Lo parameters (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded.



REV	DATE	DRN	DESCRIPTION	CHKD	APPD
E	5/21/13	KDG	ECO SP2023	KVG	KDG
D	02/19/13	KDG	ECO SP1919	CV	KDG
C	11/30/11	KDG	ECO SP1412	KVG	KDG
B	04/08/11	KDG	ECO SP1098	KVG	KDG
A	09/29/10	KDG	RELEASED	KVG	KDG

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BLOCK NOT APPLICABLE
FINISH: BLOCK NOT APPLICABLE
PROJ. FILE NO. USM–01307
FILENAME: DMC005324E2.DWG, DATE: 05–21–13, TIME: 3:15 P.M.

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX

BREAK ALL SHARP CORNERS TO .003–.015 RADIUS AND REMOVE ALL BURRS

DANIEL
Daniel Measurement and Control

TITLE: 3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM

DRN KDG	DATE 09/29/10	DWG NO. DMC–005324	REV E
CHKD KVG	DATE 09/29/10		
APPD KDG	DATE 09/29/10	SCALE NA	P/N

NOTES:

1. MAX LENGTH OF RS-485 WIRING IS 2,000 FT.

2. ETHERNET OR RS-422 IS THE PREFERRED COMMUNICATIONS INTERFACE. OPTIONALLY, RS-232 MAY BE USED FOR SHORT DISTANCES, (50 FT.)

3. POWER INPUT IS NOMINAL 24 VDC. INPUT RANGE 10.4-36V DC. POLARITY INSENSITIVE

4. AN EXPLOSION-PROOF SEAL IS REQUIRED WITHIN 457 MM(18 INCHES) OF THE ENCLOSURE.

5. TRANSDUCER CABLE IS 20 AWG, SHIELDED PAIR, 20 AWG DRAIN, BRAIDED SHIELD, REMKE INDUSTRIES OR EQUIVALENT, 15 FT. MAX.

6. FOR OPTIMUM DIAGNOSTIC INTERFACE, WIRING ETHERNET PORT IS RECOMMENDED. USE CAT5 ETHERNET CABLE

7. INTRINSICALLY SAFE WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE ARTICLE 504 OF THE NATIONAL ELECTRICAL CODE OR RULE 18-066 OF THE CANADIAN ELECTRICAL CODE.

8. DIGITAL INPUT 1 IS CONTACT CLOSURE ONLY.

9. TRANSDUCER PAIRS REQUIRED

MODEL NO.	TRANSDUCER PAIRS REQUIRED	TYPICAL CHORDS USED
3414	4	A,B,C,D
3412	2	A,B
3411	1	A
3418	8	2 x MODEL 3414

10. FODO OUTPUTS 1 THROUGH 3 CAN BE INDEPENDENTLY CONFIGURED TO FUNCTION AS FREQUENCY OUTPUTS OR DIGITAL STATUS OUTPUTS. THEY CAN EACH BE INDEPENDENTLY CONFIGURED TO DRIVE AS TTL OR OPEN COLLECTOR.

11. EXPOSION PROOF TRANSMITTER ENCLOSURE AND INTRINISICALLY SAFE BASE ENCLOSURE MUST BE MOUNTED IN A REMOTE LOCATION OFF THE METER BODY IF THE PROCESS TEMPERATURE EXCEEDS THE LOWER OR UPPER AMBIENT RATING -40 °C TO 60 °C (-40 °F TO 140 °F). THE ELECTRONICS MUST BE MOUNTED NEXT TO THE METER BODY ON A PIPE STAND OR OTHER RIGID STRUCTURE.

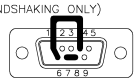
TRANSDUCER CABLES (P/N 2-3-3400-194, 15 FT. LONG) SHALL BE USED TO CONNECT THE DANIEL 3410 SERIES ELECTRONICS TO THE TRANSDUCERS INSTALLED IN A METER BODY FOR PROCESS FLUID TEMPERATURES UP TO 100 °C (212 °F). IN ANY CONFIGURATION, THE TOTAL CABLE LENGTH SHALL NOT EXCEED 4.7 METERS (15 FEET) BETWEEN THE ACQUISITION MODULE AND ANY TRANSDUCER.

12. THE INTERNAL GROUNDING TERMINAL SHALL BE USED AS THE PRIMARY EQUIPMENT GROUND. THE EXTERNAL GROUND TERMINAL IS ONLY A SUPPLEMENTAL BONDING CONNECTION WHERE LOCAL AUTHORITIES PERMIT OR REQUIRE SUCH A CONNECTION.

13. COMM SIGNAL NAMING CONVENTION IS WITH RESPECT TO METER. (I.E. PC - TX -> METER - RX)

14. RJ45 SOCKET NUMBERING

15. PC SIDE SERIAL CONNECTION MUST BE WIRED FOR COMPLETE NULL MODEM FOR SUCCESSFULL HOOKUP TO METER
NULL MODEM CONNECTIONS FOR PC END OF CABLE (RS232 WITH NO HANDSHAKING ONLY)



FEMALE 9 PIN DSUB CONNECTOR (BACK VIEW)

CPU MODULE		DB9 (FEMALE)
RX	-->	PIN 3
TX	-->	PIN 2
COM	-->	PIN 5
		PIN 1
		PIN 4
		PIN 6
		PIN 7
		PIN 8

16. CPU MODULE DIP SWITCH SETTINGS

SWITCH	DESCRIPTION
PORT A	PORT A OVERRIDE
DHCP	DHCP SERVER ENABLE
WRITE PROT.	MEMORY PROTECT

TO ENABLE THE PORT A OVERRIDE, SWITCH MUST BE MOVED FROM THE OFF TO ON POSITION. PORT A WILL BE SET TO 19200,8,N,1 ID 32 FOR TWO MINUTES.

17. MODEL 3410 SERIES TRANSDUCERS TYPE T-11, T-12, T-21, T-22, T-31 AND T-32.

THE TRANSDUCERS ARE NOT INTENDED FOR USE ACROSS A BOUNDARY WALL.

THE TEMPERATURE CLASSIFICATION OF THE TRANSDUCERS IS T4 UNLESS THE ELECTRONICS ENCLOSURE IS REMOTELY MOUNTED FROM THE METER BODY. IF THE ELECTRONICS ENCLOSURE IS NOT MOUNTED TO THE METER BODY, REFER TO THE CERTIFICATION LABEL DMC-006036 ON THE METER BODY FOR THE APPROPRIATE CLASSIFICATION OF THE TRANSDUCERS, T4 OR T3.

PROCESS TEMPERATURE MUST NOT EXCEED THE OPERATING TEMPERATURE RANGE OF THE TRANSDUCERS AS INDICATED IN THE TABLE BELOW.

TRANSDUCER TYPE	PROCESS TEMPERATURE RANGE
T-11	-20 °C (-4 °F) TO +100 °C (+212 °F)
T-12	-20 °C (-4 °F) TO +100 °C (+212 °F)
T-21 (W-01)	-20 °C (-4 °F) TO +100 °C (+212 °F)
T-22 (W-02)	-50 °C (-58 °F) TO +100 °C (+212 °F)
T-31 (W-03)	-20 °C (-4 °F) TO +100 °C (+212 °F)
T-32 (W-04)	-50 °C (-58 °F) TO +100 °C (+212 °F)

18. THE 3410 SERIES METER HAS ONE AVAILABLE SLOT FOR AN EXPANSION MODULE.

19. FACTORY CABLE INCLUDES EXPLOSION PROOF SEAL.

21. DIMENSIONS OF FLAMEPROOF JOINTS ARE OTHER THAN THE RELEVANT MINIMUM OR MAXIMUM SPECIFIED IN TABLE 3 OF EN/IEC 60079-1:2007. PLEASE CONTACT MANUFACTURER FOR DETAILS.

22. ALL CABLE ENTRY DEVICES SHALL BE CERTIFIED IN TYPE OF EXPLOSION PROTECTION FLAMEPROOF ENCLOSURE 'd', SUITABLE FOR THE CONDITIONS OF USE AND CORRECTLY INSTALLED.

23. FIELD WIRING MUST BE RATED FOR 75 °C OR HIGHER.
FOR AMBIENT TEMPERATURES BELOW -10 °C (14 °F), USE FIELD WIRING SUITABLE FOR THE MINIMUM AMBIENT TEMPERATURE.

24. REFER TO THE APPROPRIATE INSTRUCTION MANUAL FOR INSTRUCTIONS FOR SAFETY INCLUDING PUTTING INTO SERVICE, USE, ASSEMBLING AND DISMANTLING, MAINTENANCE, INSTALLATION, AND ADJUSTMENT.

3-9000-759 3410 SERIES INSTALLATION MANUAL
3-9000-769 3410 SERIES MAINTENANCE AND TROUBLESHOOTING MANUAL

25. LABEL FOR 3410 SERIES FLOW METER:
DATE CODE IS INCLUDED IN THE SERIAL NUMBER. SERIAL NUMBER FORMAT SHALL BE "YY-WWXXXX" WHERE:
YY = 2-DIGIT YEAR OF MANUFACTURE
WW = WEEK OF MANUFACTURE (01-52)
XXXX = SEQUENTIALLY INCREMENTING NUMBER

26. FOR THE U.L. U.S. MARK INVESTIGATION, THE DEVICE COMPLIES TO THE FOLLOWING STANDARDS FOR USE IN THE UNITED STATES:

UL 1203, 4TH EDITION
UL 508, 17TH EDITION
UL 913, 7TH EDITION

FOR THE U.L.-C MARK INVESTIGATION, THE DEVICE COMPLIES TO THE FOLLOWING STANDARDS FOR USE IN CANADA:

CAN/CSA C22.2 No. 30-M1986, REV. 1988-11
CAN/CSA C22.2 No. 14-10
CAN/CSA C22.2 No. 157-92

FOR THE ATEX MARK INVESTIGATION, THE DEVICE COMPLIES TO THE FOLLOWING STANDARDS FOR USE IN THE EUROPEAN UNION:

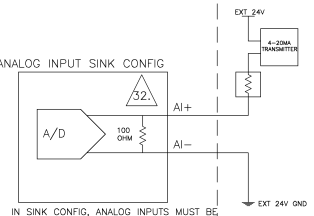
EN 60079-0:2009
EN 60079-1:2007
EN 60079-11:2007

FOR THE IECEx MARK INVESTIGATION, THE DEVICE COMPLIES TO THE FOLLOWING STANDARDS:

IEC 60079-0:2004
IEC 60079-1:2007
IEC 60079-11:2006

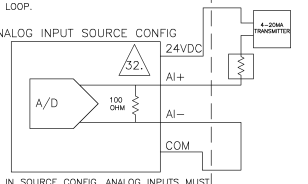
3410 SERIES ELECTRONICS | EXTERNAL CONNECTIONS

27. ANALOG INPUT SINK CONFIG



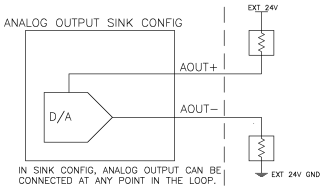
IN SINK CONFIG, ANALOG INPUTS MUST BE CONNECTED AT THE BOTTOM OF THE LOOP.

28. ANALOG INPUT SOURCE CONFIG



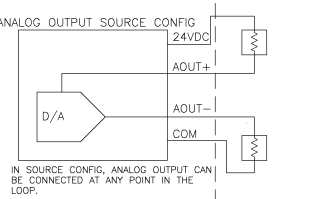
IN SOURCE CONFIG, ANALOG INPUTS MUST BE CONNECTED AT THE BOTTOM OF THE LOOP.

29. ANALOG OUTPUT SINK CONFIG



IN SINK CONFIG, ANALOG OUTPUT CAN BE CONNECTED AT ANY POINT IN THE LOOP.

30. 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

31. ANALOG INPUT 1 AND ANALOG INPUT 2 ARE FUNCTIONALLY IDENTICAL AND ARE NOT ELECTRICALLY ISOLATED FROM EACH OTHER.

32. ANALOG INPUT 1 AND ANALOG INPUT 2 HAVE ADDITIONAL 150 OHMS LOOP IMPEDANCE FOR COMPLIANCE WITH HART COMMUNICATION REQUIREMENTS.

33. 24 VOLTS DC OUTPUT CAN BE USED TO SOURCE POWER TO ONE OR MORE OF THE ANALOG INPUTS OR OUTPUTS.

34. MODEL 3418: CABLING TO CONNECTORS J1, J2 AND J6 ON ACQUISITION MODULE SHALL HAVE DISCRETE WIRES RESTRAINED USING SHRINK TUBING AS SHOWN ON SHEET 2.

REV	DATE	DRN	DESCRIPTION	CHKD	APPD
E	05/21/13	KDG	ECO SP2023	KVG	KDG
D	02/19/13	KDG	ECO SP1919	CV	KDG
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B	04/08/11	KDG	ECO SP1098	KVG	KDG
A	09/29/10	KDG	RELEASED	KVG	KDG

SI METRIC
THIRD ANGLE PROJECTION
MATERIAL: BLOCK NOT APPLICABLE
FINISH: BLOCK NOT APPLICABLE
PROJ. FILE NO. USM-01307
FILENAME: DMC005324E3.DWG, DATE: 05-21-13, TIME: 3:15 P.M.

GEOMETRIC TOLERANCES & DIMENSIONS PER ANSI Y14.5 LATEST REVISION
UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES
X.XX ±.015
X.XXX ±.005
ANGULAR ±0° 30'
FINISH 200 RA MAX
BREAK ALL SHARP CORNERS TO .003-.015 RADIUS AND REMOVE ALL BURRS

DANIEL
Daniel Measurement and Control

TITLE: 3410 SERIES ULTRASONIC METER SYSTEM WIRING DIAGRAM

DRN	DATE	DWG NO.	REV
KDG	09/29/10	DMC-005324	E
CHKD KVG	09/29/10		
APPD KDG	09/20/10	SCALE NA P/N	SHT 3 OF 3

Appendix B: Open source licenses

Source code for executable files or libraries included in this product is provided per the indicated license in the table below. Hyperlinks to the controlling organization's websites are included in Section B.1 through Section B.4.

Table B-1 Open source licences

Package	File specification	License	Summary
base_libs-1.2-1	base_libs	LGPL	Base Libraries (from toolchain)
busybox-1.1.3-1	busybox	GPL	A small executable that replaces many UNIX utilities
dev-1.1-1	dev	GPL	Device files for a small embedded system
devmem2-1.0-1	devmem2	GPL	Simple program to read/write from/to any location
ethtool-3-1	ethtool	GPL	Ethernet settings tool for PCI Ethernet cards
expat-2.0.1-1	expat	MIT	XML 1.0 parser
fake-provides-1.0-5	fake-provides	GPL	Fake provides to satisfy package dependencies
gdb-6.6cs-1	gdb	GPL	Gdb - GNU Source level debugger for C, C++
kernel-2.6.37-6	kernel-2.6.37-mpc8313erd	GPL	Linux kernel (core of the Linux operating system)
libpcap-0.8.3-1	libpcap	BSD	A system-independent interface for user-level pa
libtermcap-2.0.8-31_1	libtermcap	LGPL	A basic system library for accessing the termcap
lwIP		BSD	A lightweight TCP/IP stack
merge-0.1-1	merge	GPL	Merge files for an embedded root filesystem
modeps-1.0-1	modeps	GPL	Generate module dependency file
mtd-utils-20060302-1	mtd-utils	GPL	Memory Technology Device tools
net-tools-1.60-1	net-tools	GPL	Basic networking tools
ppp-2.4.4-1	ppp	BSD	Like a Point-to-Point Protocol daemon
skell-1.16-2	skell	GPL	Skelleton files for an embedded root filesystem
sqlite-3.6.22-1	sqlite	Public domain	SQLite is a C library that implements an embeddable SQL database

Package	File specification	License	Summary
strace-4.5.14-1	strace	BSD	trace system calls associated with a running pro
sysconfig-1.2-1	sysconfig	GPL	System configuration package
sysfsutils-2.1.0-1	sysfsutils	GPL/LGPL	sysfs utilities
tcpdump-3.8.3-1	tcpdump	BSD	A network traffic monitoring tool
termcap-1.2-1	termcap	BSD	minimal /etc/termcap needed by minicom etc
u-boot-1.3.0-1	u-boot-1.3.0-mpc8313erdb	GPL	Universal Bootloader firmware
ubi-utils-1.4.2-1	ubi-utils	GPL	Tools for maintaining Unsorted Block Image Device
vsftpd-2.2.2-1	vsftpd	GPL	vsftpd - Very Secure Ftp Daemon
zlib-1.2.3-2	zlib	zlib	Distribution zlib compression utilities and libraries

Follow the link below to the Daniel® Liquid Ultrasonic Products GPL webpage for additional open source information and zipped source code files.

http://www2.emersonprocess.com/en-US/brands/daniel/Pages/GPL3410.aspx

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For more details about GNU GPL (General Public License), follow the link below:

http://www.gnu.org/

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http://www.gnu.org/licenses/old-licenses/gpl-2.0.html

The GNU GPL is currently version 3

http://www.gnu.org/licenses/quick-guide-gplv3.html

For older versions of the GNU General Public License, follow the link below:

http://www.gnu.org/licenses/old-licenses/old-licenses.html#GPL

See GPL license on the following pages.

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Version 2, June 1991

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