UFM® UNIVERSAL FLOW MONITORS
a DwyerOmega brand

USER GUIDE

# UFM Vane/Piston Consolidated User Manual


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**Bulletin F-PI**

# Table of Contents

Retain this user manual for future reference. It contains important information about the operation and maintenance of your device.

Remove this product from service if it shows any signs of damage or malfunction. Continued use may result in injury or further damage.

The models described in this User Manual are intended for Fixed Installation only.

**WARNING: ELECTRICAL HAZARD - DISCONNECT POWER BEFORE REMOVING COVER** - This instrument was made for a specific use stated at time of order. Any other use may cause injury. Read instructions before using.

AVETRTISSEMENT: RISQUE ELECTRIQUE - DEBRANCHEZ L'ALIMENTATION AVANT DE RETIRER LE COUVERCLE. - Cet instruments a ete fabrique pour l'usage specifique indique au moment de la commande. Toute autre utilisation peut causer des blessures. Lisez les instructions avant de l'utiliser.

## 1. A, L, Z General Vane / Piston Switch Manual

Installation and Operation Manual for series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX and MX for A, L or Z control boxes with 0, 1 or 2 switches.

### 1.1. Name Plates and Product ID

This manual applies to all vane/piston meters that have one of the designators in the model codes shown in the table shown below. This can be seen on the name plate example.

| Model Code Designations for Zero, One, and Two Switches | Polysulfone | Aluminum | 316 SS |
|---|---|---|---|
| 4 to 20 mA transmitter (AX0 IP64 and ZX0 IP66 intrinsically safe with approved barriers) | AX0 | LX0 | ZX0 |
| HART with programmable switch points | AH0 | LH0 | ZH0 |
| Display only | A0 | L0 | Z0 |
| One SPDT (3 wire) | A1 | L1 | Z1 |
| One high vibration SPDT (3 wire) | A1B | L1B | Z1B |
| Two SPDT (3 wire) | A2 | L2 | Z2 |
| Two high vibration SPDT (3 wire) | A2B | L2B | Z2B |
| One SPDT (4 wire) | A3 | L3 | Z3 |
| Two SPDT (4 wire) | A4 | L4 | Z4 |
| One SPDT (3 wire) hermetically sealed | A53 | L53 | Z53 |
| Two SPDT (3 wire) hermetically sealed | A54 | L54 | Z54 |
| One SPDT (3 wire) high temperature | A61 | L61 | Z61 |
| Two SPDT (3 wire) high temperature | A62 | L62 | Z62 |
| One SPDT (3 wire) gold contact | A71 | L71 | Z71 |
| Two SPDT (3 wire) gold contact | A72 | L72 | Z72 |

## 1.2. Installation

For best results, the meters may be installed in any position as long as proper piping installation requirements are observed. This includes sufficient support of adjacent piping to minimize the system's inherent vibration. Unions of the same pipe size and full port isolation ball valves may be installed for ease of removal and servicing of equipment, if necessary.

Wire directly to the switch terminal screws.


*Figure 2: Device overview*

In One Switch units, the cam is easily adjusted by depressing the outer ring and turning it to the desired position.


*Figure 3: Cam adjustment*

**WARNING:** This instrument was made for the specific use stated at the time of order. Any other use may cause injury. Read instructions before using the device.

**Supply Connections—Wire Sizes:** Wire used to connect any Switches included must be in accordance with all local and national codes. Wire size and insulation ratings should support actual loads. See also Switch Ratings below. In all cases, wire must be, as a minimum, 20 AWG Teflon insulated rated at 600V and 200°C. It is recommended to include a disconnect switch or circuit breaker near this equipment.

## 1.3. Electrical Switch Ratings

| Switch Identification | Switch Description | Electrical Ratings |
|---|---|---|
| UFM P/N-704CE, 704CE-P4, 704CE P5<br>Model Code Designator: 1 or 2 | SPDT – (3 wire)<br>(1 or 2 switches may be provided) | 15 A – 125 V AC, 250 V AC, 480 V AC; HP – 125 V AC, ¼ HP – 250 V AC 50 Hz - 60 Hz |
| UFM P/N-986CE<br>Model Code Designator: 1B or 2B | SPDT – (3 wire)<br>High Vibration | 20 A – 125 V AC, 250 V AC, 480 V AC; ½ A – 125 V DC, ¼A -250 V DC; 1 HP – 125 V AC, 2 HP – 250 V AC 50 Hz - 60 Hz |
| UFM P/N-702<br>Model Code Designator: 61 or 62 | SPDT –<br>High Temperature | 15 A – 125 V AC, 250 V AC, 480 VAC; ½ A – 125 V DC, ¼ A -250 V DC; HP – 125 V AC, ¼ HP – 250 V AC 50 Hz - 60 Hz |
| UFM P/N-808<br>Model Code Designator: 71 or 72 | SPDT –<br>Gold Contact | 15 A – 125 V AC, 250 V AC, 480 V AC; HP – 125 V AC, ¼ HP – 250 V AC 50 Hz - 60 Hz |
| UFM P/N-703<br>Model Code Designator: 3 or 4 | SPDT – (4 wire)<br>Single-Break Form Z | 15 A – 125 V AC, 250 V AC, 480 V AC; 1 A – 125 V DC, ½ A -250 V DC; ¼ HP – 125 V AC, ½ HP – 250 V AC 50 Hz - 60 Hz |
| HAZLOC SWITCH | SPST 11A | 125/250 VAC 60 Hz, 125 VDC |
| HAZLOC SWITCH | DPDT 11A | 125/250 VAC 60 Hz, 125 VDC |

## 2. Vane/Piston H0 - Transmitter with HART

Installation and Operation Manual Series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX and MX used with control boxes: A, L, or Z with 4 to 20 mA transmitter with HART.

### 2.1. Quick Set Up

#### 2.1.1. Wiring Using Pre-Installed Wires:

Complete the loop circuit using the 2 pre-installed 18", 22 AWG wires provided.

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**Important:** Observe polarity—The red wire is positive (+), and the black wire is negative (-).

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#### 2.1.2. Wiring Removing Pre-Installed Wires:

Open cover and remove pre-installed wires. Connect a twisted wire pair (not provided) to the terminals observing the polarity marked on the PC board. The units are shipped with a red wire connected to the positive (+) terminal, and a black wire connected to the negative (-) terminal. The wire may be up to AWG 14 size, but no smaller than AWG 22.

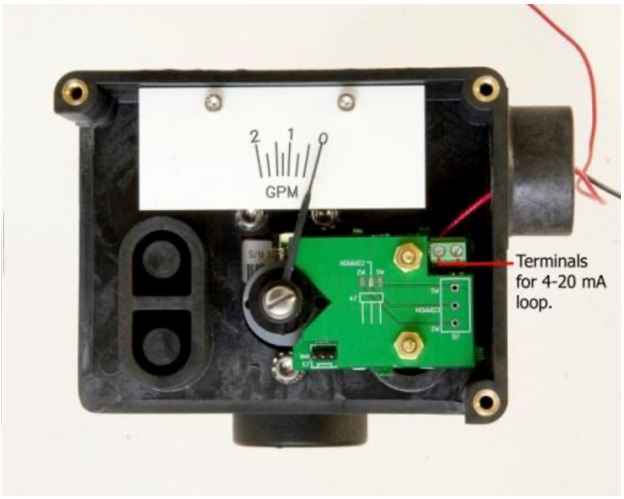



*Figure 4: Terminals for 4 to 20 mA loop*

## 2.2. Introduction to HART® Field Device Specifications

### 2.2.1. Scope

The Universal Flow Monitors water flow transmitter, model ME Transmitter complies with HART Protocol Revision 7.0. This document specifies all the device specific features and documents HART Protocol implementation details (e.g., the Engineering Unit Codes supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

### 2.2.2. Purpose

This specification is designed to complement other documentation (e.g., the installation manuals specific to PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE, and XHF model flow meters) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective.

### 2.2.3. Who Should Use this Document?

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

### 2.2.4. Abbreviations and Definitions

| | |
|---|---|
| ADC | Analog to Digital Converter |
| CPU | Central Processing Unit (of microprocessor) |
| DAC | Digital to Analog Converter |
| EEPROM | Electrically-Erasable Read-Only Memory |
| ROM | Read-Only Memory |
| PV | Primary Variable |
| SV | Secondary Variable |
| HCF | HART Communication Foundation |
| FSK | Frequency Shift Keying Physical Layer |

## 2.3. Process Interface

### 2.3.1. Magnetic Sensors

There are two built-in hall-effect sensors measuring the rotation of a permanent magnet that is mounted onto the flowmeter shaft. As the shaft rotates with flow, the sensors provide analog readings that are in turn converted to a digital value by and A/D converter. The digital values are then processed by the microcontroller and linearized, and subsequently converted to a scaled analog output via a D/A converter in the range of 4 to 20 mA.

### 2.3.2. Host Interface Analog Output 1: Process Flow

The two-wire 4 to 20 mA current loop is connected to two terminals on the transmitter circuit board. Depending on the product used, one of the two configurations are offered for field wiring.

The first option allows the user to directly connect the loop wires to the terminals on the PCB. The correct polarity is shown in the pictures below, where the red wire is connected to the (+) terminal and the black wire is connected to the (–) terminal.

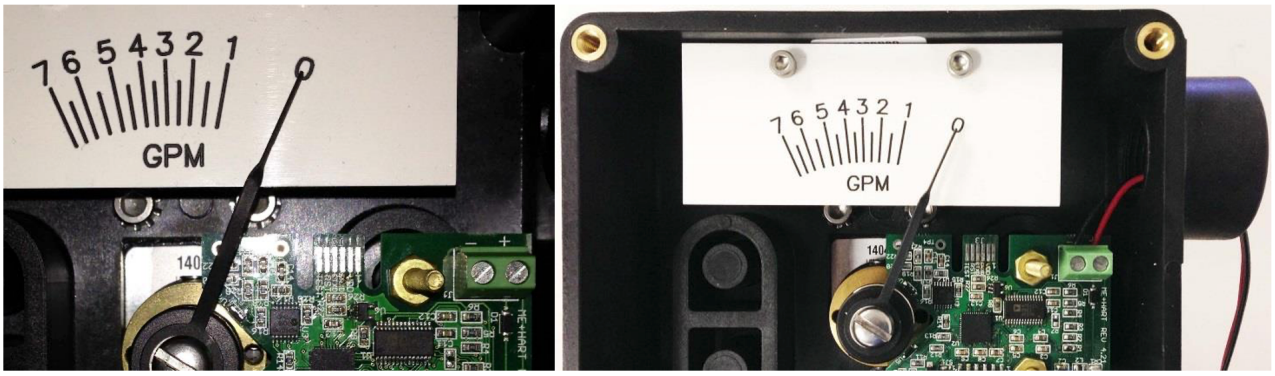



*Figure 5: PCB Polarity wiring*

## 2.4. Dynamic Variables

Two Dynamic Variables are implemented.

| | Meaning | Units |
|---|---|---|
| PV | Volumetric Flow Reading | GPM, CMH, LPM |
| SV | Totalizer Value based on PV | Follows PV Units |

The PV is derived using a calibrated linearization table applied to A/D converter readings of hall-effect sensors. The SV is based on a 5ms timer and is updated based on the current reading of flow. Both PV and SV values are smoothed.

## 2.5. Status Information

| Bit Mask | Definition | Conditions to set bit |
|---|---|---|
| 0x80(bit 7) | Device Malfunction | None |
| 0x40(bit 6) | Configuration Changed | Any change in device configuration |
| 0x20(bit 5) | Cold start | Set any time power is cycled |
| 0x10(bit 4) | More Status Available | Triggers when either alarm is active |
| 0x08(bit 3) | Loop Current Fixed | None |
| 0x04(bit 2) | Loop Current Saturated | Occurs when loop current reaches upper limit |
| 0x02(bit 1) | Non-Primary Variable out of limits | None |
| 0x01(bit 0) | Primary Variable Out of limits | Occurs when PV is being limited due to exceeding calibrated limitations |

When Bit 4 is set, Host should send Command 48 to determine which alarm is active.

### 2.5.1. Additional Device Status (Command #48)

Command #48 returns 9 bytes of data, with the following status information:

| Bit Mask | Description | Conditions |
|---|---|---|
| 0x80 | Undefined | NA |
| 0x40 | Undefined | NA |
| 0x20 | Undefined | NA |
| 0x10 | Undefined | NA |
| 0x08 | Undefined | NA |
| 0x04 | Undefined | NA |
| 0x02 | High Alarm | High Alarm is active if set |
| 0x01 | Low Alarm | Low Alarm is active if set |

### 2.5.2. Burst Mode

This Field Device does not support Burst Mode.

### 2.5.3. Catch Device Variable

This Field Device does not support Catch Device Variable.

## 2.6. Device-Specific Commands

The following device-specific commands are implemented:

| | |
|---|---|
| 128 | Read Alarm Setpoints |
| 129 | Write Low Alarm Setpoint |
| 130 | Write High Alarm Setpoint |
| 131 | Reset Totalizer |

## 2.7. Command #128: Read Alarm Setpoints

Reads the High and Low Alarm Setpoints. If zero, the alarm is disabled.

### 2.7.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| None | | |

### 2.7.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | PV Unit value |
| 1-4 | Float | High Alarm Setpoint |
| 5-8 | Float | Value of High Alarm Setpoint |

## 2.8. Command #129: Write Low Alarm Setpoint

Writes the setpoint for the Low Alarm.

### 2.8.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0-3 | Float | Low Alarm Setpoint |

### 2.8.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | PV Unit value |
| 1-4 | Float | Low Alarm Setpoint |

### 2.8.3. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 2.9. Command #131: Reset Totalizer

Resets the totalizer to zero.

### 2.9.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| None | | |

### 2.9.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| None | | |

### 2.9.3. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 2.10. Performance

### 2.10.1. Sampling Rates

Typical sampling rates are shown in the following table.

| | |
|---|---|
| PV digital value calculation | 10 per second |
| SV digital value calculation | 10 per second |
| Analog output update | 10 per second |

### 2.10.2. Power-Up

The device is typically ready within 1 second of power-up. Totalizer is initialized to zero.

### 2.10.3. Reset

Command 42 (“Device Reset”) causes the device to reset its microcontroller. The resulting restart is identical to the normal power up sequence.

### 2.10.4. Self-Test

Self-Test is not supported.

### 2.10.5. Command Response Times

| | |
|---|---|
| Minimum | 20 ms |
| Typical | 50 ms |
| Maximum | 100 ms |

## 2.11. Capability Checklist

| | |
|---|---|
| Manufacturer, model and revision | Universal Flow, ME Transmitter, Rev1 |
| Device type | Transmitter |
| HART revision | 7.0 |
| Device Description available | No |
| Number and type of sensors | 2 internal |
| Number and type of actuators | 0 |
| Number and type of host side signals | 1: 4 to 20 mA analog |
| Number of Device Variables | 4 |
| Number of Dynamic Variables | 2 |
| Mappable Dynamic Variables? | No |
| Number of common-practice commands | 5 |
| Number of device-specific commands | 4 |
| Bits of additional device status | 2 |
| Alternative operating modes? | No |
| Burst mode? | No |
| Write-protection? | No |

### 3. Vane/Piston - XØ Transmitter

Installation and Operation Manual Series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE, and XHF control boxes with transmitter. The AX0, LX0, and ZX0 are display and transmitter only. They do not contain internal switches and are intrinsically safe when used with approved barriers.

| Model Code Designations for Zero, One, and Two Switches | Polysulfone | Aluminum | 316 SS |
|---|---|---|---|
| 4 to 20 mA transmitter (AX0 IP64 and ZX0 IP66 intrinsically safe with approved barriers) | AX0 | LX0 | ZX0 |
| HART with programmable switch points | AH0 | LH0 | ZH0 |
| Display only | A0 | L0 | Z0 |
| One SPDT (3 wire) | A1 | L1 | Z1 |
| One high vibration SPDT (3 wire) | A1B | L1B | Z1B |
| Two SPDT (3 wire) | A2 | L2 | Z2 |
| Two high vibration SPDT (3 wire) | A2B | L2B | Z2B |
| One SPDT (4 wire) | A3 | L3 | Z3 |
| Two SPDT (4 wire) | A4 | L4 | Z4 |
| One SPDT (3 wire) hermetically sealed | A53 | L53 | Z53 |
| Two SPDT (3 wire) hermetically sealed | A54 | L54 | Z54 |
| One SPDT (3 wire) high temperature | A61 | L61 | Z61 |
| Two SPDT (3 wire) high temperature | A62 | L62 | Z62 |
| One SPDT (3 wire) gold contact | A71 | L71 | Z71 |
| Two SPDT (3 wire) gold contact | A72 | L72 | Z72 |

**Note**
**Do not modify this Intrinsically Safe product. Any modifications will negate the Intrinsically Safe NRTL listing. Return to factory for servicing.**

## 3.1. Nameplates and Product ID

This manual section applies to all vane/piston meters that have the designator “AX0”, “LX0” or “ZX0” in the model code. This can be seen on the name plate as shown below.

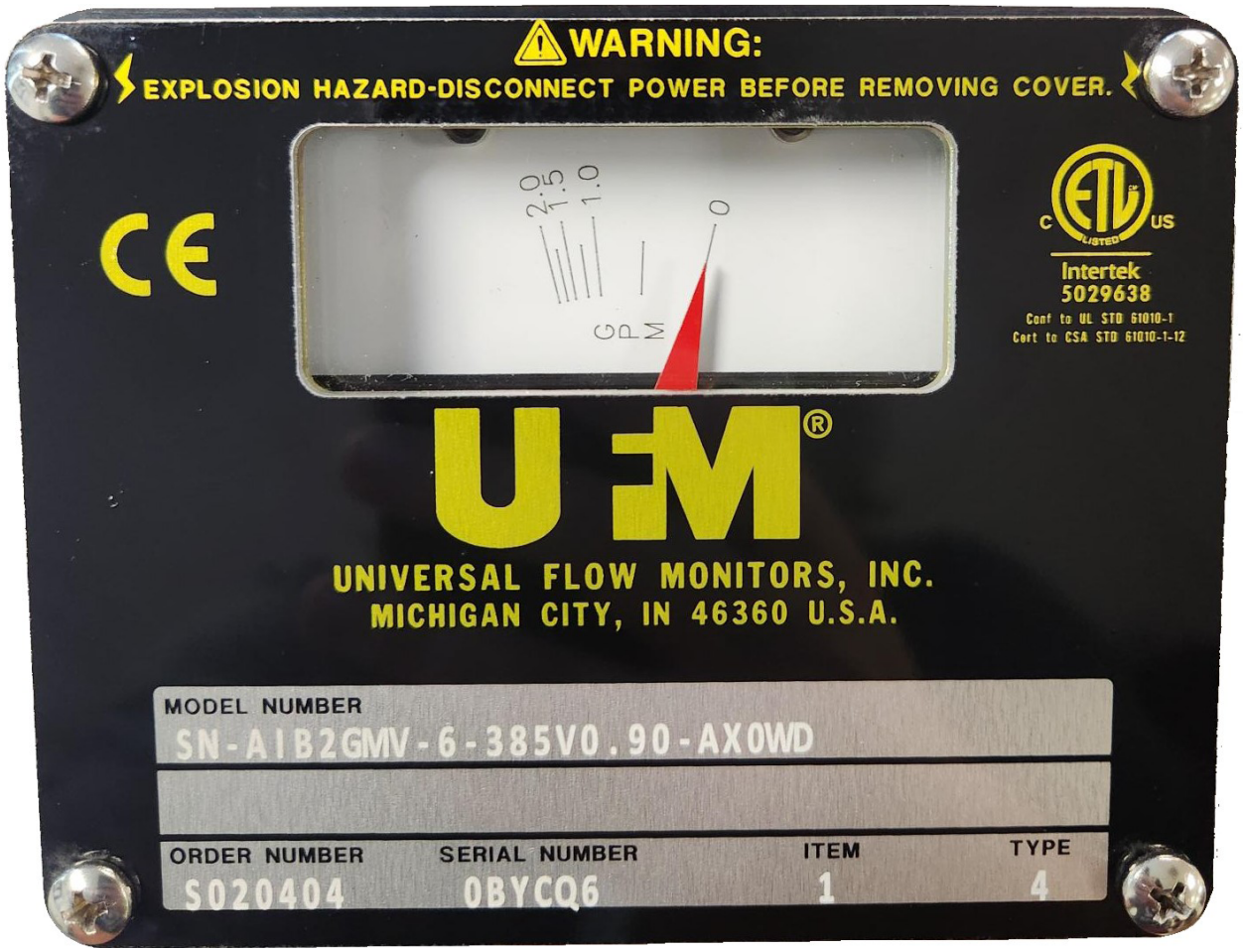



*Figure 6: Name plate and Product ID*

## 4. Vane/Piston RX/RH

Installation and Operation Manual Series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF Used with R control boxes with 4 to 20 mA transmitter or HART and optional mechanical switches. The RX0 is display and transmitter only. The RX0 does not contain any internal switches and is intricisically safe when used with approved barriers.

| **Flow rate display, hazardous location switches as follows:** | |
|---|---|
| One SPDT hazardous location | R7* |
| One DPDT hazardous location | R17* |
| Two SPDT hazardous location | R18* |
| Two DPDT hazardous location | R19* |
| Note: Flows 5 GPM or greater* | |
| **Flow rate display, 4 to 20 mA transmitter plus switch options as follows:** | |
| Display and transmitter only (intrinsically safe with no switch options with approved barriers) | RX0 |
| One SPDT (3 wire) | RX1 |
| Two SPDT (3 wire) | RX2 |
| One SPDT (4 wire) | RX3 |
| Two SPDT (4 wire) | RX4 |
| One SPDT (3 wire) high temperature | RX61 |
| **Flow rate display, HART, & 4 to 20 mA output (HART protocol is not intrinsically safe):** | |
| HART & 4 to 20 mA output only | RH0 |
| One SPDT (3 wire) | RH1 |
| Two SPDT (3 wire) | RH2 |
| One SPDT (4 wire) | RH3 |
| Two SPDT (4 wire) | RH4 |

***HAZARDOUS LOCATION**
The Round Enclosure R7, R17, R18 and R19 flow meter models are designed and agency listed for Hazardous Location applications. These models are intended for use in: Class I, Division 1 & Division 2, Groups A, B, C and D T4; Class II, Division 1, Groups E, F and G, T4 -20 °C ≤ Tamb ≤ +40 °C

### 4.1. Electrical Switches

**Electrical Switch Ratings**

| Switch Identification | Switch Description | Electrical Ratings |
|---|---|---|
| HAZLOC SWITCH | SPST | 11 A 125/250 Vac 60 Hz, 125 Vdc |
| HAZLOC SWITCH | DPDT | 11 A 125/250 Vac 60 Hz, 125 Vdc |

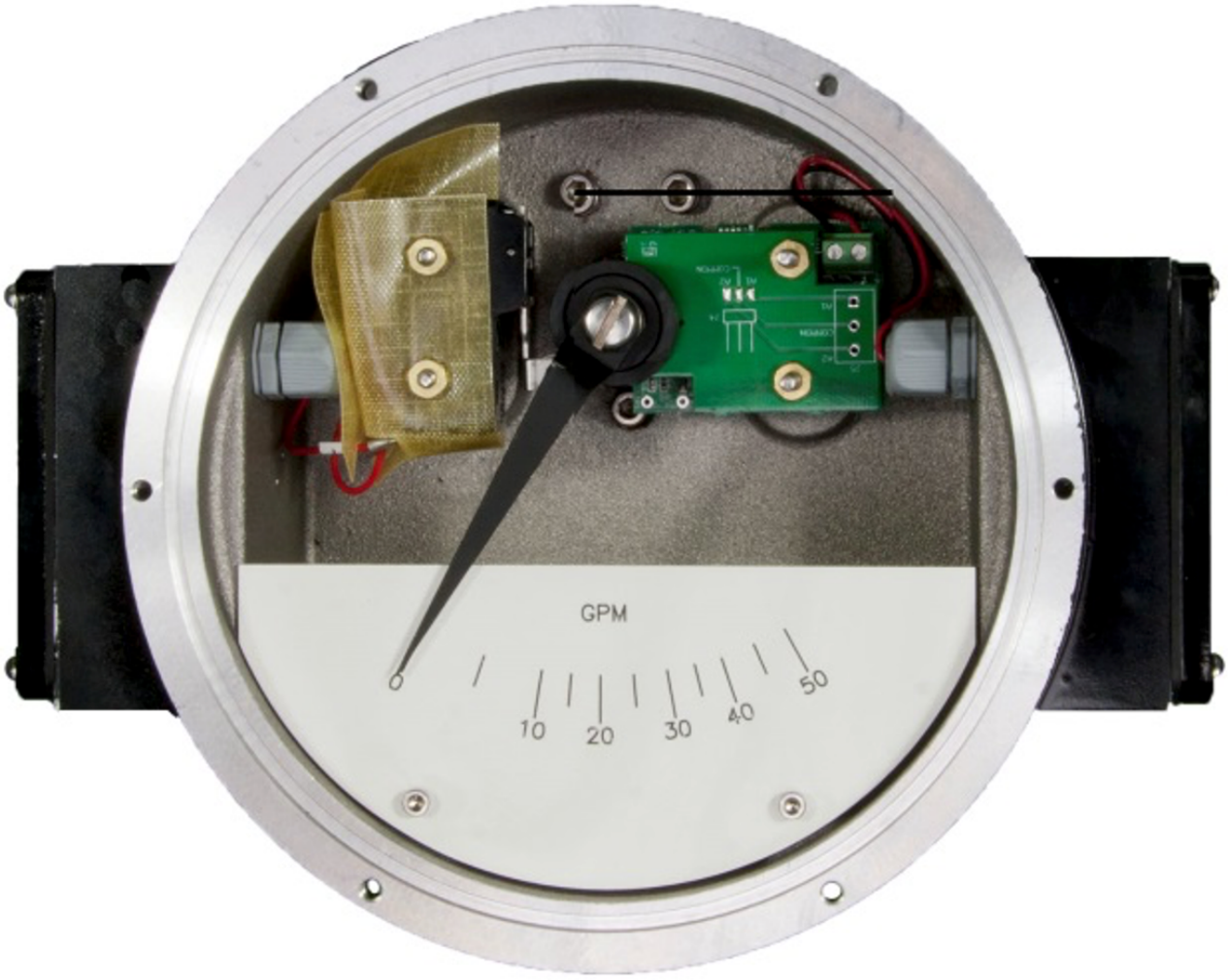



*Figure 7: R Box shown open with optional mechanical switch*

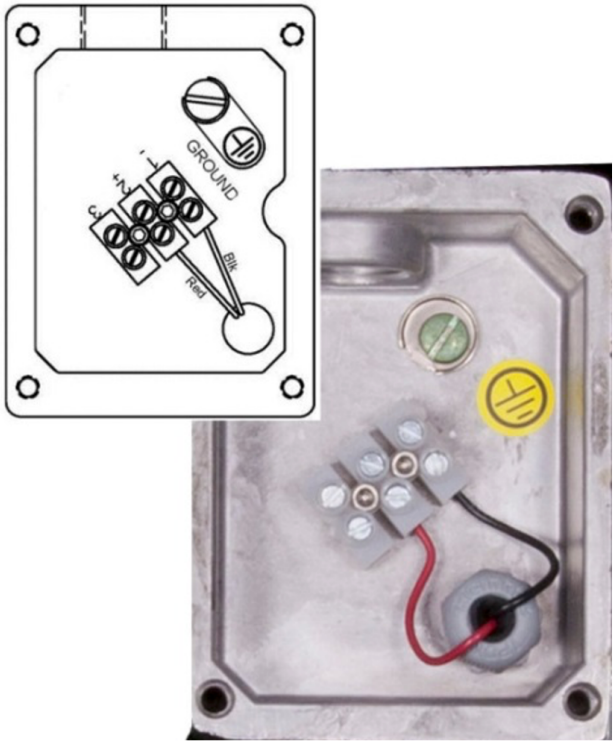



*Figure 8: Transmitter wiring with or without HART*

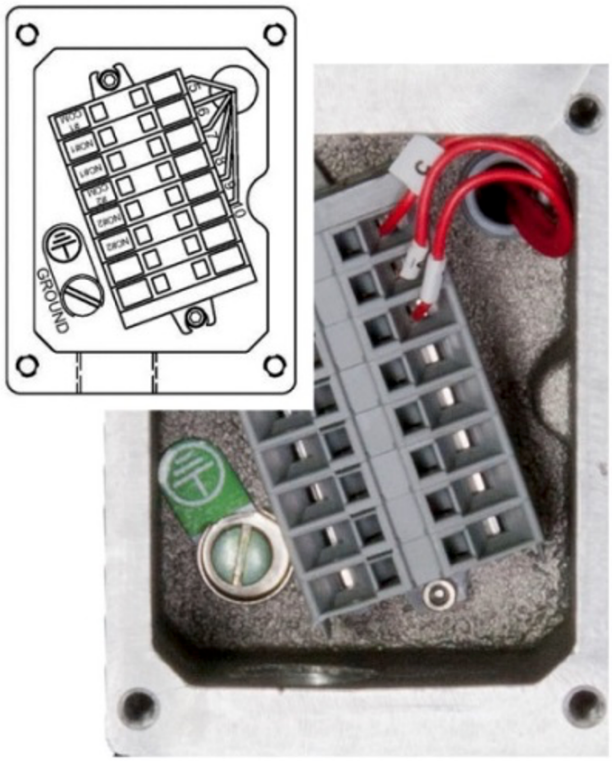



*Figure 9: Mechanical (optional) switch wiring*

## 4.2. Installation

For best results, the meters may be installed in any position as long as proper piping installation requirements are observed. This includes sufficient support of adjacent piping to minimize the system's inherent vibration. Unions of the same pipe size and full port isolation ball valves may be installed for ease of removal and servicing of equipment, if necessary.

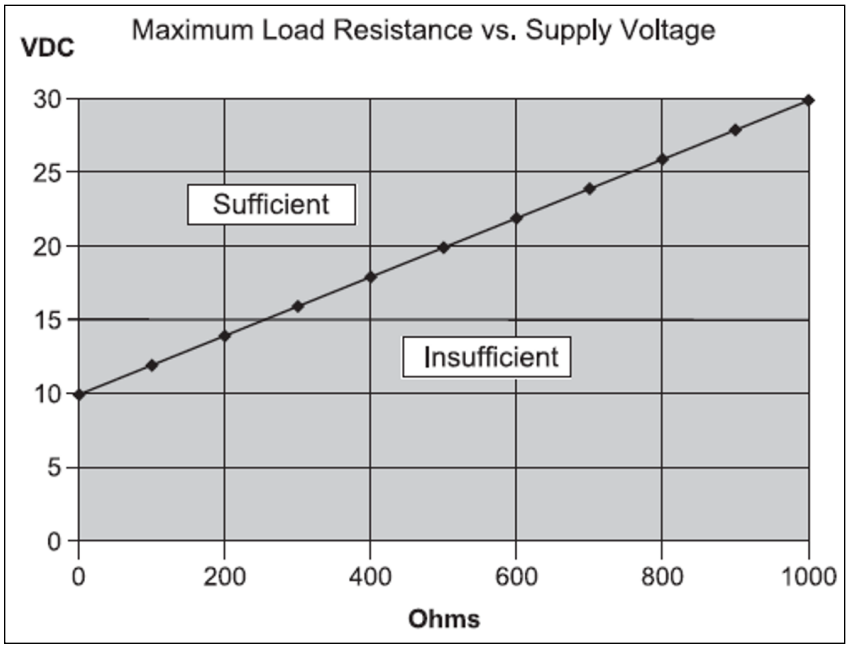



*Figure 10: Maximum load vs Supply voltage graph*

## 4.3. References

HART Smart Communications Protocol Specification. HCF_SPEC-12. Available from the HCF. Installation manuals specific to PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF model flow meters as manufactured by Universal Flow Monitors, Inc.

## 4.4. Device Identification

| | | | |
|---|---|---|---|
| **Manufacturer Name:** | Universal Flow | **Model Name(s):** | ME Transmitter |
| **Manufacture ID Code:** | 24692 (6074 Hex) | **Device Type Code:** | 230 (E1EF Hex) |
| **HART Protocol Revision** | 7.0 | **Device Revision:** | 1 |
| **Number of Device Variables** | 4 | | |
| **Physical Layers Supported** | FSK | | |
| **Physical Device Category** | Transmitter, Non-DC-isolated Bus Device | | |

*Figure 11: Device Identification*

## 4.5. Product Overview

The ME Transmitter is a two-wire loop-powered flow transmitter, with a 4 to 20 mA output. This transmitter uses a non-contact magnetic encoder for measuring the displacement of the shaft/pointer on standard UFM flowmeters. It is an add-on feature to PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF model flow meters as manufactured by Universal Flow Monitors, Inc. The ME Transmitter replaces the earlier models Digital Transmitters that utilized a potentiometer, providing improved accuracy while maintaining 100% compatibility. The analog output of this device is linear with flow over the working range of all supported flowmeters.

## 4.6. Process Interface

### 4.6.1. Magnetic Sensors

There are two built-in hall-effect sensors measuring the rotation of a permanent magnet that is mounted onto the flowmeter shaft. As the shaft rotates with flow, the sensors provide analog readings that are in turn converted to a digital value by and A/D converter. The digital values are then processed by the microcontroller and linearized, and subsequently converted to a scaled analog output via a D/A converter in the range of 4 to 20 mA.

### 4.6.2. Host Interface: Process Flow

The two-wire 4 to 20 mA current loop is connected to two terminals on the transmitter circuit board. Depending on the product used, one of the two configurations are offered for field wiring.

There is a secondary terminal strip away from the PCB (mounted in a separate compartment of the flowmeter) and is marked L+ and L-. The red wire connects the (+) terminal on the PCB to L+, and the black wire connects the (–) terminal on the PCB to L-.

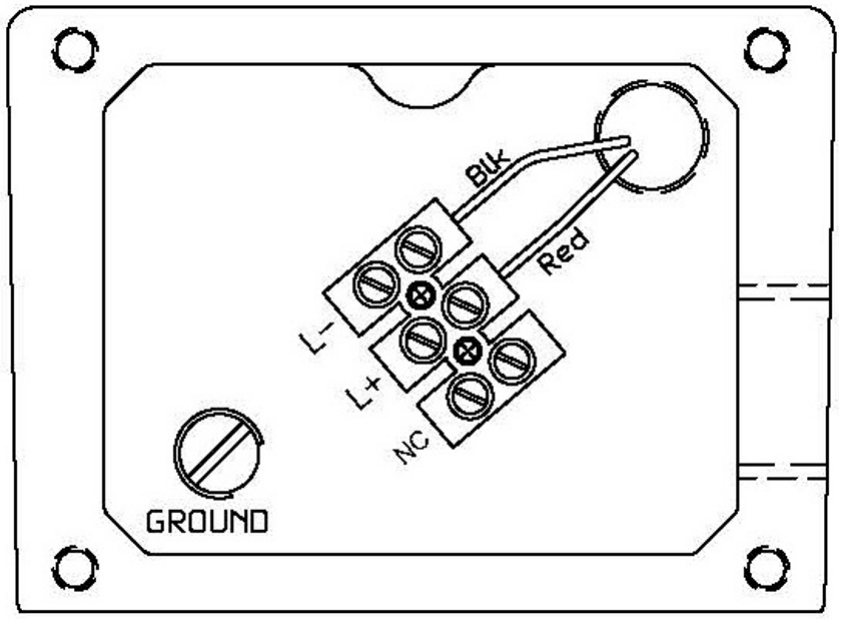



*Figure 12: PCB wiring*

This is the only output from this transmitter, representing the process flow measurement, linearized and scaled according to the configured range of the instrument. This output corresponds to the Primary Variable. HART Communication is supported on this loop.

A guaranteed linear over-range is provided. The up-scale current of 24 mA can indicate device malfunction. Current values are shown in the table below.

| | Direction | Values (percent of range) | Values (mA or V) |
|---|---|---|---|
| **Linear over-range** | Down | 0% ± 0.5% | 3.92 to 4.08 mA |
| | Up | +106.25% ± 0.1% | 20.84 mA to 21.16 mA |
| **Device malfunction indication** | Down | N/A | N/A |
| | Up | +125.0% ± 0.1% | 23.98 mA to 24.02 mA |
| **Maximum current** | | +106.25% ± 1% | 20.84 mA to 21.16 mA |
| **Multi-Drop current draw** | | | 4.0 mA |
| **Lift-off voltage** | | | 10.5 V |

## 4.7. Status Information

| Bit Mask | Definition | Conditions to set bit |
|---|---|---|
| 0x80(bit 7) | Device Malfunction | None |
| 0x40(bit 6) | Configuration Changed | Any change in device configuration |
| 0x20(bit 5) | Cold start | Set any time power is cycled |
| 0x10(bit 4) | More Status Available | Triggers when either alarm is active |
| 0x08(bit 3) | Loop Current Fixed | None |
| 0x04(bit 2) | Loop Current Saturated | Occurs when loop current reaches upper limit |
| 0x02(bit 1) | Non-Primary Variable out of limits | None |
| 0x01(bit 0) | Primary Variable Out of limits | Occurs when PV is being limited due to exceeding calibrated limitations |

When Bit 4 is set, Host should send Command 48 to determine which alarm is active.

### 4.7.1. Extended Device Status

The Field Device cannot predict when maintenance will be required. Extended Device Status is unused.

| Byte | Description | Data |
|---|---|---|
| 0-5 | Device Specific Status | Only Byte 0 is used |
| 6 | Extended Device Status | Bit 1 will be set when an alarm condition is active. |
| 7 | Device Operating Mode | 0 |
| 8 | Standard Status | 0 |

“Not used” bits are always set to 0.

Device does not support extended device status, all device status activity is included in the device status byte.

## 4.8. Universal Commands

All Universal Commands are supported as specified in the HART Universal Command Specification.

## 4.9. Common-Practice Supported Commands

The following common-practice commands are implemented:

| | |
|---|---|
| 33 | Read Device Variables |
| 35 | Write Range Values |
| 42 | Perform Master Reset |
| 44 | Write PV Units |
| 54 | Read Device Variable Information |

In command 54 the acquisition period is unused. Values are typically updated every 100 ms.

### 4.9.1. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 4.10. Command #130: Write High Alarm Setpoint

Writes the setpoint for the High Alarm.

### 4.10.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0-3 | Float | High Alarm Setpoint |

### 4.10.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | PV Unit value |
| 1-4 | Float | High Alarm Setpoint |

### 4.10.3. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 4.11. Tables

### 4.11.1. Flow Unit Codes

Subset of HART Common Unit Codes

| | |
|---|---|
| 16 | Gallons Per Minute (GPM) |
| 17 | Liters Per Minute (LPM) |
| 19 | Cubic Meters Per Hour (CMH) |

### 4.11.2. Unit Conversion

Internally, the transmitter uses Gallons per Minute. Conversions are made using a floating point factor. Values are directly converted from GPM when possible, however Alarm values changed between units are converted from stored unit value:

| New Unit | Previous Unit | Factor |
|---|---|---|
| GPM | LPM | 0.2642 |
| | CMH | 4.403 |
| LPM | GPM | 3.785 |
| | CMH | 16.666 |
| CMH | GPM | 0.2271 |
| | LPM | 0.06 |

## 4.12. Performance

### 4.12.1. Busy and Delayed-Response

Device busy is not used. Delayed-response is not used.

### 4.12.2. Long Messages

The largest data field used is in the response to Command 21: 34 bytes including the two status bytes.

### 4.12.3. Non-Volatile Memory

EEPROM is used to hold the device's configuration parameters. New data is written within 100ms of command receipt.

### 4.12.4. Modes

Fixed current mode is not implemented.

#### 4.12.5. Write Protection

Write-protection is not implemented.

#### 4.12.6. Damping

Damping is not implemented.

### 4.13. Default Configuration

Default configuration is based on a unit-by-unit basis.

## 5. Vane/Piston - TX Transmitter / TH Transmitter with HART

Installation and Operation Manual Series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF Used with T control boxes with 4 to 20 mA transmitter or HART and optional mechanical switches. Note: The 4 to 20 mA transmitter with or without the LCD and with no switches is intrinsically safe with approved barriers.*

| **Pointer, scale and 4 to 20 mA:** | |
|---|---|
| No Switches* | TX0 |
| One SPDT (3 wire) | TX1 |
| Two SPDT (3 wire) | TX2 |
| One SPDT (4 wire) | TX3 |
| Two SPDT (4 wire) | TX4 |
| One SPDT (3 wire) high temperature | TX61 |
| **Flow rate display, HART & 4 to 20 mA output (HART protocol is not intrinsically safe):** | |
| HART & 4 to 20 mA output only | TH0 |
| One SPDT (3 wire) | TH1 |
| Two SPDT (3 wire) | TH2 |
| One SPDT (4 wire) | TH3 |
| Two SPDT (4 wire) | TH4 |

| | |
|---|---|
| PIPING: | Screw pipe into meter with flow going into port marked “IN”. |
| WIRING: | Connect switch wires and/or open collector alarm and transmitter wires to the terminal strip as shown.<br><br>Wire must be in accordance with all local and national codes. Wire size and insulation ratings should support actual loads. In all cases, wire must be, as a minimum, 20 AWG Teflon insulated rated at 600 V and 200 ˚C. It is recommended to include a disconnect switch or circuit breaker near this equipment. |
| CÂBLAGE | Le câble doit être conforme à tous les codes locaux et nationaux. Le diamètre du câble et ses niveaux d’isolation doivent pouvoir supporter des charges réelles. Dans tous les cas, le câble doit être isolé au minimum en téflon de calibre 20 AWG et d’une capacité nominale de 600 V et de 200°C. Il est recommandé d’inclure un interrupteur général ou un disjoncteur à proximité de cet équipement. |
| GROUNDING: | For protection against electrical shock in case of a fault, connect an external earth ground to the grounding screws or lugs provided inside this instrument. Such attachment points are identified with a tag or label adjacent to the grounding screw or lug with the symbol. |
| MISE À LA TERRE | Pour se protéger des chocs électriques en cas de défaut à la terre, brancher une mise à la terre externe sur les vis ou cosses de mise à la terre fournies à l’intérieur de cet instrument. De tels points de fixation sont identifiés à l’aide d’une étiquette ou d’un label adjacent à la vis ou à la cosse de mise à la terre avec le symbole. |

This section applies to all vane/piston meters that have the designator “TX0, 1, 2, 3, 4, or 61” in the model code. This can be seen on the name plate as shown below.


*Figure 13: Name plate and Product ID*

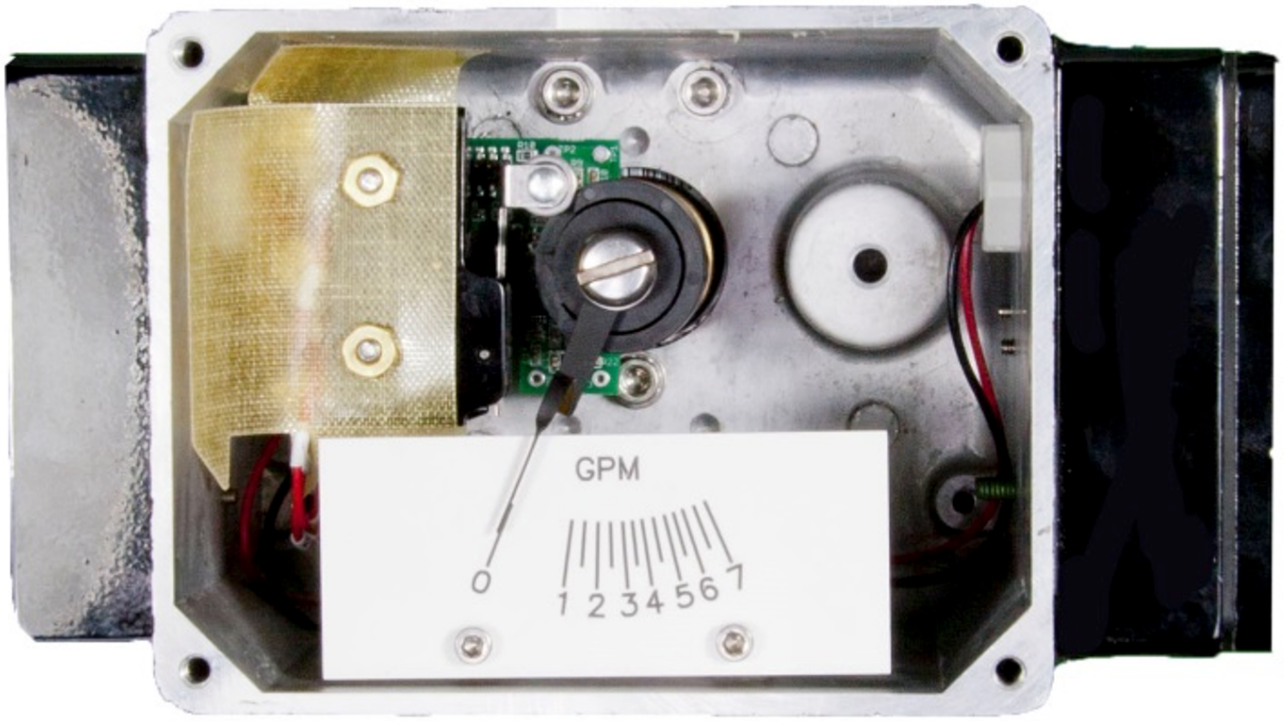



*Figure 14: T Box with optional switch and transmitter*

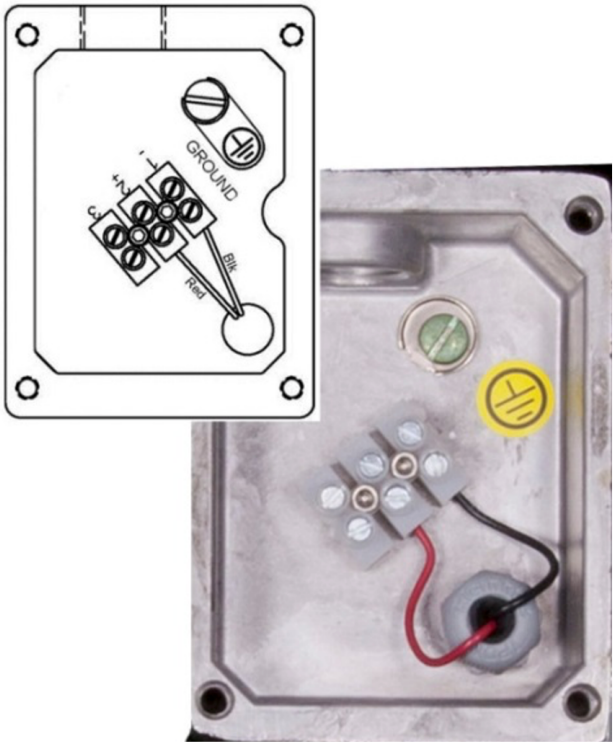



*Figure 15: Transmitter wiring with out without HART*

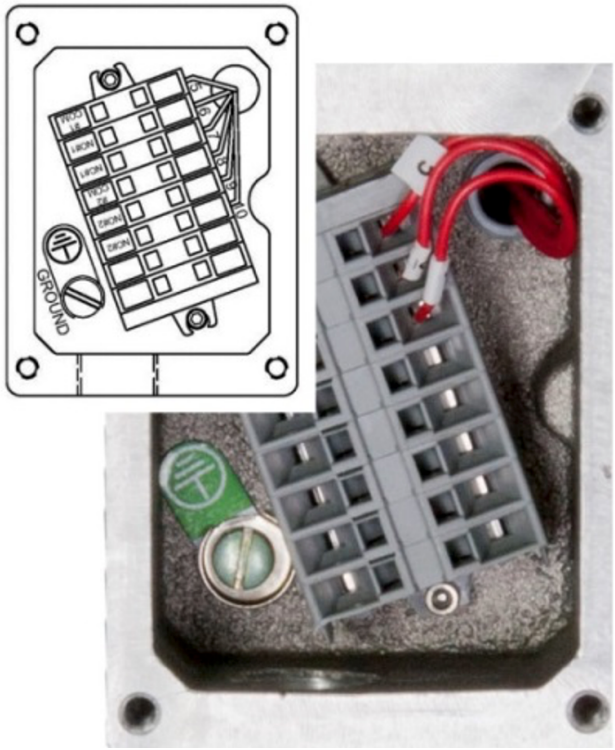



*Figure 16: Mechanical (optional) switch wiring*

## 5.1. Installation

For best results, the meters may be installed in any position as long as proper piping installation requirements are observed. This includes sufficient support of adjacent piping to minimize the system's inherent vibration. Unions of the same pipe size and full port isolation ball valves may be installed for ease of removal and servicing of equipment, if necessary.

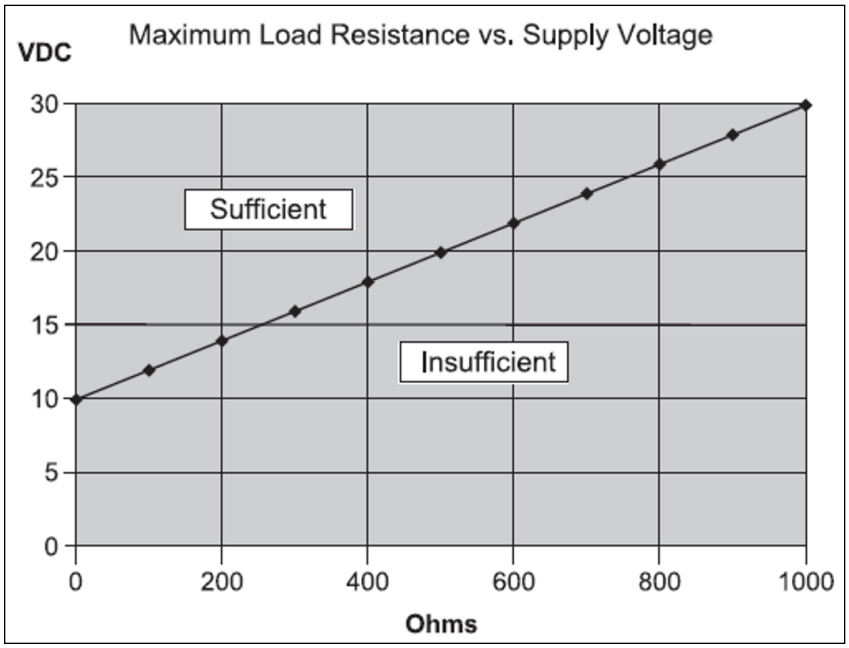



*Figure 17: Maximum load resistance vs Supply voltage*

## 5.2. Device Identification

| | | | |
|---|---|---|---|
| **Manufacturer Name:** | Universal Flow | **Model Name(s):** | ME Transmitter |
| **Manufacture ID Code:** | 24692 (6074 Hex) | **Device Type Code:** | 230 (E1EF Hex) |
| **HART Protocol Revision** | 7.0 | **Device Revision:** | 1 |
| **Number of Device Variables** | 4 | | |
| **Physical Layers Supported** | FSK | | |
| **Physical Device Category** | Transmitter, Non-DC-isolated Bus Device | | |

*Figure 18: Device identification*

## 5.3. Product Overview

The ME Transmitter is a two-wire loop-powered flow transmitter, with a 4 to 20 mA output. This transmitter uses a non-contact magnetic encoder for measuring the displacement of the shaft/pointer on standard UFM flowmeters. It is an add-on feature to PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF model flow meters as manufactured by Universal Flow Monitors, Inc. The ME Transmitter replaces the earlier models Digital Transmitters that utilized a potentiometer, providing improved accuracy while maintaining 100% compatibility. The analog output of this device is linear with flow over the working range of all supported flowmeters.

## 5.4. Process Interface

### 5.4.1. Magnetic Sensors

There are two built-in hall-effect sensors measuring the rotation of a permanent magnet that is mounted onto the flowmeter shaft. As the shaft rotates with flow, the sensors provide analog readings that are in turn converted to a digital value by and A/D converter. The digital values are then processed by the microcontroller and linearized, and subsequently converted to a scaled analog output via a D/A converter in the range of 4 to 20 mA.

### 5.4.2. Host Interface: Process Flow

The two-wire 4 to 20 mA current loop is connected to two terminals on the transmitter circuit board. Depending on the product used, one of the two configurations are offered for field wiring.

A secondary terminal strip away from the PCB (mounted in a separate compartment of the flowmeter) and is marked L+ and L-. The red wire connects the (+) terminal on the PCB to L+, and the black wire connects the (–) terminal on the PCB to L-.

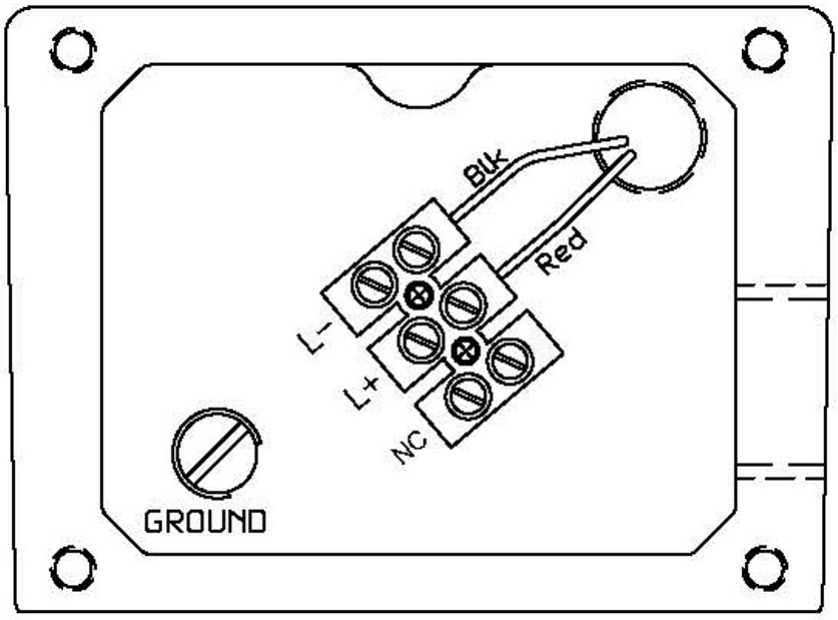



*Figure 19: PCB wiring*

This is the only output from this transmitter, representing the process flow measurement, linearized and scaled according to the configured range of the instrument. This output corresponds to the Primary Variable. HART Communication is supported on this loop.

A guaranteed linear over-range is provided. The up-scale current of 24 mA can indicate device malfunction. Current values are shown in the table below.

| | Direction | Values (percent of range) | Values (mA or V) |
|---|---|---|---|
| **Linear over-range** | Down | 0% ± 0.5% | 3.92 to 4.08 mA |
| | Up | +106.25% ± 0.1% | 20.84 mA to 21.16 mA |
| **Device malfunction indication** | Down | N/A | N/A |
| | Up | +125.0% ± 0.1% | 23.98 mA to 24.02 mA |
| **Maximum current** | | +106.25% ± 1% | 20.84 mA to 21.16 mA |
| **Multi-Drop current draw** | | | 4.0 mA |
| **Lift-off voltage** | | | 10.5 V |

## 5.5. Status Information

| Bit Mask | Definition | Conditions to set bit |
|---|---|---|
| 0x80(bit 7) | Device Malfunction | None |
| 0x40(bit 6) | Configuration Changed | Any change in device configuration |
| 0x20(bit 5) | Cold start | Set any time power is cycled |
| 0x10(bit 4) | More Status Available | Triggers when either alarm is active |
| 0x08(bit 3) | Loop Current Fixed | None |
| 0x04(bit 2) | Loop Current Saturated | Occurs when loop current reaches upper limit |
| 0x02(bit 1) | Non-Primary Variable out of limits | None |
| 0x01(bit 0) | Primary Variable Out of limits | Occurs when PV is being limited due to exceeding calibrated limitations |

When Bit 4 is set, Host should send Command 48 to determine which alarm is active.

### 5.5.1. Extended Device Status

The Field Device cannot predict, in advance, when the maintenance will be required. Extended Device Status is unused.

| Byte | Description | Data |
|---|---|---|
| 0-5 | Device Specific Status | Only Byte 0 is used |
| 6 | Extended Device Status | Bit 1 will be set when an alarm condition is active. |
| 7 | Device Operating Mode | 0 |
| 8 | Standard Status 0 | Not used |

"Not used" bits are always set to 0.

Device does not support extended device status, all device status activity is included in the device status byte.

## 5.6. Universal Commands

All Universal Commands are supported as specified in the HART Universal Command Specification.

## 5.7. Common-Practice Supported Commands

The following common-practice commands are implemented:

| | |
|---|---|
| 33 | Read Device Variables |
| 35 | Write Range Values |
| 42 | Perform Master Reset |
| 44 | Write PV Units |
| 54 | Read Device Variable Information |

In command 54 the acquisition period is unused. Values are typically updated every 100ms.

### 5.7.1. Burst Mode

This Field Device does not support Burst Mode.

### 5.7.2. Catch Device Variable

This Field Device does not support Catch Device Variable.

## 5.8. Device-Specific Commands

The following device-specific commands are implemented:

| | |
|---|---|
| 128 | Read Alarm Setpoints |
| 129 | Write Low Alarm Setpoint |
| 130 | Write High Alarm Setpoint |
| 131 | Reset Totalizer |

## 5.9. Command #129: Write Low Alarm Setpoint

Writes the Setpoint for the Low Alarm.

### 5.9.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0-3 | Float | Low Alarm Setpoint |

### 5.9.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Enum | PV Unit value |
| 1-4 | Float | Low Alarm Setpoint |

### 5.9.3. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 5.10. Command #131: Reset Totalizer

Resets the totalizer to zero.

### 5.10.1. Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| None | | |

### 5.10.2. Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| None | | |

### 5.10.3. Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1-15 | | Undefined |
| 16 | Error | Access Restricted |
| 17-31 | | Undefined |
| 32 | Error | Busy |
| 33-127 | | Undefined |

## 5.11. Performance

### 5.11.1. Sampling Rates

Typical sampling rates are shown in the following table.

| | |
|---|---|
| PV digital value calculation | 10 per second |
| SV digital value calculation | 10 per second |
| Analog output update | 10 per second |

### 5.11.2. Power-Up

The device is typically ready within 1 second of power-up. The totalizer is initialized to zero.

### 5.11.3. Reset

Command 42 (“Device Reset”) causes the device to reset its microcontroller. The resulting restart is identical to the normal power up sequence.

### 5.11.4. Self-Test

Self-Test is not supported.

### 5.11.5. Command Response Times

| | |
|---|---|
| Minimum | 20 ms |
| Typical | 50 ms |
| Maximum | 100 ms |

## 5.12. Capability Checklist

| | |
|---|---|
| Manufacturer, model and revision | Universal Flow, ME Transmitter, Rev1 |
| Device type | Transmitter |
| HART revision | 7.0 |
| Device Description available | No |
| Number and type of sensors | 2 internal |
| Number and type of actuators | 0 |
| Number and type of host side signals | 1: 4 to 20 mA analog |
| Number of Device Variables | 4 |
| Number of Dynamic Variables | 2 |
| Mappable Dynamic Variables? | No |
| Number of common-practice commands | 5 |
| Number of device-specific commands | 4 |
| Bits of additional device status | 2 |
| Alternative operating modes? | No |
| Burst mode? | No |
| Write-protection? | No |

## 6. Vane/Piston TXL

Installation and Operation Manual Series: PI, LL, LP, LH, SN, SM, SH, MN, MM, MH, SX, MX, LN, LE and XHF. Note: The TXL0 4 to 20 mA transmitter with or without the LCD and with no switches is intrinsically safe with approved barriers.*

| **LCD readout, 4 to 20 mA with 2 open collectors:** | |
|---|---|
| No switches* | TXL0 |
| One SPDT (3 wire) | TXL1 |
| One SPDT (4 wire) | TXL3 |
| One SPDT (3 wire) high temperature | TXL61 |

### 6.1. Name Plate and Product ID

This manual applies to all vane/piston meters that have the designator “TXL0, 1, 3, or 61” in the model code. This can be seen on the name plate as shown below.


*Figure 20: Name plate example*

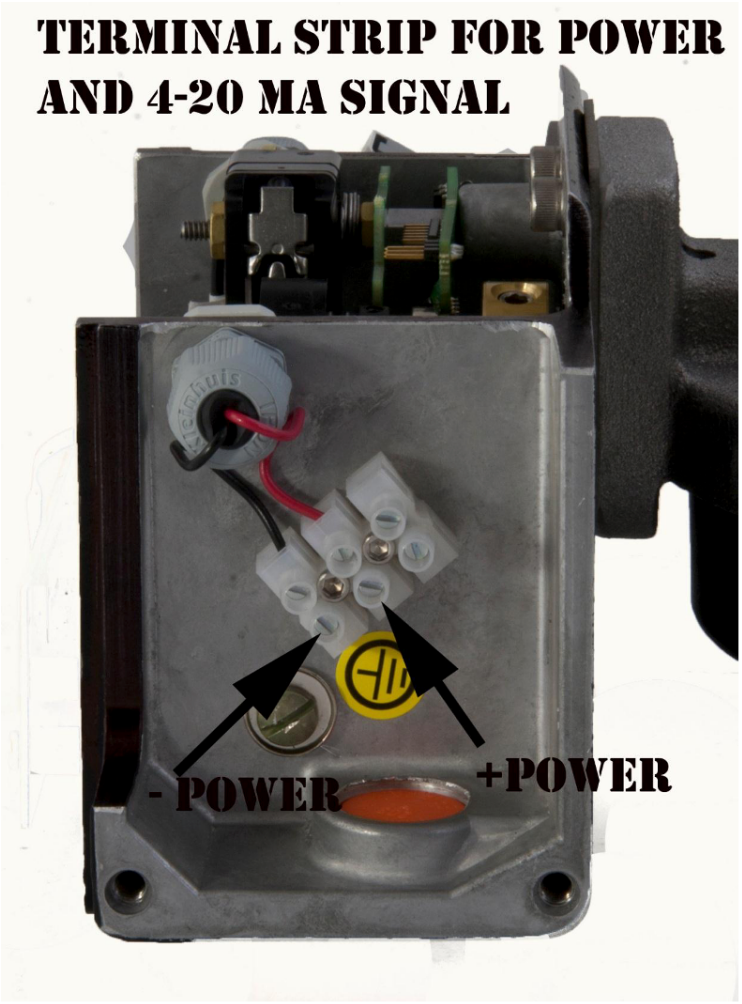



*Figure 21: Terminal strip for power and 4 to 20 mA signal*

| | |
|---|---|
| PIPING: | Screw pipe into meter with flow going into port marked "IN". |
| WIRING: | Connect switch wires and/or open collector alarm and transmitter wires to the terminal strip as shown.<br><br>Wire must be in accordance with all local and national codes. Wire size and insulation ratings should support actual loads. In all cases, wire must be, as a minimum, 20 AWG Teflon insulated rated at 600 V and 200 ˚C. It is recommended to include a disconnect switch or circuit breaker near this equipment. |
| CÂBLAGE | Le câble doit être conforme à tous les codes locaux et nationaux. Le diamètre du câble et ses niveaux d'isolation doivent pouvoir supporter des charges réelles. Dans tous les cas, le câble doit être isolé au minimum en téflon de calibre 20 AWG et d'une capacité nominale de 600 V et de 200°C. Il est recommandé d'inclure un interrupteur général ou un disjoncteur à proximité de cet équipement. |
| GROUNDING: | For protection against electrical shock in case of a fault, connect an external earth ground to the grounding screws or lugs provided inside this instrument. Such attachment points are identified with a tag or label adjacent to the grounding screw or lug with the symbol. |
| MISE À LA TERRE | Pour se protéger des chocs électriques en cas de défaut à la terre, brancher une mise à la terre externe sur les vis ou cosses de mise à la terre fournies à l'intérieur de cet instrument. De tels points de fixation sont identifiés à l'aide d'une étiquette ou d'un label adjacent à la vis ou à la cosse de mise à la terre avec le symbole. |

A typical 4 to 20 mA wiring diagram is shown below:

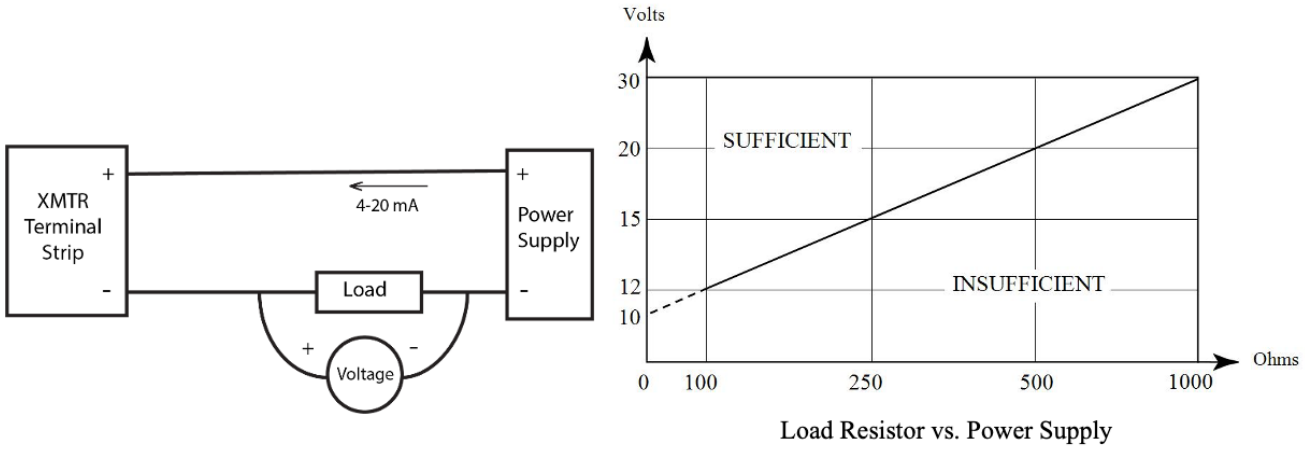



*Figure 22: 4 to 20 mA wiring diagram and load resistor vs power supply diagram*

A guaranteed linear over-range is provided. Device malfunction can be indicated by the up-scale current of 24 mA. Current values are shown in the table below.

| | Direction | Values (percent of range) | Values (mA or V) |
|---|---|---|---|
| **Linear over-range** | Down | 0% ± 0.5% | 3.92 to 4.08 mA |
| | Up | +106.25% ± 0.1% | 20.84 mA to 21.16 mA |
| **Device malfunction indication** | Down | N/A | N/A |
| | Up | +125.0% ± 0.1% | 23.98 mA to 24.02 mA |
| **Maximum current** | | +106.25% ± 1% | 20.84 mA to 21.16 mA |
| **Multi-Drop current draw** | | | 4.0 mA |
| **Lift-off voltage** | | | 10.5 V |

1. After the last digit is set, continue holding A2 until “SEt” is displayed. If you want to change the first digit again, do not hold A2. Momentarily press and release A2 and the first digit starts blinking again.

2. When finished recording the new setpoint (“SEt” is displayed), release A2.


*Figure 23: Press and release A2*

---

**Note:** Valid setpoint range is 0-100% of full-scale flow. If the alarm value is set higher than full-scale, it is clamped at full-scale upon exiting this menu.

To disable the alarm, set its value to zero.

The red ALARM 1 LED comes on when flow exceeds this setpoint. This LED is in series with the drive circuit for the high-alarm open-collector output, meaning that the output transistor is active whenever this LED is on. Some models do not have any external wiring that connects to the alarm transistor (see Model Codes).

---

In this example, the high alarm had been set for 80.0; therefore, the red LED was activated when flow reached 80.1.

The LED turns off when flow < (setpoint – hysteresis). Hysteresis is 5% of full-scale.


*Figure 24: LED activation example*

## 6.2. Set Low Flow Alarm


*Figure 25: Set Low Flow alarm*

1. Press A2 until “LFLo” is displayed, then release A2.

## 7. Device Dimension Drawings

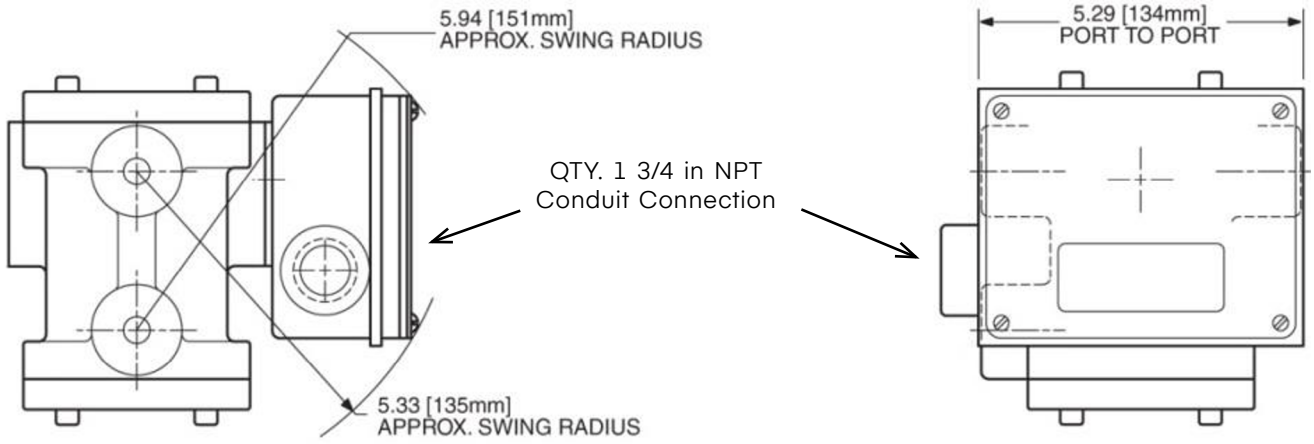



*Figure 26: Vane/Piston H0 - Transmitter with HART PI, LL, LP, and LH dimensions*

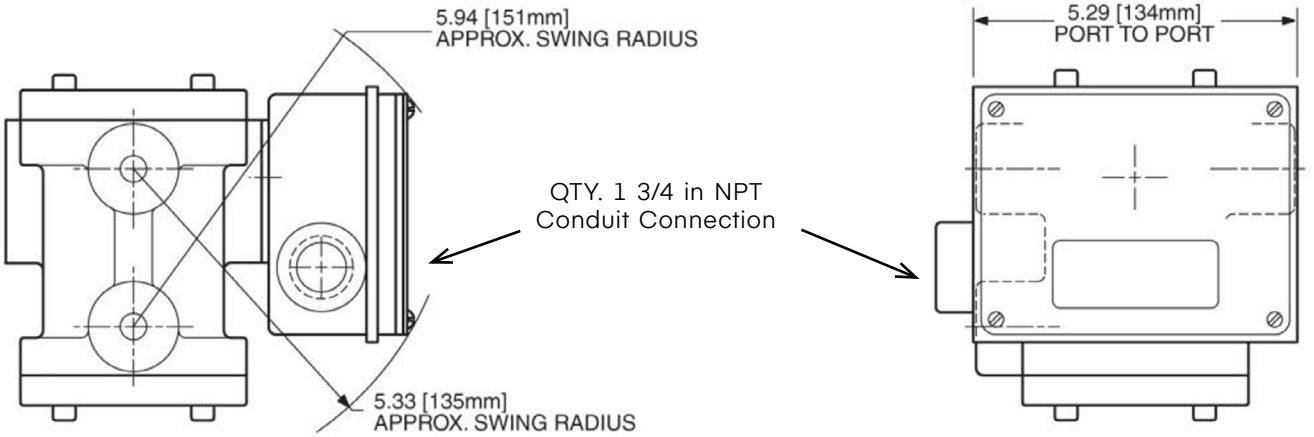



*Figure 27: Vane/Piston - XØ Transmitter PI, LL, LP, and LH dimensions*

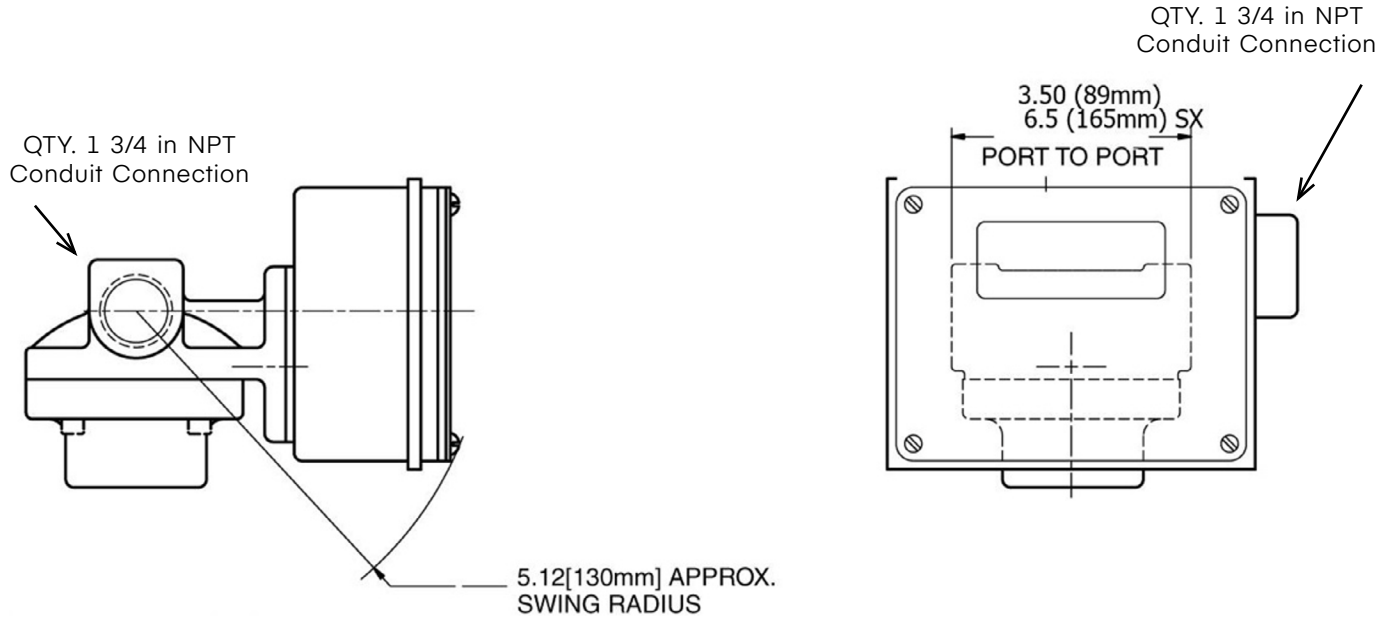



*Figure 28: Vane/Piston - XØ Transmitter SX, SN, SM, and SH dimensions*

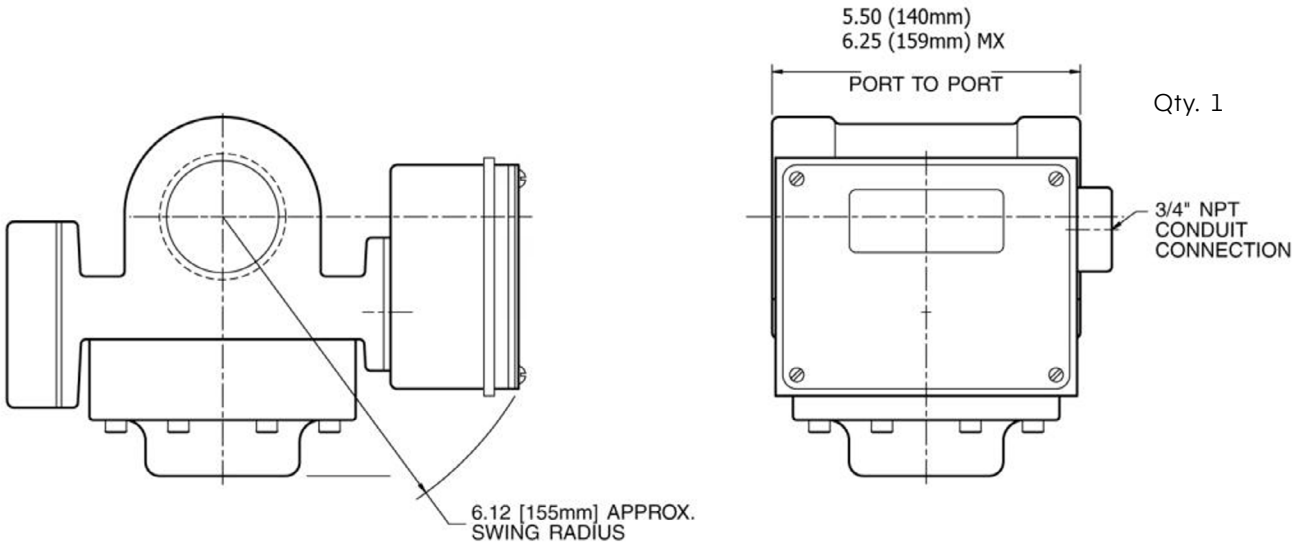



*Figure 29: Vane/Piston - XØ Transmitter MN, MM, MH, and MX dimensions*

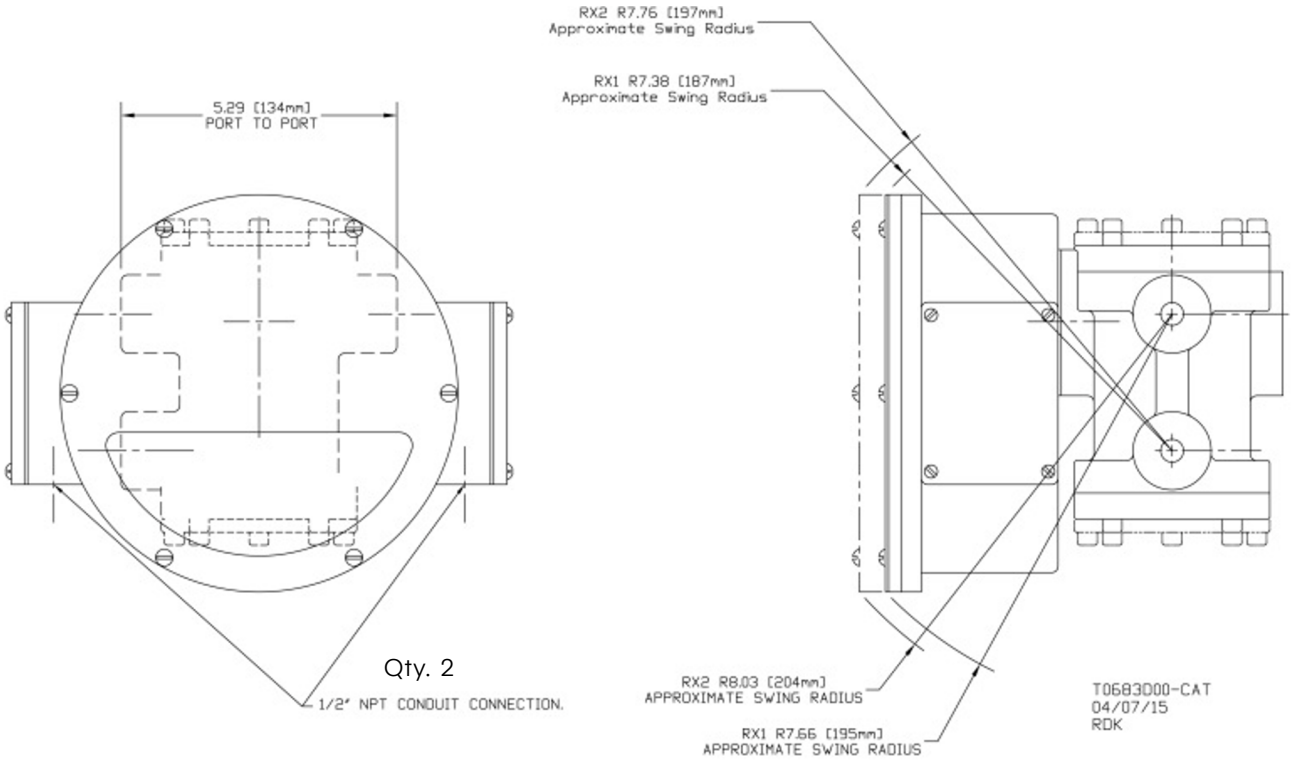



*Figure 30: Vane/Piston RX/RH PI, LL, LP, and LH dimensions*

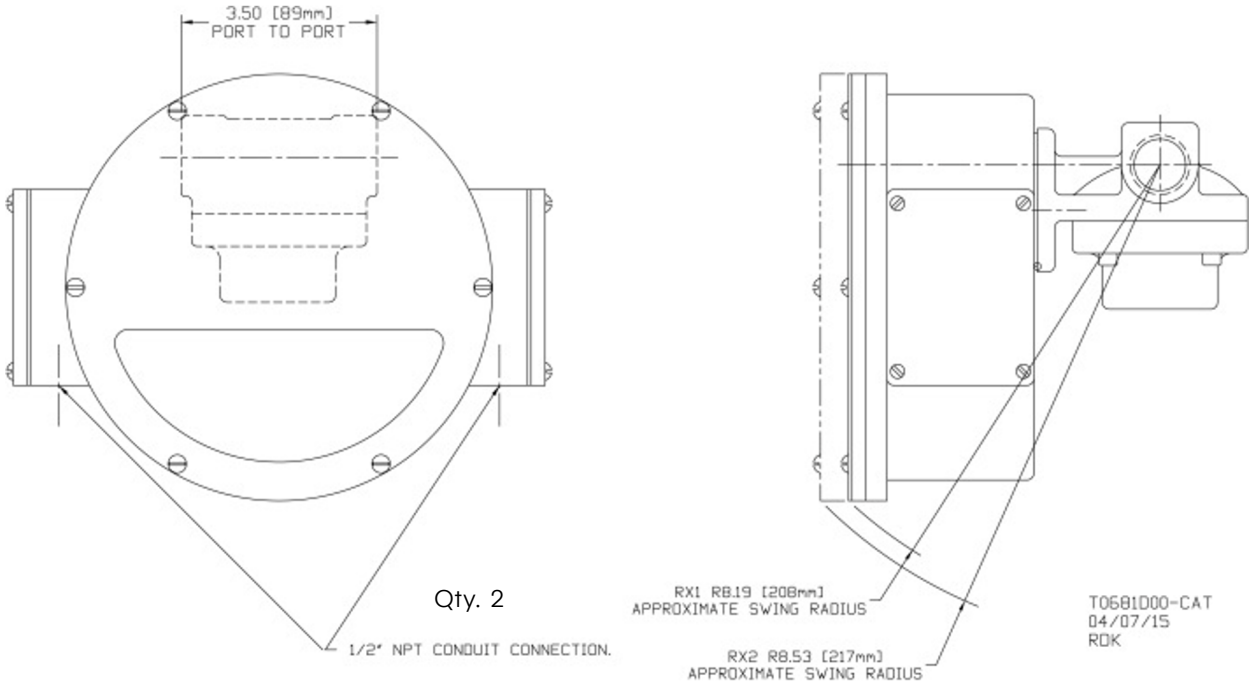



*Figure 31: Vane/Piston RX/RH SX, SN, SM, and SH dimensions*

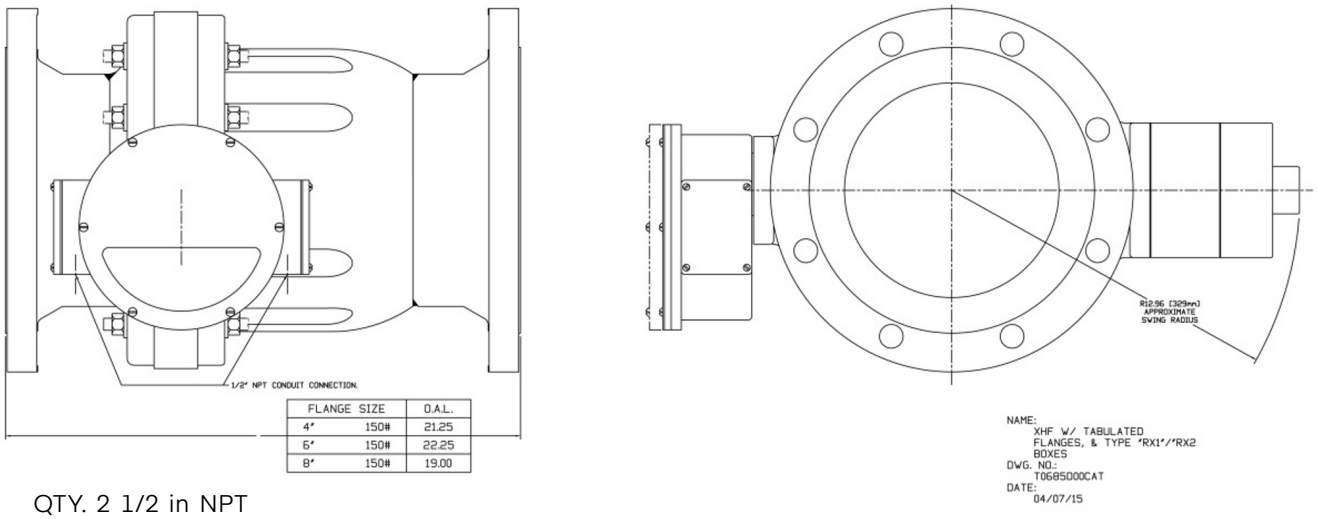



*Figure 32: Vane/Piston RX/RH XHF dimensions*

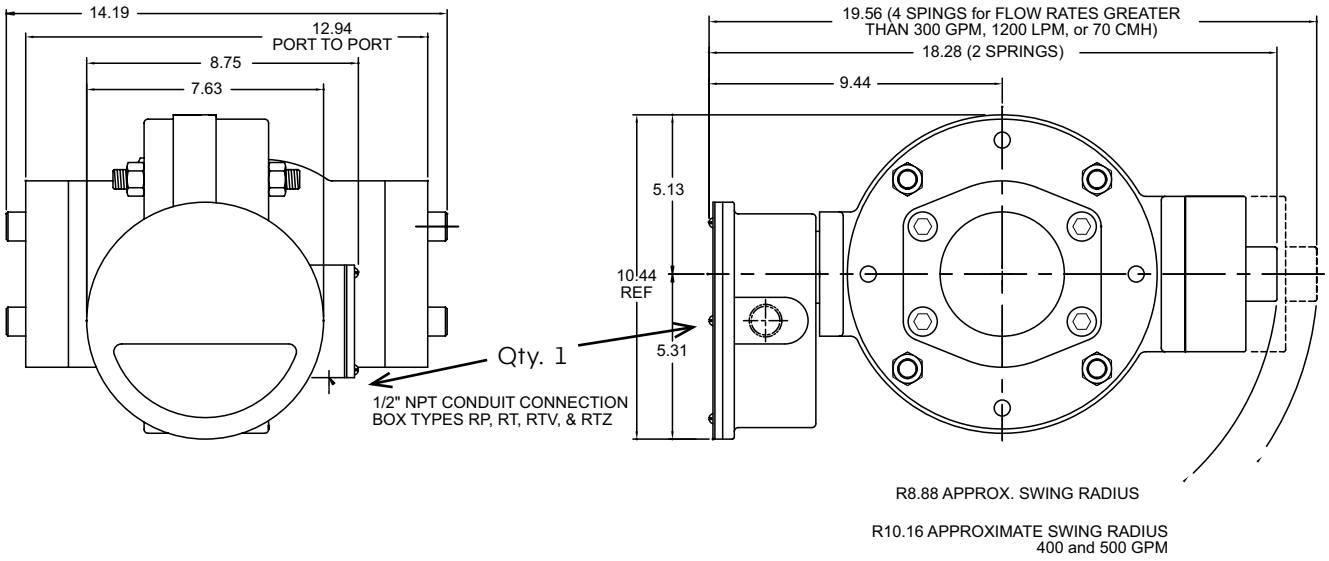



*Figure 33: Vane/Piston RX/RH LE and LN dimensions*

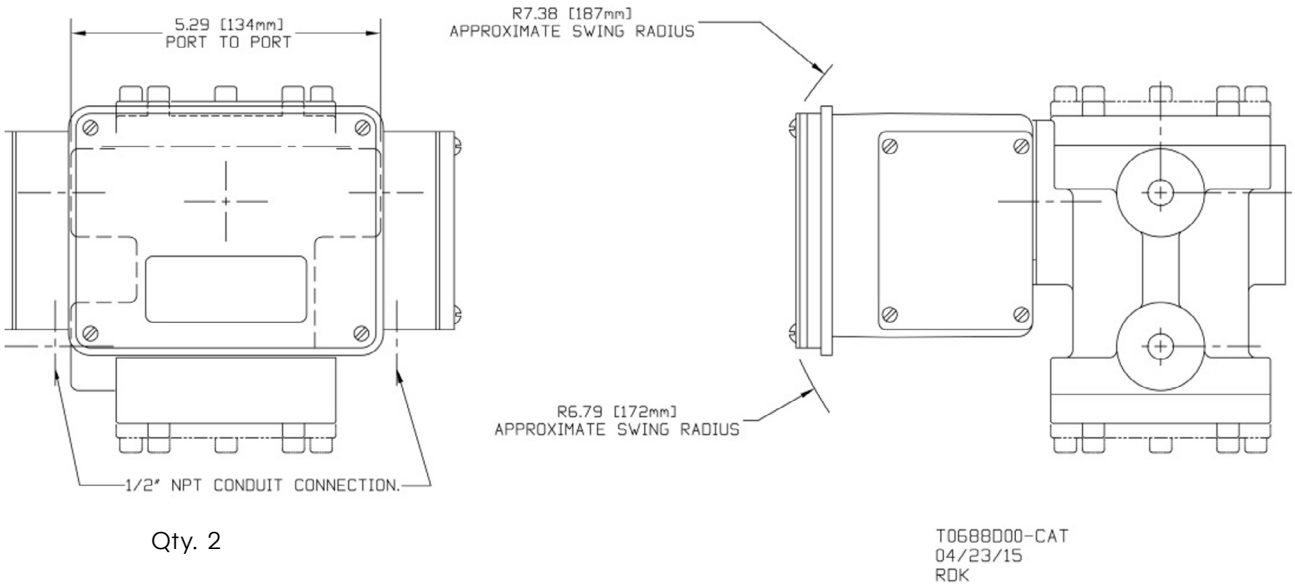



*Figure 34: Vane/Piston - TX Transmitter / TH Transmitter with HART LL, LP, and LH dimensions*

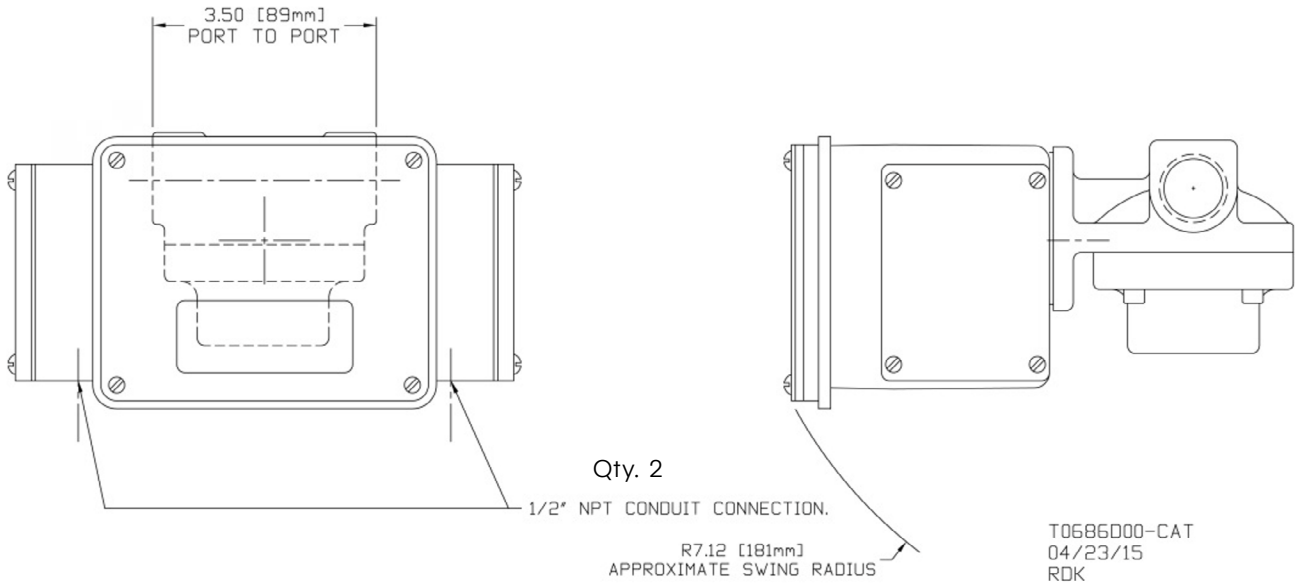



*Figure 35: Vane/Piston - TX Transmitter / TH Transmitter with HART SX, SN, SM, and SH dimensions*

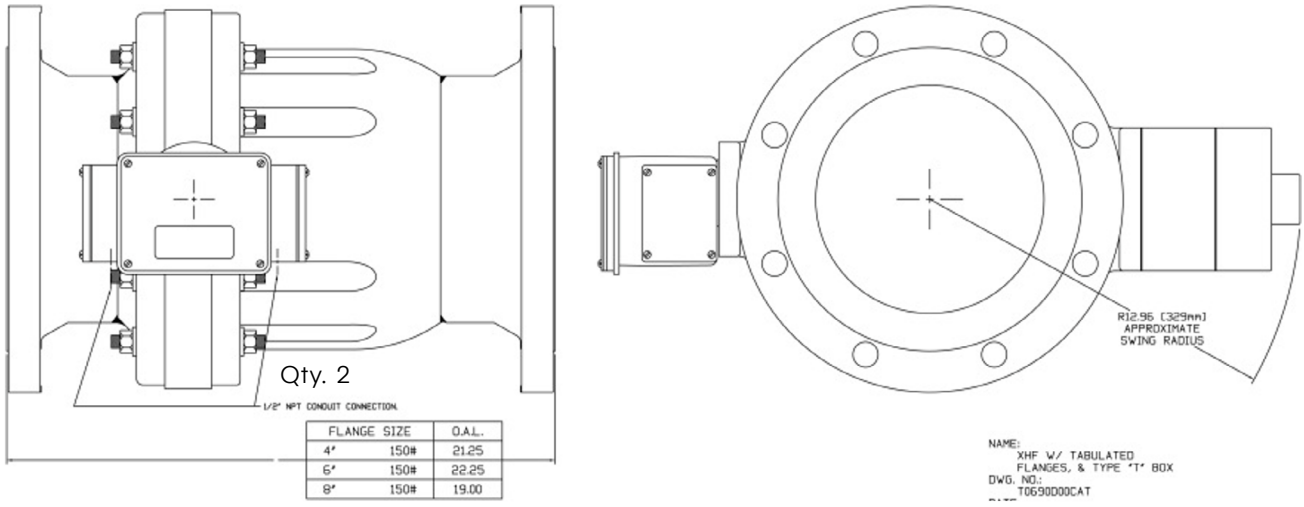



*Figure 36: Vane/Piston - TX Transmitter / TH Transmitter with HART XHF dimensions*

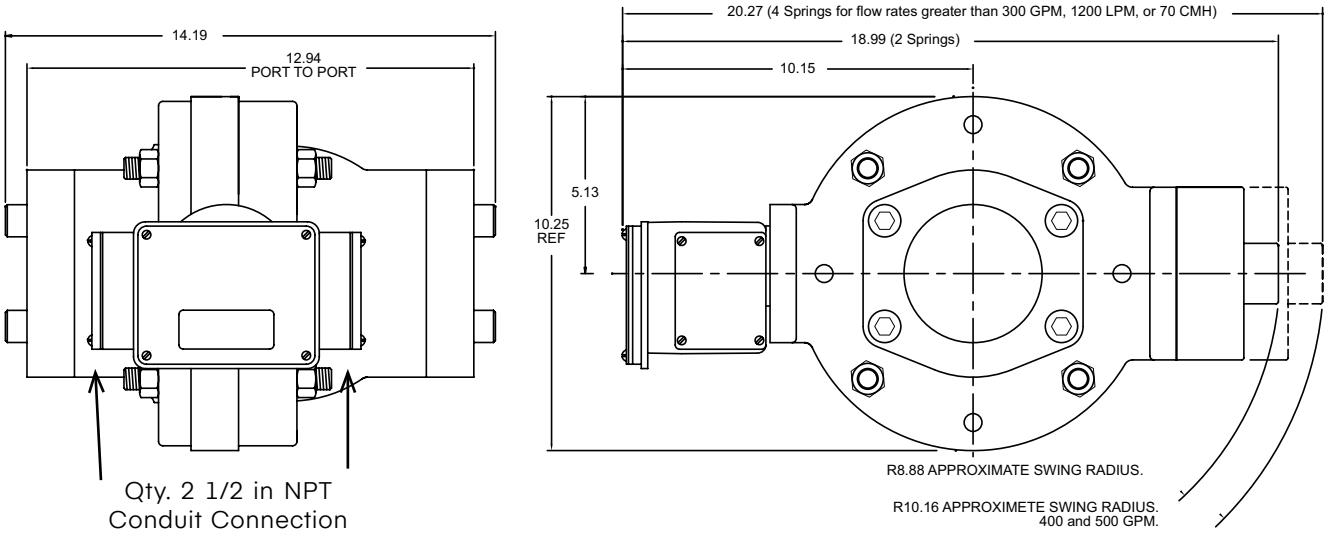



*Figure 37: Vane/Piston TX/TH LE and LN dimensions*

## 8. Compliance and Certifications

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note:

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.

CAN ICES-003(A) / NMB-003(A)

This Class A digital apparatus complies with Canadian ICES-003

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada

Due to the sensitive nature of the product, errors may be encountered in the presence of high frequency electro-magnetic fields.

If it suspected this equipment has errors due to electro-magnetic field interference, the user is encouraged to correct the interference by one or more of the following measures:

- Reorient or relocate the electro-magnetic field transmitter. Sources include: Cell phones, Wi-Fi Routers or business radios.

- Use shielded wires on the 4 to 20 mA cables.

- Contact UFM costumer support for help.

**Regulatory Declarations**

**National Recognized Test Laboratory Listing:**

ETL Control Number 5029638

ETL Test Standards:

Ordinary Location Test Standards:

UL 61010-1:2012 Ed. 3+R:19Jul2019

CSAC22.2#61010-1-12 Ed. 3+U1; U2; A1; U3

HAZLOC Test Standards:

UL 1203:2023 Ed6+R:30May2024

UL 61010-1:2012 Ed. 3+R:19Jul2019

CSA C22.2#61010-1-12 Ed. 3+U1; U2; A1; U3

CSA C22.2 No. 25:2017 Ed. 4

CSA C22.2 N0. 30:2020 Ed. 4

Intrinsically Safe Test Standards:

• Explosive Atmospheres – Part 0: Equipment – General Requirements [UL 60079-

0:2019 Ed.7+R:15Apr2020]

• Explosive Atmospheres - Part 11: Equipment Protection by Intrinsic Safety "i" [UL

60079-11:2013 Ed.6+R:25Jan2023]

• Explosive Atmospheres — Part 0: Equipment — General Requirements [CSA

C22.2#60079-0:2019 Ed.4]

• Explosive Atmospheres - Part 11: Equipment Protection by Intrinsic Safety "i"

(R2018) [CSA C22.2#60079-11:2014 Ed.2]

**CE**

The Low Voltage Directive (LVD) 2014/35/EU

EN 61010-1 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

Pressure Equipment Directive (PED) 2014/68/EU - PED CATEGORY 2 LIQUIDS ONLY

Complies with ISO 19879 Metallic tube connections for fluid power and general use- Test methods for hydraulic fluid power connections

Electromagnetic Compatibility Directive (EMC) 2014/30/EU

EN 61326-1 - Electrical equipment for measurement, control and laboratory use - EMC requirements -

Part 1: General requirements

EN 55011 - Industrial, scientific and medical equipment. Radio-frequency disturbance characteristics.

Limits and methods of measurement IEC

CISPR 16 - Specification for radio disturbance and immunity measuring apparatus and methods - Part

1-1: Radio disturbance and immunity measuring apparatus

RoHS 2011/65/EU - RoHS Annex II 2015/863 Directive

EN IEC 63000 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

WEEE 2012/19/EU

**Specifications**

**PI**

Maximum Working Pressure: (3:1 safety factor) 500 PSI (34.48 BAR) or 1500 PSI (103.42 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Maximum Ambient Temperature: 150 °F (65 °C)
Pressure Drop: 5 PSI (0.35 BAR) at full scale
Readout Accuracy at Full Scale: ±2 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/4 | 2 | 4T | 4BP | 4BT | 5 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 10 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |
| | 1 | 8 | 16T | 16BP | 16BT | 30 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 4 = 1/2 in | | | 300 | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**LL**

Maximum Working Pressure with plastic cap: (3:1 safety factor): 150 PSI (10.34 BAR)
Maximum Working Pressure with metal cap: (3:1 safety factor): 300 PSI (20.69 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (148 °C & 204 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)
Pressure Drop: 5 PSI (0.35 BAR) at full scale
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/8 | 1 | 2T | 2BP | 2BT | 2 |
| | 1/4 | 2 | 4T | 4BP | 4BT | 5 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 10 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 15 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**LP**

Maximum Working Pressure : (2:1 safety factor): 500 PSI (34.48 BAR)
Maximum Fluid Temperature: 200 °F (93° C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (148 °C & 204 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)
Pressure Drop: 5 PSI (0.35 BAR) at full scale
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/8 | 1 | 2T | 2BP | 2BT | 2 |
| | 1/4 | 2 | 4T | 4BP | 4BT | 5 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 10 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 15 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**LH**

Maximum Working Pressure: (2:1 safety factor): 1500 PSI (103.45 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (148 °C & 204 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)
Pressure Drop: 5 PSI (0.35 BAR) at full scale
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/8 | 1 | 2T | 2BP | 2BT | 2 |
| | 1/4 | 2 | 4T | 4BP | 4BT | 5 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 10 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 15 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**SN**

Maximum Working Pressure (3:1 safety factor): 300 PSI (20.69 BAR
Maximum Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (150 °C & 205 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:
Maximum flow ranges to 8 GPM/32 LPM = pressure drop from 1.9 to 2.5 PSID (2.2 PSID average).
Maximum flow ranges to 9 to 12 GPM/45 LPM = pressure drop from 1.9 to 4 PSID (2.95 PSID average).
Maximum flow ranges to 15 GPM/56 LPM = pressure drop from 1.9 to 5 PSID (3.5 PSID average).
Maximum flow ranges to 16 GPM/60 LPM = pressure drop from 1.9 to 5.5 PSID (3.7 PSID average).
Maximum flow ranges to 20 GPM/75 LPM = pressure drop from 1.9 to 6 PSID (4.0 PSID average)
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/4 | 2 | 4T | 4BP | 4BT | 8 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 8 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 12 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**SM**

Maximum Working Pressure (2:1 safety factor): 500 PSI (34.48 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:
Maximum flow range 8 GPM/32 LPM = pressure drop from 1.9 to 2.5 PSID (2.2 PSID average).
Maximum flow range 9 to 12 GPM/45 LPM = pressure drop from 1.9 to 4 PSID (2.95 PSID average).
Maximum flow ranges to 15 GPM/56 LPM = pressure drop from 1.9 to 5 PSID (3.5 PSID average).
Maximum flow ranges to 16 GPM/60 LPM = pressure drop from 1.9 to 5.5 PSID (3.7 PSID average).
Maximum flow ranges to 20 GPM/75 LPM = pressure drop from 1.9 to 6 PSID (4.0 PSID average)
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/4 | 2 | 4T | 4BP | 4BT | 8 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 8 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 12 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**SH**

Maximum Working Pressure: (3:1 safety factor): 2000 PSI (137.93 BAR)
Maximum Working Pressure Stainless Steel with special option Z67SH: 1500 PSI (103.42 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:
Maximum flow ranges to 8 GPM/32 LPM = pressure drop from 1.9 to 2.5 PSID (2.2 PSID average).
Maximum flow ranges to 9 to 12 GPM/45 LPM = pressure drop from 1.9 to 4 PSID (2.95 PSID average).
Maximum flow ranges to 15 GPM/56 LPM = pressure drop from 1.9 to 5 PSID (3.5 PSID average).
Maximum flow ranges to 16 GPM/60 LPM = pressure drop from 1.9 to 5.5 PSID (3.7 PSID average).
Maximum flow ranges to 20 GPM/75 LPM = pressure drop from 1.9 to 6 PSID (4.0 PSID average)
Readout Accuracy at Full Scale: ±5 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/4 | 2 | 4T | 4BP | 4BT | 8 |
| | 3/8 | 3 | 6T | 6BP | 6BT | 8 |
| | 1/2 | 4 | 8T | 8BP | 8BT | 12 |
| | 5/8 | | 10T | 10BP | 10BT | 15 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 20 |

**Flanged**

Ex: 2FWCS150RF = 1/4 in, Welded, Carbon steel, Class 150, Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 2 = 1/4 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 3 = 3/8 in | FT = Threaded | S = 316 Stainless | 300 | |
| 4 = 1/2 in | | | | |
| 6 = 3/4 in | | | | |
| 8 = 1 in | | | | |

**MN**

Maximum Working Pressure (3:1 safety factor): 300 PSI (20.69 BAR)
Maximum Fluid Temperature: 200°F (93°C)
Optional Max. Fluid Temperatures: 300 & 400°F (150 & 205°C) (option HT)
Maximum Ambient Temperature: 150°F (65°C)

Pressure Drop:
Maximum flow range to 80 GPM/300 LPM = pressure drop from 1.9 to 3.8 PSID.

| Max Flow Rate (GPM/LPM) | BYPASS ONLY | | DUAL SPRING* | |
|---|---|---|---|---|
| | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI |
| 90/340 | 20/75 | 4.5 | 10/40 | 6.0 |
| 100/380 | 30/100 | 4.5 | 10/50 | 6.0 |
| 110/400 | 30/100 | 5.0 | 20/90 | 6.8 |
| 120/450 | 40/150 | 5.8 | 20/90 | 6.8 |
| 130/500 | 40/150 | 5.8 | 20/90 | 6.8 |
| 140/550 | 50/170 | 6.5 | 20/90 | 6.8 |
| 150/570 | 50/170 | 6.5 | 30/100 | 6.8 |
| 160/600 | 50/170 | 6.5 | 30/100 | 7.5 |

*When dual-spring is ordered you must specify special option DS. Some dual-spring units also have partial bypass to achieve high flow ranges

Readout Accuracy at Full Scale: ±2 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/2 | 4 | 8T | 8BP | 8BT | 25 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 50 |
| | 1 | 8 | 16T | 16BP | 16BT | 70 |
| | 1 1/4 | 10 | 20T | 20BP | 20BT | 70 |
| | 1 1/2 | 12 | 24T | 24BP | 24BT | 100 |
| | 2 | 16 | | 32BP | 32BT | 160 |

**Flanged**

Ex: 4FTCS150RF = 1/2 in threaded, Carbon Steel, Class 150, Raised Face flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 4 = 1/2 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 6 = 3/4 in | FT = Threaded | S = 316 Stainless | 300 | |
| 8 = 1 in | | | | |
| 10 = 1 1/4 in | | | | |
| 12 = 1 1/2 in | | | | |
| 16 = 2 in | | | | |

Note: Manual Override Option (E) is required (by UFM manufacturing) on welded medium vane meters.

**MM**

Maximum Working Pressure (3:1 safety factor): 500 PSI (34.48 BAR)
Maximum Fluid Temperature: 200°F (93°C)
Optional Max. Fluid Temperatures: 300 & 400°F (150 & 205°C) (option HT)
Maximum Ambient Temperature: 150°F (65°C) Pressure Drop:
Maximum flow range to 80 GPM/300 LPM = pressure drop from 1.9 to 3.8 PSID

| Max Flow Rate (GPM/LPM) | BYPASS ONLY | | DUAL SPRING* | |
|---|---|---|---|---|
| | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI |
| 90/340 | 20/75 | 4.5 | 10/40 | 6.0 |
| 100/380 | 30/100 | 4.5 | 10/50 | 6.0 |
| 110/400 | 30/100 | 5.0 | 20/90 | 6.8 |
| 120/450 | 40/150 | 5.8 | 20/90 | 6.8 |
| 130/500 | 40/150 | 5.8 | 20/90 | 6.8 |
| 140/550 | 50/170 | 6.5 | 20/90 | 6.8 |
| 150/570 | 50/170 | 6.5 | 30/100 | 6.8 |
| 160/600 | 50/170 | 6.5 | 30/100 | 7.5 |

*When dual-spring is ordered you must specify special option DS. Some dual-spring units also have partial bypass to achieve high flow ranges

Readout Accuracy at Full Scale: ±2 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/2 | 4 | 8T | 8BP | 8BT | 25 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 50 |
| | 1 | 8 | 16T | 16BP | 16BT | 70 |
| | 1 1/4 | 10 | 20T | 20BP | 20BT | 70 |
| | 1 1/2 | 12 | 24T | 24BP | 24BT | 100 |
| | 2 | 16 | | 32BP | 32BT | 160 |

**Flanged**

Ex: 4FTCS150RF = 1/2 in threaded, Carbon Steel, Class 150, Raised Face flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 4 = 1/2 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 6 = 3/4 in | FT = Threaded | S = 316 Stainless | 300 | |
| 8 = 1 in | | | | |
| 10 = 1 1/4 in | | | | |
| 12 = 1 1/2 in | | | | |
| 16 = 2 in | | | | |

Note: Manual Override Option (E) is required (by UFM manufacturing) on welded medium vane meters.

**MH**

Maximum Working Pressure (3:1 safety factor): 2,000 PSI (137.93 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (150 °C & 205 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:
Maximum flow range to 80 GPM/300 LPM = pressure drop from 1.9 to 3.8 PSID

| Max Flow Rate (GPM/LPM) | BYPASS ONLY | | DUAL SPRING* | |
|---|---|---|---|---|
| | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI |
| 90/340 | 20/75 | 4.5 | 10/40 | 6.0 |
| 100/380 | 30/100 | 4.5 | 10/50 | 6.0 |
| 110/400 | 30/100 | 5.0 | 20/90 | 6.8 |
| 120/450 | 40/150 | 5.8 | 20/90 | 6.8 |
| 130/500 | 40/150 | 5.8 | 20/90 | 6.8 |
| 140/550 | 50/170 | 6.5 | 20/90 | 6.8 |
| 150/570 | 50/170 | 6.5 | 30/100 | 6.8 |
| 160/600 | 50/170 | 6.5 | 30/100 | 7.5 |

*When dual-spring is ordered you must specify special option DS. Some dual-spring units also have partial bypass to achieve high flow ranges

Readout Accuracy at Full Scale: ±2 %

**Threaded Attachment**

| | Pipe Size in Inches | NPT Female | SAE | BSPP | BSPT | Max Flow in GPM |
|---|---|---|---|---|---|---|
| Pipe size and attachment method | 1/2 | 4 | 8T | 8BP | 8BT | 25 |
| | 3/4 | 6 | 12T | 12BP | 12BT | 50 |
| | 1 | 8 | 16T | 16BP | 16BT | 70 |
| | 1 1/4 | 10 | 20T | 20BP | 20BT | 70 |
| | 1 1/2 | 12 | 24T | 24BP | 24BT | 100 |
| | 2 | 16 | | 32BP | 32BT | 160 |

**Flanged**

Ex: 4FTCS150RF = 1/2 in threaded, Carbon Steel, Class 150, Raised Face flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 4 = 1/2 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 6 = 3/4 in | FT = Threaded | S = 316 Stainless | 300 | |
| 8 = 1 in | | | | |
| 10 = 1 1/4 in | | | | |
| 12 = 1 1/2 in | | | | |
| 16 = 2 in | | | | |

Note: Manual Override Option (E) is required (by UFM manufacturing) on welded medium vane meters.

**SX**

Maximum Working Pressure PVC housing: 100 PSI (6.90 BAR)
Maximum Working Pressure Polysulfone housing: 200 PSI (13.79 BAR
Maximum Fluid Temperature PVC housing: 100°F (38°C)
Maximum Fluid Temperature Polysulfone housing: 200°F (95°C)
Maximum Ambient Temperature: 130°F (55°C)

Pressure Drop:

Maximum flow ranges to 8 GPM/32 LPM = pressure drop from 1.9 to 2.5 PSID (2.2 PSID average).
Maximum flow ranges to 9 to 12 GPM/45 LPM = pressure drop from 1.9 to 4 PSID (2.95 PSID average).
Maximum flow ranges to 15 GPM/56 LPM = pressure drop from 1.9 to 5 PSID (3.5 PSID average).
Maximum flow ranges to 16 GPM/60 LPM = pressure drop from 1.9 to 5.5 PSID (3.7 PSID average).
Maximum flow ranges to 20 GPM/75 LPM = pressure drop from 1.9 to 6 PSID (4.0 PSID average).

Readout Accuracy at Full Scale: ±5

**Porting**

| **Port Adapter** | | | | | |
|---|---|---|---|---|---|
| **NPT** | | **Max Flow** | **Plastic*** | **Plastic*** | **316 S.S.** |
| **Inches** | **mm** | **(gpm)** | **Male** | **Female** | **Female** |
| 1/4 | 6.350 | 8 | 2MP | 2FP | - |
| 1/2 | 12.70 | 10 | 4MP | 4FP | 4FS |
| 3/4 | 19.05 | 10 | 6MP | 6FP | 6FS |
| 1 | 25.40 | 20 | 8MP | - | - |

*Material will be same as housing

**Van Stone Pipe Flange**

| **Inches** | **Flanged Max Flow** | **Plastic (PVC only)** |
|---|---|---|
| 1/2 | 10 | 4R |
| 1 | 20 | 8R |

**MX**

Maximum Working Pressure PVC housing: 100 PSI (6.90 BAR)
Maximum Working Pressure Polysulfone housing: 200 PSI (13.79 BAR
Maximum Fluid Temperature PVC housing: 100°F (38°C) : 200°F (93°C)
Maximum Fluid Temperature Polysulfone housing: 200°F (95°C)
Maximum Ambient Temperature: 130°F (54°C)

Pressure Drop:

Maximum flow range to 80 GPM/300 LPM = pressure drop from 1.9 to 3.8 PSID

| Max Flow Rate (GPM/LPM) | BYPASS ONLY | | DUAL SPRING* | |
|---|---|---|---|---|
| | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI | Min. Flow Rate (GPM/LPM) | Max. Press. Drop PSI |
| 90/340 | 20/75 | 4.5 | 10/40 | 6.0 |
| 100/380 | 30/100 | 4.5 | 10/50 | 6.0 |
| 110/400 | 30/100 | 5.0 | 20/90 | 6.8 |
| 120/450 | 40/150 | 5.8 | 20/90 | 6.8 |
| 130/500 | 40/150 | 5.8 | 20/90 | 6.8 |
| 140/550 | 50/170 | 6.5 | 20/90 | 6.8 |
| 150/570 | 50/170 | 6.5 | 30/100 | 6.8 |
| 160/600 | 50/170 | 6.5 | 30/100 | 7.5 |

*When dual-spring is ordered you must specify special option DS. Some dual-spring units also have partial bypass to achieve high flow ranges

Readout Accuracy at Full Scale: ±2%

**Port Connection**

| NPT (Female adapters) | | | | |
|---|---|---|---|---|
| 316 stainless steel | 1 | 25.40 | 70 | = 8I |
| | 1 1/2 | 38.10 | 100 | = 12I |
| Titanium | 1 | 25.40 | 70 | = 8T |
| | 1 1/2 | 38.10 | 100 | = 12T |
| Monel | 1 | 25.40 | 70 | = 8L |
| | 1 1/2 | 38.10 | 100 | = 12L |
| *PVC | 1 | 25.40 | 70 | = 8V |
| | 1 1/2 | 38.10 | 100 | = 12V |
| *Polysulfone | 1 | 25.40 | 70 | = 8P |
| | 1 1/2 | 38.10 | 100 | = 12P |

*Material will be same as housing; Adapter O-ring will be same as static seal material

**LN**

Maximum Working Pressure (3:1 safety factor): 300 PSI (20.69 BAR)
Maximum Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperatures: 300 °F & 400 °F (150 °C & 205 °C) (option HT)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:
LN meters with maximum flows to 300 GPM (1200 LPM) impose a pressure drop that increases with flow from 1.9 to 3.8 PSI (avg. 2.2). LN meters with flows greater than 400 GPM have a maximum pressure drop of 5.5 PSI.

Readout Accuracy at Full Scale: ±2 %

**Port Connection**

| Inches | mm | Threaded SAE-Style Flanges (NPT) | Socket-Weld SAE-Style Flanges (Pipe) | Max. Flow | |
|---|---|---|---|---|---|
| | | | | (GPM) | (LPM) |
| 1-1/2 | 38.10 | = 12 | = 12W | 100 | 378 |
| 2 | 50.80 | = 16 | = 16W | 150 | 567 |
| 2-1/2 | 63.50 | = 20 | = 20W | 300 | 1134 |
| 3 | 76.20 | = 24 | = 24W | 400 | 1512 |
| 4 | 101.6 | = 32 | = 32W | 500 | 1890 |

Flanges are steel; stainless steel units have stainless stell flanges. ANSI flanges also available.

**Flanged**

Ex: 24FTCS150RF = 3 in Threaded, Carbon Steel Class 150 Raised Face Flange

| Pipe Size in Inches | Attachment | Material | Class | Style |
|---|---|---|---|---|
| 12 = 1 1/2 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 16 = 2 in | FT = Threaded | S = 316 Stainless | 300 | |
| 20 = 2 1/2 in | | | | |
| 24 = 3 in | | | | |
| 32 = 4 in | | | | |

**LE**

Maximum Working Pressure (2:1 safety factor): 500 PSI (34.48 BAR)
Maximum Fluid Temperature: 200°F (93°C)
Optional Max. Fluid Temperatures: 300 & 400°F (150 & 205°C) (option HT)
Maximum Ambient Temperature: 150°F (65°C)

Pressure Drop:

LE meters with maximum flows to 300 GPM (1200 LPM) impose a pressure drop that increases with flow from 1.9 to 3.8 PSI (avg. 2.2).
LE meters with flows greater than 400 GPM have a maximum pressure drop of 5.5 PSI.
Readout Accuracy at Full Scale: ±2

**Port Connection**

| Inches | mm | Threaded SAE-Style Flanges (NPT) | Socket-Weld SAE-Style Flanges (Pipe) | Max. Flow | |
|---|---|---|---|---|---|
| | | | | (GPM) | (LPM) |
| 1-1/2 | 38.10 | = 12 | = 12W | 100 | 378 |
| 2 | 50.80 | = 16 | = 16W | 150 | 567 |
| 2-1/2 | 63.50 | = 20 | = 20W | 300 | 1134 |
| 3 | 76.20 | = 24 | = 24W | 400 | 1512 |
| 4 | 101.6 | = 32 | = 32W | 500 | 1890 |
| Flanges are steel; stainless steel units have stainless stell flanges. ANSI flanges also available. | | | | | |

**Flanged**

| Ex: 24FTCS150RF = 3 in Threaded, Carbon Steel Class 150 Raised Face Flange | | | | |
|---|---|---|---|---|
| **Pipe Size in Inches** | **Attachment** | **Material** | **Class** | **Style** |
| 12 = 1 1/2 in | FW = Welded | CS = Carbon Steel | 150 | RF = ANSI raised face |
| 16 = 2 in | FT = Threaded | S = 316 Stainless | 300 | |
| 20 = 2 1/2 in | | | | |
| 24 = 3 in | | | | |
| 32 = 4 in | | | | |

**XHF**

Maximum Working Pressure (3:1 safety factor): 300 PSI (20.69 BAR)
Maximum Working Pressure for CE mark: 150 PSI (10.3 BAR) Maximum
Fluid Temperature: 200 °F (93 °C)
Optional Max. Fluid Temperature: 400 °F (205 °C)
Maximum Ambient Temperature: 150 °F (65 °C)

Pressure Drop:

Units with max flow of 800 GPM or less have a max pressure drop of 3.8 PSI. All others have maximum pressure drop of 5.5 PSI.
Readout Accuracy at Full Scale: ±2 %

**Port Connection**

| 150-lb ANSI Weld-Neck Flanges | | | | |
|---|---|---|---|---|
| Size | | Max. Flow | | Symbol |
| Inches | mm | (GPM) | (LPM) | |
| 4 | 101.6 | 600 | 2271 | 32W |
| 6 | 152.4 | 1000 | 3785 | 48W |
| 8 | 203.2 | 1500 | 5677 | 64W |

**HAZARDOUS LOCATION SPECIFICATIONS:**

R7, R17, R18 and R19 Enclosure options only.

WARNING: ELECTRICAL HAZARD - DISCONNECT POWER BEFORE REMOVING COVER -

This instrument was made for a specific use stated at time of order. Any other use may cause injury.

Read instructions before using.

AVETRTISSEMENT: RISQUE ELECTRIQUE -
DEBRANCHEZ L'ALIMENTATION AVANT DE RETIRER LE COUVERCLE. -
Cet instruments a ete fabrique pour l'usage specifique indique au moment de la commande.
Toute autre utilisation peut causer des blessures. Lisez les instructions avant de l'utiliser.

For use in:

Class I, Division 1 & Division 2, Groups A, B, C and D T4;
Class II, Division 1, Groups E, F and G, T4
-20 °C ≤ Tamb ≤ +40 °C

**INTRINSICALLY SAFE SPECIFICATIONS:**

ETL Listing number: 5029638X

Class I, Division 1, Groups A, B, C and D T3C
Class II, Division 1, Groups E, F and G, T160°C
Class III Division 1, T160°C
Class I, Zone 0, AEx ia IIC T3C Ga
Zone 20, AEx ia IIIC T160°C Da
Ex ia IIC T3C Ga
Ex ia IIIC T160° Da
- 20 °C ≤ Ta ≤ +40 °C

**Note:** Do not modify this Intrinsically Safe product. Any modifications will negate the Intrinsically Safe NRTL listing.
Model Code Designations for 4 to 20 mA transmitter (Intrinsically Safe with approved barriers)
AX0, ZX0, TX0, and RX0.
Ambient Temperature range -20 °C to 40 °C
Remove from service if moisture is condensing in the inside of the lens.
Return to factory for servicing.

Specific Conditions of Use:
Equipment is intended for fixed Installation.
Potential Electrostatic Charging Hazard:

WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD
Caution must be used when handling or cleaning products so there is no static charge buildup. Do not wipe off the equipment with dry cloth. Use only water damp cloth and allow to air dry for cleaning device. Do not use or install in high charge areas. See IEC 60079-32-1 for further information.

AVERTISSEMENT - RISQUE DE CHARGE ÉLECTROSTATIQUE POTENTIEL

Il faut faire preuve de prudence lors de la manipulation ou du nettoyage des produits afin d'éviter toute accumulation de charge statique.

N'essuyez pas l'équipement avec un chiffon sec. Utilisez uniquement un chiffon humide et laissez sécher à l'air libre pour nettoyer l'appareil. Ne pas utiliser ou installer dans des zones à charge élevée. Voir la CEI 60079-

32-1 pour plus d'informations.

The product has a maximum capacitance 40.56pF in excess of 3pF on flow body and may pose electrostatic charging hazard.
All metal parts of product must be connected to ground through < 1GΩ impedance or the user must determine the suitability for the specific application.
The equipment contains metallic material Alumimium, the user shall determine the suitability of the equipment for the particular application, for example, to avoid an ignition hazard due to impact or friction.
- For L, T and R box, the equipment contains metallic material Alumimium, the user shall determine the suitability of the equipment for the particular application, for example, to avoid an ignition hazard due to impact or friction.
- For A box, the product has a maximum capacitance 40.56pF in excess of 3pF on flow body and may pose electrostatic charging hazard. All metal parts of product must be connected to ground through < 1GΩ impedance or the user must determine the suitability for the specific application.

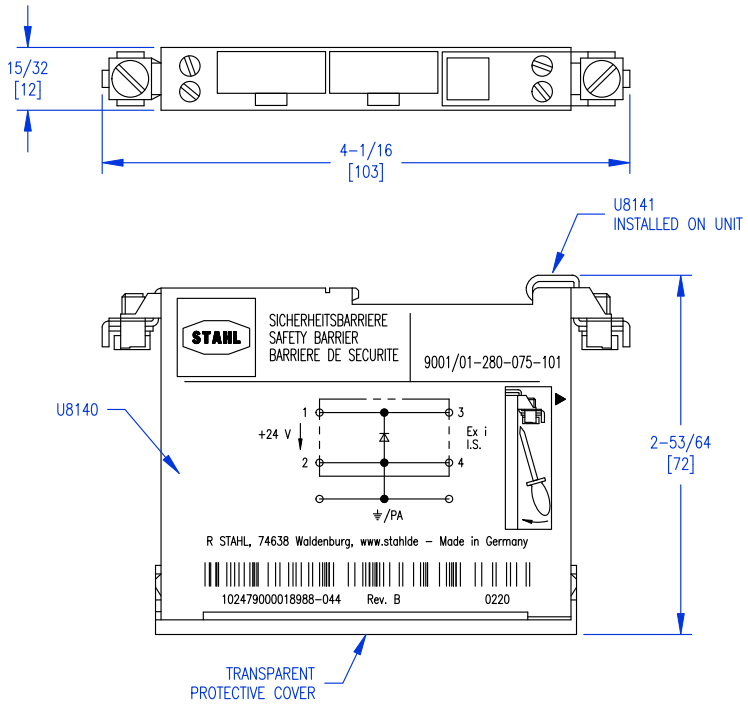
Intended installation environment for equipment:
Outdoor IP 64 for the A Box
Ambient Pollution Degree 4
Overvoltage Category 2

| FR NO | VENDOR NO | DESCRIPTION |
|---|---|---|
| U8140 | 9001/01-280-075-101 | INTRINSICALLY SAFE BARRIER |
| U8141 | 9002/001-750 | SURFACE MOUNTING ADAPTER |

NOTES:
1. DWYER INSTRUMENTS, LLC TO BE USED IN CONJUNCTION WITH VENDOR IDENTIFICATION ON ALL PRINTED MATERIALS.
2. UNIT TO BE SUPPLIED TO DWYER INSTRUMENTS, LLC AS FOLLOWS:

| QTY | DESCRIPTION |
|---|---|
| 1 | UNIT |
| 1 | INSTRUCTION BULLETIN (SUPPLIED BY VENDOR) AS SHOWN. |
| 1 | PROTECTIVE SEALED BAG (SUPPLIED BY VENDOR) |
| 1 | CARTON (SUPPLIED BY VENDOR) |

SPECIFICATIONS
NUMBER OF CHANNELS: 1
DC RATED OPERATIONAL VOLTAGE: 24 V
POWER SUPPLY: CONTROLLED, NOMINAL VOLTAGE
NOMINAL VOLTAGE: 24 V
MAXIMUM RESISTANCE Rmax: 262 Ω
MINIMUM RESISTANCE Rmin: 415 Ω
MAXIMUM OUTPUT CURRENT Imax: 51 mA
POTENTIAL: POSITIVE POTENTIAL
Uo: 28 V
Io: 75 mA
Po: 525 mW
Co (IIC): 0.083 µF
Co (IIB): 0.65 µF
Lo (IIC): 3.3 mH
Lo (IIB): 21 mH
AGENCY APPROVALS: UL, CSA, FM, ATEX PTB 01 ATEX 2088 X, IECEx IECEx PTB 09.0001X




APPROVED VENDOR:
STAHL

| NO. | CHANGES | BY/DATE |
|---|---|---|
| | | |

DATE 08-04-23
DWN BY KAS
CHKD
APPD

NAME SAFETY BARRIER MOUNTING

CD = CRITICAL DIMENSION
SCALE 1:1
SHEET 1 OF 1
WEIGHT/VOLUME
TOLERANCES DECIMAL ± .005 ANGLE ± 1° INCHES [mm]
THIRD ANGLE

DWYER INSTRUMENTS, LLC.
MICHIGAN CITY, INDIANA 46360 U.S.A.
MATERIAL
FINISH
PART NO. U8140, U8141

UNIVERSAL
FLOW MONITORS
a DwyerOmega brand

dwyeromega.com



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