UNIVERSAL
FLOW MONITORS
a DwyerOmega brand

USER'S GUIDE

UFM Vane/Piston Consolidated User's Manual

Dwyer Instruments, LLC

dwyer-inst.com/en/contact-us

Toll-Free:
1-800-872-9141 (USA only)

Telephone:
(219) 879-8000

Fax:
(219) 872-9057

Email: info@dwyermail.com

UFM ® **UNIVERSAL FLOW MONITORS**
a **DwyerOmega** brand

Table of Contents

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 (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

Figure 1: Name Plate example

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

A, L, Z General Vane / Piston Switch Manual

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 Model Code Designator: 1 or 2	SPDT – (3 wire) (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
UFM P/N-986CE Model Code Designator: 1B or 2B	SPDT – (3 wire) 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
UFM P/N-702 Model Code Designator: 61 or 62	SPDT – 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
UFM P/N-808 Model Code Designator: 71 or 72	SPDT – Gold Contact	15 A – 125 V AC, 250 V AC, 480 V AC; HP – 125 V AC, ¼ HP – 250 V AC
UFM P/N-703 Model Code Designator: 3 or 4	SPDT – (4 wire) 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

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.

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

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.
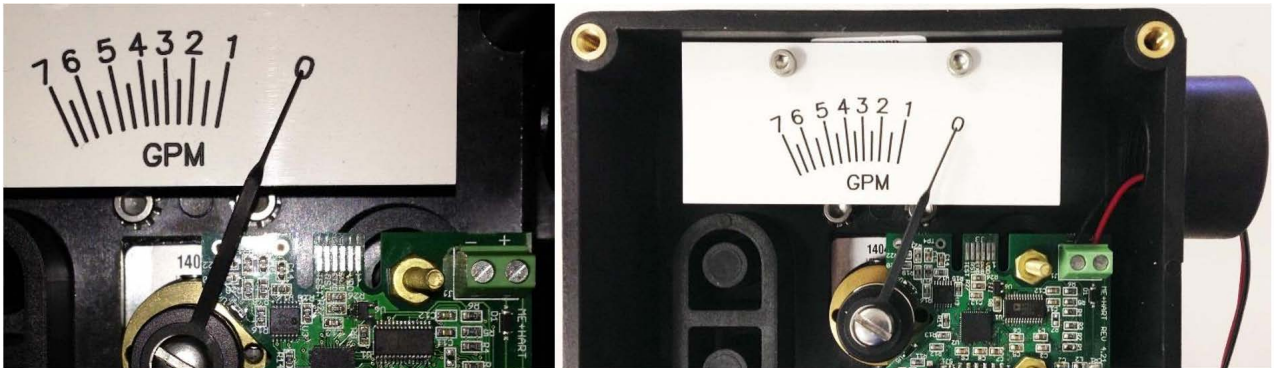
Figure 5: PCB Polarity wiring

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 (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

3.1. Nameplates and Product ID

This manual 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.
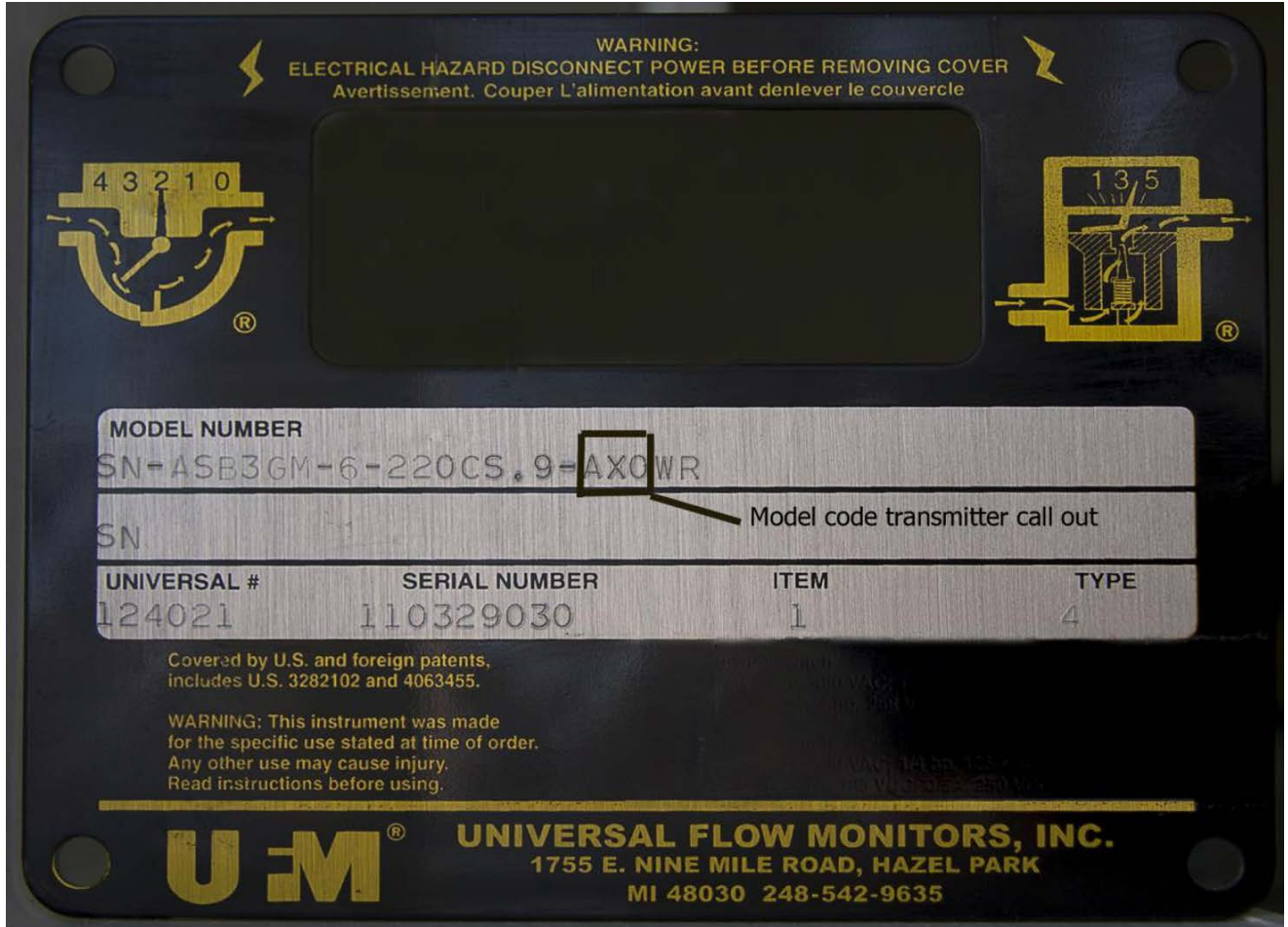

Figure 6: Name plate and Product ID

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
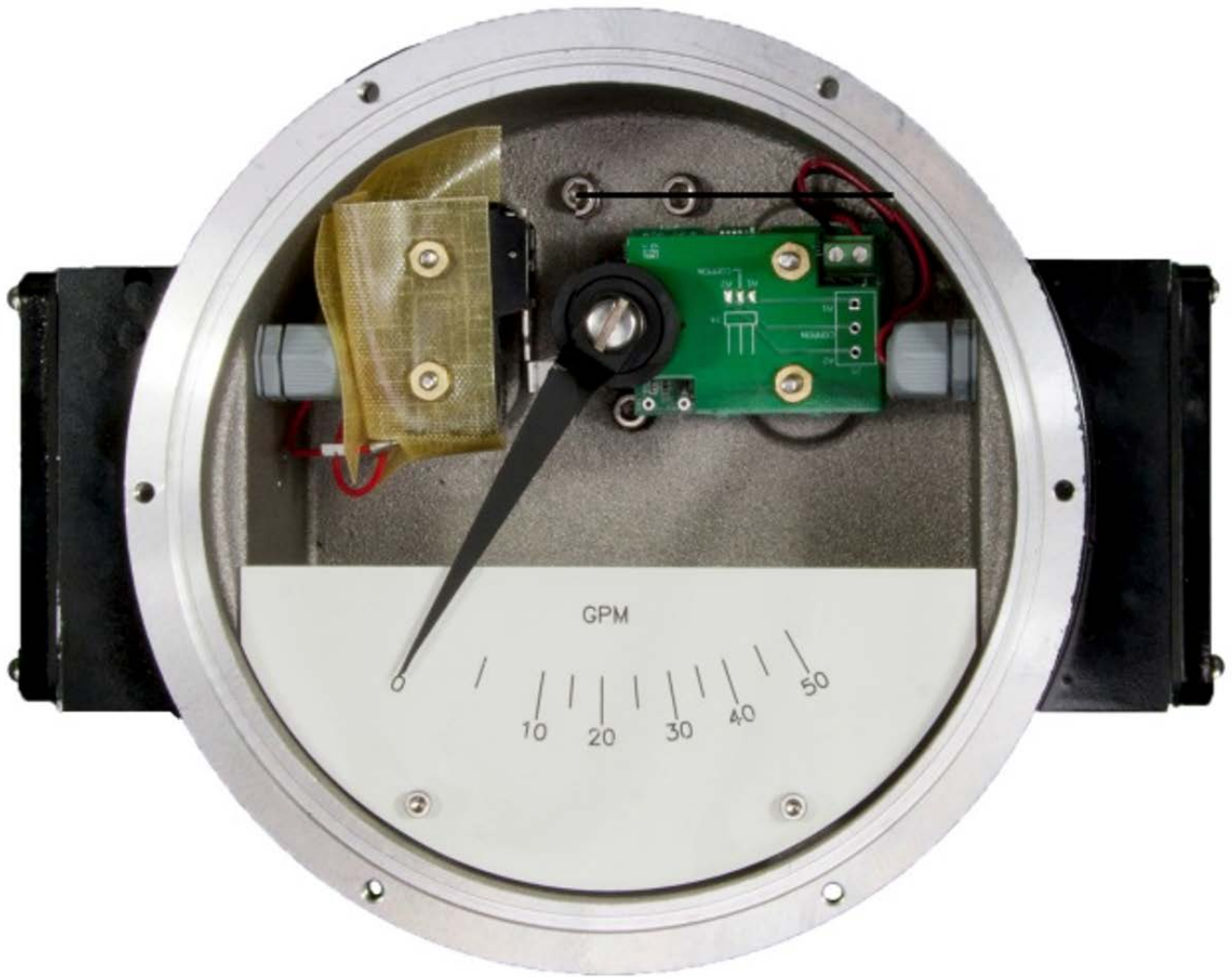
Figure 7: R Box shown open with optional mechanical switch
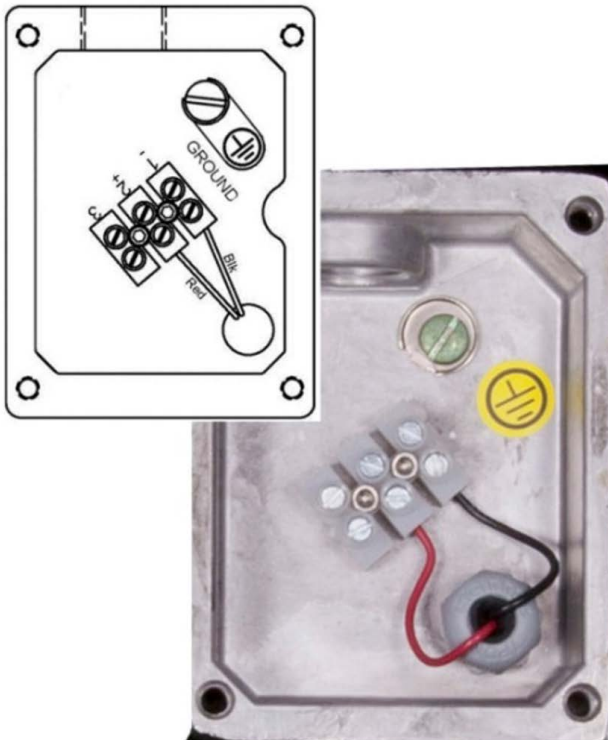
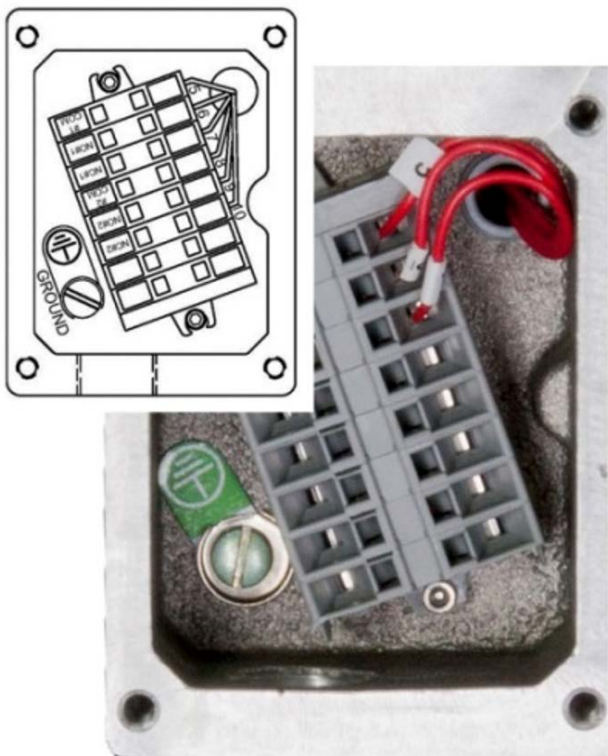*Figure 8: Transmitter wiring with or without HART*

Figure 9: Mechanical (optional) switch wiring

4.1. 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.
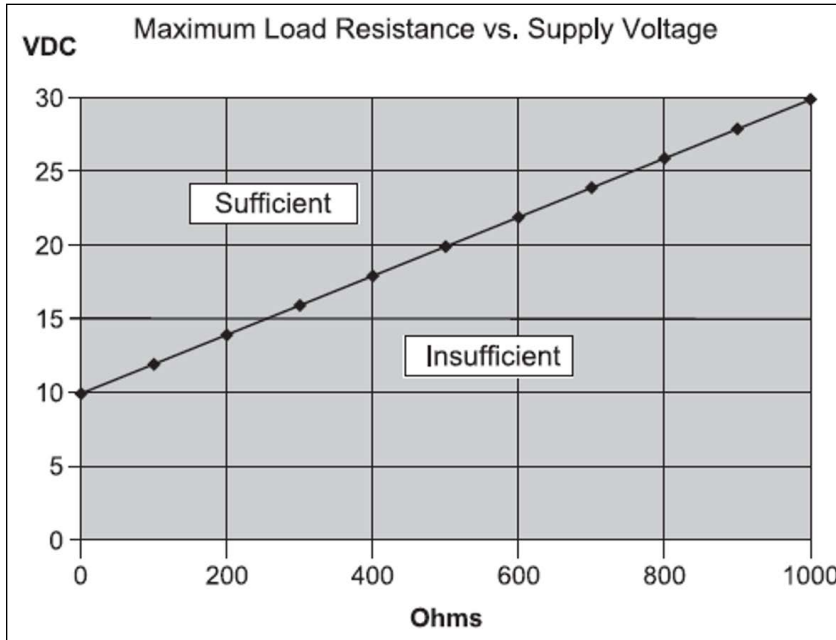
Figure 10: Maximum load vs Supply voltage graph

4.2. 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.

4.3. 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

4.4. 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.

4.5. Process Interface

4.5.1. 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.

4.5.2. 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-.
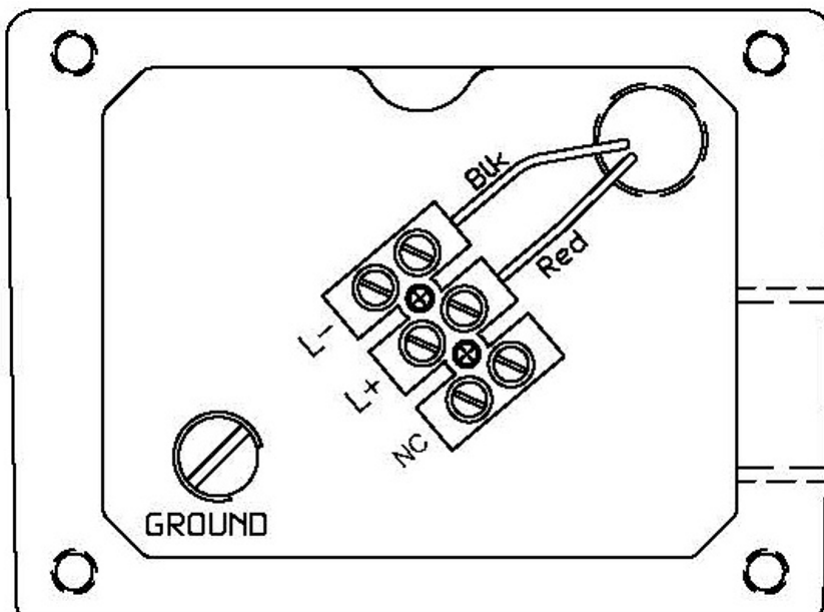

Figure 12: PCB wiring

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

4.6.   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.

4.6.1.   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.

4.7. Universal Commands

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

4.8. 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.

4.8.1. 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

4.9. Command #130: Write High Alarm Setpoint

Writes the setpoint for the High Alarm.

4.9.1. Request Data Bytes

Byte	Format	Description
0-3	Float	High Alarm Setpoint

4.9.2. Response Data Bytes

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

4.9.3. 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

4.10. Tables

4.10.1. 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)

4.10.2. 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

4.11. Performance

4.11.1. Busy and Delayed-Response

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

4.11.2. Long Messages

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

4.11.3. Non-Volatile Memory

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

4.11.4. Modes

Fixed current mode is not implemented.

4.11.5. Write Protection

Write-protection is not implemented.

4.11.6. Damping

Damping is not implemented.

4.12. 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. 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.
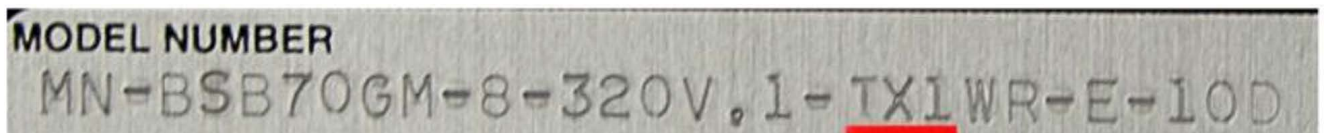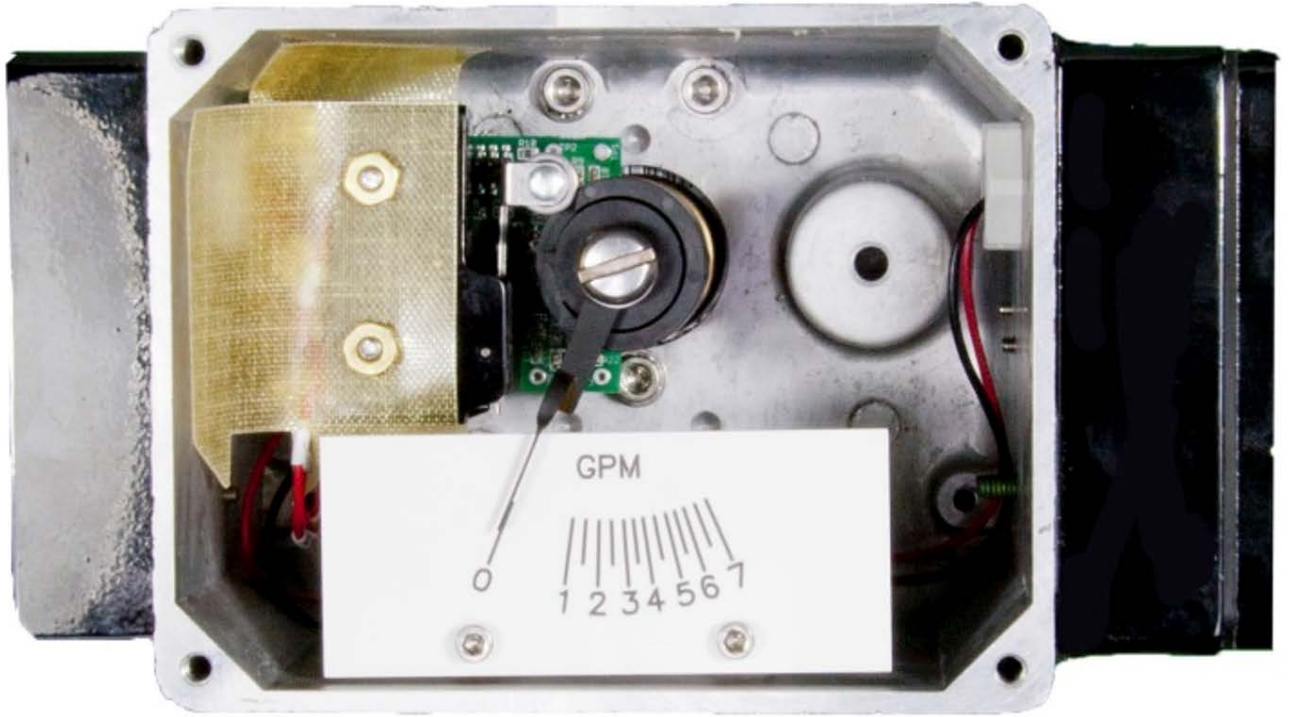

Figure 13: Name plate and Product ID

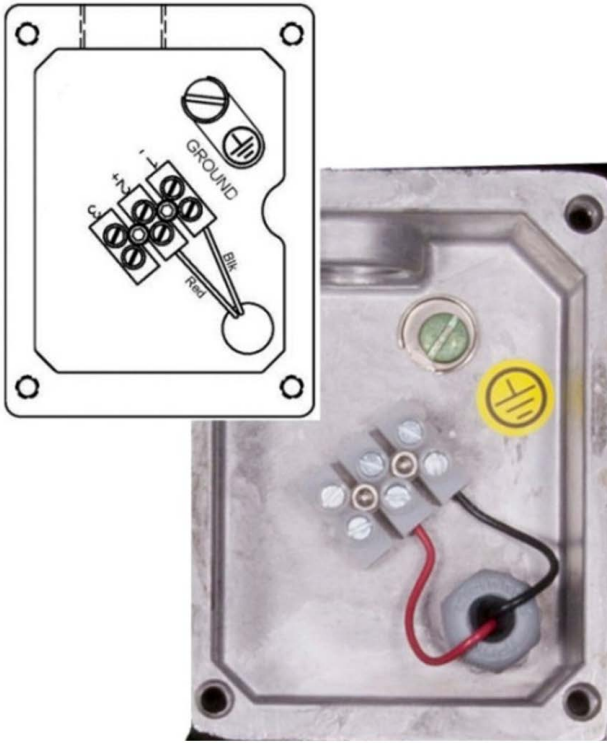*Figure 14: T Box with optional switch and transmitter*

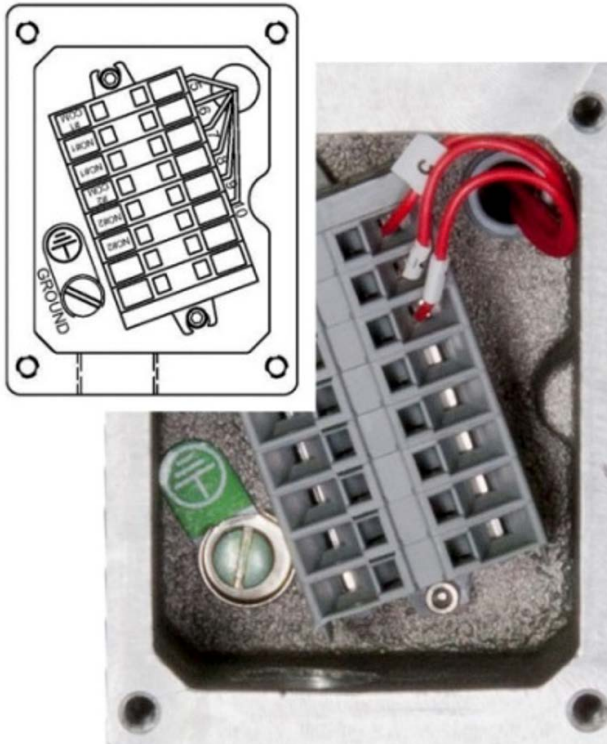*Figure 15: Transmitter wiring with out without HART*

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.
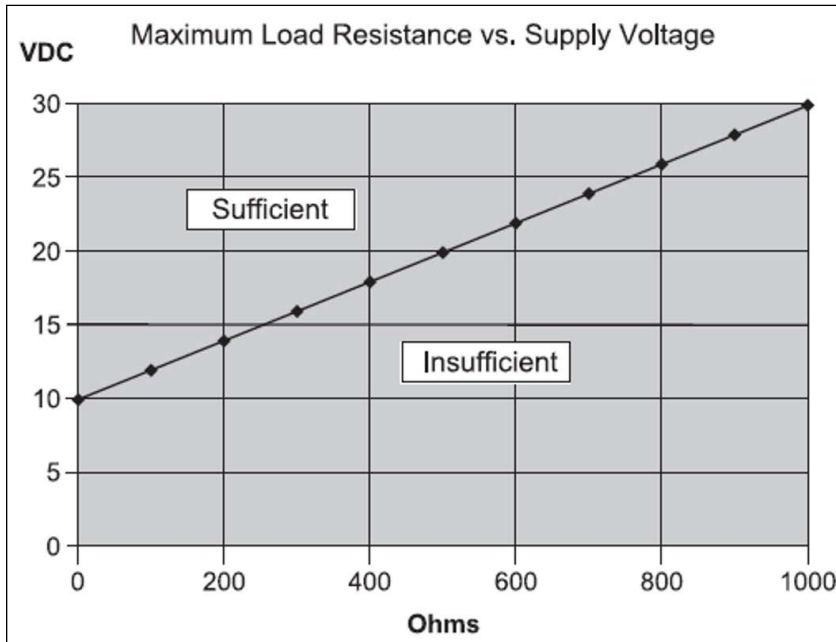

Figure 17: Maximum load resistance vs Supply voltage

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-.
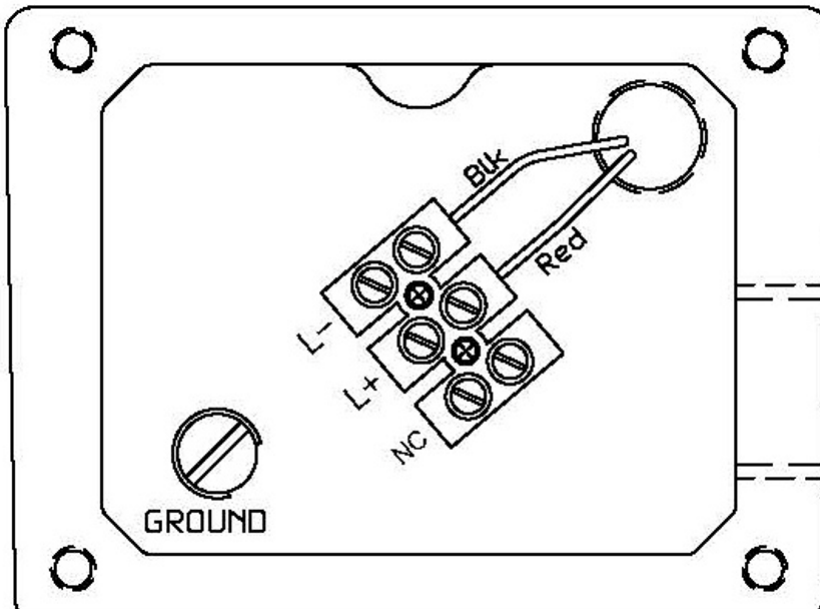

Figure 19: PCB wiring

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.
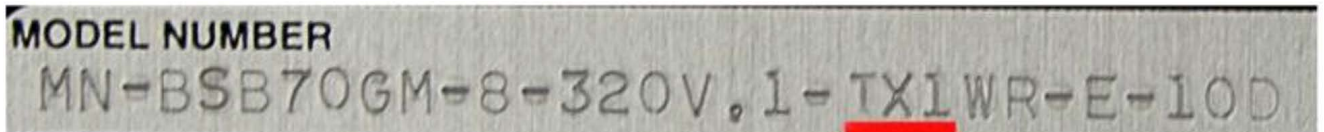

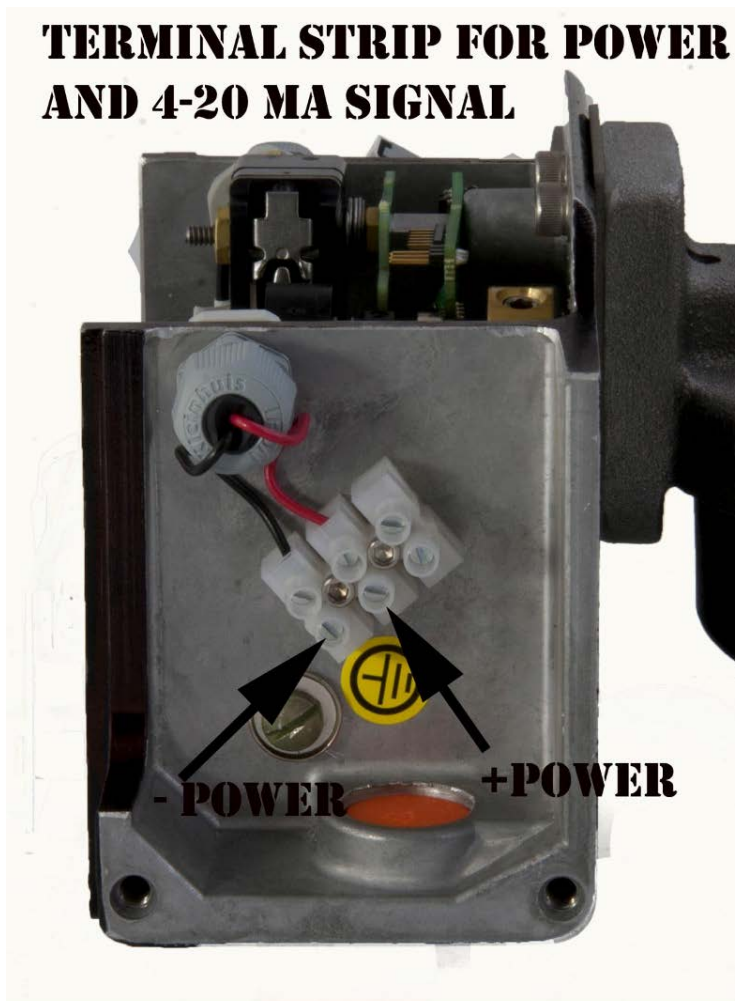
Figure 20: Name plate example

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.

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.

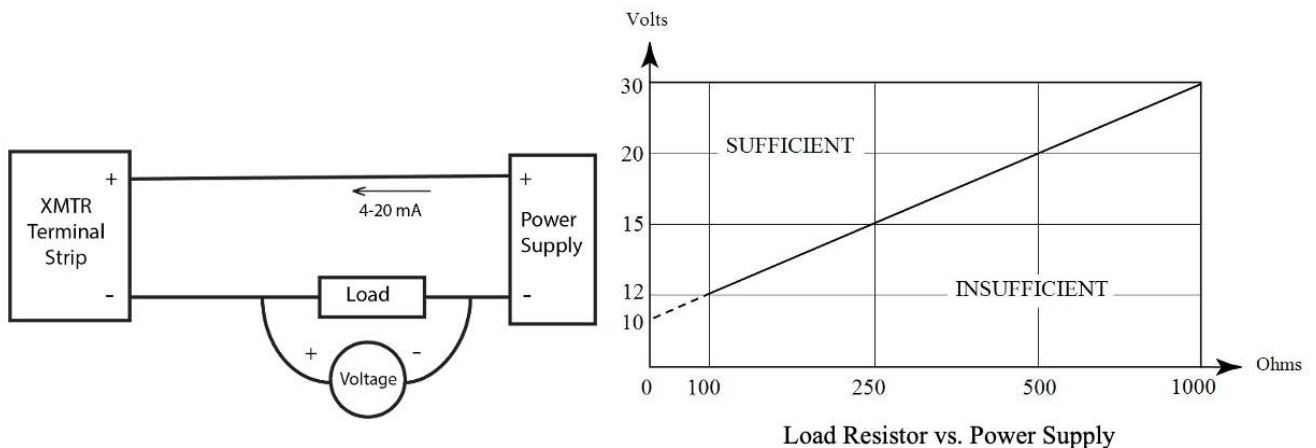A typical 4 to 20 mA wiring diagram is shown below:

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

5.94 [151mm]
APPROX. SWING RADIUS

5.33 [135mm]
APPROX. SWING RADIUS

5.29 [134mm]
PORT TO PORT

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

5.94 [151mm]
APPROX. SWING RADIUS

5.33 [135mm]
APPROX. SWING RADIUS

5.29 [134mm]
PORT TO PORT

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

3.50 (89mm)
6.5 (165mm) SX
PORT TO PORT

5.12[130mm] APPROX.
SWING RADIUS
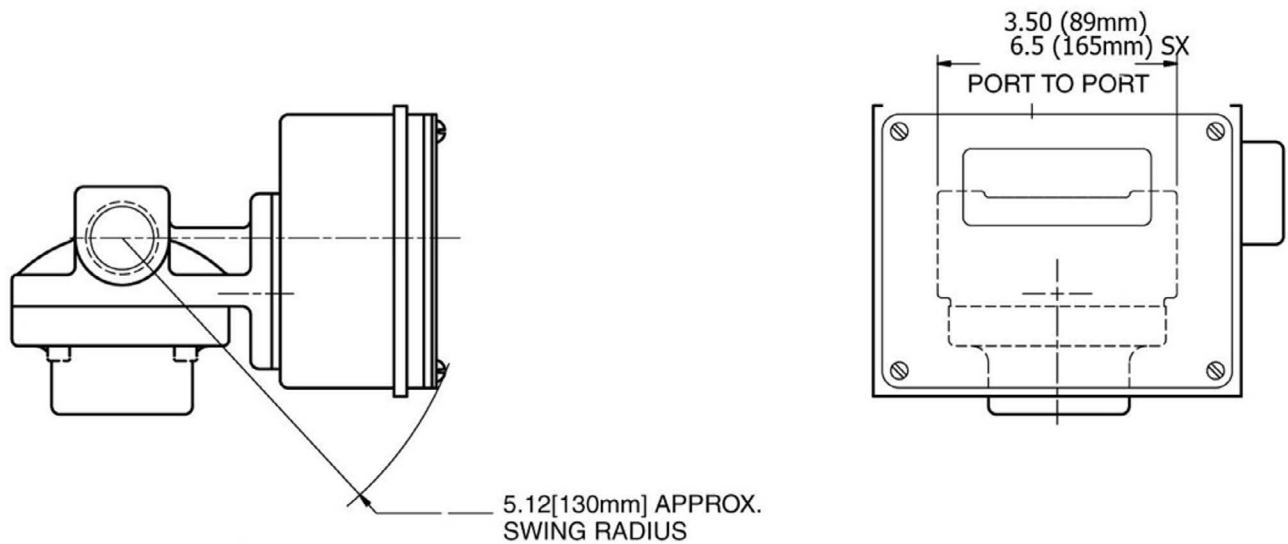
Figure 28: Vane/Piston - XØ Transmitter SX, SN, SM, and SH dimensions

5.50 (140mm)
6.25 (159mm) MX

PORT TO PORT

3/4" NPT
CONDUIT
CONNECTION

6.12 [155mm] APPROX.
SWING RADIUS
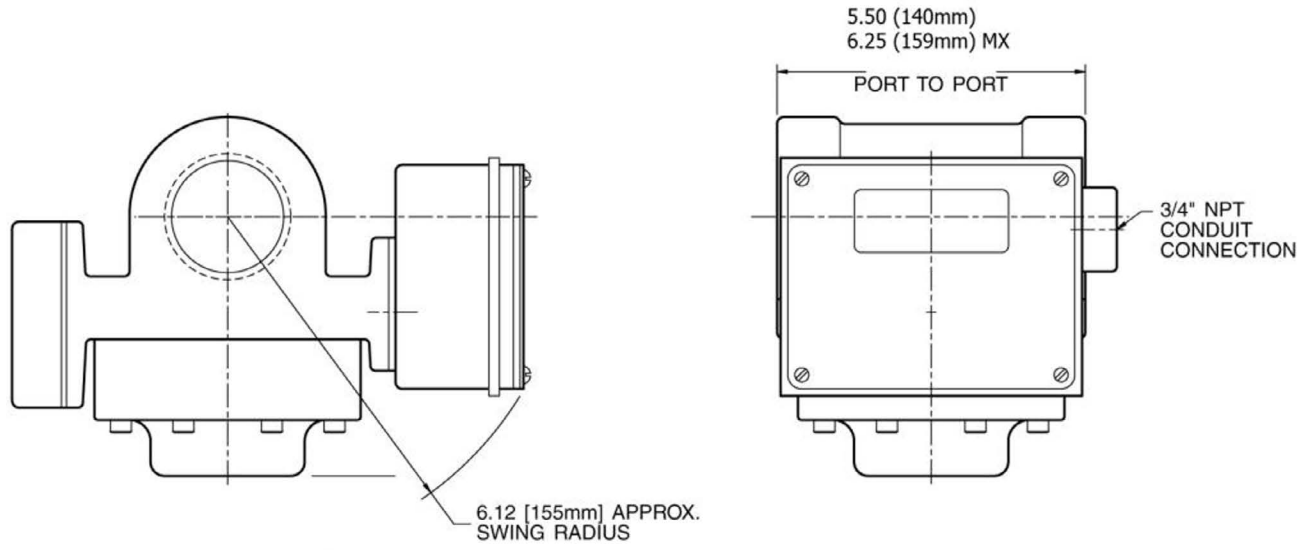
Figure 29: Vane/Piston - XØ Transmitter MN, MM, MH, and MX dimensions

RX2 R7.76 [197mm]
Approximate Swing Radius

RX1 R7.38 [187mm]
Approximate Swing Radius

5.29 [134mm]
PORT TO PORT

1/2' NPT CONDUIT CONNECTION.

RX2 R8.03 [204mm]
APPROXIMATE SWING RADIUS

RX1 R7.66 [195mm]
APPROXIMATE SWING RADIUS

T0683D00-CAT
04/07/15
RDK
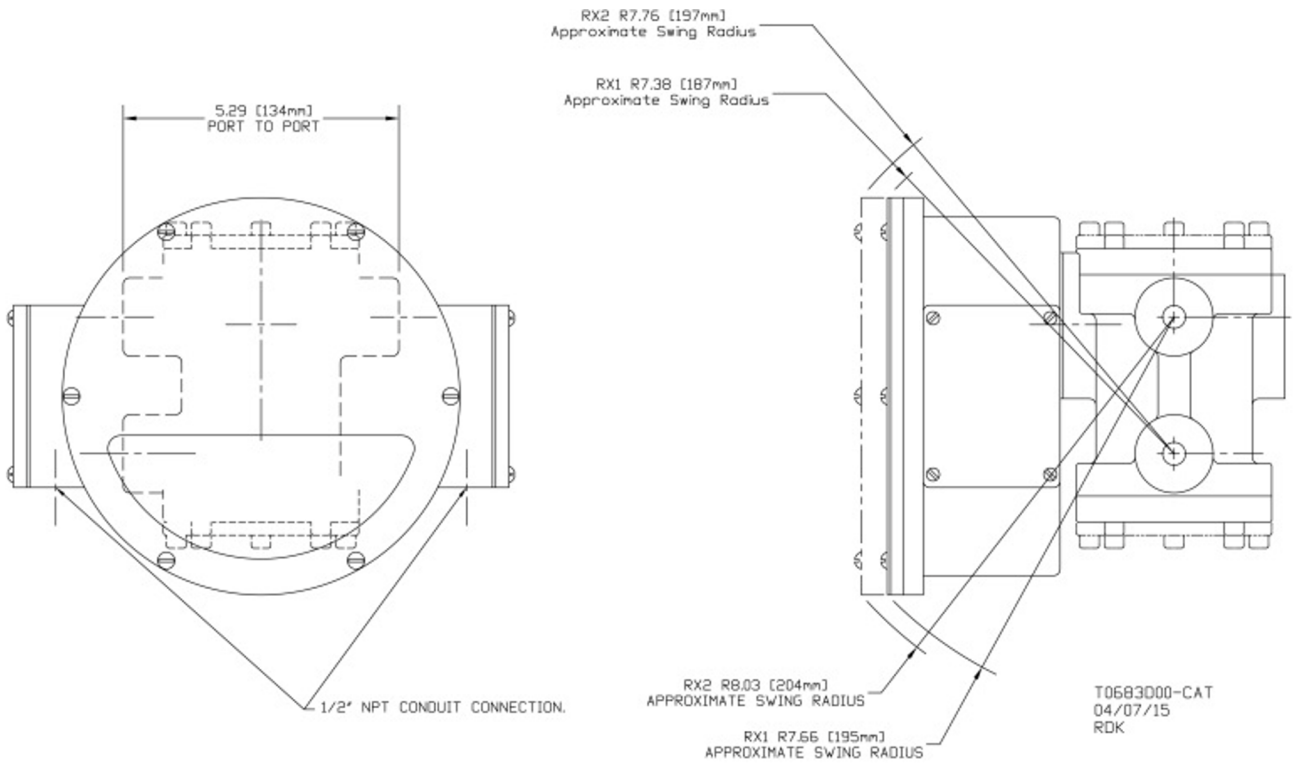
Figure 30: Vane/Piston RX/RH PI, LL, LP, and LH dimensions

3.50 [89mm]
PORT TO PORT

1/2" NPT CONDUIT CONNECTION.

RX1 R8.19 [208mm]
APPROXIMATE SWING RADIUS

RX2 R8.53 [217mm]
APPROXIMATE SWING RADIUS

T0681D00-CAT
04/07/15
RDK
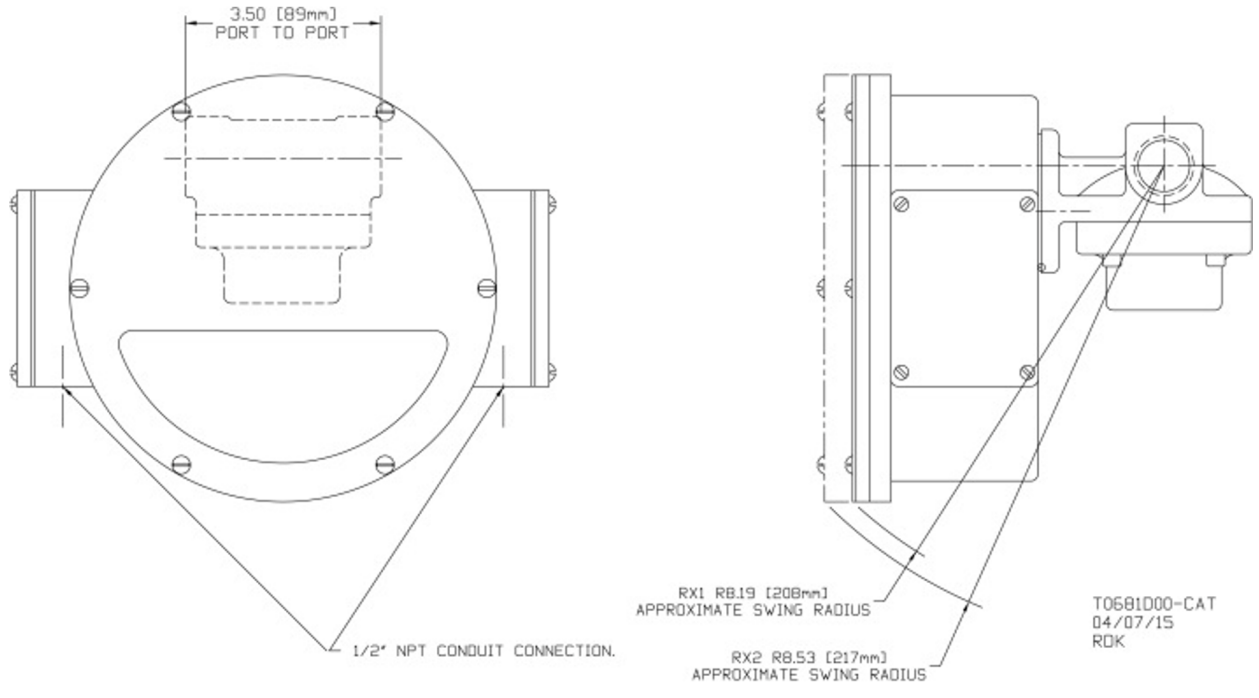
Figure 31: Vane/Piston RX/RH SX, SN, SM, and SH dimensions

1/2" NPT CONDUIT CONNECTION.

FLANGE SIZE		O.A.L.
4"	150#	21.25
6"	150#	22.25
8"	150#	19.00

R12.96 [329mm]
APPROXIMATE
SWING RADIUS

NAME:
XHF W/ TABULATED
FLANGES, & TYPE "RX1"/"RX2
BOXES
DWG. NO.:
T0685000CAT
DATE:
04/07/15
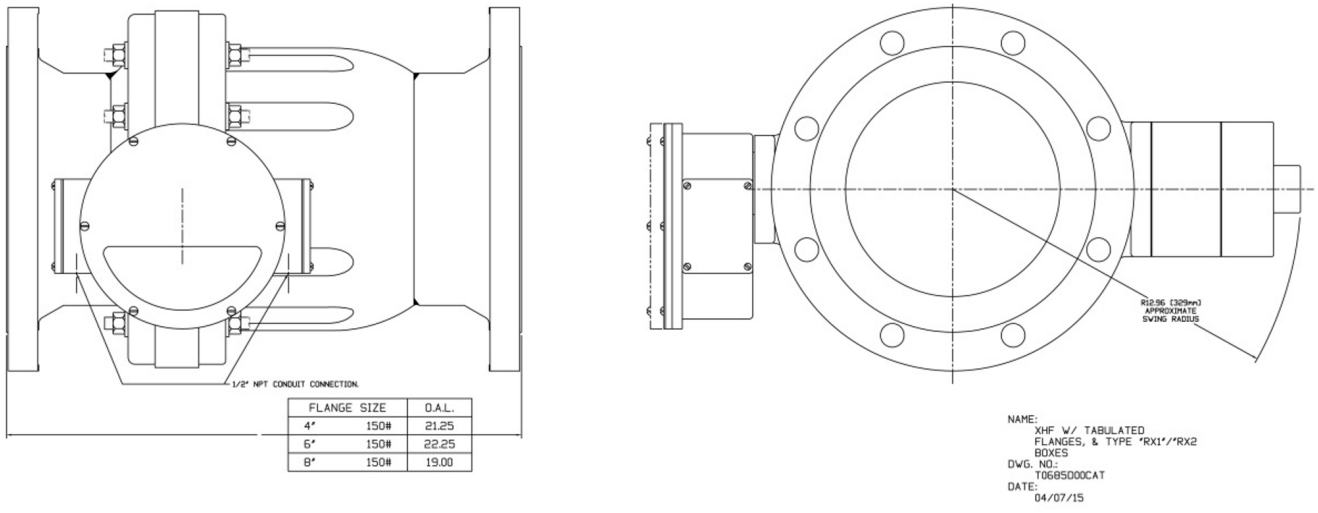
Figure 32: Vane/Piston RX/RH XHF dimensions

14.19
12.94
PORT TO PORT
8.75
7.63

1/2" NPT CONDUIT CONNECTION
BOX TYPES RP, RT, RTV, & RTZ

19.56 (4 SPINGS for FLOW RATES GREATER
THAN 300 GPM, 1200 LPM, or 70 CMH)
18.28 (2 SPRINGS)
9.44
5.13
10.44
REF
5.31

R8.88 APPROX. SWING RADIUS

R10.16 APPROXIMATE SWING RADIUS
400 and 500 GPM
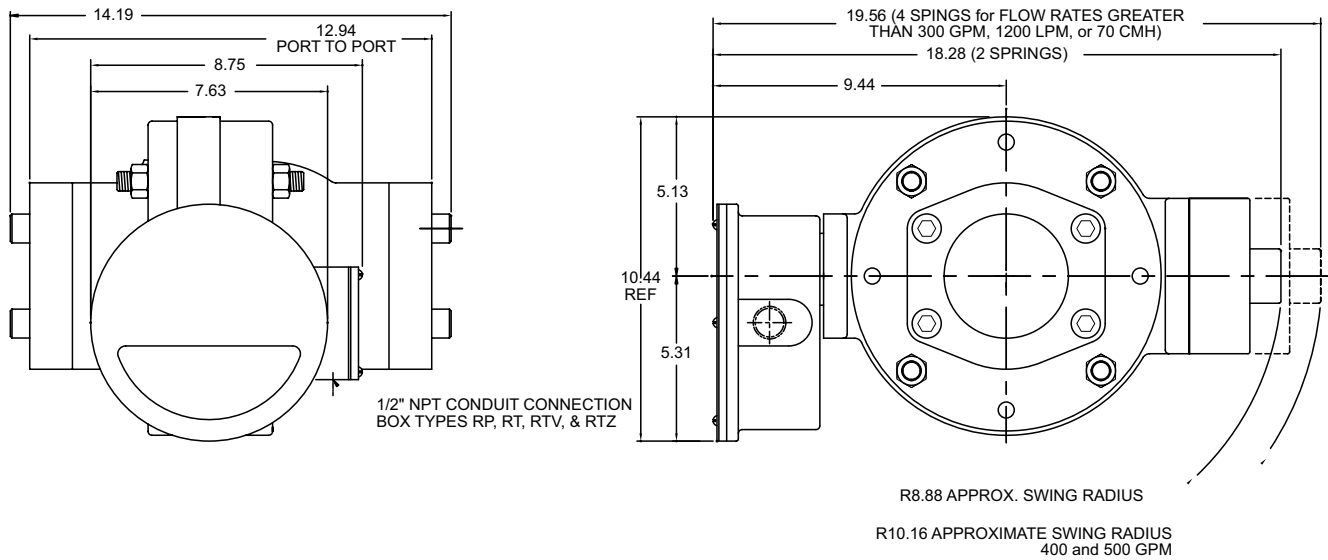
Figure 33: Vane/Piston RX/RH LE and LN dimensions

5.29 [134mm]
PORT TO PORT

R7.38 [187mm]
APPROXIMATE SWING RADIUS

R6.79 [172mm]
APPROXIMATE SWING RADIUS

1/2" NPT CONDUIT CONNECTION.

T0688D00-CAT
04/23/15
RDK
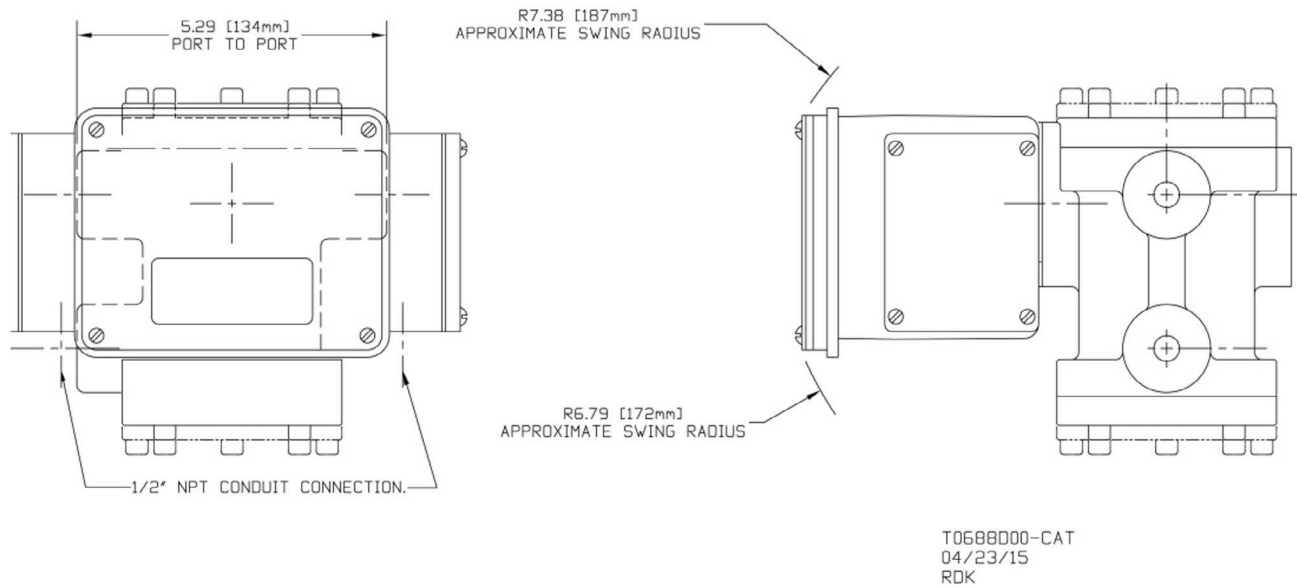
Figure 34: Vane/Piston - TX Transmitter / TH Transmitter with HART LL, LP, and LH dimensions
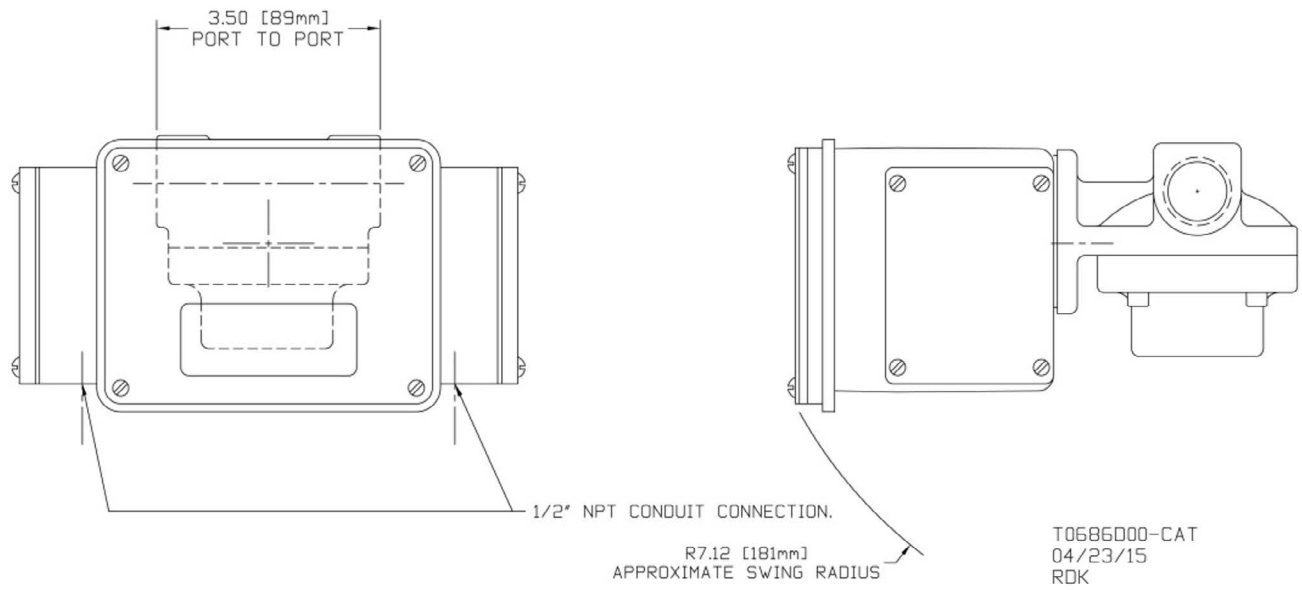
UFM Vane Piston Consolidated Manual

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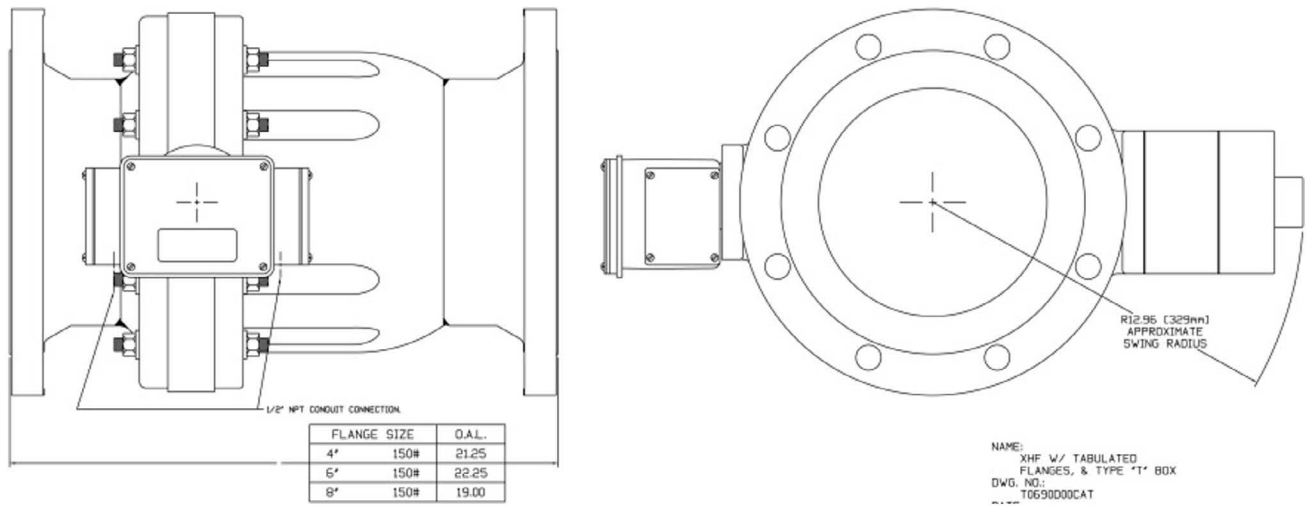

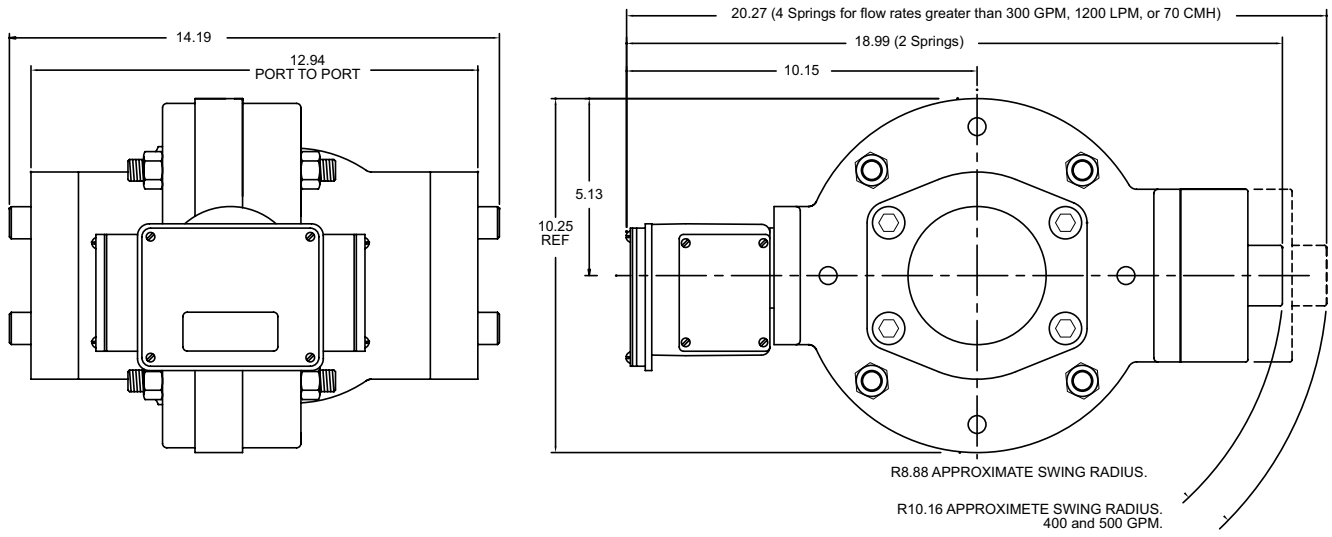*Figure 36: Vane/Piston - TX Transmitter / TH Transmitter with HART XHF dimensions*

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.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

UFM® UNIVERSAL
FLOW MONITORS
a **DwyerOmega** brand

dwyer-inst.com