

# Wallace & Tiernan® Flow Measurement Equipment By-Pass Type Varea-Meter® Units

By-Pass Varea-Meter® units can measure high volume flows through any pipeline that can be equipped with a standard differential-producing device. Accurate, reliable, and versatile, they are available in both Glass Tube and Metal Tube Varea-Meter® unit arrangements. A flow switch is optional on the Metal Tube type. An electronic transmitter can be substituted for the standard indicator with the Metal Tube Varea-Meter® units.

## Features

### Accuracy

By-pass Varea-Meter® units are accurate to within 4% of full scale when main-line orifice installation conforms to ASME or AGA procedures and by-pass piping follows Siemens Water Technologies recommendations.

### Easy, Inexpensive Installation

By-pass Varea-Meter® units are shipped ready to install with the orifice in place. No mercurial or bellows-type manometer is required. Checking or snubbing devices can be omitted, as overranging is harmless. When the metal-tube meter's float is at rest, float extensions do not project beyond the flanges. Installation is easy.

### Rugged Convenient Glass-Tube Meter

The glass-tube meter has a rigid, one-piece stainless steel frame. It features design simplicity and easy assembly. All o-rings are the same size. An external clamp holds the tube securely, and also makes it easy to remove.

### Reliable Metal-Tube Metering

The metal-tube meter's float design discourages attraction of magnetic particles. A dry snubber gives reliable gas measurement down to atmospheric pressure without dashpots or offset piping. A powerful magnetic coupling between the float magnet and the follower magnet in the indicator unit and instrumentation makes for reliable indication, flow

### Key Benefits

- Designed for process line size greater than 2 inches
- Excellent when immediate mainline access is not possible
- Used in locations too remote to power
- Wide array of material choices to fit most applications
- Electronic output available when required

switching and transmission. The indicator unit is in a gasketed aluminum housing (NEMA 4X) and has a readable 6-inch percent scale. Other scale calibrations are optional.



*Metal Tube Varea-Meter® Unit*

## Product Sheet

## Selection Procedure

### Metal & Glass Tube Selection Procedure

Gases: See Table D for calculations

Liquid: See below

As indicated in Table B, By-Pass Meter capacities are determined by main line orifice design. Capacities shown are the maximum recommended flow rates for various sizes of standard weight main line pipe equipped with a sharp edge orifice having a 0.7 diameter ratio and mounted in standard orifice flanges. Such orifices produce full-scale float displacement in By-Pass Varea-Meter® units when main line differentials are 50, 100, 200, or 400 inches of water. Lower readings result when lower flow produces lower main line differentials. Flows in the tables are the maximum rates consistent with ASME and AGA recommended practice of limiting ratio of orifice diameter to inside pipe diameter to .07 maximum. This diameter ration gives an irrecoverable pressure loss of 52.5% of main line differential.

**Table A - Equivalence Factors For Liquids**

Specific Gravity	Float Material	
	316 Stainless	Hastelloy® C
0.5	0.68	0.64
0.6	0.75	0.71
0.7	0.82	0.77
0.8	0.88	0.83
0.9	0.94	0.88
1.0	1.00	0.94
1.1	1.06	0.99
1.2	1.11	1.04
1.3	1.16	1.09
1.4	1.22	1.14
1.5	1.27	1.19
1.6	1.32	1.23
1.7	1.37	1.28
1.8	1.43	1.33



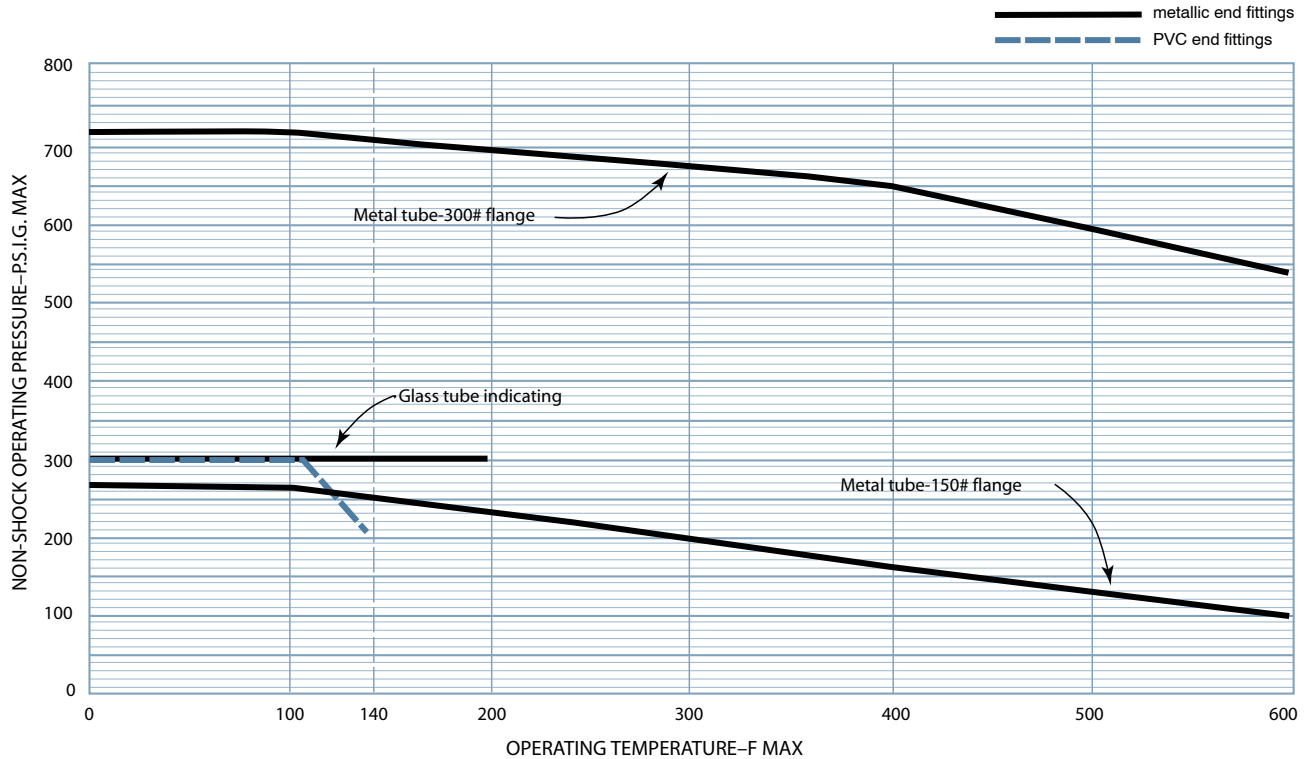
**Table B - Main Line Orifice Differential**

Main Line Pipe Size Sched 40 (Inches)	Sizing GPM (Water Equivalent)				Sizing SCFM (Air Equivalent)			
	Main Line Orifice Differential, Inches of Water				Main Line Orifice Differential, Inches of Water			
	50	100	200	400	50	100	200	400
1 1/2	36.2	50.3	71	100	145	206	290	430
2	58.7	82.9	117	165	240	340	480	710
3	131	185	255	361	540	750	1080	1580
4	222	312	440	621	1100	1540	2200	3200
5	347	488	691	974	1700	2400	3400	5000
6	500	707	999	1410	2500	3500	5000	7200
8	874	1230	1730	2440	4300	6100	8600	12600
10	1380	1940	2730	3840	6800	9700	13600	20000
12	1940	2740	3860	5440	9700	13600	19000	28000
14	2330	3300	4660	6450	Note: If any other schedule is used, multiply values in table by : $\left( \frac{\text{actual pipe ID}}{\text{Sched 40 pipe ID}} \right)^2$			
16	3050	4310	6070	8580				
18	3660	5440	7690	10800				
20	4780	6770	8080	13500				
24	6920	9790	13800	19500				

## Technical Data

### Recommended Maximum Operating Pressures

Warning: Temperature & pressure limits must not be exceeded. Do not use Glass-tube By-pass Meters for fluids which are toxic, hazardous, or which attack glass. For such applications, use the Metal-tube By-pass Meter. (Write for literature WT.500.001.000.UA.CG, a detailed listing of meter compatibility with wide range of fluids.)

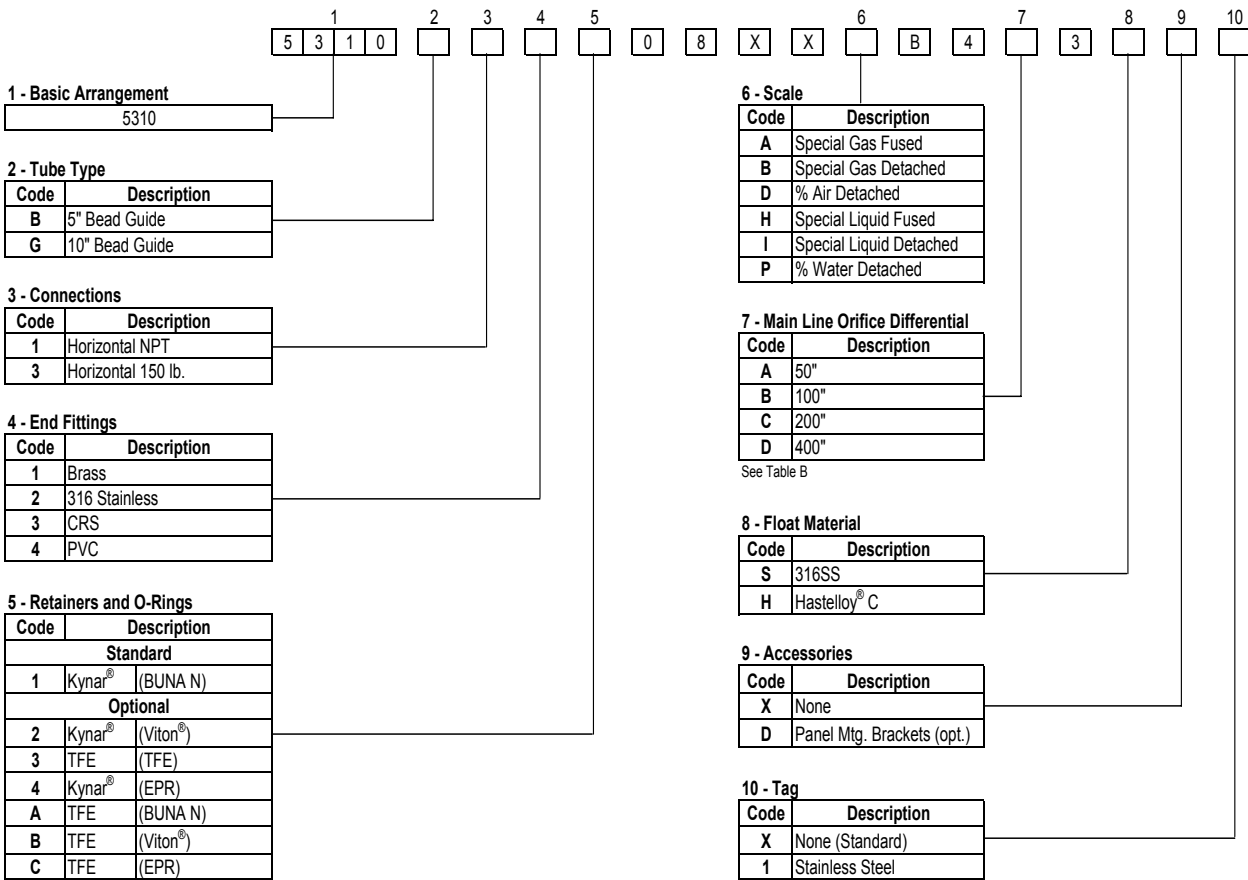


### By-Pass Varea-Meter® Unit Arrangements



	Glass-Tube Indicating	Metal Tube (1/2-inch tube)
<b>accuracy</b>	4% full scale	4% full scale
<b>scale lengths</b>	5" or 10"	6"
<b>scale units</b>	% std, others optional	% std, others optional
<b>inlet</b>	horizontal 1/2" NPT or 150# flange	vertical 1" 150 or 300# flange
<b>outlet</b>	horizontal 1/2" NPT or 150# flange	vertical 1" 150 or 300# flange
<b>max. f.s. differential</b>	50, 100, 200, 400" water 7:1 10:1 10:1 10:1	50, 100, 200, 400" water 5:1 liquids; 3:1 gases 7:1 liquids; 4:1 gases 10:1 liquids; 6:1 gases 10:1 liquids; 8:1 gases
<b>end fittings</b>	brass, carbon steel, 316 stainless, PVC	carbon steel, 316 stainless
<b>tubes</b>	borosilicate glass	316 stainless
<b>floats &amp; orifices</b>	316 stainless, Hastelloy® C	316 stainless, Hastelloy® C
<b>tube retainers</b>	Kynar®, TFE	none
<b>o-rings</b>	Buna N, TFE	none
<b>flow switch</b>	not available	optional
<b>electronic transmitter</b>	not available	optional
<b>mainline orifice plate</b>	optional	optional
<b>mainline orifice flanges</b>	optional	optional
<b>by-pass piping</b>	by customer	by customer

**Table G - Ordering Procedure For By-Pass Varea-Meter® Glass Tube Liquid/Gas Service**



Do not use glass-tube meters for fluids which are toxic, hazardous or attack glass.

### Ordering Procedure

#### Example

To order a Glass tube By-Pass meter for a main line standard weight pipe of 6" Dia. and standard differential of 100" of H<sub>2</sub>O with 10" direct reading detached scale, 316 SS float, 316 SS NPT end fittings, Kynar® retainers, Buna N o-rings, no accessories and no tag specify:

**5310 G 1 2 1 0 8 X X I B 4 B 3 S X X**

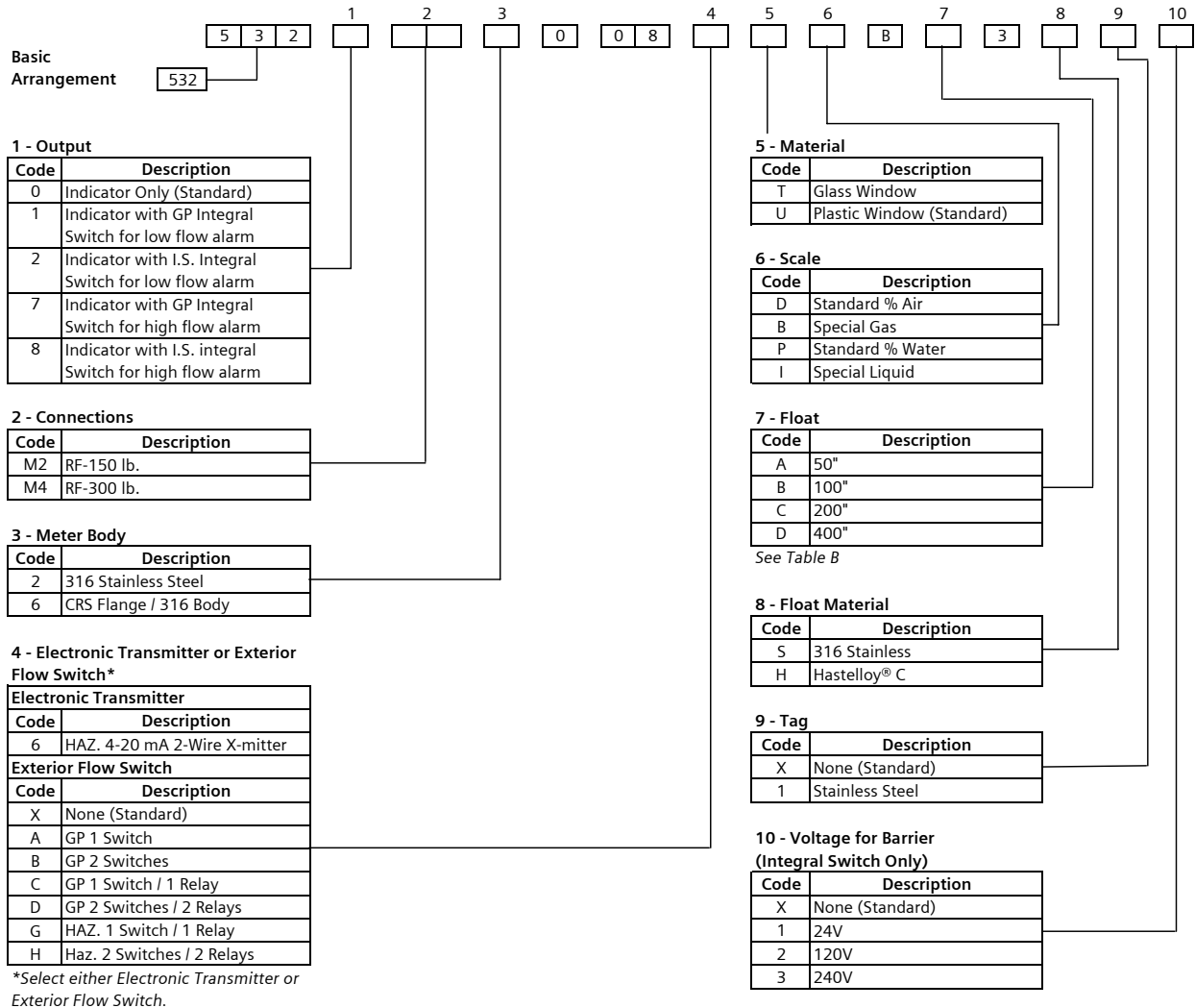
**Table C - By-Pass Piping Recommendations**

Meter Size, Inches	Pipe Size, Inches	Maximum Recommended Equivalent Length, Feet	Equivalent Length of Fittings in Feet of Straight Pipe			
			90° EL	45° EL	Valve*	Union
1/2	1/2	6	1.5	0.8	0.35	0.17
	3/4†	23	2.2	1.0	0.50	0.19
	1†	72	2.75	1.3	0.60	0.21
1/2 Metal-Tube	1†	27	2.75	1.3	0.60	0.21

\*Use gate or ball valves only and keep fittings to a minimum.

†Use reducing fittings at main line orifice and at meter if necessary.

**Table G - Ordering Procedure For By-Pass Varea-Meter® Metal Tube Liquid/Gas Service**



**Table D - Formulas**

Fluid Condition	Equivalent Flow Rate	=	Desired Flow Rate	x	Correction Factors
Standard (Qs)	Q <sub>E</sub> (SCFM)	=	Q <sub>S</sub>	x	F <sub>G</sub> x F <sub>P</sub> x F <sub>T</sub> x F <sub>U</sub>
Weight (W)	Q <sub>E</sub> (SCFM)	=	W x 13.33*	x	1/F <sub>G</sub> x F <sub>P</sub> x F <sub>T</sub> x F <sub>U</sub>

\*Substitute 11.88 for 13.33 when using Hastelloy® C float.

**Ordering Procedure**

**Example**

To order a Metal tube By-Pass meter for an 8" Dia. main line standard weight pipe, and a standard differential of 100" of H<sub>2</sub>O, for measuring liquid with a direct reading scale with magnetic indicator using standard plastic window, 316 SS 150 lb. flanges and 316 SS body, with no accessories and no tag specify:  
**532 0 M2 2 0 08 X U I B B 3 S X X**

**Table E - Gas Specific Gravity Correction F<sub>G</sub>**

$$F_G = \sqrt{\text{SP.GR.} \times \frac{7.96}{\text{FLOAT SP.GR.}}}$$

FLOAT SP.GR.  
 316SS = 7.96  
 HASTC = 8.94

**Table F - Operating Pressure Correction F<sub>P</sub>**

$$F_P = \sqrt{\frac{14.7}{14.7 + \text{psig}}}$$

**Table G - Operating Temperature Correction F<sub>T</sub>**

$$F_T = \sqrt{\frac{460 + F}{530}}$$

## Electronic Transmitter

The Varea-Com™ explosion-proof Electronic Transmitter provides accurate magnet angle detection and computation of the angle to a 4-20 mA industry standard output signal. This compact, microprocessor-driven device is capable of filling flow-correction needs at the meter, providing accurate flow information remotely to external support systems. The patented magnetic sensor with automatic gain control enables a high dynamic capture range without sacrificing accuracy.

## Features

### Separate Flow Indication

The scale and pointer readout is independent of the transmitting mechanism. The pointer indicates flow rate even if the transmitting element is removed or if power fails.

### Easy Addition in Field

Any model can be ordered mounted on a new meter or can be easily added to an already-installed meter. Field installation requires calibration to the meter.

### Design and Features

- NEMA 4, FM-Approved Hazardous Area enclosure
- Smart, microprocessor-based field transmitter; 2-wire, low power
- Patented sensor with micro-processor-controlled gain
- 4-20 mA Analog Output for magnetic angle signaling. Voltage range: 8.28 VDC
- 11-calibration-point transmitter linearization and storage in nonvolatile memory
- External Zero Button Wire
- Adjustable low-cutoff
- Adjustable low-pass filter
- PC-interface (no external power required)
- Accuracy better than 0.5% (over the range from 0.0 to 360.0 degrees, pick-up accuracy ~0.1 degree)
- Electronics designed to meet international certifications and CE requirements.



*Electronic Transmitter*

## Technical Data

**Accuracy** – Combined meter and transmitter accuracy is 4% of full scale (1% with custom calibration).

**Sensitivity** – 0.2% of full scale.

**Repeatability** – 0.3% of full scale.

**Speed of Response** – Complete response to a flow-rate change in 0.5 seconds.

**Output Signals** – 4-20 mA DC flow proportional.

### Electrical Requirements

- Input: 24 VDC
- Current Consumption: 5 mA signal current.

**Temperature Range** – Maximum fluid temperature is 600°F (316°C); ambient range is -13 to 140°F (-25°C to 60°C).

### Electrical Classification

As an explosion-proof arrangement, the transmitter is FM-approved as explosion-proof for Class I, Division 1, Group A, B, C, and D hazardous locations; and FM-approved as dust-ignition-proof for Class II, Division 1, Group E, F and G hazardous locations; suitable for Class III, Division 1.

**Connections** – Enclosed 1/2" conduit connection. Transmitter to receiver, unshielded wires.

**Dimensions** – For complete dimensions, please refer to literature: WT.520.300.102.UA.CN



*Electronic Flow Transmitter mounted on meter body*

## External Flow Switch

The Wallace & Tiernan® External Flow Switch is a compact option that gives reliable high- and/or low-flow switching. The External Flow Switch contains a powerful rotating magnet that responds linearly to float position. Its switches are long life, hermetically sealed reed types. Almost frictionless rotation of the switch magnet and its powerful bond with the float magnet give a dependable magnetic coupling. Even under sudden flow surges, switching remains reliable.

### Features

- Available in General Purpose arrangement or UL Listed Hazardous Location version.
- Easily retrofitted in the field with the meter in line.
- Switches can be set to open or close on increasing or decreasing flow.
- A simple adjustment sets each switch independently over 0 to 100% of the flow range.



*External general purpose flow switch mounted on meter body*

## Technical Data

**Repeatability** – 0.6% of full scale.

### Electrical Ratings

- Series 5600 General Purpose: one or two switches rated 250 mA at 48 VDC or 120 VAC resistive or 50 mA at 48 VDC or 120 VAC inductive; one or two single-pole, double-throw relays rated 10 amperes at 28 VDC or 120 VAC; coil supply 120 VAC, 50/60 Hz.
- Series 5500 Hazardous Location: one or two single-pole, double-throw relays rated 10 amperes at 120 VAC; coil supply 120 VAC, 50/60 Hz. UL-listed for Class I, Division 1 & 2 Groups C and D or Class II, Division 1 & 2 Groups C and D or Class II, Division 1 & 2 Group E, F, and G.

**Temperature Limits** – Ambient, -20° to 120° F (-25°C to 49°C)

**Actuating Time** – Reed switches open in one millisecond.

**Enclosures** – Heavy cast aluminum (NEMA 4) with corrosion resistant finish.

**Dimensions** – For complete dimensions, please refer to literature: WT.520.300.104.UA.CN and WT.520.300.106.UA.CN



*Flow switch with switches and relays*

## Integral Flow Switch

The Wallace & Tiernan® Integral Flow Switch is a low-cost switch that mounts inside the meter's indicator and enables remote monitoring of either high or low set points. The switch is housed in the indicator, which is in a NEMA 4 enclosure with a plastic window; a glass window is available as an option. There is also an FM-approved, intrinsically safe arrangement with a power supply and an integral (to the power supply) relay available for Class I, II & III, Division 1 & 2 hazardous areas.

## Features

### Alarm Operation

The user can easily set the switching point by removing the indicator cover and moving the switch pointer tip (located in the slot) to the desired set point. Any value along the slot can be used as the desired set position. The placement of the pointer tip provides a local and visual indication of the set point. The disc mounted on the indicator needle actuates the limit switch within the housing. This compact, inexpensive switch gives a reliable high- or low-flow signal even under sudden flow surges. The alarm can be set to open or close on increasing or decreasing process flow.



Integral flow switch  
(shown with cover removed)

## Technical Data

### Specifications

- Electrical Classification: NEMA 4 for General Purpose; Intrinsically Safe for Hazardous Areas
  - Class I, Div. 1 Haz Group A, B, C, D
  - Class II, Div. 1 Haz Group E, F, G
  - Class III, Div. 1 in accordance with Instruction Book Dwg. 520.209.130.040
- Supply Voltage:
  - NEMA 4                    30 VDC or less
  - Intrinsically Safe    24 VDC, 120 VAC or 240 VAC (based on barrier selected)

### Repeatability

Intrinsically Safe Alarm: ≤ .0004 in. of the set point.  
General Purpose Alarm: ≤ .0002 in. of the set point.

### Ambient Operating Temperature

NEMA 4                    -13° to 131° F  
                                  (-25° to 54° C)  
Intrinsically Safe    -13° to 140° F  
                                  (-25° to 60° C)

### Shipping Weights (lbs.)

Tube Size	Metal Tube Meter	Glass Tube Meter
1"	25*	20

\*Add 8 lbs. (3.6 kgs) for GP Flow Switch, 9 lbs. (4 kgs) for HAZ. Flow Switch, and 4 lbs. (1.8 kgs) for HAZ. Area Transmitter.

**Dimensions** – For complete dimensions, please refer to literature: WT.520.300.100.UA.CN (Metal Tube) and WT.520.100.100.UA.CN (Glass Tube)

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