

# **SERIES 52-205**

## **METAL TUBE VAREA-METER®**

### **STRAIGHT THROUGH TYPE ROTAMETER**

*USFilter's Wallace & Tiernan Products' (USF/W&T) Straight Through Metal Tube Varea-Meters are available in a variety of tube sizes, flange faces, and ratings. These are suitable for harsh process conditions and are designed for the measurement of high-volume flows of aggressive fluids and gases. They have high pressure and temperature limits and give reliable flow measurements over a 10:1 range. As a standard feature, a rugged, magnetically coupled flow indicator is provided. An optional flow transmitter is available to provide local indication as well as a mA output. Meters conform to NACE Standard MR-01-75, covering hydrogen sulfide-resistant surfaces.*



#### **FEATURES**

##### **ANTI-MAGNETIC-PARTICLE FLOAT**

The extra long float magnet has a reduced flux density and is located above the metering disk. This discourages accumulation of magnetic particles, specially on the disk edge where they can cause errors in indication. Meter design directs the flow into a pattern, which scrubs the float and guides clean. The Varea-Meter is ideal for suspensions and slurries.

##### **NO FLOAT EXTENSIONS**

When the float is at rest, nothing projects beyond the flanges. Spool pieces are not required for installation and a frequent cause of damage when removing meters from a line is gone. In and out piping is vertical.

##### **RELIABLE MAGNETIC COUPLING**

For reliable indication a powerful magnetic linkage exists between the float magnet and the indicator or transmitter magnets. Transmission and indication are reliable even under sudden flow surges.

##### **EASY CHANGE-OUT, EASY COUPLING**

The indication unit and the transmitters are interchangeable. A mounting clamp attaches them to the meter tube. The same clamp attaches a transmitter or flow switch 180 degrees from the indicator or transmitter. Clearance between any of these units and the tube leaves room for steam or electric tracing.

##### **EASY FIELD CALIBRATION**

Straight Through Varea-Meters can be bench calibrated. After mounting in process piping, a minor zero adjustment is made with a screwdriver. There is no need to break piping to get at the top of the meter when making this adjustment.

##### **GENERAL TECHNICAL DATA**

**Accuracy** - 2% of full scale with standard calibration. Special calibration to 1% of full scale.

**Range** - 10 to 1

**Dial Length** - 6 inches.

**Dial Units** - Percent of maximum flow is standard. GPM water, SCFM air, or special graduations are optional.

##### **Tube and Float Materials**

Tube material 316 stainless steel. Float 316 stainless steel or Hastelloy C. Write for TI 500.001 UA, which is a detailed listing of meter compatibility with a wide range of fluids.

**Connections ANSI 150 Lb. ~ 600 Lb.**

Raised face 150 lb. and 300 lb. in carbon steel, 316 stainless steel. All other facings available in 316 stainless steel only. (Extra low carbon stainless steel available on meters with 150 lb. flanges only.)



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#### SELECTION PROCEDURE FOR GAS SERVICE

Determine the capacity range, temperature and pressure capability, materials of construction, and options required for each meter. From chemical supplier, determine float material. Table I capacities are air SCFM at 14.7 PSIA and 70°F. If the gas is other than the above, its flow rate must be converted to SCFM air (Equivalent Flow Rate)

TABLE A - PRESSURE AND TEMPERATURE LIMITS

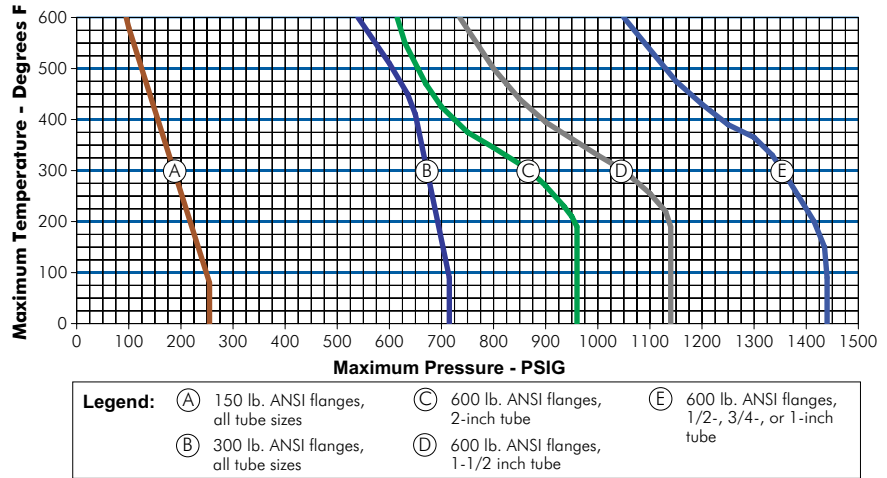


TABLE B - FORMULAS

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.

#### HOW TO DETERMINE AIR EQUIVALENT

1. From Table B select appropriate Formula to determine Equivalent Flow Rate (Q<sub>E</sub>).
2. From Table C determine F<sub>G</sub> from Specific Gravity Correction factors.
3. From Table D determine F<sub>P</sub> from Back-Pressure Correction factors.
4. From Table E determine F<sub>T</sub> from Temperature Correction factors.
5. From Table F determine F<sub>U</sub> from Unit Conversion factors.
6. Work Formula to obtain Equivalent Flow Rate (Q<sub>E</sub>).
7. Use Equivalent Flow Rate to select tube and float code from Table I on page 4.

TABLE C - 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 D - OPERATING PRESSURE CORRECTION F<sub>P</sub>

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

TABLE E - OPERATING TEMPERATURE CORRECTION F<sub>T</sub>

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

TABLE F - UNIT CONVERSION F<sub>U</sub>

LITERS/MIN	X	.03532	=	CU FT/MIN
CU METERS/MIN	X	35.316	=	CU FT/MIN
LB/MIN	X	1.0	=	LB/MIN
KG/MIN	X	2.205	=	LB/MIN

Q<sub>E</sub> SCFM AIR EQUIVALENT = DESIRED FLOW RATE (LBS/MIN) x 3.65 x √SPEC. VOL.  
USE STEAM TABLES TO DETERMINE SPECIFIC VOLUME OF STEAM CU FT/LB  
EXAMPLE: Q<sub>E</sub> SCFM 434.61 = 36.75 x 3.65 x √10.498

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**SELECTION PROCEDURE FOR LIQUID SERVICE**

Determine the capacity range, temperature and pressure capability, materials of construction, and options required for each meter. From chemical supplier, determine float material. If the liquid is other than water, the desired units are other than GPM, therefore its flow rate must be converted to GPM water (Equivalent Flow Rate).

**TABLE G - LIQUID-SPECIFIC GRAVITY CORRECTION FE**

Specific Gravity	Float Material		Specific Gravity	Float Material	
	FE 316 Stainless Steel	FE Hastelloy C		FE 316 Stainless Steel	FE Hastelloy C
0.50	.682	.642	1.30	1.164	1.086
0.55	.718	.675	1.35	1.192	1.112
0.60	.753	.709	1.40	1.218	1.136
0.65	.786	.739	1.45	1.244	1.159
0.70	.818	.768	1.50	1.271	1.184
0.75	.851	.798	1.55	1.296	1.208
0.80	.882	.827	1.60	1.323	1.231
0.85	.912	.854	1.65	1.347	1.254
0.90	.941	.882	1.70	1.374	1.278
0.95	.971	.909	1.75	1.400	1.300
1.00	1.000	.937	1.80	1.426	1.324
1.05	1.026	.962	1.85	1.450	1.346
1.10	1.055	.988	1.90	1.475	1.368
1.15	1.083	1.012	1.95	1.503	1.393
1.20	1.110	1.036	2.00	1.527	1.415
1.25	1.137	1.062			

*Note: To determine FE for specific gravities not shown in Table G, use liquid specific gravity correction equation.*

**HOW TO DETERMINE WATER EQUIVALENT**

For liquids with viscosities greater than the viscosity ceiling, consult distributor. For liquids with specific gravity other than 1.0, follow the formula to determine Equivalent Flow Rate in GPM (QE).

<b>Equivalent Flow Rate</b>	<b>=</b>	<b>Desired Flow Rate</b>	<b>x</b>	<b>Correction Factors</b>
QE GPM	=	QD	x	FE x FU

**TABLE H - UNIT CONVERSION FU**

IMP			
GAL/MIN	x 1.201	=	GAL/MIN
LTR/MIN	x .2642	=	GAL/MIN
LBS/MIN	x .1198 ÷ SL	=	GAL/MIN
KG/MIN	x .2641 ÷ SL	=	GAL/MIN

**LIQUID-SPECIFIC GRAVITY CORRECTION EQUATION**

$$F_E = \sqrt{SP.GR.}$$

1. From Table G, determine FE from Specific Gravity Correction factors.
2. From Table H, determine FU from Unit Conversation factors.
3. Work formula to obtain Equivalent Flow Rate (QE).
4. Use Equivalent Flow Rate to select tube and float code from Table I on page 4.

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**TABLE I - ORDERING NUMBERS FOR TUBES AND FLOATS**

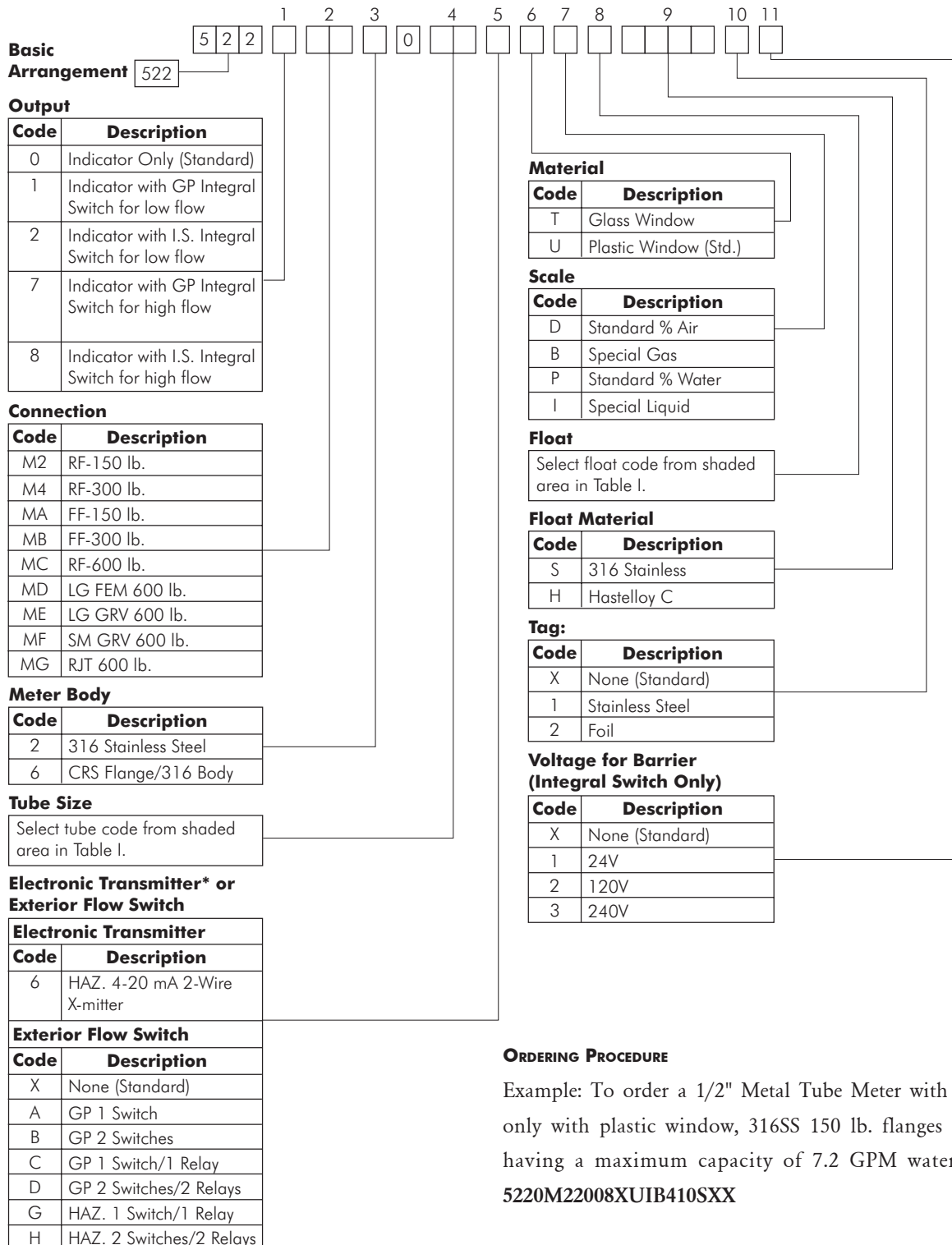
Equivalent Capacity		Tube Size Inches	Min. Operating Pres. for Gas Service PSIG	Viscosity Ceiling CSS	Pressure Drop Inches Water	ANSI Flange Size	Tube Code	Float Code
GPM	SCFM							
1.0	4.5	1/2	15	6.0	18	1	08	B102
1.5	6.5	1/2	15	5.0	32	1	08	B106
2.1	9.0	1/2	15	18.0	21	1	08	B302
2.3		1/2		1.0	41	1	08	B126
3.2	13.5	1/2	15	4.5	41	1	08	B306
3.9	16.7	1/2	15	5.0	25	1	08	B402
6.6	26.8	1/2	15	3.5	39	1	08	B406
7.2		1/2		1.6	45	1	08	B410
7.4	30.4	3/4	0	12.0	18	1	12	C402
9.2	39.4	3/4	0	13.0	25	1	12	C406
11.2	49.0	1	0	6.0	15	1	16	D402
11.6	49.0	3/4	0	12.0	38	1	12	C410
13.0		1/2		1.0	78	1	08	B426
14.5	61.0	3/4	0	2.0	49	1	12	C426
15.6	64.5	1	0	7.0	25	1	16	D406
19.0	79.0	3/4	0	1.6	108	3/4	12	C432
20.9	89.5	1-1/2	0	15.0	12	1-1/2	24	E402
23.9	102.9	1	0	5.0	54	1	16	D410
30.4	129.8	1-1/2	0	40.0	24	1-1/2	24	E406
32.9	139.3	1-1/2	0	1.6	25	1-1/2	24	E422
37.9	161.5	1	0	1.5	94	1	16	D430
49.8	203.0	2	0	45.0	15	2	32	F402
48.4	205.8	1-1/2	0	12.0	53	1-1/2	24	E410
68.1	281.9	2	0	35.0	28	2	32	F406
75.0	317.3	2	0	3.5	33	2	32	F422
88.9	350.0	1-1/2	0	3.2	134	1-1/2	24	E430
93.0	391.2	2	0	25.0	48	2	32	F410
117.5	497.3	2	0	3.0	57	2	32	F426
159.2	644.8	2	0	5.0	112	2	32	F430
178.6	694.6	2	0	3.0	133	2	32	F432

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TABLE J - ORDERING PROCEDURES FOR TUBES AND FLOATS



**Basic Arrangement** 522

**Output**

Code	Description
0	Indicator Only (Standard)
1	Indicator with GP Integral Switch for low flow
2	Indicator with I.S. Integral Switch for low flow
7	Indicator with GP Integral Switch for high flow
8	Indicator with I.S. Integral Switch for high flow

**Connection**

Code	Description
M2	RF-150 lb.
M4	RF-300 lb.
MA	FF-150 lb.
MB	FF-300 lb.
MC	RF-600 lb.
MD	LG FEM 600 lb.
ME	LG GRV 600 lb.
MF	SM GRV 600 lb.
MG	RJT 600 lb.

**Meter Body**

Code	Description
2	316 Stainless Steel
6	CRS Flange/316 Body

**Tube Size**

Select tube code from shaded area in Table I.

**Electronic Transmitter\* or Exterior Flow Switch**

Electronic Transmitter	
Code	Description
6	HAZ. 4-20 mA 2-Wire X-mitter

**Exterior Flow Switch**

Code	Description
X	None (Standard)
A	GP 1 Switch
B	GP 2 Switches
C	GP 1 Switch/1 Relay
D	GP 2 Switches/2 Relays
G	HAZ. 1 Switch/1 Relay
H	HAZ. 2 Switches/2 Relays

**Material**

Code	Description
T	Glass Window
U	Plastic Window (Std.)

**Scale**

Code	Description
D	Standard % Air
B	Special Gas
P	Standard % Water
I	Special Liquid

**Float**

Select float code from shaded area in Table I.

**Float Material**

Code	Description
S	316 Stainless
H	Hastelloy C

**Tag:**

Code	Description
X	None (Standard)
1	Stainless Steel
2	Foil

**Voltage for Barrier (Integral Switch Only)**

Code	Description
X	None (Standard)
1	24V
2	120V
3	240V

**ORDERING PROCEDURE**

Example: To order a 1/2" Metal Tube Meter with indicator only with plastic window, 316SS 150 lb. flanges and float having a maximum capacity of 7.2 GPM water specify: **5220M22008XUIB410SXX**

\* Select either Exterior Flow Switch or Electronic Transmitter.

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## METAL TUBE VAREA-METER®

### STRAIGHT THROUGH TYPE ROTAMETER

#### ELECTRONIC TRANSMITTER

USFilter's Wallace & Tiernan Products' (USF/W&T) 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.

#### TECHNICAL DATA

**Accuracy** - Combined meter and transmitter accuracy is 2% 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; ambient range is -13 to 140°F.

#### 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 CN 521.274 UA.

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#### **EXTERNAL FLOW SWITCH**

*USFilter's Wallace & Tiernan Products' (USF/W&T) 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. The switch is available in a UL-listed, hazardous location\* arrangement (Series 5500) and a general purpose arrangement (Series 5600) in a NEMA 4 enclosure.*

*The External Flow Switch is easily added in the field with the meter in the line. No extension rod, on interference with vertical piping. Switches can be set to open or close on increasing or decreasing flow. In the general purpose model, this is done without removing the cover. A screwdriver adjustment sets each switch independently over 0 to 100% of the flow range.*

*\*As defined in Article 500, NEC.*



#### **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.

**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 CN 521.276 UA and CN 521.278 UA.

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#### INTEGRAL FLOW SWITCH

USFilter's Wallace & Tiernan Products' (USF/W&T) 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.

#### 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:  $\leq .0004$  in. of the set point.

General Purpose Alarm:  $\leq .0002$  in. of the set point.

##### Ambient Operating Temperature

NEMA 4 -13 to 131° F

Intrinsically Safe -13 to 140° F

##### Shipping Weights (lbs.)

Tube Size	1/2"	3/4"	1"	1 1/2"	2"
Meter with Magnetic Indicator	25*	25*	25*	40*	55*

\* Add 8 lbs. for GP Flow Switch, 9 lbs. for HAZ. Flow Switch. Add 4 lbs. for HAZ. Area Transmitter.

To find out more about how to put USFilter to work for you, contact us at

# USFilter

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