

racine™ VORTEX Product Summary

High-accuracy vortex-shedding flow meters for gases, liquids and steam;
in wafer, insertion, and in-line designs



Vortex Flow Meters

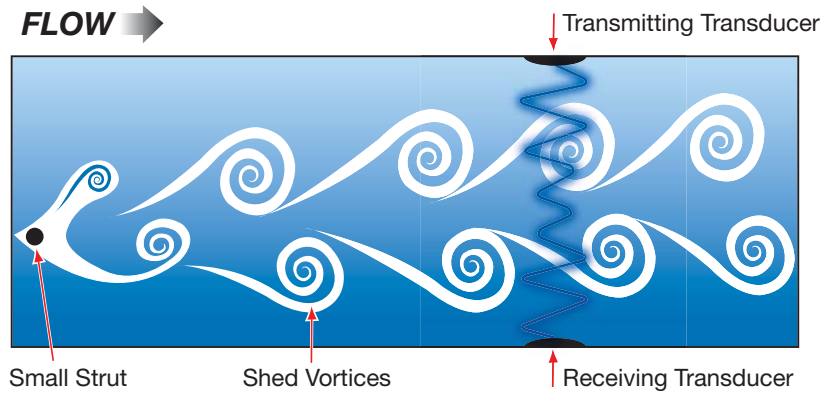
Operating Principle

An everyday example of a vortex shedding phenomenon is a flag waving in the breeze: the flag waves due to the vortices shed by wind moving across the flagpole. Within the flow meter as flowing media moves across the strut or "bluff bar" vortices are also shed, but on a smaller scale. The meter transmits an ultrasonic beam through the vortex pattern downstream of the strut. As vortices are shed the carrier wave of the ultrasonic signal modulates. The modulation of the carrier wave is measurable and proportional to the number of vortices shed. Digital processing enables the vortices to be counted, and this value is

converted into a velocity. Software converts velocity into a volumetric flow rate, in units of measure selected by the operator.

Racine Vortex flow meters utilize the smallest strut in the industry, which allows for high levels of sensitivity; superior performance at low flow rates; high turndown ratios; and low pressure drop.

Through the use of an internal RTD and an external pressure sensor (optional), the flow meter software will compensate for changes in pressure and temperature, to achieve an accurate mass flow measurement (gas meters).



Racine Vortex vs. Common Construction

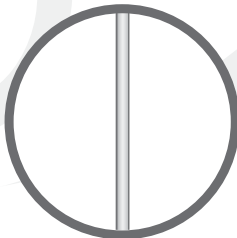
Typical vortex shedding flow meters use a large bluff body, often in conjunction with a piezoelectric sensor or pressure transducer. These large bodies are needed in order to generate a pivot, torque or pressure differential of sufficient magnitude (see example below). Racine vortex flow meters utilize ultrasonic sensing technology, allowing the meters to perform with an extremely small bluff body. As a result, system pressure drop and meter turndown ratio are greatly improved.

Flow Meter Selection

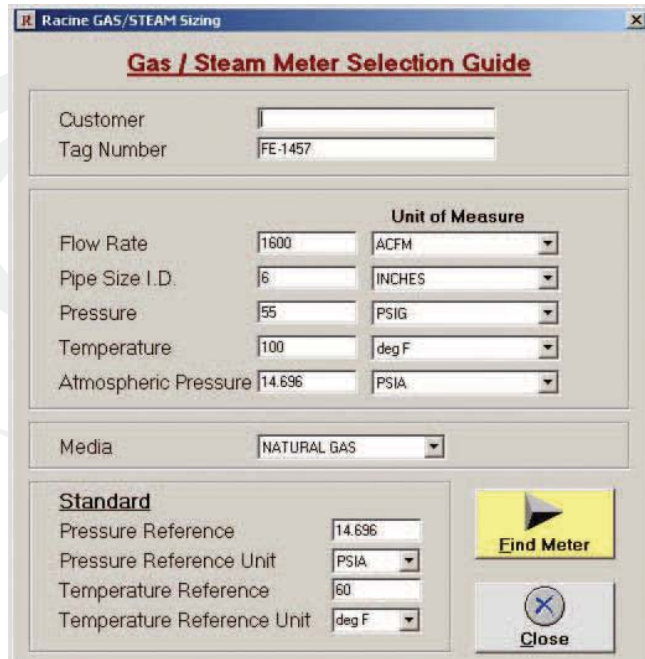
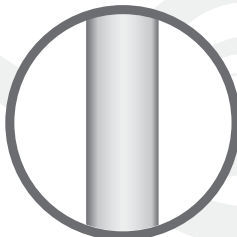
Racine vortex offers a sophisticated software program to aid in the flow meter selection process. The program accounts for system pressure and temperature, as well as media density, viscosity and specific gravity. Select from a complete list of Metric and English engineering units, using default or customized reference standards for pressure and temperature. This program may be downloaded at no charge from www.racinevortex.com.

Pipe head-on view

Racine Vortex 1.5" Gas Wafer Flow Meter. Bluff body blocks 9% of pipe cross-sectional area.



Typical 1.5" Gas Wafer Flow Meter. Bluff body blocks 43% of pipe cross-sectional area.




Vortex Gas Flow Meters - *Stainless Steel*

RWG & RWBG Series Wafer-Style Gas Meter

- **Applications:**
 - Combustion air
 - Compressed air
 - Incineration gas
 - Natural gas
 - Nitrogen
 - Digester gas (BioGas: CH₄ + CO₂)
 - Chemical processing
- Low pressure drop
- NIST traceable calibration
- HART® Communications Protocol



Specifications


Measured:	Gas/Air
Flow Range:	0.4 to 16 through 20 to 600 acfm
Accuracy:	±1% of reading over the upper 90% of the flow range
Repeatability:	0.5% of reading
Output Signal:	2-wire, 4-20mA loop
Input Power:	24 VDC
Certifications:	CE: EN61326-1:2002 Optional Intrinsically Safe conforms to: ATEX  II 2G Ex ib IIB T4 Zone 1 Group IIB T4 (Canada) and AEx ib IIB T4 (USA)

RNG Series Insertion-Style Gas Meter

- **Applications:**
 - Flare gas
 - Stack gas
 - Natural gas
 - Digester gas (BioGas: CH₄ + CO₂)
 - Air
- Not sensitive to gas composition changes
- High accuracy in wet gas applications
- 70:1 turndown ratio
- HART® Communications Protocol



Specifications

Measured:	Gas/Air
Velocity Range:	2 to 140 FPS (0.6 to 43 MPS)
Accuracy:	±1% of reading over the upper 90% of the flow range
Repeatability:	0.5% of reading
Output Signal:	2-wire, 4-20mA loop
Input Power:	24 VDC
Certifications:	CE: EN61326-1:2002 Optional Intrinsically Safe conforms to: ATEX  II 2G Ex ib IIB T4 Zone 1 Group IIB T4 (Canada) and AEx ib IIB T4 (USA)

Vortex Liquid Flow Meters - *Stainless Steel*

RNL Series Insertion-Style Liquid Flow Meter

- **Applications:**
 - Boiler feed water and condensate
 - Cooling tower
 - Pool and water park
 - Chemical processing
 - Municipal water treatment
 - Ground water monitoring
 - Irrigation systems
- Pipe sizes 4" (102 mm) and higher
- Very low pressure drop

Specifications

Measured:	Liquids
Velocity Range:	2 to 18 FPS (0.6 to 5.5 MPS)
Accuracy:	±2% of reading
Repeatability:	0.5% of reading
Output Signal:	2-wire, 4-20mA loop; 3-wire, 4-20mA and/or pulse
Input Power:	13 to 32 VDC
Certifications:	CE




Vortex Insertion Steam Flow Meter

RNS Series Insertion Steam Flow Meter

- **Applications:**
 - Non-condensing steam
 - Process steam (saturated)
 - Energy and boiler monitoring
 - Building and facilities management
- Pipe sizes from 6" to 72" (152 to 1829 mm)
- 35:1 turndown ratio
- HART® Communication Protocol

Specifications

Measured:	Saturated and superheated* steam
Velocity Range:	5 to 175 FPS (1.5 to 53 MPS)
Operating Temperature:	-20 °F to +366 °F (-28 °C to +186 °C)
Ambient Temperature Limits:	-20 °F to +155 °F (-28 °C to +68 °C)
Operating Pressure:	-5 to 150 PSIG (-0.3 to 10.3 bar)
Accuracy:	±1% of reading over the upper 90% of the flow range
Repeatability:	0.5% of reading
Input Power:	24 VDC
Signal Output:	2-wire, 4-20mA loop
RTD:	Platinum, PT-100, high accuracy temperature measuring element
Construction:	316 stainless steel, PEEK™, INCONEL®, AFLAS®, Viton® wetted parts, Type 4x (IP66) transmitter enclosure standard
Communications:	HART® Protocol (via PC or HART Modem)
Certifications:	CE: EN61326-1:2002 Optional Intrinsically Safe conforms to: ATEX  II 2G Ex ib IIB T4 Zone 1 Group IIB T4 (Canada) and AEx ib IIB T4 (USA)
Options:	2 line, 8 digit rate/totalizer display Remote electronics




Vortex Wafer Steam Flow Meter

RWS Series Wafer Steam Flow Meter

- **Applications:**
 - Non-condensing steam
 - Process steam (saturated)
 - Energy and boiler monitoring
 - Building and facilities management
- 316SS wetted parts
- Extremely small bluff bar results in negligible pressure drop
- NIST traceable calibration
- HART® Communication Protocol



Specifications

Measured:	Saturated and superheated* steam
Flow Range:	0.4 to 16 through 20 to 600 acfm
Operating Temperature:	-20 °F to +366 °F (-28 °C to +186 °C)
Ambient Temperature Limits:	-20 °F to +155 °F (-28 °C to +68 °C)
Operating Pressure:	-5 to 150 PSIG (-0.3 to 10.3 bar)
Accuracy:	±1% of reading over the upper 90% of the flow range
Repeatability:	0.5% of reading
Input Power:	24 VDC
Signal Output:	2-wire, 4-20mA loop
RTD:	Platinum, PT-100, high accuracy temperature measuring element
Construction:	316 stainless steel, PEEK™, INCONEL®, AFLAS®, Viton® wetted parts, Type 4x (IP66) transmitter enclosure standard
Communications:	HART® Protocol (via PC or HART Modem)
Certifications:	CE: EN61326-1:2002 Optional Intrinsically Safe conforms to: ATEX  II 2G Ex ib IIB T4 Zone 1 Group IIB T4 (Canada) and AEx ib IIB T4 (USA)
Options:	2 line, 8 digit rate/totalizer display Remote electronics

* Superheated steam applications require an external pressure transducer

Vortex Liquid Flow Meters - *Thermoplastic*

The RVL series meter utilizes vortex-shedding technology to provide a repeatable flow measurement accurate to 1% of full scale. The meter has no moving parts, and any potential for fluid contamination is eliminated by the meter's corrosion-resistant all plastic construction.

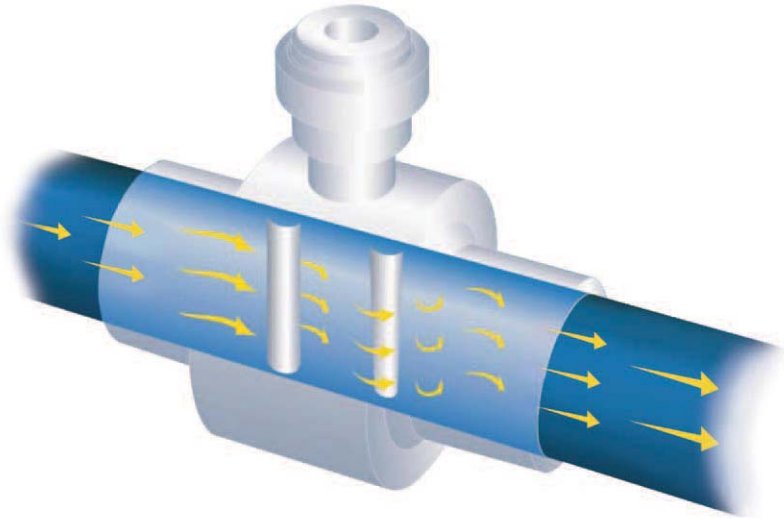
The meter includes a compact 2-wire (4-20mA) or 3-wire (0-5 VDC or pulse) transmitter, contained within a conveniently replaceable plug-in electronics module. All electronics are housed in a corrosion-resistant enclosure.

Unlike meters containing metal or moving parts, the RVL is perfect for aggressive or easily contaminated fluids. Applications range from ultra-pure water to highly corrosive chemicals and slurries. Units may be re-calibrated and the meter output span reprogrammed in the field.

RVL meters are available in the following materials of construction: CPVC, PVC, PVDF and Polypropylene (PP).

Operating Principle

Operation of the RVL vortex flow meter is based on the vortex shedding principle. As fluid moves around a body, vortices (eddies) are formed and move downstream. They form alternately, from one side to the other, causing pressure fluctuations. These are sensed by a piezoelectric crystal in the sensor tube, and are converted to a 4-20mA, 0-5 VDC or pulse signal. The frequency of the vortices is directly proportional to the flow rate. This results in extremely accurate and repeatable measurements using no moving parts.



Applications

- Semiconductor equipment
- Low viscosity slurry
- Chemical processing
- DI water: semiconductor, institutional
- DI water skids
- Water/wastewater
- Pharmaceutical

Material Selection

When choosing the best flow meter for a process, it is necessary to review the fluid to be measured, its concentration, the minimum and maximum operating temperatures, operating pressure, fluid viscosity, suspended particles, density of the fluid and, most importantly, expected flow range.

One advantage of utilizing a RVL vortex flow meter is that there are no gaskets or elastomers in the meter. Therefore, one need only be concerned with the thermoplastic material used in body construction.

In a thermoplastic piping system, the material chosen for the flow meter should match that of the pipe wherever possible.

Note: See product specifications on page 6.

Chemical Compatibility

A - Excellent B - Good C - Fair D - Severe effect

Chemical	Compatibility			
	PVC	PVDF	CPVC	Polypropylene
Aluminum Hydroxide	A	A	A	A
Chlorine Water	A	B	A	D
Fuel Oils	A	B	N/A	A
Hydraulic Oil	A	A	N/A	D
Hydrochloric Acid 37%	B	A	A	C
Hydrofluoric Acid 20%	B	A	C	A
Isopropyl Alcohol	A	N/A	C	A
Nitric Acid (Concentrated)	B	A	D	D
Phosphoric Acid (>40%)	B	B	A	A
Potassium Hydroxide	A	A	A	A
Propylene Glycol	C	N/A	C	A
Sulfuric Acid (10-75%)	A	A	A	A

Vortex Liquid Flow Meters - *Thermoplastic*

RVL Series In-Line Liquid Flow Meters

Specifications

Connection:	Butt or NPT thread
Line Sizes:	½" to 2" (12.7 mm to 50.8 mm)
Flow Ranges:	0.6 - 5 GPM through 16.7 - 200 GPM (2.3 - 18.9 LPM through 63.1 - 757.1 LPM)
Accuracy:	±1% of full scale, 4-20mA and 0-5 VDC; ±2% of full scale, frequency pulse
Repeatability:	±0.25% actual flow
Output Signal:	4-20mA, 0-5 VDC or frequency pulse (source-sink driver; 1A source / 1.5A sink; typical output resistance 10 Ohms)
Input Power:	13 to 30 VDC
Certifications:	CSA Standard C22.2 No. O-M and No. 142-M; CE
Material Options:	PVC, CPVC, PVDF



RVL Series Wafer Liquid Flow Meters

Specifications

Connection:	Wafer (mounts between flanges)
Line Sizes:	½" to 3" (12.7 mm to 76.2 mm)
Flow Ranges:	1.3 - 15 GPM through 25 - 300 GPM (4.7 - 56.8 LPM through 94.6 - 1135.5 LPM)
Accuracy:	±1% of full scale, 4-20mA and 0-5 VDC; ±2% of full scale, frequency pulse
Repeatability:	±0.25% actual flow
Output Signal:	4-20mA, 0-5 VDC or frequency pulse (source-sink driver; 1A source / 1.5A sink; typical output resistance 10 Ohms)
Input Power:	13 to 30 VDC
Certifications:	CSA Standard C22.2 No. O-M and No. 142-M; CE
Material Options:	PVC, CPVC, PP, PVDF



RVL Series In-Line Flare End Liquid Flow Meters

Specifications

Connection:	Tube (flare-end)
Line Sizes:	½" to 1" (12.7 mm to 25.4 mm)
Flow Ranges:	0.6 - 5 GPM through 2.1 - 25 GPM (2.3 - 18.9 LPM through 7.9 - 94.6 LPM)
Accuracy:	±1% of full scale, 4-20mA and 0-5 VDC; ±2% of full scale, frequency pulse
Repeatability:	±0.25% actual flow
Output Signal:	4-20mA, 0-5 VDC or frequency pulse (source-sink driver; 1A source / 1.5A sink; typical output resistance 10 Ohms)
Input Power:	13 to 30 VDC
Certifications:	CSA Standard C22.2 No. O-M and No. 142-M; CE
Material:	PVDF



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