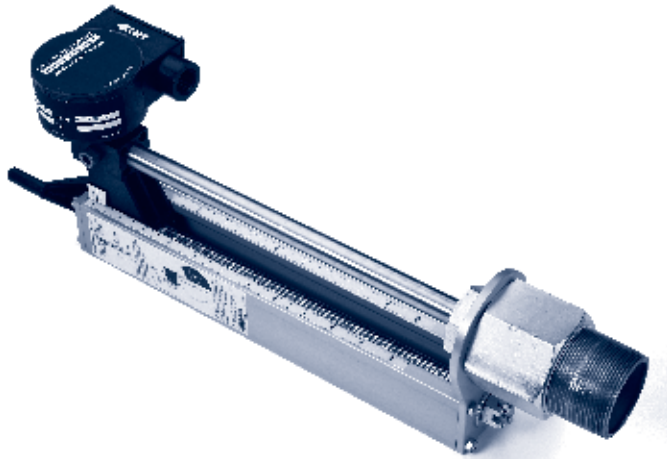


Hydro-Flow Model 3100

Installation and Operation Guide



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Understanding Vortex Flow Meters

Vortex shedding flow meters measure flow by detecting the frequency at which vortices are alternately shed from a bluff body. The vortices create low and high pressure zones behind the bluff body which are detected as a force acting on the sensor wing. This force is transmitted through the sensor wing to the Hydro-Flow piezo-resistive sensor mounted inside the flow line. Hydro-Flow's unique and proprietary microprocessor-based piezo-resistive sensor can accurately and reliably process vortex signals 25 times smaller than permitted by other technologies.

According to physical laws, the shedding frequency is directly proportional to the average flow velocity. This effect can be observed in the fluttering of a flag.



Vortex flow meters are preferred for many applications requiring wide flow range, accuracy, and reliability (no moving parts).

Handling Your Flow Meter

Even though the flow meter is one of the most rugged in the industry, exercise reasonable care with the flow meter.

- *When not installed, store the flow meter with the installation manual in its shipping container.*
- *Do not ram or poke objects into the meter bore or onto the sensor wing/shedder. Hydro-Flow is a no moving parts flow meter. If you push hard enough to see a part move, the flow meter is probably damaged.*
- *Pay particular attention to the direction of flow. The flow must impact the surface of the stainless steel shedder. The direction of the flow is clearly indicated on the flow meter electronics. The flow meter will not work if you install it backwards.*
- *The flow meter's installation location is important for optimum performance accuracy; a quick review of "Installing Your Flow Meter" on page 3 will be helpful.*

Identifying Your Flow Meter

An identification plate (ID) is attached to your flow meter. For model code information, see “Hydro-Flow Model and Suffix Codes” on page 2.

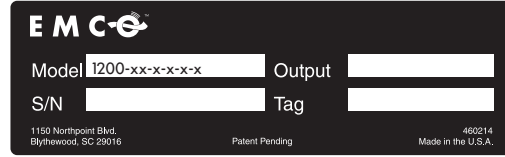


Figure 1. Flow meter identification (ID) plate

Hydro-Flow Model and Suffix Codes

Table 1. Hydro-Flow model and suffix code identification table

Category	Suffix Codes					
Type						
Retractable insertion	3100	...	...	...	...	...
Line Size						
3" (80 mm)	...	03	...	...	...	...
through	...	to	...	...	...	...
20" (500 mm)	...	20	...	...	...	...
Mounting						
Thread-o-let	1	...	...	...
Saddle for steel pipe	2	...	...	...
Output						
Pulse	1	...	...
Current: 4 mA to 20 mA	2	...	...
No output	3	...	...
Display						
No Display	1	...
Rate/Total Display	2	...
Measuring Units						
English	1
Metric	2
Example (3100-12-1-2-2-2):	3100	12	1	2	2	2
<i>A 12" retractable insertion flow meter with thread-o-let mounting, 4mA to 20mA analog output, and rate/total display in metric units.</i>						

Ordering Considerations

When ordering, please specify pipe size, material, and schedule (or outside and inside diameter of pipe).

Standard English measuring units are gallons per minute (gpm) and gallons. Standard metric measuring units are cubic meters per hour (m³/hr) and cubic meters (m³).

Please specify other desired measuring units for which the flow meter should be configured. Other units, such as acres, cubic feet, barrels, and liters are available and can be set by the factory.

Installing Your Flow Meter

Upon receiving your Hydro-Flow equipment, verify that all materials on the packing list are present. Check for possible shipping damage and notify the freight carrier or your Hydro-Flow representative if there is any damage.

Before installing your flow meter, verify that the model is consistent with your requirements. See “Hydro-Flow Model and Suffix Codes” on page 2 for identification information.

Selecting the Best Flow Meter Location

For optimum performance, you must consider straight run requirements and flow meter installation location relative to flow direction. Figure 2 illustrates possible flow meter locations. The good flow meter locations are recommended to ensure that the pipe and the flow meter will always be filled with fluid.

Straight Run Requirements

The straight run of the pipe must have the same nominal diameter (D) as the flow meter body. Figure 2 illustrates the minimum requirements for straight run piping.

Note: Consult the factory if you have special requirements.

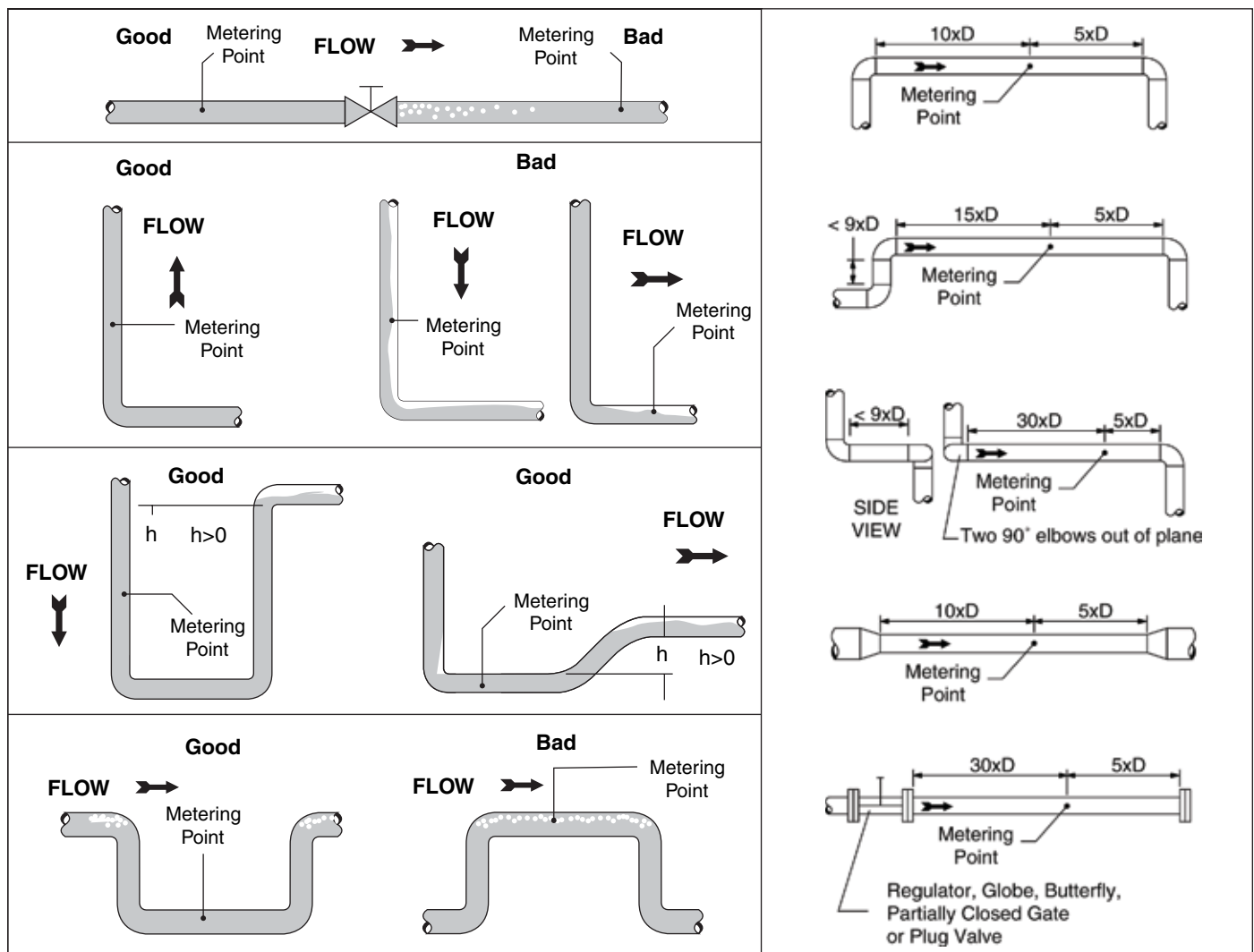


Figure 2. Flow meter location illustrations and straight run requirements

Mechanical Drawing: Model 3100

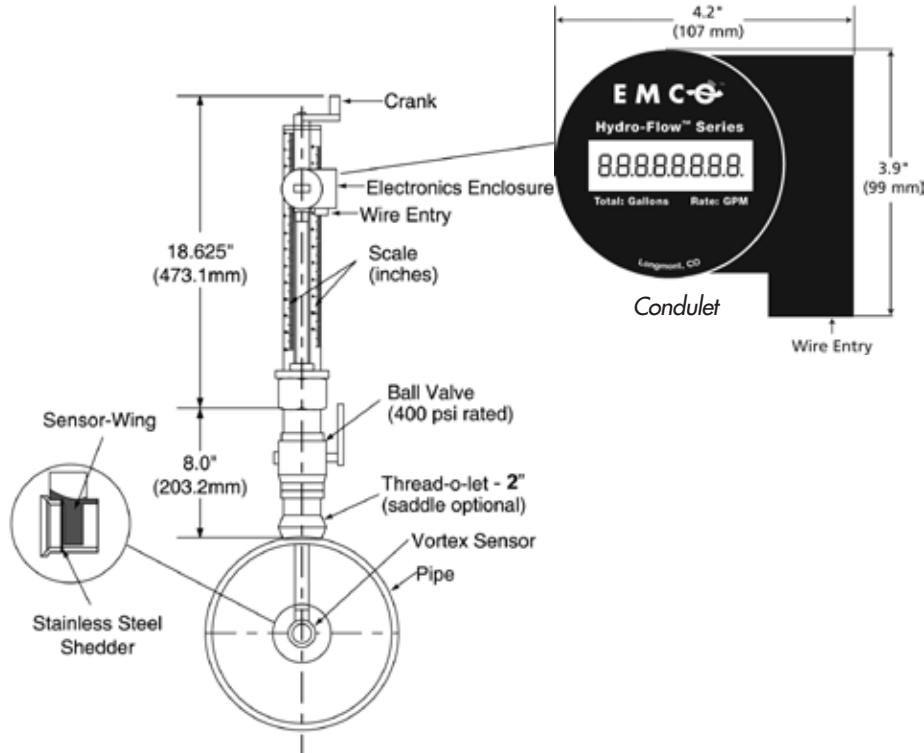


Figure 3. Hydro-Flow Model 3100 flow meter with detail of conduit

Mechanical Installation

General mechanical installation information:

The Hydro-Flow model 3100 retractable insertion flow meter allows for installation without the need to depressurize the pipeline. The retractor serves to position the vortex flow sensor in the pipe. When the retractor is used with an isolation valve, it is wet tap compatible.

The retractor is a non-rising stem type, thus providing maximum installation ease and operator safety. Note: Manual force to push the flow sensor into the pipe is not required.

Wet Tapping

Flow meter is supplied with a 2" thread-o-let. A 1.875" hole opening is required.

CAUTION: Local State regulation often require a wet tap permit. The manufacturers of the wet tap equipment and/or the contractors performing the contract are responsible for providing the proof of such a permit.

Thread-o-let Installation

CAUTION: Line must be depressurized if wet tap is not performed.

To Mount the Flow Meter in a Thread-o-let Installation:

1. Drill or bore and deburr a 1.875" diameter hole in pipe. Use a 1-7/8" hole saw.

Note: Flame cutting is discouraged.

2. The hole should not be blocked. Center the 2" thread-o-let over hole (see Figure 4).

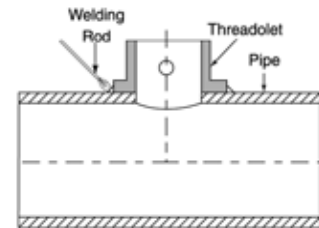


Figure 4. Thread-o-let hardware installation

3. Weld the thread-o-let on the pipe using standard trade practices. Trade practices may vary by locality. Welding should be done by an experienced certified welder.

4. Attach flow meter to isolation valve.

5. Fully open isolation valve.

CAUTION: Failure to fully open valve prior to installation will cause irreparable damage to the flow sensor. A bold, very visible warning sign is recommended to alert operator.

6. Turn crank clockwise to insert the flow sensor into the pipe. Do so until the calculated scale reading lines up with the arrow on the retractor bar assembly.

CAUTION: Do not force sensor into pipe if the mechanical resistance suddenly increases—this condition generally indicates the pipe tap is too small.

Calculating the Proper Scale Reading

For all pipe sizes, the proper scale reading is equal to the distance from the top of the pipe to the bottom of the aluminum plate at the bottom of the scale (see Figure 5). This measurement equals "A".

Note: Use the scale on the left for pipe sizes 6" and smaller. Use the scale on the right for pipe sizes 8" and larger.

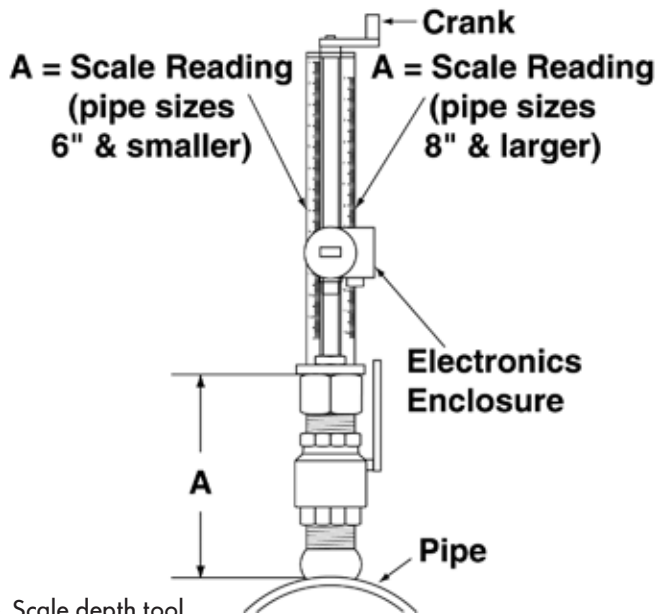


Figure 5. Scale depth tool

The scale on the retractor indicates the position of the flow sensor axis to within 0.05 inches with respect to the reference surface (see Figure 6). Reference surface is marked on retractor.

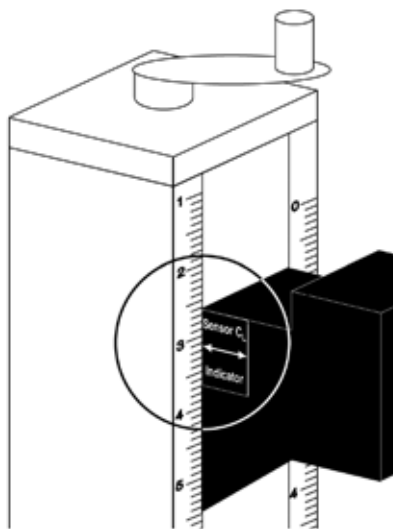


Figure 6. Scale depth tool indicator

Saddle Clamp Installation

CAUTION: Line must be depressurized if wet tap is not performed.

To Mount the Flow Meter in a Saddle Clamp Installation:

1. Drill or bore and deburr a 1.875" diameter hole in pipe. Use a 1-7/8" hole saw.

Note: Flame cutting is discouraged.

2. Clean pipe surface thoroughly—particularly in the area where the gasket will sit. Check saddle gasket for proper positioning in saddle body.

3. Lubricate pipe and face of gasket with soap and water. Add antifreeze in freezing weather. Mount saddle body with gasket in place on pipe.

4. Install bales and washers on open lug side.

5. Tighten nuts evenly until saddle body conforms snugly to the pipe.

6. Turn crank clockwise to insert the flow sensor into the pipe until the calculated scale reading lines up with the arrow on the retractor assembly.

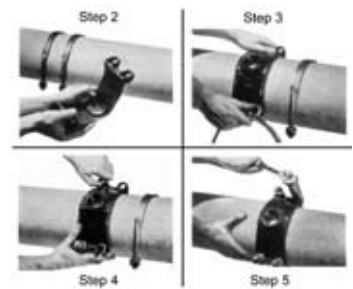


Figure 7. Saddle clamp installation

CAUTION: Do not force sensor into pipe if the mechanical resistance suddenly increases—this condition generally indicates the pipe tap is too small.

Making Electrical Connections

The pulse output of the Hydro-Flow flow meter functions by momentarily shorting the (+) terminal to the (-) terminal.

CAUTION: If the flow meter is connected directly to a DC power source without the series resistor, both the flow meter and the power source may be damaged.

The wiring polarity must be observed for proper operation of the flow meter. If the flow meter is wired backwards to the current-limited power source, the flow meter will not be damaged but it will not function properly.

Pulse Output Electrical Installation

The Hydro-Flow pulse output flow meter may be used with a 10 VDC to 32 VDC power supply and series current limiting resistor. The voltage at the flow meter terminals is internally limited to 8.0 ±1.0 VDC under noflow conditions, dropping to less than 1.0 V for the 2.5 to 5 millisecond duration of the output pulse. Figure 8 illustrates a typical installation.

Note: The totalizer or flow computer input must be rated for an 8-volt pulse input.

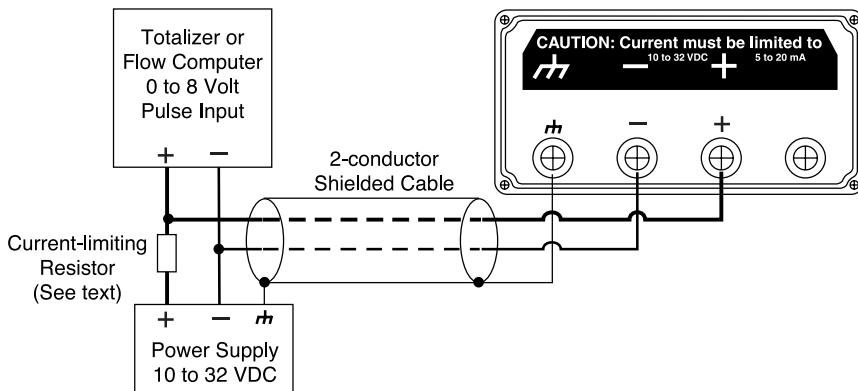


Figure 8. Wiring diagram (pulse output)

Cabling (Pulse Output)

The cable may be up to 2000 feet of #20 AWG or larger shielded two-conductor cable. The shield lead from the meter may be connected to an earth ground, such as a copper cold water pipe. The shield improves noise immunity and provides a return path for electrical surges. Its use is optional in installations in which transients and noise are not a problem.

Current Limiting Resistor (Pulse Output)

The current limiting resistor is required to limit the normal operating current in the flow meter to a value between 5 mA and 20 mA (with a meter voltage of 8 volts and less than 25 mA). The value of the resistor is determined by the power supply voltage, the operating meter current, and the cable resistance.

Table 2 lists standard ½ watt 5% resistor values which will work in most installations. For power supply voltages between those in the table, use the lower value of resistor.

Table 2. Current limiting resistor for pulse output

Supply Voltage (DC)	Current Limiting Resistor Values (Ω)	
	Minimum	Maximum
10	400	400
12	480	800
14	260	1200
16	640	1600
18	720	2000
20	800	2400
22	880	2800
24	960	3200
26	1040	3600
28	1120	4000
30	1200	4400
32	1280	4800

4 mA to 20 mA Current Output or No Output (Display Only) Electrical Installation

The Hydro-Flow flow meter may be configured to output a 4 mA to 20 mA analog signal proportional to flow rate.

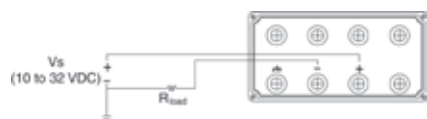


Figure 9. Wiring diagram (4 mA to 20 mA current loop)

Cabling (4 mA to 20 mA Output or No Output)

The flow meter may be connected with up to 2000 feet of #22 AWG or larger cable. Shielded cable may be necessary in some environments to reduce electrical noise; if used, the shield should be connected at one end only to an earth ground point, such as a copper cold water pipe.

Load Resistances (4 mA to 20 mA Output)

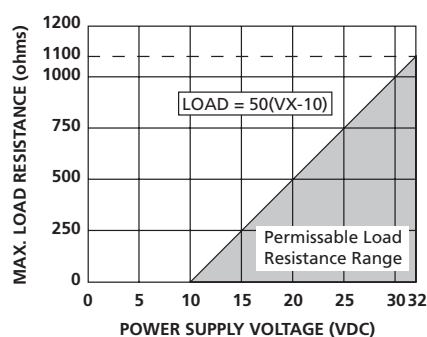


Figure 10. Maximum load resistance (4 mA to 20 mA output)

Electrical Specifications

Table 5. Electrical specifications

Enclosure	Reinforced Polycarbonate, NEMA 6
Output Signal Options	<ul style="list-style-type: none"> Pulse output: frequency proportional to flow rate. <p>Power supply: 10 VDC to 32 VDC power supply with current limited by series resistance to between 5 mA and 20 mA. Maximum pulse width is 5 ms. See Table 2 on page 6 for standard output scaling.</p> <p>Other pulse output settings can be configured by the factory or reconfigured in the field using Hydro-Flow Field-Pro software.</p> <ul style="list-style-type: none"> Analog output: 4 mA to 20 mA analog current loop, current proportional to flow rate. <p>Power supply: 10 VDC to 32 VDC compliance. 4 mA = zero flow; 20 mA = maximum flow listed in Table 2 on page 6.</p> <p>Other 20 mA settings can be configured by the factory or reconfigured in the field using Hydro-Flow Field-Pro software.</p> <ul style="list-style-type: none"> No output: display only. Power supply: 8 VDC to 32 VDC, 4 mA maximum
Display Option	LCD display alternately shows 4-digit rate and 8-digit total flow.

Mechanical Specifications

Table 4. Mechanical specifications

Type	Retractable insertion
Measurable Fluids	Water; water/glycol mixtures; condensate
Pipe Sizes	3" to 20" (80 mm to 500 mm)
Fluid Temperature	32°F to 160°F (0°C to 71°C) all connections
Fluid Pressure	<ul style="list-style-type: none"> Thread-o-let connection: 400 psi (27.5 bar) maximum Saddle connection: 300 psi (20.7 bar) maximum
Ambient Temperature	-20°F to 140°F (-29°C to 60°C)
Flow Range	<ul style="list-style-type: none"> Minimum: 1.0 foot per second (0.3 m per second) Maximum: 15 feet per second (4.5 m per second)
Measuring Units	<ul style="list-style-type: none"> English: gallons Metric: cubic meters <p>Note: Other measuring units available upon request or measuring units can be reconfigured using Hydro-Flow Field-Pro software.</p>
Accuracy (combined linearity and repeatability)	±1.0% of full scale
Insertion Assembly	<ul style="list-style-type: none"> Valve: ball type, 400 psi (27.5 bar) Retractor: nonrising stem Position indication: permanent scale
Materials of Construction	Retractor: aluminum, nickel-plated steel
Wetted parts	<ul style="list-style-type: none"> Vortex sensor: Ultem® (plastic) Shedder bar: 316 stainless steel Stem: 316 stainless steel O-rings: EPDM
Mounting Options	<ul style="list-style-type: none"> Carbon steel saddle for steel pipes Carbon steel thread-o-let
Pipe Connection	2" NPT
Straight Run Piping	<p>Typical 10 diameters upstream, 5 diameters downstream.</p> <p>Note: For more information, see "Straight Run Requirements" on page 3.</p>

Hydro-Flow Model 3100 Flow Ranges

Table 3. Model 3100 flow ranges

Line Size Inches (mm)	3" (80)	4" (100)	6" (150)	8" (200)	10" (250)	12" (300)	14" (350)	16" (400)	18" (450)	20" (500)
Minimum flow(gpm)	26.6	40.0	100.0	166.6	266.6	366	416.6	566.6	733.4	933.4
Maximum flow	400	600	1500	2500	4000	5500	6250	8500	11000	14000
Minimum flow (m3/h)	6.0	9.0	22.8	37.8	60.6	83.2	94.6	128.8	166.6	212
Maximum flow	90.8	136.3	340.7	567.8	908.5	1249.2	1419.5	1930.6	2498.4	3179.7
Pulses per gallon <small>Note 1</small>	25	15	6	4	2	2	1	1	1	0.5
Pulses per cubic meter <small>Note 1</small>	5000	5000	2000	1000	500	500	500	200	200	200

Note 1 When flow meter is configured for pulse output

Safety Information

Safe operation of this product can be guaranteed only if it is properly installed, commissioned, used and maintained by qualified personnel in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment, must also be complied with.



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For information on EMCO flow products, contact:
EMCO Flow Systems - 2150 Miller Drive - Longmont, Colorado 80501
T: 800.356.9362 or 303.682.7060
F: 303.682.7069

sales@emcoflow.com
www.emcoflow.com



SPIRAX SARCO, INC.
1150 NORTHPOINT BLVD.
BLYTHEWOOD, SC 29016
phone: 1.800.883.4411
or 803.714.2000
fax: 803.714.2222
www.spiraxsarco.com

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