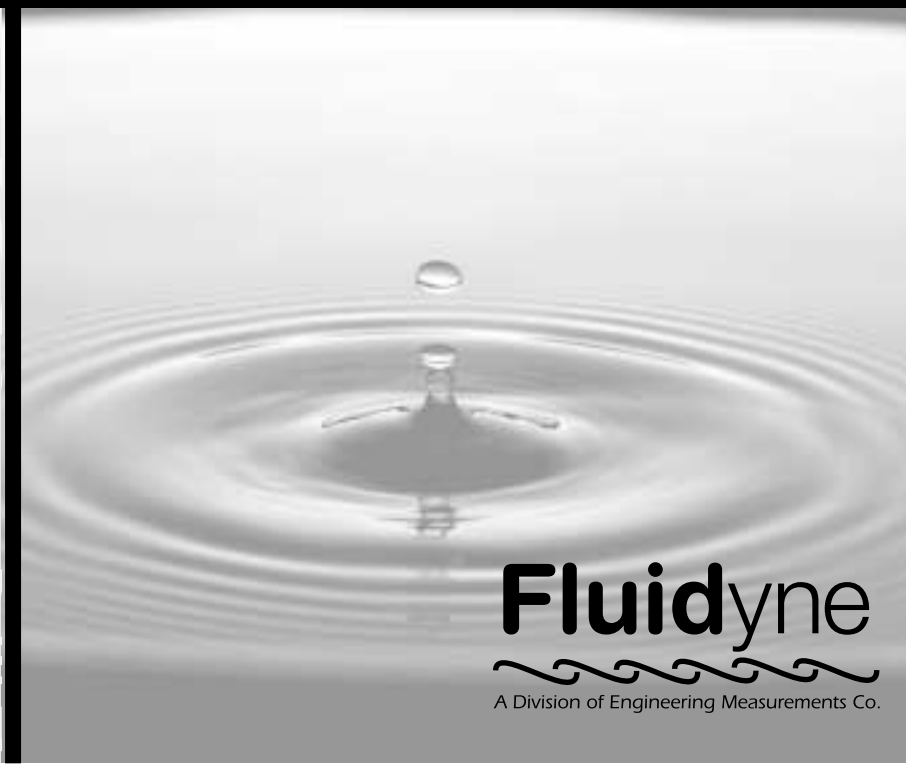
Hydro-Flow™ Model 3100
Retractable Insertion Vortex Flowmeter
Installation and Operation Manual



Fluidyne

A Division of Engineering Measurements Co.

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MODEL AND SUFFIX CODES

Category	Description	Suffix Codes					
Type	Retractable Insertion	3100	...	...	...	...	...
Line Size	3 thru 20 in. (80 - 500mm)	...	03	...	...	...	...
		...	thru	...	...	...	...
		...	20	...	...	...	...
Mounting	Thread-o-let	...	...	1	...	...	...
	Saddle for Steel Pipe	...	...	2	...	...	...
Output	Pulse	...	...	...	1	...	...
	Current, 4-20 mA	...	...	...	2	...	...
	No Output	...	...	...	3	...	...
	For Use With Solar Power Supply (Low power consumption - 2 mA)	...	...	...	4	...	...
Display	No Display	...	...	...	...	1	...
	Rate/Total Display	...	...	...	...	2	...
Measuring Units	English	...	...	...	...	...	1
	Metric	...	...	...	...	...	2

Example: **Hydro-Flow 3100-12-1-2-2-2**

A 12" retractable insertion flowmeter with thread-o-let mounting, 4-20 mA analog output and a rate/total display with Metric measuring units.

Notes:
1. Standard English measuring units are gallons per minute (gpm) and gallons. Standard metric measuring units are cubic meters per hour (m^3/hr) and cubic meters (m^3). Please specify other desired measuring units for which the flowmeter should be configured. Other units, such as acres, cubic feet, barrels and liters are available and can be set by the factory.
2. Please specify pipe size, material and schedule OR outside and inside diameter of pipe.

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What is a Vortex Flowmeter?

Vortex shedding flowmeters 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.

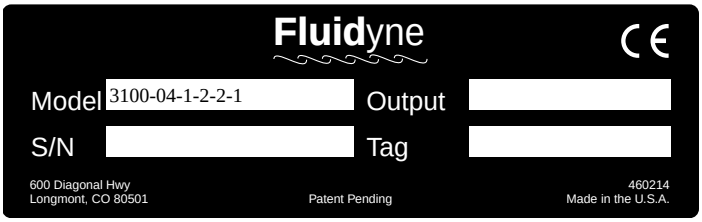
According to well proven physical laws, the shedding frequency is directly proportional to the average flow velocity. This effect can be observed in the fluttering of a flag.

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

When You Receive the Flowmeter

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

A permanent identification plate (ID) is attached to your flowmeter; verify the model is consistent with your requirements. (See Model & Suffix Code Table, p. 2.)



For example, if you ordered a 4" Hydro-Flow™ 3100 flowmeter with a thread-o-let fitting, 4-20 mA analog output and a Rate/Total display with English measuring units, the model number should read 3100-04-1-2-2-1, as in the above ID.

Common Sense / Meter Handling Issues

You are in receipt of a precision, world-class instrument. Even though the flowmeter is one of the most rugged in the industry, exercise reasonable care with the flowmeter.

1. When not installed, store the flowmeter with the installation manual in its shipping container.
2. Do not ram or poke objects into the meter bore or onto the sensor wing/shedder. Hydro-Flow™ is a no moving parts flowmeter. If you push hard enough to see a part move, the flowmeter is probably damaged.
3. 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 flowmeter electronics. The flowmeter will not work if you install it backwards.
4. The flowmeter's installation location is important for optimum performance accuracy; a quick review of Installation Guidelines, p. 4, will be helpful.

Selecting the Best Flowmeter Location

Not all plumbing is laid out with flowmetering in mind. For optimum performance, you must consider straight run requirements and the flowmeter's installation location relative to flow direction. Figures 1 and 2 illustrate useful examples of both proper and improper flowmeter installations. If you have special requirements, PLEASE consult the factory.

Flowmeter Location

Figure 1 illustrates possible flowmeter locations. The good flowmeter locations are recommended to ensure that the pipe and the flowmeter will always be filled with fluid.

Straight Run Requirements

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

Figure 1. Flowmeter Location

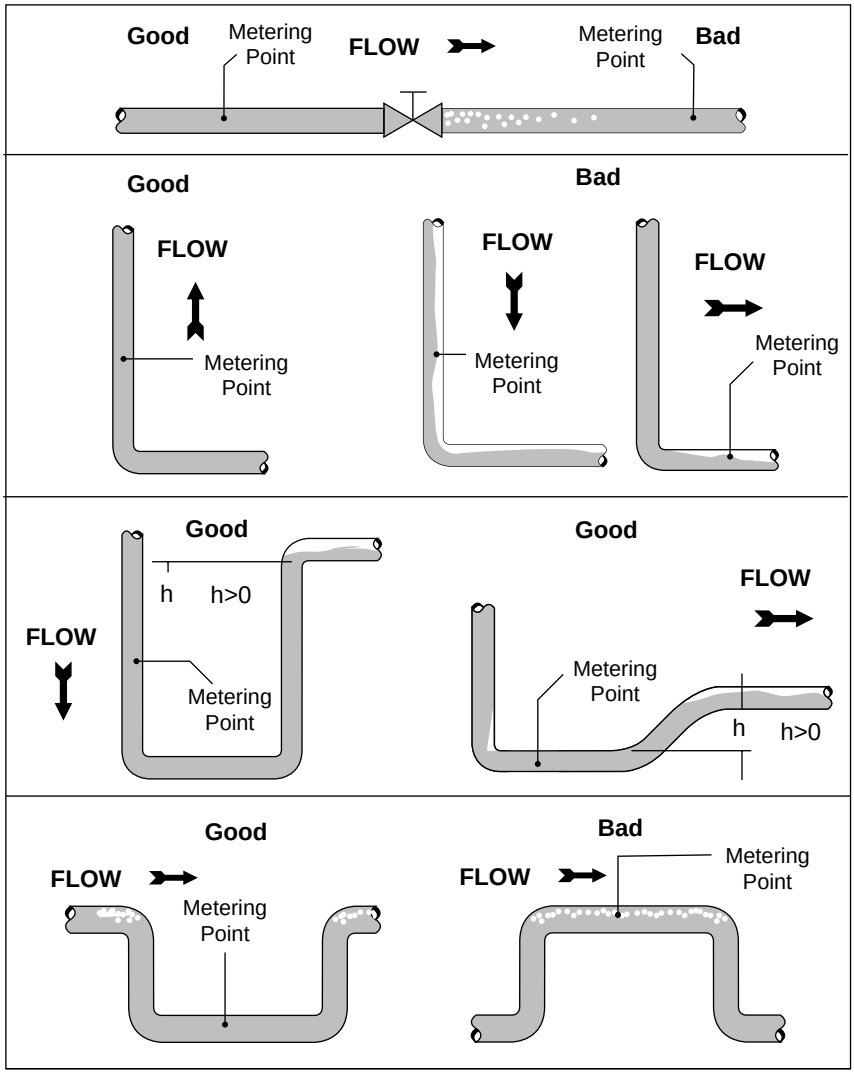
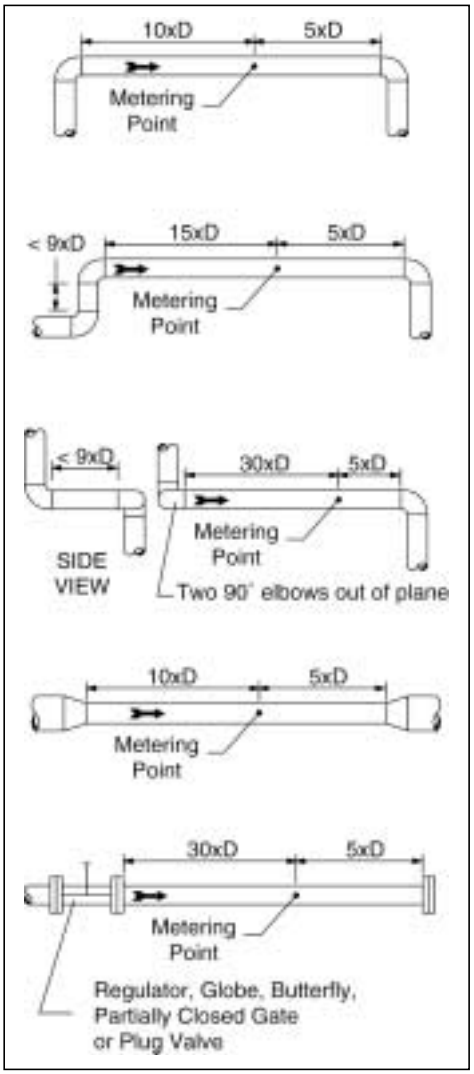


Figure 2. Straight Run Requirements



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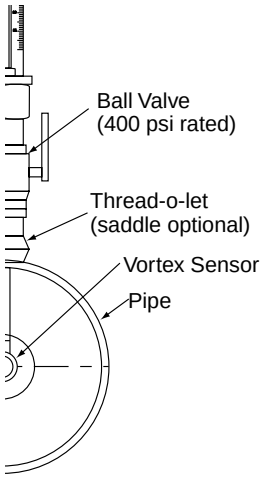
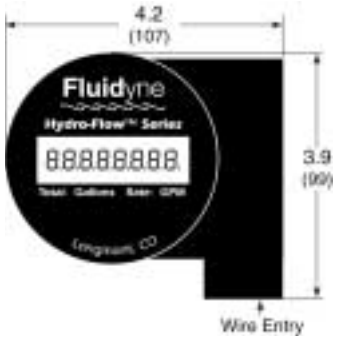
Mechanical Drawing: Model 3100



Dimensional Drawing: Condulet (shown with display)



Mechanical Installation

General Mechanical Installation Information

The Hydro-Flow™ Model 3100 retractable insertion flowmeter allows for installation without the need to depressurize the pipeline. The retractor serves to position the vortex flow sensor in the pipe and when used with an isolation valve is "wet tap" compatible.

The retractor is a non-rising stem type, thus providing maximum installation ease and operator safety (manual force to PUSH the flow sensor into the pipe is not required).

Figure 3. Thread-o-let Installation

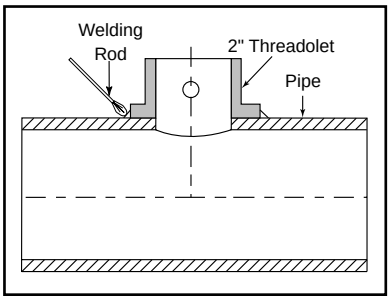


Figure 4. Scale Depth

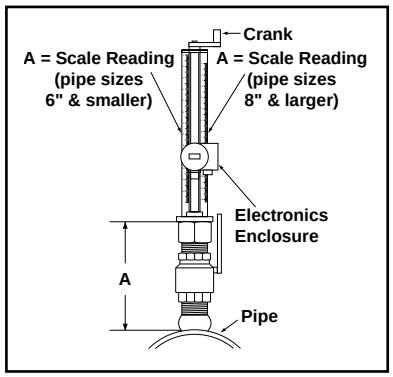
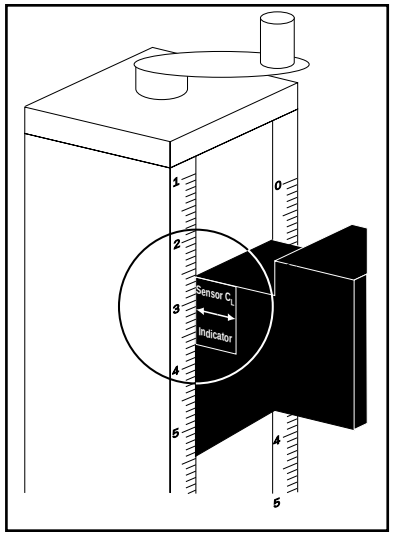


Figure 5. Scale Indicator



Wet Tapping

Flowmeter 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.*

1. Drill or bore and *de-burr* a 1.875" diameter hole in pipe. Use a 1 7/8" hole saw.
   Caution: *Flame cutting is discouraged.*
2. The hole should not be blocked. Center the 2" thread-o-let over hole (*See Figure 3*).
3. Weld the thread-o-let onto the pipe using standard trade practices. Trade practices may vary by locality. Welding should be done by an experienced certified welder.
4. Attach flowmeter to isolation valve.
5. Fully open isolation valve.
   Note: *Failure to fully open valve prior to installation will cause irreparable damage 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 4.*) This measurement equals "A." IMPORTANT: Use the scale on the left for pipe sizes 6" and smaller. Use the scale on the right for pipe sizes 8" and larger.

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 5.*) Reference surface is marked on retractor.

Saddle Clamp Installation

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

1. Drill or bore and *de-burr* a 1.875" diameter hole in pipe. Use a 1 7/8" hole saw.
   Caution: *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. (*See Figure 6 below.*)
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. 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.*

Figure 6. Steps 2 thru 5 for Saddle Clamp Installation

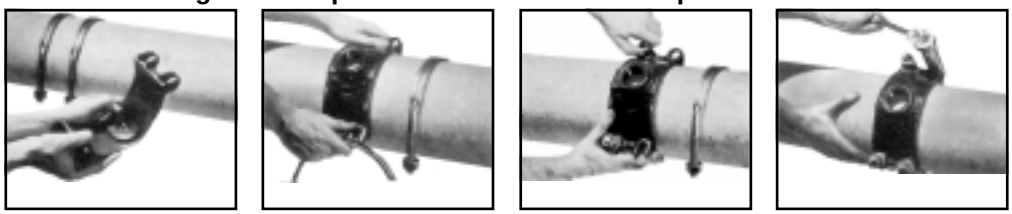


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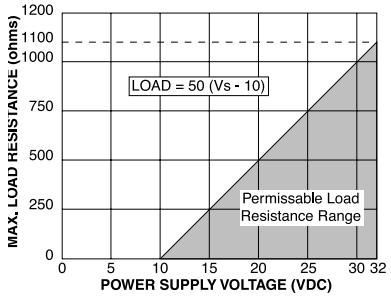
TABLE 1. CURRENT LIMITING RESISTOR FOR PULSE OUTPUT

Supply Voltage (DC)	Current Limiting Resistor Values (ohms)	
	Min	Max
10	400	400
12	480	800
14	560	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

Graph 1. Maximum Load Resistance for 4-20 mA Ouput



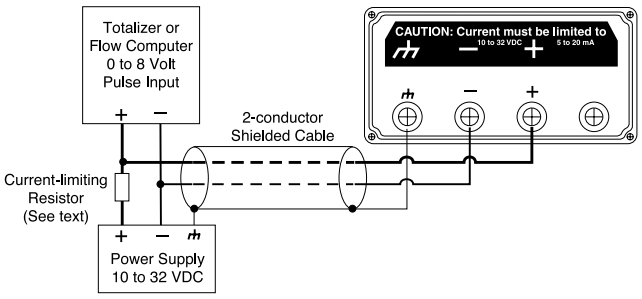
CAUTION

The pulse output of the Hydro-Flow™ flowmeter functions by momentarily shorting the + terminal to the – terminal. If the flowmeter is connected directly to a DC power source without the series resistor, both the flowmeter and the power source may be damaged. The wiring polarity must be observed for proper operation of the flowmeter. If the flowmeter is wired backwards to the current-limited power source, the flowmeter will not be damaged but it will not function properly.

Pulse Output Electrical Installation

The Hydro-Flow™ pulse output flowmeter may be used with a 10 to 32 volt DC power supply and series current limiting resistor. The voltage at the flowmeter terminals is internally limited to 8.0 ±1.0 volts DC under no-flow conditions, dropping to less than 1.0 volt for the 2.5 to 5 millisecond duration of the output pulse. Figure 4 below illustrates a typical installation. ***Note:*** *The totalizer or flow computer input must be rated for an 8-volt pulse input.*

Figure 7. Wiring Diagram - Pulse Ouput



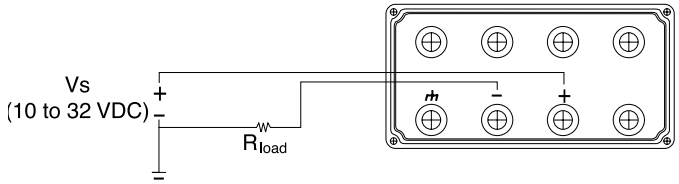
The cable may be up to 2000 feet of #20 AWG or larger shielded two-conductor cable. The shield lead from the meter may be connected to an earth ground, such as a copper cold water pipe. The shield improves noise immunity and provides a return path for electrical surges. Its use is optional in installations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

The current limiting resistor is required to limit the normal operating current in the flowmeter to a value between 5 and 20 mA with a meter voltage of 8 volts, and less than 25 mA with the meter terminals short-circuited. The value of the resistor is determined from the power supply voltage, the operating meter current and the cable resistance. Table 1 lists standard 1/2 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.

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

The flowmeter 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.

Figure 8. Wiring Diagram - 4-20 mA Current Loop



Mechanical Specifications

Type
Retractable Insertion

Measurable Fluids
Water; Water/Glycol Mixtures; Condensate

Pipe Sizes
3" to 20" (80 to 500 mm)

Fluid Temperature
32° to 212° F (0° to 100° C) for all connections

Fluid Pressure
400 psi (27.5 bar) maximum for thread-o-let connection
300 psi (20.7 bar) maximum for saddle connection

Ambient Temperature
- 20 to 140 °F (- 29 to 60 °C)

Flow Range
0.5 feet, or 0.15 meters, per second minimum
15 feet, or 4.5 meters, per second maximum

Measuring Units
English.....Gallons
Metric.....Cubic Meters
Other measuring units available upon request or measuring units can be reconfigured using Fluidyne's Field-Pro™, PC compatible configuration software.

Accuracy (Combined Linearity and Repeatability)
±1.0% of full scale

Insertion Assembly
Valve.....Ball Type, 400 psi (27.5 bar)
Retractor.....Non-Rising Stem
Position Indication .Permanent Scale

Materials of Construction
Retractor.....Aluminum, Nickel Plated Steel

Wetted Parts
Vortex Sensor .....Ultem® (Plastic)
Shedder Bar .....316 Stainless Steel
Stem .....316 Stainless Steel
O-rings .....EPDM

Mounting Options
Carbon steel saddle for steel pipes
Carbon steel thread-o-let

Pipe Connection
2" NPT

Straight Run Piping
Typical 10 diameters upstream, 5 diameters downstream.
(*See Figure 2, p.4.*)

Electrical Specifications

Enclosure
Reinforced Polycarbonate, NEMA 6

European CE Mark
Approved

Output Signal Options
Pulse Output.....Frequency proportional to flow rate. Power Supply: 10-32 VDC power supply with current limited by series resistance to between 5 and 20 mA. Maximum pulse width is 5 ms. See Table 2 for standard output scaling. Other pulse output setting can be configured by the factory or reconfigured in the field using Fluidyne's Field-Pro™.

Analog Output.....4-20 mA analog current loop, current proportional to flow rate. Power Supply: 10-32 VDC compliance. 4 mA = zero flow; 20 mA = maximum flow listed in Table 2. Other 20 mA setting can be configured by the factory or reconfigured in the field using Fluidyne's Field-Pro™.

No Output.....Display only. Power Supply: 8-32 VDC, 4 mA maximum.

Display Option
LCD display alternately shows 4-digit rate and 8-digit total flow.

TABLE 2. MINIMUM AND MAXIMUM FLOW RANGES

Line Size in. (mm)	3 (80)	4 (100)	6 (150)	8 (200)	10 (250)
Min. Flow Max. Flow (gpm)	13.3 (400)	20.0 (600)	50.0 (1500)	83.3 (2500)	133.3 (4000)
Min. Flow Max. Flow (m^3/h)	3.0 (90.8)	4.5 (136.3)	11.4 (340.7)	18.9 (567.8)	30.3 (908.5)
Pulses/gal[1)]	25	15	6	4	2
Pulses/m^3[1)]	5,000	5,000	2,000	1,000	500

Line Size in. (mm)	12 (300)	14 (350)	16 (400)	18 (450)	20 (500)
Min. Flow Max. Flow (gpm)	18.3 (5,500)	208.3 (6,250)	283.3 (8,500)	366.7 (11,000)	466.7 (14,000)
Min. Flow Max. Flow (m^3/h)	41.6 (1,249.2)	47.3 (1,419.5)	64.4 (1,930.6)	83.3 (2,498.4)	106.0 (3,179.7)
Pulses/gal[1)]	2	1	1	1	0.5
Pulses/m^3[1)]	500	500	200	200	200

1. When flowmeter is configured for pulse output.

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