eno scientific

STATIC WATER LEVEL MEASUREMENT

FLOW METER
USER MANUAL

www.enoscientific.com

Eno Scientific
1606 Faucette Mill Rd
Hillsborough, NC 27278
USA

www.enoscientific.com
919-778-2660

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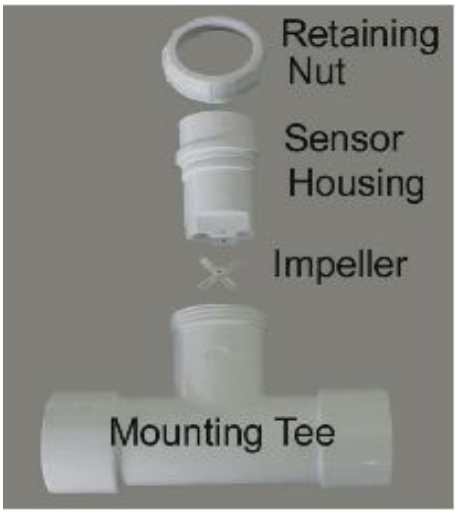
PRODUCT OVERVIEW

The Eno Scientific paddle wheel flow meters measure water flow by converting the rotation of the internal paddle wheel into a number of electrical pulses proportional to the amount of water passing through. The flow meter is a modular unit resembling a pipe tee with PVC slip type pipe connections on the run and a socket on the branch to mount the sensor unit. The housings are made of PVC with sockets for schedule 40 PVC pipe connections in a variety of sizes. The sensor unit contains the paddle wheel and electronics, and easily mounts to any of the housing sizes with a simple hand-tightened ring nut. The PVC housings are designed to permanently install at the test site to provide a socket for the flow sensor. The sensor can be connected while testing is under way, then can then be removed and replaced with a cap for future testing.

The output from the sensor unit can be plugged into an Eno Scientific Well Sounder for data collection and readout. It is designed to use very little power to conserve battery life.

Additional housings, caps and other accessories are available from your local distributor or on our website at www.enoscientific.com.

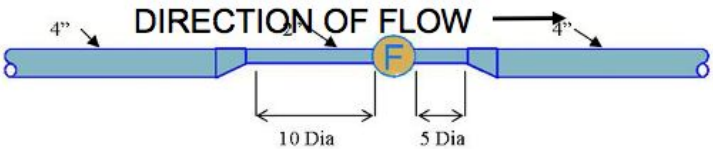


FLOW SENSOR OPERATING RANGE

Eno Scientific flow sensors use a rotating impeller to sense the water moving through a closed pipe. As the water moves, it drags the paddles with it, producing a digital pulse as each paddle passes the sensor. Note that the pipe must be full for the impeller to accurately reflect flow. The table below shows the flow rate range for each sensor size. The pressure drop through the sensor at maximum flow rates are included for reference.

Nominal Pipe Size		1 "	1 1/2"	2"
	Feet per Sec	GPM	GPM	GPM
Minimum Flow	0.25	0.86	1.8	2.8
	1	3.5	7.24	11.3
	2	7	14.5	23
	3	10.4	22	34
	5	17	36	57
	7	24	51	79
	10	35	72	113
	12	42	87	136
Maximum Flow	15	52	108	170
Pressure Drop at Maximum Flow		0.25 psi	0.18 psi	0.15 psi

Water flowing too slow or too fast will not be measured accurately. Eno Scientific flow sensors measure flow over a range from 0.25 fps to 15 fps. It is important that the flow size be selected based on the flow rate to be measured and not the pipe size.The most common mistake in selecting a flow sensor is to oversize the unit and not be able to measure low flow. The flow sensor will operate at significantly higher velocities than commonly used for sizing pipe. Note: a 2" flow sensor has an operating range high enough for use with 3 or 4 inch diameter pipelines running at lower velocities. If the system flow rate falls below the minimum shown in these tables, use a smaller diameter flow sensor installed in a "meter run"- a section of pipe containing 10 diameters of straight pipe ahead of the sensor and 5 diameters of straight pipe after the sensor, as shown below.



FLOW SENSOR INSTALLATION: MECHANICAL

Always install a flow sensor in a straight section of pipe where there is a minimum of 10 diameters upstream (ahead) and a minimum of 5 diameters downstream (behind) of the flow sensor. Pipe bends, other fittings, valves, pipe enlargements or reductions or anything else that would cause a flow disturbance should not be present in this length of pipe.

The flow meter may be installed in any orientation, horizontal or vertical. It is important, however, that the pipe be full of water without bubbles or debris. With this in mind, in a vertical pipe, upflow is preferable to downflow. Orient the sensor so that it is easily removeable for service or replacement with a cap.

If the flow sensor is installed below grade, provide access to the sensor by installing a valve box or meter pit over it. In underground installations, sensor tees are usually installed with the insert located in the 12:00 o'clock or straight up position to make removal easier. Be sure to leave an adequate loop of wire to allow the sensor insert to be removed for service while still remaining attached.

The PVC pipe sockets are intended to be solvent welded to the PVC pipe using standard solvent welding techniques. Threaded connectors or unions may be welded to the tee for a removable installation. Disassemble the flow sensor before joining the tee to the piping system. Remove the flow sensor from the housing by loosening the retaining nut by turning it counter-clockwise then pulling the sensor housing straight out. **Caution: do not pull by the wires!**

After installation of the tee, make sure the pipe is clean and free of any debris. Then re-install the sensor into the tee. Align the ridge on the sensor housing with the groove in the sensor socket, then carefully slide the sensor all the way into the socket. Slide the retaining nut over the sensor housing and hand tighten. Do not use a sealant or teflon tape on the threads.

FLOW SENSOR INSTALLATION: ELECTRICAL

The flow sensor comes in two configurations:

1 – with a plugged cable for simple attachment to other Eno Scientific devices such as the Well Sounder. Installation is simple. Plug the cable into the compatible connector on the Well Sounder. Where the connector is occupied by another device such as the probe, a splitter is available to provide sockets for both devices. An extension cable is available if the flowmeter is to be mounted more than 6 feet from the Well Sounder connection point.

2 – with 3 separate wire leeds for connection to a well sounder or other devices. The three leeds must be connected as follow:

Black	-	signal and power ground
Red	-	power 5 – 12 VDC
Brown	-	signal

Caution: improper connection may damage or destroy the sensor.

Attachment to a Well Sounder with this configuration requires a breakout adapter which provides a plugged connection to the Well Sounder on one end and terminals on the other end for the connection of the sensor leeds.

If the sensor is to be mounted more than 4 feet from the connection point, the leeds can be spliced and extended using wire as small as #28 AWG up to 300 feet. On runs of more than 20 feet, it is recommended that shielded cable be used and that the shield be tied to a good earth ground. Otherwise lightning induced transients may damage the sensor or other equipment.

USING FLOW METER WITH THE WELL SOUNDER

Once the flow meter is attached to the Well Sounder, enable the flow meter by pressing the SET button several times until the Flow Meter enable screen is displayed. Press the UP button until Enabled is displayed. The flow meter functions in the Well Sounder are now turned on.

Press the SET button once more to show the auto calibration screen. To perform an automatic calibration, press the UP button to start. Turn on the pump or open a valve to pump 5 gallons into a bucket. As the bucket reaches the 5 gallon mark, press the DOWN button on the keypad. Calibration is complete and has compensated for any irregularities of the installation.

There may be situations where an auto-calibration is not possible. In this case, when on the auto calibration screen, press the ENTER button to show the scale factor screen. Use the UP or DOWN buttons to enter the scale factor for the installed flow meter. When the correct scale factor shows on the display, the calibration is complete and the DISP button may be pressed to resume operation mode on the Well Sounder.

Scale factors are as follow for the three housing sizes:

1”	.0057
1.5”	.0121
2”	.0209

Once the display mode is active, press the DOWN button to the new flow meter information screens, Flow, Flow rate and Recov rate.

Flow - displays the total water through the flow meter in gallons or liters if in metric mode. The total can be reset by pressing the ENTER button while viewing on the display.

Flow Rate – displays the rate at which water is flowing through the flow meter in gallons per minute (liters/minute). The flow rate displays a running average of the flow per time. The flow rate may appear to not be very responsive as a result. An instant reading can be obtained by pressing the ENTER button while viewing the flow rate. This clears the running average and starts over.

Recov Rate – displays the instantaneous recovery rate of the well. This is the net difference between the change in the level of the well and the water being pumped from the well. This value is also filtered with a running average which can be reset by pressing the ENTER button as above.

USING FLOW METER WITH OTHER EQUIPMENT

The flow meter can be used with data loggers which can count pulses and accept a TTL level signal or a switch to ground signal. The data can be configured as a totalizer tracking the total water pumped or as a frequency counter tracking the instantaneous flow rate. The calibration constants are different.

As a flow totalizer, the scale factors convert each pulse to a volume of water in gallons as follow:

1”	.0057
1.5”	.0121
2”	.0209

Keep in mind that the total water volume will only be accurate if the flow rate is greater than the minimum flow rate for the flow meter used.

As a frequency counter, the scale factors convert pulses per second to gallons per minute and include an offset

Size	K	Offset
1”	.322	0.20
1.5”	.650	0.75
2”	1.192	0.94

The offset increases the accuracy in the operating range of the flow meter but also will yield a net flow when the flow rate is below the minimum or zero. Used to calculate total water pumped, this technique is not appropriate.

SPECIFICATIONS

Materials:
Housings – Type 1 PVC
Rotor – HDPE
O-ring – Buna N
Axle – Tungsten Carbide

Plumbing:
Pipe size – Schedule 40 PVC
Pressure - 240PSI

Physical:
Pipe size – Schedule 40 PVC
Test Pressure – 240 PSI
Temperature: 32 – 140 F (0 – 60 C)
Dimensions:

1”	5.75 x 4.5 x 2.4”
1.5”	6.25 x 5.25 x 2.4”
2”	7.11 x 5.75 x 3”

Clearance for sensor removal: 3.5”

Electrical:
Power: 5 – 24V @ 500 uA max
Output signal: Pull-to-ground (+V – 0V)
Pulse width: ~5mS
Frequency: .3 – 200 Hz

WARRANTY AND SERVICE

Eno Scientific warrants to the user that all products manufactured by Eno Scientific, will be free from defects in workmanship and materials for 1 year from the date of shipment.

Eno Scientific warrants to repair or replace any such defective equipment or part (determined to our satisfaction to have a defect in workmanship or original material) upon receipt and inspection of such defective equipment to Eno Scientific with all shipping pre paid by the user.

In no event shall Eno Scientific be liable for any direct, indirect or consequential damages, abuse, acts of third parties (rental equipment), environmental conditions or other expenses which may arise in connection with such defective equipment. This warranty shall not apply to damage of equipment caused by incorrect installation, usage, lightning, storage, alteration or inadequate care.

This warranty does not apply to parts, assemblies or devices not manufactured by Eno Scientific which are covered by other manufacturers' warranties. There are no warranties except as specifically provided in writing herein.

Contact Eno Scientific with any warranty or service questions.

For additional information, please visit our website at www.enoscientific.com.