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## SCOPE OF THIS MANUAL

This manual contains installation, operation and maintenance procedures for the Dynasonics RS-900w Polymer Ultrasonic flow sensors. Proper performance and reliability of the product depend upon installation in accordance with these instructions.



This safety sign signifies that this document must be read prior to starting work or before operating equipment.

## INTRODUCTION

The RS-900w Polymer Ultrasonic Flow Sensors can be used with any compatible irrigation controller, decoder sensor or pulse input type flow monitor. These ultrasonic flow sensors provide highly accurate readings of flow rate over a large range of flow conditions.

The ultrasonic flow sensor uses sound waves, transmitted through the moving water in the irrigation pipe, to measure the speed of the water flow. Two transmitters generate and receive the soundwaves. The soundwave moving upstream will be slower than the soundwave moving downstream. The difference in the transit time equates to the velocity of water flowing through the pipe.

The flow sensor generates an electrical pulse frequency proportional to the flow rate. An internal preamplifier allows the pulse signal to travel up to 2000 feet (610 sensors) without further amplification. Power to operate the flow sensor is provided by the irrigation controller or flow monitor.

Flow sensors of similar type are interchangeable, so there is no need for recalibration after servicing or replacement. Ultrasonic and Impeller type flow sensors can also be interchanged because the output signal is similar, however the K and Offset values might be different and require reprogramming at the irrigation controller or flow monitor.

### **CAUTION**

**THE ULTRASONIC STYLE FLOW SENSOR DESCRIBED IN THIS MANUAL IS NOT INTENDED FOR USE IN SAFETY CRITICAL APPLICATIONS. USE OF THE DEVICE IN THIS MANNER IS DONE AT THE SOLE DISCRETION OF THE CUSTOMER AND/OR END USER OF THE DEVICE.**

**THE ULTRASONIC STYLE FLOW SENSOR DESCRIBED IN THIS MANUAL IS NOT INTENDED FOR USE IN SYSTEMS WITH FLAMMABLE LIQUIDS OR GASES. ADDITIONALLY, THE DEVICE IS NOT INTENDED FOR SYSTEMS CONTAINING HAZARDOUS FLUIDS OR FLUIDS OTHER THAN WATER.**

**THE ULTRASONIC STYLE FLOW SENSOR DESCRIBED IN THIS MANUAL MUST BE INSTALLED IN ACCORDANCE WITH ALL LOCAL AND FEDERAL CODES OR END-USE STANDARDS, AS APPLICABLE.**

**IF THE DEVICES DESCRIBED IN THIS MANUAL ARE USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.**

**IF THE SYSTEM PRESSURE EXCEEDS 200 PSI (1379 KPA), A PRESSURE SAFETY VALVE MUST BE INSTALLED.**

## INSTALLATION

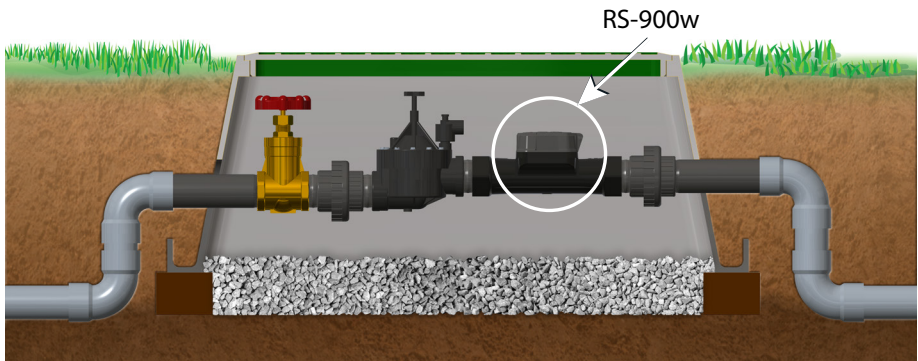
Depressurize, vent and drain the piping system prior to any installation or maintenance of the flow sensor.

### General Installation Information

The accuracy of flow measurement for all flow measuring devices is dependent on proper location of the sensor in the piping system. Entrapped air in the pipe will cause inaccurate or “no-flow” readings. Accumulated debris or sediment in the pipe will also affect accuracy and repeatability.

Ultrasonic flow sensors are less affected by irregular flow velocity profiles caused by valves, fittings, pipe bends, or other obstructions than Impeller style flow sensors. The RS-900w flow sensor is designed with a long body that provides sufficient upstream and downstream straight-pipe requirement in most situations. It can be connected directly to a master valve or other device.

### Installation Details



### Mechanical Installation Procedure

1. Make sure the RS-900w flow sensor arrow faces the direction of flow.
2. Apply Teflon tape to the threads on the pipe and screw the pipe into the flow sensor. DO NOT OVERTIGHTEN.

### Electrical Installation Procedure

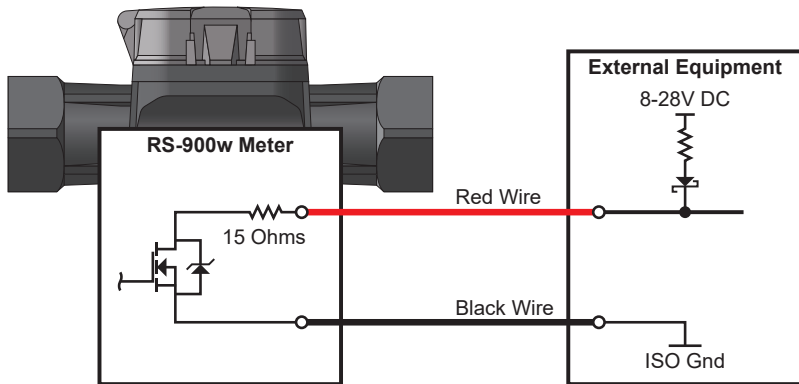
#### IMPORTANT

*Disconnect the power from the flow sensor source and/or receiving device prior to any installation or maintenance of the system. Flow sensor source and/or receiving device must provide basic isolation from mains for safe operation of the system.*

**NOTE:** If the flow sensor has white and black wires instead of red and black, connect the white wire wherever red is indicated.

1. Use watertight connectors/gel caps to connect the wire leads from the RS-900w flow sensor to a 2-conductor shielded 20 AWG (or larger) copper wire.
2. Route the cable from the RS-900w flow sensor to the irrigation controller or a Badger Meter flow monitor. The cable may be extended up to 2000 feet. Be sure to leave enough flexibility in the cable or conduit to allow for future service of the flow sensor, if necessary.

- When connecting to an irrigation controller or Badger Meter flow monitor, locate the section of terminal strip on the monitor labeled SENSOR INPUT or SENSOR. Connect the red (or white) wire to IN (+), SIGNAL (+) or SIGNAL terminal, connect the black wire to GND, SIGNAL (-) or COM terminal.
- When interfacing with other equipment, consult the equipment manufacturer for input designations. The signal wave forms and power requirements are as shown in the "[Specifications](#)" on page 8.
- After all electrical connections have been made, turn on power at the irrigation controller or a Badger Meter flow monitor.



The output of the flow sensor is essentially a 15 Ohm switch with a 600  $\mu$ A current. With no flow running, the flow sensor will appear to the controller input as a small current load. When the flow rate is above the minimum threshold, it appears as a quick series of 5 millisecond connections to ground.

## LED Light Operation

LED lights on the top of the RS-900w flow sensor will indicate the conditions in the table below.



LED Light	Condition	Correction
Power LED (Green) Off	There is no power to the flow sensor or insufficient power for normal operation, or the Red and Black wires have been reversed at the controller.	Check the power and wiring.
Power LED (Green) On	Power is connected and is sufficient for operation.	Normal operation
Forward Flow LED (Green) Off	Insufficient water in the pipe for proper operation.	Check to ensure the pipe is full of water and no air is trapped in the sensor.
	No water flow.	Check for closed valves or obstructions preventing water flow if not expected.
Forward Flow LED (Green) Flashing	Water is flowing in the forward direction. LED will flash proportionally to the flow rate.	Normal operation.
Reverse Flow LED (Red) On or flashing	Water is flowing in the reverse direction. LED will flash proportionally to the flow rate.	Check arrow on sensor is in the same direction as expected flow. Check for reverse flow conditions.

## CONTROLLER SETTINGS

The RS-900w flow sensor uses unique K and offset numbers for calibration. These numbers are derived from calibration runs using NIST traceable instruments. Using both a K-factor and an offset number provides higher accuracy than using a K-factor alone. The K and offset numbers for each sensor configuration are listed in the "[Calibration Table](#)" below.

Use the K and offset values in the frequency equation:  $\text{Frequency} = \frac{\text{GPM}}{K} - \text{Offset}$

This equation describes the frequency of the output signal of all RS-900w flow sensors. By substituting the appropriate K-factor and offset values from the table, the flow sensor's output frequency can be calculated for each pipe size. This information is required when calibrating an output board, or when using the raw flow sensor data as direct output to interface with a device that is not a Badger Meter product.

### Calibration Table

Size	K	Offset	Flow Range
1 inch (NPT or BSP)	0.25	0.000	1.30...50.0 GPM
1-1/2 inch (NPT or BSP)	1.70	-0.316	3.09...125 GPM
2 Inch (NPT or BSP)	2.85	0.144	5.13...200 GPM

## TROUBLESHOOTING

The RS-900w flow sensor is an active device that can be verified with the LED lights on the upper body, or tested at the connection point of the controller to which they are connected. Before trying to troubleshoot, confirm that the flow rates are well above the minimum recommended flow rates in the "[Calibration Table](#)" on page 7. This will usually purge any air out of the line.

Symptom	Possible Cause	Recommended Action
All LED lights are off	Power is not connected	<ul style="list-style-type: none"> <li>Measure voltage at wire termination. If the voltage at the controller drops below 7V DC when the sensor is connected, then the wires are swapped or there is a short or moisture in the wiring.</li> <li>Check voltage polarity: red wire +, black wire -</li> <li>Check for damaged wires or splices.</li> </ul>
No flow reading at controller, and Power LED is on and Forward Flow LED is off	No water in sensor No flow	<ul style="list-style-type: none"> <li>Check to ensure the pipe is full of water and no air is trapped in the sensor.</li> <li>Check for closed valves or obstructions preventing water flow.</li> </ul>
No flow reading at controller, and Power LED is on and Forward Flow LED is flashing	Controller is not programmed correctly Flow rate is too low for controller	<ul style="list-style-type: none"> <li>Check K and offset settings in the controller.</li> <li>Check the minimum frequency of the controller.</li> <li>Disconnect sensor from the controller and simulate an input to see if the controller registers a reading.</li> </ul>
No flow reading at controller, and Power LED is on and Reverse Flow LED is on or flashing	Sensor is installed backwards Backflow conditions	<ul style="list-style-type: none"> <li>Check arrow on sensor is in the same direction as expected flow.</li> <li>Check for possible backflow conditions, such as leaking check valves when pumps are turned off.</li> </ul>

## SPECIFICATIONS

<b>Materials</b>	Body: glass filled nylon				
	Upper: polyphenylene oxide				
<b>Sizes</b>	1 in. female taper threaded (NPT or BSP)				
	1-1/2 in. female taper threaded (NPT or BSP)				
	2 in. female taper threaded (NPT or BSP)				
<b>Flow Range &amp; Accuracy</b>	<b>Sensor Size</b>	<b>Normal Flow Range</b>		<b>Extended Low Flow Range</b>	
		<b>Flow Range gal/min (liters/min)</b>	<b>Accuracy % of reading</b>	<b>Flow Range gal/min (liters/min)</b>	<b>Accuracy gal/min (liters/min)</b>
	1 in.	1.30...50.0 (4.92...189)	± 2	0.26...1.30 (0.98...4.92)	± 0.05 (± 0.19)
	1-1/2 in.	3.09...125 (11.7...473)	± 2	0.62...3.09 (2.35...11.7)	± 0.13 (± 0.47)
2 in.	5.13...200 (19.4...757)	± 2	1.03...5.13 (3.90...19.4)	± 0.20 (± 0.76)	
<b>LED Indicators</b>	Power (On/Off indication)				
	Reverse Flow (Flashing proportional to flow rate)				
	Forward Flow (Flashing proportional to flow rate)				
<b>Pressure Rating</b>	200 psi (13.8 bar) working pressure				
<b>Fluid Temperature</b>	32...140° F (0...60° C)				
<b>Ambient Temperature</b>	32...140° F (0...60° C)				
<b>Power/Output</b>	Supply voltage = 8V DC min; 28V DC max.				
	Quiescent current = 600 µA (typical)				
	OFF state (VHigh) = Supply voltage – (600 µA * Supply impedance)				
	ON state (VLow) = 1.2V DC @ 40 mA (15 Ω + 0.7V DC)				
<b>Output Frequency</b>	0.5...200 Hz				
<b>Output Pulse Width</b>	5 msec ±25%, 50% duty cycle above 100 Hz				
<b>Environmental</b>	Suitable for outdoor use below grade				
	IP 68 / NEMA 4X				
	Suitable for use in submerged installations (< 3 ft water, 24 hours)				
	Suitable for pollution degree 4 environments				
	Altitude: <2000 m (6560 ft)				
<b>Electrical Cable</b>	Relative Humidity: 0...90%, non-condensing				
	4 ft of 2-conductor AWG 18 drain wire; shielded UL type PTLC wire provided for connection to display, monitor or controller; rated to 221° F.				
	May be extended to a maximum of 2000 feet with 20 AWG (or larger) copper wire suitable for direct burial, or appropriate for installation.				
<b>Water System Certification</b>	NSF/ANSI/CAN 61 and 372 certified option				
<b>Compliance</b>	CE EMC Directive 2014/30/EU				

### Control. Manage. Optimize.

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