Troubleshooting Guide

FS Series Flow Sensors

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Overview:

This procedure allows the Flow Sensor and associated wiring to be tested independently of an Irrigation Controller. A Battery and Resistor combination is used if no powered controller is available for the voltage and frequency measurement tests.

When broken up into its component parts, an irrigation system consists of the following elements: Controller, Wiring/Splices, and Sensor, for two-wire systems, also decoders.

The purpose of this procedure is to isolate the elements to rule out each as the cause until the actual failure cause is isolated.

The procedure consists or four parts. If the complete circuit fails any of the test steps, isolate the flow senor by breaking the last splice closest to the flow sensor, and repeat test on the wiring and sensor separately in order to determine if the problem is with the wiring or the sensor itself.

1 Check controller settings for correct Flow Sensor installation

2. Testing wiring to the flow sensor for ground faults resulting from moisture penetration into the wiring, splices, or sensor itself.

3. Testing for broken or shorted wires, splices, or problems internal to the sensor itself

4. Confirming frequency output and confirmation of actual flow rate sensor is reporting.

Test Equipment:

(Battery and Resistor are not required if Controller is operational)

1. **Multi-meter** with Ohms, Volts, and Hz (Radio Shack Model 2200075 (shown) or Equivalent)

2. **1K Resistor** (Radio Shack 271-1118 or Equivalent)

3. **9 Volt Battery**

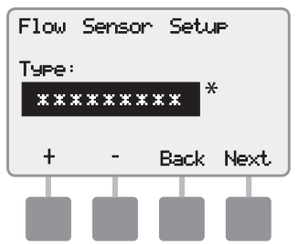
4. **Connector clip for 9V Battery** (Radio Shack 270-325 or Equivalent)

If an operational flow meter or controller is not available, it can be simulated with a Battery and Resistor. Connect one end of the 1.0k resistor to the Red Battery Clip wire, and the other end of the resistor to the Flow Sensor + Wire (Usually Red or White). Connect the Black Battery Clip Wire to the Flow Sensor (-) Black Wire. Follow the directions, the same as if the controller was powering the sensor.

STEP 1

Check Controller Settings for Correct Flow Sensor Configuration

1. At the controller, turn the dial to "Module Programming". The LCD screen should display "Flow Smart Module".
2. Press "Next". The LCD screen should display: "Flow Sensor Setup" and "SEEF/SELF Settings", etc. Select "Flow Sensor Setup" and press "Next".
3. The LCD screen should display:



** "Disabled" or "Custom" or "FS050P" or "FS150P" or "FS350B" or etc…*

4. Make sure that the settings are representative of the installed flow sensor. For "Custom" settings of k-factor and offset factor, please contact flow sensor manufacturer. For Rain Bird's flow sensors, please chose the appropriate flow sensor from the provided list.

Are the settings correct? YES

NO

Update settings and check flow sensor operation.

STEP 2

Test for Voltage on the Sensor Wires

1. At the controller end, completely disconnect any and all wires running to the flow Sensor.
2. Set multi-meter on its Auto-Ranging Voltage setting.
3. Connect the multi-meter Black wire to Earth Ground (This can be a pipe, fence, grounding rod, or building steel beam). Electrical panel ground can also be used if available.
4. Touch the Red Multi-Meter test lead to each of the Flow Sensor Wires one at a time, and take note of the reading.

Is the voltage greater than a few milli-volts? YES → This suggests a problem with the wiring. Confirm that these wires really do run to the flow sensor and not to something else.

NO

STEP 3

Test for Ground Faults

1. Confirm that the controller is still completely disconnected from any and all wires running to the Flow Sensor.
2. Set multi-meter on its highest OHM's scale, and short its Red and Black test leads together to confirm proper operation.
3. Connect the multi-meter Black wire to Earth Ground (This can be a pipe, fence, grounding rod, or building steel beam). Electrical panel ground can also be used if available.
4. Touch the Red Multi-Meter test lead to each of the Flow Sensor Wires one at a time, and take note of the reading.

Is the resistance lower than 1 Meg Ohm? NO

YES

Anything less than 1 Meg Ohm suggests a problem with either the wiring, splices, or flow sensor itself.

STEP 4

Test for Broken or Shorted Wires, Bad Splices, or Internal Sensor Problem

1. If controller is operational, measure the Open Circuit voltage on the terminals to which the flow sensor will be connected. If not, use the Battery Resistor combination shown above, and measure the voltage, between the open end of the resistor and the black battery clip.

   Connect the flow sensor and with no flow, re-measure the voltage on the same terminals.

   The sensor draws about 0.6mA, so the voltage should be slightly less than measured open circuit. For example, the Battery Voltage would have been about 9.1VDC, so with 0.6mA flowing through the 1k resistor the expected voltage across the flow sensor would be 8.5VDC. Since controllers vary on design, voltages will vary.

   However, the following list may be helpful and a general guide.

Did the voltage drop about ½ to 1VDC? NO → **Was there no change in voltage?** NO → **Was there a drop to less than 1VDC?** NO → **Is the voltage unstable?** YES

- **Did the voltage drop about ½ to 1VDC?** YES → This is normal. Continue to Step 4.
- **Was there no change in voltage?** YES → Indicates a **broken** wire, splice, or internal problem with the sensor.
- **Was there a drop to less than 1VDC?** YES → Indicates a **Short** in the wiring or sensor.
- **Is the voltage unstable?** YES → This may indicate flow in the pipe, something is interfering with normal operation, an intermittent connection, or internal problem in the sensor itself.

STEP 5

Measure Flow Rate in HZ and convert to GPM

1. Establish a flow of at least 1 Ft/Sec to insure the impeller rotates.
2. Without moving the Multi-meter leads from the connections of Step#3, switch the Multi-meter to read Frequency (Hz).
3. Note the Hz reading, and estimate the actual expected flow rate at the time the measurement was taken.
4. Locate the K and Offset values found in the Flow Sensor owner's manual. For example, if the flow sensor was a 228 Series 2" PVC → K = 2.8429 Offset = 0.1435
5. Use equation to convert Hz to GPM:
   GPM = (Measured Hz + Offset)*K
   If for example 23.5 Hz was measured in this 228PV-2 sensor:
   GPM = (23.5 + 0.1435) * 2.8429 = 67.2 GPM

Model for	K	Offset	Suggested Operating Range (gpm)
228PV15xx-xxxx	1.697	-0.316	5…100
228PV20xx-xxxx	2.8429	0.1435	10…200
228PV30xx-xxxx	8.309	0.227	20…300
228PV40xx-xxxx	13.74283	0.23707	40…500

6. Compare the computed flow rate with the expected flow rate, and as shown on the controller or monitor if operational. If all are in agreement, everything is working properly.