TORO Count on it.

TFS Series, Toro Flow Sensor Installation Instructions

Overview

The Toro flow sensors provide an accurate flow measurements by generating a frequency signal (pulses per second) that is proportional to the flow rate. The Toro flow sensors are designed for below grade applications for irrigation monitoring where the flow rates are between 0.5–30 ft/sec and temperatures are below 180º Fahrenheit. The Toro flow sensors are supplied with two single conductor, 18 AWG solid copper wire leads with U.L. Style 116666 direct burial insulation. An internal preamplifier allows the pulse signal to travel up to 2000′ without further signal amplification.

Models

Model Number	Size	Description
TFS-050	1/2″	Flow Sensor, 1/2″, Plastic Tee
TFS-075	3/4″	Flow Sensor, 3/4″, Plastic Tee
TFS-100	1″	Flow Sensor, 1″, Plastic Tee
TFS-150	1.5″	Flow Sensor, 1.5″, Plastic Tee
TFS-200	2″	Flow Sensor, 2″, Plastic Tee
TFS-300	3″	Flow Sensor, 3″, Plastic Tee
TFS-400	4″	Flow Sensor, 4″, Plastic Tee

Controller Compatibility

The Toro flow sensors are compatible with the following controllers:

- Toro TMC-424
- Toro Sentinel™
- Irritrol MC-E
- Toro Intelli-Sense™ TIS-360/480
- Toro SitePro®
- Any controller compatible with Frequency output flow sensor (Pulse per Second proportional to flow velocity)

Sizing

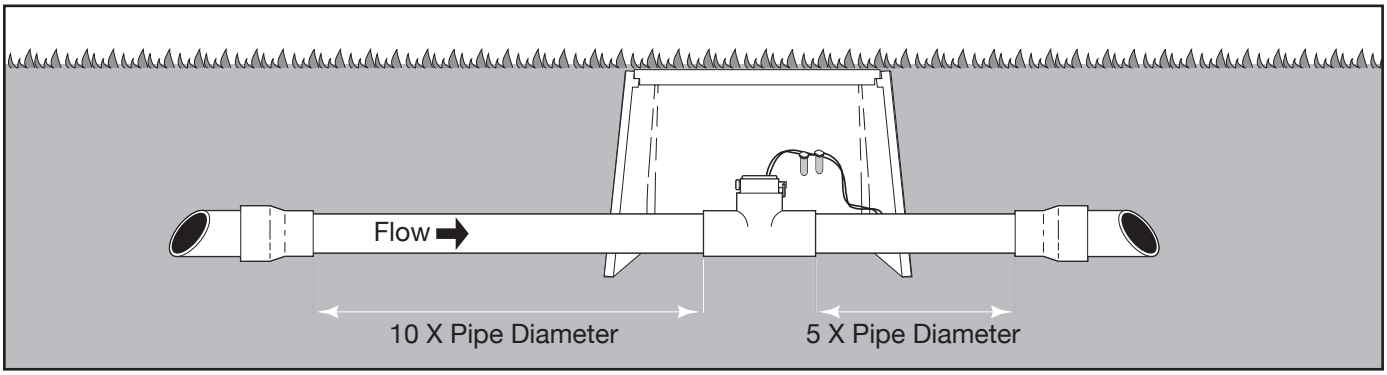
The following table indicates the suggested flow range of the Toro flow sensors. Although the sensors will operate above and below the indicated flow rates, following the suggested range will ensure the best performance from the flow sensor. Sensors should be sized according to flow rates rather than pipe size.

Model Number	Suggested Operating Range (Gallons / Minute)	Suggested Operating Range (Liters / Second)	Suggested Operating Range (Cubic Meters / Hour)
TFS-050	1.2 – 12	0.1 – 0.8	0.3 – 2.7
TFS-075	2.7 – 28	0.2 – 1.8	0.6 – 6.4
TFS-100	5 – 50	0.3 – 3.2	1.1 – 11.4
TFS-150	5 – 100	0.3 – 6.3	1.1 – 22.7
TFS-200	10 – 200	0.6 – 12.6	2.3 – 45.4
TFS-300	20 – 300	1.3 – 18.9	4.5 – 68.1
TFS-400	40 – 500	2.5 – 31.5	9.1 – 113.6

Flow Sensor to Pipeline Installation

The accuracy of the flow sensor's measurement is highly dependent on proper sensor location within the piping system. Irregular flow velocity caused by valves, fittings, pipe bends, etc. can lead to inaccurate flow rate measurements even though local flow velocity measurements may be accurate. A sensor located in the pipe where it can be affected by air bubbles, floating debris, or sediment may not achieve full accuracy and could be damaged. The Toro flow sensors are designed to operate reliably even under adverse conditions but following recommendations will ensure maximum system accuracy.

Select a location along the pipe system that is 10 times the pipe diameter upstream and 5 times the pipe diameter downstream to minimize flow disturbance. Pipe bends, valves, pipe fittings, pipe enlargements and reductions should not be present within this pipe length.



Note: For 1.5″ and larger flow sensors, install according to the flow direction shown by the arrow on the tee. For 1.0″ and smaller flow sensors, installation is not dependent on flow direction.

Flow Sensor to Pipeline Installation

Step 1 - Remove the sensor from the tee.

a. For 1.5″ and larger Sensors: Pull the clevis pin that retains the flow sensor to the tee, then carefully remove it from the tee.

b. For 1.0″ and smaller Sensors: Unscrew the sensor cap from the tee by turning it counterclockwise. Carefully pull the sensor out from the tee.

Step 2 - Properly clean the pipe ends and tee socket.

Step 3 - Use solvent cement to secure the pipes to the tee.

Step 4 - Reinstall the sensor to the tee as follows:

a. For 1.5″ and larger Sensors:

i. Align the flow arrow on top of the sensor housing to the direction of the flow.
ii. Carefully press the sensor straight into the tee.
iii. Install the clevis pin through the tee and sensor.
iiii. Install the cotter ring into the clevis pin.

b. For 1.0″ and smaller Sensors:

i. Carefully line up the guide pin on the sensor to the slot on the tee.
ii. Carefully press the sensor straight into the tee.
iii. Screw the sensor cap firmly onto the tee.

Note: Hand tighten the sensor only.

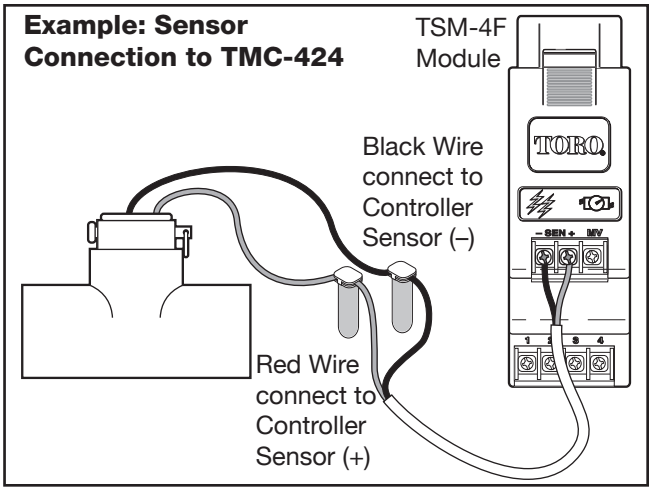
Step 5 - Complete the wiring connections.

Cable Installation

Step 1 - Use a twisted pair cable suitable for direct burial to connect the sensor to the controller. Multi-pair telecommunication cable or direct burial cables may be used. Shielded cable is recommended. Connect the cable wires to the sensor wires.

Step 2 - Waterproof the splices. Two part epoxy waterproofing kits or waterproof wire connectors are recommended.

Step 3 - Route the cable from the sensor to the controller. The cable may be extended up to 2000′ if using a 2-conductor shielded 18 AWG or larger stranded copper wire with appropriate ratings. Be sure to leave enough flexibility in the cable for future sensor servicing.



Step 4 - When connecting to a Toro controller, connect the red wire to “IN”, “SIGNAL” or “(+)” terminal and the black wire to “GND”, “SIGNAL”, “(–)” or “COM” terminal.

Calibration Tables

For controllers displaying Flow Rate (GPM, etc.), the Toro flow sensor use a unique K and Offset numbers for calibration. The Calibration Table below provides the calibration data for each of the Toro flow sensors when installed in SCH 40 piping.

Model Number	Size	Description	K Value	Offset
TFS-050	1/2″	Flow Sensor, 1/2″, Plastic Tee	0.07800	0.9
TFS-075	3/4″	Flow Sensor, 3/4″, Plastic Tee	0.15630	0.9
TFS-100	1″	Flow Sensor, 1″, Plastic Tee	0.26112	1.2
TFS-150	1.5″	Flow Sensor, 1.5″, Plastic Tee	1.69900	-0.31600
TFS-200	2″	Flow Sensor, 2″, Plastic Tee	2.84290	0.14350
TFS-300	3″	Flow Sensor, 3″, Plastic Tee	8.30900	0.22700
TFS-400	4″	Flow Sensor, 4″, Plastic Tee	13.74283	0.23707

Troubleshooting

Step 1 - If the voltage at the sensor input is less than 7 VDC during “NO Flow” situation, disconnect the sensor from the sensor terminals. Re-measure the voltage at the sensor terminals. The voltage reading should be between 8–20 VDC. If the voltage at the sensor terminals is still below 7 VDC, the controller may be the cause of the problem (hardware or firmware). If the proper voltage is present at the sensor terminals, proceed to Step 2.

Step 2 - If you suspect that the sensor is defective, test the controller’s circuitry by connecting a wire to one of the sensor terminal. Use the other end of the wire to short the other sensor terminal repeatedly to simulate a flow signal. Depending on the controller, you night be required to continue this for a few seconds for the controller to register a reading. If the display do not show a flow reading, it indicates a problem with the controller. If the controller does register a flow reading, then the defect might be between the communication cable and the sensor. Proceed to Step 3.

Step 3 - Test the cable for continuity. Disconnect the splices from the sensor and connect the cable wires together. Take the cable wires at the controller side and test for continuity. Use a volt meter with a continuity tester. If the volt meter indicates good continuation in the cable, then the cable is not defective, continue to Step 4. If the cable indicates no continuation, then a break in the circuit is present within the cable. If there are any splices in the cable, check and re-secure it. Check the cable’s continuity again. Replace the cable if you still detect a continuity break.

Step 4 - Drain the pipe line and verify that the pressure is relieved. Remove the sensor from the tee (See **Flow Sensor to Pipeline Installation, Step 1**). If the sensor has been disconnected from the controller, reconnect it to test. Spin the impeller by hand. If the controller detects a flow and the impeller spins freely, then the flow rate may have been below our design minimum or the pipeline system is full of air pockets. If the sensor fails to send a flow signal when the impeller is spinning, then the sensor is defective. Replace the sensor.

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