

# Calsense Tee-Type Flow Meter Installation Guide

## Summary

Used in conjunction with the Calsense CS3000 controller, Calsense impeller and ultrasonic flow sensors provide accurate flow readings as well as accumulated flow. Twelve models are available, which cover applications for a wide range of flow ranges, pipe sizes, and pressure specifications. Long-term stability and a high-resolution measurement range make it possible not only to measure water usage but also to detect leaks across your irrigation system.

## Flow Sensor Models

Model	Tee Housing	Type	Recommended Design Flow Range	Accuracy	Max Working Pressure	Operating Temperature
<b>FM 1.5</b>	Sch 80 PVC	Impeller	0.5-30 ft/sec	± 1.0% of full scale	100 PSI @ 77°F	35 to 110°F
<b>FM 2</b>						
<b>FM 3</b>						
<b>FM 1B</b>	Bronze		0.5-15 ft/sec	± 1% of reading	400 PSI @ 100°F	32 to 150°F
<b>FM 1.25B</b>						
<b>FM 1.5B</b>						
<b>FM 2B</b>	Sch 80 PVC	Ultrasonic	0.5-30 ft/sec	± 1.0% of full scale	200 PSI @ 100°F	32 to 150°F
<b>FM 1U</b>						
<b>FM 1.5U</b>						
<b>FM 2U</b>	Sch 80 PVC	Ultrasonic	0.1-15 ft/sec	± 2% of reading	203 PSI @ 70°F	32 to 140°F
<b>FM 3U</b>						
<b>FM 4U</b>						

## Physical Installation

**IMPORTANT!** Depressurize and vent the piping system prior to any installation or maintenance of the flow sensor.

The accuracy of flow measurement for all flow measuring devices is highly dependent on proper location of the sensor in the piping system. Irregular flow velocity profiles caused by valves, fittings, pipe bends, or other obstructions can lead to inaccurate overall flow rate

indications, even though local flow velocity measurement may be correct. A sensor may not achieve full accuracy and could be damaged if it is installed in the pipe where it can be affected by air bubbles, floating debris, or sediment. Calsense flow sensors are designed to work reliably under adverse conditions, but the following recommendations should be followed to ensure maximum system accuracy:

- Choose a location along the pipe where 10 pipe diameters upstream and 5 pipe diameters downstream of the sensor provide no flow disturbance. Pipe bends, valves, other fittings, pipe enlargements and reductions should not be present in this length of pipe.
- For impeller flow sensors, the preferred location for the sensor around the circumference of a horizontal pipe is at the 12 o'clock position. The sensor should never be at the bottom of the pipe, as sediment may collect there. Locations off top dead center cause the impeller friction to increase, which may affect performance at low flow rates and increase wear. Any circumferential location is correct for installation in vertical pipes, with rising flow preferred to reduce the effects of any trapped air.
- For ultrasonic flow sensors, install Tee/insert at a 60° to 90° angle from vertical.

**Note:** For 1-inch pipe installations, this 60° to 90° angle is especially important for the most accurate meter operation.

For below ground installation, install a valve box around the Tee. Valve box extensions may be needed, depending on depth.

**Note:** A minimum of 10 in. thick layer of gravel should be installed below the meter and valve box.

### PVC Impeller Flow Sensors

**Note:** The intended direction of flow is shown by arrows on the PVC Tee.

To install the sensor Tee:

1. Remove the clevis pin and remove the sensor from the Tee.
2. Thoroughly clean the pipe ends and Tee sockets.
3. Use solvent cement to attach the pipe to the Tee.
4. Hold the cemented parts together for at least 30 seconds.
5. Reinstall the sensor in the Tee as follows:
  - a. Align the flow arrow on the top of the sensor housing in the direction of flow.
  - b. Carefully press the sensor straight into the Tee.
  - c. Install the clevis pin through the Tee, the sensor, and the conduit cap, and install the cotter ring.

## Brass Impeller Flow Sensors

Models FM 1B, FM 1.25B, FM 1.5B

**Note:** The intended direction of flow is shown by arrows on the cast bronze Tee.

To install the sensor Tee:

1. Apply pipe compound over the first 3 or 4 threads of the mating pipe.
2. Thread the pipe into the sensor Tee until hand tight.
3. Using a wrench, tighten the pipe 1-1/2 more turns.

To reinstall the sensor in the Tee:

1. Apply a small amount of silicone grease to the O-rings on the sensor insert and chamfer on the inside lip of the Tee. Clean off any grease which could be deposited on the impeller.
2. Align the flow arrow on the sensor with the direction of flow.
3. Carefully press the sensor straight into the Tee.
4. Install the clevis pin through the Tee, sensor, and conduit cap, and install the split ring.
5. Before pressurizing the pipe, verify that:
  - All threaded connections are tight.
  - The flow direction arrows on the Tee and sensor are aligned with the flow direction.
  - The clevis pin and cotter ring are installed.

### Model FM 2B

These Tee-type sensors have a factory set insertion depth and alignment. Remove the sleeve assembly by removing the top 7/16-inch nuts only. Pull the sleeve assembly straight out of the mounting adaptor.

**IMPORTANT!** Do not disturb the position of the thread hex adapter or the lower two nuts on the threaded rods of the hex adapter. This could lead to inaccurate calibration and faulty reading of the flow rate.

To install the sensor Tee:

1. Remove the clevis pin and remove the sensor from the Tee.

**Note:** If soldering threaded adapters is to be done near the assembly, remove the sensor sleeve, and O-rings from the Tee or Hex Mounting Adapter, to prevent heat damage to the O-rings and plastic parts.
2. Apply pipe compound over the first 3 or 4 threads of the mating pipe.
3. Thread the pipe into the sensor Tee until hand tight.
4. Tighten the pipe, using a wrench, 1-1/2 more turns.

To reinstall the sensor in the Tee:

1. Apply a small amount of silicone grease to O-rings on the sensor sleeve assembly and chamfer on inside lip of Tee. Clean off any grease which could be deposited on the impeller.
2. Align flow arrow on sensor with direction of flow.
3. Carefully press sleeve straight into hex mounting adaptor.
4. Install the 7/16 in. lock nuts on the threaded rod and tighten. Do not move the bottom nuts as they set sensor depth.
5. Before pressurizing the pipe, verify that:
  - All threaded connections are tight.
  - The flow direction arrows on the Tee and sensor are aligned with the flow direction.
  - The 7/16-inch nuts are re-installed on the threaded rods above the metal collar.

## PVC Ultrasonic Flow Sensors

**Note:** The intended direction of flow is shown by arrows on the PVC Tee.

To install the sensor Tee:

**Note:** There is no need to remove the insert to install the meter.

**Note:** Flow must go uphill through the meter, never downhill through the meter to avoid air bubbles or air pockets captured in the Tee.

1. Thoroughly clean the pipe ends and Tee sockets.
2. Use solvent cement to attach the pipe to the Tee.
3. Hold the cemented parts together for at least 30 seconds.

## Electrical Installation

**IMPORTANT!** Disconnect the power from the CS3000 controller prior to any installation or maintenance of the system. Failure to power off the controller may cause severe injury or damage to the product. Installation should be performed by personnel familiar with good safety practice in handling electrical equipment.

The sensor leads are supplied with watertight caps over the ends. **DO NOT** remove the plastic caps from the sensor leads until you are ready to splice.

### Installing using Conventional Wire to CS3000 Controller

**Note:** **DO NOT** remove the plastic caps from the sensor leads until ready to splice.

1. Use a black and red twisted pair 14 AWG cable suitable for direct burial to connect the sensor to the controller. The cable can be extended up to 2,000 feet using 2-conductor shielded 14 AWG (or larger) copper wire with proper ratings. Be sure to leave enough flexibility in the cable or conduit to allow for future service of the sensor, if necessary.
2. For each wire connection, make a watertight splice using either 3M™ Scotchcast™ Connector Sealing Pack 3570G-N (recommended) or Spears® Dri-Splice Seal DS-300 with

DS-100 Dri-Splice Wire Connector per the instructions in Installing Wire Connectors below.

3. Make sure the epoxy is hardened before inverting the splice or dropping it in standing water.

**IMPORTANT! DO NOT** make an underground splice.

4. Route the cable from the sensor to the Calsense CS3000 controller.
5. Connect the red wire to the FM RED terminal on the POC kit at the controller.
6. Connect the black wire to the GND terminal on the POC kit at the controller.

## Installing using 2-Wire to CS3000 Controller

1. For each wire connection between the decoder make a watertight splice using 3M™ Scotchcast™ Connector Sealing Pack 3570G-N per the instructions in Installing Wire Connectors below. The red wire from the flow sensor should connect to the red wire on the decoder. The black wire from the flow sensor should connect to the black wire on the decoder.
2. For more information about wiring a flow sensor to a 2-Wire system, see the Installation Calsense POC Decoder instructions, available on <https://calsense.com>.

## Installing Wire Connectors

### 3M™ Scotchcast™ Connector Sealing Pack 3570G-N

**IMPORTANT!** The 3M Scotchcast Connector Sealing Pack 3570G-N should remain sealed in the guard bag (white aluminized bag) until ready to use. In wintry weather, warm closed mixing pouch to 50°F or warmer prior to mixing. Keep in a warm area, such as truck cab or inside pocket, until ready to use.

1. Thoroughly clean and dry the surface of the substrate to which the material will bond.
2. Remove guard bag, using caution not to damage inner bag.
3. Grip both edges of bag at the center barrier and wrinkle and flex the bag across the barrier. This will weaken the barrier.
4. Squeeze the clear side of the resin, forcing the resin through the center barrier.
5. Mix thoroughly to a uniform color by squeezing contents back and forth 25-30 times.
6. Squeeze resin to one end of bag and cut off the other end.
7. Strip 1/2" – 5/8" of the jacket away from the end of each of the flow sensor and 2-Wire decoder wires.
8. Twist each wire to the correct field wire. For example, twist the red wire from the flow sensor to the red field wire.
9. Cut off excessive bare wire as needed before inserting wire into the wire nut.
10. Insert wires into the recommended size wire nut and twist it securely onto the wires.
11. Slowly insert connection into sealing pack until it fits snugly against the opposite end.

**Note:** Be sure the resin covers the open end of the wire nut.

12. Wrap open end of bag with electrical tape and position the taped end up until resin gels (8-12 min. @ 73°F). Cure time is 24-hours @ 70°F.

### Spears® Dri-Splice Seal DS-300 with DS-100 Dri-Splice Wire Connector

**Note:** This type of connector is not suitable for 2-Wire installations. 3M Scotchcast Connector Sealing Pack 3570G-N **must** be used for any connections along a 2-Wire path.

1. Strip 1/2" – 5/8" of the jacket away from the end of each of the flow sensor and 2-Wire decoder wires.
2. Insert wires through holes in base of body.
3. Twist stripped wires together and apply crimp sleeve with an indent type crimping tool. Trim excess bare wire.
4. Fill plug to brim with Spears DS-300 sealant.
5. Invert body and insert plug into body until it snaps tight.
6. Push wires all the way into the plug to completely seal the crimp sleeve.
7. Be certain sealant has formed into all holes in the body.