

Introduction:

FSI-S00 impeller flow sensors provide accurate digital output signals proportional to the velocity of the liquid flowing through the pipe. The square wave digital signal is converted to flow rate by the receiving monitor or control device using calibration constants supplied by CST and listed on page 4 of this guide.

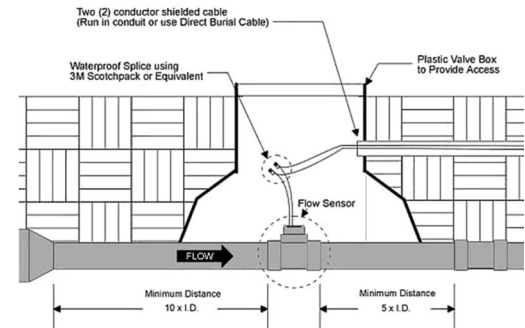
The sensor uses the same two wire path for power supply and signal output. The sensor circuit contains a pre-amplifier allowing the signal to travel up to 2,000 feet using shielded, twisted pair cable.



The flow sensor insert, held in place with a retaining nut, contains the detection circuitry and carries the unique four-bladed impeller on a transverse axle. The insert attaches to a housing that controls the location and alignment of the impeller. The housing is mounted in a PVC saddle therefore no additional mounting hardware is required. The axle and impeller along with the sealing o-ring are replaceable in the field.

Mechanical Installation– Location and Orientation:

Because an impeller sensor measures the velocity of the liquid and converts it to a flow measurement based on area, proper flow measurement depends on the condition of the pipe interior and the sensor's location in the piping system. The pipeline must be full, free from trapped air, floating debris and built up sediment. The mounting saddle should be installed with a minimum of 10 diameters of straight pipe (ex. 30 inches for 3 inch pipe), upstream and a minimum of 5 diameters of straight pipe (ex. 15 inches for 3 inch pipe) downstream to eliminate irregular flow profiles caused by valves, fittings or pipe bends.



1. Always install with the flow arrow on the sensor pointed downstream. Allow 3 3/4" clearance to remove flow sensor insert from the saddle for service. The saddle is usually installed with the housing up in the vertical or 12:00 o'clock position. However, if necessary, it may be installed with sensor housing at an angle from vertical to provide clearance.
2. Flow sensors may be installed inside a building, outside above grade or underground. If installed above grade, consider security issues to prevent damage or disassembly. If installed below grade, provide access for service.

3. Flow sensors are most typically installed below grade in a horizontal section of pipe with the sensor housing up. Do not direct bury the flow sensor. Provide a meter pit or valve box of adequate size and drainage to service the sensor. Provide a service loop in the wire connections to allowing the sensor housing to be brought above grade.
4. Flow sensors may be installed on vertical sections of pipe providing that the piping is full and does not contain trapped air. A vertical pipe with rising flow is preferred over falling flow. The sensor housing may be oriented in any direction radially around the pipe.

Mechanical Installation– Installing sensor in pipe

Do not attempt to Hot Tap!
The pipe must be drained and depressurized for installation

Disassemble the flow sensor.

1. Disassemble the flow sensor insert by turning the retaining nut counter-clockwise and pulling the insert housing straight out of the tee. **Do not pull on the wire leads!**



2. Remove the tapered wedge from the side of the saddle and fold the bottom half of the saddle down to separate it at the hinge.

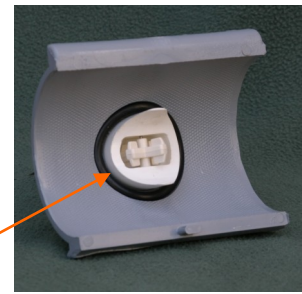
Prepare the Pipe.

1. The PVC saddle type flow sensor is attached to the outside of a section of PVC pipe with the same nominal size as the saddle after an entry hole for the sensor insert has been drilled through the pipe. Use Best Industry Practices to insure that the sensor is installed correctly.
2. Locate a straight section of pipe with a minimum of 15 diameters of straight pipe. Clean a 12 inch (minimum) section of pipe 10 diameters downstream of any valve, fitting or change in size to mount the saddle.
3. Use a 1 ¼ inch hole saw, **NO SMALLER NOR LARGER**, to drill the entry hole in the center of the cleaned area of the empty depressurized pipe. Make sure the hole is perpendicular to the pipe and centered. Remove the pipe coupon with the saw; do not allow it to fall into the pipe. Remove the burr from the edge of the hole.

Attach the saddle.

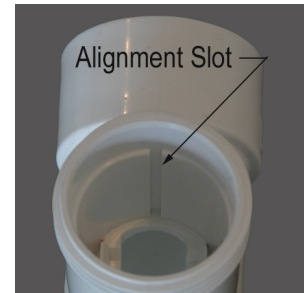
4. Make sure the o-ring seal is in place on the underside of the saddle around the protruding sensor housing.

O-Ring

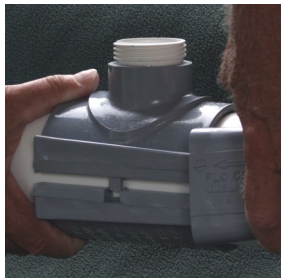


5. Place the top half of the saddle with the alignment slot inside the sensor housing on the downstream side, over the pipe so that the mount fits into the drilled hole.

Mount



6. Attach the bottom half of the saddle to the top half on the hinged side of the top half and close it around the pipe.



7. Push the larger end of the tapered wedge over the guides sliding it until the saddle halves are clamped together. The wedge should go on half-way by hand. Finish setting wedge with a couple of taps with a rubber mallet.

8. Reassemble the flow sensor insert with the arrow on the top of the housing in the downstream direction. This will align the guide key on the insert with the slot inside the housing. Push straight in so that the key enters the slot until the o-ring seals the opening. Slide the retaining nut over the wire leads and tighten by hand turning it clockwise.



Electrical Installation

1. Two conductors are required to connect the flow sensor to the monitor or control device.
2. The **RED** lead from the sensor is the **+** (**Positive**) lead and the **BLACK** lead from the sensor is the **-** (**Negative**) lead. Observe polarity when extending these conductors and connect them to the **+** and **-** leads or terminals of the FLOW SENSOR INPUT of the monitor or controller. **Do not connect flow sensor to Power or Valve circuits!**
3. Use a shielded Direct Burial cable with at least one twisted pair of conductors. Multiple pair cable may be used. Use #20 AWG or larger stranded copper wire conductors to extend the distance up to 2,000 feet.
4. Waterproof the splices. The preferred method is the two part epoxy kit, Scotchlok 3570 as manufactured by 3M. Follow all manufacturer's instructions.
5. Make sure that the flow sensor housing is installed in the tee or the retaining nut is on the wire leads before making the splices.
6. Provide a service loop in the cable to allow the flow sensor housing to be removed from the tee and brought above grade for servicing.

Calibration Constants

To program the monitor to read flow rate in GPM (gallons per minute).

Frequency = (GPM/K) - Offset

FSI-S30-001 **K = 2.75** and **Offset = 1.58**

FSI-S40-001 **K = 4.53** and **Offset = 1.11**

.

Operation

1. Make sure the flow sensor is assembled and the retaining nut is tightened (hand tight) before pressurizing system.
2. Fill pipeline and eliminate trapped air.
3. Flow sensor should begin transmitting flow immediately, however most monitors and control devices have a flow averaging routine that requires several seconds before the device begins to display flow.
4. Always wait for flow to stabilize before setting control limits. Stabilization may take several minutes in large piping systems.