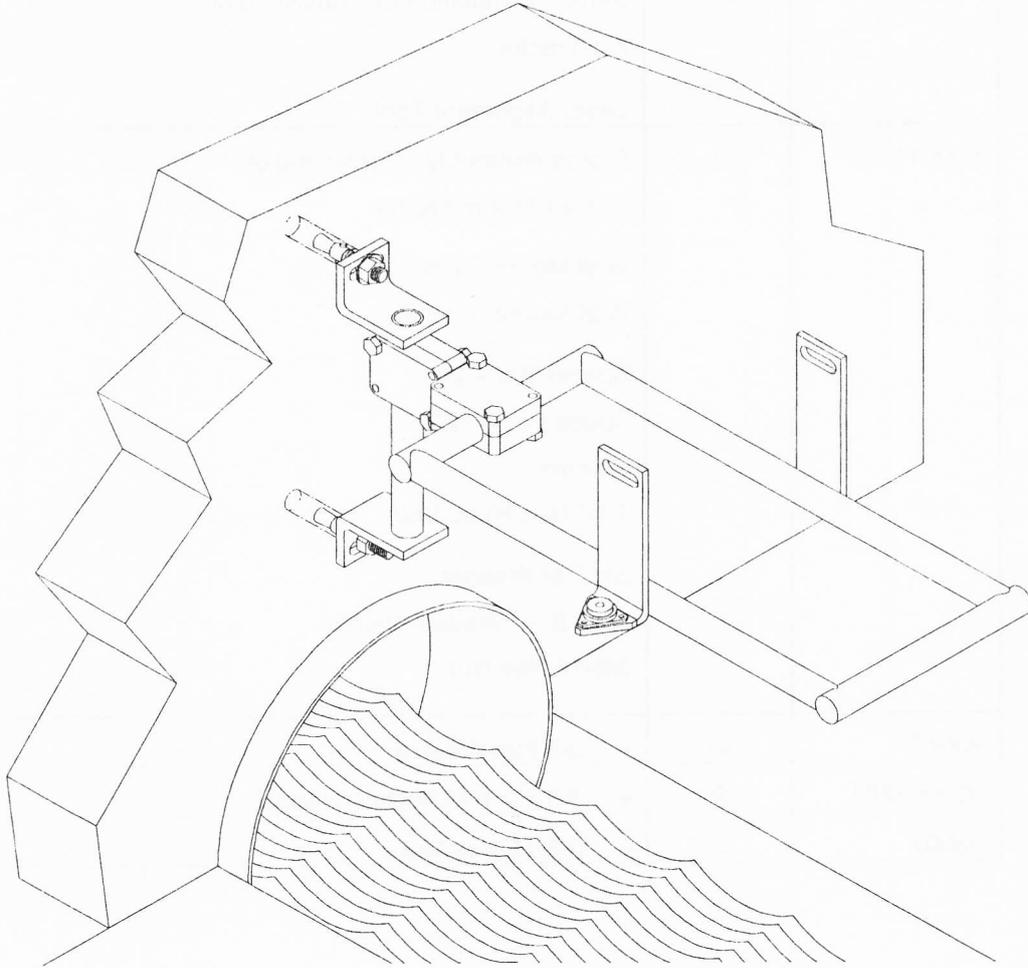


FLO-DAR™ SENSOR INSTALLATION INSTRUCTIONS

The frame is mounted by drilling two holes in the wall of the manhole above the flow, installing two concrete anchors and attaching and aligning the frame. The objective is to level the frame assembly over the center of the flow for optimum location. The sensor is then locked into the frame and connected to a remotely located monitor.



WHAT YOU NEED TO GET STARTED

Before going into the field check that all parts are present (see figure). Also, determine what tools are needed for the complete installation. It is suggested that the frame and mounting hardware be assembled before arriving at the installation site. Loosening the clamps will then allow a normal installation once in the manhole.

Part Number	Quantity	Description
	1	Sensor Installation Kit consisting of: Flo-Tractor Laser Alignment Tool
800011701	1	Frame Assembly - Consisting of: Sensor Mount Frame Wall Mount Frame Wall Mount Bracket Spacer Bar – 2” Space Bar – 12” Clamps 1 ¼” Hex-Head Bolt 3/8 Flat Washer 3/8 x 2 ¼” Wedge Anchor 3/8-15 Hex Nut
93047	2	• 3/8 Flat Washer
920003701	2	• 3/8 x 2 1/4" Anchor Wedge
93007	2	• 3/8-15 Hex Nut

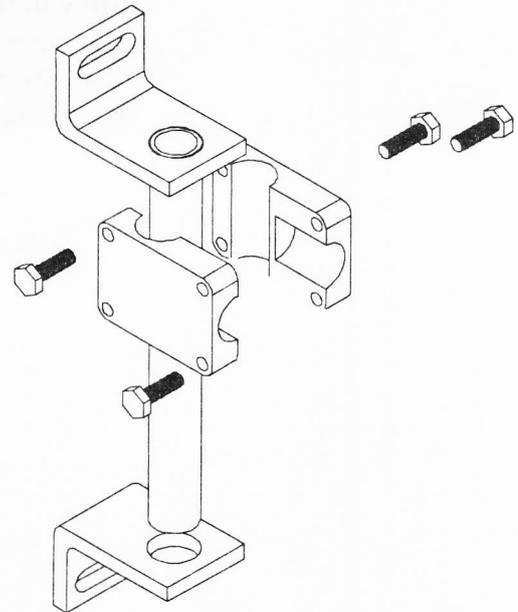
TOOLS REQUIRED

The following tools will ensure a smooth installation. The hammer drill will be used to drill into the concrete (or brick). The flashlight and mirror will be used to observe upstream or downstream obstructions. The tape measure will be used as an alternate means of measuring (Flo-Tractor recommended).

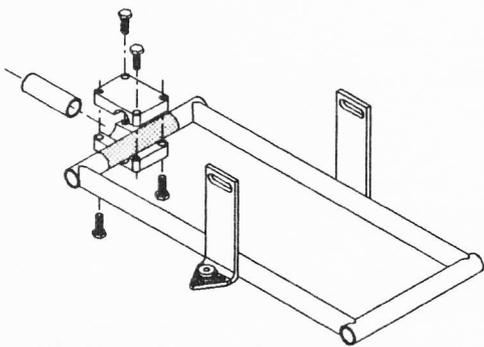
- Hammer drill
- 1/4" concrete bit
- 3/8" concrete bit
- 7/16" Socket / wrench
- 9/16" Socket / wrench
- 3/8" Drive Ratchet or greater
- Hammer
- Marker
- Flashlight
- Mirror
- Tape measure
- Screwdrivers
- Straight-edge

ASSEMBLING THE WALL MOUNT CLAMP

- 1 Assemble two clamp halves over wall mount using four 1/4-20 bolts (see figure).
- 2 Insert two bolts in diagonally opposite, non-threaded corners.
- 3 Hand tighten bolts uniformly until they are finger-tight.
- 4 Position clamp to just under top bracket.
- 5 Insert and hand tighten the remaining two bolts.
- 6 With a 7/16" socket, tighten bolts uniformly just enough to keep clamp in place.



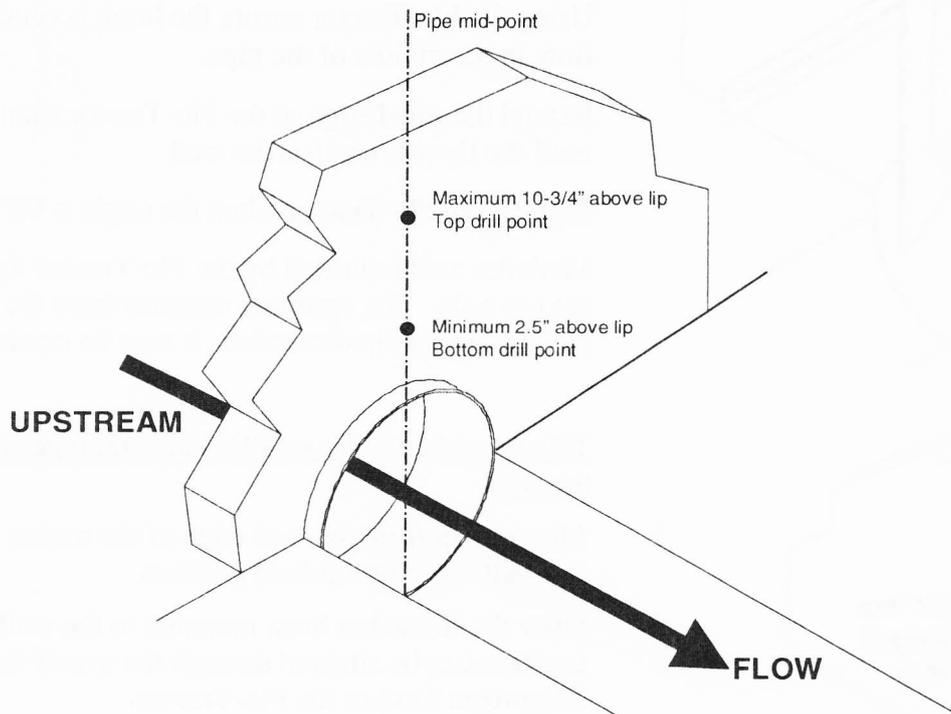
ASSEMBLING THE FRAME CLAMP



- 1 Determine the front end of the frame (see figure). The front end has a knurled area for better gripping action of the clamp.
- 2 Assemble clamp halves over front end of frame using four $\frac{1}{4}$ -20 bolts.
- 3 Insert two bolts in diagonally opposite, non-threaded corners.
- 4 Hand tighten bolts until they are finger-tight.
- 5 Insert the $2\frac{1}{4}$ " spacer in frame clamp. The 12" spacer is provided for a spare $2\frac{1}{4}$ " section and a $7\frac{3}{4}$ " spacer for pipe lips greater than $5\frac{1}{2}$ ".
- 6 Insert and hand tighten the remaining two bolts.
- 7 With a $\frac{7}{16}$ " socket, tighten frame clamp bolts uniformly just enough to keep it in place.

WHERE TO INSTALL THE SENSOR

Determining the ideal position for the sensor frame by inspecting the upstream and downstream flow characteristics is crucial for proper installation. Use the flashlight and mirror if necessary. Flow should be free of any standing waves, pools, undesirable materials, and foreign objects that might disrupt the flow contour.



Locating the sensor above areas of low turbulence will result in the highest accuracy. In general, the best choice for an installation site is a manhole just downstream from a long, straight channel or pipe. It is also important to locate the sensor so that it is accessible for ease of installation and maintenance.

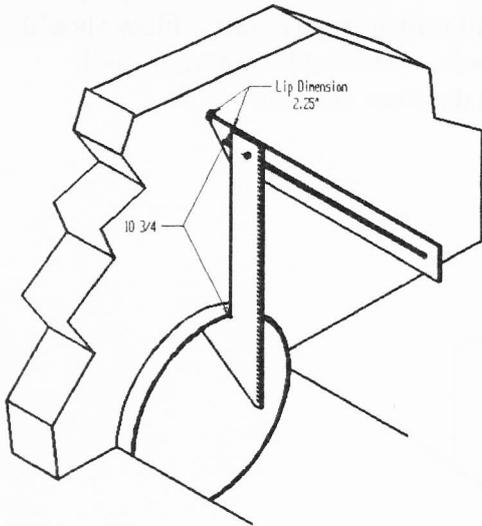
For a typical mounting the upper stud is located 10-3/4" above the inside wall of the pipe. The lower concrete stud should not be located any closer than 2.5" from the inside wall of the pipe. This ensures that the sensor is above the flow under normal full flow conditions. This position is for a pipe configuration that is either flush with the wall or has a limited positive lip.

Upstream and downstream flow disruptions may be checked using a mirror and flashlight. It is desirable to locate the sensor on the upstream wall but it will operate as well on the downstream wall.

After determining the general wall location, proceed with marking and securing the frame assembly as described in the following procedures.

LOCATE THE INSTALLATION POINTS

This procedure is for a pipe that is flush with the wall or that has a positive lip of 11" or less. Keep in mind that the mount is very versatile and understanding its capabilities will make installation smoother.



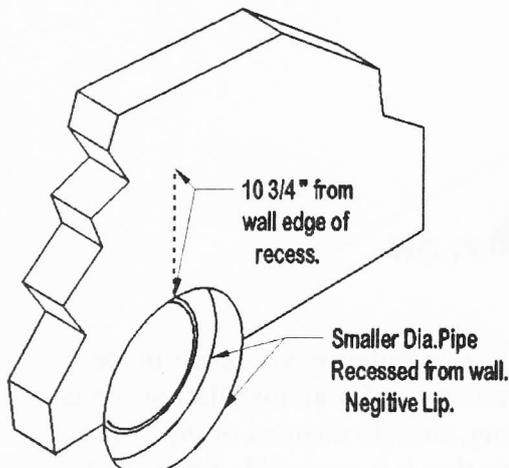
Using the Flo-Tractor ensure the hook is centered over the flow in the middle of the pipe.

Extend the ruled edge of the Flo-Tractor (in a "T" shape) until the tip just touches the wall.

Tighten the Flo-Tractor when the angle is 90°.

Mark the wall indicated by the Flo-Tractor tip. This will be the top hole. The optimum distance from the pipe lip is 10-3/4". Note the lip dimension, it may be needed later.

This procedure is for smaller diameter pipes recessed from the wall.



- 1 Measure up from the wall edge of the recess 10 3/4" and mark the wall for your top-hole position.
- 2 Once the frame has been mounted to the wall, proper vertical position can be attained through the use of the Laser Alignment Tool or the Flo-Tractor.

INSTALLING THE SENSOR MOUNT

NOTE

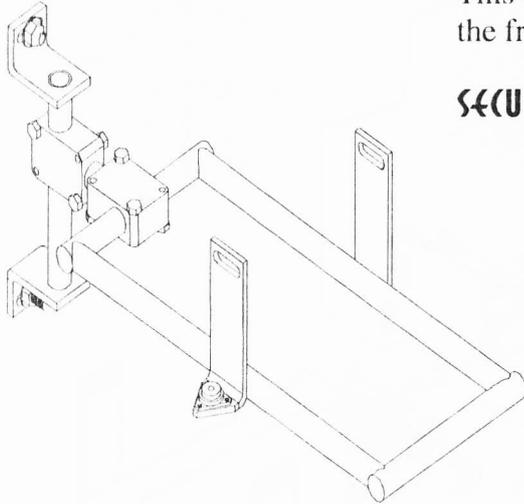
Check anchor bolt threads for obstructions.

This installation procedure includes securing and adjusting the frame.

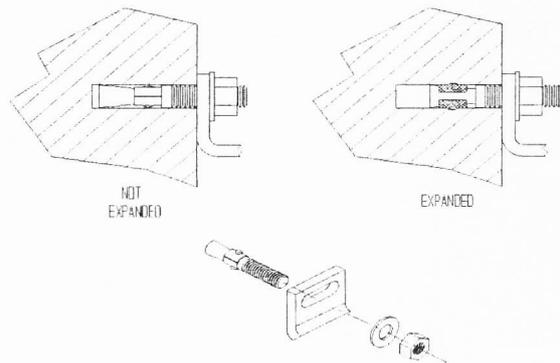
SECURING THE MOUNTING HARDWARE (TOP HOLE)

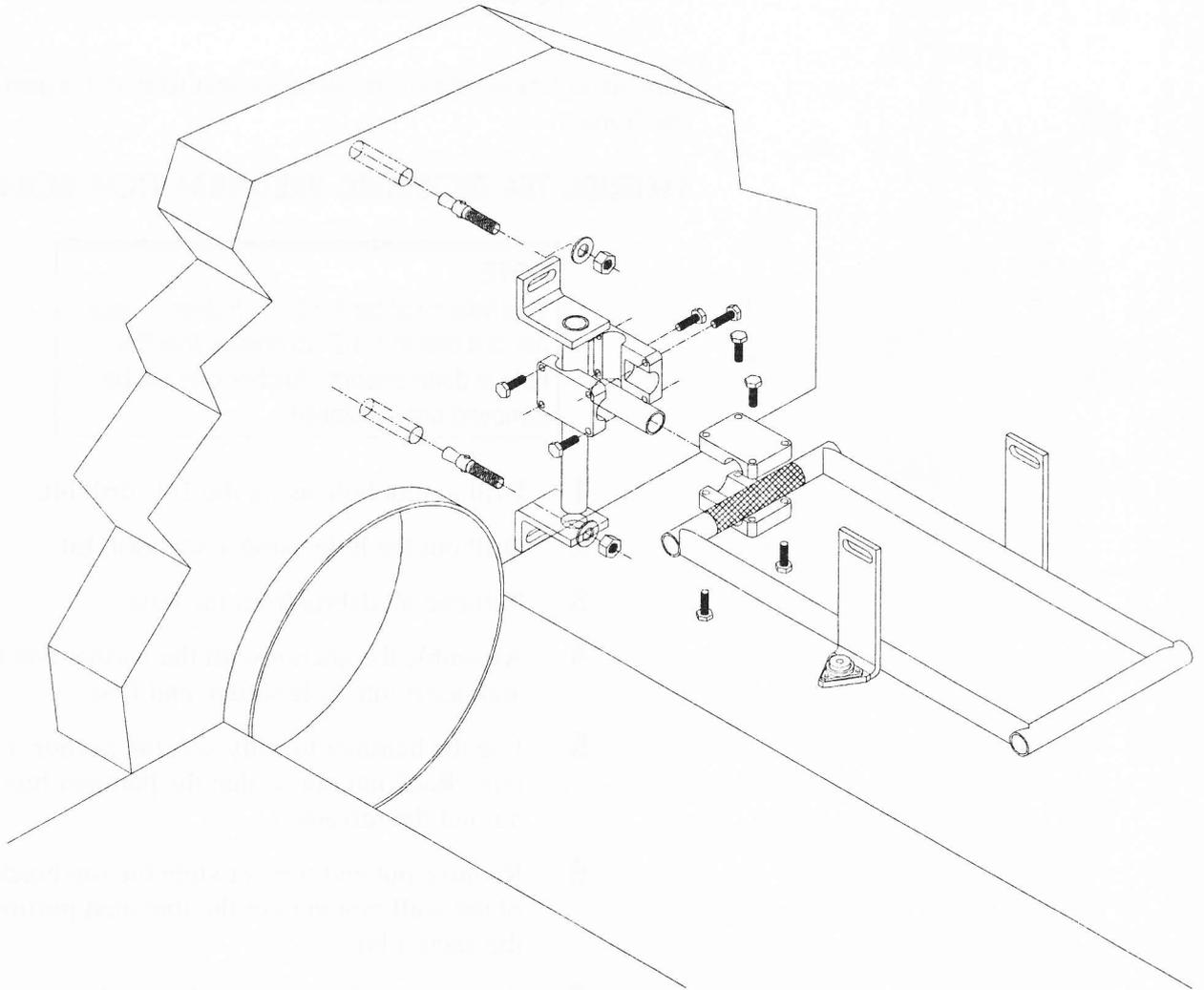
NOTE

The hole must be 1-1/2" inch deep. Tape the drill bits at 1-1/2" to ensure that the hole is deep enough. Anchor can not be removed once installed.



- 1 Drill a pilot hole using the 1/4" drill bit.
- 2 Drill out the hole using a 3/8" drill bit.
- 3 Remove all debris from the hole.
- 4 Assemble the anchor with the washer and nut and insert into hole wedge end first.
- 5 Use the hammer to fully seat the anchor in the hole. Back nut out so that the hammer hits the nut not the threads.
- 6 Remove nut and washer slide the top bracket of the wall mount over the threaded portion of the anchor bolt.
- 7 Slide the washer onto the threaded portion flush to the bracket.
- 8 Position, then tighten the nut using a 9/16" socket to draw the wedge into the collar that expands against the hole. Do not over-torque.





Exploded view of all parts needed for standard mounting frame installation

SECURING THE MOUNTING HARDWARE (BOTTOM HOLE)

- 1 Remove the top bracket in order to slide the bottom bracket onto the wall mount.
- 2 Position the other bracket at the bottom of the wall mount.
- 3 Reposition the top bracket on the anchor and slide the bottom bracket until a suitable drilling surface is found.
- 4 Assemble the anchor with the washer and nut and insert into hole wedge end first. Mark the wall through the bracket slot and remove the wall mount and brackets out of your way.
- 5 Drill and clean the second hole using the 1/4" and 3/8" drill bits.
- 6 Assemble the anchor. Insert the anchor, wedge end first.
- 7 Reposition the top and bottom brackets onto the anchors.

NOTE

Loosen top bracket as needed to insert the wall mount into the bracket.

- 8 Slide the washer onto the threaded portion flush to the brackets.
- 9 Position, then tighten the nuts using the 9/16" socket.
- 10 Tighten both nuts.

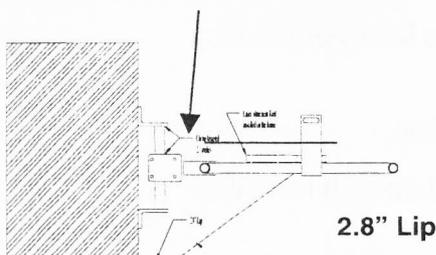
FINAL SENSOR MOUNT ASSEMBLY

- 1 Install frame assembly into wall mount clamp.
- 2 Ensure the spacer is fully inserted into the wall mount clamp.
- 3 Ensure that the wall mount clamp is positioned just under the top bracket.
- 4 Tighten all clamp bolts just enough to stabilize frame position.

VERTICAL ADJUSTMENT OF THE FRAME

The purpose of this adjustment is to ensure the optimum location for velocity measurement.

Clamp Lowered 2"



Laser beam passes just below inside edge of pipe. An object can be placed in front of the beam to show its

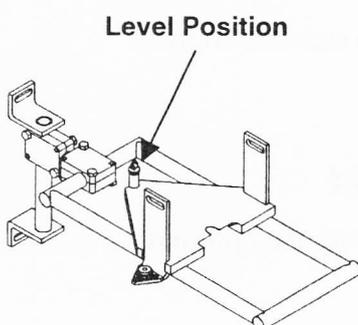
- 1 Ensure clamp bolts are just loose enough to move the frame, but tight enough to hold the frame steady once positioned.
- 2 Using the Flo-Tractor, measure the length of the pipe lip.
- 3 Determine how far the wall mount clamp must be lowered using the chart.

Using the 2 1/4" Spacer		Using the 8" Spacer	
If Lip is	Move Clamp Down	If Lip is	Move Clamp Down
0.0"	0.0"	5.7"	0.0"
0.0"-0.7"	0.5"	5.8"-6.4"	0.5"
.8"-1.4"	1.0"	6.5"-7.1"	1.0"
1.5"-2.1"	1.5"	7.2"-7.8"	1.5"
2.2"-2.8"	2.0"	7.9"-8.5"	2.0"
2.9"-3.5"	2.5"	8.6"-9.2"	2.5"
3.6"-4.2"	3.0"	9.3"-9.9"	3.0"
4.3"-4.9"	3.5"	10.0"-10.6"	3.5"
5."-5.6"	4.0"	10.7"-11.3"	4.0"

- 4 Using the Flo-Tractor, measure down from the underside of the top wall mount bracket.
- 5 Lower the wall mount clamp until the top of clamp aligns with the measurement.
- 6 Tighten clamp bolts.
- 7 Ensure bolts are tight enough to hold the frame steady.
- 8 You can verify the velocity beam location using the Flo-Tractor and/or the Laser Alignment Tool.

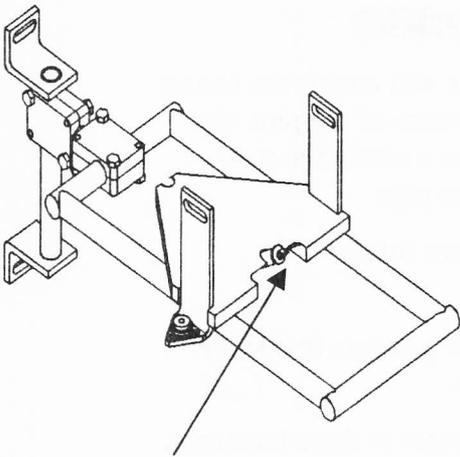
HORIZONTAL ADJUSTMENT OF THE FRAME

The purpose of this adjustment is to center the level sensor over the flow. This adjustment also effects the velocity position.



- 1 Assemble the alignment tool with the laser pointer in the level sensor hole.
- 2 Position the alignment tool in the frame.
- 3 Loosen frame mount clamp bolts just enough to enable tapping the frame into position.
- 4 Position the tape measure just inside the pipe midpoint horizontally across the flow.

- 5 If the laser beam does not align on the center measurement, tap frame side to side on the front end of the frame (horizontal).
- 6 If the frame assembly still cannot be centered, tap the rear end of the frame (yaw).
- 7 When the bubble is centered and the beam is centered, tighten all bolts.



REMAINING ADJUSTMENTS OF THE FRAME

- 1 Verify both critical positions and adjust as necessary.
- 2 Once frame is in desired location and level, ensure all nuts and bolts are securely tightened using the ratchet and socket.

ALTERNATE ADJUSTMENT OF THE FRAME

Use this method when the laser alignment tool isn't available.

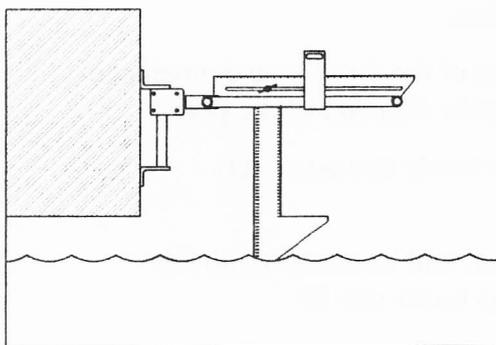
- 1 Check bubble level after each frame movement.
- 2 Loosen frame and wall mount clamp bolts just enough to tap the frame into final position.

Horizontal Adjustment

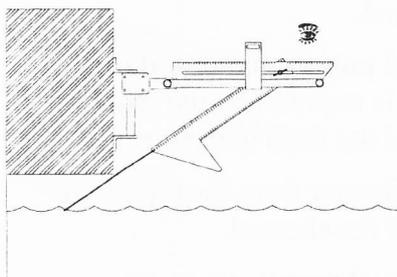
- 1 Configure Flo-Tractor in the level position and place it in the center of the frame.
- 2 Determine the center point of the flow using the tape measure.
- 3 Adjust frame as necessary to center frame on tape measure using the Flo-Tractor as a pointer.

Vertical Adjustment

- 1 Configure Flo-Tractor in velocity position and place it in center of the frame.
- 2 Using the angled portion of the Flo-Tractor for line of sight or a guide for additional straight edge, position frame so that angled arm of Flo-Tractor is slightly below inside diameter of pipe.
- 3 It may be necessary to reposition the frame horizontally by tapping the front end of the frame.



Flo-Tractor in Level Position

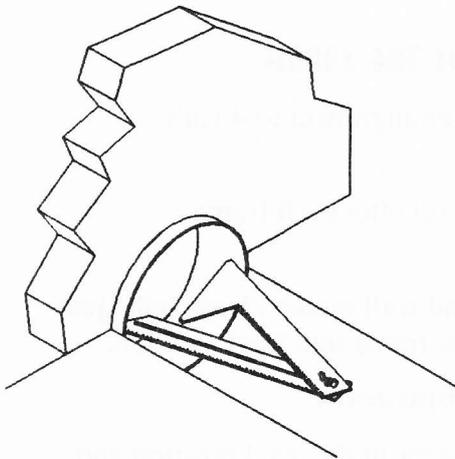


Flo-Tractor in velocity position.

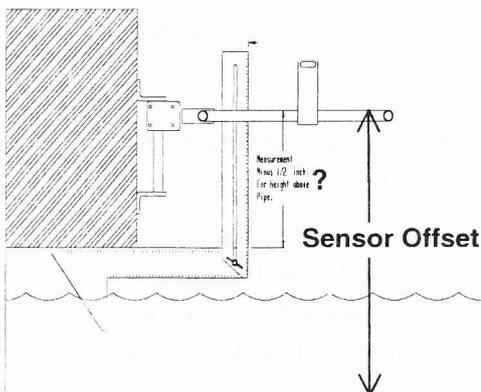
- 4 Check that the vertical clamp has not moved.
- 5 Check that the horizontal placement is still centered.
- 6 When the bubble is centered and the beam is aligned with the flow, tighten all bolts.

MEASURING THE PIPE INSIDE DIAMETER

This calculation is also critical. This will enable the sensor to determine the height above the bottom of the pipe (for the level transducer) and to enter into a surcharge mode when the flow breaches the top of the pipe.



- 1 Assemble the Flo-Tractor into a “V” configuration.
- 2 Position the Flo-Tractor pointers inside the center of the pipe walls.
- 3 Check inside pipe diameter at three locations.
- 4 Re-tighten the Flo-Tractor after each measurement.
- 5 Use the tape measure to record the outside distance between the Flo-Tractor tips after each measurement.
- 6 Take the average of the three measurements to represent the inside diameter of the pipe.
- 7 Record the pipe inside diameter (ID) measurement.
- 8 This measurement will be entered into the monitor site set-up under site ID.



Measure from top inside of pipe to top of frame then add pipe dimension to get sensor offset.

DETERMINING SENSOR OFFSET

Sensor offset is the distance from the top of the mounting frame to the bottom of the channel.

Sensor offset needs to be entered into the monitor during initial set-up for a given site. It is required by the monitor in order to determine the level of the fluid in the channel.

Sensor offset can be measured directly from the top of the mounting frame to the bottom of the channel.

In situations when it is not practical to measure to the bottom of the pipe, an alternative method using the

Flo-Tractor is described below and shown in the adjacent figure.

- 1** Assemble the Flo-Tractor into an “L” configuration.
- 2** Position the Flo-Tractor pointer section under the lip of the pipe in at least six inches to form a firm base.
- 3** Adjust the vertical extension length of the Flo-Tractor at the base to fully extend beyond the frame clamp.
- 4** Check that both sections of the Flo-Tractor are flush at the base (zero inches). When the extension is fully upright at 90 degrees, tighten the wing nut.
- 5** Slide the pointer section along the inside pipe until the top of the extension is approximately $3 \frac{3}{4}$ inches away from the upright.
- 6** Record the height measurement from the inside of the pipe to the top of the frame.
- 7** Add this measurement to the pipe diameter to get the Sensor Offset.

INSTALLING THE SENSOR

The sensor may be moved from one site to another without entering the manhole. Only the initial frame installation requires entering the manhole. The cable connects the sensor unit (factory installed) to the secondary unit (customer installed). Do not remove the cable at the sensor end unless required to do so. See Chapter 8, Flo-Dar System Maintenance.

CAUTION

Never raise or lower the sensor with the cable.
Always use the bale.

SENSOR INSTALLATION

The sensor only fits into the frame one way. Properly installed, the sensor handle will point away from the wall. The sensor is positioned and locked into the frame using a pole with the hook attachment. The hook fits into the locking bale of the sensor and lowered into the frame with the cable trailing away to the center of the manhole.

- 1 Check cable connection to sensor. Connector is keyed to fit only one way.
- 2 Ensure hook attachment is securely attached to the end of the pole.
- 3 Position hook into sensor locking bar.
- 4 Lower sensor with cable trailing away from the manhole wall onto the frame.
- 5 Turn pole clockwise to engage the locking bars into the frame side mounts.

CAUTION

The locking bars will only turn so far. Do not force the bars beyond the stops.

- 6 Coil excess cable and secure to top rung of manhole.

CAUTION

Do not apply stress to the sensor end of the cable. Allow some slack after the coil is secured

OPTIONAL INSTALLATION

The sensor may be reinstalled without entering the manhole. The procedure above may be used in those instances. The frame must be installed by entering the manhole just once. At that time, the sensor may be installed to check the system alignment. In this instance you will not need the pole and hook attachment. The sensor lock may be turned by hand. If the sensor is installed, observe all cautions concerning the cable described in the standard installation.

