

# ADFM® Pro20 Velocity Profiler

## Physical Installation

### Overview

The ADFM Pro20 Velocity Profiler is designed for high accuracy flow measurement for applications in pipe diameters/flow depths up to 20 ft, and in channels up to 10 ft wide. Common applications include installation in circular, rectangular, or trapezoidal channels. The system is also frequently installed in multi-point channels. A variety of hardware accessories for sensor installation is available from Teledyne Isco (see Table 1 on page 8). In many cases, these accessories can be adapted for use in other channel shapes.

### Preparation

Information about the installation site, and pipe or channel cross-sectional geometry must be measured and recorded. You will need this information in order to select the proper hardware and accessories, and to pro-

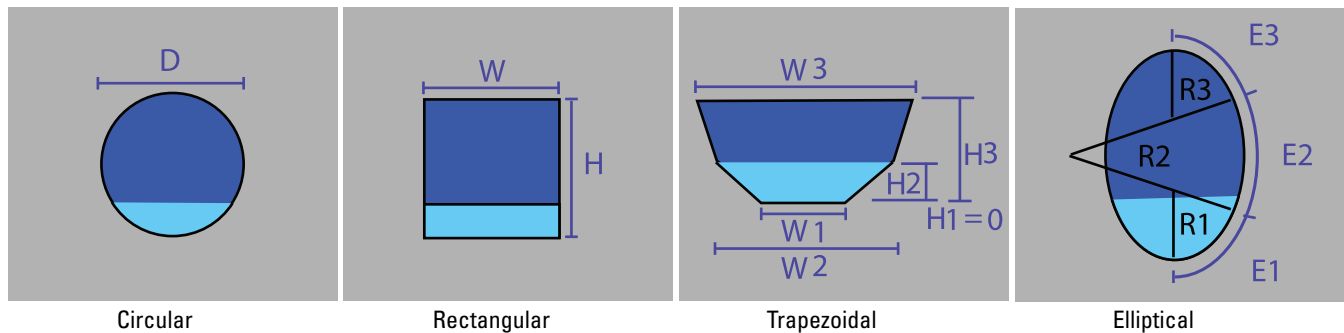
gram the ADFM flow meter. Accurate flow measurement is dependent upon exact dimensional data.

Measure and record the distance from the bottom of the channel to the top of permanent silt, if any. This is the **Bed Level** entered into your software, and is used to calculate required sensor elevation, if any (see the section *Applications With Permanent Silt* on page 7).

Measure and record the distance from the invert (bottom) of the pipe or channel to the bottom of the sensor. This is the **Zero Offset** entered into your software.

### Common Channel Shapes

For common geometries with the standard measurements described below, the channel shape must be symmetrical about the vertical center line. These common geometries include: Circular, Rectangular, Trapezoidal, and Elliptical (Figure 1).



**Figure 1: Common pipe and channel shapes**

### Geometry and Parameters

#### Circular

D = Diameter

#### Rectangular & Trapezoidal

W = Width

H = Height

H1 = 0

#### Elliptical

R = Radii

E = Angles

### Multi-Point (Irregular) Channel Shapes

For irregular-shaped channels, measure and record the channel width divided by 2 for 10 different depths:

Width/2 = X

Depth = Y

### Installing the Electronics Controller

The ADFM electronics controller housing and options are selected according to your application needs.

**Electronics Box** — The electronics are housed in a box, which can be mounted on a wall or in an environmental console enclosure.

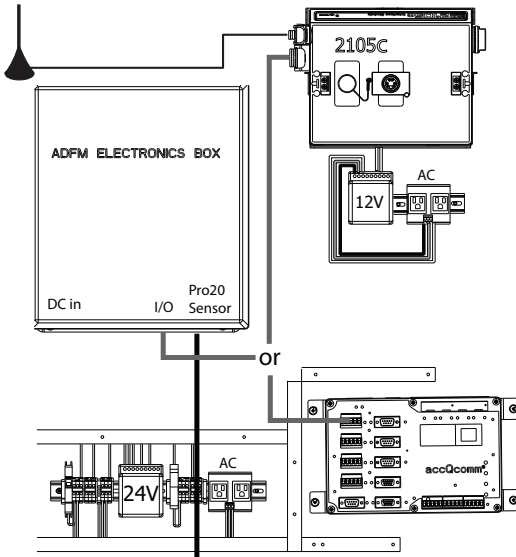
**Electronics Canister** — The electronics are housed in a cylindrical canister for suspension within a manhole.



**Figure 2: Pro20 sensor (bottom) with canister (left) and box (right)**

## Wall Mounting w/o Console Enclosure

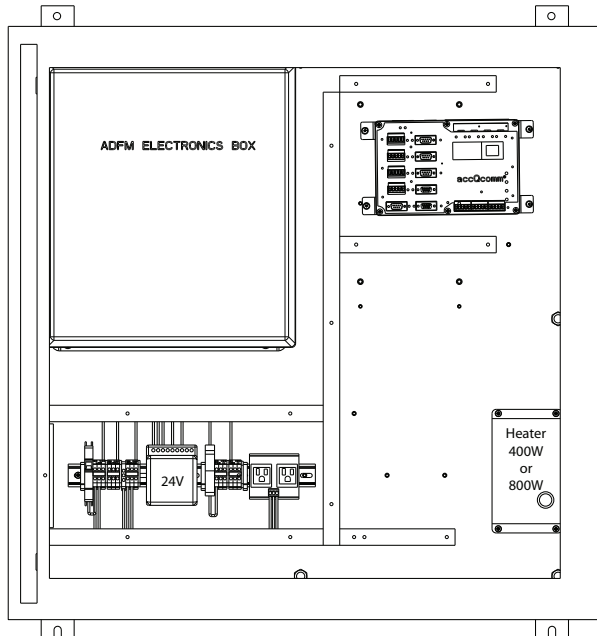
The ADFM NEMA 4X electronics box may be used indoors or outdoors. However, some other system components, such as the accQcomm Interface Module, must be installed in a dry, dust-free, climate-controlled environment.



**Figure 3: Wall-mounted electronics box** with optional interface module

## Console Enclosure Mounting

Stainless steel environmental console enclosures are available from Teledyne Isco for outdoor or indoor installations without climate control, and where dust or moisture is present. The electronics box and all other electronics must be mounted within the enclosure.



**Figure 4: Console-mounted electronics box** with optional interface module & heater

## Site Requirements

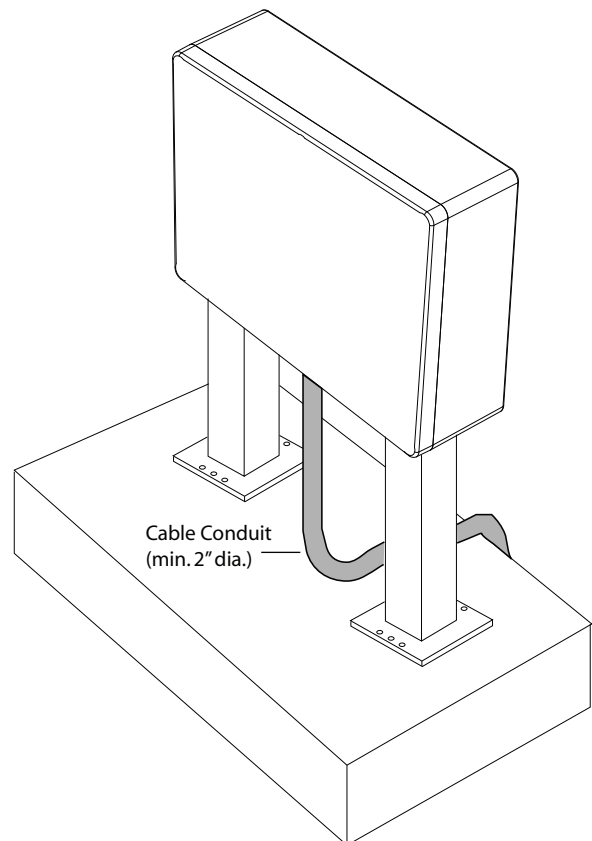
The installation site must allow for proper securing of all electronics, cables, sensors, and hardware.

24 VDC at 3W is required. Depending on the configuration, some installations require AC voltage for heaters and other options.

Where an environmental enclosure will be used, a user-supplied concrete pad and steel stand (as in Figure 5), or other secure method, is recommended.

### **Note**

Environmental enclosures are not shipped with access holes for conduit connection. All cable entries must have appropriate ID, user-supplied conduit connections or cord-grip fittings to retain the NEMA 4X rating. Conduit and wires must be sealed to prevent harmful gases and moisture from entering the enclosure. **Failure to seal conduit could reduce equipment life.**



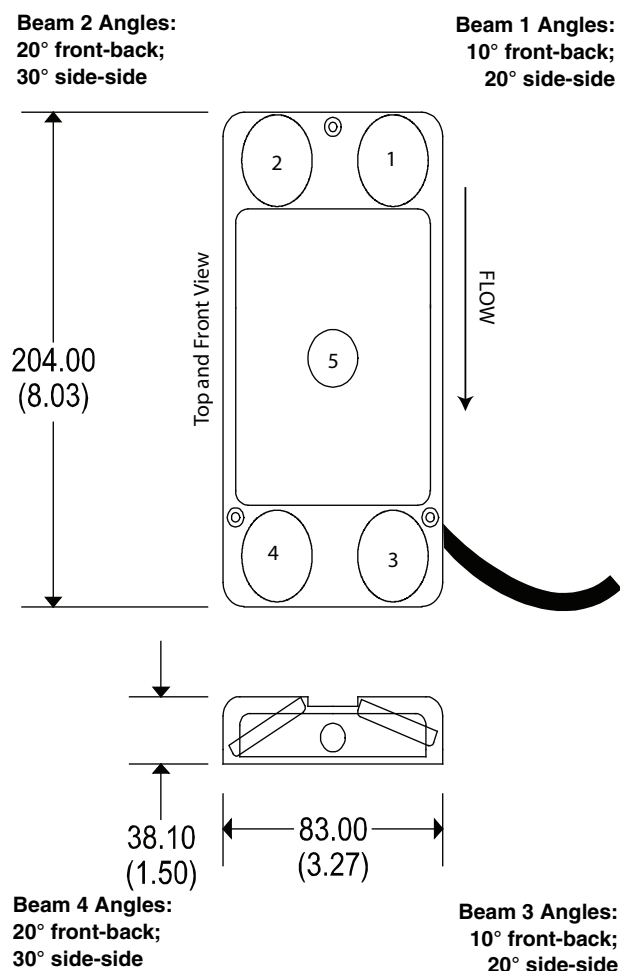
**Figure 5: Environmental enclosure** mounting example

### **Note**

Whenever possible, the sensor installation site should allow for easy removal and reinstallation in the event that cleaning, testing, or replacement is required.

## Sensor Installation

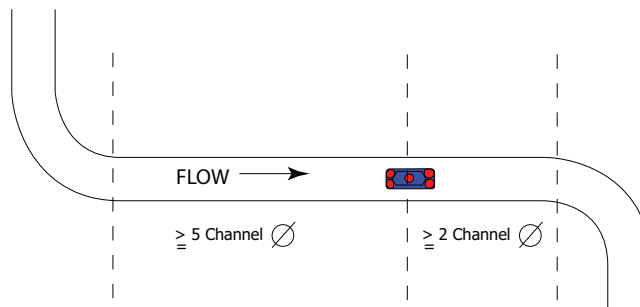
For proper operation, it is essential that the sensor be installed according to the positioning and cabling instructions described here.



**Figure 6: Sensor dimensions and beam geometry**

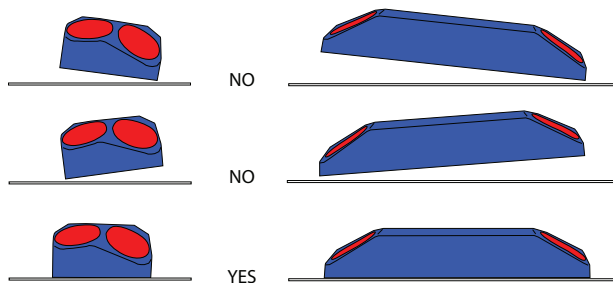
### Positioning

Place the sensor in the straightest possible run, at a minimum of 5 channel diameters downstream from a bend and 2 channel diameters upstream from a bend. The sensor should be securely positioned, with minimal potential for fouling or damage from sediment or debris. In installations where high velocity/debris will be present, you may consider protecting the entire cable length (i.e., with user-supplied rigid conduit or metal framing).



**Figure 7: Sensor positioning**

In all installations, the sensor mounting must be firmly anchored flat against the invert (center) of the channel (zero pitch, zero roll).



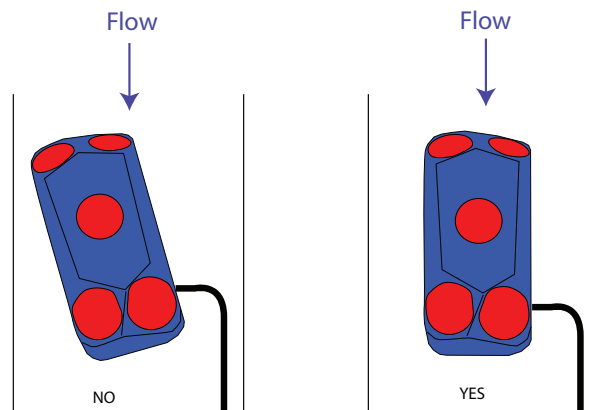
**Figure 8: Mount sensor flat on channel floor**

### ☒ Note

If debris and/or silt are expected, the sensor must be elevated with the proper fairing/spacer combination to ensure proper operation, as described on the last page.

Sites where a large amount of aeration or turbulence will be present often require the use of a secondary pressure transducer. In these cases, the mounting of the secondary sensor, including elevation and orientation, must also be considered.

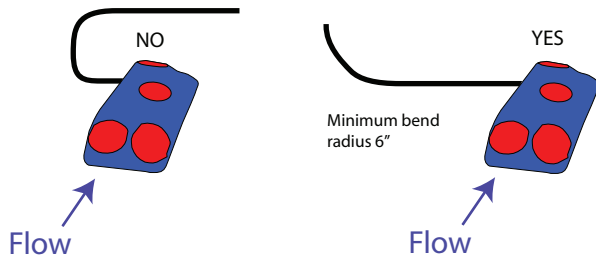
The long side of the sensor must be parallel with the longitudinal axis of the channel.



**Figure 9: Sensor alignment with channel wall**

## Cabling

Be careful to route the cable away from the side of the sensor where it is attached. Improper cable routing increases the possibility of debris fouling.



**Figure 10: Sensor cable direction**

During installation, ensure that the cable connector end is sealed for protection in case it comes into contact with water.

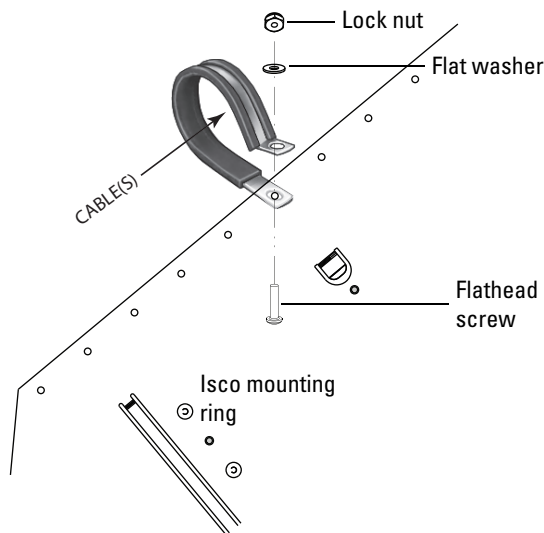
If a mounting apparatus (such as a ring or rectangular frame) is used, cables should be fastened to its downstream side. All permanent installations require the cables to be secured to the channel wall and mounting apparatus with rubber-cushioned stainless steel loop straps at 6" (nominal) intervals.

Cable mounting kit, Pro20 only:

part #60-7709-003

Cable mounting kit, Pro20 + pressure sensor:

part #60-7709-002



**Figure 11: Securing the cable(s) with SST straps**

User-supplied cable conduit must have a minimum inner diameter of **2 inches** (to accommodate the cable connector). If routing requires bending the cable, it must have a minimum bend radius of **6 inches**. The sensor cable should not be spliced, and should remain intact from the sensor to the control box.

### ☒ **Note**

Always secure the sensor cable to the mounting apparatus and channel wall. **Permanent installations** require the use of bolted stainless steel straps. Plastic cable ties alone are not recommended for any installation, but if used, should have minimum 50 lb loop strength.

## Circular Channels

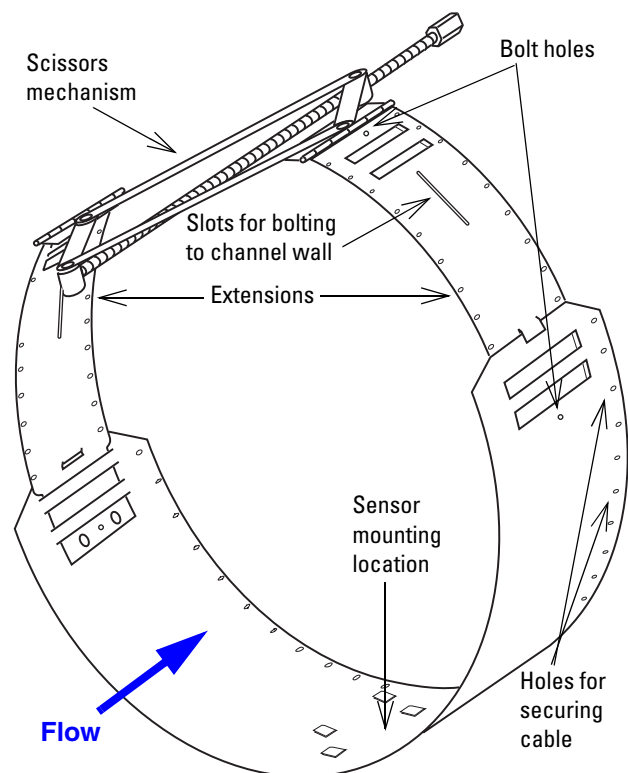
For large diameter pipes and manhole inverts, Isco's adjustable Scissors Ring (also known as the Universal Mounting Ring) is available in sets consisting of a base section, a scissors mechanism for adjustment, and one or more pairs of extensions to fit the specific channel size. The base section is equipped with holes and tabs for mounting other Isco sensors.

### ☒ **Note**

Complete information about the Scissors Ring is provided in the *Isco Mounting Rings Installation and Operation Guide* (available at [www.isco.com](http://www.isco.com)), or call the factory for details about choosing and installing your configuration.

### **WARNING**

**Use gloves and eye protection when assembling and installing the Isco Mounting Rings.**



**Figure 12: Scissors Ring**

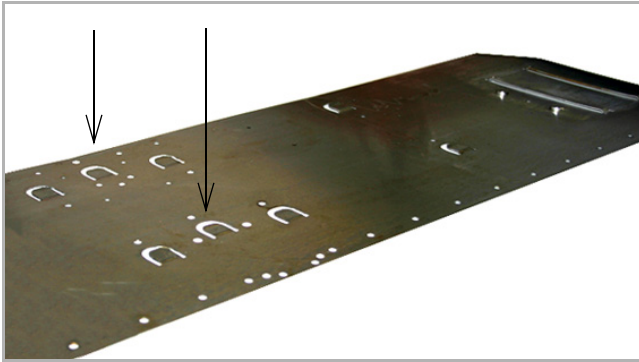
Sensor Mounting Hardware Kit: Part #60-3004-178

Secondary Sensor Hardware Kit: Part #60-7709-001



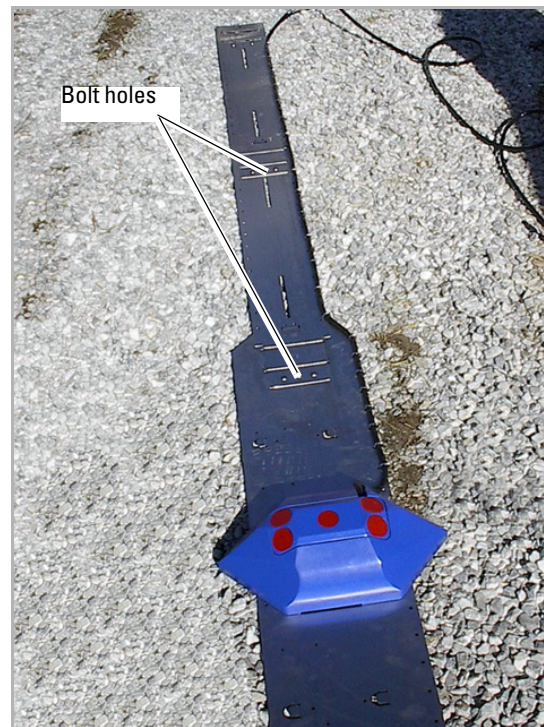
#### Scissors ring assembly:

1. In order for the Pro20 sensor (or fairing/spacer) to be mounted flush against the bottom of the scissors ring, and to avoid accumulation of debris, the six tabs in the center of the base section must be flattened. This can be accomplished by hammering and bending the tabs.

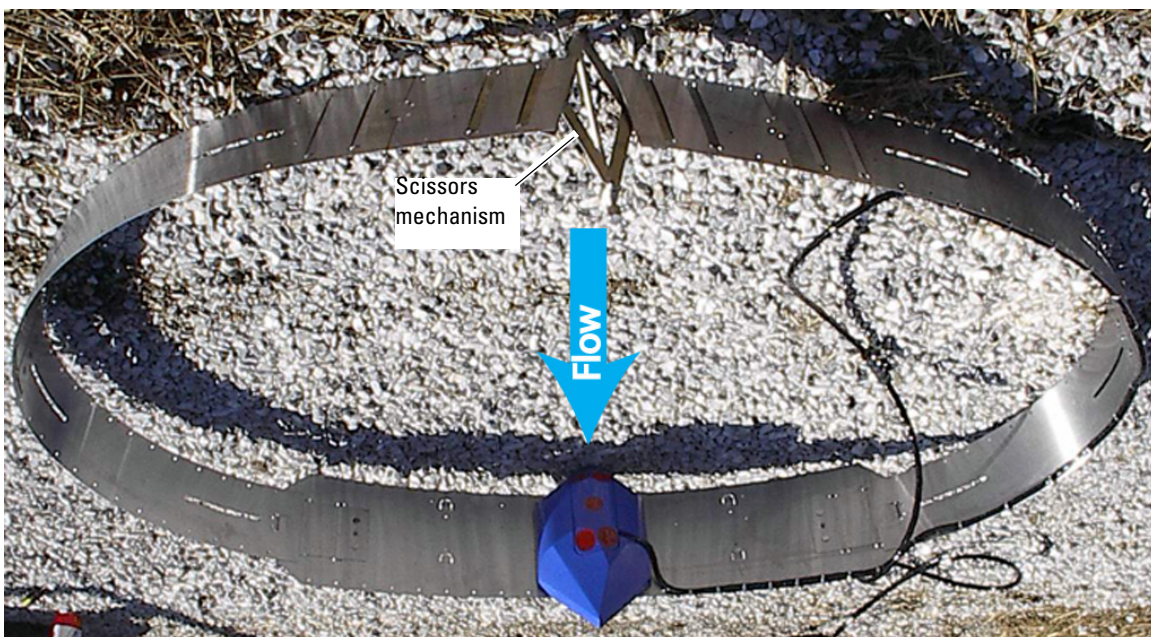


**Figure 13: Flatten six center tabs on base section**

2. Assemble the Scissors Ring, attach the sensor, and secure the cables above ground.
3. Assemble the ring, making sure the tongue sections are fully inserted into the slotted sections and over the securing buttons.
4. Bolt the sections together to increase safety and prevent the assembly from being dislodged or separated by the flow stream.



**Figure 14: Assembling the ring and mounting the sensor** Pro20 sensor with debris fairing



**Figure 15: Ring assembled, ready for installation**

5. Lower the assembly into the pipe with the sensor directly on the bottom center, parallel with the channel wall, facing into the flow. Tighten the scissors assembly to expand the ring outward so that it is pressed entirely flat against the pipe wall (Figure 16).
  - a. For additional reinforcement, anchor the ring to the pipe wall using the slots provided and user-supplied  $\frac{1}{4}$ " x  $2\frac{1}{4}$ " SST concrete wedge anchors.
  - b. For manhole invert installations, the scissors mechanism may be omitted. Anchor the base section and any extensions to the pipe wall.

#### **Note**

Be very careful to position the sensor flat against the channel floor, facing into the flow.

6. Secure the cable along the top or side of the pipe to prevent damage, dislodging, and collection of debris.



**Figure 16: Expand and secure the ring against the channel wall**

### Large Flows and Moving Debris

Under high velocity conditions (greater than five feet per second or 1.5 meters per second) and/or moving debris, the ring may require anchoring to keep it tight against the pipe. The flow could lift the ring off the bottom of the pipe, or even carry it downstream.

This problem is more prevalent in larger diameter pipes, and in pipes with a smooth inside surface (plastic, for example). If any of these conditions are

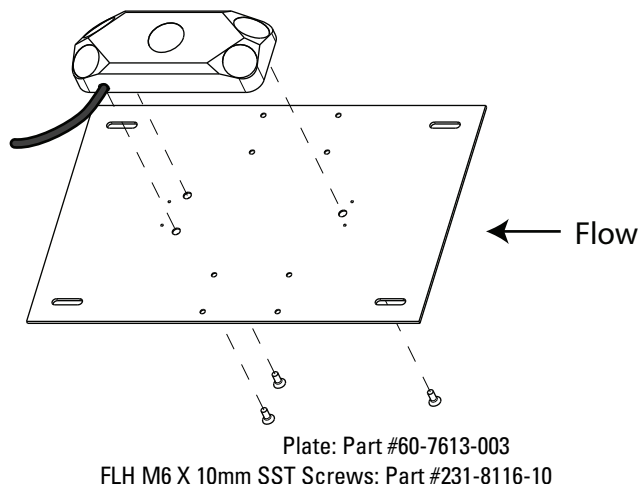
present, or if movement of the spring ring is suspected, anchoring the ring is highly recommended. This is usually accomplished using threaded fasteners anchored or driven into the wall of the channel, typically wedge anchors set in a pre-drilled hole, or with a power actuated stud gun.

Please contact the factory for recommendations on installation in manhole inverts, or in pipes larger than 80 inches in diameter.

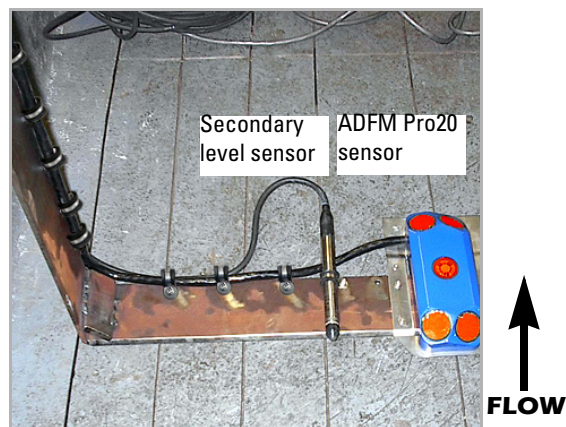
### Rectangular Channels

In rectangular channels, the Pro20 sensor is commonly installed using a flat mounting plate anchored to the channel floor, and/or a removable rectangular frame inserted into guide slots in the channel walls.

In some cases, particularly when the Pro20 sensor will be installed using a diver or other special methods, the sensor will be mounted on a rectangular plate, which is then anchored directly to the channel floor.



**Figure 17: Attaching the sensor to a mounting plate**

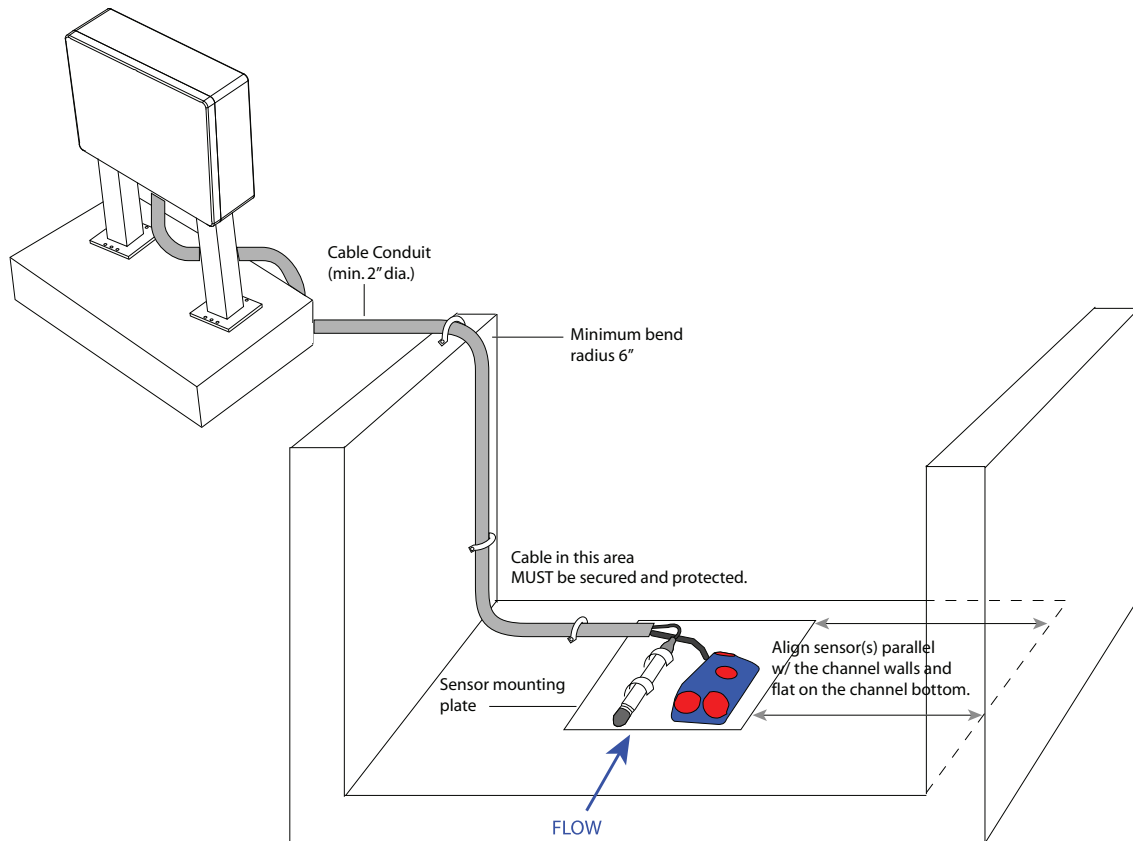


**Figure 18: Rectangular frame mounting** Secondary level sensor shown



Where a rectangular frame is used, verify the exact channel width at different depths and ensure that no obstructions will hinder insertion and removal of the frame. When designing mounting methods and accessories, avoid conditions where accumulation of solids on

or against the frame is likely. Ensure that the installation allows access for servicing, clearing of debris, and removal/replacement of the frame.



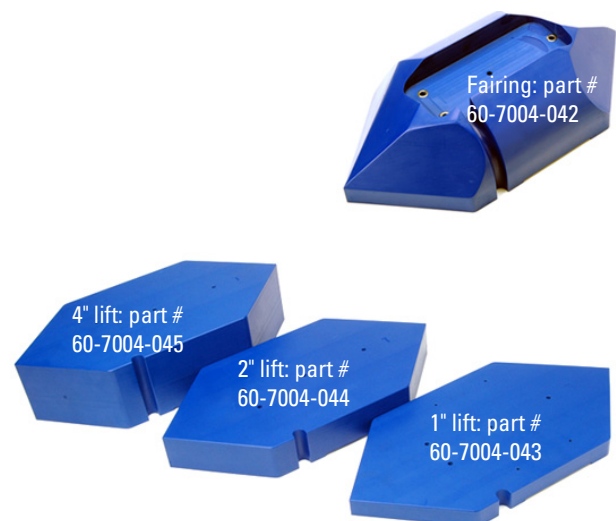
**Figure 19: Installation example** Rectangular channel

## Applications With Permanent Silt

For pipes or channels where sediment or debris will be present, Teledyne Isco offers mounting accessories for elevating the sensor.

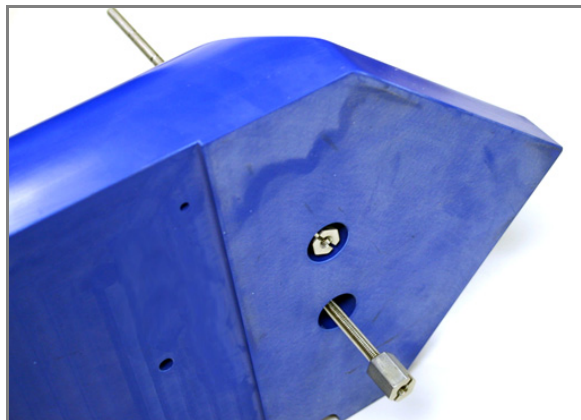
The debris fairing attaches directly to the mounting plate or ring, and the sensor is mounted in the top of the fairing for a lift of 3 inches. Fairing spacers add 1, 2, and 4 inches each, and may be combined for additional lift.

The sensor, fairing, and spacer(s) are attached to the mounting plate with three threaded couplers and mounting screws.



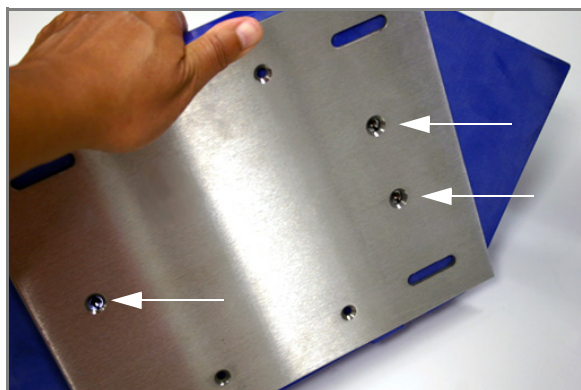
**Figure 20: Fairing and spacers for added lift**

1. Insert the threaded couplers into the fairing or bottom spacer.  
Additional couplers may be connected if extra spacers are required.



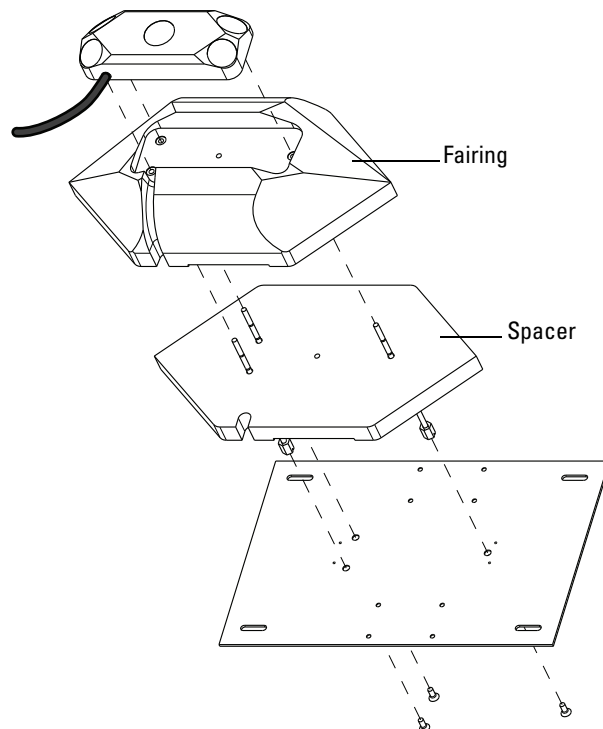
**Figure 21: Inserting the threaded couplers**

2. Position the mounting plate over the couplers with the countersunk holes facing out. Attach with the mounting screws.

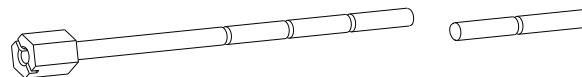


**Figure 22: Attaching the mounting plate**

3. Break off any excess length from the threaded couplers (Figure 24) such that the remaining threads attach the sensor snugly into the fairing.



**Figure 23: Sensor with fairing and fairing spacer**



**Figure 24: Threaded couplers: break off at joint part #60-7614-001**

**Table 1: Accessory Part Numbers**

|  |             |
|--|-------------|
| Cable mounting kit - Pro20 sensor only               | 60-7709-003 |
| Cable mounting kit - Pro20 & pressure sensor         | 60-7709-002 |
| Single SST Loop - Pro20 sensor only                  | 489-0016-23 |
| Single SST Loop - Pro20 & pressure sensor            | 489-0016-25 |
| Scissors Ring standard sensor mounting hardware kit  | 60-3004-178 |
| Scissors Ring secondary sensor mounting hardware kit | 60-7709-001 |
| Sensor mounting plate                                | 60-7613-003 |
| Sensor mounting screws                               | 231-8116-10 |
| Debris fairing                                       | 60-7004-042 |
| Spacer, 1 inch lift                                  | 60-7004-043 |
| Spacer, 2 inch lift                                  | 60-7004-044 |
| Spacer, 4 inch lift                                  | 60-7004-045 |
| Threaded coupler                                     | 60-7614-001 |
| Replacement hardware kit for fairing/spacer          | 60-7619-001 |

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