

# accQpulse Velocity Profiler Sensor Installation Guide

## Overview

This instruction guide is for the installation of the accQpulse shallow water and deep water sensors. The accQpulse Velocity Profiler is designed for high accuracy flow measurement in both shallow and deep water applications.

- The shallow water sensor can be used in non-full pipes 3 to 48 inches (76 mm to 1.2 m) in diameter, or open channel with flow depths 3 to 48 inches (76 mm to 1.2 m).
- The deep water sensor can be used in non-full pipes 6 to 192 inches (152 mm to 4.9 m) in diameter, or open channels with flow depths 6 to 192 inches (152 mm to 4.9 m).

The accQpulse consists of a sensor, electronics housing, cables, and software. A Windows® compatible computer is required for data collection.

## Site Preparation

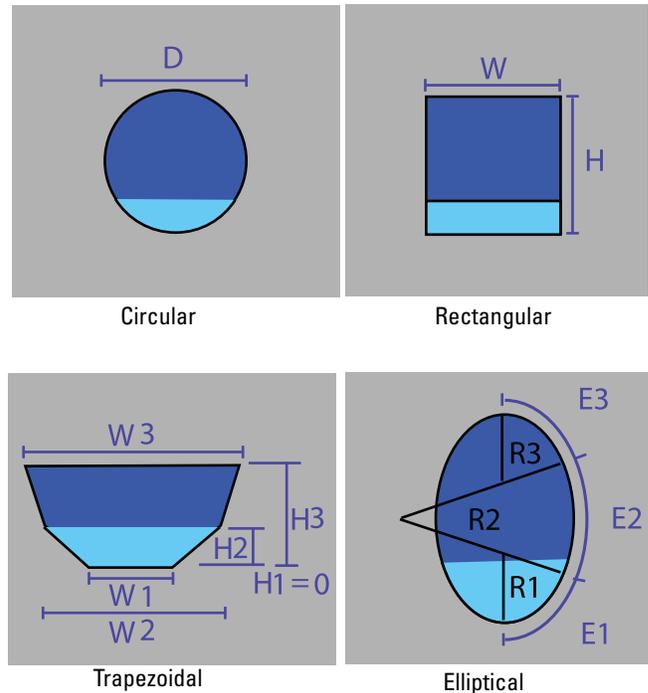
Information about the installation site and pipe or channel cross-sectional geometry must be measured and recorded. This information is required to select the proper hardware and accessories, and to program the accQpulse flow meter and sensors. Accurate flow measurement is dependent upon exact dimensional data.

Measure and record the distance from the bottom of the channel to the top of permanent silt/debris, if any. This is the **Bed Level** entered into your software.

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:

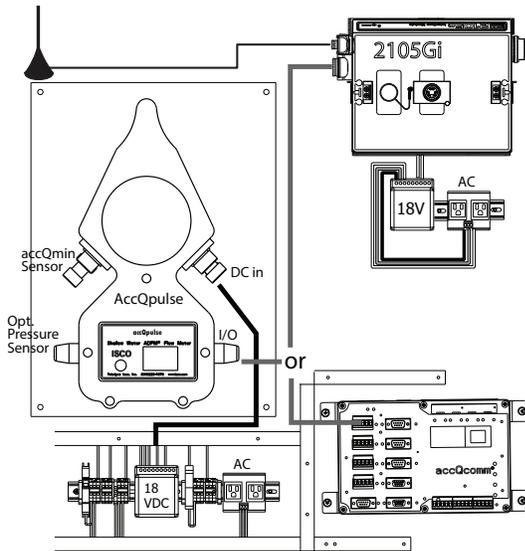
Width/2 = X

Depth = Y

## Installing the accQpulse Electronics Controller

### Wall Mounting without Console Enclosure

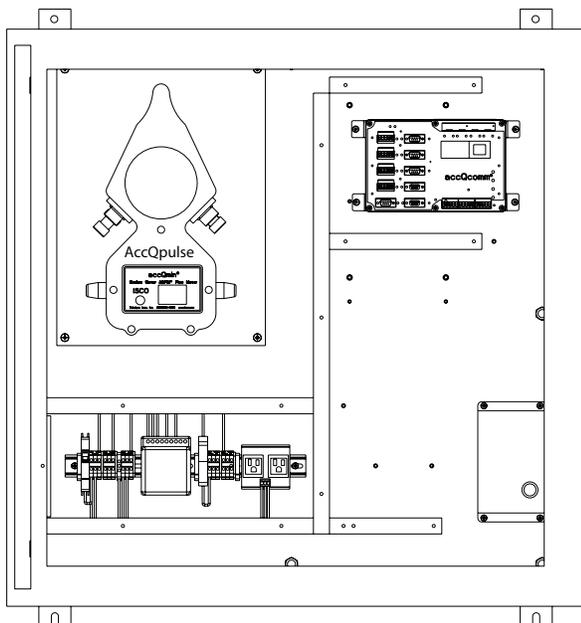
Attach the wall mounting plate to the back of the accQpulse flow meter housing, using the four supplied bolts. Attach the plate securely to the wall.



**Figure 2: Wall-mounted flow meter** 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 flow meter and all other electronics must be mounted within the enclosure.



**Figure 3: Console-mounted flow meter** with optional interface module & heater

## Suspension Harness

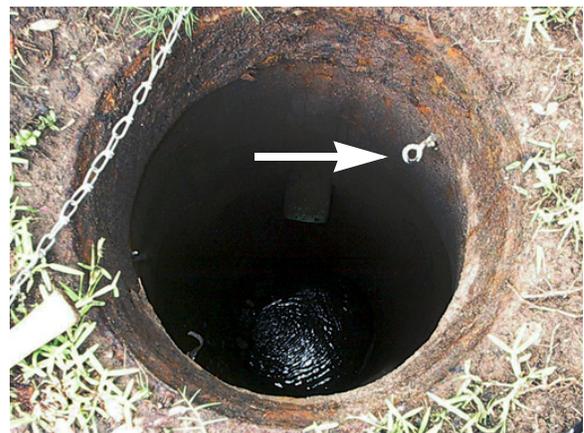
To suspend the accQpulse flow meter housing, loop the suspension harness around the meter's handle and a ladder rung, or the Teledyne Isco spreader bar.



**Figure 4: accQpulse suspension harness**

## Eyebolt Suspension

For manhole mounting, without rungs or spreader bar, use a  $\frac{5}{16}$ " or  $\frac{3}{8}$ " threaded eyebolt with lag shield (anchor lug). Drill a hole near the top of the manhole, just below the cap, and insert the lag shield and eyebolt. Attach the accQpulse to the eyebolt with a wire cable.



**Figure 5: Eyebolt suspension in manhole**

## Site Requirements

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

18 VDC is required, either from three 6-volt lantern batteries, or an external DC power supply. Both power sources can be connected; the source supplying the highest voltage will automatically be the source powering the system.

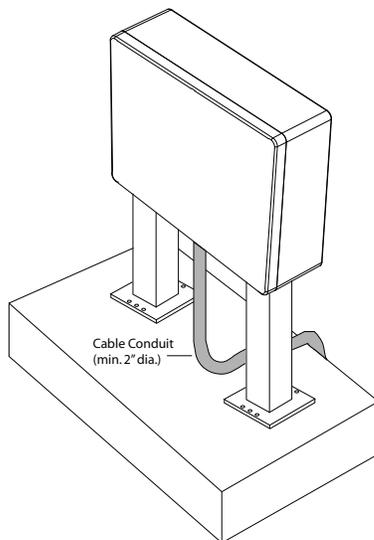
The use of the two power sources together, with the higher voltage coming from the external source, can provide uninterrupted system operation during brief power outages.

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 6), 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 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.**



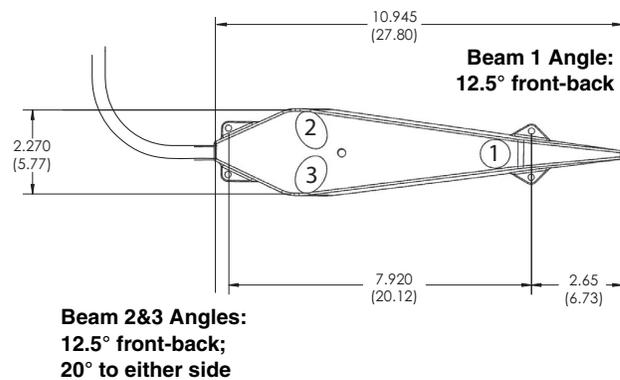
**Figure 6: Environmental enclosure** mounting example

## Shallow Water Sensor Installation

The following section is for installing the shallow water sensor. This sensor is designed for high accuracy flow measurement applications in pipe diameters/flow depths up to 48 in, and in channels up to 48 in 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 “Accessory Part Numbers” on page 6.). In many cases, these accessories can be adapted for use in other channel shapes.

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



**Figure 7: Shallow water sensor dimensions and beam angles**

### **WARNING**

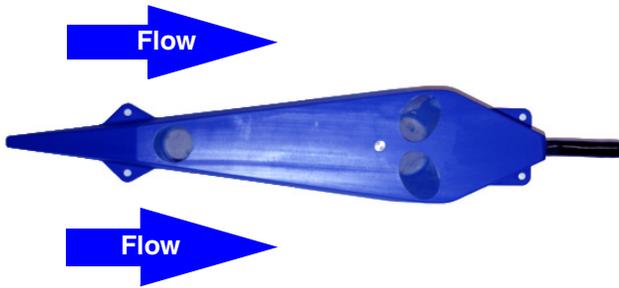
**Use gloves and eye protection when assembling and installing the Teledyne Isco Mounting Rings or other sensor mounting equipment.**

### **Note**

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

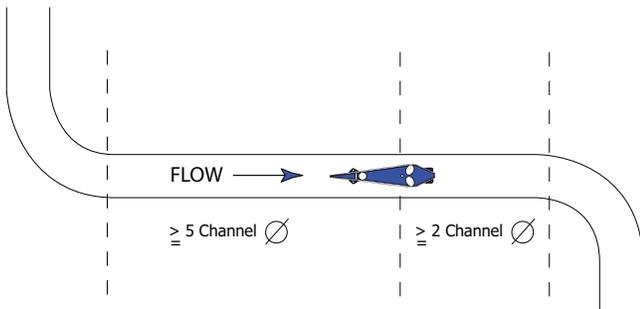
## Positioning of the Shallow Water Sensor

For accurate measurement, the sensor must be mounted in the invert (bottom) center of the pipe channel. The top of the sensor must be level, with the point of the sensor facing upstream, into the flow.



**Figure 8: Orientation of the shallow water sensor**

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.



**Figure 9: Sensor positioning**

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

In installations where high velocity/debris will be present, consider protecting the entire cable length (i.e., with user-supplied rigid conduit or metal framing).

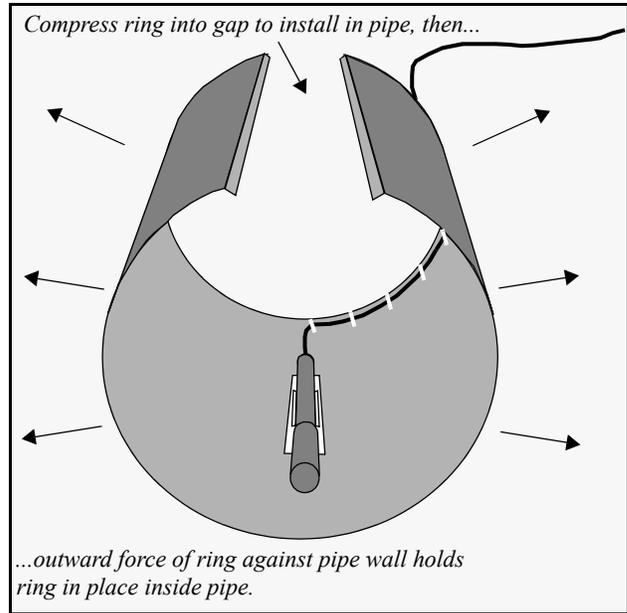
**Circular Channels: Mounting Rings**

For pipes and round-bottomed flow streams up to 15" (38.1 cm) in diameter, **stainless steel self-expanding mounting rings (Spring Rings)** are available. For pipes larger than 15" in diameter, Teledyne Isco offers the **Scissors Rings (Universal Mounting Rings)**.

**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.

**Spring Rings** – To install a spring ring, compress the ring, slip it inside the pipe, and then allow it to spring out to contact the inside diameter of the pipe. The inherent outward spring force of the ring firmly secures it in place.



**Figure 10: Spring ring compression & expansion**

**Scissors Ring** – This device consists of two or more metal strips that lock together with tabs to form a single assembly. There is a base section where the sensors are mounted, two or more extension sections (usually), and a scissors section at the top that expands the entire assembly and tightens it inside the pipe. The scissors section contains a long bolt that increases the length of the section as it is tightened.

Secure the unit in place by tightening the scissors mechanism with a 5/8" socket wrench or other suitable tool. Ring sections are .040" thick half-hard 301 stainless steel sheet. All other parts are also stainless steel, except for the plastic cable ties in the hardware kit.

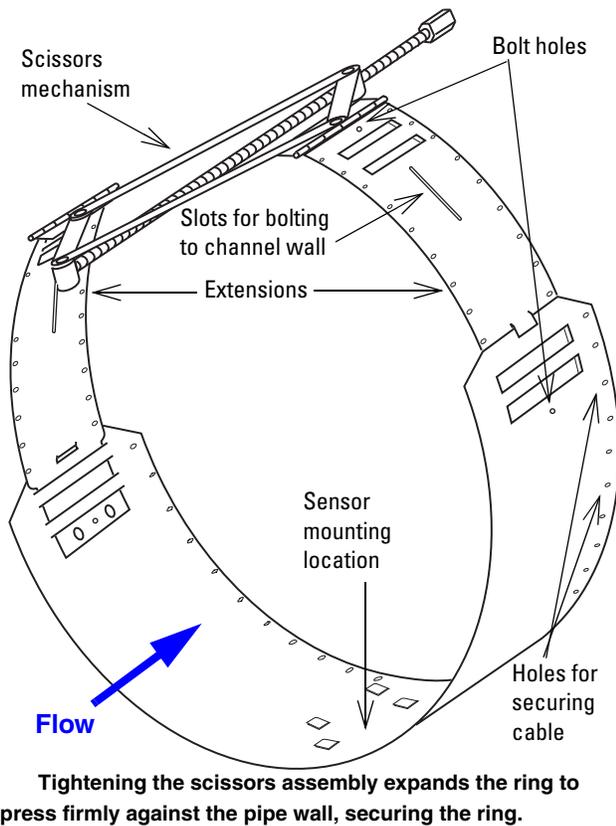
Each extension adds 9.0", 21.5", 31.5", or 41.5", respectively, to the circumference of the ring. Used alone, the base section fits a pipe that is approximately 16" to 19" in diameter. The 9.0" (smallest) extensions can be used to take up or remove slack, to bring the scissors mechanism into a position where it can be effectively tightened.

**Note**

The hardware kit includes flat head bolts and nuts. Teledyne Isco strongly recommends bolting the assembled scissors ring together before installation, using the holes provided for that purpose. Bolting the tongue sections together can greatly increase safety and prevent the assembly from being torn apart.

**Do not overtighten the mechanism.** It is designed to flex somewhat to provide a positive lock, once moderately tightened.

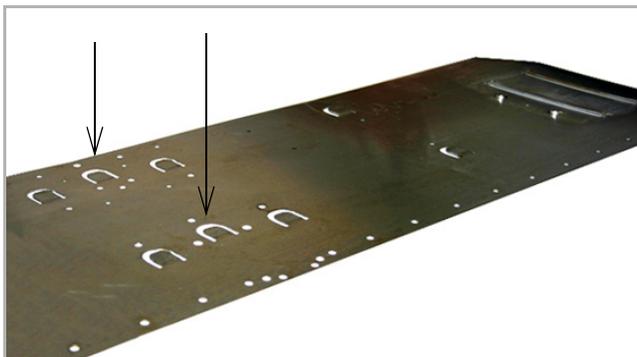
For installations in larger channels and/or high flow, extensions 2, 3, and 4 have slots for attaching the ring to the channel wall using appropriate anchoring hardware.



**Figure 11: Scissors Ring adjustment**

**Scissors ring assembly: –**

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



**Figure 12: Flatten two 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.
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.
  - 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.

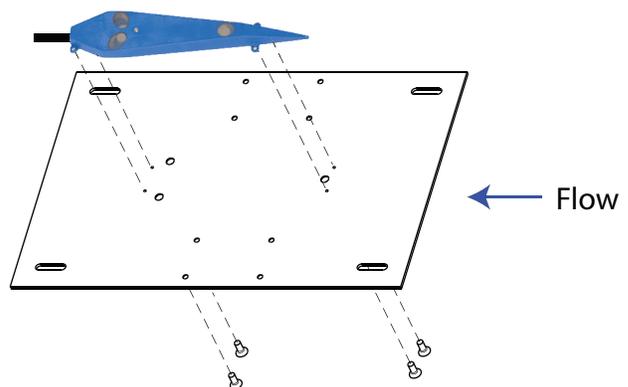
**Note**

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.

**Rectangular Channels: Mounting Plate**

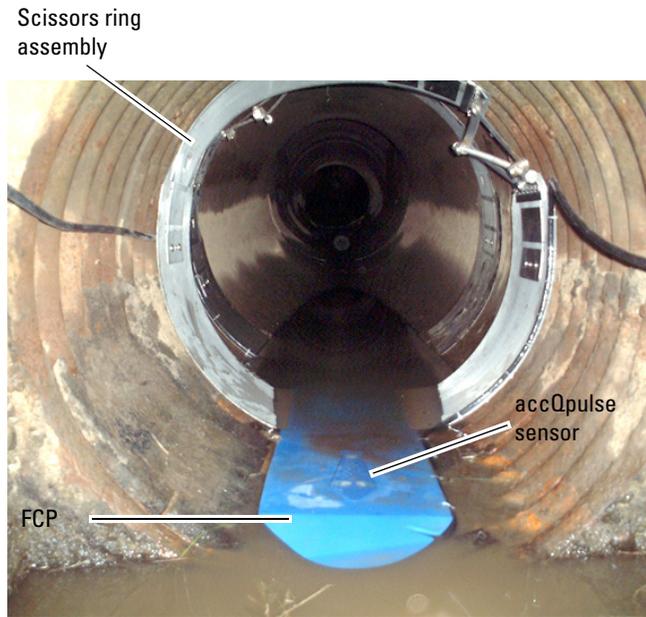
In rectangular channels, the sensor is commonly installed using a flat mounting plate anchored to the channel floor, and/or a removable rectangular frame inserted into guide slots in the channel walls.



**Figure 13: Sensor mounting plate**

**Flow Conditioning Platform (FCP)**

The sensor assembly has four mounting holes. To avoid damage to the sensor assembly, you should use only these holes for mounting the sensor to the Flow Conditioning Platform (FCP). If the FCP is used, center the platform in the invert of the pipe, as shown below.



**Figure 14: FCP and Scissors ring installation**

**Mounting the Shallow Water Sensor** – To mount the shallow water accQpulse sensor on a ring with the FCP:

1. Place the sensor in the cutout from the underside of the FCP. The top of the sensor (transducer side up) should be flush with the top of the FCP. Insert the 4 sensor mounting screws and tighten.
2. Position the bottom of the FCP in the center of the sensor mounting ring, with the ring in the FCP indentation. Align the 4 mounting holes in the bottom of the FCP with 4 of the holes in the ring. Insert 4 screws through the ring into the FCP mounting holes and tighten.
3. Guide the sensor cable into the cable slot on the underside of the FCP and position the cable along the edge of the FCP up to the ring and insert cable ties (zip ties) through the holes on the downstream edge of the ring to secure the cable along the ring to the side or top of the pipe. Cut off excess tie straps.
4. Slide the mounting ring into the pipe and align the ring/sensor in the pipe. The sensor/FCP should be centered in the invert of the pipe, with the pointed end of the sensor facing upstream. The top of the sensor/FCP should be level. Secure the ring and sensor cable in the pipe.
  - a. To install the mounting ring, compress the ring, slip it inside the pipe, and then allow it to spring out to contact the inside diameter of the pipe. The inherent outward spring force of the ring firmly secures it in place.

## Cabling for the Shallow Water Sensor

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

Attach the cable to the flow stream wall to prevent it from vibrating, moving around, tangling, or possibly collecting debris. If a mounting apparatus (such as a ring or rectangular frame) is used, cables should be fastened to its **downstream** side.

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 flow meter.

### **Note**

Always secure the sensor cable to the mounting apparatus and channel wall. **Permanent installations** require the use of bolted stainless steel straps.

## Shallow Water Sensor Accessory Part Numbers

Table 1 provides part numbers for commonly ordered accQpulse shallow water sensor installation accessories.

**Table 1: Accessory Part Numbers**

Flow Conditioning Platform, 8"	60-7404-002
Flow Conditioning Platform, 12"	60-7404-003
Flow Conditioning Platform, 18"	60-7404-004
Flow Conditioning Platform, 24"	60-7404-005
Sensor Mounting Plate	60-7613-003
Suspension Harness Kit	60-7109-002
Spreader Bar	60-3004-110
Eyebolt Assembly	60-7104-007
<i>Spring Rings (Each ring includes plastic ties to fasten the cable and a manual)</i>	
6" Dia	68-3200-007
8" Dia	68-3200-008
10" Dia	68-3200-009
12" Dia	68-3200-010
15" Dia	68-3200-011
<i>Scissors Rings (Each scissors ring kit includes a base section, scissors mechanism, extensions, plastic ties, and a manual)</i>	
16-24" Pipe	68-3000-042
26-38" Pipe	68-3000-043

## Deep Water Sensor Installation

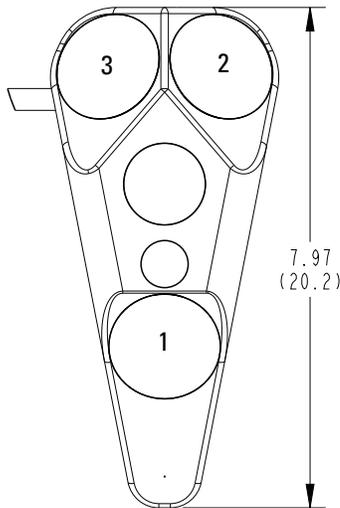
The following section is for installing the deep water sensor. The deep water sensor is designed for high accuracy flow measurement applications in pipe diameters/flow depths up to 16 ft, and in channels up to 16 ft wide. Common applications include installation in circular, rectangular, or trapezoidal 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 2 on page 12). In many cases, these accessories can be adapted for use in other channel shapes.

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

**Beam 3 Angles:** 20° front-back; 25° side-side

**Beam 2 Angles:** 20° front-back; 25° side-side

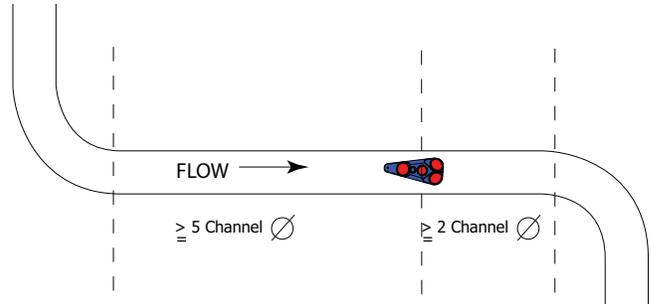


**Beam 1 Angles:** 20° front-back;

**Figure 15: Sensor dimensions and beam geometry**

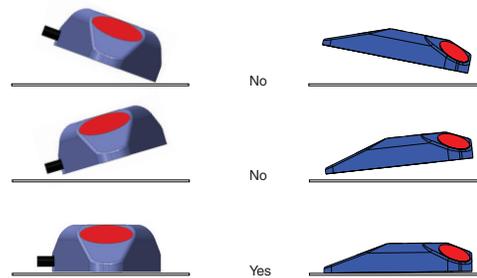
### Positioning of the Deep Water Sensor

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 16: Sensor positioning**

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



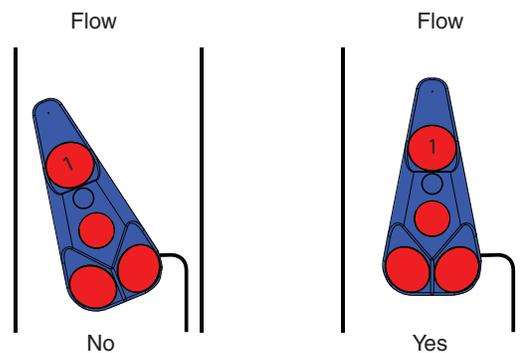
**Figure 17: Mount sensor flat on channel floor**

**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.

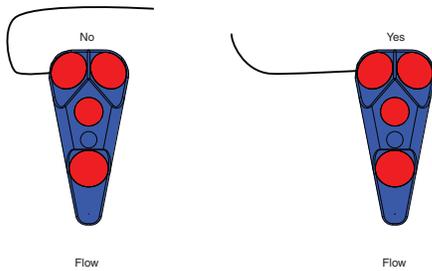
The sensor must have beam one facing into the flow (Figure 22).



**Figure 18: Sensor alignment with channel wall**

### Cabling for the Deep Water Sensor

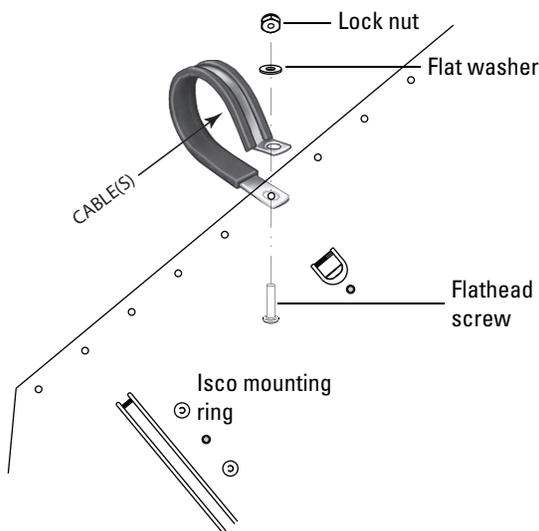
Be careful to route the cable away from the side of the sensor where it is attached. Improper cable routing increases the possibility of debris fouling.



**Figure 19: Sensor cable direction**

During installation of the deep water sensor, 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.



**Figure 20: 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 Channel: Mounting Rings

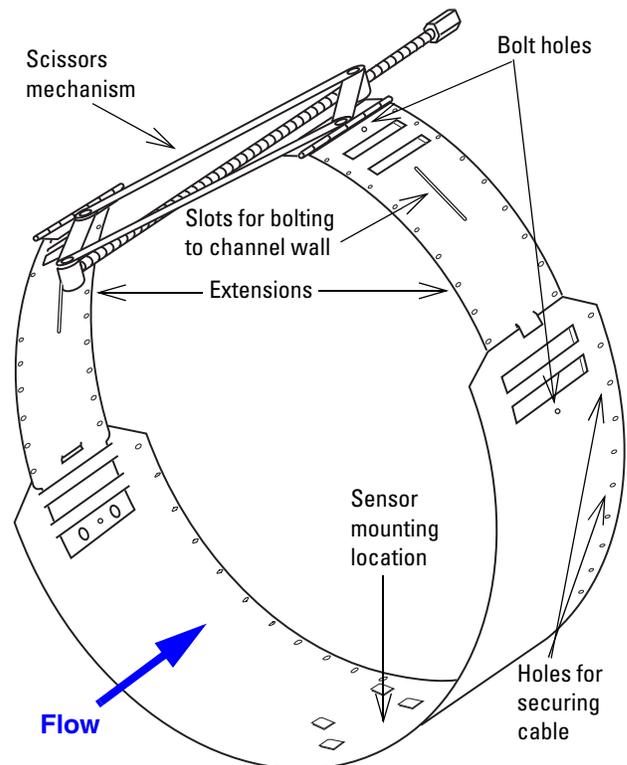
For large diameter pipes and manhole inverts, Isco's adjustable Scissors Ring (also known as the Universal Mounting Ring) is available in sets consisting of a base section, a scissors mechanism for adjustment, and one or more pairs of extensions to fit the specific channel size. The base section is equipped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

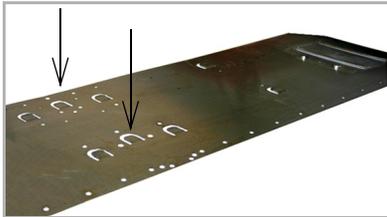


**Figure 21: Scissors Ring**  
 Sensor Mounting Hardware Kit: Part #60-3004-178  
 Secondary Sensor Hardware Kit: Part #60-7709-001

## Scissors Ring Assembly

To assemble the scissor ring:

1. In order for the deep water 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.

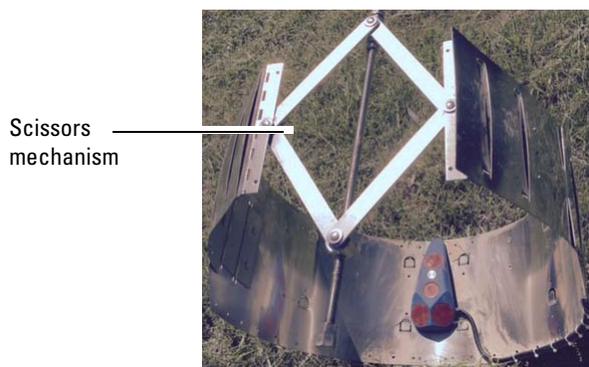


**Figure 22: Flatten six center tabs on base section**

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 23: Assembling the ring and mounting the sensor**



**Figure 24: 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

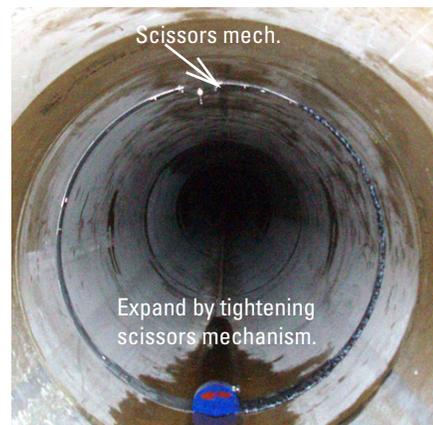
scissors assembly to expand the ring outward so that it is pressed entirely flat against the pipe wall (Figure 25).

- 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 25: 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.

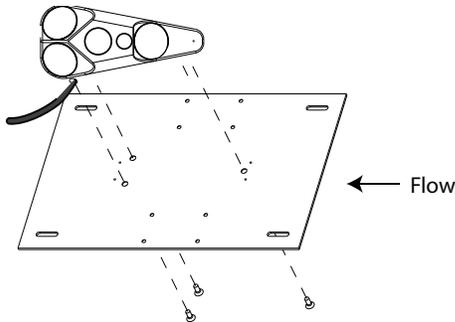
This problem is more prevalent in larger diameter pipes, and in pipes with a smooth inside surface (plastic, for example). If any of these conditions are present, or if movement of the spring ring is suspected, anchoring the ring is highly recommended. This is usually accomplished using threaded fasteners 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.

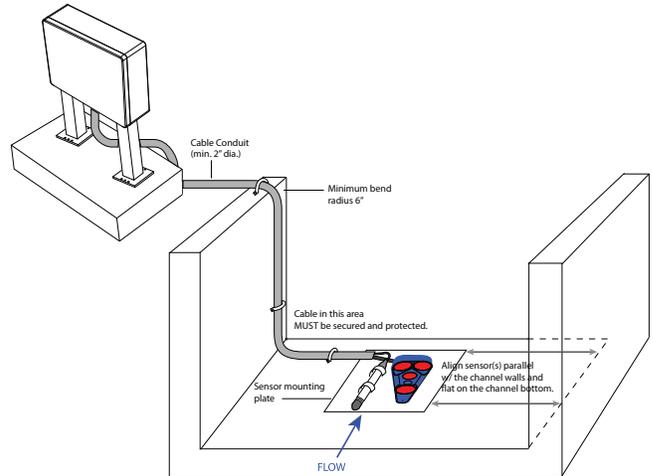
## Rectangular Channels

In rectangular channels, the deep water 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.

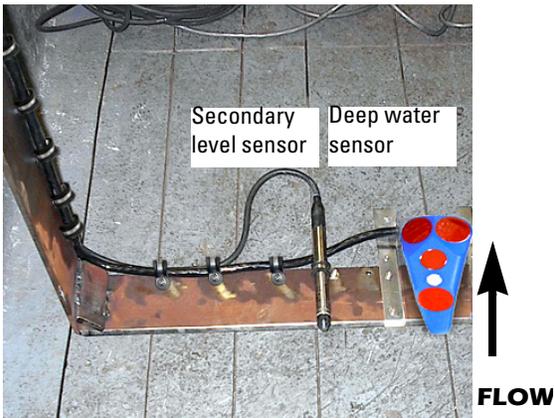
In some cases, particularly when the deep water sensor will be installed using a diver or other special methods, the sensor will be mounted on a rectangular plate, which is then anchored directly to the channel floor.



**Figure 26: Attaching the sensor to a mounting plate**



**Figure 28: Installation example** Rectangular channel



**Figure 27: Rectangular frame mounting** Secondary level sensor shown

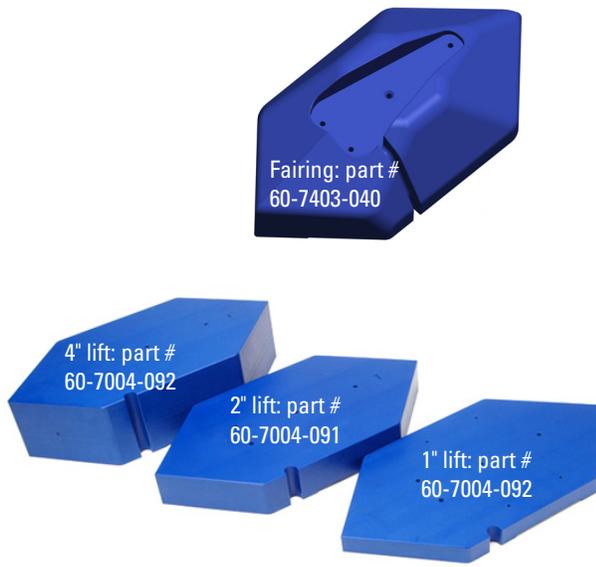
Where a rectangular frame is used, verify the exact channel width at different depths and ensure that no obstructions will hinder insertion and removal of the frame. When designing mounting methods and accessories, avoid conditions where accumulation of solids on or against the frame is likely. Ensure that the installation allows access for servicing, clearing of debris, and removal/replacement of the frame.

## Applications With Permanent Silt

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

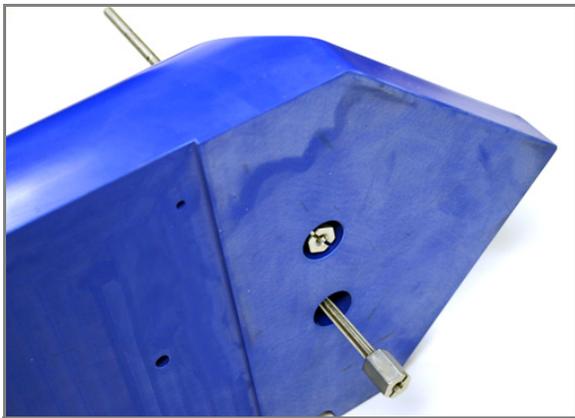
The debris fairing attaches directly to the mounting plate or ring, and the sensor is mounted in the top of the fairing for a lift of 3 inches. Fairing spacers add 1, 2, and 4 inches each, and may be combined for additional lift.

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



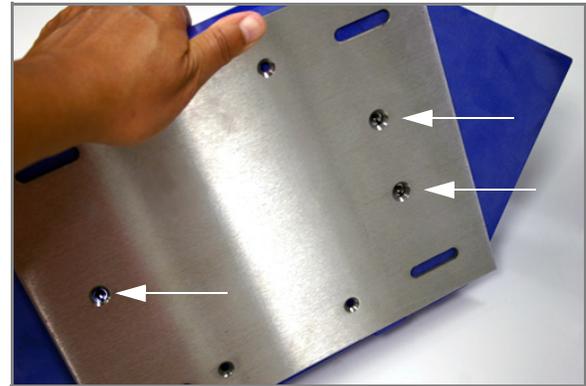
**Figure 29: Fairing and spacers for added lift**

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



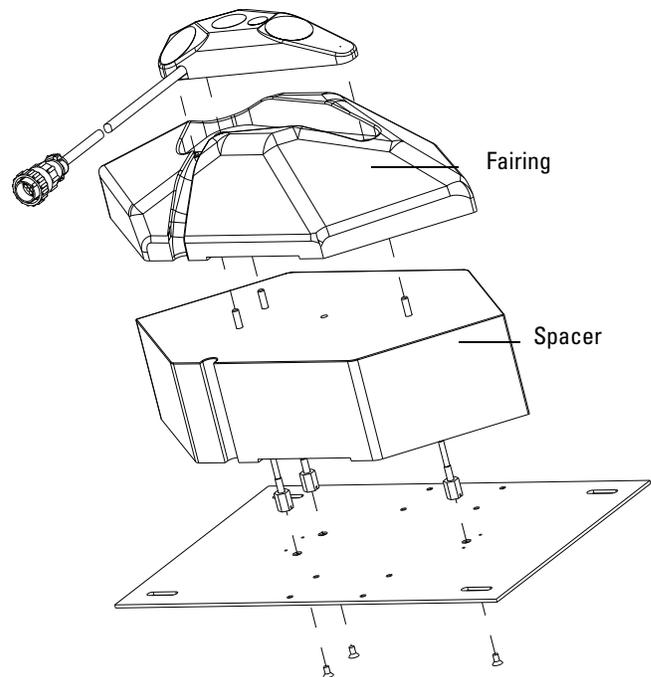
**Figure 30: Inserting the threaded couplers**

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



**Figure 31: Attaching the mounting plate**

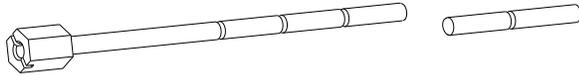
3. Break off any excess length from the threaded couplers (Figure 33) such that the remaining threads attach the sensor snugly into the fairing.



**Figure 32: Sensor with fairing and fairing spacer**

**✓ Note**

To prevent damage to the sensor body a maximum of 2 spacers should be used to avoid threading the threaded rods too far into the sensor body.



**Figure 33: Threaded couplers: break off at joint**  
part #60-7614-150

### Deep Water Sensor Accessory Part Numbers

Table 2 provides part numbers for commonly ordered accQpulse deep water sensor installation accessories.

**Table 2: Accessory Part Numbers**

Deep Water Sensor Fairing 3"	60-7403-040
Deep Water Sensor Debris Kit 3"	60-7404-046
Sensor Mounting Plate	60-7613-003
Suspension Harness Kit	60-7109-002
Spreader Bar	60-3004-110
Eyebolt Assembly	60-7104-007
Deep Water Debris Fairing Kit Spacer, 1 inch lift	60-7004-090
Scissor Rings 16-24" Pipe	68-3000-042
Scissor Rings 26-38" Pipe	68-3000-043
Deep Water Debris Fairing Kit Spacer, 2 inch lif	60-7004-091
Deep Water Debris Fairing Kit Spacer, 4 inch lift	60-7004-092

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