

# OWNER'S GUIDE & INSTALLATION INSTRUCTIONS

## Thru-Hull, Retractable *with* Valve Speed & Temperature Sensor

Model ST600

Record the information found on the cable tag for future reference.

Part No. \_\_\_\_\_ Date \_\_\_\_\_

04/12/11

17-038-01 rev. 04

Follow the precautions below for optimal product performance and to reduce the risk of property damage, personal injury, and/or death.

**WARNING:** Always wear safety goggles and a dust mask when installing.

**WARNING:** The valve is not a watertight seal! Always use the insert or blanking plug secured with the safety wire for a watertight seal.

**WARNING:** The o-rings must be intact and well lubricated to make a watertight seal.

**WARNING:** Always attach the safety wire to prevent the insert or blanking plug from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly.

**WARNING:** Immediately check for leaks when the boat is placed in the water. Do not leave the boat unchecked for more than three hours. Even a small leak may allow considerable water to accumulate.

**CAUTION:** Never use a fairing with a plastic housing; the protruding sensor would be vulnerable to damage from impact.

**CAUTION:** Never install a metal housing on a vessel with a positive ground system.

**CAUTION:** Never pull, carry, or hold the sensor by its cable; this may sever internal connections.

**CAUTION:** The arrow on the top of the insert must point forward toward the bow.

**CAUTION:** Never use solvents. Cleaners, fuel, sealants, paint, and other products may contain strong solvents, such as acetone, which attack many plastics, greatly reducing their strength.

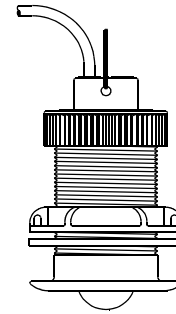
**IMPORTANT:** Please read the instructions completely before proceeding with the installation. These instructions supersede any other instructions in your instrument manual if they differ.

### Applications

- **Plastic** housing recommended for fiberglass or metal hull only. *Never install a plastic housing in a wood hull since swelling of the wood may fracture the plastic.*
- **Bronze** housing recommended for wood or fiberglass hull only. *Never install a bronze housing in a metal hull because electrolytic corrosion will occur.*

### Pretest

Connect the sensor to the instrument and spin the paddlewheel. Check for a speed reading and the approximate air temperature (in appropriate). If there is no reading(s) or it is inaccurate, check the connections and try again. If there is still a problem, return the product to the place of purchase.



### Tools & Materials

- Safety goggles
- Dust mask
- Water-based anti-fouling paint (**mandatory in salt water**)
- Electric drill with 10 mm (3/8") or larger chuck capacity
- Drill bit: 3 mm or 1/8"
- Hole saw: 51 mm or 2"
- Sandpaper
- Mild household detergent or weak solvent (alcohol)
- File (installation in a metal hull)
- Marine sealant (suitable for below waterline)
- Additional washer [for aluminum hull less than 6 mm (1/4") thick]
- Slip-joint pliers (installing a metal housing)
- Grommet(s) (some installations)
- Cable ties
- Installation in a cored fiberglass hull (see page 3)
  - Hole saw for hull interior: 60 mm or 2-3/8"
  - Fiberglass cloth and resin
  - or Cylinder, wax, tape, and casting epoxy

### Mounting Location

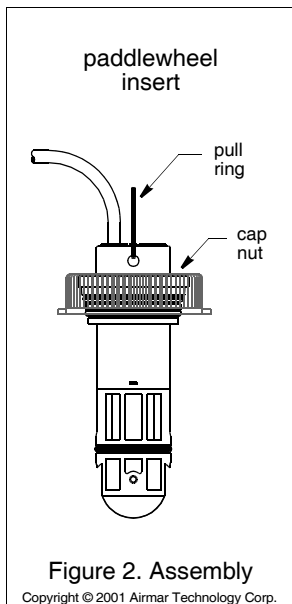
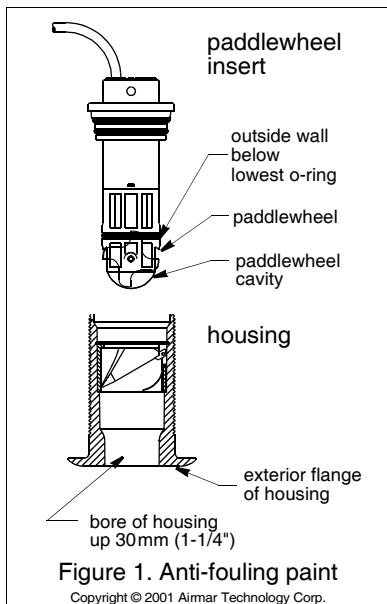
**CAUTION:** Do not mount the sensor near water intake or discharge openings; behind strakes, fittings, or hull irregularities that will disturb the flow.

**CAUTION:** Never mount the sensor directly ahead of a depth transducer, since turbulence generated by the paddlewheel's rotation will adversely affect the depth transducer's performance, especially at high speeds. Mount side by side.

**CAUTION:** Do not mount in line with trailer rollers or bunks that may damage the transducer's face.

Turbulence-free water must flow under the paddlewheel at all speeds. Choose an accessible spot inside the vessel. Allow a minimum of 200 mm (8") of headroom for the height of the housing, tightening the nuts, and removing the insert.

- **Displacement hull powerboats**—Locate amidships near the centerline.
- **Planing hull powerboats**—Mount well aft to ensure that it is in contact with the water at high speeds.
- **Fin keel sailboats**—Mount on or near the centerline and forward of the fin keel 300–600 mm (1–2').
- **Full keel sailboats**—Locate amidships and away from the keel at the point of minimum deadrise.



## Anti-fouling Paint

Aquatic growth can accumulate rapidly on the sensor's surface reducing performance within weeks. Surfaces exposed to salt water must be coated with anti-fouling paint. *Use water-based anti-fouling paint only.* Never use ketone based anti-fouling paint, since ketones attack many plastics possibly damaging the sensor.

It is easier to apply anti-fouling paint before installation, but allow sufficient drying time. Reapply paint every 6 months or at the beginning of each boating season. Paint the following surfaces (see Figure 1):

- Outside wall of paddlewheel insert below lowest o-ring
- Paddlewheel cavity
- Paddlewheel
- Bore of housing up 30mm (1-1/4")
- Exterior flange of housing
- Blanking plug below lowest o-ring including the exposed end

## Assembly

Slide the cap nut along the cable until it rests on the top of the paddlewheel insert. Attach the pull ring to the insert capturing the cap nut (see Figure 2). Similarly attach the pull ring to the blanking plug capturing the cap nut.

## Installation

### Hole Drilling

**Cored fiberglass hull**—Follow separate instructions on page 3.

1. Drill a 3mm or 1/8" pilot hole from inside the hull. If there is a rib, strut, or other hull irregularity near the selected mounting location, drill from the outside.
2. Using the 51 mm or 2" hole saw, cut the hole perpendicular to the hull from outside.
3. Sand and clean the area around the hole, inside and outside, to ensure that the sealant will adhere properly to the hull. If there is any petroleum residue inside the hull, remove it with either mild household detergent or a weak solvent (alcohol) before sanding.

**Metal hull**—Remove all burrs with a file and sandpaper.

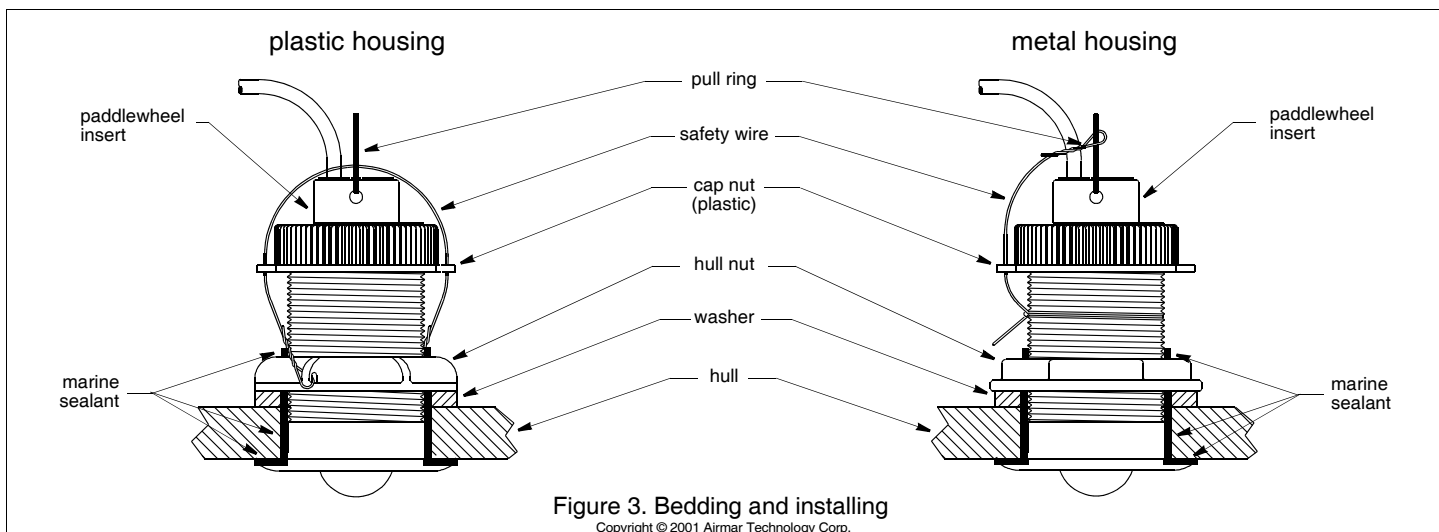
### Bedding

**CAUTION:** Be sure the surfaces to be bedded are clean and dry.

Apply a 2mm (1/16") thick layer of marine sealant around the flange of the housing that contacts the hull and up the sidewall of the housing (see Figure 3). *The sealant must extend 6mm (1/4") higher than the combined thickness of the hull, washer, and hull nut.* This will ensure there is sealant in the threads to seal the hull and to hold the hull nut securely in place.

### Installing

1. From outside the hull, push the housing into the mounting hole using a twisting motion to squeeze out excess sealant (see Figure 3). *Align the arrow on the flange of the housing to point forward toward the bow.* If the sensor is not installed on the centerline of the boat, angle the housing slightly toward the centerline to align it with the water flow.
2. From inside the hull, slide the washer onto the housing.
  - Aluminum hulls less than 6mm (1/4") thick**—Use an additional rubbery, plastic, or fiberglass washer. Never use a wood backing block, since swelling of the wood can overstress the plastic housing causing a fracture. Never use bronze since electrolytic corrosion will occur.
3. Screw the hull nut in place being sure the notch on the upper rim of the housing and the arrow on the flange are still positioned forward toward the bow (see Figure 7).
  - Plastic housing**—Do not clamp tightly on the wrenching flats, causing the housing to fracture.
  - Plastic hull nut**—**Hand-tighten** only. Do not over tighten.
  - Metal hull nut**—Tighten the hull nut with slip-joint pliers.



**Cored fiberglass hull**—Do not over tighten, crushing the hull.

**Wood hull**—Allow the wood to swell before tightening the nut.

4. Remove any excess sealant on the outside of the hull to ensure smooth water flow under the paddlewheel.
5. After the sealant cures, inspect the o-rings on the paddlewheel insert (replace if necessary) and lubricate them with the silicone lubricant supplied. The o-rings must be intact and well lubricated to make a watertight seal.
6. Slide the paddlewheel insert into the housing with the arrow on the top pointing forward toward the bow. Seat it into place with a pushing twisting motion until the key fits into the notch. *The arrow on the top of the insert, the notch, and the arrow on the flange of the housing will all be aligned.* Be careful not to rotate the housing and disturb the sealant. Screw the cap nut in place and **hand-tighten** only. Do not over tighten (see Figure 3).

7. Attach the safety wire to prevent the insert from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly.

**Plastic housing**—Attach the safety wire to one eye in the hull nut. Keeping the wire taut throughout, lead the wire in a counterclockwise direction and thread it through one eye in the cap nut, the pull ring, the second eye in the cap nut, and the second eye in the hull nut. Twist the wire securely to itself.

**Metal housing**—Wrap one end of the safety wire tightly around the housing and twist it together with the long end. Keeping the wire taut throughout, lead the wire straight up and through the eye in the cap nut. Loop the wire through the pull ring and twist it securely to itself.

### Cable Routing & Connecting

**CAUTION:** If your sensor came with a connector, do not remove it to ease cable routing. If the cable must be cut and spliced, use Airmar's splash-proof Junction Box 33-035 and follow the instructions provided. Removing the waterproof connector or cutting the cable, except when using a watertight junction box, will void the sensor's warranty.

1. Route the cable to the instrument being careful not to tear the cable jacket when passing it through the bulkhead and other parts of the boat. Use grommets to prevent chafing. To reduce electrical interference, separate the sensor cable from other electrical wiring and the engine. Coil any excess cable and secure it in place using cable ties to prevent damage.
2. Refer to the instrument owner's manual to connect the sensor to the instrument.

### Checking for Leaks

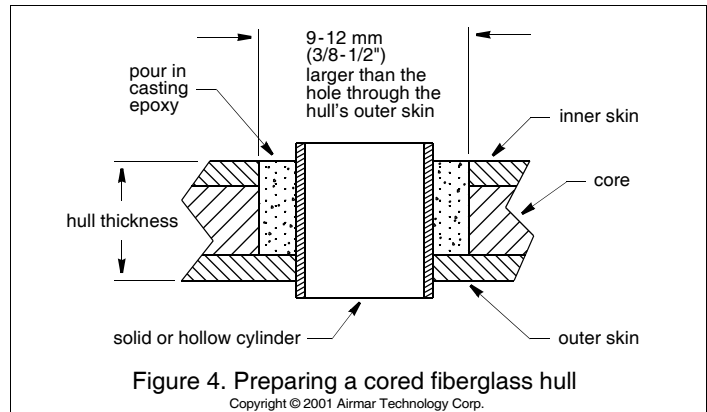
When the boat is placed in the water, **immediately** check around the thru-hull sensor for leaks. Note that very small leaks may not be readily observed. Do not leave the boat in the water unchecked for more than 3 hours. If there is a small leak, there may be considerable bilge water accumulation after 24 hours. If a leak is observed, repeat "Bedding" and "Installing" **immediately** (see page 2).

### Installation in a Cored Fiberglass Hull

**CAUTION:** Completely seal the hull to prevent water seepage into the core.

The core (wood or foam) must be cut and sealed carefully. The core must be protected from water seepage and the hull must be reinforced to prevent it from crushing under the hull nut allowing the housing to become loose.

1. Drill a 3mm or 1/8" pilot hole from inside the hull. If there is a rib, strut, or other hull irregularity near the selected mounting location, drill from the outside. (If the hole is drilled in the wrong location, drill a second hole in a better location. Apply masking tape to the outside of the hull over the incorrect hole and fill it with epoxy.)



2. Using the 51 mm or 2" hole saw, cut the hole from outside the hull through the *outer* skin only (see Figure 4).
3. From inside the hull, use the 60mm or 2-3/8" hole saw to cut through the *inner* skin and most of the core. The core material can be very soft. Apply only light pressure to the hole saw after cutting through the *inner* skin to avoid accidentally cutting the *outer* skin.
4. Remove the plug of core material so the *inside* of the outer skin and the inner core of the hull are fully exposed. Clean and sand the inner skin, core, and the outer skin around the hole.
5. If you are skilled with fiberglass, saturate a layer of fiberglass cloth with a suitable resin and lay it inside the hole to seal and strengthen the core. Add layers until the hole is the correct diameter.  
Alternatively, a hollow or solid cylinder of the correct diameter can be coated with wax and taped in place. Fill the gap between the cylinder and hull with casting epoxy. After the epoxy has set, remove the cylinder.
6. Sand and clean the area around the hole, inside and outside, to ensure that the sealant will adhere properly to the hull. If there is any petroleum residue inside the hull, remove it with either mild household detergent or a weak solvent (alcohol) before sanding.
7. Proceed with the "Bedding" and "Installing" on page 2.

### Operation, Maintenance, Repair & Parts

#### How the Valve Works

**The valve is not a watertight seal!** The sensor incorporates a self-closing valve which minimizes the flow of water into the boat when the paddlewheel insert is removed. The curved flap valve is activated by both a spring and water pressure. Water pushes the flap valve upward to block the opening, so there is no gush of water into the boat. *Always use the paddlewheel insert or the blanking plug secured with the safety wire for a watertight seal.*

#### Using the Blanking Plug

To protect the paddlewheel, use the blanking plug when:

- The boat will be kept in salt water for more than a week.
  - The boat will be removed from the water.
  - Aquatic growth build-up on the paddlewheel is suspected due to inaccurate readings from the instrument.
1. On the blanking plug, inspect the o-rings (replace if necessary) and lubricate them with the silicone lubricant supplied or petroleum jelly (Vaseline®). The o-rings must be intact and well lubricated to make a watertight seal.
  2. Remove the paddlewheel insert from the housing by removing the safety wire and unscrewing the cap nut (see Figure 3).
  3. Grasp the pull ring and remove the paddlewheel insert with a slow pulling motion.  
**NOTE:** *In the unlikely event that the paddlewheel insert cannot be removed, see "Servicing the Valve Assembly" on page 4.*
  4. Slide the blanking plug into the housing with the arrow on the top pointing forward toward the bow. Seat it into place with a



Figure 5. Paddlewheel & Valve Kit 33-250

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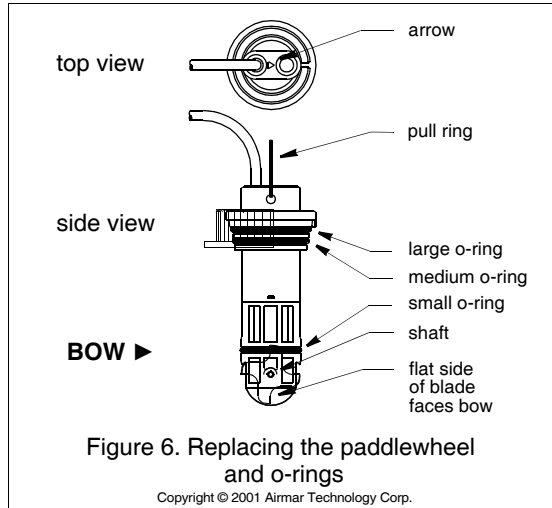


Figure 6. Replacing the paddlewheel and o-rings

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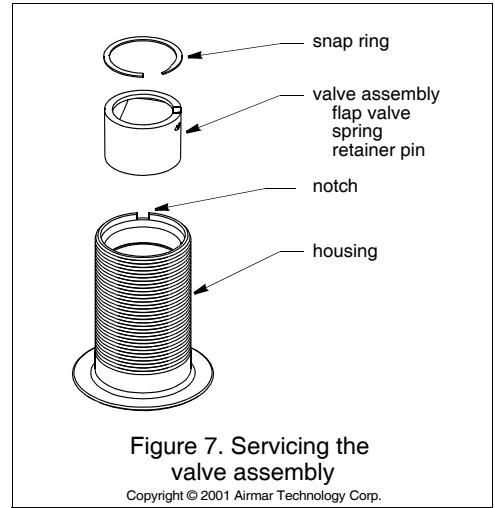


Figure 7. Servicing the valve assembly

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pushing twisting motion until the key fits into the notch. Screw the cap nut in place. **Hand-tighten** only. Do not over tighten.

5. Reattach the safety wire to prevent the insert from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly.

### Cleaning the Paddlewheel

Aquatic growth can impede or freeze the paddlewheel's rotation and must be removed. Clean the surface using a Scotch-Brite® scour pad and mild household detergent. If fouling is severe, push out the paddlewheel shaft using a spare shaft or a 4D finish nail with a flattened point. Then, lightly wet sand the surface with fine grade wet/dry paper.

### Replacing the Paddlewheel & O-rings

The water lubricated paddlewheel bearings have a life of up to 5 years on low-speed boats [less than 10kn (11 MPH)] and 1 year on high-speed vessels. Paddlewheels can fracture and shafts can bend due to impact with water borne objects and mishandling in boat yards. O-rings must be free of abrasions and cuts to ensure a watertight seal. A replacement Paddlewheel & Valve Kit 33-250 is available (see Figure 5).

1. Using the new paddlewheel shaft, push the old shaft out about 6mm (1/4"). With pliers, remove the old shaft (see Figure 6).
2. Place the new paddlewheel in the cavity with the flat side of the blade facing the same direction as the arrow on the insert top.
3. Tap the new shaft into place until the ends are flush with the insert.
4. Install a *large* o-ring near the pull ring, a medium o-ring below it, and a *small* o-ring near the paddlewheel.
5. Place the three remaining o-rings in similar positions on the blanking plug.

### Servicing the Valve Assembly

Should the valve fail, remove it for servicing.

1. On the blanking plug, inspect the o-rings (replace if necessary) and lubricate them with the silicone lubricant supplied or petroleum jelly (Vaseline®). The o-rings must be intact and well lubricated to make a watertight seal.
2. Remove the paddlewheel insert from the housing (see Figure 3).
3. Remove the snap ring from the valve assembly using a screwdriver to pry the end of the ring free. Lift the ring out (see Figure 7).
4. Slide the valve assembly upward and out of the housing slowly.

**NOTE:** The flap valve retainer pin is a loose slip-fit and may slide out when the assembly is removed.

5. Hold the cap nut on the blanking plug while sliding it into the housing with the arrow on the top pointing forward toward the bow. Seat the plug with a pushing twisting motion until the key fits into the notch. Screw the cap nut in place and **hand-tighten** only. Do not over tighten. Reattach the safety wire (see Figure 3).
6. Clean, repair, or replace the valve assembly so the flap valve moves freely and seats against the valve housing.
7. To reinstall the valve assembly, first reassemble the flap valve in the valve housing with the retainer pin and spring in place (see Figure 7).
8. Remove the blanking plug. Slide the valve assembly into the housing with the flap valve pointing downward. Insert the snap ring being certain that it **locks into the groove** in the housing wall.
9. Hold the cap nut on the blanking plug while sliding it into the housing. Be sure the arrow on the top is pointing forward toward the bow. Seat it into place with a pushing twisting motion until the key fits into the notch. Screw the cap nut in place. **Hand-tighten** only. Do not over tighten.
10. Reattach the safety wire to prevent the insert from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly (see Figure 3).

### Winterizing

After the boat has been hauled for winter storage, remove the blanking plug to let the water drain away before reinserting it. This will prevent any water from freezing around the blanking plug and possibly cracking it.

### Replacement Sensor & Parts

The information needed to order a replacement Airmar transducer is printed on the cable tag. Do not remove this tag. When ordering, specify the part number and date. For convenient reference, record this information on the top of page one.

If you have purchased a plastic housing and have a wood hull or desire greater strength, purchase a metal housing. Lost, broken, or worn parts should be replaced immediately.

Blanking Plug Kit	Cap Nut	Hull Nut	Housing & Hull Nut Kit	Pdwhl & Valve Kit
20-600	04-234-1 (plastic) 02-131-01 (bronze)	04-004 (plastic) 02-030 (bronze)	33-340-02 (plastic) 33-340-01 (bronze)	33-250

Obtain parts from your instrument manufacturer or marine dealer.

Gemeco  
(USA)

Tel: 803-693-0777  
Fax: 803-693-0477  
email: sales@gemeco.com

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