OWNER'S GUIDE & INSTALLATION INSTRUCTIONS

Thru-Hull: *Retractable with Valve*

Shorty™ **Speed** & **Temperature Sensor**

Models: **S300, ST300**

Patent http://www.airmar.com/patent.html

Record the information found on the cable tag for future reference.
Part No.:_____Date_____

P371
low-profile

P398
flush

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 glasses, a dust mask, and ear protection when installing.

WARNING: **The valve is not a watertight seal!** Always use the insert or the 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 sensor 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 pull, carry, or hold the sensor by its cable; this may sever internal connections.

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

CAUTION: Never use solvents. Cleaners, fuel, sealant, paint, and other products may contain solvents that can damage plastic parts.

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

- Recommended for fiberglass or metal hull only
  Never install a plastic housing in a wood hull, since swelling of the wood can possibly fracture the plastic.
- Low profile P371 recommended for cruising sailboats or planing hull powerboats
- Flush P398 recommended for racing sailboats or high-speed powerboats
- Minimum space required above the installed sensor: 153mm (6")
- Accommodates hull thickness:
  Minimum   6mm (1/4")
  Maximum   25mm (1")

Tools & Materials

Safety glasses
Dust mask
Ear protection
Water based anti-fouling paint (**mandatory in salt water**)
Electric drill with minimum 10mm (3/8") chuck capacity
Drill bit   3mm *or* 1/8"
Hole saw   51mm *or* 2"
Countersink tool (installing P398 flush housing)
Sandpaper
Mild household detergent *or* weak solvent (such as alcohol)
File (installation in a metal hull)
Marine sealant (suitable for below waterline)
Additional washer [aluminum hull less than 6mm (1/4") thick]
Grommet(s) (some installations)
Cable ties
Installation in a cored fiberglass hull (page 3):
  Hole saw for hull interior   60mm *or* 2-3/8"
  Fiberglass cloth and resin
  or Cylinder, wax, tape, and casting epoxy

Mounting Location

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

CAUTION: Do not mount the speed sensor directly ahead of a depth transducer, since turbulence generated by the paddlewheel's rotation will adversely affect the transducer's performance, especially at high speeds. Mount side by side.

Turbulence-free water must flow under the paddlewheel at all boat speeds. Choose an accessible spot inside the vessel. Allow a minimum of 153mm (6") of headroom for the height of the housing, tightening the nuts, and removing the insert.
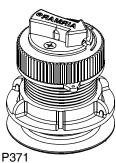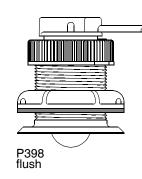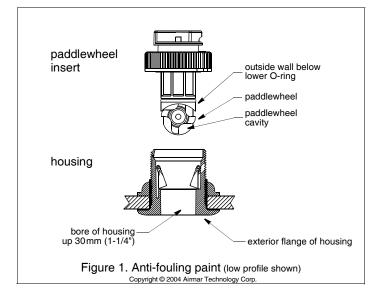
Pretest

Connect the sensor to the instrument and spin the paddlewheel. Check for a speed reading (and the approximate air temperature if applicable). If there is no reading(s), check all the connections and repeat the test. If there is still no reading(s) or it is inaccurate, return the product to the place of purchase.

Figure 1. Anti-fouling paint (low profile shown)
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Figure 2. Bedding and installing (low profile shown)
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- **Fin keel sailboats**—Mount on or near the centerline and forward of the fin keel 300–600 mm (1–2').
- **Full keel sailboats**—Mount amidships and away from the keel at the point of minimum deadrise angle.
- **Displacement hull powerboats**—Locate amidships near the centerline.
- **Planing hull powerboats**—Mount well aft to insure that the sensor is in contact with the water at high speeds.

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 paint, since ketones can attack many types of plastic possibly damaging the sensor.

It is easier to apply anti-fouling paint before installing the sensor, but allow sufficient drying time. Reapply paint every 6 months or at the beginning of each boating season. Paint the following surfaces (Figure 1):
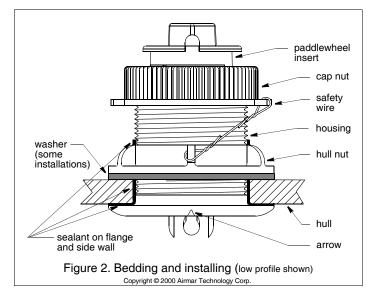
- Outside wall of the paddlewheel insert below the lower O-ring
- Paddlewheel cavity
- Paddlewheel
- Bore of the housing up 30 mm (1-1/4")
- Exterior flange of the housing
- Blanking plug below the lower O-ring including the exposed end

Installation
Hole Drilling

Cored fiberglass hull—Follow separate instructions on page 3.

1. Drill a 3 mm 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 a 51 mm or 2" hole saw, cut a hole perpendicular to the hull from outside the boat.
   P398—Use a countersink tool to make a "seat" in the hull.
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

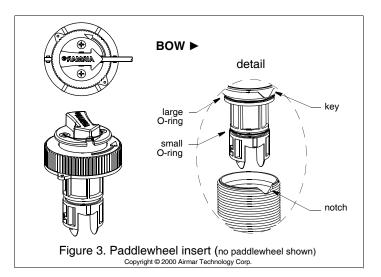**CAUTION**: Be sure the surfaces to be bedded are clean and dry.

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

Installing

CAUTION: The arrow on the flange of the housing must point forward toward the bow for the paddlewheel insert to align properly.

1. From outside the hull, push the housing into the mounting hole using a twisting motion to squeeze out excess sealant. *Align the arrow on the flange of the housing pointing forward toward the bow* (Figure 2). 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 any washer(s) onto the housing.
   NOTE: Some installations do not have a washer.

   Aluminum hull less than 6 mm (**1/4"**) **thick**—Use an additional rubbery, plastic, or fiberglass washer. Never use wood, since it will swell, possibly fracturing the plastic housing. Never use bronze, since electrolytic corrosion will occur.

Figure 3. Paddlewheel insert (no paddlewheel shown)
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3. Screw the hull nut in place, being sure the notch on the upper rim of the housing and the corresponding arrow on the flange are still positioned forward toward the bow. Do not clamp tightly on the wrenching flats, possibly causing the housing to fracture. **Hand tighten** only. Do not over tighten.

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

4. Remove any excess sealant on the outside of the hull to ensure smooth water flow under the paddlewheel.

5. The O-rings must be intact and well lubricated to make a watertight seal. After the sealant cures, inspect the O-rings on the paddlewheel insert (replace if necessary) and lubricate them with the silicone lubricant supplied (Figure 3).

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 several turns, then check that the insert's arrow is still facing forward toward the bow. Continue to tighten the cap nut. **Hand tighten** only. Do not over tighten.

7. Always 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. Attach the safety wire to one eye in the hull nut (Figure 2). Keeping the wire taut, lead the wire in a counterclockwise direction and thread it through one eye in the cap nut. Twist the end securely to the wire.

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 No. 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(s) and other parts of the boat. Use grommet(s) 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 with 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 sensor for leaks. Note that very small leaks may not be readily observed. *Do not leave the boat in the water for more than 3 hours before checking it again*. 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** (page 2).

Installation in a Cored Fiberglass Hull

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.

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

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 a 51mm or 2" hole saw, cut the hole from outside the hull through the *outer* skin only (Figure 4).

3. From inside the hull, use a 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 is fully exposed. Sand and clean 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.
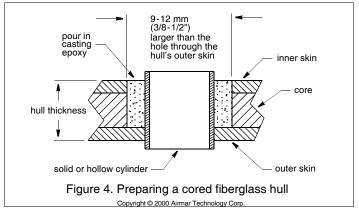
6. Sand and clean the area around the hole, inside and outside, to ensure that the sealant will adhere properly to the hull. If there is any petroleum residue inside the hull, remove it with either mild household detergent or a weak solvent (alcohol) before sanding.

7. Proceed with "Bedding" and "Installing" (page 2).

Operation, Maintenance & Parts

CAUTION: Do not remove the screws on the top of the sensor. To remove the insert, unscrew the cap nut. This will jack the insert up. Then remove the cap nut and insert as a single unit.

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 vessel 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 (Figures 1 and 5). *Always install the paddlewheel insert or blanking plug secured with the safety wire for a watertight seal.*

Figure 4. Preparing a cored fiberglass hull

Using the Blanking Plug

To protect the paddlewheel insert, use the blanking plug:

- When the boat will be kept in salt water for more than a week.

- When the boat will be removed from the water.

- When aquatic growth build-up on the paddlewheel is suspected due to inaccurate readings from the instrument.

1. The O-rings must be intact and well lubricated for a watertight seal. Inspect the O-rings on the blanking plug (replace if necessary) and lubricate them with the silicone lubricant supplied or petroleum jelly (Figure 3).

2. Remove the safety wire from the cap nut (Figure 2).

3. To remove the paddlewheel insert from the housing, unscrew the cap nut (Figure 5). This will jack the insert out of the housing. *Do not unscrew the screws.* Replace the paddlewheel insert with the blanking plug. Seat it into place with a pushing twisting motion until the key fits into the notch in the housing. Screw the cap nut in place and **hand tighten** only. Do not over tighten.

   NOTE: If the flap valves do not move freely and block the blanking plug from being inserted, clean the valve assembly so the flap valves move freely and rest against the valve housing. In the unlikely event that the flap valves cannot be freed, you may need to push the flap valves down or break them off.

4. Reattach the safety wire to the cap nut to prevent the blanking plug from backing out in the unlikely event that the cap nut fails or is screwed on incorrectly (Figure 2).
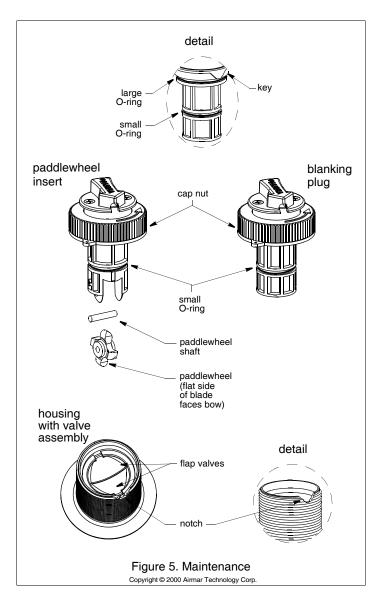
Servicing the Paddlewheel Insert

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.

The water lubricated paddlewheel bearings have a life of up to 5 years on low-speed boats [less than 10 kn (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.

1. Using the new paddlewheel shaft, push the old shaft out about 6 mm (1/4"). With pliers, remove the old shaft (Figure 5).

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 in the new shaft until the ends are flush with the sides of the insert.

4. Install a *large* O-ring near the top and a *small* O-ring near the paddlewheel.

5. Place the remaining two O-rings in similar positions on the blanking plug.

Winterizing

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

detail

large O-ring · small O-ring · key

paddlewheel insert · blanking plug · cap nut · small O-ring · paddlewheel shaft · paddlewheel (flat side of blade faces bow) · housing with valve assembly · detail · flap valves · notch

Figure 5. Maintenance

Sensor Replacement & Parts

The information needed to order a replacement sensor 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.

Lost, broken, and worn parts should be replaced immediately. Obtain parts from your instrument manufacturer or marine dealer.

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