AIRMAR®
TECHNOLOGY CORPORATION

Owner's Guide & Installation Instructions

Heading Sensor

Models: **H2183**

U.S. Patent No. 8,326,561
UK Patent No. 2 460 158

Record the serial number found on the underside of the sensor.
Serial No._____ Date of Purchase_____

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Introduction

Thank you for purchasing an Airmar solid-state sensor. The compact housing is waterproof with a single removable cable. The H2183 is actually three sensors in a single unit—a three-axis magnetic compass, a three-axis accelerometer, and a three-axis rate gyro. Data is simultaneously output in digital NMEA 0183 and NMEA 2000° formats.

Functions & Outputs	H2183
Magnetic compass heading	✔
Heading relative to true north [1]	✔
Rate of Turn	✔
Angle of pitch and roll	✔
Rate of pitch & roll	✔
NMEA 0183: RS422	Optional
NMEA 0183: RS232	Optional
NMEA 20000®; CAN	✔

1. Only available if magnetic variation is available from an external device such as a GPS.

Features

- Fast response time
- Stable and accurate data in dynamic conditions
- Can be programmed to compensate for an installation that is not aligned to the front of the vehicle/bow of the boat and/or level
- Can be calibrated to compensate for magnetic deviation caused by ferrous metals and other electro-magnetic fields
- Waterproof housing
- Waterproof cable system
- Bracket or flush mount

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WARNING

Navigation Aid Only—The sensor is only an aid to navigation and should never be solely relied upon. It is not a replacement for traditional navigation aids and techniques, and human judgement. Only official government nautical charts contain all the information needed for safe navigation.

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

WARNING: **Correct Installation Important**
The sensor must be installed and operated according to the instructions in this owner's guide.

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

WARNING: **Steel Vehicle/Boat**
Do not install the sensor within a steel vehicle/boat because it is a ferrous (magnetic) material. Instead, use Airmar's model GH2183, combination GPS and compass that can be mounted above the vehicle/boat.

WARNING: **Compass Safe Distance**
The sensor must be a minimum of 0.3m (1') from other standard and steering compasses.

WARNING: **Do Not Install Near Artificial Magnetic Field**
Observe a safe distance from ferrous metals and anything that can create a magnetic field to prevent interference to the magnetic compass.

WARNING: **Electrical Safety**
The power supply must be OFF before making electrical connections.

WARNING: **Voltage**
The power supply voltage must be 9 - 40 VDC.

WARNING: **Fuse or Circuit Breaker**
A safe installation requires a 0.5 amp fast-blow fuse or circuit breaker.

WARNING: **Battery**
Make power connections to a power source that is isolated from the engine start battery(s). Voltage drops may cause the sensor to lose information and/or change operating mode.

WARNING: **Calibrating the Compass**
The internal compass may need to be calibrated after the sensor is installed. Perform the pretest to determine if calibration is necessary.

Cables & Connecting/Converting Hardware

The Heading Sensor can be connected in several ways. **You must have the correct cable and any needed hardware before beginning the installation.**

Sensor Cables	Length	Part No.
• NMEA 0183 Cable	10m	33-862-02
• NMEA 2000® Cable	6m	33-1029-02
• NMEA 2000® Cable	10m	33-1104-01

NOTE: Additional cable lengths are available.

Connecting/Converting Hardware	Length	Part No.
• NMEA 0183 to USB, Data Converter		33-801-01
• NMEA 0183 to USB Combiner		NDC-4-AIR
• NMEA 2000® CAN to USB, U200 Gateway		33-727-01
• NMEA 0183 & NMEA 2000® Splitter	15m	33-632-01
• NMEA 0183 & NMEA 2000® Splitter	30m	33-632-02

Tools & Materials

Safety goggles
Dust mask
Torpedo level
Pencil
Electric drill
Drill bits and hole saws:

Pilot hole	3mm *or* 1/8"
Bracket screw holes	4mm, #23, *or* 9/64"
Flush mount stud holes	6mm *or* 1/4"
Flush mount cable hole	38mm *or* 1-1/2"

Phillips screwdrivers
Marine sealant (aluminum hull)
Loctite® 242® *or* other removable thread locker (Flush Mount installation)
Deck gland (some installations)
Grommets (some installations)
Cutting pliers (some installations)
Heat-shrink tubing (some installations)
Heat gun (some installations)
Wire strippers (some installations)
Multimeter (some installations)
Cable ties (some installations)

Where to Purchase Parts

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

Gemeco	Tel:	803.693.0777
(USA)	Fax:	803.693.0477
	Email:	sales@gemeco.com
Airmar EMEA	Tel:	+33.(0)2.23.52.06.48
(Europe, Middle East, Africa)	Fax:	+33.(0)2.23.52.06.49
	Email:	sales@airmar-emea.com

Choosing the Mounting Location

For accurate readings, selecting the best location for the sensor is very important. It can be mounted on either a vertical or a horizontal surface. Choose a location that balances the requirements below.

- Mount the sensor as close to the vehicle/boat's center of gravity as possible. The lower it can be mounted, the more stable it will be, thus giving more accurate compass readings.
- Mount near the center of the vehicle/boat's fore-aft axis. This will give more accurate pitch and roll readings. Avoid the areas near the front/bow and the rear/stern.
- To prevent interference to the internal magnetic compass, mount the sensor:
  - A minimum of 0.3m (1') from other standard and steering compasses.
  - Away from any structures or equipment that contains ferrous metals.
  - Away from anything that may create a magnetic field such as: magnetized materials, electric motors, electronic equipment, engines, generators, power/ignition cables, and batteries. For distances, follow the respective manufacturer's recommendations.
  - *Do not install within a steel vehicle/boat (magnetic material).*
- Choose a surface with minimal vibration for more stable data.
- Mount reasonably level (with the waterline on a boat) for accurate pitch and roll readings.

Installing

CAUTION: The word 'FORWARD' on the sensor must be facing forward and parallel to the centerline of the vehicle/boat for accurate compass readings.

CAUTION: Mount the sensor near the center of gravity of the vehicle/boat and reasonably level (with the waterline on a boat) for accurate pitch and roll readings.

IMPORTANT: Plan the cable route between the sensor and the display and/or network before beginning the installation.

Mounting on a Vertical Surface
Mounting the Bracket

1. At the selected mounting location, draw a level line using a torpedo level (see Figure 1).
2. Holding the bracket even with the level line, trace the outline of the two vertical slots. *Do not mark the location of the two interior screw holes at this time.*
3. Using a 3mm or 1/8" bit, drill the pilot holes in the CENTER of the slots. This will allow you to adjust the bracket up and down.
4. Using a 4mm, #23, or 9/64" bit, drill the two mounting holes.
   Fiberglass—Minimize surface cracking by running the drill in reverse until the gelcoat is penetrated.
5. Lightly fasten the bracket to the mounting surface with two of the stainless steel screws supplied. Place the torpedo level on the top of the bracket. Adjust the bracket until it is level. Tighten the screws.
   Aluminum hull—Apply marine sealant to the threads of all four stainless steel screws before fastening them in place. This will prevent electolytic corrosion between the dissimilar metals.
6. Using a 3mm or 1/8" bit, drill the pilot holes for the two center screws. Then use a 6mm or 1/4" bit to drill the holes.
7. Fasten the remaining two stainless steel screws in the center holes to lock the bracket in place.
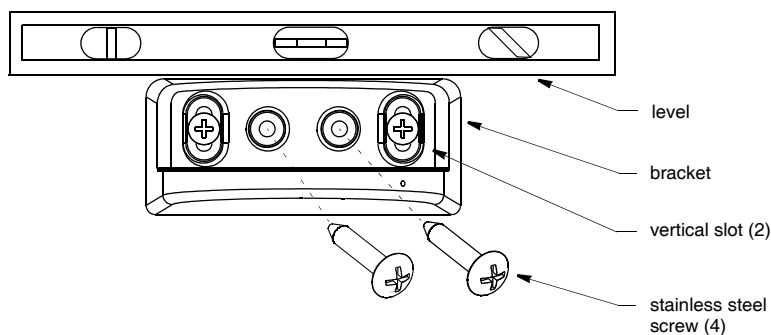

Figure 1. Mounting the bracket
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Preparing the Sensor

WARNING: Do not use the studs if there is any danger that a person may be injured by the protruding metal.

1. Remove the label from over the sensor's socket (part A) (see Figure 2).
2. There are two ways to attach the sensor to the bracket. Choose either a or b.
   a. **Studs**—It is easier to install and adjust the sensor using the M5 studs. However they will protrude about 20 mm (3/4") below the bracket after installation. Apply *removable* thread locker to the two studs. Screw the studs into the underside of the sensor.
   b. **Screws**—Omit the studs. After the sensor is aligned in the bracket, use the brass machine screws supplied to fasten it in place. The sensor will be flush with the bracket when the installation is complete.
3. Remove the protective cap from the *sensor* connector on the cable. (Save the cap to protect the connector, when the sensor is removed.)
4. Pass the *instrument* connector-end of the cable through the center of the gasket.
5. Plug the sensor connector firmly into the sensor. It fits one way only.
6. Push the gasket (part B) against the sensor (and onto the studs if applicable). Be sure to orient the gasket so that the groove fits over the alignment tab on the connector and the sensor's socket. The screw holes in both the sensor and the gasket must be aligned. (It may be helpful to hold the gasket in place with double-sided tape.)

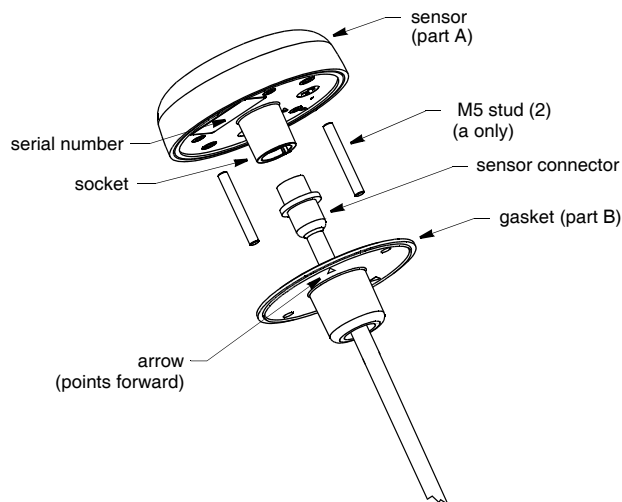   *NOTE*: The arrow on the gasket will face the same direction as the word 'FORWARD' on the sensor.

Figure 2. Preparing the sensor
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Attaching the Sensor to the Bracket

1. Feed the cable through the mounting bracket (see Figure 3).

2. Align the word 'FORWARD' pointing forward and parallel to the centerline of the vehicle/boat while holding the gasket firmly against the sensor.

    a. **Studs**—Push the studs through the mounting bracket. Fasten the sensor to the bracket with a flat washer, a lock washer, and a thumb nut (with the metal side against the washer) on each stud. **Hand-tighten** only. Do not over tighten.

    b. **Screws**—Place the sensor on the bracket, being sure the screw holes in both the sensor and the gasket are aligned. From the underside of the bracket, fasten the sensor with the two flat washers, lock washers, and brass machine screws supplied.

3. Be sure the word 'FORWARD' on the sensor is pointing forward and parallel to the centerline of the vehicle/boat. To prevent the sensor from rotating after it is aligned in the bracket, fasten the 1/2" pan-head set-screw into the most convenient of the two alternative holes.
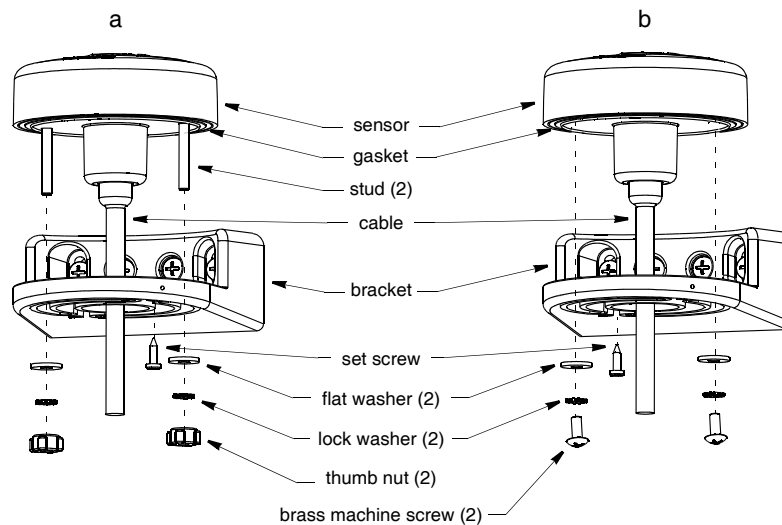

Figure 3. Installing the sensor in the mounting bracket

Flush Mounting on a Horizontal Surface

1. Remove the label from over the sensor's socket (part A) (see Figure 4).

2. Apply *removable* thread locker to the two studs supplied. Screw the studs into the underside of the sensor.

3. Using a torpedo level, check that the mounting surface is reasonably level. If necessary, use shims to level the surface or choose another mounting location.

4. Using the gasket (part B) as a template, position it at the selected mounting location *upside down with the arrow facing forward and parallel to the centerline of the* vehicle/boat. Mark the position of the two mounting holes and the center cable hole.

5. Using a 3mm or 1/8" bit, drill the pilot holes. Using a 6mm or 1/4" bit, drill the two mounting holes for the studs. Drill the cable hole with a 38mm or 1-1/2" hole saw. **Fiberglass**—Minimize surface cracking by running the drill in reverse until the gelcoat is penetrated.

6. Pass the *instrument* connector-end of the cable through the center of the gasket and down through the center mounting hole in the vehicle/boat.

7. Plug the sensor connector firmly into the sensor's socket.

8. Orient the gasket with the arrow facing in the same direction as the word 'FORWARD' on the sensor. Push the gasket onto the studs and slide it over the connector.

   NOTE: The gasket fits one way only. A groove in the gasket fits over the alignment tab on the connector.

9. With the word 'FORWARD' pointing forward and parallel to the centerline of the vehicle/boat, push the studs through the mounting surface. *Check to be sure the gasket is tucked under the lip of the sensor.* From underneath the mounting surface, slide a flat washer and lock washer onto each stud. Fasten them with the thumb nuts: metal side touching the washer. **Hand-tighten** only. Do not over tighten.
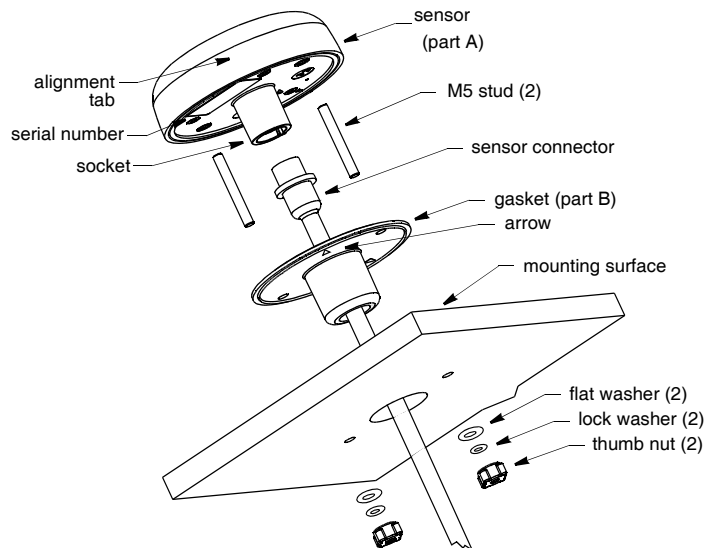

Figure 4. Flush mount

Cable Routing & Connecting

Depending on the equipment you will be using, route the sensor cable to an Airmar Converter or Combiner, an NMEA 0183 display, an NMEA 2000 network, a laptop, or other device. After reading the cautions below, go to the appropriate instructions.

CAUTION: Do not remove the waterproof connector(s) to ease cable routing. Buy a cable without a connector. Instructions for wiring are supplied.

CAUTION: To reduce electrical interference from other electrical wiring and any any equipment with strong magnetic fields such as radar equipment, radio transmitters, engines, generators, etc., separate the cables by at least 1m (3'). Ensure that all the cable shields are appropriately grounded.

CAUTION: Be careful not to tear the cable jackets when passing them through compartments, bulkheads, or walls. Use a deck gland to prevent water seepage into a boat. Use grommets to prevent chaffing.

CAUTION: Use a multimeter to check the polarity and the connections to the power supply before applying power to the sensor.

CAUTION: Coil any excess cable(s) and secure with cable ties to prevent damage.

Connecting to a Data Converter, Combiner, or Splitter
Follow the installation instructions that are supplied with the unit.

Connecting to an NMEA 0183 Display
Route the sensor cable to the display. *Do not fasten the cable in place at this time.*

Connector on Display End
If your sensor cable has a connector on the display end, and it can be plugged into the port on your NMEA 0183 display; do so now. Coil any excess cable and secure it with cable ties to prevent damage. Fasten the cable in place.

No Connector on Display End: Wiring

If your sensor cable does not have a connector on the display end, it must be hard wired. Referring to the owner's manual that came with your display, connect the colored wires as shown in Figure 5.

CAUTION: Your sensor has either an RS422 *or* RS232 interface. You must follow the wiring diagram in Figure 5 that matches your sensor. If the sensor is wired for the wrong interface, it will not transmit and receive data properly.

NOTE: If your display does not have NMEA 0183 output connections, the yellow and orange wires are not needed. Apply heat-shrink tubing to each unused wire. (Alternatively, the yellow and orange wires can be connected to an external sensor.)

NOTE: The display power may be wired directly to the sensor cable, or it may be wired separately.

1. Allowing an extra 25 cm (10") for wiring ease, cut the cable to length.
2. Strip 60 mm (2-1/2") of the outer jacket and foil shielding from the cut end of the cable (see Figure 5).
3. Strip 10 mm (3/8") of conductor insulation from the end of each colored wire.
4. Protect the cable's foil shielding from causing a short by using heat-shrink tubing around the jacket where the wires emerge from the cable. The tubing must overlap the wires a minimum of 6 mm (1/4"). Shrink the tubing using a heat gun.
5. Being sure the power supply is OFF, connect the wires to the display.
6. Fasten the cable in place.
7. Your installation is complete. To begin receiving data, refer to the owner's manual that came with your display.
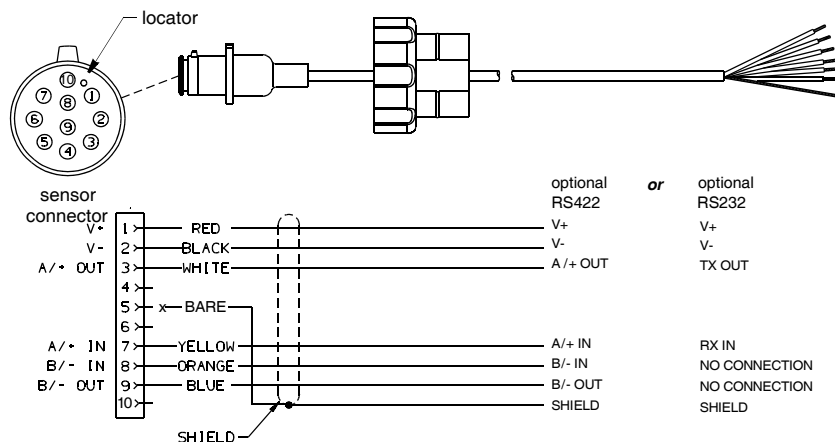

Figure 5. NMEA 0183 Sensor Cable

Connecting to an NMEA 2000® Network

CAUTION: Only two termination resistors are required on an NMEA 2000 network. More than two will degrade the bus performance.

Route the sensor cable to the NMEA 2000 network. Plug the NMEA 2000 connector into the network node (see Figure 6). Coil any excess cable and secure with cable ties to prevent damage.
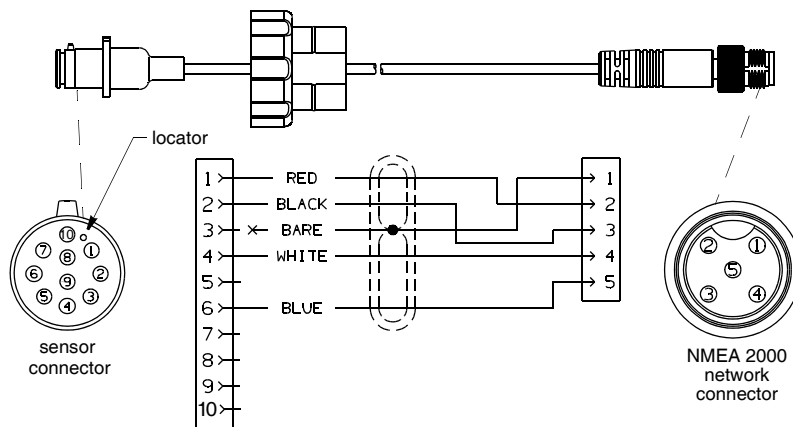
Figure 6. NMEA 2000® Sensor Cable [6m (20') shown]

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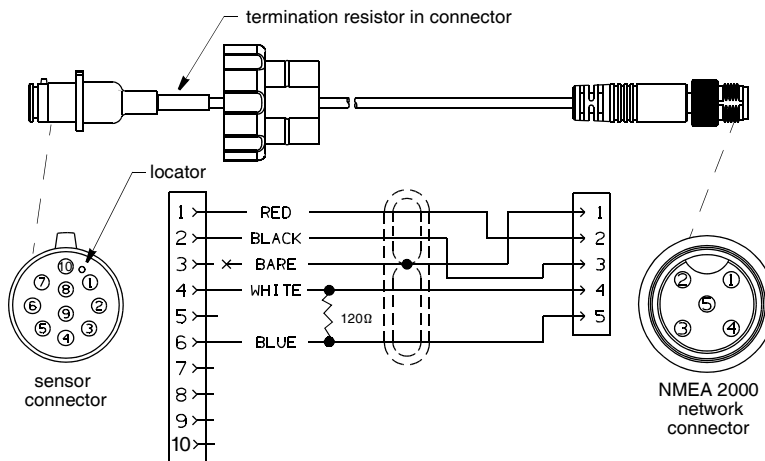*NOTE: Sensor cables longer than 6m (20') have a termination resistor built into the sensor connector (see Figure 7).*

Figure 7. NMEA 2000® Sensor Cable [10m (33') shown]

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Calibrating the Compass

WARNING: The internal compass may need to be calibrated after the sensor is installed for maximum accuracy. Perform the pretest below to determine if calibration is necessary.

CAUTION: **Boat**—The Pretest and AutoCalibration Procedure must be done in calm seas in a 0.8 km (0.5 mile) open area away from other boats and ferrous objects such as structures and aids to navigation. Avoid congested areas and waters with strong currents as calibration will be difficult and possibly hazardous.

Pretest
Go to an appropriate site.
- **Vehicle**—Drive to an open parking lot or field, away from other vehicles and ferrous objects.
- **Boat**—In calm seas, navigate to an open area of water, 0.8 km (0.5 mile) of open space away from other boats and ferrous objects.

While making a full circle, compare the heading data to another compass. Check all headings. If the data agrees, there is no magnetic influence on the sensor. The compass does NOT need to be calibrated.
If the data does not agree, continue with the calibration instructions below.

How to Calibrate
Calibration can be done in one of two ways.
- Calibrate the compass using the WeatherCaster™ software and a PC.
- Follow the AutoCalibration Procedure below.

AutoCalibration Procedure

IMPORTANT: Calibration requires the vehicle/boat to complete 2 to 3 circles.

IMPORTANT: In the event of a calibration failure, repeat the procedure.

1. At the site where the pretest was performed, select the display page on the NMEA Instrument that shows Heading.
2. Shut OFF and then turn ON the DC power that is connected to the sensor.
3. Within 2 minutes of cycling power to the sensor, start the vehicle/boat in a slow [4.5 to 7 MPH (4 to 6 knots)] circular turn that takes about 2 to 3 minutes to complete.*

   If the vehicle/boat completes 1.5 circles within 3 to 4.5 minutes, AutoCalibration will begin. Heading will stop being reported on any NMEA 0183 or NMEA 2000 display until the calibration is finished.
4. Keep turning in the same circle for 1 to 2 more complete circles.
   Do not change the speed or rate of turn through the circle.
5. When calibration is completed successfully, Heading will return to the display. If calibration fails, the display will flash Heading ON and OFF in 10 second intervals for 60 seconds. (Display times may vary by manufacturer.)

* The optimum rate of turn is 180°/ minute: 3°/second, 30°/10 seconds, 45°/15 seconds, and 90°/30 seconds.

Maintenance

CAUTION: Do not disassemble the sensor. There are no user-serviceable parts inside. Removing the screws from the sensor (part A) will damage the waterproof seal, thus voiding the warranty.

CAUTION: Do not immerse in water or pressure wash. Doing so may allow water to infiltrate the sensor, voiding the warranty.

Since the sensor has no moving parts, it requires minimal maintenance. Clean the sensor with a soft damp cloth and mild household detergent.

Troubleshooting

Problems with the Sensor
- Is there power to the sensor?
- Are all the connections tight?
- Is the cable-run free of kinks or damage?
- Is the wiring correct?
- Is there damage to the sensor?
- Is the sensor exposed to excessive vibration?

Inaccurate Compass Readings
- Is the sensor installed facing forward and parallel to the centerline of the vehicle/boat?
- Does the compass need to be calibrated?
- Is there interference from ferrous metals, electronic equipment, electric motors, batteries, or cables that are creating a magnetic field?
- Is the sensor mounted near the vehicle/boat's center of gravity?

Problems with the Rate Gyro or Accelerometer
- Is the sensor installed reasonably level with the waterline?
- Is the sensor mounted near the center of the vehicle/boat's fore-aft axis?

Firmware Revisions

Airmar may release updated versions of the sensor's firmware. Periodically, check Airmar's website at www.airmar.com to down-load the latest revision, or contact Technical Support for a CD.

NMEA 2000: Load Equivalency Number

LEN is the amount of current a devise draws from an NMEA 2000 network.
(1 LEN = 50 mA)

LEN.................2

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