CAST™ Application
User Guide

for DX900+
Electromagnetic Multilog Sensor

U.S. Patent No. 7,369,458. UK 2 414 077. Patents Pending

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About the CAST™ App

Using CAST™, the Customizable Adaptive Sensor Technology app by Airmar, easily view, analyze, and share sensor data to evaluate your sailing performance. Simply install the CAST app on your iOS or Android device to view available NMEA data over a Bluetooth® or network connection. Create custom gauges and page views to see only the data that is important to you. With CAST you can perform speed, temperature, and attitude calibrations without extra converters or cables. In addition to firmware updates, the app logs all of the NMEA sensor data over a customized time period for analysis. Smart devices with Bluetooth connectivity can be used to view the data, creating a mobile powerhouse.

Downloading the CAST App

CAST is compatible with Bluetooth® LE-enabled iOS or Android devices.

1. Go to the App Store or Google Play Store.

2. Search on the word Airmar.

3. Download the free CAST app (Figure 1).

Figure 1. CAST app icon
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Connecting a Sensor

1. Open the CAST app by touching the [icon] icon on your mobile device.
2. The **My Sensors** page will open (Figure 2).

   NOTE: *After the first use, the panel on the left will list the sensors that have been connected in the past.*

3. To add a sensor, touch [+] near the bottom of the page.
4. The **Discovered Sensors** panel will open on the right side of the page.

   Discovered Sensors will list the sensors that are discovered by Bluetooth.

5. Touch the sensor that you want to add. It will move onto the **My Sensors** panel on the left.
6. In **My Sensors**, touch the sensor you want to connect.

   NOTE: *After a sensor is listed in* **My Sensors**, *it will remain on the list. Whenever you open CAST, just touch the sensor to connect it.*

   NOTE: *To remove a sensor from the* **My Sensors** *list, select the sensor and touch* [—] *.*

Sensors that have been connected in the past will be listed here.
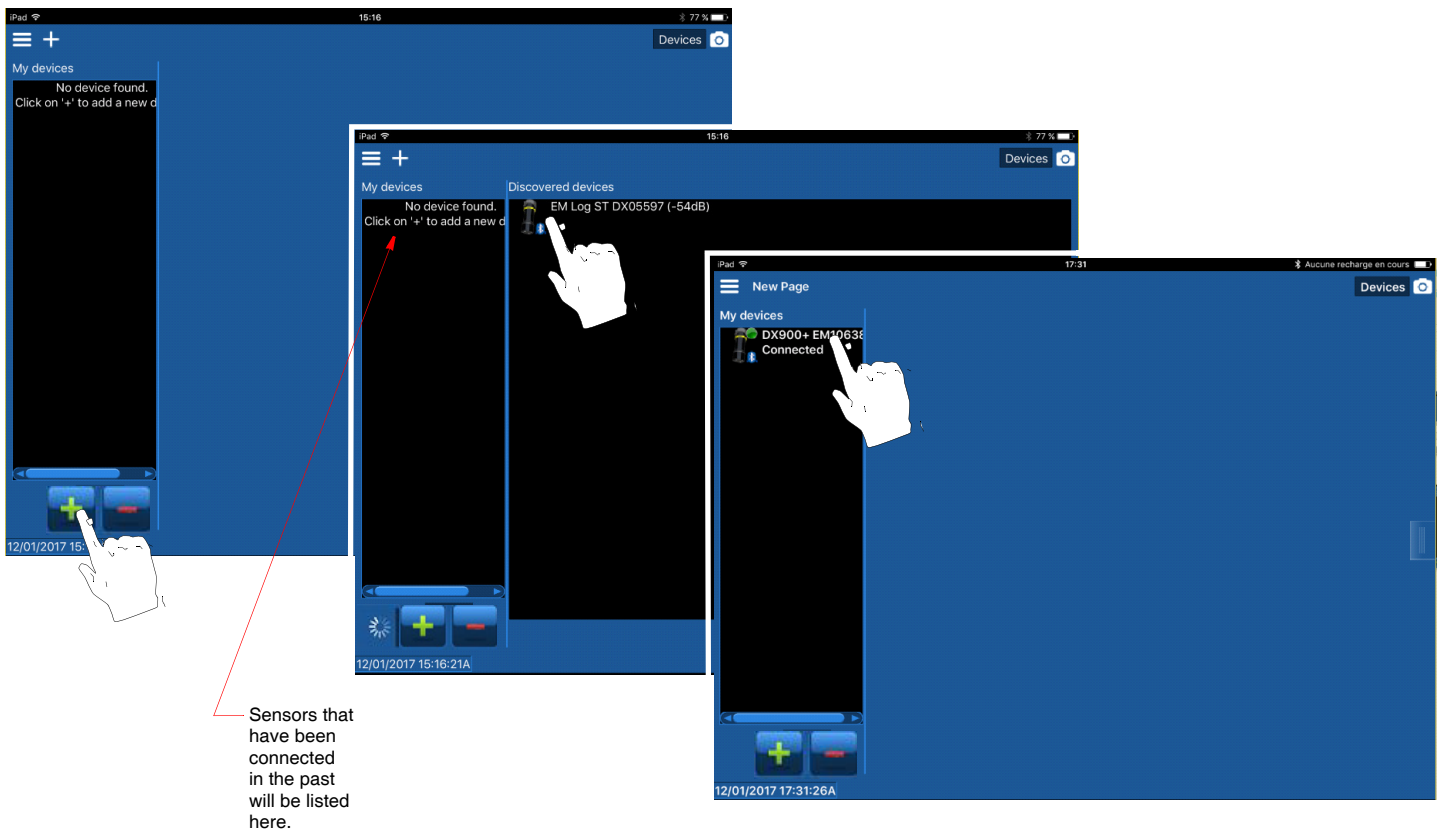
Figure 2. Adding and connecting a sensor
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CAST App Pages

Standard Page

Touch **Standard** on the right panel to access the following (Figure 3):

- Device Identity—Information about the connected sensor
  - Serial Number—Found on the cable tag
  - Part Number—Given by Airmar
  - Firmware Version
- Data Filtering—Adjust the noise filter on the following:
  - Speed
  - Pitch & Roll
  - Temperature
- Calibration—Auto-calibrate the following:
  - Auto-calibrate Attitude
  - Auto-calibrate Speed
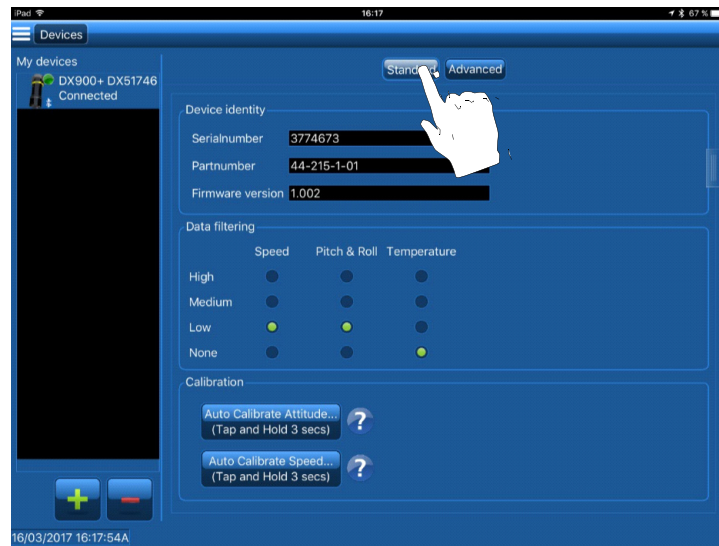
Figure 3. Standard page
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Advanced Page

Touch **Advanced** to access the following (Figure 4):

- **Calibration**: Calibrate manually
- **Reset to Factory**: Reset to the Factory Default settings
- **Update Firmware**: Update the firmware in your sensor
- **Reset Trip Water Distance**: Reset the trip's distance over water
- **Export Settings**: Export the sensor's settings by text or email, or store on a mobile phone. This is useful to verify the firmware version, serial numbers, factory offsets, etc.

Figure 4. Advanced page

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Sensor Data Panel

Quickly access real-time data from the sensor using the **Sensor Data** panel.

Touch the ▌▌ side button. The **Sensor Data** panel will slide to the left (Figure 5).

To close the **Sensor Data** panel, touch the ▌▌ side button again. The **Sensor Data** panel will slide out of sight to the right.

Figure 5. **Sensor Data** panel

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Testing the Sensor: Simulation Mode

Use Simulation Mode to test that the sensor is able to send data over the Bluetooth connection and the network cable. The simulation is a two-minute sequence of prerecorded test data stored within the sensor.

1. Connect to the sensor.

2. Touch **Advanced** (Figure 6).

3. Scroll to *Simulation Mode*.

4. To begin, touch **Start Simulation**.

> *NOTE*: The **Start Simulation** button will change to **Stop Simulation**.

> *NOTE*: A red alarm will appear at the bottom of the page.
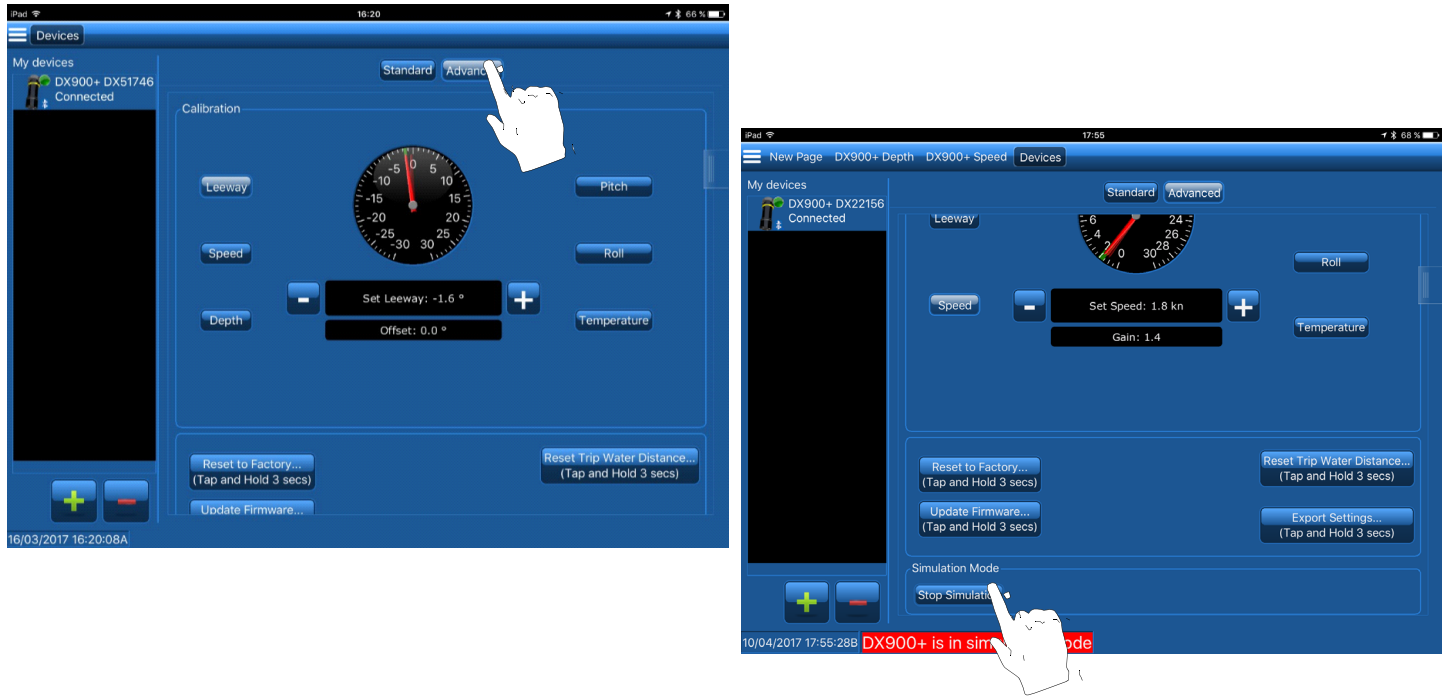
enlarged to show detail
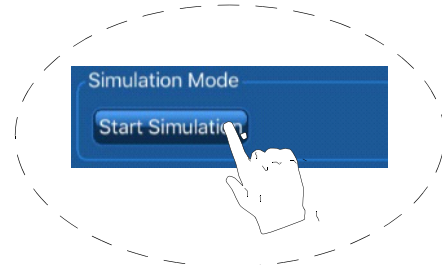
Figure 6. Simulation Mode
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NOTE: To deactivate Simulation Mode, touch **Stop Simulation**.

5. Touch the ▮ side button. The **Sensor Data** panel will slide to the left (Figure 7).

6. Check for 🟢 flashing green lights to indicate that data is being received.

flashing green light (8)

Figure 7. CAST is receiving real-time data from the sensor
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Checking for Excessive Electromagnetic Noise

Before leaving the port, it is important to check that the sensor is operating properly. If there is too much electromagnetic noise, make changes at that time.

1. Make sure the boat is not moving, and is as flat as possible in the water.
2. Connect to the sensor.
3. Check that the Speed Filter is set to Medium (see page 21, Figure 17 to set the Speed filter).
4. Create a display page of history plots with longitudinal and transverse speed data (Figure 8).

   NOTE: Go to Predefined Display Page on page 22 to create a custom display page.
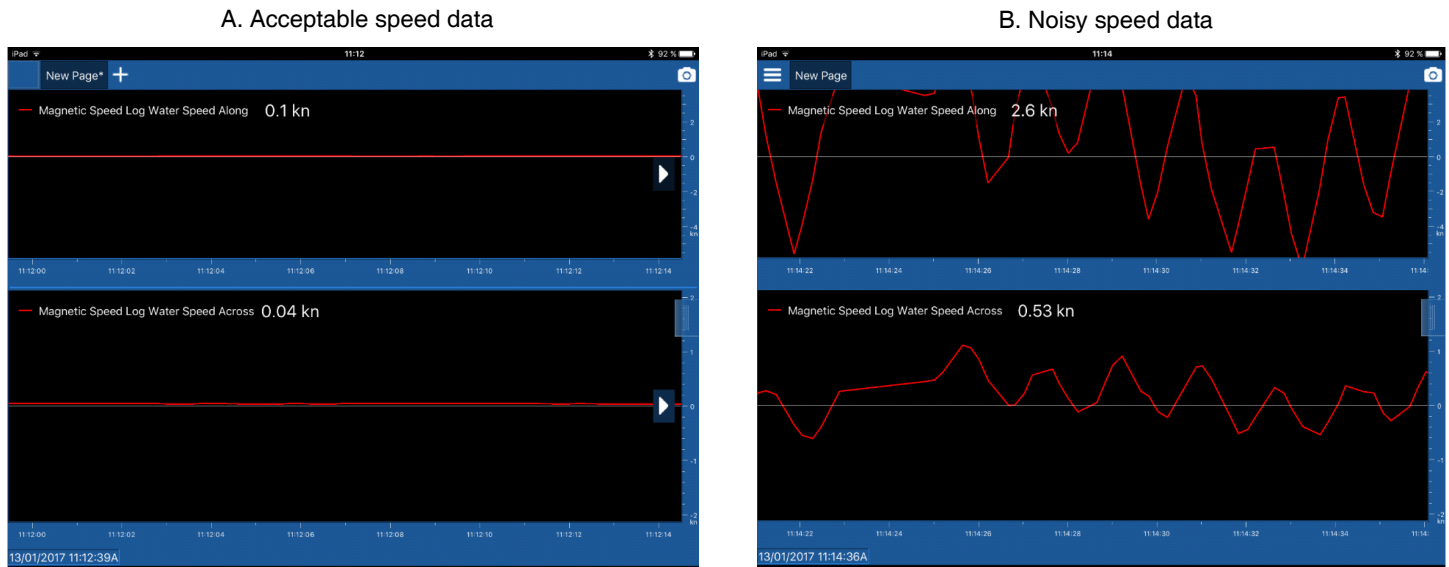
A. Acceptable speed data

B. Noisy speed data

Figure 8. Checking speed data for electromagnetic noise
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If there is no current, the speed measurements should not vary by more than ± 0.2 knots.(Figure 8A).

If the speed measurements look similar to Figure 8B, see the table below.

Water type	Possible cause	Recommended corrective action
Fresh water	Sensor is more susceptible to environmental noise in fresh water.	Check that the noise is not coming through the NMEA network cable. Disconnect the NMEA cable so that data is received through the Bluetooth connection only. Recheck the speed data.
		Check that the noise is not coming from the power supply. Supply the sensor with a separate +12VDC battery. Recheck the speed data.
		If the boat is located in a big marina, try the procedure at a different location. Marinas can be a very noisy environment.
Salt water	Power supply signal is not clean. Other equipment connected to the power supply may be generating noise in the cable.	Check that the noise is not coming from the power supply. Supply the sensor with a separate +12VDC battery. Recheck the speed data.
		If the boat is located in a big marina, try the procedure at a different location. Marinas can be a very noisy environment.

Calibrating

NOTE: All offsets are stored in the sensor. Therefore all connected devices will report the same data.

CAUTION: Calibrate before leaving the port while the boat is not moving and as flat as possible in the water.

Calibration can be done in two ways
- Automatic calibration is available for the following functions:
  - Attitude
  - Speed
- Manual calibration is possible to correct the following functions using an offset.
  - Pitch and Roll
  - Speed
  - Temperature
  - Depth
  - Leeway—*NOTE: Changing the offset will affect the speed*.

Manual Calibration: How the Dial Works
When you enter a function such as speed or temperature, the red and green hands will be at the same position on the dial, displaying the sensor value.

When you tap the ▬ or ➕ the green hand moves to display the offset value.

When you stop tapping, the offset is applied to the sensor. The red hand slowly moves to the position of the green hand.

The red and green hands will continue to display the sensor value with the offset until it is changed.

Attitude Calibration
Auto-calibrate
Depending upon where the sensor is installed in the hull, the senor may not be exactly vertical. If the sensor is not vertical, it will affect the pitch and roll readings. Correct for the angle of installation by auto-calibrating the Attitude.

1. Connect to the sensor.
2. Touch **Standard**.
3. Go to the *Calibration* section (Figure 9).
4. Touch and hold **Auto-calibrate Attitude** for 3 seconds.
5. Touch the [ ] side button to see real-time data from the sensor. The **Sensor Data** panel will slide to the left.
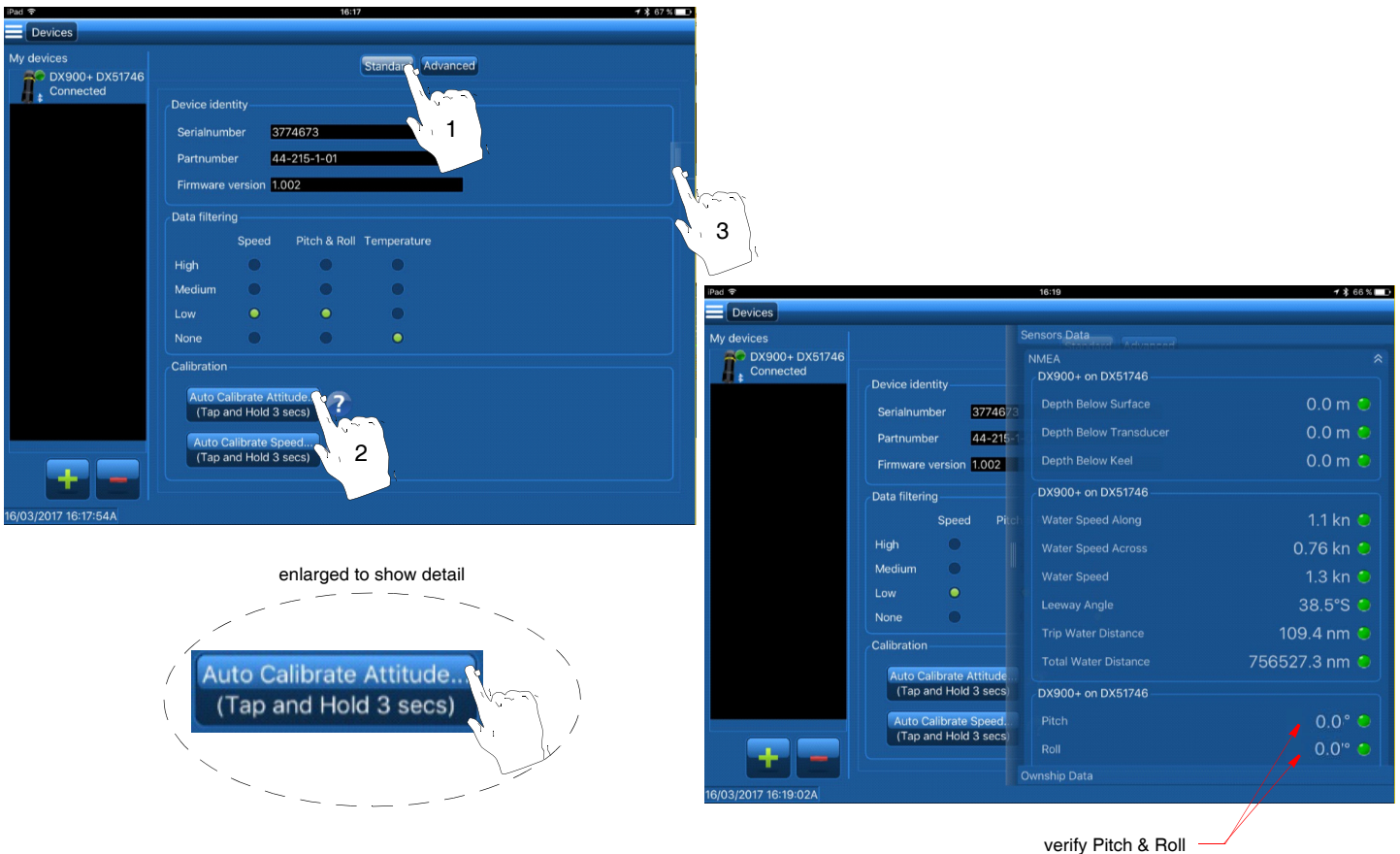6. Verify that the pitch and roll fields show approximately 0°.

Figure 9. Auto-calibrate Attitude
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Speed Calibration

CAUTION: For accurate speed readings, the Speed function must be calibrated.

CAUTION: Speed calibration must be performed in calm water *without* a current.

The speed must be calibrated to compensate for the shape of the hull and location of the sensor in the hull.

Speed calibration can be done in two ways:
• Auto-calibrate
• Manually calibrate

Auto-calibrate

NOTE: *If your mobile device does not have a GPS, use a separate GPS instrument and calibrate the sensor manually.*

CAUTION: Auto-calibrate requires a mobile device equipped with GPS.

CAUTION: The boat must travel a straight course to avoid generating any transverse speed.

1. Bring the boat to cruising speed (above 5 knots).
2. Travel on a straight course.
3. Wait a minimum of 10 seconds after reaching cruising speed.
4. Connect to the sensor.
5. Touch **Standard** (Figure 10).
6. Go to the *Calibration* section.
7. Touch and hold **Auto-calibrate Speed** for 3 seconds.

8. While keeping the straight course, touch the █ side button to see real-time data from the sensor. The **Sensor Data** panel will slide to the left.
9. Verify the following:
   • Leeway angle is about 0°.
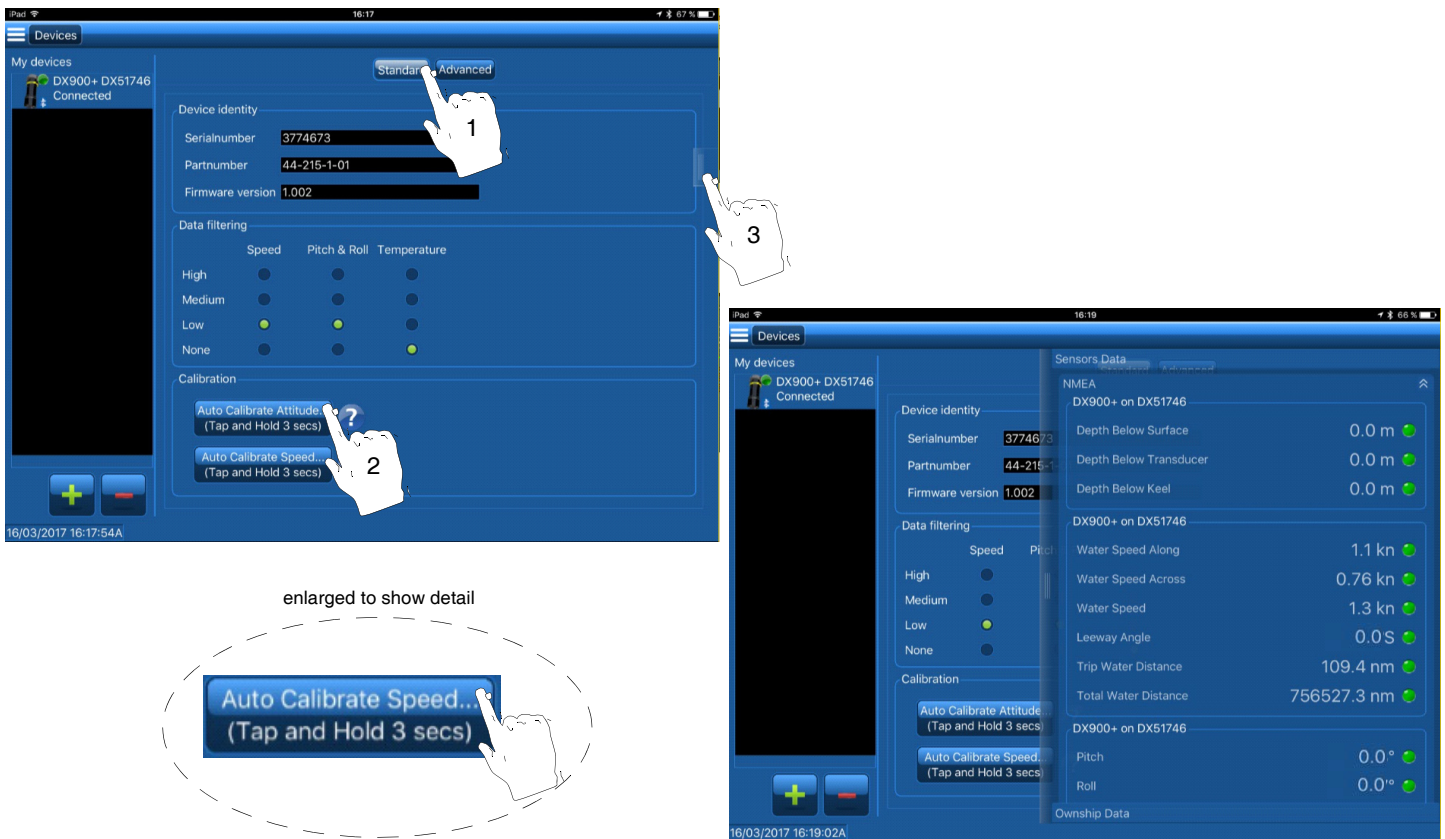   • Boat speed is near the Speed Over Ground (SOG) reference measurement.

enlarged to show detail

Figure 10. Auto-calibrate Speed
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Manually Calibrate

A dial is used to manually calibrate a function (Figure 11). When you select a function by touching the function button, both the red and green hands on the dial will display the same value. To input an offset, do the following:

- The red hand shows the real-time data from the sensor.

- The green hand shows the offset that has been input by the user.

- Tap the ▬ or ✚ to move the green hand.

- When the ▬ or ✚ buttons are released, the red hand slowly moves to the position of the green hand.

Figure 11. Dial used in manual calibration (Leeway shown)
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CAUTION: The manual speed calibration must be performed in two consecutive steps. The sensor will NOT be calibrated if the correct order is not followed.

Step 1. Sensor Installation-angle Correction

The sensor may not be oriented properly in relation to the longitudinal axis of the boat. Improper orientation would cause the longitudinal and transverse speeds to be incorrect.

Step 2. Speed Gain

The sensor measures speed close to the hull's bottom surface. Different hull shapes affect the water flow, thus the speed reading.

NOTE: Speed gain can vary from 0.5 to 2.5.

1. Bring the boat to cruising speed (above 5 knots).
2. Travel on a straight course with no cross current.
3. Wait a minimum of 10 seconds after reaching cruising speed.
4. Connect the sensor.
5. Touch **Advanced** (Figure 12).
6. In the *Calibration* section, touch **Leeway**.
7. The red hand shows the real-time data from the sensor. Verify that it reads a Leeway angle of about 0°.

   If the Leeway angle is NOT 0°, adjust the leeway angle to 0° by tapping ![-] or ![+].

Figure 12. Manually offset the Leeway angle
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8. Verify the boat's Speed Over Ground (SOG) using the reference GPS.

9. In the *Calibration* section, touch **Speed** (Figure 13).

10. The red hand shows the real-time data from the sensor. Verify that it matches the SOG reference speed.

11. If the red hand shows an inaccurate speed, adjust the speed gain by tapping ▬ or ➕ to move the green hand to the desired speed.

Figure 13. Manually offset Speed
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Temperature Calibration

If the sensor is not reading the accurate water temperature, it can be corrected by setting an offset.

1. Measure the water temperature with a reference sensor.
2. Connect to the sensor.
3. Touch **Advanced** (Figure 14).
4. In the *Calibration* section, touch **Temperature**.
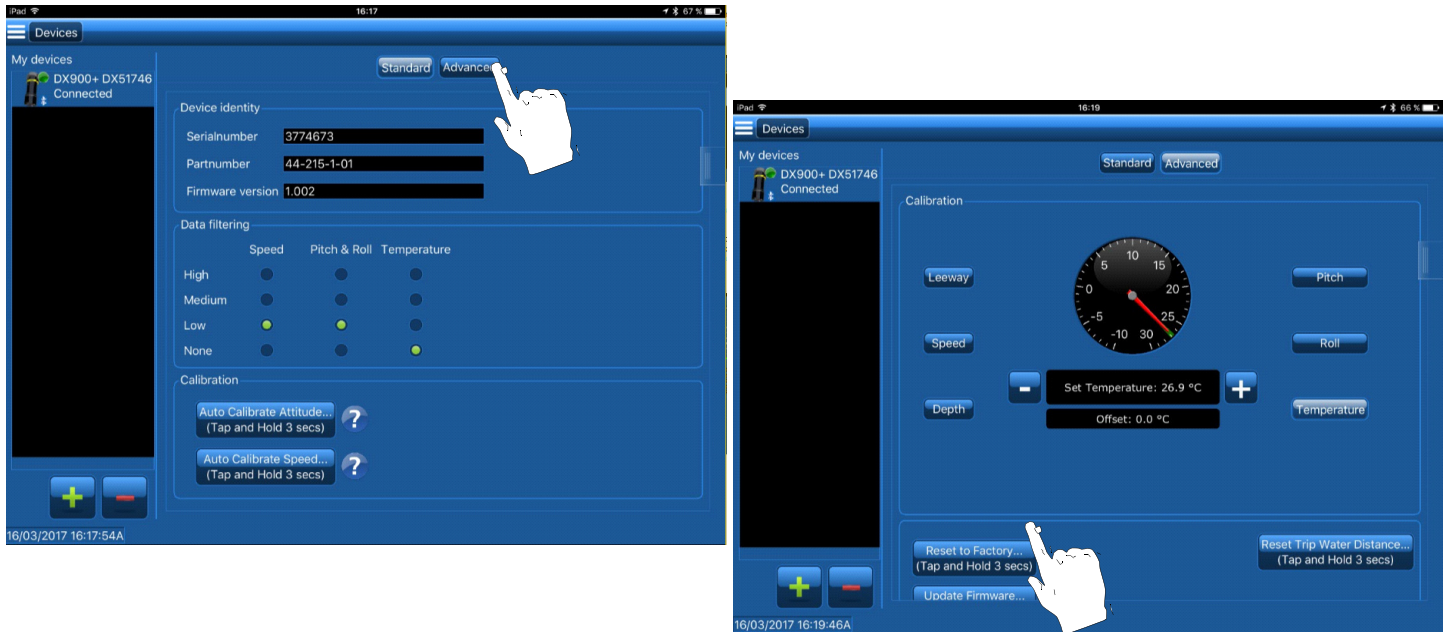5. The red hand shows the real-time data from the sensor.

6. If the red hand shows and inaccurate temperature, adjust the temperature offset by tapping [−] or [+] to move the green hand to the desired temperature.

7. Touch the [■] side button to see real-time data from the sensor. The **Sensor Data** panel will slide to the left.

enlarged to show detail
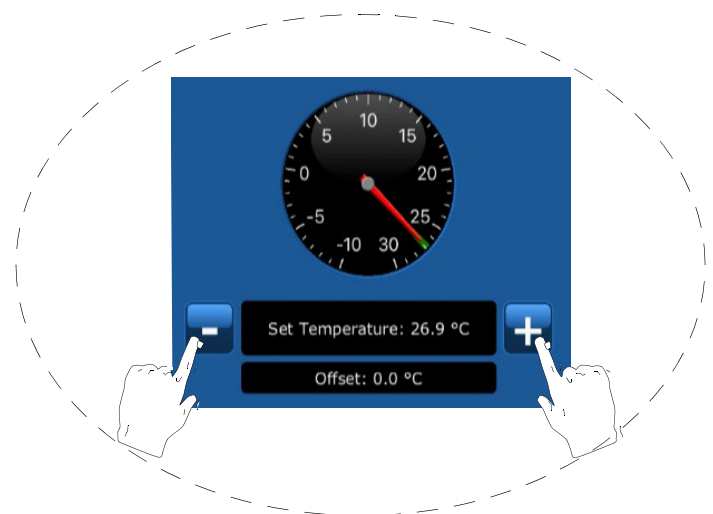
Figure 14. Calibrate the Temperature function

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Depth Calibration

NOTE: *The Depth function is not available on Speed and Temperature only sensors.*

Water depth can be displayed in three ways (Figure 15).
• Depth below the sensor
• Depth below the water surface
• Depth below the keel
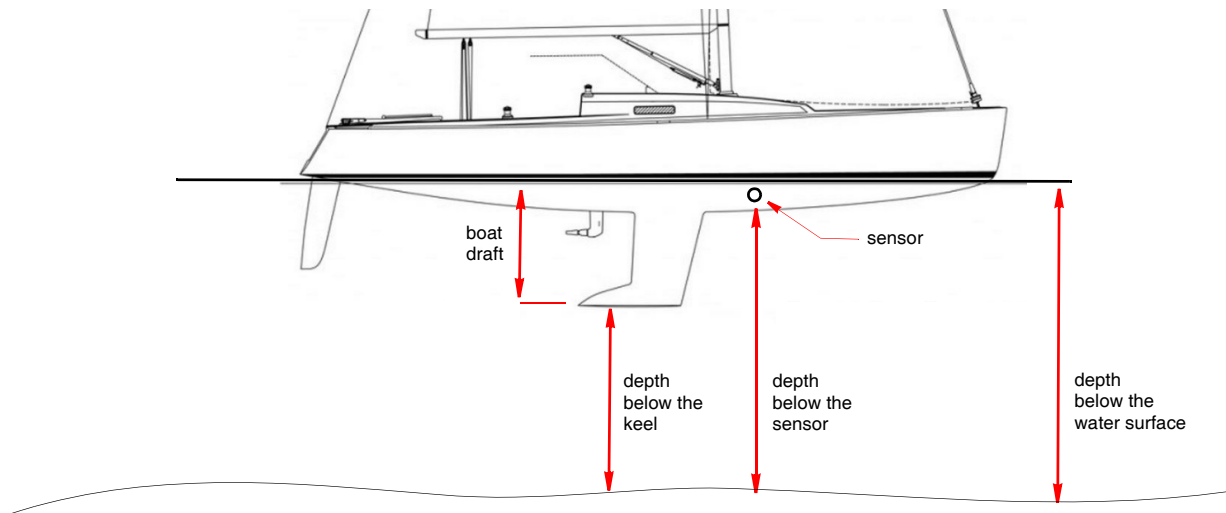
Figure 15. Measuring the water depth
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The sensor measures the water depth below the transducer. To display water depth below the keel or the water surface, you must enter an offset.

CAUTION: Water depth calibration must be performed in calm water *without* a current.

1. Set the boat in a fixed place.
2. Measure the water depth using a lead line.
3. Connect to the sensor.
4. Touch **Advanced** (Figure 16).
5. In the *Calibration* section, touch **Depth**.
6. The red hand shows the water depth below the sensor.
7. To measure water depth from the following:
   • Water surface—Enter the water depth as measured by the lead line. Tap the Water Depth ▬ or ➕ to move the green hand to the correct depth. The offset below will correspond to the distance between the waterline and the sensor.
   • Keel—Enter the boat draft offset by tapping ▬ or ➕ to move the green hand. The offset below will correspond to the distance between the keel and the sensor.
8. Touch the ▯ side button to see real-time data from the sensor. The **Sensor Data** panel will slide to the left.
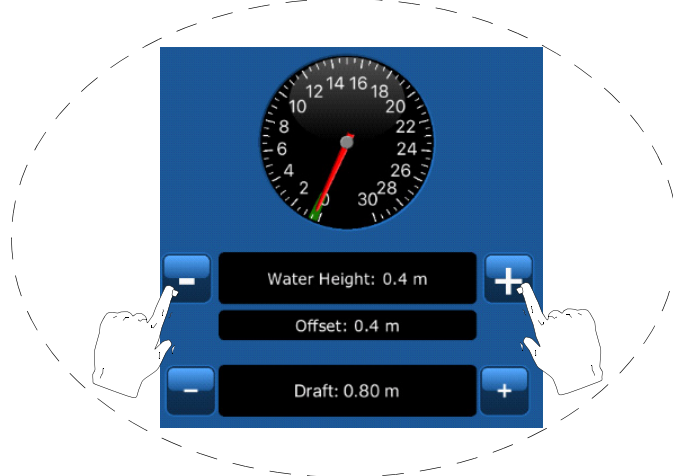9. Scroll to Depth readings and verify that the depth measurements have been corrected.

Water Depth offset enlarged to show detail
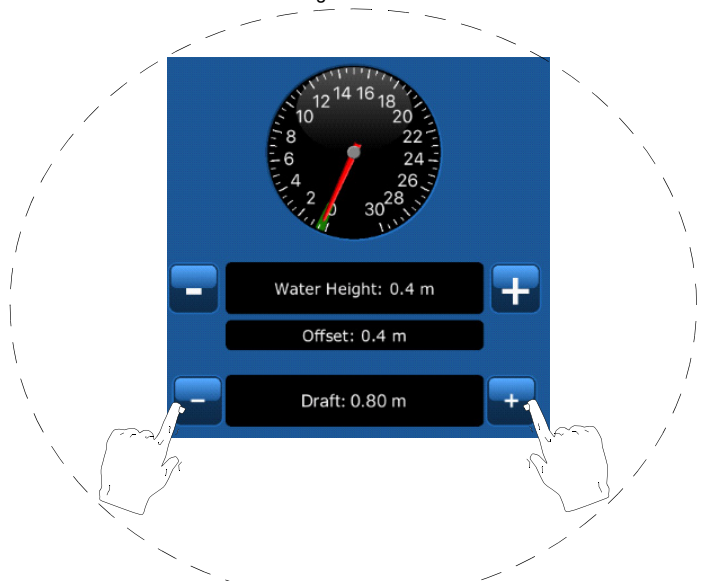

Draft enlarged to show detail

Figure 16. Calibrate the Depth function
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Configuring the Sensor

Filters

Data Filtering removes some of the electronic noise in the environment. There are filters for the following:

- Speed
- Pitch & Roll
- Temperature

The Data Filter is a low pass type with a constant equal to:

- None: 0 seconds
- Low: 1 second
- Medium: 2 seconds
- High: 4 seconds

To change the **Data filtering** setting:

1. Connect to the sensor.

2. Touch **Standard** (Figure 17).

3. Go to *Data filtering*.

4. Touch the ● button for the desired Data filtering setting. When the filter is set, the appropriate button will turn ● .

Figure 17. Setting the Data Filters

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Baud Rate (*Speed & Temperature Sensor Only*)

NOTE: *The Baud Rate CANNOT be changed on a Depth, Speed, and Temperature sensor.*

Baud rate can be from 4800 to 115200 baud.

Changing the baud rate will automatically change the NMEA sentence intervals in order to maximize the data output in accordance with the bandwidth (see Table below).

NMEA sentences		Baud Rate					
		4800	9600	19200	38400	57600	115200
ID	Data	Refresh rate (/sec)	Refresh rate (/sec)	Refresh rate (/sec)	Refresh rate (/sec)	Refresh rate (/sec)	Refresh rate (/sec)
$VMVBW	Dual speed	5	10	10	10	10	10
$YXMTW	Water temperature	1	5	5	5	5	5
$YXXDR	Pitch & Roll	1	1	5	5	5	5
$VMNLA	Leeway	1	5	5	5	5	5
$VMVLW	Distance	1	1	1	1	1	1
$VMVHW	Boat speed	1	1	1	1	1	1
$YXXDR	Board temperature	1	1	1	1	1	1

To change the Baud Rate setting:

1. Connect to the sensor.
2. Touch **Standard** (Figure 18).
3. Go to the *Baud Rate* section.
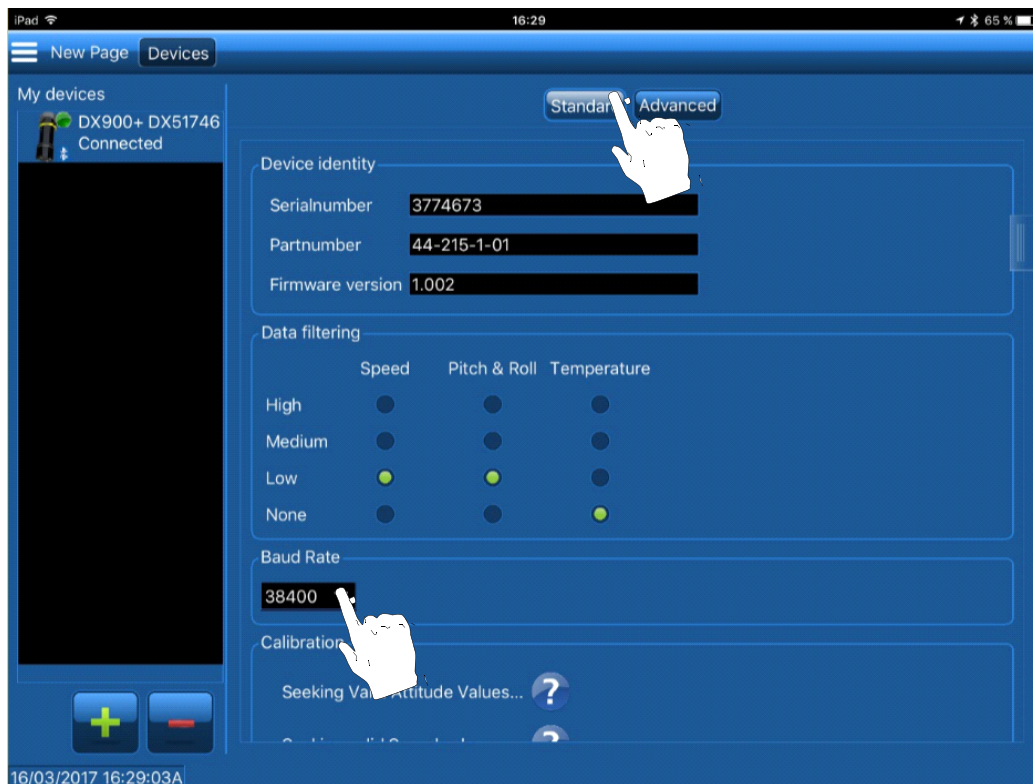4. Touch the arrow to see the drop-down menu. Select the desired setting.

Figure 18. Adjusting the Baud Rate (Speed & Temperature sensors only)

NMEA Sentences: Enabling and Intervals (*Speed & Temperature Model Only*)

NOTE: *Enabling/disabling NMEA sentences and changing intervals is NOT possible in a Depth, Speed, and Temperature sensor.*

To enable/disable the output of NMEA data and/or set different intervals:

1. Connect to the sensor.
2. Touch **Advanced** (Figure 19).
3. Go to the *NMEA Sentences* section.
4. To activate or deactivate an NMEA sentence, touch the ▮ button. When a sentence is activated, a ✔ will appear.
5. To change the interval of a specific sentence, touch the arrow to see the drop-down menu. Touch to select the desired refresh rate.
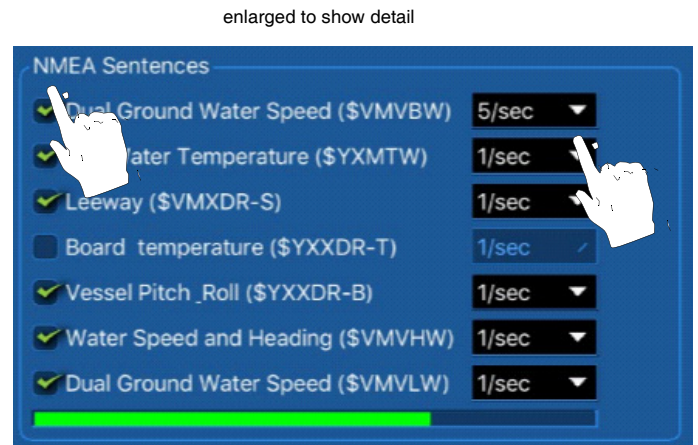

Figure 19. Enabling/disabling NMEA sentences and changing the refresh rate (Speed & Temperature sensors only)

Displaying Data

To display real-time data from the sensor, use one of the following:

• Predefined display pages
• Custom display pages

Predefined Display Page

1. Connect to the sensor.

2. Touch the [menu icon] menu button to see the control panel, drop-down menu (Figure 20).

3. Touch **Customize**.

4. When the dialog box opens, touch **OK**.

Figure 20. Accessing a predefined display page

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5. Touch the button that matches your sensor (Figure 21). A page will open displaying the real-time data from the sensor.

- • DX900+ Depth page displays:
  Depth
  Speed
  Water surface temperature
- • DX900+ Speed page displays:
  Speed
  Pitch & Roll
  SOG
  Leeway

- • GPS

Figure 21. Predefined display page (DX900+ Speed shown)

Custom Display Pages

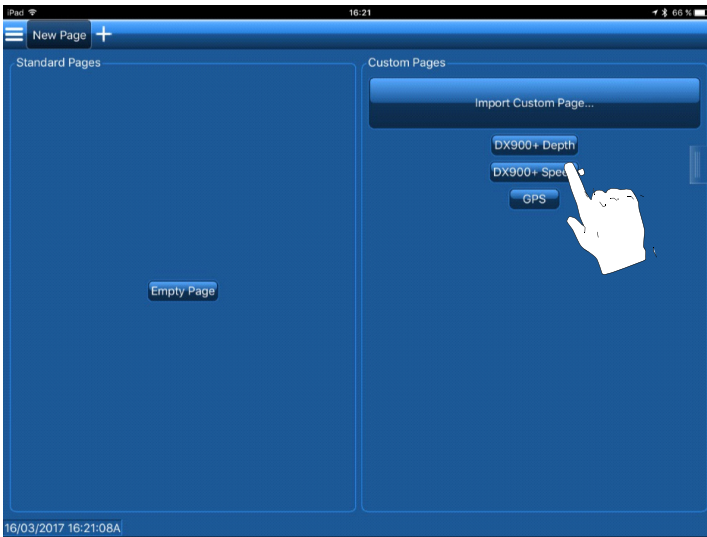You can completely customize the way data is displayed.

1. Connect to the sensor.

2. Touch the ☰ menu button to see the control panel, drop-down menu (Figure 22).

3. Touch **Customize**.

4. When the dialog box opens, touch **OK**.

Figure 22. Accessing a custom display page
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5. Touch ![+] to create a new custom page (Figure 23).

6. Touch **Empty Page**.

7. To display data on the New Page, touch the ![icon] side button to open the **Sensor Data** panel.

8. Touch the data you would like to display. Maintain pressure while the side panel moves to the right.

9. Drag and drop the data onto the hatched area.
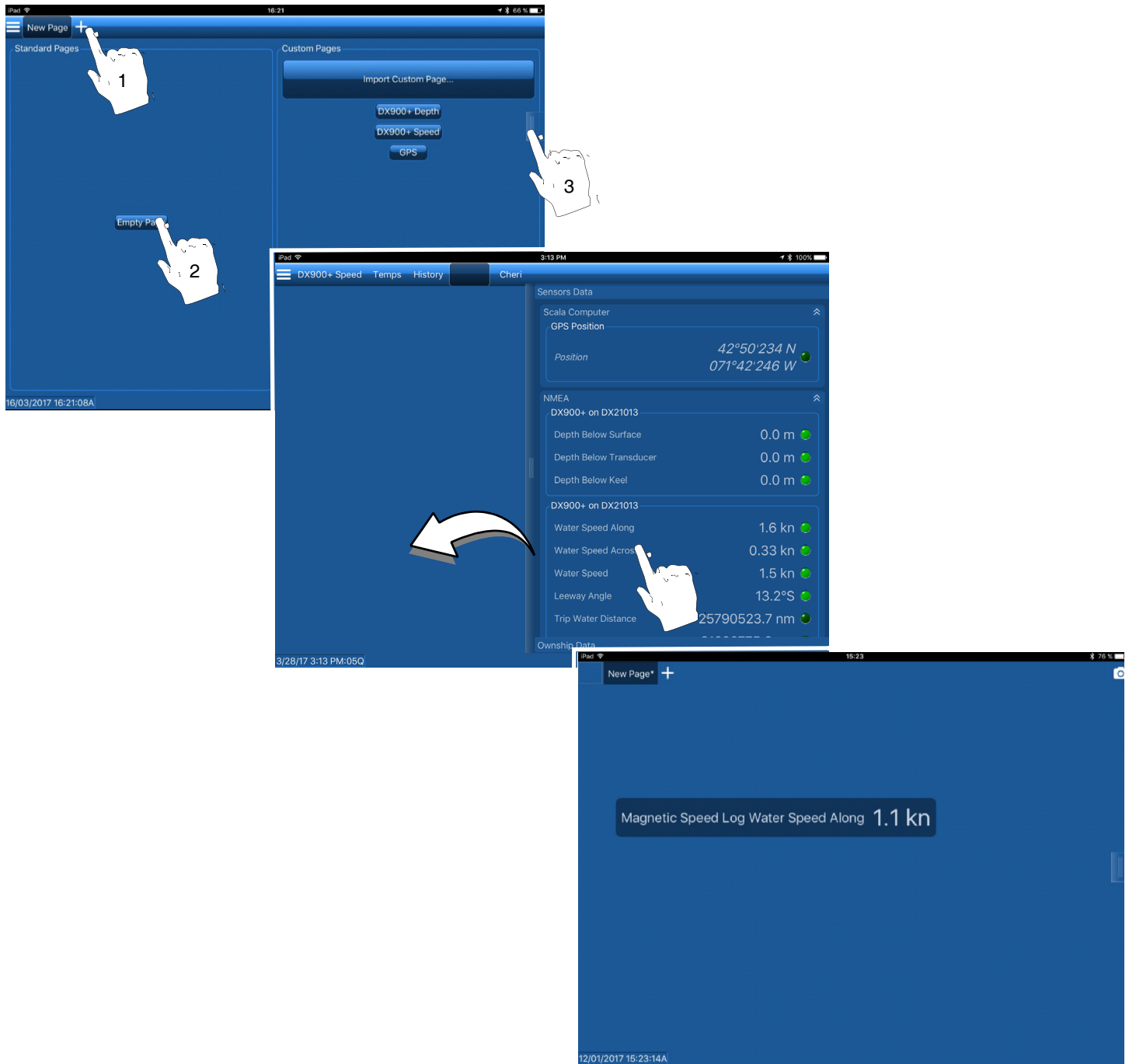
NOTE: *To display other data, repeat the operation.*

Figure 23. Creating a Custom Page and selecting data to display (Water Speed Along shown)
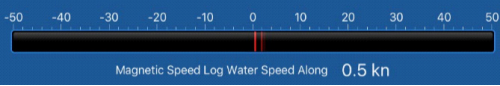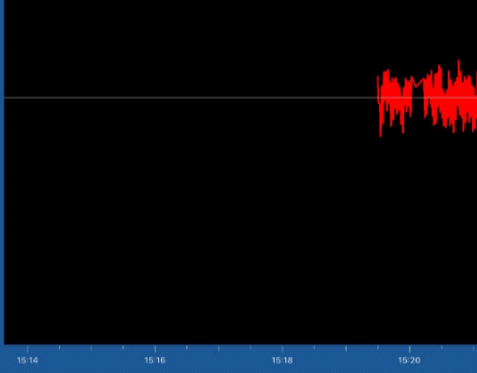
NOTE: *You will be prompted to select the type of display.*

Types of Displays

NOTE: *Some data can only be displayed using some of these options.*

Data can be displayed as (see table below):

- Text
- Dial
- Gauge
- History plot

Text	
Dial	
Gauge	
History plot	

To select the display type, touch the appropriate ● button (Figure 24). The selected button will turn ● .
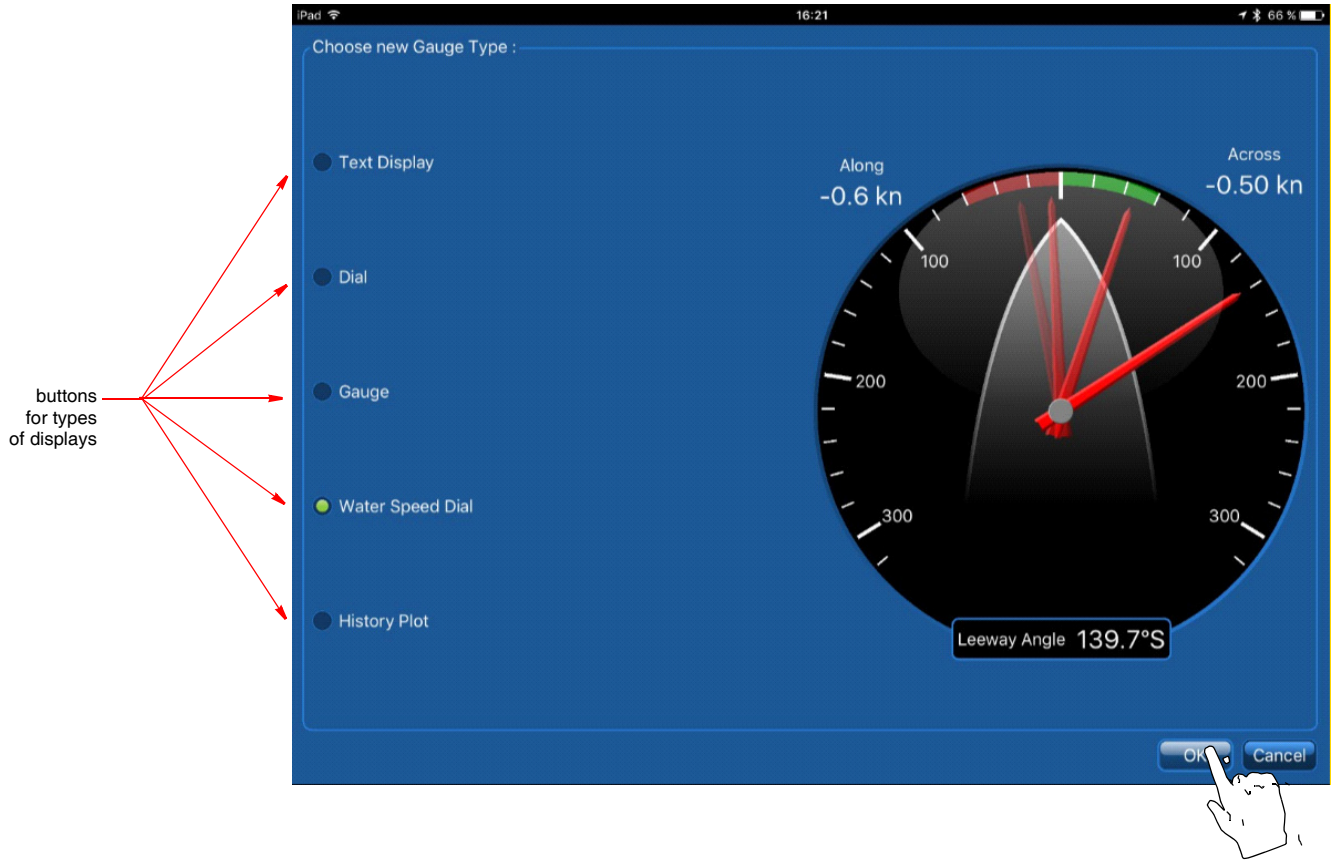
Figure 24. Display options
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Rename the Custom Display Page

1. Connect to the sensor.

2. Touch the [icon] menu button to see the control panel, drop-down menu.

3. Touch **Customize**.

4. Touch and hold the **New Page** to see the drop-down menu (Figure 25).

5. Touch **Rename**.

6. At the top of the page, enter the desired name.
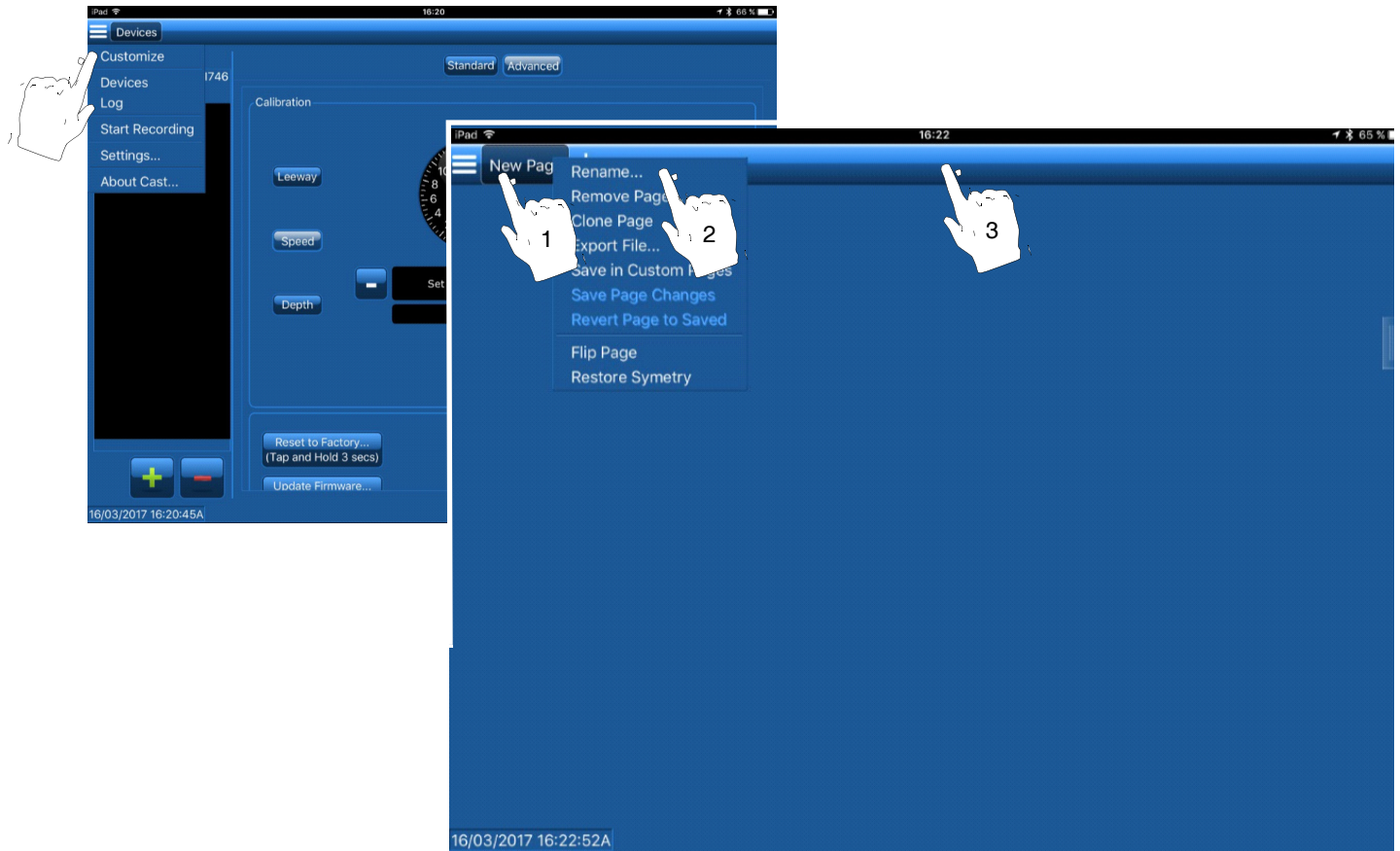
Figure 25. Rename the custom page
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Change CAST Settings

In Settings, you can change the following using the tabs at the top of the page:

- Units of measure
- Storages
- Date Recorder
- NMEA Inputs
- NMEA Outputs
- Alarms

To access the settings:

1. Connect to the sensor.

2. Touch the ▤ menu button to see the control panel, drop-down menu (Figure 26).

3. Touch **Settings**.
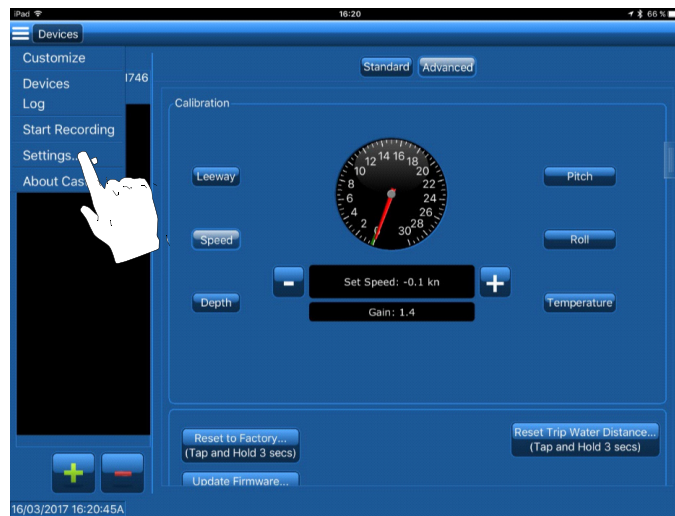
Figure 26. Selecting Settings from the drop-down menu
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Change the Units of Measure

1. Touch the **Units** tab (Figure 27).

2. Select the function.

3. Touch the arrow to see the drop-down menu.

4. Touch to select the new unit of measure.

5. When finished, touch **Close**.
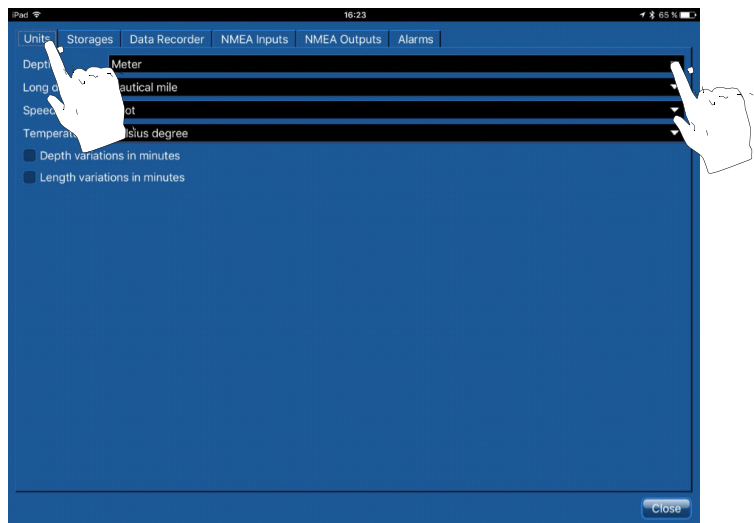
Figure 27. Changing Units of measure
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Alarms

You can configure alarms to alert you when a parameter passes a certain value. For example, you can set an alarm to warn when the depth below the keel is less than 0.5m or when the leeway angle is more than 5°.

Alarms can be configured on the following:
• Category
• Sensor
• Data Type

To set an alarm:

1. Connect to the sensor.

2. Touch the **Alarms** tab (Figure 28).

3. Touch **Add**.

4. In the *Alarm Data* section, select one of the following to alarm:
   - Category
   - Sensor
   - Data Type

5. Touch the arrow to see the drop-down menu.

6. Touch your selection.

7. In the *Alarm Conditions* section, set the upper and lower limits that will trigger the alarm.

8. In the *Alarm Notifications* section, select the type of notification from one or more of the following:
   • Show in status bar
   • Sound
   • Priority

9. Touch **OK**.
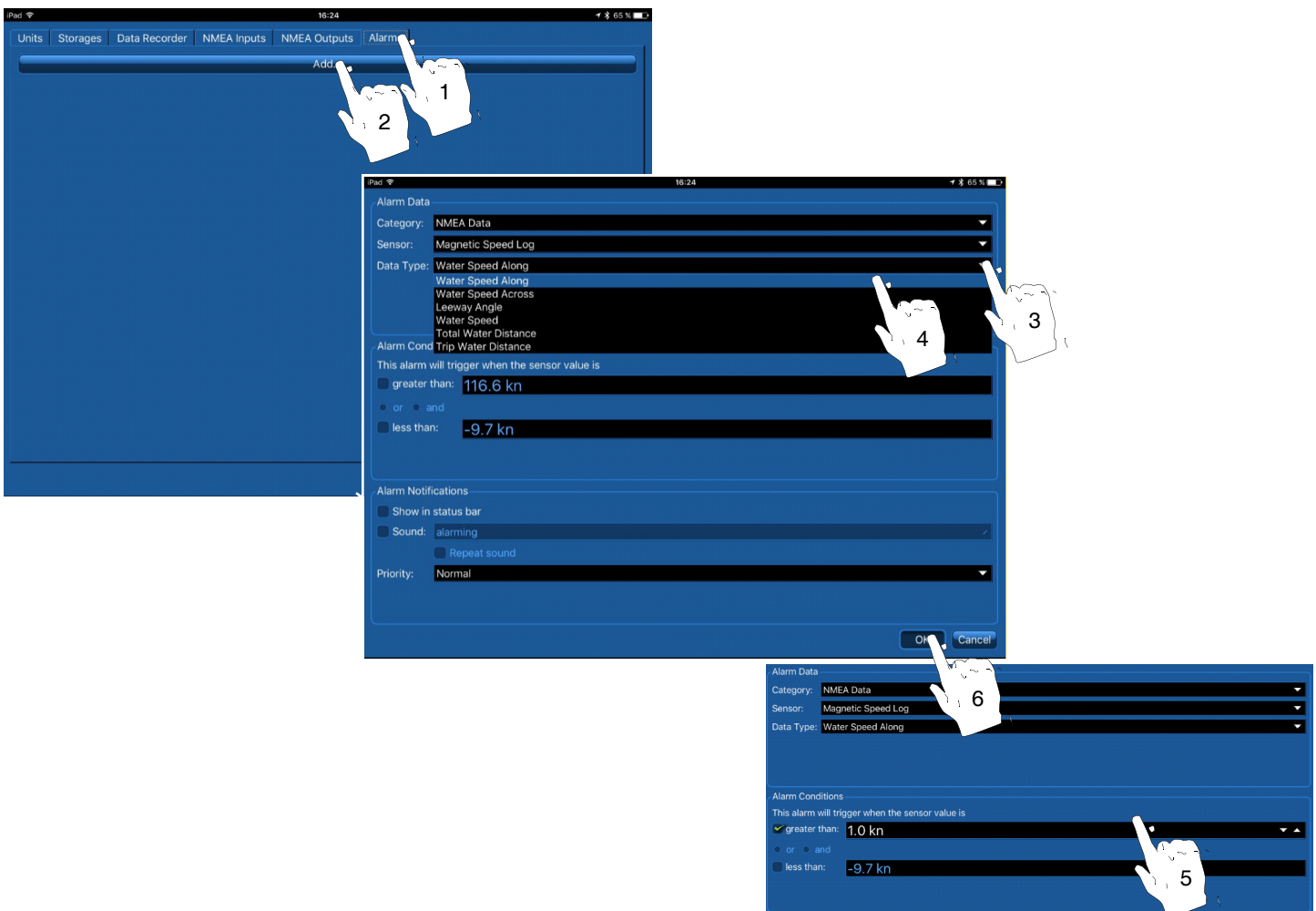
Figure 28. Setting an Alarm
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NOTE: *If you selected* **Show in Status Bar**, *you will see a red bar every time the alarm is triggered (Figure 29).*
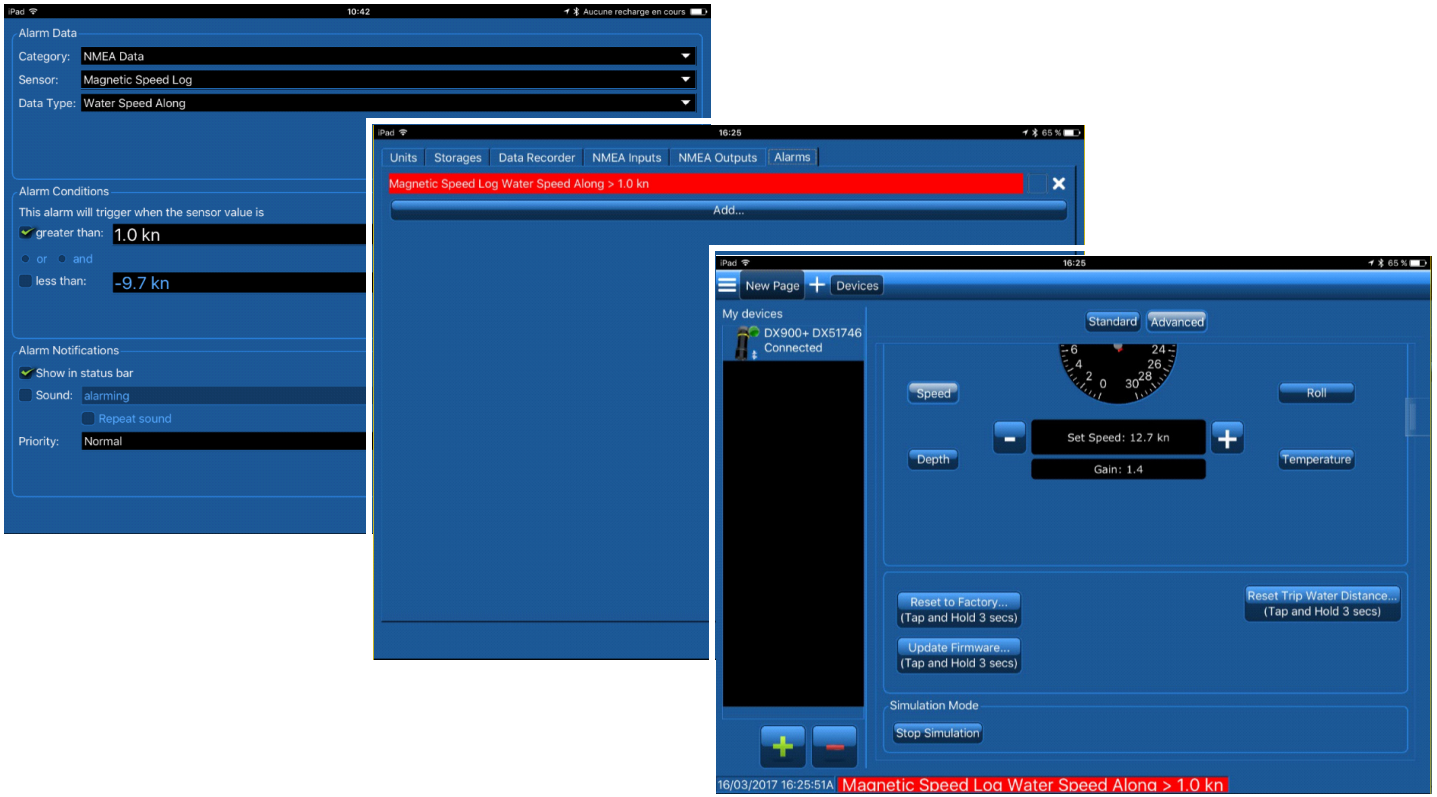
Figure 29. Alarm Status Bars
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Reset to Factory Default Settings

It is possible to reset the sensor to its factory settings.

1. Connect to the sensor.
2. Touch **Advanced** (Figure 30).
3. Touch and hold **Reset to Factory** for 3 seconds.
4. When the dialog box opens, touch **OK.**

Figure 30. Restore Factory settings

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Reset the Trip Water Distance

It is possible to reset the sensor trip distance to 0 Nautical miles.

1. Connect to the sensor.

2. Touch **Advanced** (Figure 31).

3. Touch and hold **Reset Trip Water Distance** for 3 seconds.

Figure 31. Reset Trip Water Distance

Copyright© 2017 Airmar Technology Corporation
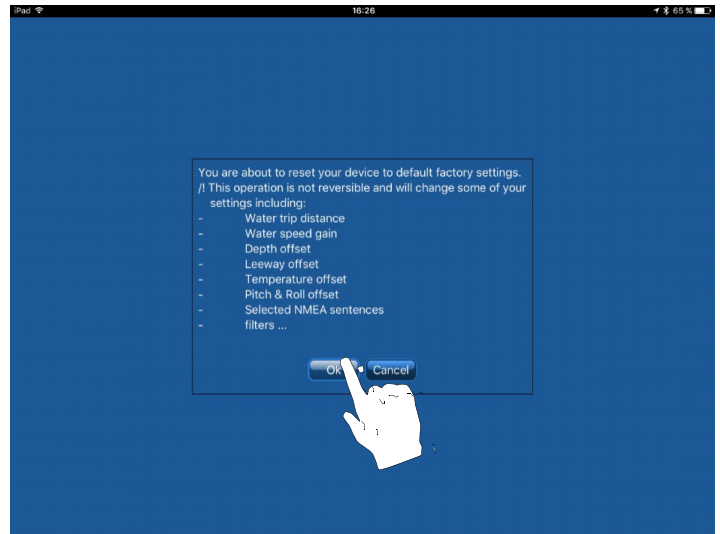
Update the Sensor Firmware

It is possible to update the sensor's firmware via the CAST application with a Bluetooth connection.

Before proceeding with the firmware update, be sure:

• You have an Internet connection to retrieve the new firmware from the Airmar Server.

• You have sufficient battery power to supply the sensor and your mobile device during the 3-minute update.

• Carefully read the information on the dialog box to identify (Figure 32):
  - The current firmware version on your sensor.
  - The latest firmware version available on the server.

NOTE: *You can only update the firmware; it is not possible to install an older version.*

1. Connect to the sensor.

2. Touch **Advanced**.

3. Touch and hold **Update Firmware** for 3 seconds.

4. Carefully read the information in the dialog box to verify that an update is possible. Touch **OK.**
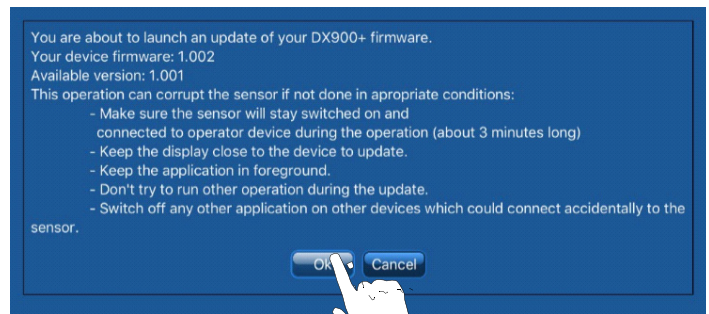

Figure 32. Update Firmware
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5. When the update is complete, you will see the message, Firmware Update Complete.

6. You can verify the firmware version of your sensor on the **Standard** page, *Device identity*, *Firmware version* (Figure 33)
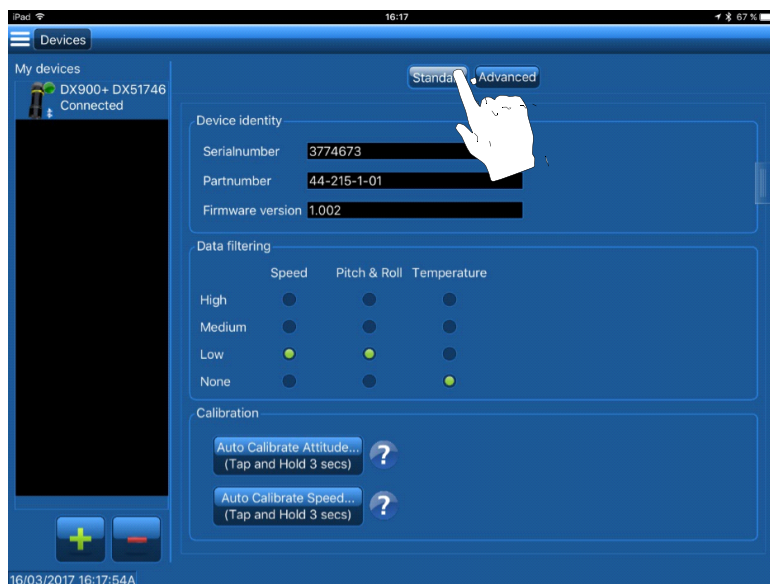

Figure 33. Verify the Firmware version
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Export Settings

1. Connect to the sensor.

2. Touch **Advanced**

3. Touch and hold **Export Settings** for 3 seconds.

   An XML file will be created that contains all the configuration parameters of the sensor.

4. Touch **OK** to email, text, or store the file on the phone.

Troubleshooting

Problem	Possible cause	Recommended corrective action
Noise is observed on the speed data when the boat is stopped in FRESH WATER.	The sensor is more susceptible to environmental noise in fresh water.	Check that the noise is not coming through the NMEA cable. Disconnect the NMEA cable to have data through the Bluetooth connection only. Recheck the speed data.
		Check that the noise is not coming from the power supply. Supply the sensor with a separate +12VDC battery and recheck the speed data.
		If the boat is located in a big marina, try the procedure at a different location. Marinas can be a very noisy environment.
Noise is observed on the speed data when the boat is stopped in SALT WATER.	Power supply signal is not clean. Other equipment on the same supply can generate noise in the line.	Check that the noise is not coming from the power supply. Supply the sensor with a separate +12VDC battery and recheck the speed data.
		If the boat is located in a big marina, try the procedure at a different location. Marinas can be a very noisy environment.

NMEA data is not received on my OEM equipment.	Sensor didn't start up.	Check that sensor has started up.
		   - You can try to put your ear close to the acoustic face of the sensor. In operation the sensor will emit a light repetitive sound. If you hear the sound, that means the sensor is working. Check the NMEA wires.
		   - Check that you can connect to the sensor via Bluetooth. If not, check the sensor's power supply.

	NMEA wires are reversed.	Check that the sensor is sending data via the Bluetooth connection using the CAST app. If yes, swap the NMEA wires.
I can't connect to the sensor on my CAST app.	Sensor didn't start up.	Check that sensor has started up. - You can try to put your ear close to the acoustic face of the sensor. In operation the sensor will emit a light repetitive sound. If you do NOT hear the sound, check the sensor's power supply.
	Somebody else is connected to the sensor.	Check that the sensor in NOT connected to someone else in the vicinity via a Bluetooth connection. The sensor can be connected to only one device at a time.
	CAST app is not able to connect.	Re-start the app and re-try to connect to the sensor.
Speed gain is very high (above 3).	Sensor is not fully inserted in its housing.	Remove the sensor insert and replace it with the blanking plug. Make sure the O-rings on the insert are lubricated with silicon. Replace the insert in its housing.
I still have a difference in speed after calibrating the sensor.	Calibration was done in an area with current.	Try to re-calibrate the sensor in a calm water with no currents.

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