



# GHP™ Reactor Steer-by-Wire



## Installation Instructions

### Important Safety Information

#### **⚠ WARNING**

See the *Important Safety and Product Information* guide in the product box for product warnings and other important information.

You are responsible for the safe and prudent operation of your vessel. The autopilot is a tool that enhances your capability to operate your boat. It does not relieve you of the responsibility of safely operating your boat. Avoid navigational hazards and never leave the helm unattended.

Always be prepared to promptly regain manual control of your boat.

Learn to operate the autopilot on calm and hazard-free open water.

Use caution when operating the autopilot near hazards in the water, such as docks, pilings, and other boats.

#### **⚠ CAUTION**

When in use, beware of hot motor and solenoid components and the risk of entrapment from moving parts.

Failure to install and maintain this equipment in accordance with these instructions could result in damage or injury.

#### **NOTICE**

To avoid damage to your boat, the autopilot system should be installed by a qualified marine installer. Specific knowledge of hydraulic steering componentry and marine electrical systems is required for proper installation.

### Installation Preparation

The autopilot system consists of multiple components. You should familiarize yourself with all of the component mounting and connection considerations before beginning installation. You must know how the components operate together in order to correctly plan the installation on your boat.

You can consult the layout diagrams ([Power and Data Layout](#)) to help understand the mounting and connection considerations.

You should lay out all of the components on the boat as you plan the installation to make sure your cables will reach each component. If needed, extension cables (sold separately) for various components are available from your Garmin® dealer or from [www.garmin.com](http://www.garmin.com).

You should record the serial number of each component for registration and warranty purposes.

### Tools Needed

- Safety glasses
- Drill and drill bits
- 90 mm (3.5 in.) hole saw or a rotary cutting tool
- Wire cutters/strippers
- Phillips and flat screwdrivers
- Cable ties
- Waterproof wire connectors (wire nuts) or heat-shrink tubing and a heat gun
- Marine sealant
- Portable or handheld compass (to test for magnetic interference)
- Anti-seize lubricant (optional)

**NOTE:** Mounting screws are provided for the main components of the autopilot system. If the provided screws are not appropriate for the mounting surface, you must provide the correct types of screws.

### Mounting and Connection Considerations

The autopilot components connect to each other and to power using the included cables. Ensure that the correct cables reach each component and that each component is in an acceptable location before mounting or wiring any components.

#### **Helm Control Mounting Considerations**

##### **NOTICE**

This device should be mounted in a location that is not exposed to extreme temperatures or conditions. The temperature range for this device is listed in the product specifications. Extended exposure to temperatures exceeding the specified temperature range, in storage or operating conditions, may cause device failure. Extreme-temperature-induced damage and related consequences are not covered by the warranty.

The mounting surface must be flat to avoid damaging the device when it is mounted.

Using the included hardware and template, you can flush mount the device in the dashboard. If you want to mount the device using an alternative method where it appears flat with the front of the dashboard, you must purchase a flat-mount kit (professional installation recommended) from your Garmin dealer.

When selecting a mounting location, observe these considerations.

- The mounting location should be at or below eye level to provide optimal viewing as you operate your vessel.
- The mounting location should allow easy access to the keys on the device.
- The mounting surface must be strong enough to support the weight of the device and protect it from excessive vibration or shock.
- To avoid interference with a magnetic compass, the device should not be installed closer to a compass than the compass-safe distance value listed in the product specifications.
- The area behind the mounting surface must allow room for the routing and connection of the cables.

#### **Helm Control Connection Considerations**

- The helm control must connect to the NMEA 2000® network.
- Optional NMEA® 0183 devices, such as wind sensors, water-speed sensors, or GPS devices can be connected to the helm control using a data cable ([NMEA 0183 Connection Considerations](#)).

### CCU Mounting and Connection Considerations

- The CCU is the primary sensor of the GHP Reactor Steer-by-Wire autopilot system. For best performance, observe these considerations when selecting a mounting location.
  - A handheld compass should be used to test for magnetic interference in the area where the CCU is to be mounted. If the needle on a handheld compass moves when you hold it where you intend to mount the CCU, magnetic interference is present. You must choose another location and test again.
  - The CCU should be mounted on a rigid surface for best performance.
  - Although the CCU can be installed in any orientation on your boat, you can avoid the step of defining north in the setup procedure by meeting all of these considerations when selecting a mounting location (optional).
    - The connectors on the CCU must point toward the bow.
    - The base of the CCU must be at a right angle to the roll and pitch axis of the boat.
    - The CCU must be located near the center of rotation of the boat, slightly toward the front, if necessary.
- The CCU cable connects the CCU to the steering system and is 3 m (9 ft.) long.
  - If the CCU cannot be mounted within 3 m (9 ft.) of the steering system, extension cables are available from your local Garmin dealer or at [www.garmin.com](http://www.garmin.com).
  - This cable must not be cut.

### Finding the Best Mounting Location

- Create a list of all suitable mounting locations for the CCU where no iron, magnets, or high-current wires are located within 60 cm (2 ft.).

A large magnet, such as a subwoofer-speaker magnet should be no closer than 1.5 m (5 ft.) to these locations.

- Locate the center of rotation of the boat, and measure the distance between the center of rotation and each of the suitable mounting locations you listed in step 1.

- Select the location closest to the center of rotation.

If more than one location is approximately the same distance from the center of rotation, you should select the location that best meets these considerations.

- The best location is closest to the centerline of the boat.
- The best location is lower in the boat.
- The best location is slightly forward in the boat.

### Alarm Mounting and Connection Considerations

- The alarm should be mounted near the primary helm station.
- The alarm can be mounted under the dashboard.
- If needed, the alarm wires can be extended with 28 AWG (0.08 mm<sup>2</sup>) wire.

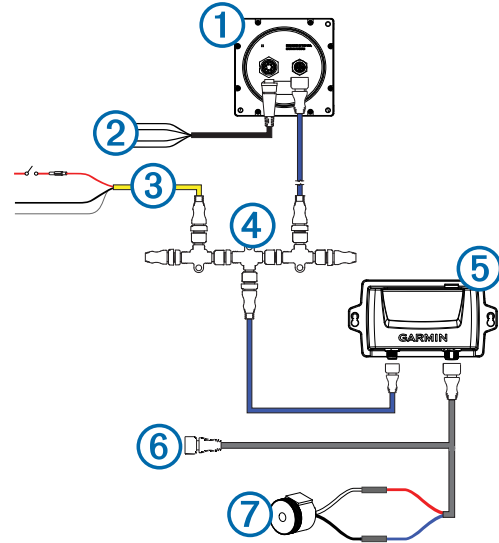
### NMEA 2000 Connection Considerations

- The CCU and the helm control must connect to a NMEA 2000 network.
- If your boat does not already have a NMEA 2000 network, one can be built using the included NMEA 2000 cables and connectors ([Building a Basic NMEA 2000 Network for the Autopilot System](#)).
- To use the advanced features of the autopilot, optional NMEA 2000 devices, such as a wind sensor, a water-speed sensor, or a GPS device, can be connected to the NMEA 2000 network.

### Power and Data Layout

#### ⚠ WARNING

When connecting the power cable, do not remove the in-line fuse holder. To prevent the possibility of injury or product damage caused by fire or overheating, the appropriate fuse must be in place as indicated in the product specifications. In addition, connecting the power cable without the appropriate fuse in place will void the product warranty.



Item	Description	Important Considerations
①	Helm control	
②	Helm control data cable	This cable should be installed only if you are connecting the autopilot to optional NMEA 0183 devices, such as a wind sensor, a water-speed sensor, or a GPS device ( <a href="#">NMEA 0183 Connection Considerations</a> ).
③	NMEA 2000 power cable	This cable should be installed only if you are building a NMEA 2000 network. Do not install this cable if there is an existing NMEA 2000 network on your boat. The NMEA 2000 power cable must be connected to a 9 to 16 Vdc power source.
④	NMEA 2000 network	The helm control and the CCU must be connected to a NMEA 2000 network using the included T-connectors ( <a href="#">NMEA 2000 Connection Considerations</a> ). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors ( <a href="#">Building a Basic NMEA 2000 Network for the Autopilot System</a> ).
⑤	CCU	The CCU can be mounted in a non-submerged location near the center of the boat, in any orientation ( <a href="#">CCU Mounting and Connection Considerations</a> ). The CCU must be located away from sources of magnetic interference.
⑥	Engine connection	The CCU connects either to the engine control directly or through an adapter. Additional instructions are provided with the adapter, if applicable.
⑦	Alarm	The alarm provides audible alerts from the autopilot system, and should be installed near the helm control ( <a href="#">Installing the Alarm</a> ).

### Installation Procedures

#### ⚠ CAUTION

Always wear safety goggles, ear protection, and a dust mask when drilling, cutting, or sanding.

## NOTICE

When drilling or cutting, always check what is on the opposite side of the surface.

After you have planned the autopilot installation on your boat and satisfied all of the mounting and wiring considerations for your particular installation, you can begin mounting and connecting the components.

### Helm Control Installation

You must install the helm control by flush-mounting it in the dashboard near the helm and connecting it to a NMEA 2000 network.

To use advanced features of the autopilot, optional NMEA 2000-compatible or NMEA 0183-compatible devices, such as a wind sensor, water-speed sensor, or GPS device, can be connected to the NMEA 2000 network or connected to the helm control through NMEA 0183.

### Mounting the Helm Control

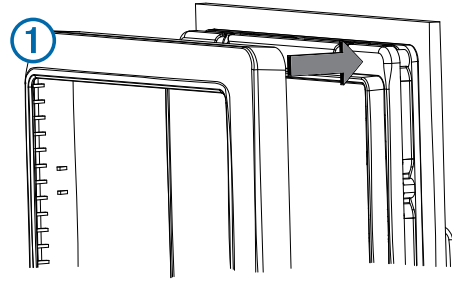
## NOTICE

If you are mounting the device in fiberglass, when drilling the four pilot holes, it is recommended to use a countersink bit to drill a clearance counterbore through only the top gel-coat layer. This will help to avoid any cracking in the gel-coat layer when the screws are tightened.

Stainless-steel screws may bind when screwed into fiberglass and overtightened. Garmin recommends applying an anti-seize lubricant to the screws before installing them.

Before you can mount the helm control, you must select a mounting location ([Helm Control Mounting Considerations](#)).

- 1 Trim the flush-mount template and ensure it fits in the selected mounting location.  
The flush-mount template is included in the helm control product box.
- 2 Secure the template to the selected mounting location.
- 3 If you plan to cut the hole with a rotary cutting tool instead of a 90 mm (3.5 in.) hole saw, use a 10 mm (3/8 in.) drill bit to drill a pilot hole as indicated on the template to begin cutting the mounting surface.
- 4 Using the hole saw or rotary cutting tool, cut the mounting surface along the inside of the dashed line indicated on the template.
- 5 If necessary, use a file and sandpaper to refine the size of the hole.
- 6 Place the helm control into the cutout to confirm that the four mounting holes on the template are in the correct locations.
- 7 If the mounting holes are not correct, mark the correct locations of the four mounting holes.
- 8 Remove the helm control from the cutout.
- 9 Drill the four 2.8 mm ( $7/64$  in.) pilot holes.  
If you are mounting the helm control in fiberglass, you should use a countersink bit as advised in the notice.
- 10 Remove the remainder of the template.
- 11 Place the included gasket on the back of the device.  
You can apply marine sealant around the gasket to prevent leakage behind the dashboard (optional).
- 12 Place the helm control into the cutout.
- 13 Securely fasten the helm control to the mounting surface using the supplied screws.  
If you are mounting the helm control in fiberglass, you should use an anti-seize lubricant as advised in the notice.
- 14 Snap the decorative bezel ① into place.



### Mounting the CCU

- 1 Determine the mounting location.
- 2 Using the CCU as a template, mark the two pilot hole locations on the mounting surface.
- 3 Using a 3 mm ( $1/8$  in.) bit, drill the pilot holes.
- 4 Use the included screws to attach the CCU to the mounting surface.

### Connecting the CCU

- 1 Route the connector end of the CCU cable to the steering system connection or CAN bus and make the connection.
- 2 Route the orange and blue wires from the bare-wire portion of the CCU cable to the location where you plan to install the alarm ([Installing the Alarm](#)).

If the cable is not long enough, extend the appropriate wires with 0.08 mm<sup>2</sup> (28 AWG) wire.

### Connecting to the Steering System of the Boat

## NOTICE

Do not connect the steering controller cable to a NMEA 2000 network.

The autopilot requires a powered CAN bus to communicate with the steering controller. Ensure the steering controller CAN bus is properly powered and terminated. Consult the boat manufacturer if needed.

The steering controller cable allows the autopilot system to communicate with the steering system of the boat through a steering controller CAN bus. Additional instructions are supplied with the CAN bus.

If needed, consult the manufacturer of your boat for assistance locating the steering-system access.

- 1 Locate the steering-system access for your boat.
- 2 Connect the steering controller cable from the CCU to the steering system through the included steering controller CAN bus.

**NOTE:** If necessary, the steering controller cable can be extended using a NMEA 2000 extension cable.

### Installing the Alarm

Before you can mount the alarm, you must select a mounting location ([Alarm Mounting and Connection Considerations](#)).

- 1 Route the alarm cable to the bare-wire end of the CCU cable.  
If the cable is not long enough, extend the appropriate wires with 28 AWG (0.08 mm<sup>2</sup>) wire.
- 2 Connect the cables, based on this table.

Alarm Wire Color	CCU Cable Wire Color
White (+)	Orange (+)
Black (-)	Blue (-)

- 3 Solder and cover all bare-wire connections.
- 4 Secure the alarm with cable ties or other mounting hardware (not included).

## NMEA 2000 and the Autopilot Components

### NOTICE

If you have an existing NMEA 2000 network on your boat, it should already be connected to power. Do not connect the NMEA 2000 power cable to an existing NMEA 2000 network, because only one power source should be connected to a NMEA 2000 network.

You can connect the helm control and the CCU through an existing NMEA 2000 network. If you do not have an existing NMEA 2000 network on your boat, all the parts needed to build one are supplied in the autopilot package ([Building a Basic NMEA 2000 Network for the Autopilot System](#)).

To use advanced features of the autopilot, optional NMEA 2000 devices, such as a GPS device, can be connected to the NMEA 2000 network.

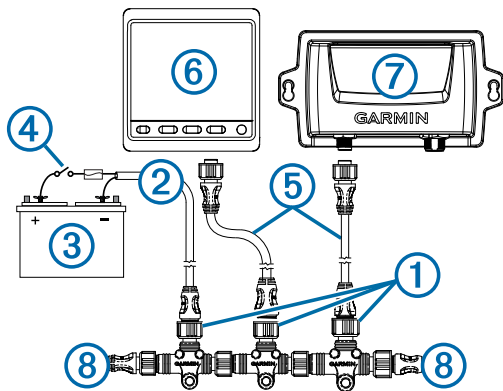
If you are unfamiliar with NMEA 2000, you should read the “NMEA 2000 Network Fundamentals” chapter of the *Technical Reference for NMEA 2000 Products*. To download this document, select Manuals on the product page for your device at [www.garmin.com](http://www.garmin.com).

### Building a Basic NMEA 2000 Network for the Autopilot System

### NOTICE

If you are installing a NMEA 2000 power cable, you must connect it to the boat ignition switch or through another in-line switch. NMEA 2000 devices will drain your battery if the NMEA 2000 power cable is connected to the battery directly.

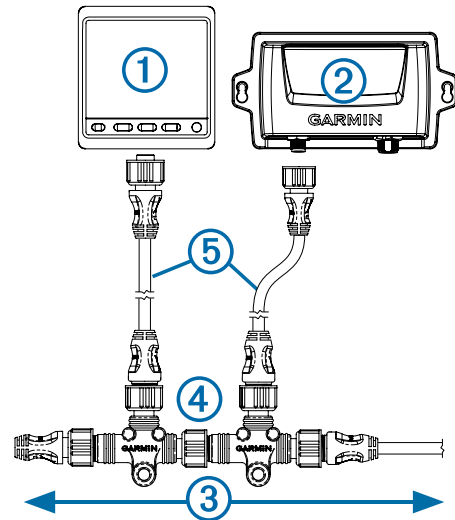
- 1 Connect the three T-connectors ① together side-by-side.



- 2 Connect the included NMEA 2000 power cable ② to a 9 to 12 Vdc power source ③ through a switch ④.  
Connect the power cable to the ignition switch of the boat if possible, or route it through an inline switch (not included).  
**NOTE:** The braided drain wire (bare) on the NMEA 2000 power cable must be connected to the same ground as the black wire on the NMEA 2000 power cable.
- 3 Connect the NMEA 2000 power cable to one of the T-connectors.
- 4 Connect one of the included NMEA 2000 drop cables ⑤ to one of the T-connectors and to the helm control ⑥.
- 5 Connect the other included NMEA 2000 drop cable to the other T-connector and to the CCU ⑦.
- 6 Connect the male and female terminators ⑧ to each end of the combined T-connectors.

### Connecting the Autopilot Components to an Existing NMEA 2000 Network

- 1 Determine where to connect the helm control ① and the CCU ② to your existing NMEA 2000 backbone ③.



- 2 In the location where you want to connect the helm control, disconnect one side of a NMEA 2000 T-connector ④ from the network.
- 3 If necessary, connect a NMEA 2000 backbone extension cable (not included) to the side of the disconnected T-connector to extend the NMEA 2000 network backbone.
- 4 Add an included T-connector for the helm control to the NMEA 2000 backbone by connecting it to the side of the disconnected T-connector or backbone extension cable.
- 5 Route the included drop cable ⑤ to the helm control and to the bottom of the T-connector added in step 4.  
If the included drop cable is not long enough, you can use a drop cable up to 6 m (20 ft.) long (not included).
- 6 Connect the drop cable to the helm control and the T-connector.
- 7 Repeat steps 2 through 6 for the CCU.

### Connecting Optional NMEA 2000 Devices to the Autopilot System

You can use advanced features of the autopilot system by connecting optional NMEA 2000 compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device to the NMEA 2000 network.

**NOTE:** You can connect optional devices that are not NMEA 2000 compatible to the helm control through NMEA 0183 ([NMEA 0183 Connection Considerations](#)).

- 1 Add an additional T-connector (not included) to the NMEA 2000 network.
- 2 Connect the optional NMEA 2000 device to the T-connector by following the instructions provided with the device.

### Configuring the Autopilot

The autopilot must be configured and tuned to your boat dynamics. The Dockside Wizard and the Sea Trial Wizard on the helm control are used to configure the autopilot. These wizards walk you through the necessary configuration steps.

### The Dockside Wizard

### NOTICE

If you perform the Dockside Wizard while your boat is out of the water, provide rudder-movement clearance to avoid damage to the rudder or other objects.

You can complete the Dockside Wizard while the boat is in or out of the water.

If the boat is in the water, it must be stationary while you complete the wizard.

## Performing the Dockside Wizard

### NOTICE

If you have a boat with a power assist steering system, turn on the power assist steering system before performing the Dockside Wizard to avoid damaging the steering system.

- 1 Turn on the autopilot.  
The first time you turn on the autopilot, you are prompted to complete a short setup sequence.
- 2 If the Dockside Wizard does not start automatically after the setup sequence, select **Menu > Setup > Dealer Autopilot Setup > Wizards > Dockside Wizard**.
- 3 Select the vessel type.
- 4 Test the steering direction ([Testing the Steering Direction](#)).
- 5 If necessary, select the speed source ([Selecting the Speed Source](#)).
- 6 If necessary, verify the tachometer ([Verifying the Tachometer](#)).
- 7 Review the results of the Dockside Wizard ([Reviewing the Results of the Dockside Wizard](#)).

### Testing the Steering Direction

- 1 While moving at a low rate of speed, select **←** and **→**.  
When you select **←**, the rudder must turn the boat to the left. When you select **→**, the rudder must turn the boat to the right.
- 2 Select **Continue**.
- 3 Select an option:
  - If the steering test turns the boat in the correct direction, select **Yes**.
  - If the steering test turns the boat in the opposite direction, select **No** and repeat steps 1 through 3.

### Selecting the Speed Source

Select an option:

- If you connected a NMEA 2000 compatible engine (or engines) to the NMEA 2000 network, select **Tach. - NMEA 2000 or Proprietary**.
- If NMEA 2000 tachometer data source is not available or unusable, select **GPS** as a speed source.
- If you did not connect a NMEA 2000 tachometer or GPS device as a speed source, select **None**.

**NOTE:** If the autopilot does not perform well using **None** as the speed source, Garmin recommends connecting a tachometer through the NMEA 2000 network or using a GPS device as the speed source.

### Verifying the Tachometer

This procedure does not appear when GPS or None is selected as the speed source.

With the engine (or engines) running, compare the RPM readings on the helm control with the tachometer (or tachometers) on the dashboard of your boat.

If the RPM numbers do not align, there may be a problem with the NMEA 2000 speed source or connection.

### Reviewing the Results of the Dockside Wizard

The helm control displays the values you chose when you ran the Dockside Wizard.

- 1 Examine the results of the Dockside Wizard.
- 2 Select any incorrect value, and select **Select**.
- 3 Correct the value.
- 4 Repeat steps 2–3 for all incorrect values.
- 5 When you are finished reviewing the values, select **Done**.

## The Sea Trial Wizard

The Sea Trial Wizard configures the fundamental sensors on the autopilot, and it is extremely important to complete the wizard in conditions appropriate for your boat.

### Important Sea Trial Wizard Considerations

The Sea Trial Wizard must be completed in calm water. Because the nature of calm water is relative to the size and shape of the boat, before you begin the Sea Trial Wizard, the boat must be in an appropriate location.

- The boat must not rock while sitting still or moving very slowly.
- The boat must not be significantly affected by the wind.

While completing the Sea Trial Wizard, observe these considerations.

- Weight on the boat must remain balanced. While completing any of the steps in the Sea Trial Wizard, do not move around on the boat.

### Performing the Sea Trial Wizard

- 1 Drive your boat to an open area of calm water.
- 2 Select **Menu > Setup > Dealer Autopilot Setup > Wizards > Sea Trial Wizard**.
- 3 If necessary, configure the planing RPM.  
This step applies only to planing-hull power boats with the speed source set to Tach. - NMEA 2000 or Proprietary.
- 4 If necessary, configure the planing speed.  
This step applies only to planing-hull power boats with the speed source set to GPS.
- 5 If necessary, configure the high RPM limit.  
This step applies only to power boats with the speed source set to Tach. - NMEA 2000 or Proprietary or GPS.
- 6 If necessary, configure the maximum speed.  
This step applies only to power boats with the speed source set to GPS.
- 7 Calibrate the compass ([Calibrating the Compass](#)).
- 8 Perform the **Autotune** procedure ([Performing the Autotune Procedure](#)).
- 9 Set north ([Setting North](#)) if GPS-heading information is available, or set the fine heading adjustment ([Setting the Fine Heading Adjustment](#)) if GPS-heading information is not available.

### Calibrating the Compass

- 1 Select an option:
  - If you are performing this procedure as part of the Sea Trial Wizard, select **Begin**.
  - If you are performing this procedure outside of the Sea Trial Wizard, from the heading screen, select **Menu > Setup > Dealer Autopilot Setup > Compass Setup > Calibrate Compass > Begin**.
- 2 Follow the directions on the helm control until calibration is complete, taking care to keep the boat as steady and flat as possible.  
The boat should not list during calibration.
- 3 Select an option:
  - If the calibration completes successfully, select **Done**.
  - If the calibration is not successful, select **Retry** and repeat steps 1 through 3.

When the calibration is complete, calibration values are displayed. You can use these values to determine the quality of the calibration procedure.

### Compass-Calibration Values

After the compass calibration process is complete, you can review the results provided on the helm control to determine the successfulness of the calibration.

**Magnetic Environment:** Indicates the level of distortion of the Earth's magnetic field at the mounting location.

- A value of 100 indicates the device experiences no magnetic interference at the mounting location.
- If this value is low, you might need to move the CCU and calibrate the compass again.
- A value of 100 is ideal, but it is not necessary for the autopilot to function correctly. If the CCU is mounted in an optimal location on your boat, you should continue configuring the autopilot and evaluate the performance again later.

**Spin Quality:** Represents how level the boat remained during the compass-calibration process.

- A value of 100 indicates the boat remained perfectly level during compass calibration.
- If this value is low, you might need to calibrate the compass again.

### Performing the Autotune Procedure

Before you can begin this procedure, you must have a large stretch of open water available.

- 1 Adjust the throttle so the boat travels at a typical cruising speed that provides responsive steering.
- 2 Select an option:
  - If you are performing this procedure as part of the Sea Trial Wizard, select **Begin**.
  - If you are performing this procedure outside of the Sea Trial Wizard, from the heading screen, select **Menu > Setup > Dealer Autopilot Setup > Autopilot Tuning > Autotune > Begin**.

The boat performs various zigzag motions while the Autotune is in progress.

- 3 After the procedure is finished, follow the on-screen instructions.
- 4 Select an option:
  - If the **Autotune** procedure is not successful, but you have not reached maximum cruising speed, increase the speed and repeat steps 1 through 3 until the **Autotune** procedure completes successfully.
  - If the **Autotune** procedure is not successful, and you have reached maximum cruising speed, reduce your speed to the initial **Autotune** speed and select **Alternate Autotune** to begin an alternate procedure.

When the Autotune procedure is complete, gain values are displayed. You can use these values to determine the quality of the Autotune procedure.

### Autotune Gain Values

After the autotune procedure is complete, you can review the gain values provided on the helm control. You can record these numbers for reference if you want to run the autotune procedure at a later time or if you want to manually adjust the gain settings (not recommended) ([Adjusting the Autopilot Gain Settings](#)).

**Gain:** Sets how tightly the autopilot holds the heading and how aggressively it makes turns.

**Counter Gain:** Sets how aggressively the autopilot adjusts any over-steering after making a turn.

### Setting North

Before you can begin this procedure, you must have a large stretch of open water available.

**NOTE:** If you followed the guidelines when mounting the CCU, this procedure may not be necessary ([CCU Mounting and Connection Considerations](#)).

This procedure appears if the autopilot is connected to an optional GPS device ([Connecting Optional NMEA 2000 Devices to the Autopilot System](#)), and the device has acquired a GPS

position. During this procedure, the autopilot uses the GPS heading information to calibrate north on the autopilot system. If you do not have a GPS device connected, you are prompted to set the fine heading adjustment instead ([Setting the Fine Heading Adjustment](#)).

- 1 Drive your boat at cruising speed in a straight line.
- 2 Select an option:
  - If you are performing this procedure as part of the Sea Trial Wizard, select **Begin**.
  - If you are performing this procedure outside of the Sea Trial Wizard, from the heading screen, select **Menu > Setup > Dealer Autopilot Setup > Compass Setup > Set North > Begin**.
- 3 Continue to drive the boat at cruising speed in a straight line and follow the on-screen instructions.
- 4 Select an option:
  - If the calibration completes successfully, select **Done**.
  - If the calibration is not successful, repeat steps 1 through 3.

### Setting the Fine Heading Adjustment

This procedure appears only if you do not have an optional GPS device connected to the autopilot ([Connecting Optional NMEA 2000 Devices to the Autopilot System](#)). If the autopilot is connected to a GPS device that has acquired a GPS position, you are prompted to set north instead ([Setting North](#)).

- 1 Using a handheld compass, identify north.
- 2 Select an option:
  - If you are performing this procedure as part of the Sea Trial Wizard, adjust the fine heading setting until it matches north on the magnetic compass.
  - If you are performing this calibration outside of the Sea Trial Wizard, from the heading screen, select **Menu > Setup > Dealer Autopilot Setup > Compass Setup > Fine Heading Adjustment**, and adjust the fine heading setting until it matches north on the magnetic compass.
- 3 Select **Done**.

### Testing and Adjusting the Configuration

#### NOTICE

Test the autopilot at a slow speed. After the autopilot has been tested and adjusted at a slow speed, test it at a higher speed to simulate normal operating conditions.

- 1 Drive the boat in one direction with the autopilot engaged (heading hold).

The boat may oscillate slightly, but it should not oscillate significantly.
- 2 Turn the boat in one direction using the autopilot and observe the behavior.

The boat should turn smoothly, not too quickly or too slowly. When you turn the boat using the autopilot, the boat should approach and settle on the desired heading with minimal overshoot and oscillation.
- 3 Select an option:
  - If the boat turns too quickly or too sluggishly, adjust the autopilot acceleration limiter ([Adjusting the Acceleration Limiter Settings](#)).
  - If the heading hold oscillates significantly or the boat does not correct when turning, adjust the autopilot gain ([Adjusting the Autopilot Gain Settings](#)).
  - If the boat turns smoothly, the heading hold oscillates only slightly or not at all, and the boat adjusts the heading correctly, the configuration is correct, and no further adjustments are necessary.

## Adjusting the Acceleration Limiter Settings

- 1 Enable Dealer Mode ([Enabling Dealer Configuration](#)).
- 2 Select **Menu > Setup > Dealer Autopilot Setup > Autopilot Tuning > Acceleration Limiter**.
- 3 Select an option:
  - Increase the setting if the autopilot turns too quickly.
  - Decrease the setting if the autopilot turns too slowly.

When you manually adjust the acceleration limiter, make relatively small adjustments. Test the change before making additional adjustments.

- 4 Test the autopilot configuration.
- 5 Repeat steps 3–4 until the autopilot performance is satisfactory.

## Adjusting the Autopilot Gain Settings

- 1 Enable Dealer Mode ([Enabling Dealer Configuration](#)).
- 2 Select **Menu > Setup > Dealer Autopilot Setup > Autopilot Tuning > Rudder Gains**.
- 3 Select an option based on the type of boat:
  - If you have a displacement-hull powerboat or a powerboat with the speed source set to **None**, select **Gain** and adjust how tightly the rudder holds the heading and makes turns.  
If you set this value too high, the autopilot may be overactive and attempt to constantly adjust the heading at the slightest deviation. An overactive autopilot can drain the battery at a faster-than-normal rate.
  - If you have a displacement-hull powerboat or a powerboat with the speed source set to **None**, select **Counter Gain** and adjust how tightly the rudder corrects the turn overshoot.  
If you set this value too low, the autopilot can overshoot the turn again when it attempts to counter the original turn.
  - If you have a planing-hull powerboat with the speed source set to **Tach. - NMEA 2000 or Proprietary** or **GPS**, select **Low Speed** or **High Speed** and adjust how tightly the rudder holds the heading and makes turns at low speed or high speed.  
If you set this value too high, the autopilot may be overactive and attempt to constantly adjust the heading at the slightest deviation. An overactive autopilot can drain the battery at a faster-than-normal rate.
  - If you have a planing-hull powerboat with the speed source set to **Tach. - NMEA 2000 or Proprietary** or **GPS**, select **Low Speed Counter** or **High Speed Counter** to adjust how tightly the rudder corrects the turn overshoot.  
If you set this value too low, the autopilot can overshoot the turn again when it attempts to counter the original turn.
- 4 Test the autopilot configuration, and repeat steps 2 and 3 until the autopilot performance is satisfactory.

## Advanced Configuration

Advanced configuration options are not available on the helm control under normal conditions. To access the advanced configuration settings of the autopilot, you must first enable Dealer Mode ([Enabling Dealer Configuration](#)).

### Enabling Dealer Configuration

- 1 From the heading screen, select **Menu > Setup > System > System Information**.
- 2 Hold the center key for 5 seconds.  
Dealer Mode appears.
- 3 Select **Back > Back**.

If the option for Dealer Autopilot Setup is available on the Setup screen, the procedure was successful.

## Advanced Configuration Settings

You can run the autotune process, calibrate the compass, and define north on the autopilot without running the wizards. You can also define each setting individually, without running the configuration processes.

### Running the Automated Configuration Processes Manually

- 1 Enable Dealer Mode ([Enabling Dealer Configuration](#)).
- 2 From the heading screen, select **Menu > Setup > Dealer Autopilot Setup**.
- 3 Select an automated process:
  - Select **Compass Setup > Calibrate Compass** to start the compass calibration procedures ([Calibrating the Compass](#)).
  - Select **Compass Setup > Set North** to start the procedures to define north ([Setting North](#)).
  - Select **Autopilot Tuning > Autotune** to start the automatic autopilot tuning procedures ([Performing the Autotune Procedure](#)).
- 4 Follow the on-screen instructions.

### Defining Individual Configuration Settings Manually

Configuring certain configuration settings may require you to modify other settings. Review the "Detailed Configuration Settings" section ([Detailed Configuration Settings](#)) prior to modifying any settings.

- 1 Enable Dealer Mode ([Enabling Dealer Configuration](#)).
- 2 From the heading screen, select **Menu > Setup > Dealer Autopilot Setup**.
- 3 Select a setting category.
- 4 Select a setting to configure.  
Descriptions of each setting are available in the appendix ([Detailed Configuration Settings](#)).
- 5 Configure the value of the setting.

## Appendix

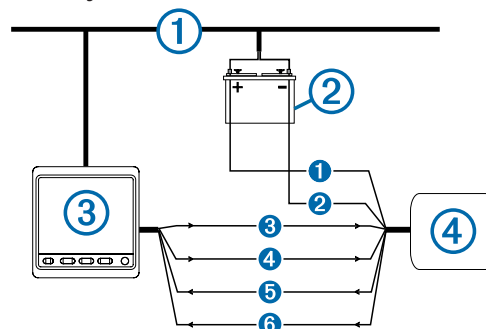
### NMEA 0183 Connection Diagrams

These wiring diagrams are examples of different situations you may encounter when connecting your NMEA 0183 device to the helm control.

#### NMEA 0183 Connection Considerations

- The installation instructions provided with your NMEA 0183 compatible device should contain the information you need to identify the transmitting (Tx) and receiving (Rx) A (+) and B (-) wires.
- When connecting NMEA 0183 devices with two transmitting and two receiving wires, it is not necessary for the NMEA 2000 bus and the NMEA 0183 device to connect to a common ground.
- When connecting a NMEA 0183 device with only one transmitting (Tx) wire or with only one receiving (Rx) wire, the NMEA 2000 bus and the NMEA 0183 device must be connected to a common ground.

#### Two-Way NMEA 0183 Communication



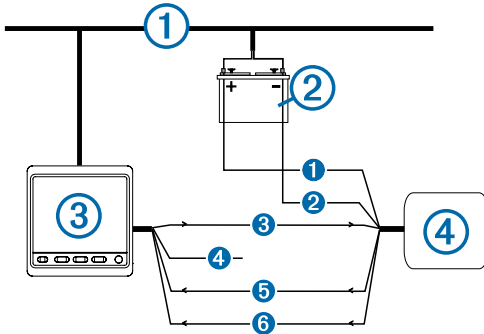
①	NMEA 2000 network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	N/A	NMEA 0183 ground
③	Blue — Tx/A (+)	Rx/A (+)
④	White — Tx/B (-)	Rx/B (-)
⑤	Brown — Rx/A (+)	Tx/A (+)
⑥	Green — Rx/B (-)	Tx/B (-)

**NOTE:** When connecting a NMEA 0183 device with two transmitting and two receiving lines, it is not necessary for the NMEA 2000 bus and the NMEA 0183 device to connect to a common ground.

**Only One Receiving Wire**

If your NMEA 0183-compatible device has only one receiving wire (Rx), it must be connected to the blue wire (Tx/A) from the helm control, and the white wire (Tx/B) from the helm control must remain unconnected.



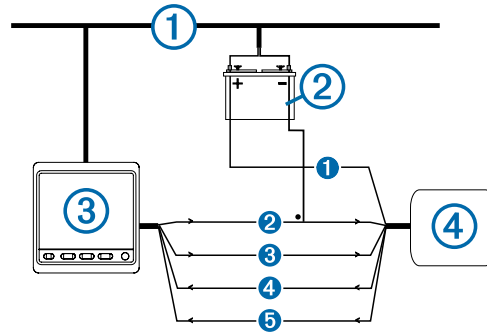
①	NMEA 2000network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	N/A	NMEA 0183 ground
③	Blue — Tx/A (+)	Rx
④	White — unconnected	N/A
⑤	Brown — Rx/A (+)	Tx/A (+)
⑥	Green — Rx/B (-)	Tx/B (-)

**NOTE:** When connecting a NMEA 0183 device with only one receiving (Rx) line, the NMEA 2000 bus and the NMEA 0183 device must be connected to a common ground.

**Only One Transmitting Wire**

If your NMEA 0183-compatible device has only one transmitting wire (Tx), it must be connected to the brown wire (Rx/A) from the helm control, and the green wire (Rx/B) from the helm control must be connected to NMEA 0183 ground.



①	NMEA 2000 network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	Green — Rx/B (-) (connect to NMEA 0183 ground)	NMEA 0183 ground
③	Blue — Tx/A (+)	Rx/A (+)
④	White — Tx/B (-)	Rx/B (-)
⑤	Brown — Rx/A (+)	Tx/A (+)

**NOTE:** When connecting a NMEA 0183 device with only one transmitting (Tx) line, the NMEA 2000 bus and the NMEA 0183 device must be connected to a common ground.

**Specifications**

**CCU**

Specification	Measurement
Dimensions (L × W × H)	170 × 90 × 50 mm (6.7 × 3.5 × 2 in.)
Weight	200 g (7 oz.)
Temperature range	From -15° to 70°C (from 5° to 158°F)
Material	Fully gasketed, high-impact plastic
Water resistance	IEC 60529 IPX7*
CCU cable length	3 m (9 ft.)
NMEA 2000 input voltage	From 9 to 16 Vdc
NMEA 2000 LEN	4 (200 mA)

\*The device withstands incidental exposure to water of up to 1 m for up to 30 min. For more information, go to [www.garmin.com/waterrating](http://www.garmin.com/waterrating).

**Helm Control**

Specification	Measurement
Dimensions without sun cover (H × W × D)	110 x 115 x 30 mm (4.33 x 4.53 x 1.18 in.)
Dimensions with sun cover (H × W × D)	115 x 120 x 35.5 mm (4.53 x 4.72 x 1.40 in.)
Weight without sun cover	247 g (8.71 oz.)
Weight with sun cover	283 g (9.98 oz.)
Temperature range	From -15° to 70°C (from 5° to 158°F)
Compass-safe distance	209 mm (8.25 in.)
Material	Case: fully-gasketed polycarbonate Lens: glass with an anti-glare treatment
Water resistance	IEC 60529 IPX7*
Power usage	2.5 W max
Unit max. voltage	32 Vdc
NMEA 2000 input voltage	9 to 16 Vdc



Specification	Measurement
NMEA 2000 (LEN)	6 (300 mA at 9 Vdc)
*The device withstands incidental exposure to water of up to 1 m for up to 30 min. For more information, go to <a href="http://www.garmin.com/waterrating">www.garmin.com/waterrating</a> .	

### Alarm

Specification	Measurement
Dimensions (L×diameter)	$29/32 \times 1$ in. (23 × 25 mm)
Weight	2.4 oz. (68 g)
Temperature range	From 5°F to 140°F (from -15°C to 60°C)
Cable length	10 ft. (3.0 m)

### NMEA 2000 PGN Information

#### CCU

Type	PGN	Description
Transmit and receive	059392	ISO acknowledgment
	059904	ISO request
	060928	ISO address claim
	126208	NMEA: Command/Request/Acknowledge group function
	126464	Transmit/Receive PGN list group function
	126996	Product information
Transmit only	127257	Transmit/Receive attitude data
	127251	Transmit/Receive rate of turn
	127250	Vessel heading
	127258	Magnetic variation
	127488	Engine parameters: Rapid update
	128259	Water speed
	129025	Position: Rapid update
	129026	COG & SOG: Rapid update
	129283	Cross track error
	129284	Navigation data
Receive only	130306	Wind data

### Helm Control

Type	PGN	Description	
Transmit and receive	059392	ISO Acknowledgment	
	059904	ISO Request	
	060928	ISO Address Claim	
	126208	NMEA - Command/Request/Acknowledge Group Function	
	126464	Transmit/Receive PGN List Group Function	
	126996	Product Information	
Transmit only	128259	Water Speed	
	129025	Position - Rapid Update	
	129026	COG & SOG - Rapid Update	
	129283	Cross Track Error	
	129284	Navigation Data	
	129540	GNSS Satellites in View	
	130306	Wind Data	
	Receive only	127245	Rudder Data
		127250	Vessel Heading
		127488	Engine Parameters - Rapid Update
128259		Water Speed	
129025		Position - Rapid Update	
129029		GNSS Position Data	
129283		Cross-Track Error	
129285		Navigation - Route/WP information	

Type	PGN	Description
	130306	Wind Data
	130576	Small Craft Status

### NMEA 0183 Information

When connected to optional NMEA 0183-compatible devices, the autopilot uses the following NMEA 0183 sentences.

Type	Sentence
Transmit	hdg
Receive	wpl
	gga
	grme
	gsa
	gsv
	rmc
	bod
	bwc
	dtm
	gll
	rmb
	vhw
	mww
	xte

### Error and Warning Messages

Error Message	Cause	Autopilot Action
ECU Voltage is Low	The pump supply voltage has fallen below 10 Vdc for longer than 6 seconds.	<ul style="list-style-type: none"> <li>Alarm sounds for 5 seconds</li> <li>Continues in normal operation</li> </ul>
Autopilot is not receiving navigation data. Autopilot placed in Heading Hold.	The autopilot is no longer receiving valid navigation data while performing a Route To maneuver. This message also appears if navigation is stopped on a chartplotter before the autopilot is disengaged.	<ul style="list-style-type: none"> <li>Alarm sounds for 5 seconds</li> <li>Autopilot transitions to heading hold</li> </ul>
Connection with Autopilot Lost	The helm control has lost connection with the CCU.	N/A
Lost Wind Data (sailboat only)	The autopilot is no longer receiving valid wind data.	<ul style="list-style-type: none"> <li>Alarm sounds for 5 seconds</li> <li>Autopilot transitions to heading hold</li> </ul>
Error: Lost Communication Between ECU and CCU (when the autopilot is engaged)	Communication between the CCU and the pump has timed out.	<ul style="list-style-type: none"> <li>The helm control beeps, and autopilot transitions to standby.</li> </ul>

### Detailed Configuration Settings

Although all of the configuration is typically completed automatically through wizards, you can manually adjust any setting to fine-tune the autopilot.

Advanced configuration settings are available only when using Dealer Mode ([Enabling Dealer Configuration](#)). User-specific settings are available during normal operation of the autopilot. See the configuration section of the owner's manual provided with the autopilot for more information.

**NOTE:** Depending upon the configuration of the autopilot, certain settings may not appear.

**NOTE:** On a powerboat, each time you change to the Speed Source setting, you must review the Verify Tachometer, Low RPM Limit, High RPM Limit, Planing RPM, Planing Speed, or

Max. Speed settings, where applicable, before performing the autotune procedure ([Performing the Autotune Procedure](#)).

### **Autopilot Tuning Settings**

To open the general autopilot tuning settings, select **Menu > Setup > Dealer Autopilot Setup**.

**Acceleration Limiter:** Allows you to limit the speed of autopilot-controlled turns. You can increase the percentage to limit the turn rate, and decrease the percentage to allow higher turn rates.

### **Speed Source Settings**

**NOTE:** Speed source settings are available only for power boats.

To open the speed source settings, select **Menu > Setup > Dealer Autopilot Setup > Speed Source Setup**.

**Speed Source:** Allows you to select the speed source.

**Verify Tachometer:** Allows you to compare the RPM readings on the helm control with the tachometers on the dashboard of your boat.

**Planing RPM:** Allows you to adjust the RPM reading on the helm control at the point when your boat transitions from displacement to planing speed. If the value does not match the value on the helm control, you can adjust the value.

**Planing Speed:** Allows you to adjust the planing speed of your boat. If the value does not match the value on the helm control, you can adjust the value.

**Low RPM Limit:** Allows you to adjust the lowest RPM point of your boat. If the value does not match the value on the helm control, you can adjust the value.

**High RPM Limit:** Allows you to adjust the highest RPM point of your boat. If the value does not match the value on the helm control, you can adjust the value.

**Max. Speed:** Allows you to adjust the maximum speed of your boat. If the value does not match the value on the helm control, you can adjust the value.

### **Rudder Gain Settings**

**NOTE:** If you set these values too high or too low, the autopilot may become overactive, attempting to constantly adjust the heading at the slightest deviation. An overactive autopilot can cause excess wear on the pump and drain the battery at a faster-than-normal rate.

Select **Menu > Setup > Dealer Autopilot Setup > Rudder Gains**.

**NOTE:** These settings apply only to sailboats, displacement-hull powerboats, and powerboats with the speed source set to None.

**Gain:** Allows you to adjust how tightly the rudder holds a heading and makes turns.

**Counter Gain:** Allows you to adjust how tightly the rudder corrects turn overshoot. If you set this value too low, the autopilot can overshoot a turn when attempting to counter the original turn.

**NOTE:** These settings apply only to planing-hull powerboats with the speed source set to Tach. - NMEA 2000 or Proprietary or GPS.

**Low Speed:** Allows you to set the rudder gain for low speeds. This setting applies when the vessel operates below planing speed.

**Low Speed Counter:** Allows you to set the rudder gain counter-correction for low speeds. This setting applies when the vessel operates below planing speed.

**High Speed:** Allows you to set the rudder gain for high speeds. This setting applies when the vessel operates above planing speed.

**High Speed Counter:** Allows you to set the rudder gain counter-correction for high speeds. This setting applies when the vessel operates above planing speed.

### **Steering System Settings**

To open the steering system settings, select **Menu > Setup > Dealer Autopilot Setup > Steering System Setup**.

**Verify Steering Dir.:** Allows you to set the direction the rudder must move to turn the vessel to port and to starboard. You can test and reverse the steering direction if necessary.

### **Registering Your Device**

Help us better support you by completing our online registration today.

- Go to <http://my.garmin.com>.
- Keep the original sales receipt, or a photocopy, in a safe place.

### **Contacting Garmin Product Support**

- Go to [www.garmin.com/support](http://www.garmin.com/support) and click **Contact Support** for in-country support information.
- In the USA, call (913) 397.8200 or (800) 800.1020.
- In the UK, call 0808 2380000.
- In Europe, call +44 (0) 870.8501241.

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