GHP™ Reactor Mechanical

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.

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 Mechanical 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 ECU and is 5 m (16 ft.) long.
  - If the CCU cannot be mounted within 5 m (16 ft.) of the ECU, extension cables are available from your local Garmin dealer or at www.garmin.com.
  - This cable must not be cut.

Finding the Best Mounting Location

1. 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.
2. 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.
3. 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.

ECU Mounting and Connection Considerations

- The ECU can be mounted on a flat surface, facing any direction.
- Mounting screws are included with the ECU, but you may need to provide different screws if the supplied screws are not suitable for the mounting surface.
- The ECU must be located within 0.5 m (19 in.) of the drive unit.
  - The cables connecting the ECU to the drive unit cannot be extended.
- The ECU must be mounted in a location where it will not be submerged or exposed to wash down.
- The ECU power cable connects to the boat battery, and it can be extended if needed (Power Cable Extensions).

Drive Unit Mounting and Wiring Considerations

- If a compatible drive unit is not already installed on your boat, the drive unit is sold separately, and must be installed by an experienced professional in order to correctly steer your boat.
- The drive unit must be installed before the ECU is permanently mounted.
- The cables connected to the drive unit cannot be extended.
- If you are connecting to an existing drive unit (not sold by Garmin), a drive unit power cable (sold separately) must be used to adapt your drive unit for use with the autopilot system (Connecting to an Existing Drive Unit).
  - The drive unit power cable cannot be extended.
- If you are connecting to a solenoid drive unit, a solenoid power cable (sold separately) must be used to adapt your solenoid drive unit for use with the autopilot system (Connecting to a Solenoid Drive Unit).
  - The solenoid power cable cannot be extended.
- If you are connecting to a drive unit not sold by Garmin, you must also install a rudder feedback sensor, such as the Garmin GRF™ 10, or connect to an existing rudder-feedback sensor using a rudder feedback cable (sold separately).

  NOTE: The GHP Reactor Mechanical autopilot is compatible with a typical three-terminal, potentiometer-type rudder feedback sensor only. The system does not work with a frequency-based rudder feedback sensor.

Shadow Drive™ Mounting Considerations

NOTE: The Shadow Drive is a sensor you install in the hydraulic steering lines of your boat. It detects when you manually take control of the helm and suspends autopilot control of the boat. It is an optional accessory that can be used only on a boat with a hydraulic steering system.

- The Shadow Drive must be mounted horizontally and as level as possible, with cable ties firmly securing it in place.
- The Shadow Drive must be mounted at least 305 mm (12 in.) away from magnetic materials or devices, such as speakers or electric motors.
- The Shadow Drive should be mounted closer to the helm than to the pump.
- The Shadow Drive should be mounted lower than the helm, but higher than the pump.
- The Shadow Drive must not be connected directly to the fitting at the back of the helm. There must be a length of hose between the fitting at the helm and the Shadow Drive.
- The Shadow Drive must not be connected directly to a hydraulic T-connector in the hydraulic line. There must be a length of hose between a T-connector and the Shadow Drive.
- In a single-helm installation, there must not be a T-connector between the helm and the Shadow Drive.
- In a dual-helm installation, the Shadow Drive should be installed between the pump and the hydraulic T-connector that leads to the upper and lower helm, closer to the helm than to the T-connector.
- The Shadow Drive must be installed in either the starboard steering line or the port steering line.

  The Shadow Drive must not be installed in either the return line or the high-pressure line, if applicable.

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^2) wire.

NMEA 2000 Connection Considerations

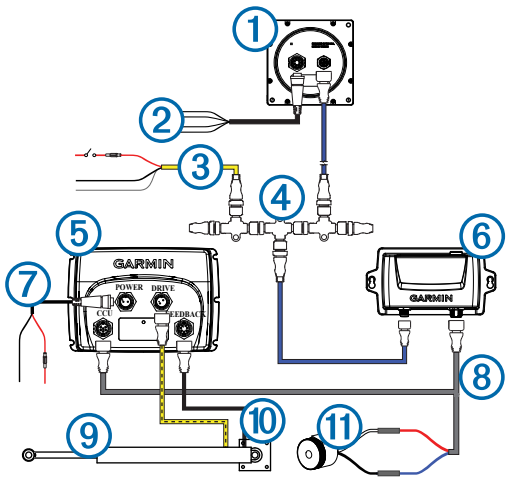
- The CCU and the helm control must connect to a NMEA 2000 network.
- If your boat does not already have a NMEA 2000 network, one can be built using the included NMEA 2000 cables and connectors (Building a Basic NMEA 2000 Network for the Autopilot System).

- 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

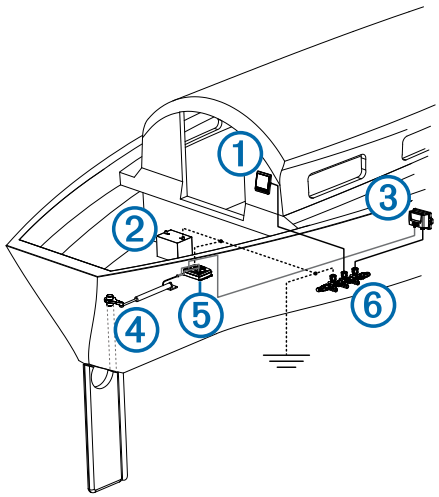
When connecting the power cable, do not remove the in-line fuse holder. To prevent the possibility of injury or product damage caused by fire or overheating, the appropriate fuse must be in place as indicated in the product specifications. In addition, connecting the power cable without the appropriate 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 (NMEA 0183 Connection Considerations).
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 (NMEA 2000 Connection Considerations). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (Building a Basic NMEA 2000 Network for the Autopilot System).
⑤	ECU	
⑥	CCU	The CCU can be mounted in a non-submerged location near the center of the boat, in any orientation (CCU Mounting and Connection Considerations). The CCU must be located away from sources of magnetic interference.
⑦	ECU power cable	The ECU must be connected to a 12 to 24 Vdc power source. To extend this cable, use the correct wire gauge (Power Cable Extensions).
⑧	CCU cable	To extend this cable to reach the ECU, extensions (sold separately) may be necessary (CCU Mounting and Connection Considerations). This cable connects to the alarm.
⑨	Drive unit	This diagram shows only the electrical connections for the drive unit (sold separately). Detailed installation instructions are included with the drive unit. If you purchased a drive unit from Garmin, it will come with the power and feedback cables needed.
⑩	Drive unit power and feedback cables	The drive unit power cable cannot be cut or extended. If you are using the autopilot with a drive unit not sold by Garmin, a drive unit power cable (sold separately) must be used (Connecting to an Existing Drive Unit). If you are using the autopilot with a solenoid drive unit, a solenoid power cable (sold separately), must be used (Connecting to a Solenoid Drive Unit). If you are using the autopilot with a drive unit not sold by Garmin or a solenoid drive unit, you must also install a Garmin rudder feedback sensor (recommended), or connect to an existing rudder feedback sensor using a rudder feedback cable (sold separately) (Drive Unit Installation).
⑪	Alarm	The alarm provides audible alerts from the autopilot system, and should be installed near the helm control (Installing the Alarm).

Component Layout

Single-Helm Layout



NOTE: This diagram is for planning purposes only. If needed, specific connection diagrams are included in the detailed installation instructions for each component.

Item	Description	Important Considerations
①	Helm control	
②	12 to 24 Vdc battery	The ECU must be connected to a 12 to 24 Vdc power source. To extend this cable, use the correct wire gauge (Power Cable Extensions). The NMEA 2000 power cable must be connected to a 9 to 16 Vdc power source.
③	CCU	The CCU can be mounted in a non-submerged location near the center of the boat, in any orientation (CCU Mounting and Connection Considerations). The CCU must be located away from sources of magnetic interference.

Item	Description	Important Considerations
④	Drive unit	The drive unit power cable cannot be cut or extended. If you are using the autopilot with a drive unit not sold by Garmin, a drive unit power cable (sold separately) must be used (Connecting to an Existing Drive Unit). If you are using the autopilot with a solenoid drive unit, a solenoid power cable (sold separately), must be used (Connecting to a Solenoid Drive Unit).
⑤	ECU	
⑥	NMEA 2000 network	The helm control and the CCU must be connected to a NMEA 2000 network using the included T-connectors (NMEA 2000 Connection Considerations). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (Building a Basic NMEA 2000 Network for the Autopilot System).

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).

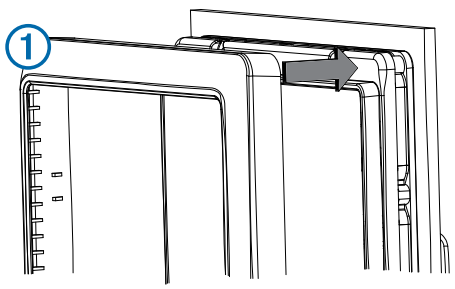
1. Trim the flush-mount template and ensure it fits in the selected mounting location.

   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.

ECU Installation

Mounting the ECU

Before you can mount the ECU, you must select a location and determine the correct mounting hardware (ECU Mounting and Connection Considerations).

1. Hold the ECU in the intended mounting location and mark the locations of the mounting holes on the mounting surface, using the ECU as a template.
2. Using a drill bit appropriate for the mounting surface and selected mounting hardware, drill the four holes through the mounting surface.
3. Secure the ECU to the mounting surface using the selected mounting hardware.

Connecting the ECU to Power

⚠ 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.

You should connect the ECU power cable directly to the boat battery, if possible. Although it is not recommended, if you connect the power cable to a terminal block or other source, you must connect it through a 40 A fuse.

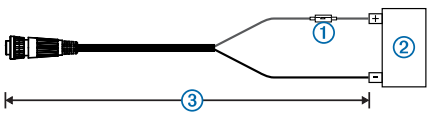
If you plan to route the ECU power through a breaker or a switch near the helm, you should consider using an appropriately sized relay and control wire instead of extending the ECU power cable.

1. Route the connector-terminated end of the ECU power cable to the ECU, but do not connect it to the ECU.
2. Route the bare-wire end of the ECU power cable to the boat battery.

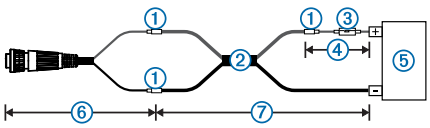
   If the wire is not long enough, it can be extended (Power Cable Extensions).
3. Connect the black wire (-) to the negative (-) terminal of the battery, and connect the red wire (+) to the positive (+) terminal of the battery.
4. After you install all of the other autopilot components, connect the power cable to the ECU.

Power Cable Extensions

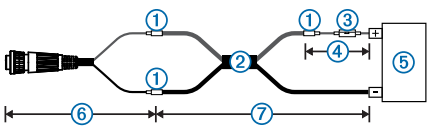
If necessary, the power cable can be extended using the appropriate wire gauge for the length of the extension.



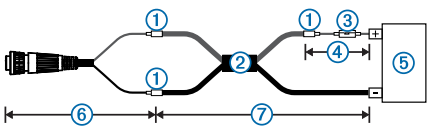
Item	Description
①	Fuse
②	Battery
③	9 ft. (2.7 m) no extension



Item	Description
①	Splice
②	10 AWG (5.26 mm²) extension wire
③	Fuse
④	8 in. (20.3 cm)
⑤	Battery
⑥	8 in. (20.3 cm)
⑦	Up to 15 ft. (4.6 m)



Item	Description
①	Splice
②	8 AWG (8.36 mm²) extension wire
③	Fuse
④	8 in. (20.3 cm)
⑤	Battery
⑥	8 in. (20.3 cm)
⑦	Up to 23 ft. (7 m)



Item	Description
①	Splice
②	6 AWG (13.29 mm²) extension wire
③	Fuse
④	8 in. (20.3 cm)
⑤	Battery
⑥	8 in. (20.3 cm)
⑦	Up to 36 ft. (11 m)

Drive Unit Installation

The drive unit (sold separately) must be connected to your rudder control so the GHP Reactor Mechanical autopilot can steer your boat. When you purchase a drive unit sold by Garmin, it will include the correct cables, connectors, and instructions.

If a drive unit is installed on your boat already, you can use a drive unit power cable (sold separately) to adapt your drive unit for use with the autopilot system.

If you connect the autopilot system to a drive unit not sold by Garmin, you must also provide rudder-feedback information by installing and connecting a Garmin rudder-feedback sensor (recommended) or by connecting to an existing rudder-feedback sensor on your boat using a rudder feedback cable (sold separately).

Installing a Garmin Drive Unit

Follow the installation instructions provided with your Garmin drive unit to mount it and connect it to your rudder control and autopilot system.

Corrosion Blocker

NOTICE

To ensure long life of all parts, apply corrosion blocker to the drive unit at least twice yearly.

A marine-rated corrosion blocker should be applied to the drive unit after all connections are made.

Connecting to an Existing Drive Unit

You must install a drive unit power cable to use a drive unit not sold by Garmin with the GHP Reactor Mechanical autopilot. This cable is sold separately.

These instructions do not apply to a solenoid-type drive unit (Connecting to a Solenoid Drive Unit).

1. If necessary, use the installation instructions provided with the drive unit to install it on your boat.
2. If your drive unit has cables connected, disconnect the cables.
3. Consult the documentation provided by the manufacturer of your drive unit to identify the connections on your drive unit.
4. Connect the drive unit power cable (not included) to your drive unit, based on the wire colors and functions in the table.

   The drive unit power cable cannot be extended.

Wire Color	Function
Red	Drive unit positive (+)
Black	Drive unit negative (-)
Blue	Clutch power (cut and tape this wire if your drive unit has no clutch)
White	Clutch ground (cut and tape this wire if your drive unit has no clutch)

5. Connect the drive unit power cable to the ECU.

Connecting to a Solenoid Drive Unit

You must install the solenoid power cable to use a solenoid drive unit with the GHP Reactor Mechanical autopilot system. This cable is sold separately.

These instructions apply only to solenoid-type drive units.

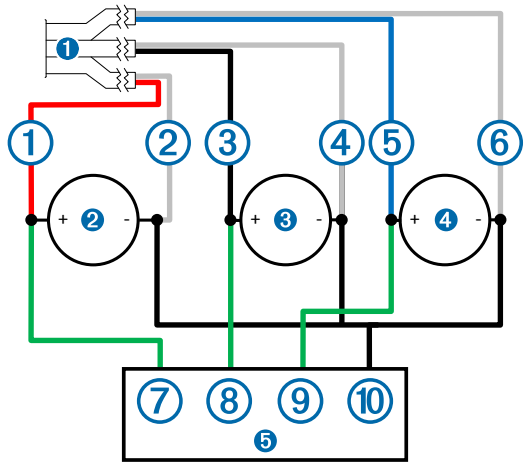
1. If necessary, use the installation instructions provided with the solenoid drive unit to install it on your boat.

2 If your solenoid drive unit has cables connected, disconnect the cables.

3 Consult the documentation provided by the manufacturer of your solenoid drive unit to identify the connections on your drive unit.

4 Connect the solenoid power cable (not included) to your solenoid drive unit, based on the diagram and tables.

The solenoid power cable is 0.8 m (2.6 ft.) long, and cannot be extended.



Item	Description	Notes
❶	Solenoid power cable	Sold separately.
❷	Starboard solenoid	
❸	Port solenoid	
❹	Bypass solenoid	May not be present in all systems.
❺	Auxiliary steering system	May not be present in all systems.

Wire	Color	Description
①	Red	Connect to starboard solenoid positive (+).
②	White/red	Connect to starboard common (-).
③	Black	Connect to port solenoid positive (+).
④	White/black	Connect to port common (-).
⑤	Blue	Connect to bypass solenoid positive (+). Cut and tape this wire if no bypass solenoid is present.
⑥	White/blue	Connect to bypass solenoid common (-). Cut and tape this wire if no bypass solenoid is present.
⑦	N/A	Auxiliary steering starboard positive (+) (if present).
⑧	N/A	Auxiliary steering port positive (+) (if present).
⑨	N/A	Auxiliary steering bypass positive (+) (if present).
⑩	N/A	Auxiliary steering common (-) (if present).

5 Connect the solenoid power cable to the ECU.

Installing a Garmin Rudder Feedback Sensor

If you installed a drive unit provided by Garmin, rudder feedback data is provided by the drive unit, and a separate rudder feedback sensor is not required. If you are connecting the autopilot to a drive unit not sold by Garmin, you must also install a rudder feedback sensor, such as the GRF 10 (sold separately).

Follow the installation instructions provided with your GRF rudder feedback sensor to connect it to your rudder control and autopilot system.

Connecting to an Existing Rudder Feedback Sensor

If you connected the autopilot to a drive unit not sold by Garmin, and you plan to connect to a rudder feedback sensor not sold by Garmin, you must use a rudder feedback cable to connect your sensor to the GHP Reactor Mechanical autopilot. This cable is sold separately.

NOTE: The GHP Reactor Mechanical autopilot is compatible with a typical three-terminal, potentiometer-type rudder feedback sensor only. The system does not work with a frequency-based rudder feedback sensor.

1 If necessary, use the installation instructions provided with the rudder feedback sensor to install it on your boat.

2 If your rudder feedback sensor has cables connected, disconnect the cables.

3 Consult the documentation provided by the manufacturer of your rudder feedback sensor to identify the connections on your rudder feedback sensor.

4 Connect the rudder feedback cable (not included) to your drive unit, based on the wire colors and functions in the table.

If necessary, the cable can be extended using 22 AWG (0.33 mm^2) wire.

Wire Color	Function
Red	Rudder feedback positive (+)
Black	Rudder feedback negative (-)
Yellow	Rudder feedback wiper

5 Connect the rudder feedback cable to the ECU.

Connecting the CCU

1 Route the connector end of the CCU cable to the ECU 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^2 (28 AWG) wire.

3 Route the brown and black wires from the bare-wire portion of the CCU cable to the location where you plan to install the Shadow Drive (Installing the Shadow Drive) (optional).

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

If you do not plan to install the Shadow Drive, cut and tape the brown and black wires.

Installing the Shadow Drive

NOTE: The Shadow Drive is an optional accessory that can be used only on a boat with a hydraulic steering system.

Connecting the Shadow Drive to the Hydraulic System

Before you can install the Shadow Drive, you must select a location at which to connect the Shadow Drive to the hydraulic steering of your boat (Shadow Drive™ Mounting Considerations).

Use hydraulic connectors (not included) to install the Shadow Drive in the appropriate hydraulic line.

Connecting the Shadow Drive to the CCU

1 Route the bare-wire end of the CCU cable to the Shadow Drive.

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

2 Connect the cables, based on this table.

Shadow Drive Wire Color	CCU Cable Wire Color
Red (+)	Brown (+)
Black (-)	Black (-)

3 Solder and cover all bare-wire connections.

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^2) 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.

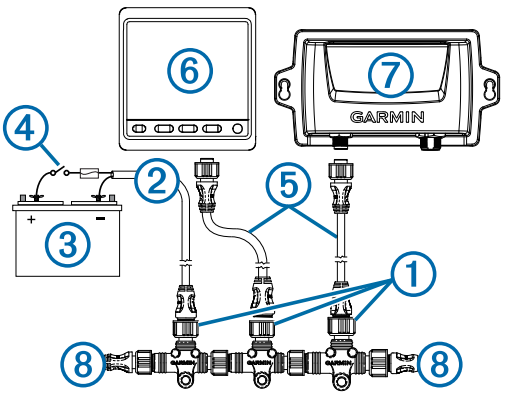
If you are unfamiliar with NMEA 2000, you should read the "NMEA 2000 Network Fundamentals" chapter of the *Technical Reference for NMEA 2000 Products*. To download this document, select Manuals on the product page for your device at www.garmin.com.

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.

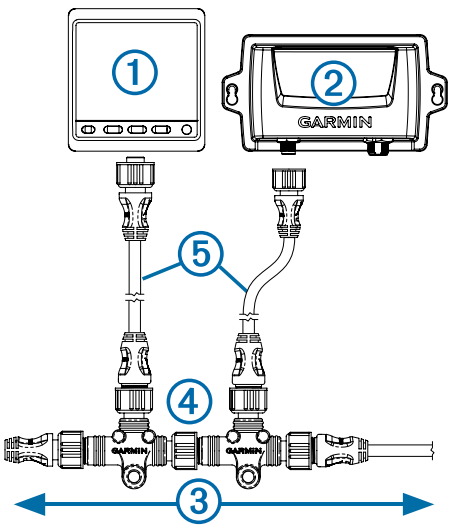
4 Connect one of the included NMEA 2000 drop cables ⑤ to one of the T-connectors and to the helm control ⑥.

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 Wizardwhile 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. Select the drive unit class (Selecting the Drive Unit Class).
5. If you have a drive unit not sold by Garmin, select the drive-unit voltage and the drive-unit-clutch voltage (Selecting the Drive-Unit Voltage and Drive-Unit-Clutch Voltage).
6. If you have a solenoid drive unit, select the solenoid voltage and the solenoid bypass-valve voltage (Selecting the Solenoid Voltage and Solenoid Bypass-Valve Voltage).
7. If necessary, enable the Shadow Drive (Enabling the Shadow Drive).
8. Calibrate the rudder sensor (Calibrating the Rudder).
9. If you have a drive unit not sold by Garmin, tune the drive unit (Tuning an Existing Drive Unit).
10. Test the steering direction (Testing the Steering Direction).
11. If necessary, select the speed source (Selecting the Speed Source).
12. If necessary, verify the tachometer (Verifying the Tachometer).
13. Review the results of the Dockside Wizard (Reviewing the Results of the Dockside Wizard).

Selecting the Drive Unit Class

On the helm control, select an option:

- If you installed a Garmin Class A drive unit, select **Class A**.
- If you installed a Garmin Class B drive unit, select **Class B**.
- If you connected the autopilot to an existing solenoid drive unit, select **Solenoid**.
- If you connected the autopilot to an existing drive unit not sold by Garmin, select **Other**.

Selecting the Drive-Unit Voltage and Drive-Unit-Clutch Voltage

NOTICE

Providing an incorrect drive-unit-voltage value or drive-unit-clutch-voltage value for your drive unit can damage your drive unit.

These settings apply only to drive units not sold by Garmin.

1. Consult the manufacturer of your drive unit to determine the drive-unit voltage and drive-unit clutch voltage.
2. On the helm control, select the voltage approved for your drive unit.
3. Select the voltage approved for your drive-unit clutch.

Selecting the Solenoid Voltage and Solenoid Bypass-Valve Voltage

NOTICE

Providing an incorrect solenoid-voltage value or solenoid-bypass-valve-voltage value for your drive unit can damage your drive unit.

These settings apply only to solenoid-type drive units.

1. Consult the manufacturer of your solenoid drive unit to determine the solenoid voltage and the solenoid bypass-valve voltage.
2. On the helm control, select the voltage approved for your solenoid drive unit.
3. Select the bypass-valve voltage approved for your solenoid drive unit.

Calibrating the Rudder

NOTE: If an error appears during these steps, the rudder feedback sensor may have reached its limit. If this happens, the rudder feedback sensor may not have been installed correctly. If the problem persists, you can continue with calibration by moving the rudder to the farthest position that does not report an error.

1. Position the rudder so that the boat would steer fully starboard and select **OK**.
2. After the starboard calibration is complete, position the rudder so that the boat would steer fully port, and select **OK**.
3. After the port calibration is complete, center the rudder position, let go, and select **Begin**.

   The autopilot takes control of the rudder.
4. Without touching the rudder or helm control, allow the autopilot to calibrate the rudder.
5. Select an option:
   - If the calibration did not complete successfully, repeat steps 1 through 4.
   - If the calibration completed successfully, select **OK**.

Enabling the Shadow Drive

If you installed the autopilot on a boat with a hydraulic steering system, you can install a Garmin Shadow Drive valve (sold separately).

On the helm control, select an option:

- Select **No** if you did not install a Shadow Drive valve.
- Select **Yes** if you installed a Shadow Drive valve.

Tuning an Existing Drive Unit

NOTE: This process does not apply to solenoid drive units.

If you connected the autopilot to a drive unit not sold by Garmin, you must tune the drive unit for use with the autopilot system.

1. Center the rudder position and let go of the helm.
2. On the helm control, select **Continue**.

   The autopilot takes control of the rudder as it tunes the drive unit. A message appears on the helm control when the tuning is complete.
3. After the tuning is complete, select an option:
   - If the tuning completes successfully, select **Done**.
   - If the tuning is not successful, repeat steps 1 through 3.

   NOTE: If needed, you can refine the tuning later, using the advanced settings (Performing Advanced Tuning Procedures for an Existing Drive Unit).

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 though 3.

Selecting the Speed Source

NOTE: This procedure applies only to power planing hull and power displacement hull vessels. It does not appear when configuring the autopilot for a sailboat.

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 applies only to power planing hull and power displacement hull vessels. It does not appear when configuring the autopilot for a sailboat.

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.
- On sailboats, the sails must be lowered.
- On sailboats, the motor must remain in a position that drives the boat in a straight direction.

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 sailboat, 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 sailboat, 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.

Manually Adjusting the Settings for an Existing Unit

NOTICE

Providing an incorrect Drive Unit Voltage, Clutch Voltage, or Drive Unit Max. Current value for your existing drive unit can damage your drive unit.

1. Enable dealer configuration (Enabling Dealer Configuration).
2. From the Heading screen, select **Menu** > **Setup** > **Dealer Autopilot Setup** > **Steering System Setup** > **Drive Unit Class**.
3. Select **Other** or **Solenoid**, according to the setting chosen in the **Dockside Wizard**.
4. Select an option:
   - Select **Generic Tune** to re-run the tuning procedure you completed during the **Dockside Wizard** (Tuning an Existing Drive Unit).
   - Select **Drive Unit Voltage** to adjust the drive-unit voltage according to the specifications provided by your drive-unit manufacturer.
   - Select **Clutch Voltage** to adjust the clutch voltage according to the specifications provided by your drive-unit manufacturer.
   - Select **Drive Unit Max. Current** to set the drive-unit-rated current value according to the specifications provided by your drive-unit manufacturer.
   - Select **Advanced Tuning** to perform high-level drive unit adjustments (Performing Advanced Tuning Procedures for an Existing Drive Unit).
   - Select **Restore Defaults** to reset the existing-drive-unit settings to the default values.

     After you reset the drive-unit settings to the default values, you must perform the **Generic Tune** procedure (Tuning an Existing Drive Unit).

If you adjust any of these values or run any of these tuning procedures, you must perform the autotune procedure again.

Performing Advanced Tuning Procedures for an Existing Drive Unit

NOTICE

You should perform these procedures only if you completely understand the concepts of drive-unit speed and error tolerance as defined below. Incorrectly setting these values can damage your drive unit, drain your battery at a faster-than-normal rate, or result in poor autopilot performance.

For almost every installation of a drive unit not sold by Garmin, the generic tuning procedure performed during the Dockside

Wizard is sufficient to calibrate the drive unit for use with the autopilot system. Use these advanced-tuning procedures only when you need to make slight adjustments to the performance of the drive unit.

Tuning the Speed on an Existing Drive Unit

This setting does not apply to solenoid drive units.

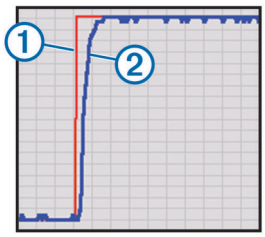
The speed of the drive unit determines how quickly it reacts to commands from the autopilot.

If you set the speed value too low, the drive unit appears slow and takes a long time to respond to commands from the autopilot.

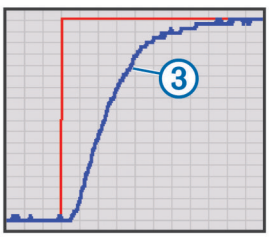
If you set the speed value too high, the drive unit reacts too quickly and can force the rudder to the stops at a high rate of speed. This could damage the drive unit or rudder stops and drain your battery at a faster-than-normal speed.

1. From the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Setup** > **Steering System Setup** > **Drive Unit Class** > **Other** > **Advanced Tuning** > **Tune Speed**.
2. Center the rudder position, let go of the rudder control, and select **Begin**.

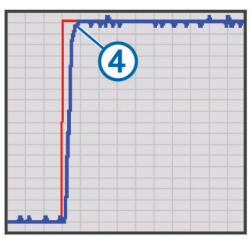
   A graph appears. The red line ① represents the intended position of the rudder. The blue line ② represents the actual position of the rudder.



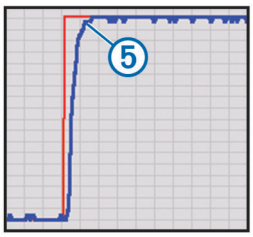
3. Select **Tune**, and observe the graph.
   - The intended rudder position (indicated by the red line) moves from +5° to -5° each time you select Tune, and the drive unit steers the rudder accordingly (indicated by the blue line).
   - If the drive-unit-speed value is set too low, it responds slowly. After you select Tune, the blue line draws a large slope ③ to the red line.



   - If the drive-unit-speed value is set too high, it reacts immediately and might force the rudder to the stops quickly. After you select Tune, the blue line draws a hard straight line that hits the red line without a slope ④.



   - If the drive unit speed is configured correctly, it reacts quickly and eases into the stop. After you select Tune, the blue line draws a straight line with a small slope ⑤ as it approaches the red line.



4. If necessary, select **Adjust**.
5. Select an option:
   - If the drive-unit-speed value is set too low, increase the value and repeat step 3.
   - If the drive-unit-speed value is set too high, decrease the value and repeat step 3.
6. After the drive-unit speed is tuned correctly, select **Done**.

Tuning the Error Tolerance on an Existing Drive Unit

If you have a drive unit not sold by Garmin, you can adjust the error tolerance on this existing drive unit if needed.

The error tolerance of the drive unit determines how much error the autopilot allows before adjusting the drive unit.

If you set the error tolerance too low, the drive unit reacts to the slightest course deviation. This causes the drive to work harder and may drain your battery at a faster-than-normal speed.

If you set the error tolerance too high, the drive unit does not react until your course is off a significant distance. This causes a less reliable heading hold, and can result in unnecessarily large course corrections.

1. From the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Setup** > **Steering System Setup** > **Drive Unit Class**.
2. Select **Other** or **Solenoid**, based on your selection in the **Dockside Wizard**.
3. Select **Advanced Tuning** > **Tune Error Tolerance**.
4. Center the rudder position, let go of the rudder control, and select **Begin**.
5. Select **Tune**.

   The rudder position moves from +5° to -5° each time you select Tune, and the drive unit steers the rudder accordingly.
6. After the drive unit stops, observe the **Rudder Error** and **Drive Unit Power** fields for 30 seconds.
   - If the Drive Unit Power field fluctuates, your error tolerance is set too low.
   - If the Drive Unit Power field stays at 0%, but the Rudder Error field shows a 1% or greater degree of error, your error tolerance is set too high.
   - An ideal error-tolerance configuration holds the Rudder Error field at approximately 0.5%, while the Drive Unit Power field stays at 0% for 30 seconds or longer.
7. If necessary, select an option:
   - If the drive-unit error-tolerance is set too low, select **Adjust**, increase the value, and repeat steps 3 through 6.
   - If the drive-unit error-tolerance is set too high, select **Adjust**, decrease the value, and repeat steps 3 through 6.
8. After the drive-unit error-tolerance is tuned correctly, select **Back**.

Appendix

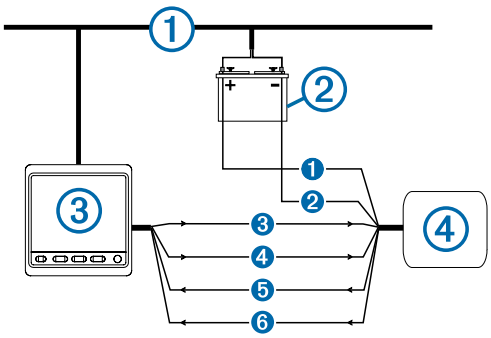
NMEA 0183 Connection Diagrams

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



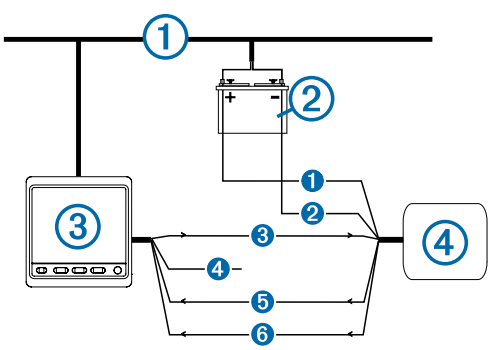
①	NMEA 2000 network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
❶	N/A	Power
❷	N/A	NMEA 0183 ground
❸	Blue — Tx/A (+)	Rx/A (+)
❹	White — Tx/B (-)	Rx/B (-)
❺	Brown — Rx/A (+)	Tx/A (+)
❻	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.



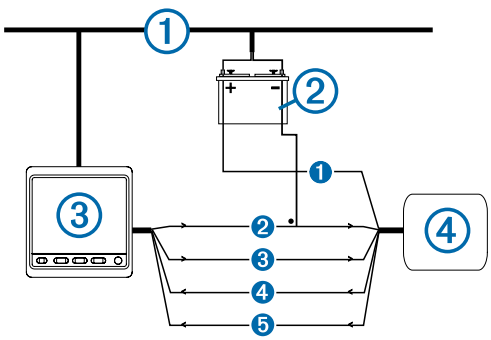
①	NMEA 2000network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
❶	N/A	Power
❷	N/A	NMEA 0183 ground
❸	Blue — Tx/A (+)	Rx
❹	White — unconnected	N/A
❺	Brown — Rx/A (+)	Tx/A (+)
❻	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
❶	N/A	Power
❷	Green — Rx/B (-) (connect to NMEA 0183 ground)	NMEA 0183 ground
❸	Blue — Tx/A (+)	Rx/A (+)
❹	White — Tx/B (-)	Rx/B (-)
❺	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	5 m (16 ft.)
NMEA 2000 input voltage	From 9 to 16 Vdc

Specification	Measurement
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.	

ECU

Specification	Measurement
Dimensions (W × H × D)	168 × 117 × 51 mm (6.6 × 4.6 × 2 in.)
Weight	680 g (24 oz.)
Temperature range	From -15° to 60°C (from 5° to 140°F)
Material	Fully gasketed, high-impact aluminum alloy
Water resistance	IEC 60529 IPX7*
Power cable length	2.7 m (9 ft.)
Input voltage ⎓	From 11.5 to 30 Vdc
Fuse	40 A, blade-type
Main power usage	1 A (not including the drive unit)
*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.	

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
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 www.garmin.com/waterrating.	

Alarm

Specification	Measurement
Dimensions (L×diameter)	$^{29}/_{32}$ × 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
	127257	Transmit/Receive attitude data
	127251	Transmit/Receive rate of turn
Transmit only	127245	Rudder data
Transmit only	127250	Vessel heading
Receive only	127245	Rudder data
Receive only	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
	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
	129284	Navigation Data
	129285	Navigation - Route/WP information
	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

Type	Sentence
	mwv
	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.	• Alarm sounds for 5 seconds • Continues in normal operation
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.	• Alarm sounds for 5 seconds • Autopilot transitions to heading hold
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.	• Alarm sounds for 5 seconds • Autopilot transitions to heading hold
Low GHC™ Supply Voltage	The supply voltage level has fallen below the value specified in the low voltage alarm menu.	N/A
Error: ECU High Voltage	The pump supply voltage has risen above 33.5 Vdc.	• Alarm sounds for 5 seconds • The ECU shuts down
Error: ECU Voltage has Dropped Rapidly	The ECU voltage has dropped quickly below 7.0 Vdc.	• Alarm sounds for 5 seconds • The error is cleared when the ECU voltage rises above 7.3 Vdc.
Error: ECU High Temperature	The ECU temperature has risen above 100°C (212°F).	• Alarm sounds for 5 seconds • The ECU shuts down
Error: Lost Communication Between ECU and CCU (when the autopilot is engaged)	Communication between the CCU and the pump has timed out.	• The helm control beeps, and autopilot transitions to standby.

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.

Rudder Sensor Settings

NOTE: Rudder sensor settings apply only when a rudder sensor is connected to the autopilot system.

To open the rudder sensor settings, select **Menu** > **Setup** > **Dealer Autopilot Setup** > **Steering System Setup** > **Rudder Sensor Setup**.

Max. Port Angle: Allows you to enter the angle at which your rudder turns furthest port.

Max. Starboard Angle: Allows you to enter the angle at which your rudder turns furthest starboard.

Calibrate Rudder Sensor: Initiates a procedure that establishes the maximum range of movement of the rudder and calibrates the rudder-position sensor. If an error appears during the calibration, the rudder-position sensor has likely reached its limit. The sensor might not be correctly installed. If the problem persists, you can bypass this error by moving the rudder to the farthest position that does not report an error.

Calibrate Rudder Center: Initiates a procedure that establishes the center position of the rudder. You can use this calibration if the on-screen rudder position indicator does not match the true rudder center on your boat.

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 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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