GHP™ 20 SmartPump Installation Instructions

To obtain the best possible performance and to avoid damage to your boat, install the Garmin® marine autopilot system according to these instructions. Professional installation of the autopilot system is highly recommended. Specific training in steering systems and in marine electrical connections is required to properly install the autopilot system.

Read all installation instructions before proceeding with the installation. If you experience difficulty during the installation, contact Garmin Product Support (page 20).

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 will enhance your capability to operate your boat. It does not relieve you from 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

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

Equipment to be connected to this product should have a fire enclosure or be provided with a fire enclosure.

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

Installation Preparation

⚠ 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.

The autopilot system consists of multiple components. 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 (page 3) to help understand the mounting and connection considerations.

Record the serial number of each component for registration and warranty purposes (page 20).

Tools Needed

- Safety glasses
- Drill and drill bits
- Wrenches
- 3½ in. (90 mm) hole saw
- Wire cutters/strippers
- Phillips and flat screwdrivers
- Cable ties
- Waterproof wire connectors (wire nuts) or heat shrink tubing and a heat gun
- Marine sealant
- Marine corrosion inhibitor spray
- Portable or handheld compass (to test for magnetic interference)
- Hydraulic hose with machine-crimped or field-replaceable fittings that have a minimum rating of 1000 lbf/in^2
- Hydraulic T-fittings
- Inline hydraulic shut-off valves
- Hydraulic fluid
- Thread sealant
- Hydraulic bleeding equipment
- Anti-seize lubricant (optional)

NOTE: Mounting screws are provided for the helm control, course computer unit (CCU), and pump. 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.

CCU Mounting Considerations

- The course computer unit (CCU), or compass ball, must be mounted in the forward half of the boat, no higher than 10 ft. (3 m) above the waterline.
- The CCU (or the pump) must not be mounted in a location where it will be submerged or exposed to wash-down.
- The CCU must not be mounted near magnetic material, magnets (speakers and electric motors), or high-current wires.
- The CCU must be mounted at least 24 in. (0.6 m) away from movable or changing magnetic disturbances such as anchors, anchor chains, wiper motors, and tool boxes.
- A handheld compass should be used to test for magnetic interference in the area where the CCU is to be mounted.

  If the handheld compass does not point north when you hold it where you want to mount the CCU, there is magnetic interference. Choose another location and test again.
- The CCU can be mounted below the waterline if it is not in a location where it will be submerged or exposed to wash-down.
- The CCU bracket must be mounted on a vertical surface or under a horizontal surface, so the connected wires hang straight down.
- Mounting screws are included with the CCU. You must provide different screws if the supplied screws are not suitable for the mounting surface.

CCU Connection Considerations

- The CCU cable connects the CCU to the pump and is 16 ft. (5 m) long.
  - If the CCU cannot be mounted within 16 ft. (5 m) of the pump, replacement and extension cables are available from your local Garmin dealer or at http://buy.garmin.com.
  - The CCU cable must not be cut.

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 (page 12).
- To use the advanced features of the autopilot, optional NMEA 2000-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, can be connected to the NMEA 2000 network.

Helm Control Mounting Considerations

- The mounting location should provide optimal viewing as you operate your vessel.
- The mounting location should allow easy access to the keys on the helm control.
- The mounting surface must be strong enough to support the weight of the helm control and protect it from excessive vibration or shock.
- The area behind the mounting surface must allow room for the routing and connection of the cables.
- There should be at least a 3 in. (8 cm) clearance behind the case of the helm control.
- The mounting location must be at least 9½ in. (241 mm) from a magnetic compass, to avoid interference.
- The mounting location must be in an area that is not exposed to extreme temperature conditions (page 18).

Helm Control Connection Considerations

- The helm control must connect to the NMEA 2000 network.
- Optional NMEA® 0183-compatible devices, such as wind sensors, water-speed sensors, or GPS devices can be connected to the helm control using a data cable (page 13).

Pump Mounting Considerations

Consult the hydraulic-layout diagrams starting on page 6 to help determine the pump-installation location.

- The pump must be mounted at a location to which you can extend the hydraulic steering lines of the boat.
- The pump has five hydraulic-connector fittings, although only three are used when installing the pump as recommended. The illustration on page 2 may be helpful when determining the fitting layout that is best for your installation location.

Pump Hydraulic Considerations

NOTICE

When adding hydraulic line to the system, use only hose with machine-crimped or field-replaceable fittings that have a minimum rating of 1000 lbf/in² (6,895 kPa).

Do not use plumber's tape on any hydraulic fitting. Use an appropriate thread sealant rated for marine use on all pipe threads in the hydraulic system.

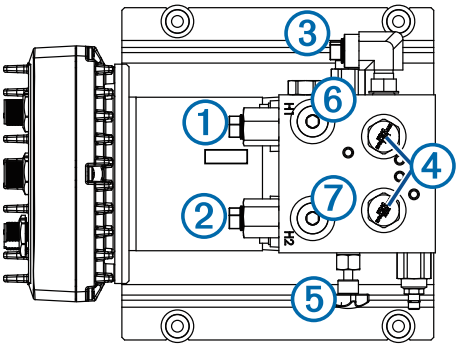
Do not attempt to use the autopilot to steer the boat until you bleed all air from each part of the hydraulic system.

Consult the hydraulic-layout diagrams starting on page 6 to help determine how to best install the pump in the hydraulic system of the boat.

The recommended pump installation method requires the installation of T-fittings and shutoff valves so the pump can be removed for service without disabling the steering system. This type of installation will use only three of the five ports on the manifold. Although it is not recommended, all five ports can be used instead of installing shutoff valves. See page 2 for more information on the fittings and alternate connection methods.

Pump Valves and Fittings

The pump can be connected to the hydraulic system using one of two methods. The recommended three-connector method uses only the C1 ① and C2 ② fittings, with a T-connector splitting the connection between the helm and cylinder. The return line fitting ③ connects to only the helm. The check valves ④ should not be reconfigured if the boat is equipped with a balanced cylinder. If the boat is equipped with an unbalanced cylinder, the check valves must be reconfigured (page 2). The bypass valve ⑤ is opened only for hydraulic bleeding, and must be fully tightened during normal operation.



If necessary, the H1 ⑥ and H2 ⑦ fittings can be used with the recommended three-connector installation instead of the C1 and C2 fittings.

Alternatively, the pump can be installed using all five connectors. This installation option uses the C1 and C2 fittings to connect the pump to the cylinder and the H1 and H2 fittings to connect the pump to the helm. This type of installation is not recommended, because the pump cannot be removed for service without disabling the steering system of the boat.

Configuring the Pump for an Unbalanced Cylinder

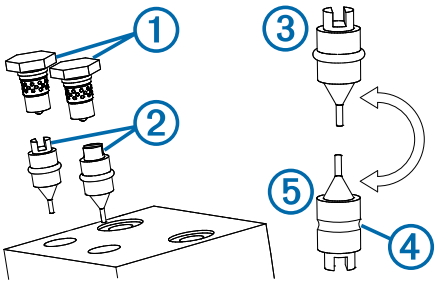
NOTICE

To avoid damage to the pump, keep all parts clean and free of dust and debris while configuring the pump for an unbalanced-cylinder steering system.

If you remove the check valves after bleeding the hydraulic system, you must bleed it again. Reconfiguring the check valves may introduce air into the hydraulic system.

If the boat has an unbalanced cylinder steering system, you must configure the pump to work properly with the steering system.

1 Remove the check valves ① from the pump manifold.



2 Pull the pistons ② out of the pump manifold.

The pump is configured from the factory with the pistons in the balanced configuration ③.

3 Remove the o-rings ④ from the pistons and discard them.

If you cannot easily pull the o-rings from the pistons, you may need to cut them.

4 Re-insert the pistons into the pump manifold in the unbalanced configuration ⑤.

5 Insert the check valves into the pump manifold, and tighten them.

Shadow Drive™ Mounting Considerations

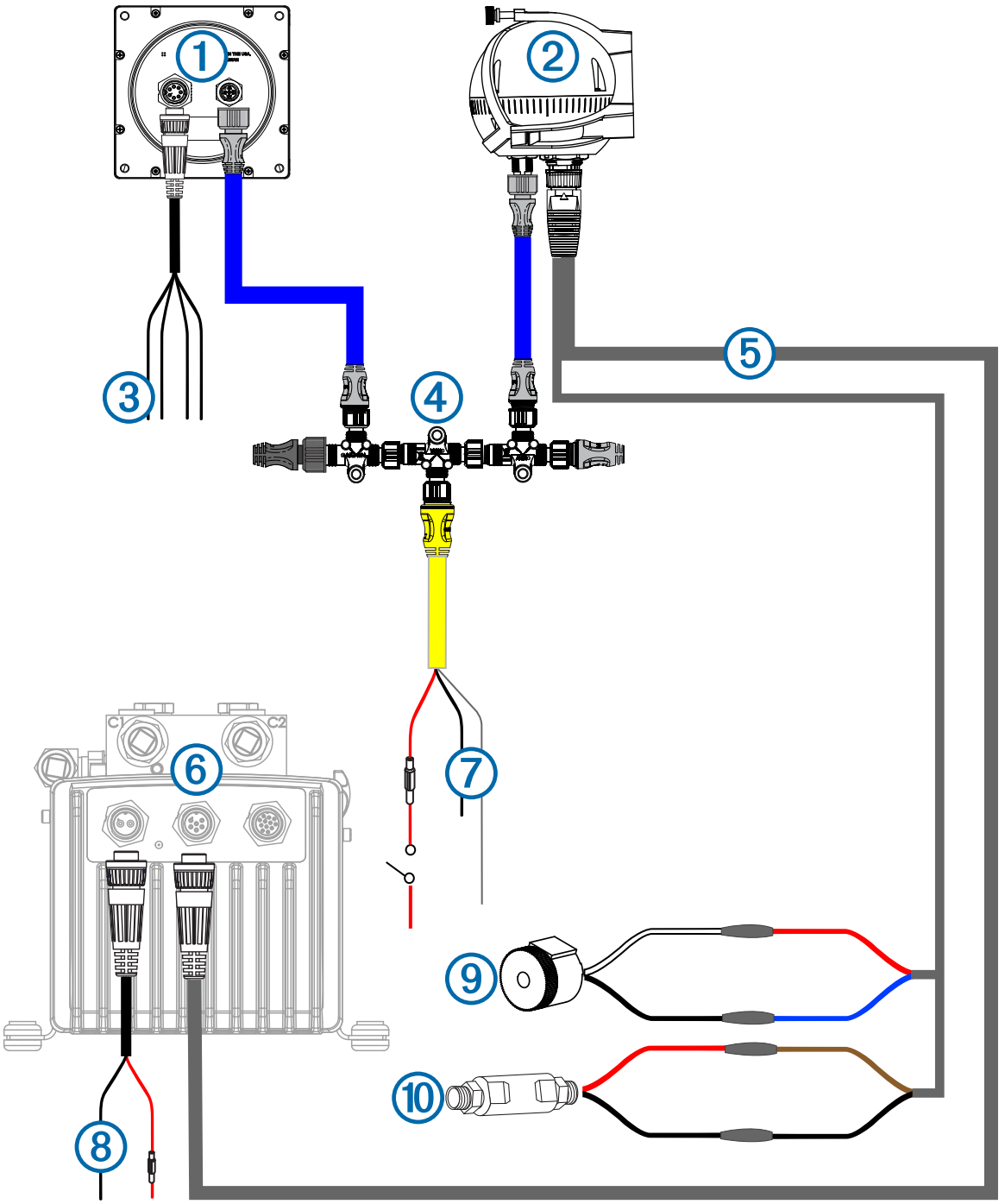
- The Shadow Drive must be mounted horizontally and as level as possible, with cable ties firmly securing it in place.
- The Shadow Drive must be mounted at least 12 in. (305 mm) away from magnetic material, such as speakers and electric motors.
- The Shadow Drive should be mounted closer to the helm 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 lower helm, closer to the helm than to the pump.
- The Shadow Drive can be installed in either the starboard steering line or the port steering line.

  The Shadow Drive must not be installed in the return line.

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.

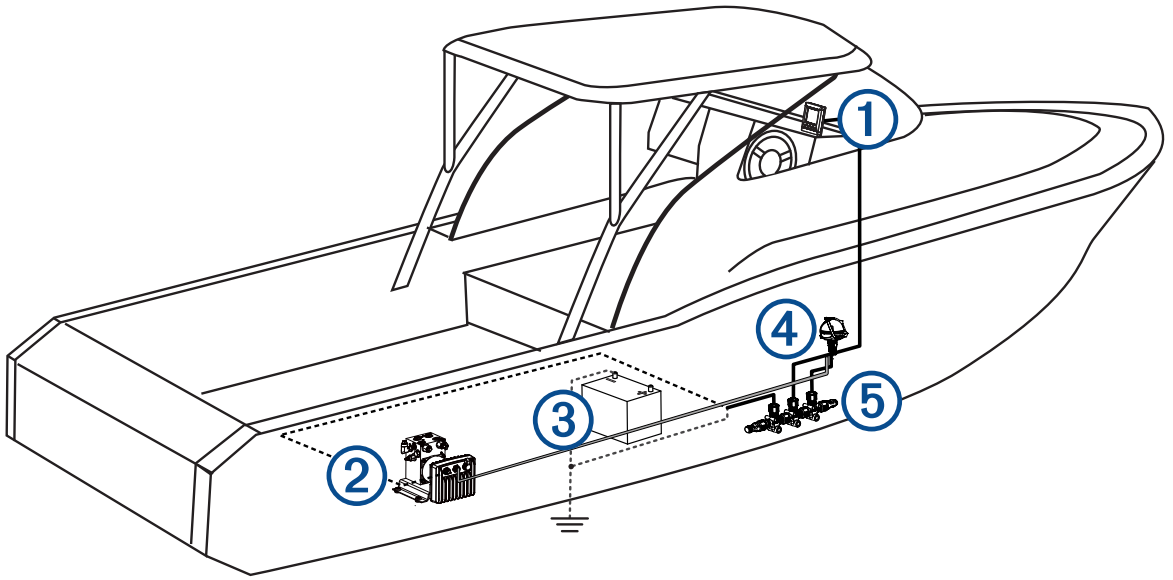


Item	Description	Important Considerations
①	Helm control	
②	CCU	This is the compass ball.
③	Helm control data cable	This cable should be installed only if you are connecting the autopilot to optional NMEA 0183-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device (page 13)
④	NMEA 2000 network	The helm control and the CCU must be connected to a NMEA 2000 network using the included T-connectors (page 2). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (page 12).
⑤	CCU cable	To extend this cable to reach the pump, purchase the necessary extensions (page 1). This cable connects to the alarm and the shadow drive.
⑥	Pump	This diagram does not show any hydraulic connections. See page 6 for hydraulic-layout diagrams.
⑦	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 (page 2). The NMEA 2000 power cable must be connected to a 9–16 Vdc power source.

Item	Description	Important Considerations
⑧	Pump power cable	The pump can be connected to a 12–24 Vdc power source. To extend this cable, use the correct wire gauge (page 13).
⑨	Alarm	See page 11 for alarm-wiring information.
⑩	Shadow Drive	See page 12 for Shadow Drive wiring information.

Component Layout

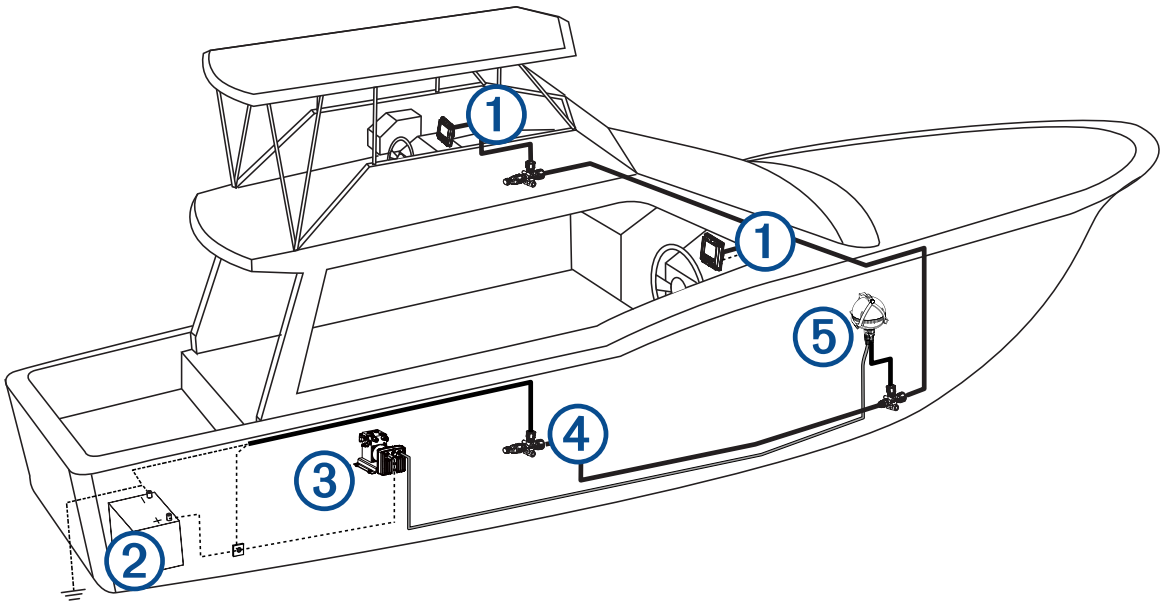
Single-Helm Layout



NOTE: This diagram is for planning purposes only. Specific connection diagrams are included in the detailed installation instructions for each component. Hydraulic connections are not shown in this diagram.

Item	Description	Important Considerations
①	Helm control	
②	Pump	
③	12–24 Vdc battery	The pump can be connected to a 12–24 Vdc power source. The NMEA 2000 power cable must be connected to a 9–16 Vdc power source.
④	CCU	The CCU must be installed in the front half of the boat, no higher than 10 ft. (3 m) above the waterline.
⑤	NMEA 2000 Network	The helm control and the CCU must be connected to a NMEA 2000 network using the included T-connectors (page 2). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (page 12).

Dual-Helm Layout Guidelines



NOTE: This diagram is for planning purposes only. Specific connection diagrams are included in the detailed installation instructions for each component. Hydraulic connections are not shown in this diagram.

Item	Description	Important Considerations
①	Helm control	
②	12–24 Vdc battery	The pump can be connected to a 12–24 Vdc power source. The NMEA 2000 power cable must be connected to a 9–16 Vdc power source.
③	Pump	
④	NMEA 2000 network	The helm control and the CCU must be connected to a NMEA 2000 network using the included T-connectors (page 2). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (page 12).
⑤	CCU	The CCU must be installed in the front half of the boat, no higher than 10 ft. (3 m) above the waterline.

Hydraulic Layouts

NOTICE

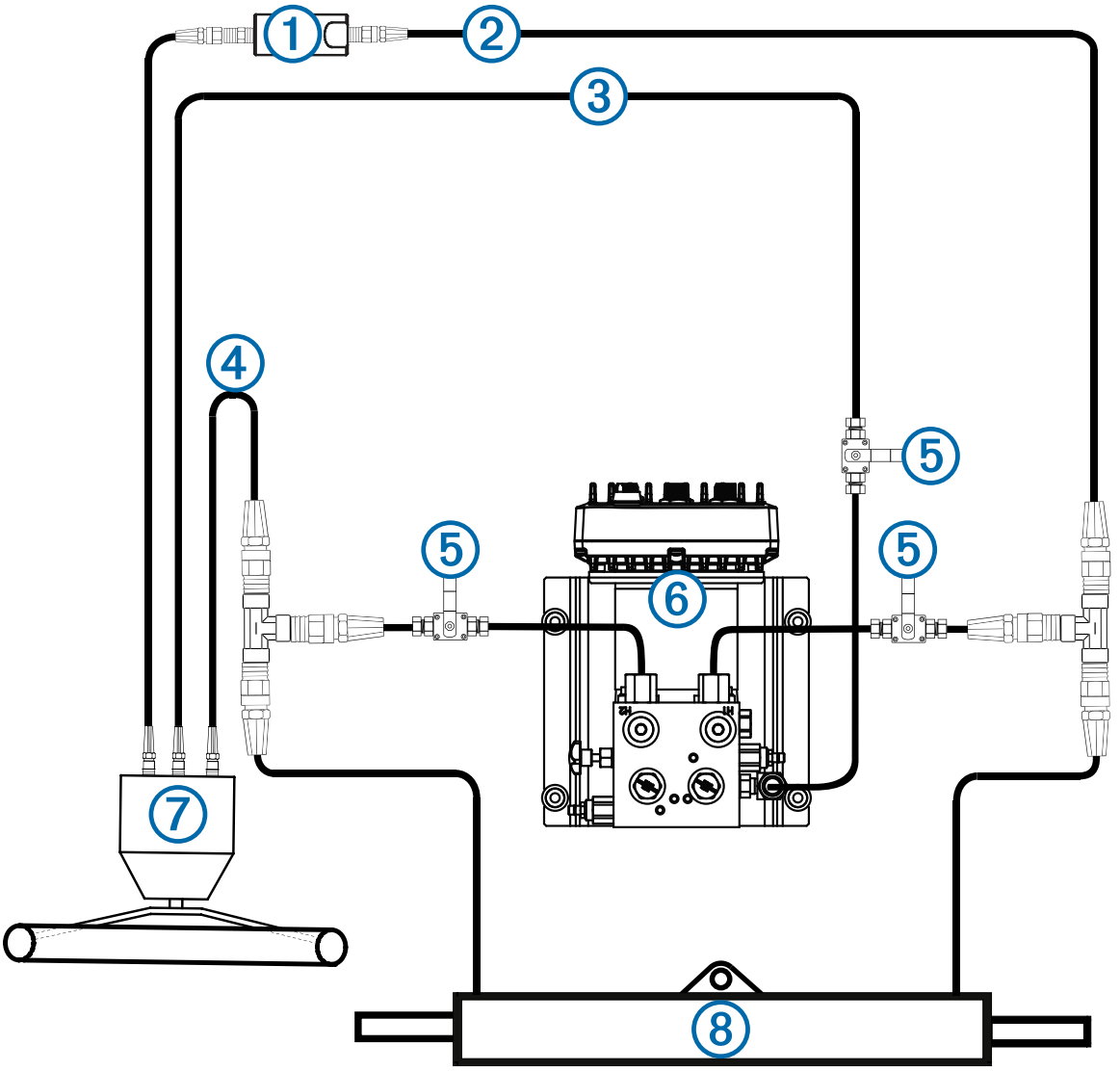
If the steering system in your boat does not match any of the hydraulic layouts in this manual and you are unsure how to install the pump, contact Garmin Product Support.

Before you start the pump installation, identify the type of hydraulic steering system in your boat. Each boat is different, and you must consider certain aspects of the existing hydraulic layout before deciding where to mount the pump.

Important Considerations

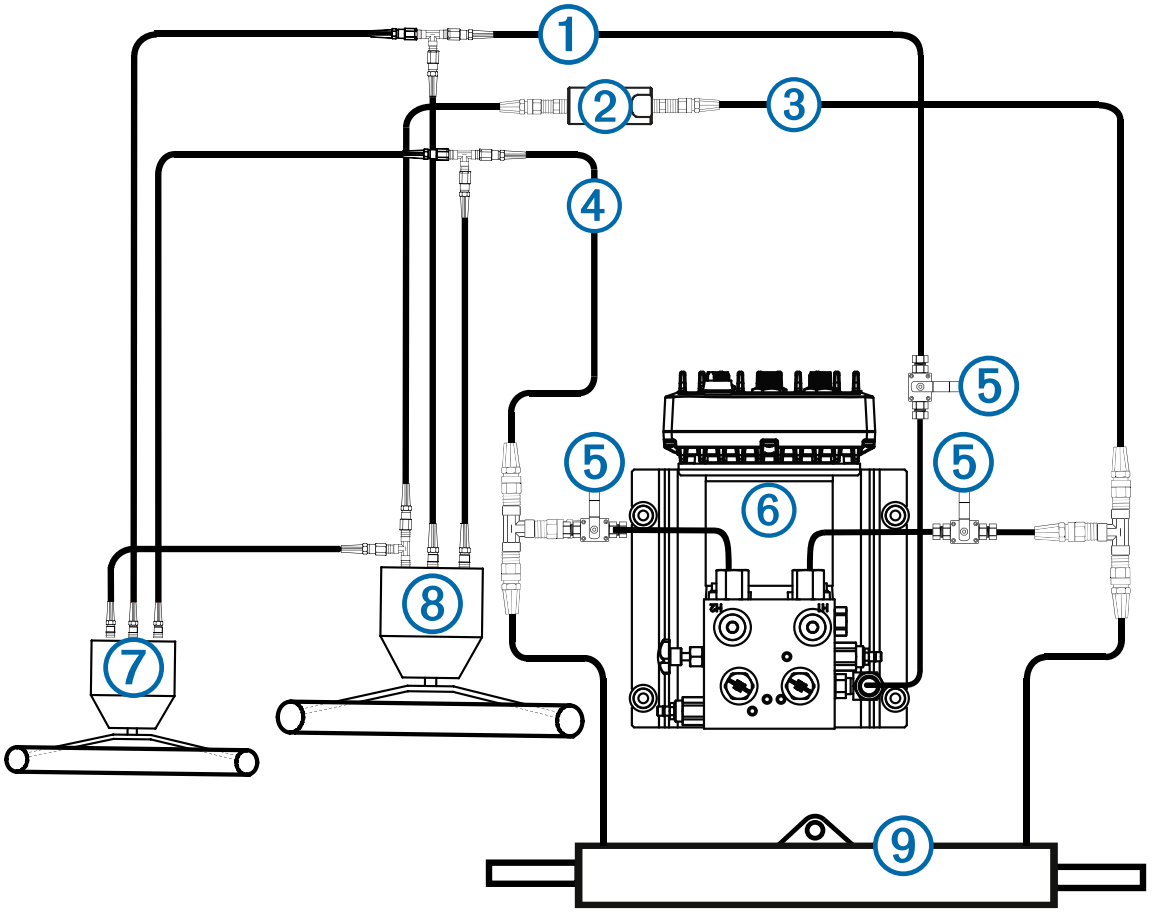
- The pump must be reconfigured if the boat is equipped with an unbalanced steering cylinder (page 2).
- Garmin recommends using T-connectors to connect the hydraulic lines to the pump.
- To allow for easy pump disabling and removal, Garmin recommends installing shut-off valves in the hydraulic lines between the pump manifold and T-connectors.
- Teflon® tape must not be used on any hydraulic fitting.
- An appropriate thread sealant should be used on all pipe threads in the hydraulic system.

Single-Helm without Power Assist Layout



①	Shadow Drive
②	Starboard line
③	Return line
④	Port line
⑤	Shut-off valves
⑥	Pump
⑦	Helm
⑧	Steering cylinder

Dual-Helm without Power Assist Layout



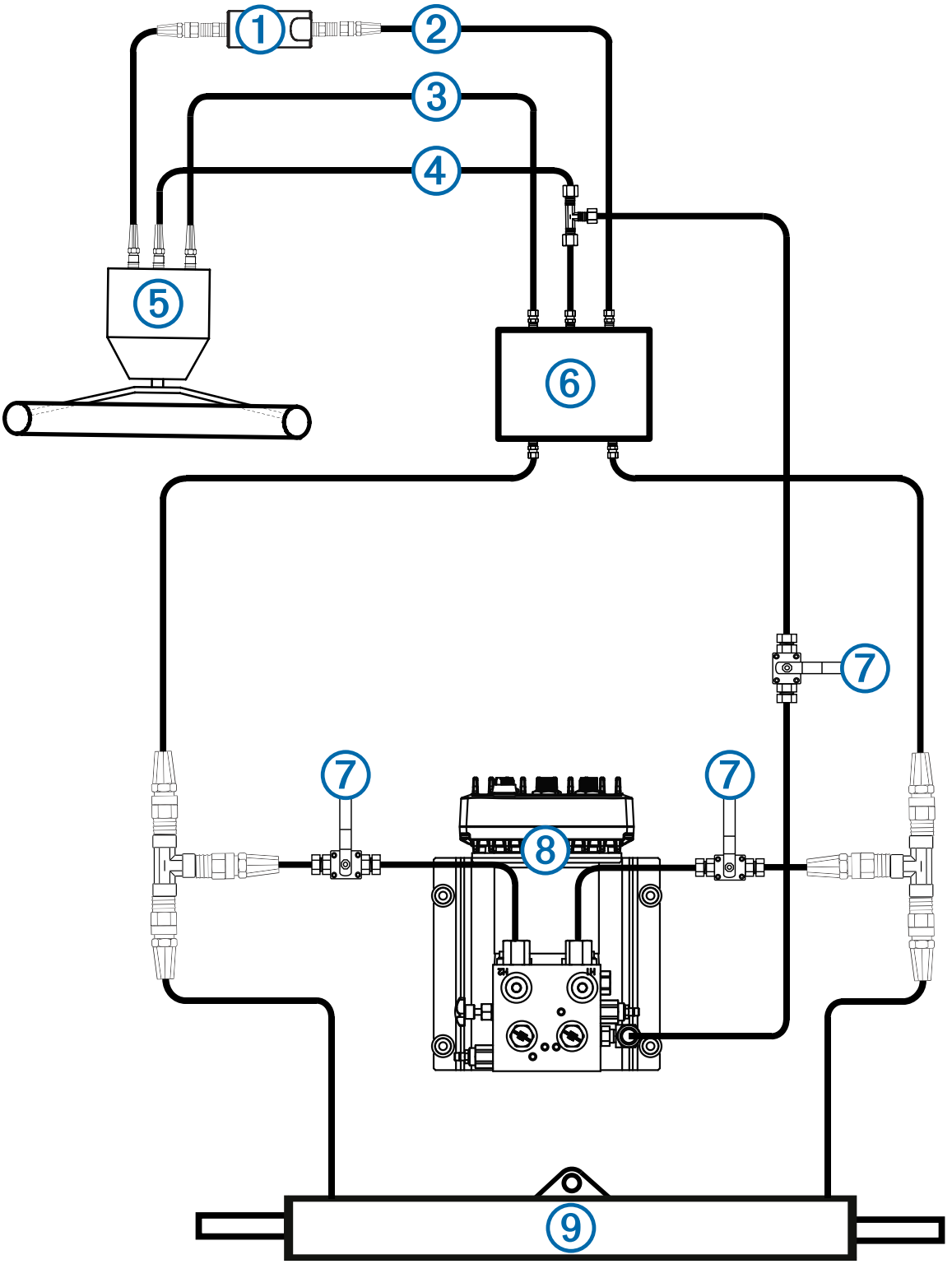
①	Return line
②	Shadow Drive
③	Starboard line
④	Port line
⑤	Shut-off valves
⑥	Pump
⑦	Upper helm
⑧	Lower helm
⑨	Steering cylinder

Single-Helm with Power Assist Layout

NOTICE

The pump must be installed between the cylinder and the power-assist module to function correctly.

NOTE: Removal of the power assist-module may be necessary to gain access to the fittings, hoses, and bleed-tee fitting.

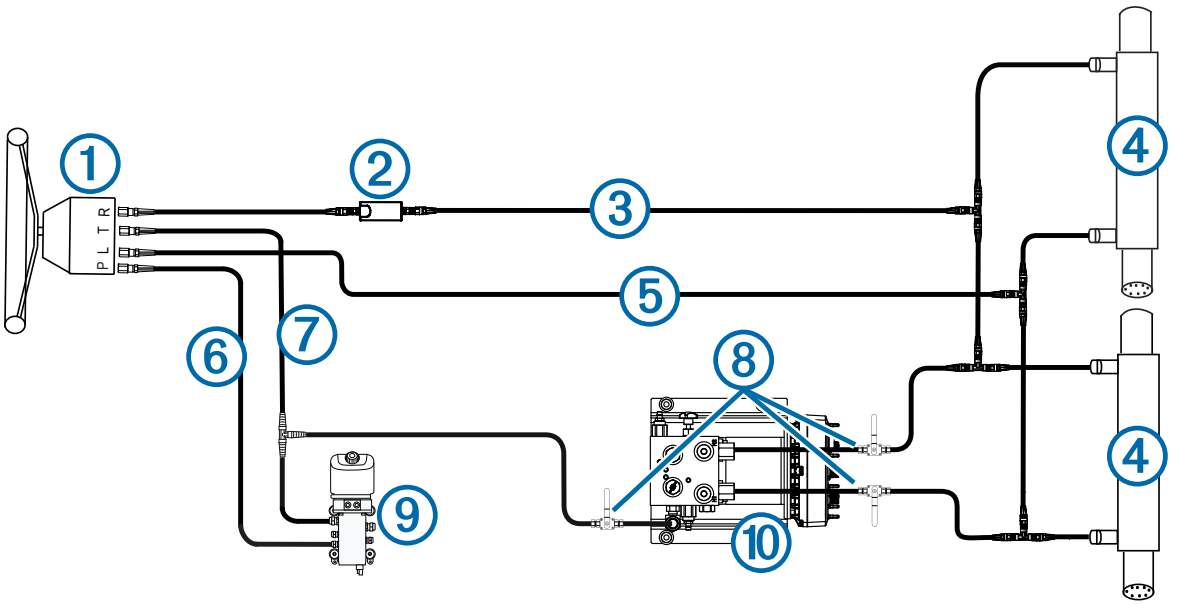


①	Shadow Drive
②	Starboard line
③	Port line
④	Return line
⑤	Helm
⑥	Power-assist module
⑦	Shut-off valves
⑧	Pump
⑨	Steering cylinder

Single-Helm with Uflex® MasterDrive™ Layout

⚠ CAUTION

When installing the pump in a system with a Uflex MasterDrive, do not cut the high-pressure line connecting the power unit to the helm to avoid injury or property damage.

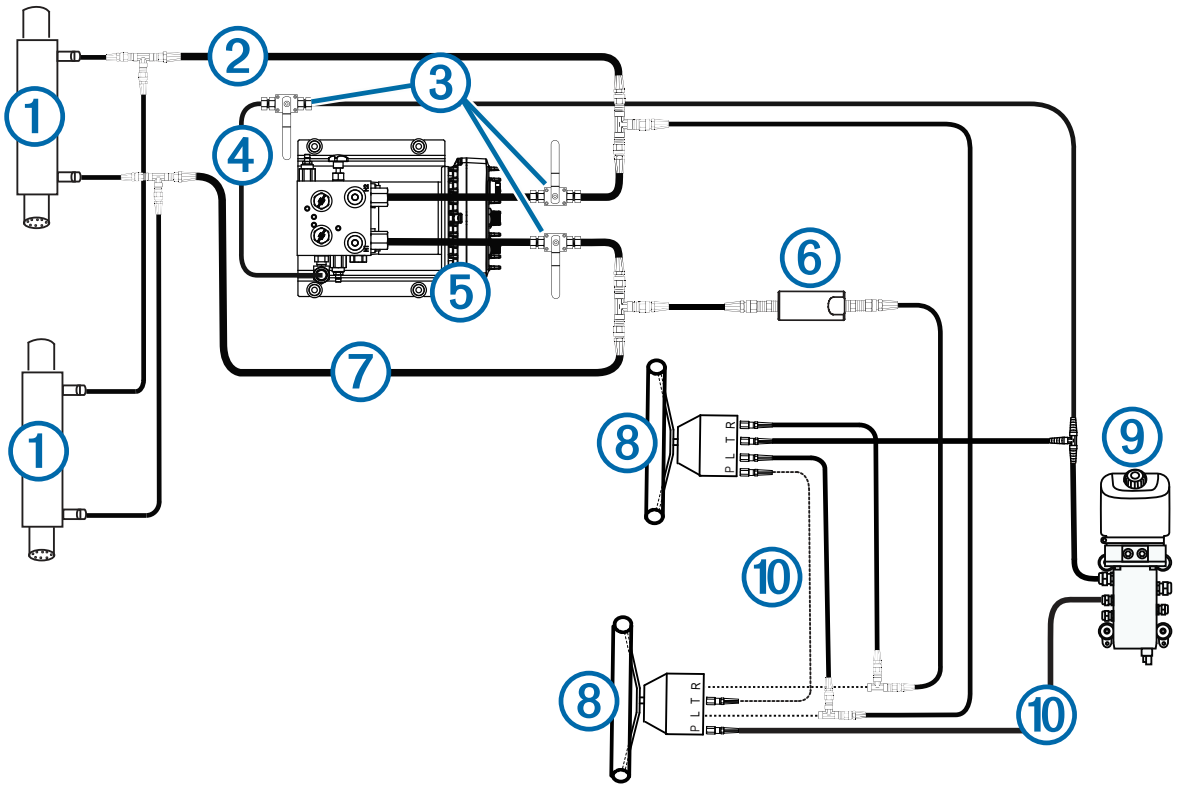


①	Helm
②	Shadow Drive
③	Starboard line
④	Steering cylinders
⑤	Port line
⑥	High pressure line - DO NOT CUT
⑦	Return line
⑧	Shutoff valves
⑨	Uflex MasterDrive power unit
⑩	Pump

Dual-Helm with Uflex MasterDrive Layout

⚠ CAUTION

When installing the pump in a system with a Uflex MasterDrive, do not cut the high-pressure line connecting the power unit to the helm to avoid injury or property damage.



①	Steering cylinders
②	Port line
③	Shutoff valves
④	Return line
⑤	Pump
⑥	Shadow Drive
⑦	Starboard line
⑧	Helms
⑨	Uflex MasterDrive power unit
⑩	High pressure line - DO NOT CUT

Installation Procedures

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.

CCU Installation

To install the CCU, you must mount it to your boat (page 10), connect it to the pump (page 11), connect it to a NMEA 2000 network (page 2), and connect it to the alarm (page 11).

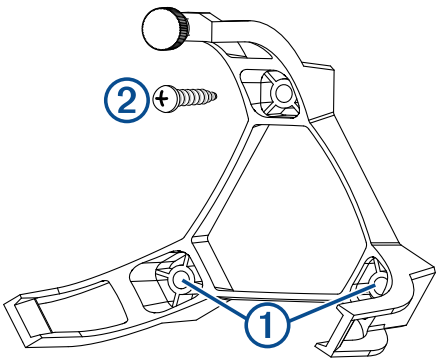
Installing the CCU Mounting Bracket

Before you can mount the CCU, you must select a mounting location (page 1) and determine the correct mounting hardware (page 1).

The CCU bracket has two portions, the mounting portion and the securing portion.

1. Use the mounting portion of the CCU bracket as a mounting template.

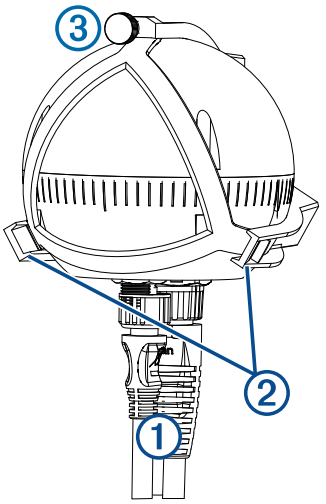
   If you are installing the CCU on a vertical surface, install the bracket with an opening at the bottom, so that the cables can hang straight down and are not blocked by the mounting hardware ①.



2. Use a pencil to mark the pilot-hole locations at the mounting location.
3. Drill the pilot holes.
4. Use screws ② to secure the CCU bracket to the mounting location.

Securing the CCU in the CCU Bracket

1. Connect the CCU cable and the NMEA 2000 drop cable to the CCU.
2. Place the CCU in the CCU bracket with the wires ① hanging straight down .



3 Place the top of the bracket over the ball and snap it into the mounted bracket, starting with the two arms ② that do not have the thumbscrew ③.

4 With the cables hanging straight down, connect the arm with the thumbscrew.

NOTE: The cables must hang straight down for the CCU to accurately read your heading.

5 Hand-tighten the thumbscrew until the CCU is held firmly in the bracket.

Do not overtighten the thumbscrew.

Connecting the CCU

1 Route the connector end of the CCU cable to the pump and make the connection.

2 Route the red and blue wires from the bare-wire portion of the CCU cable to the location where you plan to install the alarm (page 11).

If the cable is not long enough, extend the appropriate wires with 28 AWG (0.08 mm^2) 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 (page 12).

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

4 Cut and cover the remaining bare wires. The remaining bare wires are not used.

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

The temperature range for the helm control is from 5°F to 158°F (from -15°C to 70°C). Extended exposure to temperatures outside of this range (in storage or operating conditions) may cause failure of the LCD screen or other components. This type of failure and related consequences are not covered by the manufacturer's limited warranty.

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-galling, stainless anti-seize lubricant to the screws before installing them.

Before you can mount the helm control, you must select a mounting location (page 2).

1 Trim the flush-mount template and ensure it will fit in the location where you plan to mount the helm control.

The flush-mount template is included in the helm control product box.

2 Remove the liner from the adhesive on the back of the template and apply it to the location where you plan to mount the helm control.

3 If you will be cutting the hole with a jigsaw instead of a 3.5 in. (90 mm) hole saw, use a 3/8 in. (10 mm) drill bit to drill a pilot hole as indicated on the template to begin cutting the mounting surface.

4 Using the jigsaw or the 3.5 in. (90 mm) hole saw, cut the mounting surface along the inside of the dashed line indicated on the flush-mount 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 $^1/_8$ in. (3.2 mm) pilot holes.

If you are mounting the helm control in fiberglass, use a countersink bit as advised in the notice.

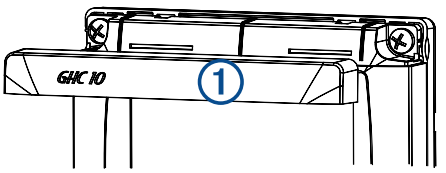
10 Remove the remainder of the template.

11 Place the helm control into the cutout.

12 Securely fasten the helm control to the mounting surface using the supplied screws.

If you are mounting the helm control in fiberglass, use a anti-galling lubricant as advised in the notice.

13 Snap the mounting covers ① into place.



Installing the Alarm

Before you can mount the alarm, you must select a mounting location (page 1).

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 (+)	Red (+)
Black (-)	Blue (-)

3 Solder and cover all bare-wire connections.

4 Secure the alarm with cable ties or other appropriate mounting hardware (not included).

Installing the Shadow Drive

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, after you have read and followed the mounting and connection considerations (page 3).

For further assistance, consult the hydraulic-layout diagrams (page 6).

Use the included connectors 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 mm²) 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.

About 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 included 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 (page 12).

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

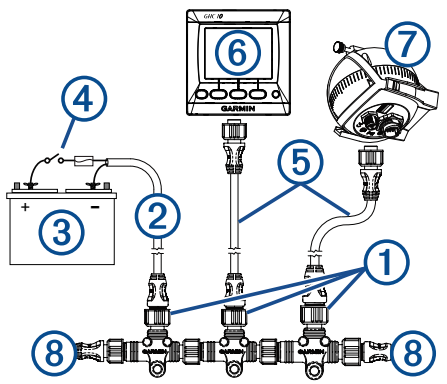
For more information on NMEA 2000, go to www.garmin.com.

Building a Basic NMEA 2000 Network for the Autopilot System

NOTICE

You must connect the included NMEA 2000 power cable 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 by their sides.

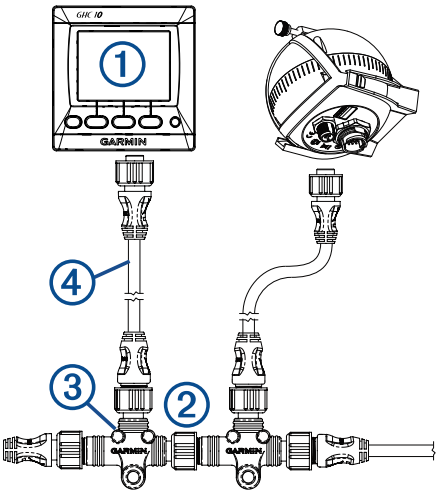


2. Connect the included NMEA 2000 power cable ② to a 12 Vdc power source ③ through a switch.

   Connect the power cable to the ignition switch ④ of the boat if possible, or route it through an inline switch (not included).
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 Helm Control to the Existing NMEA 2000 Network

1. Determine where to connect the helm control ① to your existing NMEA 2000 backbone ②.

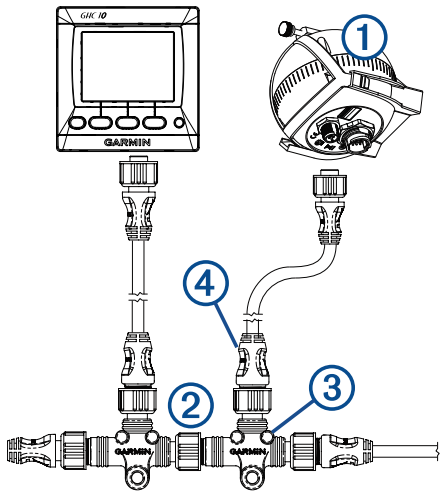


2. Disconnect one side of a NMEA 2000 T-connector ③ from the network.
3. If necessary, to extend the NMEA 2000 network backbone, connect a NMEA 2000 backbone extension cable (not included) to the side of the disconnected T-connector.
4. Add the included T-connector for the helm control to the NMEA 2000 backbone by connecting it to the side of the disconnected T-connector or backbone extension cable.
5. Route the included drop cable ④ 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 20 ft. (6 m) long (not included).
6. Connect the drop cable to the helm control and the T-connector.

Connecting the CCU to the Existing NMEA 2000 Network

1. Determine where to connect the CCU ① to your existing NMEA 2000 backbone ②.



2 Disconnect one side of a NMEA 2000 T-connector from the network.

3 If necessary, to extend the NMEA 2000 network backbone, connect a NMEA 2000 backbone extension cable (not included) to the side of the disconnected T-connector.

4 Add the included T-connector ③ for the CCU 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 ④ to the CCU 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 20 ft. (6 m) long (not included).

6 Connect the drop cable to the CCU and the T-connector.

Connecting Optional 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.

You can connect optional devices that are not NMEA 2000 compatible to the helm control through NMEA 0183 (page 13).

1 Add an additional T-connector (not included) to the NMEA 2000 network.

2 Connect the device to the T-connector by following the instructions provided with the device.

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.

Pump Installation

Mounting the Pump

Before you mount the pump, if your boat has an unbalanced cylinder steering system, you must re-configure the pump to work properly with the unbalanced cylinder (page 2).

Before you can mount the pump, you must select a location (page 2) and determine the correct mounting hardware (page 1).

1 Hold the pump in the intended mounting location and mark the locations of the mounting holes on the mounting surface, using the pump 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 pump to the mounting surface using the selected mounting hardware.

Connecting the Hydraulic Lines to the Pump

Refer to the layout diagrams beginning on page 7 for assistance.

1 Disconnect the necessary lines from the hydraulic system.

2 Add a T-connector to the starboard and port lines of the system between the helm and the steering cylinder.

NOTE: If the boat has a power-assist module, add the T-connectors between the power-assist module and the steering cylinder.

3 Complete an action:

- If the boat does not have a power-assist module, add enough hydraulic hose to connect the return fitting on the helm to the pump fitting labeled with a T.
- If the boat has a power-assist module, a return line should already exist between the helm and the power-assist module. Add a T-connector to the return line of the system between the power-assist module and the helm.

4 Add hydraulic hose to the unused fitting on each T-connector, with enough hose to connect the T-connector to the pump fittings.

5 Connect the starboard line T-connector to a pump fitting labeled with a C1 or C2.

6 Connect the port line T-connector to the pump fitting labeled with a C1 or C2 that you did not use in step 4.

7 Complete an action:

- If the boat does not have a power-assist module, connect the return fitting on the helm to the pump fitting labeled with a T.
- If the boat has a power-assist module, connect the return line T-connector to the pump fitting labeled with a T.

8 Install the Shadow Drive in the port or starboard hydraulic line between the helm and the T-connector (page 12).

9 Install a shut-off valve (not included) on each hydraulic line that connects directly to the pump.

10 Insert, tighten, and seal the included plugs in the unused pump fittings, if they are not already in place.

Connecting the Pump 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 pump 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, connect it through a 40 A fuse.

If you plan to route the pump through a breaker or a switch near the helm, you should use an appropriately sized relay and control wire. Do not extend the pump power cable in this case.

1 Route the connector-terminated end of the power cable to the pump, but do not connect it to the pump.

2 Route the bare-wire end of the power cable to the boat battery.

If the cable is not long enough, it can be extended by splicing a larger wire (page 14).

Observe the cautions at the beginning of this section about extending the power cable.

3 Connect the black wire (-) to the negative (-) terminal of the battery.

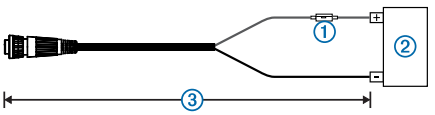
4 Connect the red wire (+) to the positive (+) terminal of the battery.

5 Leave the power cable disconnected from the pump at this time.

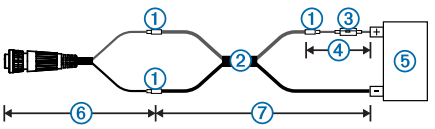
You should connect the power cable to the pump only after you install all of the other autopilot components to avoid unwanted activity from the pump.

Power Cable Extensions

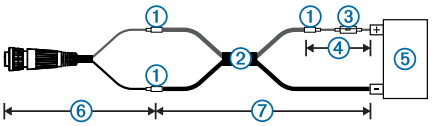
If necessary, the power cable can be extended using the appropriate wire gauge for the length of the extension.



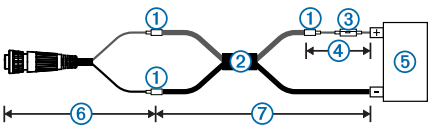
Item	Description
①	Fuse
②	Battery
③	9 ft. (2.7 m) no extension



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)

Bleeding the Hydraulics

NOTICE

The following is a general procedure for bleeding a hydraulic steering system. Refer to the instructions provided by the manufacturer of the steering system for more-specific information about bleeding the system.

Before you bleed the hydraulic system, ensure that all hose connections are complete and fully tightened.

1 Select an option:
- If the helm reservoir contains insufficient fluid, fill it with the appropriate amount of hydraulic fluid.
- If the helm reservoir contains excess fluid, remove the excess to avoid fluid overflow during the bleeding process.

2 Manually steer the helm to both cylinder stops.

3 Manually steer the helm fully to port.

4 Open a bypass valve at the cylinder fitting.

5 Turn the helm slowly to port over three minutes.

6 Close the cylinder bypass valve.

7 If necessary, add fluid to the helm reservoir.

8 Repeat steps 2 through 7 until the helm reservoir remains full.

9 Open the bypass valve on the pump manifold.

10 Turn on the autopilot system and disable the Shadow Drive.

Refer to the owner's manual provided with the autopilot system for more information on disabling the Shadow Drive.

11 Hold ⬅ on the helm control for 10 seconds and watch for steering movement.

12 Select an option:
- If there is steering movement, proceed to step 13.
- If there is no movement, hold ➡ until steering movement occurs.

13 Hold the soft key that produces steering movement, and steer fully to the stop.

14 Steer the helm to the opposite stop using the helm control.

15 Close the bypass valve on the pump manifold.

The hydraulic bleeding is now complete.

After hydraulic bleeding is complete, re-enable the Shadow Drive.

Corrosion Blocker

NOTICE

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

A marine-rated corrosion blocker should be applied to the pump after all hydraulic and electrical connections are made and the hydraulic system has been bled.

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 Docksidewhile 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

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 Configuration** > **Wizards** > **Dockside Wizard**.
3. Select the vessel type.
4. If necessary, calibrate the rudder sensor.
5. Test the steering direction (page 15).
6. If necessary, select the speed source (page 15).
7. If necessary, verify the tachometer (page 15).
8. Test the helm lock-to-lock.
9. Review the wizard results (page 15).

Testing the Steering Direction

1. Test the steering direction.

   When you select ⬅, the rudder must turn so that the boat steers to the left, and when you select ➡, the rudder must turn so that the boat steers 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**.
4. If you selected **No** in step 3, repeat steps 1–2.

Selecting the Speed Source

Select an option:

- If you connected a NMEA 2000-compatible engine (or engines) to the NMEA 2000 network, select **NMEA 2000**.
- If a NMEA 2000 tachometer data is unavailable 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 NMEA 2000 or using a GPS device as the speed source.

Verifying the Tachometer

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

1. 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.
2. If necessary, adjust the readings on the helm control until they match the tachometer (or tachometers) on your boat.

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 Configuration** > **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 **None**.
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 **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 (page 15).
8. Perform the autotune procedure (page 16).
9. Set north (page 16).
10. If necessary, set the fine heading adjustment (page 16).

Calibrating the Compass

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**, and continue to drive in a straight line.
   - If you are performing this calibration outside of the Sea Trial Wizard, from the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Automated Setup** > **Calibrate Compass** > **Begin**.
3. When instructed, turn the boat clockwise slowly until calibration is complete, taking care to make the turn as steady and flat as possible.

   The boat should not list during calibration.
4. Select an option:
   - If the calibration completes successfully, select **Done**.
   - If the calibration fails, select **Retry** and repeat steps 1–3.

Performing the Autotune Procedure

Before you 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**, and continue to drive in a straight line.
   - If you are performing this calibration outside of the Sea Trial Wizard, from the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Automated Setup** > **Autotune** > **Begin**.

   The boat performs a number of zigzag motions while the autotune is in progress.

   When complete, a message is shown.
3. Select an option:
   - If the autotune completes successfully, select **Done** and take manual control of the boat.
   - If the autotune fails, increase the throttle, select **Retry**, and allow the system to perform the autotune again.
4. Select an option:
   - If the autotune fails, but you have not reached maximum cruising speed, repeat steps 1–3 until the autotune completes successfully.
   - If the autotune fails and you have reached maximum cruising speed, reduce your speed to the initial autotune speed and select **Alternate Autotune** to begin an alternate autotune procedure.

Setting North

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

This procedure appears if the autopilot is connected to an optional GPS device (page 13), 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 instead to set the fine heading adjustment (page 16).

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**, and continue to drive in a straight line.
   - If you are performing this calibration outside of the Sea Trial Wizard, from the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Automated Setup** > **Set North** > **Begin**.
3. Allow the autopilot to calibrate north.

   When the calibration is complete, a message is shown.
4. Select an option:
   - If the calibration completes successfully, select **Done**.
   - If the calibration fails, repeat steps 1–3.

Setting the Fine Heading Adjustment

This procedure appears only if you do not have an optional GPS device connected to the autopilot (page 13). If the autopilot is connected to a GPS device that has acquired a GPS position, you are prompted to set north instead (page 16).

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 Configuration** > **Automated Setup** > **Fine Heading Adjustment**, and adjust the fine heading setting until it matches north on the magnetic compass.
3. After the fine heading setting matches north on the magnetic compass, 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 (page 16).
   - If the heading hold oscillates significantly or the boat does not correct when turning, adjust the autopilot gain (page 16).
   - 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 (page 17).
2. Select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **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 (page 17).
2. Select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Autopilot Tuning** > **Rudder Gains**.
3. Select an option based on the type of boat:
   - If you have a sailboat, 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, attempting 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, select **Counter Gain** and adjust how tightly the rudder corrects the turn overshoot.

     If you set this value too high, the autopilot can overshoot the turn again when attempting to counter the original turn.

- If you have a powerboat, 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, attempting 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 powerboat, select **Low Speed Counter** or **High Speed Counter** to adjust how tightly the rudder corrects the turn overshoot.

  If you set this value too high, the autopilot can overshoot the turn again when attempting to counter the original turn.

4 Test the autopilot configuration, and repeat steps 2–3 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 (page 17).

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 Configuration** 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 (page 17).

2 From the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Automated Setup**.

3 Select **Calibrate Compass**, **Set North**, or **Autotune**.

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 (page 19) prior to modifying any settings.

1 Enable Dealer Mode (page 17).

2 From the heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration**.

3 Select a setting category.

4 Select a setting to configure.

Descriptions of each setting are available in the appendix (page 19).

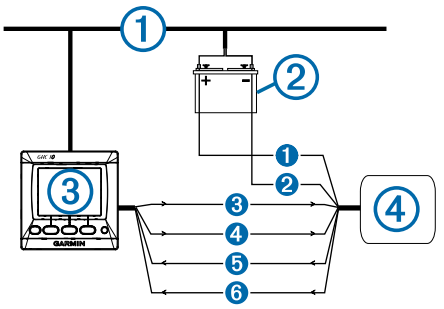
5 Configure the value of the setting.

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.

Two-Way NMEA 0183 Communication



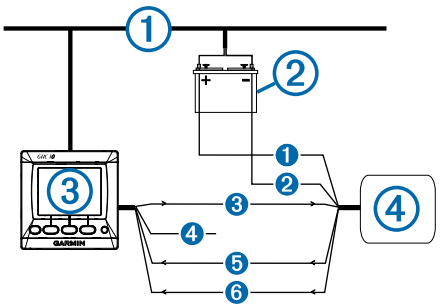
①	NMEA 2000 network (provides power to the helm control)
②	12 Vdc power source
③	Helm control
④	NMEA 0183-compatible device

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

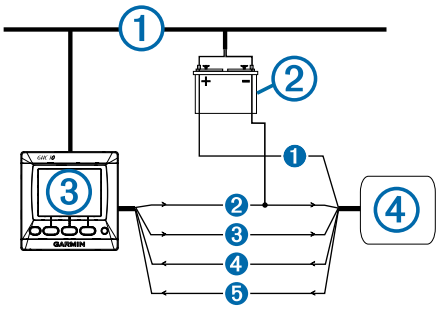
Wire	Helm Control Wire Color — Function	NMEA 0183-Compatible Device Wire Function
❶	N/A	Power
❷	N/A	NMEA 0183 ground
❸	Blue — Tx/A (+)	Rx
❹	White — unconnected	N/A
❺	Brown — Rx/A (+)	Tx/A (+)
❻	Green — Rx/B (-)	Tx/B (-)

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

SmartPump

Specification	Measurement
Dimensions (H×W×D)	7¾ × 7½ × $9^{5}/_{8}$in. (197 x 190 x 244 mm)
Weight	16.5 lbs (7.5 kg)
Temperature range	From 5°F to 131°F (from -15°C to 55°C)
Material	• Electronics control unit (ECU): Fully gasketed, aluminum alloy • Bracket: Carbon steel • Manifold: Aluminum alloy • Motor: Aluminum alloy
Power cable length	9 ft. (2.7 m)
Input power	11.5–30 Vdc
Fuse	40 A, blade-type
Main power usage	• Standby: Less than 1 A • Engaged: 5–10 A • Peak: 34 A

CCU

Specification	Measurement
Dimensions (diameter)	$3^{19}/_{32}$ in. (91.4 mm)
Weight	5.6 oz. (159 g)
Temperature range	From 5°F to 140°F (from -15°C to 60°C)
Material	Fully gasketed, high-impact plastic, waterproof to IEC 60529 IPX7 standards
CCU cable length	16 ft. (5 m)
NMEA 2000 LEN	3 (150 mA)

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)

Helm Control

Specification	Measurement
Dimensions (H×W×D)	$4^{5}/_{16}$ × $4^{3}/_{8}$ × $1^{29}/_{32}$ in. (109 × 111 × 48 mm)
Weight	9.6 oz. (272 g)
NMEA 2000 drop cable and power cable	6 ft. (1.8 m)
Data cable	6½ ft. (2.0 m)
Temperature range	From 5°F to 158°F (from -15°C to 70°C)
Compass-safe distance	9½ in. (241 mm)
Case material	Fully gasketed, high-impact plastic, waterproof to IEC 60529 IPX7 standards
Power usage	2.5 W max
NMEA 2000 input voltage	9–16 Vdc
NMEA 2000 LEN	6 (300 mA)

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	127245	Rudder Data
	127250	Vessel Heading
Receive only	127245	Rudder Data
	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

Type	PGN	Description
	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
	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.	• The ECU shuts down
Error: ECU Voltage has Dropped Rapidly	The ECU voltage has dropped quickly below 7.0 Vdc.	• Alarm sounds until acknowledged. • The error is cleared when the ECU voltage rises above 7.3 Vdc.
Error: ECU High Temperature	The ECU temperature has risen above 212°F (100°C).	• Alarm sounds for 5 seconds • Pump is disabled
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 (page 17). 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 (page 16).

Autopilot Tuning Settings

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

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 Configuration** > **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, 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.

To open the rudder gain settings, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Rudder Gains**.

Gain: Allows you to adjust how tightly the rudder holds a heading and makes turns (sailboat only).

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

Low Speed: Allows you to set the rudder gain for low speeds (power boat only). This setting applies to the vessel when operating below planing speed.

Low Speed Counter: Allows you to set the rudder gain counter-correction for low speeds (power boat only). This setting applies to the vessel when operating below planing speed.

High Speed: Allows you to set the rudder gain for high speeds (power boat only). This setting applies to the vessel when operating above planing speed.

High Speed Counter: Allows you to set the rudder gain counter-correction for high speeds (power boat only). This setting applies to the vessel when operating above planing speed.

Navigation Settings

To open the navigation settings, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Navigation Setup**.

Fine Heading Adjustment: Allows you to set the lubber line (heading offset) for the autopilot.

Navigation Gain: Allows you to adjust how aggressively the autopilot eliminates cross-track error while following a Route To pattern.

If this value is too high, the autopilot can oscillate back and forth across the course line over long distances. If this value is too low, then the autopilot may respond slowly in eliminating cross-track error.

Navigation Trim Gain: Allows you to adjust the acceptable amount of long term cross-track error while following a Route To pattern. Only adjust this setting after the navigation gain has been set.

If this value is too high, the autopilot will overcompensate for cross-track error. If this value is too low, the autopilot will allow a large long term cross-track error.

NMEA Navigation Settings

NOTE: NMEA navigation settings apply only when a NMEA 0183 GPS device is connected to the autopilot system.

To open the NMEAsettings, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Navigation Setup** > **NMEA Setup**.

NMEA Checksum: When set to **Off**, this setting allows you to still use the connected NMEA 0183 GPS device if it incorrectly calculates checksums. When set to **Off**, data integrity is compromised.

Reversed XTE: Allows you to correct the steering direction if the connected NMEA 0183 GPS device sends the incorrect steering direction with the cross-track error signal.

Steering System Settings

To open the steering system settings, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **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 Configuration** > **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

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

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- In the USA, call (913) 397.8200 or (800) 800.1020.
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