GHP™ 12 Installation Instructions

To obtain the best possible performance and to avoid damage to your boat, install the Garmin® GHP 12 marine autopilot system according to the following 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.

NOTE: There is an installation checklist on the last page of these instructions. Remove the last page and refer to the checklist as you proceed through the GHP 12 installation.

Registering the Device

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

For future reference, write the serial number assigned to each component of your GHP 12 system in the spaces provided on page 3. The serial numbers are located on a sticker on each component.

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.

Important Safety Information

⚠ WARNINGS

You are responsible for the safe and prudent operation of your vessel. The GHP 12 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 GHP 12 on calm and hazard-free open water.

Use caution when operating the GHP 12 near hazards in the water, such as docks, pilings, and other boats.

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

⚠ CAUTION

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.

NOTICE

When drilling or cutting, always check the opposite side of the surface. Be aware of fuel tanks, electrical cables, and hydraulic hoses.

Contents

GHP 12 Package Contents and Tools Needed

The GHP 12 autopilot system consists of multiple components. Familiarize yourself with all of the components before beginning installation. You must know how the components operate together in order to correctly plan the installation on your boat.

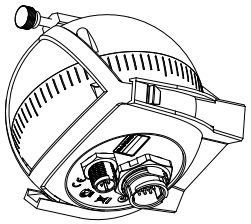
As you familiarize yourself with the GHP 12 components, confirm that your package includes the items listed below. All the components, except the drive unit and (optional) Shadow Drive, are included in the GHP 12 core box. The drive unit is sold separately (page 9). If any parts are missing, contact your Garmin dealer immediately.

Record the serial number of each component in the space provided.

Main Components

The GHP 12 autopilot system consists of four main components: the Course Computer Unit (CCU), the Electronic Control Unit (ECU), the GHC™ 20 user control interface, and the drive unit (sold separately, see page 9).

CCU

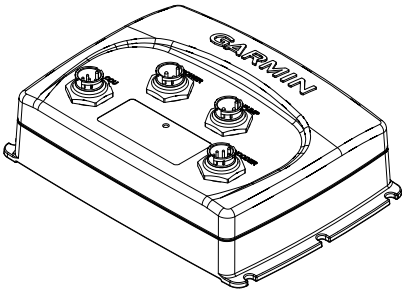


The CCU acts as the brain of the GHP 12. The CCU contains the sensory equipment used to determine heading. The CCU connects to the ECU and to the GHC 20 with a single cable. The CCU also connects to a NMEA 2000® network to communicate with the GHC 20, and to optional NMEA 2000-compatible devices, such as a chartplotter and a wind sensor (page 12).

Serial Number

_____

ECU

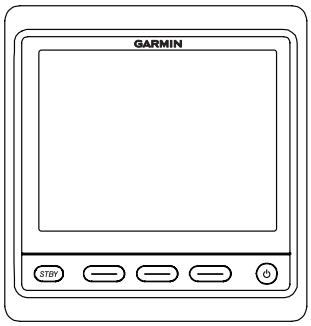


The ECU connects to the CCU and to the drive unit. The ECU controls the drive unit based on information from the CCU. The ECU powers both the CCU and the drive unit.

Serial Number

_____

GHC 20



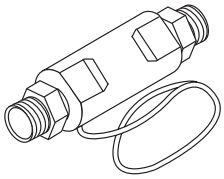
The GHC 20 is the primary interface used to operate the GHP 12 autopilot system. Using the GHC 20, you engage and steer the GHP 12. You also set up and customize the GHP 12 using the GHC 20.

The GHC 20 connects to a NMEA 2000 network to communicate with the CCU. The GHC 20 also connects with optional NMEA 2000-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, to use advanced features of the GHP 12. If NMEA 2000-compatible devices are not available, you can connect the GHC 20 to optional NMEA 0183-compatible devices instead.

Serial Number

_____

Shadow Drive



The Shadow Drive (optional accessory) is a sensor you install in the hydraulic steering lines of your boat. The Shadow Drive can only be used on a boat with a hydraulic steering system.

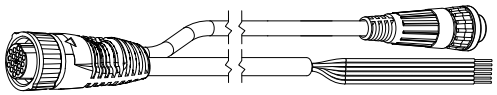
While the GHP 12 is engaged, the Shadow Drive temporarily disengages the autopilot when you manually take control of the helm. When you establish a new straight line heading, the Shadow Drive automatically reengages the autopilot

Cables and Connectors

The GHP 12 autopilot system includes multiple cables. These cables connect the components to power, to each other, to an alarm, and to optional devices.

CCU/ECU Interconnect Cable

This cable connects the CCU to the ECU. A portion of this cable contains color-coded wires with bare ends. These wires connect the CCU to the alarm and to the yellow wire from the GHC 20.



CCU/ECU Interconnect Extension Cables

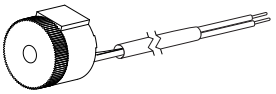
When installing the GHP 12 system, you may need to mount the CCU farther than 16 ft. (5 m) from the ECU. Garmin offers optional replacement or extension cables for purchase if this is necessary.

Type	Length
Replacement	32 ft. (10 m)
Replacement	66 ft. (20 m)
Extension	16 ft. (5 m)
Extension	50 ft (15 m)
Extension	82 ft. (25 m)

Contact your local Garmin dealer or Garmin Product Support for ordering information.

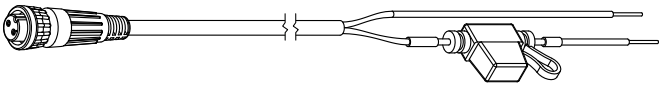
Alarm

The alarm provides audible alerts from the GHP 12 (page 11).



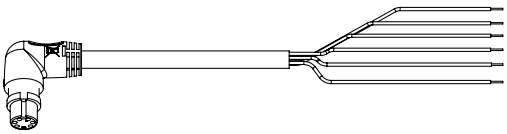
ECU Power Cable

This cable powers the ECU (page 10).



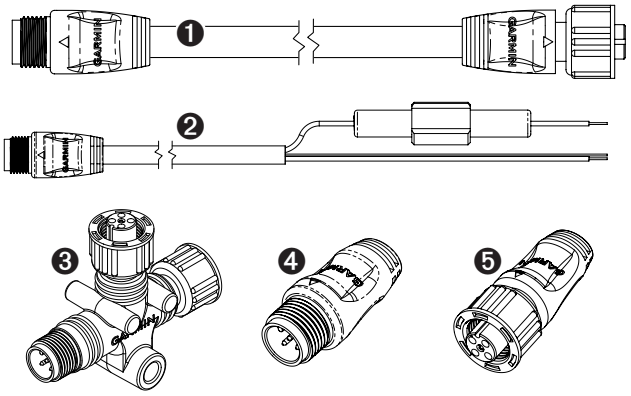
GHC 20 NMEA 0183 Data Cable

This cable connects the GHC 20 to the yellow wire of the CCU, and to the same ground as the ECU (page 12). This cable can also be used to connect the GHC 20 to optional NMEA 0183-compatible devices (page 14).



NMEA 2000 Cables and Connectors

The NMEA 2000 cables connect the CCU and the GHC 20 to the NMEA 2000 network. Either connect the CCU and the GHC 20 to an existing NMEA 2000 network using the included T-connectors and drop cables, use all of the included NMEA 2000 cables and connectors to build a NMEA 2000 network on your boat if needed (page 12).



❶	NMEA 2000 drop cable, 6 ft. (2 m) (×2)
❷	NMEA 2000 power cable
❸	NMEA 2000 T-connector (×3)
❹	NMEA 2000 terminator, male
❺	NMEA 2000 terminator, female

NMEA 2000 Extension Cables

NMEA 2000 extension cables are available if needed. Contact your local Garmin dealer or Garmin Product Support for ordering information.

Tools Needed

- Safety glasses
- Drill and drill bits
- 3 1/2 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
- Portable or handheld compass (to test for magnetic interference when determining the best location to install the CCU)
- Anti-seize lubricant (optional)

NOTE: Mounting screws are provided for the GHC 20, for the CCU, for the ECU, and for the pump. If the provided screws are not appropriate for the mounting surface, you must provide the correct types of screws.

Installation Preparation

Before installing the GHP 12 autopilot system, you must plan where all the components will be located on your boat. Temporarily place all the components where you intend to install them. Read these considerations and consult the diagrams on pages 7 and 8 before you begin planning your installation.

NOTE: There is an installation checklist on the last page of these instructions. Remove the last page and refer to the checklist as you proceed through the GHP 12 installation.

Mounting and Connection Considerations

The GHP 12 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.

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 using a non-Garmin drive unit, a GHP 12 drive unit power cable (sold separately), and a GHP 12 rudder feedback cable (sold separately) must be used to adapt your drive unit for use with the GHP 12 (page 9).

  The GHP 12 drive unit power cable cannot be extended.

ECU Mounting and Wiring 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 power cable connects to the boat battery, and it can be extended if needed (page 10).
- The ECU must be located within 19 in. (0.5 m) of the drive unit.
- **The cables connected to the drive unit cannot be extended.**

CCU Mounting Considerations

- **The CCU must be mounted in the forward half of the boat, no higher than 10 ft. (3 m) above the waterline.**
- The CCU or the ECU must not be mounted in a location where they 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 chain, 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 in the location you want to mount the CCU, then 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 that the connected wires hang straight down.
- Mounting screws are included with the CCU, but you may need to provide different screws if the supplied screws are not suitable for the mounting surface.

CCU Wiring Considerations

- The CCU/ECU interconnect cable connects the CCU to the ECU and is 16 ft. (5 m) long.
  - If the CCU cannot be mounted within 16 ft. (5 m) of the ECU, replacement and extension cables are available (page 4).
  - **The CCU/ECU interconnect cable must not be cut.**
- The CCU/ECU interconnect cable connects the CCU to the GHC 20 with a single yellow signal wire (page 11). The autopilot system will not power on if this connection is not made.

Alarm Mounting and Wiring Considerations

- The alarm should be mounted near the helm station.
- The alarm can be mounted under the dashboard if you prefer.
- If needed, the alarm wires can be extended with 28 AWG (.08 mm^2) wire.

NMEA 2000 Wiring Considerations

- The CCU and the GHC 20 connect to the 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 13).
- To use advanced features of the GHP 12, 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.

GHC 20 Mounting Considerations

NOTICE

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

- The mounting location should provide optimal viewing as you operate your vessel.
- The mounting location should allow easy access to the keys on the GHC 20.
- The mounting surface must be strong enough to support the weight of the GHC 20 and protect it from excessive vibration or shock.
- The area behind the 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 GHC 20.
- The location must be at least 8 1/4 in. (209 mm) from a magnetic compass, to avoid interference.
- The location must be in an area that is not exposed to extreme temperature conditions (page 23).

GHC 20 Wiring Considerations

- You must connect the GHC 20 to the NMEA 2000 network.
- For the autopilot to function, you must correctly connect two wires from the GHC 20 data cable:
  - The yellow wire from the GHC 20 data cable must be connected to the yellow wire of the CCU/ECU interconnect cable.
  - The black wire from the GHC 20 data cable must be connected to the same ground as the ECU.

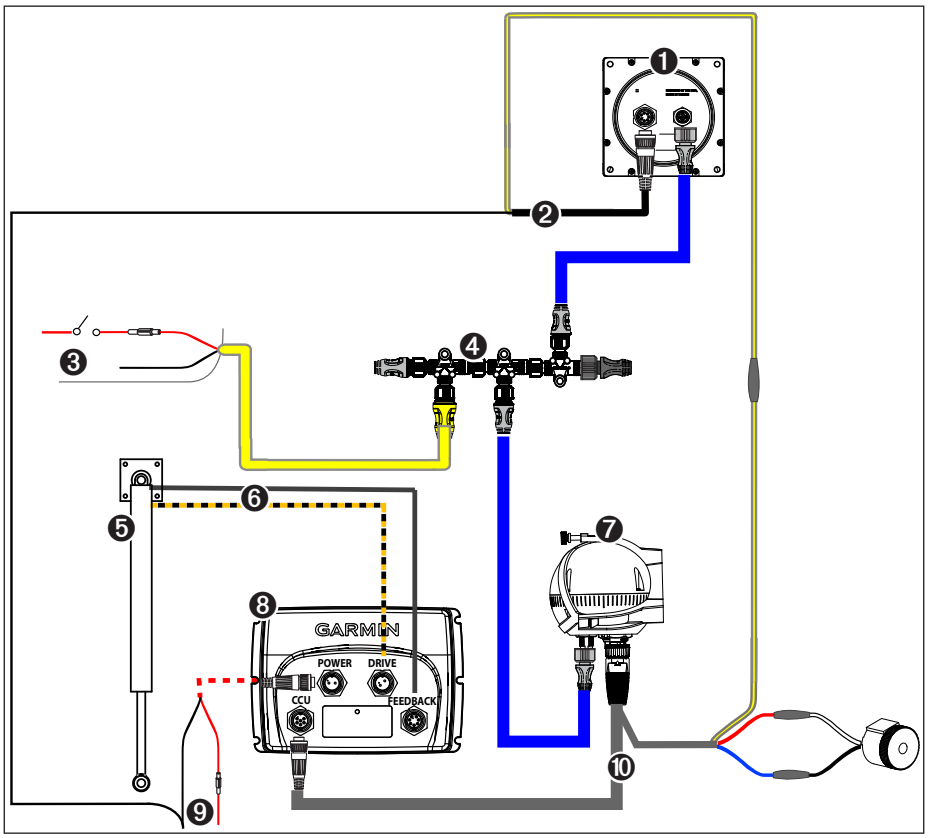
- Optional NMEA 0183-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, can be wired to the GHC 20 data cable (page 14).

Shadow Drive Mounting Considerations

- Mount the Shadow Drive horizontally and as level as possible, using cable ties to firmly secure it in place.
- Mount the Shadow Drive at least 12 in. (0.3 m) away from magnetic material, such as speakers and electric motors.
- Install the Shadow Drive closer to the helm than to the pump.
- Install the Shadow Drive lower than the helm, but higher than the pump.
- Avoid making loops in the hydraulic lines.
- Do not install the Shadow Drive directly to the fittings at the back of the helm. Install a length of hose between the fitting at the helm and the Shadow Drive.
- Do not install the Shadow Drive directly to a hydraulic T-connector in the hydraulic line. Install a length of hose between a T-connector and the Shadow Drive.
- In a single-helm installation, do not install a T-connector between the helm and the Shadow Drive.
- In a dual-helm installation, install the Shadow Drive between the pump and the lower helm, closer to the helm than to the pump.
- Install the Shadow Drive in either the starboard steering line or the port steering line. Do not install the Shadow Drive in the return line.
- Do not use Teflon tape on any hydraulic fitting. Use an appropriate thread sealant such as Loctite® Pro Lock Tight® multipurpose anaerobic gel, part number 51604, or equivalent, on all pipe threads in the hydraulic system.

General Connections Diagram

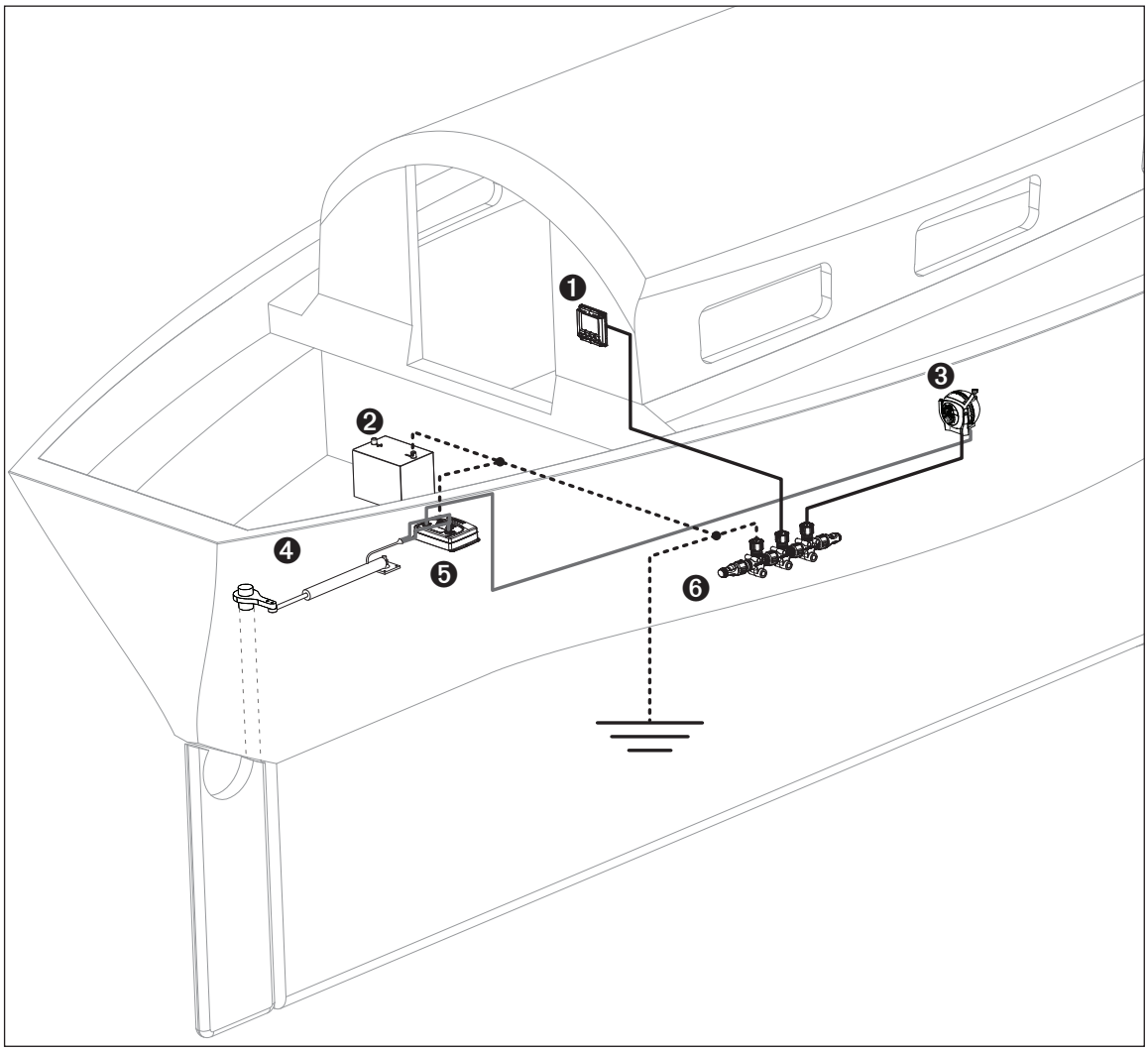
Refer to this diagram for component-interconnection reference only. Follow the detailed installation instructions for each component (pages 9–14).



Item	Description	Important Considerations
❶	GHC 20	
❷	GHC 20 data cable	In order for the autopilot to turn on, the yellow wire from this cable must be connected to the yellow wire from the CCU/ECU Interconnect cable, and the black wire from this cable must be connected to the same ground as the ECU (page 12).
❸	NMEA 2000 power cable	This cable should only be installed 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 13). The NMEA 2000 power cable must be connected to a 9–16 Vdc power source.
❹	NMEA 2000 network	The GHC 20 and the CCU must be connected to the NMEA 2000 network using the included T-connectors (page 12). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (page 13).
❺	Drive unit	The drive unit must be installed by an experienced professional (page 9).
❻	Drive unit power and feedback cables	**The drive unit power cable cannot be cut or extended.** If you are using the GHP 12 with a non-Garmin drive unit, you must purchase a GHP 12 drive unit power cable and a GHP 12 rudder feedback cable (page 9).
❼	CCU	Mount the CCU with the cables pointing straight down (page 10).
❽	ECU	The ECU can be mounted in any orientation.
❾	ECU power cable	The ECU can be connected to a 12–24 Vdc power source. To extend this cable, use the correct wire gauge (page 10). The black wire from the GHC 20 data cable must connect to the same ground as this cable (page 12).
❿	CCU/ECU interconnect cable	In order for the autopilot to turn on, the yellow wire from this cable must be connected to the yellow wire from the GHC 20 data cable. To extend this cable to reach the ECU, purchase the necessary extensions (page 4). The red and blue wires from this cable connect to the alarm (page 11).

General Component Layout Diagram

Refer to this diagram for component-layout reference only. Follow the detailed installation instructions for each component (pages 9–14).



Item	Description	Important Considerations
❶	GHC 20	In order for the autopilot to turn on, the yellow wire from the GHC 20 data cable must be connected to the yellow wire from the CCU/ECU Interconnect cable, and the black wire from the GHC 20 data cable must be connected to the same ground as the ECU (page 12).
❷	12-24 Vdc battery	The ECU can connect to a 12–24 Vdc power source. The NMEA 2000 power cable must be connected to a 9–16 Vdc power source.
❸	CCU	The CCU must be installed in the front half of the boat, **no higher than 10 ft. (3 m) above the waterline**
❹	Drive unit	**Do not cut or extend the drive unit cables.** If you are using the GHP 12 with a non-Garmin drive unit, you must purchase a GHP 12 drive unit cable (page 9).
❺	ECU	The ECU can either be connected to a 12 or a 24 Vdc battery.
❻	NMEA 2000 network	The GHC 20 and the CCU must be connected to the NMEA 2000 network using the included T-connectors (page 12). If there is not an existing NMEA 2000 network on your boat, you can build one using the supplied cables and connectors (page 13).

Installation Procedures

After you have planned the GHP 12 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.

Drive Unit Installation

The drive unit drives the rudder and is sold separately from the GHP 12. When you purchase a drive unit from Garmin, it will have the correct cables and connectors.

If a drive unit is installed on your boat already, you can purchase GHP 12 drive unit cables (not included) to adapt your drive unit for use with the GHP 12.

Installing a Garmin Drive Unit

Use the installation instructions provided with the drive unit to install it on your boat.

Preparing a non-Garmin Drive Unit

In order to use a non-garmin drive unit with the GHP 12, you must install both the GHP 12 drive unit power cable and the GHP 12 rudder feedback cable. Both cables are sold separately.

These instructions do not apply to a solenoid-type drive unit. To prepare a solenoid-type drive unit, see page 9.

1. If your drive unit has cables connected, disconnect the cables.
2. Consult the documentation provided by the manufacturer of your drive unit to identify the connections on your drive unit.
3. Connect the GHP 12 drive unit power cable (not included) to your drive unit, based on the wire colors and functions defined below.

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)

The GHP 12 drive unit power cable cannot be extended.

4. Connect the GHP 12 rudder feedback cable (not included) to your drive unit, based on the wire colors and functions defined below.

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

If necessary, extend the appropriate wire with 22 AWG (.33 mm^2) wire.

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

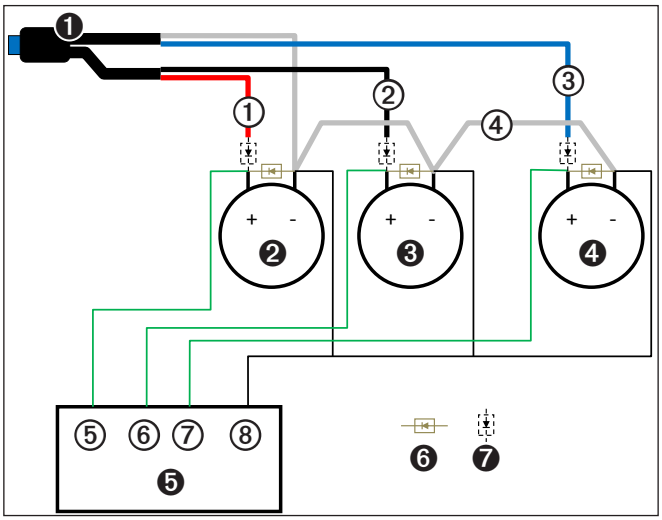
Preparing a Solenoid Drive Unit

In order to use a solenoid drive unit with the GHP 12, you must install both the GHP 12 drive unit power cable and the GHP 12 rudder feedback cable. Both cables are sold separately.

These instructions apply only to solenoid-type drive units. To prepare a non-solenoid drive unit, see page 9.

1. If your solenoid drive unit has cables connected, disconnect the cables.
2. Consult the documentation provided by the manufacturer of your solenoid drive unit to identify the connections on your drive unit.
3. Connect the GHP 12 drive unit power cable (not included) to your solenoid drive unit, based on the diagram and tables below.

   The GHP 12 drive unit power cable cannot be extended.



Item	Description	Notes
❶	GHP 12 Drive Unit 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.
❻	Flyback diode	Required for all installations.
❼	Blocking diode	Required if an auxiliary steering system is present.

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

4. Connect the GHP 12 rudder feedback cable (not included) to your drive unit, based on the wire colors and functions defined below.

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

   If necessary, extend the appropriate wire with 22 AWG (.33 mm^2) wire.
5. If necessary, use the installation instructions provided with the drive unit to install it on your boat.

Installing The GHP 12 Drive Unit Power Cable Fuse

The GHP 12 drive unit power cable is shipped with a 40 A, blade-type fuse. The included fuse must not be used if it is not the appropriate fuse for your drive unit.

1. Consult the manufacturer of your drive unit to determine the correct fuse type.
2. Select an option:
   - If the 40 A fuse is appropriate, install it in the fuse holder.
   - If your drive unit requires a different fuse, install the correct fuse for your drive unit.

ECU Installation

To install the ECU, you must mount it to your boat, connect it to the drive unit, and prepare the battery wiring.

Mounting the ECU

Before you can install the ECU, you must select a mounting location and determine the correct mounting hardware (page 5).

1. Cut out the mounting template provided on page 29.
2. Tape the template to the mounting location.
3. Drill pilot holes at the four mounting locations.
4. Use screws to mount the ECU.

Connecting the Drive Unit to the ECU

Connect the two cables from the drive unit to the connectors marked DRIVE and FEEDBACK on the ECU.

The connectors are keyed and color coded to the appropriate fittings on the wires.

Connecting the ECU to Power

NOTICE

Do not remove the in-line fuse holder from the battery cable when connecting to the battery. If you remove the in-line fuse holder, you will void the GHP 12 warranty and possibly damage the GHP 12 autopilot system.

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, connect it through a 40 A fuse.

If you plan to route the ECU through a breaker or a switch near the helm, 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. Consult the table to determine the correct wire gauge for an extended run.

Length of the Extension	Recommended Wire Gauge
10 ft. (3 m)	12 AWG (3.31 mm^2)
15 ft. (4.5 m)	10 AWG (5.26 mm^2)
20 ft. (6 m)	10 AWG (5.26 mm^2)
25 ft. (7.5 m)	8 AWG (8.36 mm^2)

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. Do not connect the ECU power cable to the ECU.

   Connect the power cable to the ECU only after you install all of the other GHP 12 components.

CCU Installation

To install the CCU, you must mount it to your boat, connect it to the ECU, connect it to a NMEA 2000 network, and connect it to the alarm and to the yellow CCU signal wire on the GHC 20.

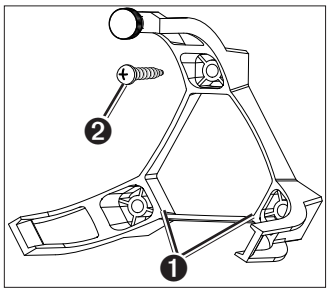
Installing the CCU Mounting Bracket

Before you can mount the CCU, you must select a location and determine the correct mounting hardware (page 5).

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

1. Cut out the mounting template provided on page 29.
2. Tape the template to the mounting location.

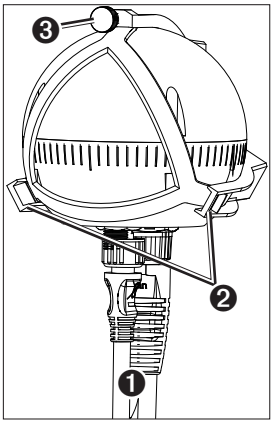
   If you are installing the CCU on a vertical surface, install the mounting portion of the bracket with an opening ❶ at the bottom.



3. Drill pilot holes at the three mounting locations.
4. Use screws ❷ to secure the mounting portion of the CCU bracket.

Securing the CCU in the CCU Bracket

1. Connect the CCU/ECU interconnect cable and the NMEA 2000 drop cable to the CCU.
2. Place the CCU in the mounting portion of the CCU bracket with the wires hanging straight down ❶.
3. Place the securing portion of the bracket over the ball and snap it it into the mounting portion of the bracket, starting with the two arms ❷ that do not have the thumbscrew ❸.



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

   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-terminated end of the CCU/ECU interconnect cable to the ECU and make the connection.
2. Route the wires from the bare-wire portion of the cable to the CCU/ECU interconnect cable.
   - Route the red and blue wires 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 (.08 mm^2) wire.
   - Route the yellow wire to the location where you plan to install the GHC 20 (page 11).

     If the cable is not long enough, extend the yellow wire with 22 AWG (.33 mm^2) wire.
3. Cut and tape the remaining bare wires; they are not used.

Alarm Installation

The alarm audibly alerts you to important GHP 12 events. It must be installed near the helm station.

Mounting the Alarm

Before you can mount the alarm, you must select a mounting location (page 5).

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

Connecting the Alarm

1. Route the alarm-cable to the bare-wire end of the CCU/ECU interconnect cable.

   If the cable is not long enough, extend the appropriate wires with 28 AWG (.08 mm^2) wire.
2. Connect the cables, based on the table below.

Alarm Wire Color	CCU/ECU Interconnect Cable Wire Color
White (+)	Red (+)
Black (-)	Blue (-)

3. Solder and cover all bare-wire connections.

GHC 20 Installation

Install the GHC 20 by flush-mounting it in the dashboard near the helm, connecting it to the yellow wire from the CCU/ECU interconnect cable, and connecting it to a NMEA 2000 network.

To use advanced features of the GHP 12, optional NMEA 2000-compatible or NMEA 0183-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, can be connected to the NMEA 2000 network or connected to the GHC 20 through NMEA 0183.

Mounting the GHC 20

NOTICE

The temperature range for the GHC 20 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 GHC 20 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 GHC 20, you must select a mounting location (page 5).

1. Trim the flush-mount template and ensure it will fit in the location where you plan to mount the GHC 20.

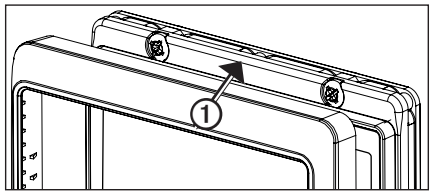
   The flush-mount template is included in the product box, not in these instructions.

   The flush-mount template has adhesive on the back.
2. Remove the protective liner from the adhesive on the back of the template and apply it to the location where you plan to mount the GHC 20.
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 GHC 20 into the cutout to confirm that the four mounting holes are correct.
7. Select an option:
   - If the mounting holes are correct, proceed to step 8.
   - If the mounting holes are not correct, mark the correct locations of the four mounting holes.
8. Remove the GHC 20 from the cutout.
9. Drill the four 7/64 in. (2.8 mm) pilot holes.

   If you are mounting the GHC 20 in fiberglass, 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 and apply marine sealant around the gasket to prevent leakage behind the dashboard.
12. Place the GHC 20 into the cutout.
13. Securely fasten the GHC 20 to the mounting surface using the supplied screws.

    If you are mounting the GHC 20 in fiberglass, use a anti-galling lubricant as advised in the notice.

14. Snap the decorative bezel ① into place.



Connecting the GHC 20

For the autopilot system to function correctly, you must connect two wires from the GHC 20 data cable (yellow and black).

1. Connect the yellow wire from the GHC 20 data cable to the yellow wire from the CCU/ECU interconnect cable.

   If the cable is not long enough, extend the yellow wire with 22 AWG (.33 mm^2) wire.
2. Connect the black wire from the GHC 20 data cable to the same ground location as the ECU.

   If the cable is not long enough, extend the black wire with 22 AWG (.33 mm^2) wire.
3. Solder and cover all bare-wire connections.

Multiple GHC 20 Considerations

You can install multiple GHC 20 devices (sold separately) to control the autopilot from different locations on the boat.

- All additional GHC 20 devices must be connected to the NMEA 2000 network (page 12).
- To use an additional GHC 20 to turn on the autopilot, connect the yellow and black wires from the additional GHC 20 to the same wires as the primary GHC 20.
  - If you connect additional GHC 20 devices to turn on the autopilot, you must turn them all off to turn off the autopilot.
  - If you do not connect an additional GHC 20 to turn on the autopilot, then the additional GHC 20 will enter standby mode when you turn it off, and the autopilot will remain on until turned off by the primary GHC 20.

Connecting the Devices to a NMEA 2000 Network

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.

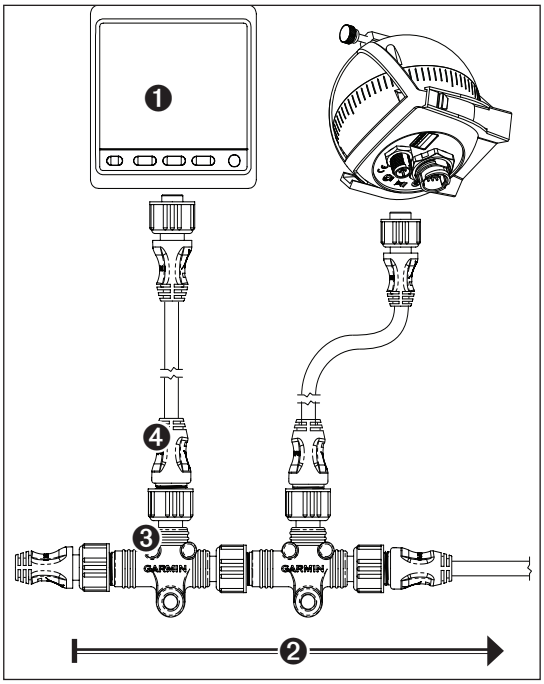
You can connect the GHC 20 to the CCU through an existing NMEA 2000 network. If you do not have an existing NMEA 2000 network on your boat, all the parts needed to build one are supplied in the GHP 12 package (page 13).

Optionally, you can connect NMEA 2000-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, to your NMEA 2000 network to use the advanced features of the GHP 12.

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

Connecting the GHC 20 to an Existing NMEA 2000 Network

1. Determine where to connect the GHC 20 ❶ to your existing NMEA 2000 backbone ❷.



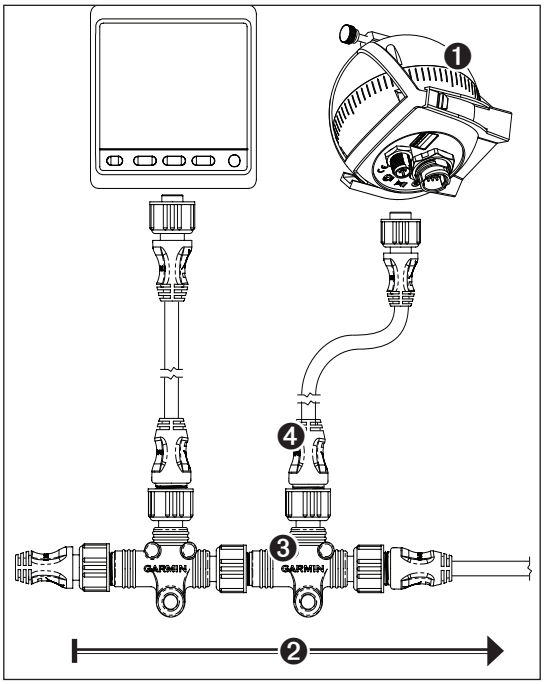
2. Disconnect one side of a NMEA 2000 T-connector from the network.
3. If necessary, to extend the NMEA 2000 network backbone, connect a NMEA 2000 backbone extension cable (not included) to the side of the disconnected T-connector.
4. Add the included T-connector ❸ for the GHC 20 to the NMEA 2000 backbone by connecting it to the side of the disconnected T-connector or backbone extension cable.
5. Route the included drop cable ❹ to the bottom of the T-connector added in step 4, and connect it to the T-connector.

   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 to the GHC 20.
7. Connect the drop cable to the T-connector you added in step 3, and to the GHC 20.

   NOTE: In order for the autopilot to turn on, the yellow wire from the GHC 20 data cable be connected to the yellow wire from the CCU/ECU Interconnect cable, and the black wire from the GHC 20 data cable must be connected to the same ground as the ECU (page 12).

Connecting the CCU to an Existing NMEA 2000 Network

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



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 ❸ 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 ❹ to the bottom of the T-connector added in step 4, and connect it to the T-connector.

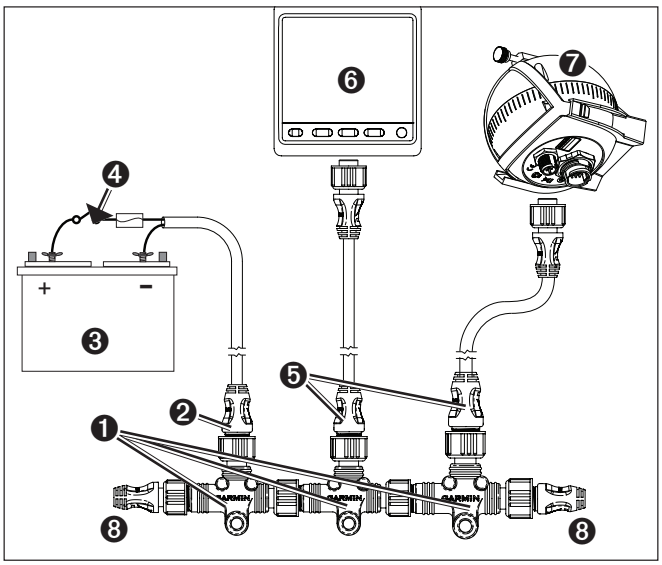
   If the included drop cable is not long enough, you can use a drop cable up to 20 ft. (6 m) long (not included).
6. Connect the drop cable to the to the CCU.

Building a Basic NMEA 2000 Network for the GHC 20 and the CCU

NOTICE

You must connect the included NMEA 2000 power cable to the boat ignition switch, or through another in-line switch. The GHC 20 will drain your battery if the NMEA 2000 power cable is connected to the battery directly.

1. Connect the three T-connectors ❶ together by their sides.



2. Connect included NMEA 2000 power cable ❷ to a 12 Vdc power source ❸ through a switch.

   Connect to the ignition switch ❹ of the boat if possible, or through an in-line 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 ❺ to one of the T-connectors and to the GHC 20 ❻.
5. Connect the other included NMEA 2000 drop cable to the other T-connector and to the CCU ❼.
6. Connect the male and female terminators ❽ to each end of the combined T-connectors.

   NOTE: The GHC 20 must connect to the CCU with the yellow CCU signal wire in the GHC 20 data cable. The black wire must connect to CCU ground (page 12).

Connecting Optional Devices to the GHP 12 Autopilot System

To use advanced features of the GHP 12, optional NMEA 2000-compatible or NMEA 0183-compatible devices, such as a wind sensor, a water-speed sensor, or a GPS device, can be connected to the NMEA 2000 network or to the GHC 20 through NMEA 0183.

Connecting an Optional NMEA 2000-compatible Device to the GHP 12

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

- To identify the Transfer (Tx) A(+) and B(-) wires for your NMEA 0183-compatible device, consult the installation instructions for your device.
- When connecting NMEA 0183 devices 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.
- When connecting a NMEA 0183 device with only one transmitting (Tx) line or with only one receiving (Rx) line, the NMEA 2000 bus and the NMEA 0183 device must be connected to a common ground.

Connecting an Optional NMEA 0183-compatible Device to the GHC 20

1. Determine the NMEA 0183 wiring assignments of your NMEA 0183-compatible device.
2. Refer to the table below to wire your NMEA 0183-compatible device to the GHC 20.

GHC 20 Data Cable Wire Color	Function
Black	CCU signal ground
Yellow	CCU signal
Blue	Tx/A (+)
White	Tx/B (-)
Brown	Rx/A (+)
Green	Rx/B (-)

   Three examples of various wiring situations are provided in the appendix (page 21).
3. If necessary, use 22 AWG (.33 mm^2) twisted-pair wire for extended runs of wire.
4. Solder and cover all bare-wire connections.

Shadow Drive Installation

The Shadow Drive (optional accessory) is a sensor you install in the hydraulic steering lines of your boat. The Shadow Drive can only be used on a boat with a hydraulic steering system.

To install the Shadow Drive, connect it to the hydraulic steering line of your boat and connect it to the CCU/ECU interconnect cable.

Connecting the Shadow Drive to the Hydraulics

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 6).

Use the connectors included with the Shadow Drive to install the Shadow Drive in the hydraulic line.

Connecting the Shadow Drive

When connecting the Shadow Drive to the hydraulic system, follow the important considerations (page 6).

To connect the Shadow Drive, connect it to the CCU/ECU interconnect cable.

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

   If the cable is not long enough, extend the appropriate wires with 28 AWG wire.
2. Connect the cables, based on the table below.

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

3. Solder and cover all bare-wire connections.

Configuring the GHP 12

The GHP 12 must be configured and tuned to your boat dynamics. Use the dockside wizard and the sea trial wizard on the GHC 20 to configure the GHP 12. These wizards walk you through the necessary configuration steps.

Dockside Wizard

NOTICE

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

You can complete the dockside wizard while your boat is in or out of the water. If your boat 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 before performing the dockside wizard to avoid damaging the steering system.

1. Turn on the GHP 12.

   The first time you turn on the GHP 12, you are prompted to complete a short setup sequence on the GHC 20.
2. If necessary, complete the setup sequence.
3. Start the dockside wizard (page 15).
4. Select the vessel type.
5. Select the drive unit class (page 15).
6. If you have a non-Garmin drive unit, select the drive unit voltage (page 15).
7. If you have a non-Garmin drive unit, select the clutch voltage (page 15).
8. If you have a solenoid drive unit, select the bypass-valve voltage (page 15).
9. If necessary, enable the Shadow Drive (page 15).
10. Calibrate the rudder (page 15).
11. If you have a non-Garmin drive unit, tune the drive unit (page 16).
12. Test the steering direction (page 16).
13. If you have a power boat, select the speed source and verify the tachometer (page 16).
14. Review the wizard results (page 16).

Starting the Dockside Wizard

1. After you complete the initial setup, select an option:
   - If the dockside wizard starts automatically, proceed to step 2.
   - If the dockside wizard does not start automatically, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Wizards** > **Dockside Wizard**.
2. Select **Begin**.

Selecting the Drive Unit Class

- 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 have a solenoid drive unit, select **Solenoid**.
- If you have a non-Garmin drive unit, select **Other**.

Selecting the Drive Unit Voltage

NOTICE

Providing an incorrect drive-unit-voltage value for your non-Garmin drive unit can damage your drive unit.

NOTE: This setting applies only to non-Garmin (other) drive units.

1. Consult the manufacturer of your non-Garmin drive unit to determine the drive-unit voltage.
2. Select the voltage approved for your drive-unit motor.

Selecting the Clutch Voltage

NOTICE

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

NOTE: This setting applies only to non-Garmin (other) drive units.

1. Consult the manufacturer of your non-Garmin drive unit to determine the drive-unit-clutch voltage.
2. Select the voltage approved for your drive-unit clutch.

Selecting the Solenoid Voltage

NOTICE

Providing an incorrect drive-unit-voltage value for your non-Garmin drive unit can damage your drive unit.

NOTE: This setting applies only to non-Garmin solenoid drive units.

1. Consult the manufacturer of your non-Garmin solenoid drive unit to determine the drive-unit voltage.
2. Select the voltage approved for your solenoid drive-unit.

Selecting the Bypass Valve Voltage

NOTE: This setting applies only to non-Garmin solenoid drive units.

1. Consult the manufacturer of your non-Garmin solenoid drive unit to determine the bypass-valve voltage.
2. Select the voltage approved for your solenoid bypass valve.

Enabling Shadow Drive

If you installed the GHP 12 on a boat with a hydraulic steering system, you can install a Garmin Shadow Drive device (sold separately - page 3).

- Select **No** if you did not install a Shadow Drive device.
- Select **Yes** if you installed a Shadow Drive device (page 6).

Calibrating the Rudder

NOTE: If an error appears during these steps, the rudder feedback sensor may have reached its limit. Make sure the feedback sensor has been installed correctly. If the problem persists, bypass this error 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 will take control of the rudder.
4. Wait while the autopilot calibrates the rudder.
5. Select an option:
   - If the calibration completed successfully, select **OK**.
   - If the calibration did not complete successfully, repeat steps 1–4.

Tuning a Non-Garmin Drive Unit

NOTE: This does not apply to a solenoid drive unit.

If you installed a non-Garmin drive unit, you must calibrate the drive unit for use with the GHP 12.

1. Center the rudder position, let go, and select **Continue**.

   The autopilot will take control of the rudder as it tunes the drive unit.
2. When the process is complete, select **Done**.

   If you encounter an error during the tuning process, repeat the tuning procedure.

NOTE: If needed, you can further refine the tuning later (page 20).

Testing the Steering Direction

1. Use the arrows on the GHC 20 to test the steering direction.

   When you select the right arrow, the rudder should turn so that the boat would steer to the right, and when you select the left arrow, the rudder should turn so that the boat would steer to the left.
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

NOTE: This procedure applies only to power planing hull and power displacement hull vessel types. It will not appear when configuring the GHP 12 for a sailboat.

Select an option:

- If you connected a NMEA 2000-compatible engine (or engines) to the NMEA 2000 network, select NMEA 2000.
- If you did not connect a NMEA 2000-compatible engine (or engines), select the engine (or engines) to which you connected the tachometer sensor from the CCU.
  - For a single-engine boat, select **Tachometer - Analog Port**, or **Tachometer - Analog Starboard**, according to how you connected the tachometer wiring.
- If tachometer data is unavailable or unusable, select **GPS data** as a speed source.
  - When GPS data is used as a speed source, the maximum speed for all vessel types must be configured.
- If you did not connect a speed source, select **None**.
  - If the autopilot does not perform well using None as the speed source, Garmin recommends connecting a tachometer or GPS as the speed source.

Verifying the Tachometer

NOTE: This procedure applies only to power planing hull and power displacement hull vessel types. It will not appear when configuring the GHP 12 for a sailboat.

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 GHC 20 with the tachometer (or tachometers) on the dashboard of your boat.
2. If the values do not match, use the arrows to adjust the Pulses Per Rev values.

   NOTE: When you adjust the Pulses Per Rev with the arrows, there is a delay before the new RPM readings appear on the GHC 20. Ensure you wait until the GHC 20 adjusts to the new reading for each adjustment.

Reviewing the Results of the Dockside Wizard

The GHC 20 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 and 3 for all incorrect values.
5. When you are finished reviewing the values, select **Done**.

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.

You must perform the sea trial wizard while under motor, and not while under sail.

Important Sea Trial Wizard Considerations

Complete the sea trial wizard in calm water. Because the nature of calm water is relative to the size and shape of your boat, before you begin the sea trial wizard, you must drive your boat to a location where:

- Your boat does not rock while sitting still or moving very slowly.
- Your boat is not significantly affected by the wind.

While completing the Sea Trial Wizard in calm water, you must:

- **Keep the weight on your boat balanced. DO NOT move around on the boat while completing any of the steps in the Sea Trial Wizard**.
- Keep the sails lowered.
- Keep the motor in 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. Start the sea trial wizard.
3. If necessary, configure the planing RPM (page 17).
4. If necessary, configure the planing speed (page 17).
5. If necessary, configure the high RPM limit (page 17).
6. If necessary, configure the maximum speed (page 17).
7. Calibrate the compass.
8. Perform the autotune procedure.
9. Set north.
10. If necessary, set the fine heading adjustment.

Starting the Sea Trial Wizard

Before you start the sea trial wizard, you must drive to an open area of calm water.

1. Select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Wizards** > **Sea Trial Wizard**.
2. Select **Begin**.

Configuring the Planing RPM

NOTE: This setting is only applicable to power boats, and does not appear if you select displacement hull as your vessel type, or if you select None as the speed source.

1. Note the RPM reading from the tachometer on the dashboard of your boat at the point your boat transitions from displacement to planing speed.
2. If the tachometer value does not match the value on the GHC 20, use the arrows to adjust the value on the GHC 20.
3. Select **Done**.

Configuring the Planing Speed

NOTE: This setting is only applicable to power boats, and appears only when GPS is selected as the speed source and Planing Hull is selected as the vessel type.

1. Note the speed over ground reading from the instrument on the dashboard of your boat at the point your boat transitions from displacement to planing speed.
2. If the planing speed from your instrument does not match the value on the GHC 20, use the arrows to adjust the value on the GHC 20.
3. Select **Done**.

Configuring the High RPM Limit

NOTE: This setting is only applicable to power boats, and appears only when GPS is selected as the speed source.

1. Note the RPM reading from the tachometer on the dashboard of your boat at the point your engines are at full throttle.
2. If the tachometer value does not match the value on the GHC 20, use the arrows to adjust the value on the GHC 20.
3. Select **Done**.

Configuring the Maximum Speed

NOTE: This setting is only applicable to power boats, and appears only when GPS is selected as the speed source.

1. Note the speed over ground reading from the instrument on the dashboard of your boat at the point your engines are at full throttle.
2. If the speed from your instrument does not match the value on the GHC 20, use the arrows to adjust the value on the GHC 20.
3. Select **Done**.

Calibrating the Compass

1. Drive your boat at cruising speed in a straight line.
2. Select **Begin**, and continue to drive in a straight line.
3. When instructed, turn the boat slowly clockwise, taking care to make the turn **as steady and flat** as possible.

   Turn slowly so that the boat DOES NOT list.

   After you successfully complete the calibration, the GHC 20 displays a completion message.
4. Select an option:
   - If the calibration completes successfully, select **Done**.
   - If the calibration fails, select **Retry** and repeat steps 1–4.

Performing the Autotune Procedure

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

1. Adjust the throttle so that the boat travels at a typical cruising speed that provides responsive steering.
2. Select **Begin**.

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

   The GHC 20 displays a completion message.
3. Select an option:
   - If the autotune completed successfully, select **Done** and take manual control of the boat.
   - If the autotune failed, increase the throttle and select **Retry**.

4. If autotune fails again, repeat steps 1–3 until the autotune completes successfully.
5. If the autotune procedure continues to fail after you reach maximum cruising speed, reduce your speed to the initial autotune speed and select **Alternate Autotune** to begin an alternate autotuning procedure.

Setting North

To complete this configuration, you must have at least 45 seconds of hazard-free, open water available.

This procedure appears if you connect an optional GPS device to the GHP 12 (page 14), and the device has acquired a GPS position. If you do not have a GPS device connected, you are prompted to set the fine heading adjustment (page 18).

1. Drive the boat in a straight line at cruising speed, and select **Begin**.

   The GHC 20 displays a completion message when the calibration is compete.
2. Select an option:
   - If the calibration completed successfully, select **Done**.
   - If the calibration failed, repeat steps 1–2.

Setting the Fine Heading Adjustment

This procedure appears only if you do not have an optional GPS device connected to the GHP 12 (page 14). If you do have a GPS device installed on your boat that has acquired a GPS position, are prompted to set north instead (page 18).

1. Using a handheld compass, identify north.
2. Adjust the fine heading setting until it matches north on the magnetic compass.
3. Select **Done**.

Evaluating the Results of the Autopilot Configuration

1. Test the autopilot at a slow speed.
2. If necessary, adjust the gain setting.
3. If you receive an "Error: ECU Drive Circuit Overload. See manual for tips on reducing load error" message, see the tips on page 19.
4. If necessary, adjust the acceleration limiter setting.
5. Test the autopilot at a higher speed (normal operating conditions).
6. If necessary, adjust the gain and acceleration limiter settings.

Testing and Adjusting the Autopilot Configuration

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

   The boat should not oscillate significantly; however, a small amount of oscillation is normal.
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 18).
   - If the heading hold oscillates significantly or the boat does not correct when turning, adjust the autopilot gain (page 18).
   - If you receive an "Error: ECU Drive Circuit Overload. See manual for tips on reducing load error" message, see the tips on page 19.
   - If the boat turns smoothly, the heading hold oscillates only slightly or not at all, and the boat adjusts the heading correctly, proceed to step 5.
4. Repeat steps 2 and 3 until the boat turns smoothly the heading hold oscillates only slightly or not at all, and the boat adjusts the heading correctly.
5. For planing powerboats, repeat steps 1–4 at faster speeds.

Adjusting the Acceleration Limiter Settings

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

1. Enable Dealer Mode (page 19).
2. On the GHC 20, 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.
4. Test the autopilot configuration.
5. Repeat steps 2 and 3 until the GHP 12 performance is satisfactory.

Adjusting the Autopilot Gain Settings

NOTE: When you manually adjust the rudder gain (or counter gain), make relatively small adjustments, and adjust only one value at a time. Test the change before making additional adjustments.

1. Enable Dealer Mode (page 19).
2. On the GHC 20, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Autopilot Tuning** > **Rudder Gains**.
3. Select an option:
   - If you have a sailboat, select an option:
     - Select **Rudder Gain** to 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 cause excess wear and tear on the drive unit, and drains the battery at a faster-than-normal rate.
     - Select **Counter Gain** 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.

- If you have a powerboat, select an option:
  - Select **Low Speed** or **High Speed** and use the arrows on the GHC 20 to 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 cause excess wear and tear on the drive unit, and drains the battery at a faster-than-normal rate.
  - 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 and 3 until the GHP 12 performance is satisfactory.

Reducing the Risk of ECU Drive Circuit Overload

This applies only when the GHP 12 is installed on a power boat.

If you receive an "Error: ECU Drive Circuit Overload. See manual for tips on reducing load error" message, use these tips to help reduce the load:

- Ensure the appropriate pump has been correctly installed on your boat.
- If possible, use larger inside diameter hydraulic hoses on your steering system.
- Mount the pump closer to the cylinder to limit the length of the hose runs.
- Eliminate unneeded hydraulic fittings in the hydraulic system.
- If overloading occurs during the autotune procedure, skip the procedure and manually tune the autopilot.
- Increase the rudder rate limiter setting to slow the fluid rate.
- Reduce rudder gain to limit pump activity.

Adjusting the Rudder Rate Limiter

This applies only when the GHP 12 is installed on a power boat.

If the "ECU Drive Circuit Overload. See manual for tips on reducing load error" message continues to appear, you may need to adjust the rudder rate limiter.

NOTE: Complete rudder rate adjustments only at the dock or while your boat is not moving.

NOTE: If you adjust the rudder rate limiter, you must perform the autotune procedure.

1. Enable the advanced configuration procedure (page 19).
2. On the GHC 20, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Autopilot Tuning** > **Rudder Rate Limiter**.
3. Select **Continue**.

   Autopilot takes control of the rudder.
4. Use the arrows on the GHC 20 to adjust the speed of the limiter.
   - 0% is the is the default speed for the rudder rate limiter.
   - Lower rudder rate limiter numbers allow the rudder to move faster between the right rail and left rail.
   - Lower rudder rate limiter numbers increase the running current.
   - Higher rudder rate limiter numbers decrease the running current.
5. Select **Done**.
6. Test the rudder rate limiter settings.
7. Repeat steps 2–6 until rudder rate limiter performance is satisfactory.
8. Perform the autotune procedure.

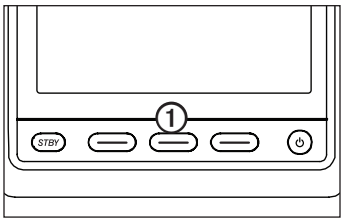
Advanced Configuration

Advanced configuration options are not available on the GHC 20 under normal conditions. To access the advanced configuration settings of the GHP 12, enable Dealer Mode.

Enabling Dealer Autopilot Configuration

1. From the heading screen, select **Menu** > **Setup** > **System** > **System Information**.
2. Press and hold the center soft key ① for 5 seconds.

   Dealer Mode appears.



3. Press **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 automated configuration process, calibrate the compass, and define north on the GHP 12 through the GHC 20 without running the wizards. You can also define each setting individually, without running the configuration processes.

Manually Running the Automated Configuration Procedures

1. Enable Dealer Mode (page 19).
2. From the Heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Automated Setup**.
3. Select **Autotune**, **Calibrate Compass**, or **Set North**.
4. Follow the on-screen instructions (page 15).

Manually Defining Individual Configuration Settings

1. Enable Dealer Mode (page 19).
2. From the Heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration**.
3. Select the a setting category.
4. Select a setting to configure.

   Descriptions of each setting are available in the appendix (page 25).
5. Configure the value of the setting.

NOTE: Configuring certain settings in the advanced configuration procedure may require you to modify other settings. Review the GHP 12 Configurations Settings section (page 25) prior to modifying any settings.

Manually Adjusting the Settings for a Non-Garmin Drive Unit

NOTICE

Providing an incorrect drive-unit-voltage, clutch-voltage, or max-current value for your non-Garmin drive unit can damage your drive unit.

NOTE: If you adjust any of these values or run any of these tuning procedures, you must re-run the autotune procedure (page 19).

1. Enable Dealer Mode (page 19).
2. From the Heading screen, select **Menu** > **Setup** > **Dealer Autopilot Configuration** > **Steering System Setup** > **Drive Unit Class**.
3. Select **Other** or **Solenoid**, according to what you set in the dockside wizard.
4. Select an option:
   - Select **Generic Tune** to re-run the tuning procedure you completed during the dockside wizard (page 16).
   - Select **Drive Unit Voltage** to set the drive-unit voltage according to the specifications provided by your drive-unit manufacturer.
   - Select **Clutch Voltage** to set 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 (page 20).
   - Select **Restore Defaults** to reset the non-Garmin drive unit to default values.

     You must perform the generic tune procedure if you reset your drive unit to the default values.

Performing Advanced Tuning Procedures for Non-Garmin Drive Units

NOTICE

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 non-Garmin drive-unit installation, the generic tuning procedure performed during the dockside wizard is sufficient to calibrate the drive unit to the GHP 12. Use the advanced tuning procedures only if you would like to make slight adjustments to the performance of the drive unit.

Tuning the Speed on a non-Garmin Drive-Unit

This setting does not apply to solenoid drive units.

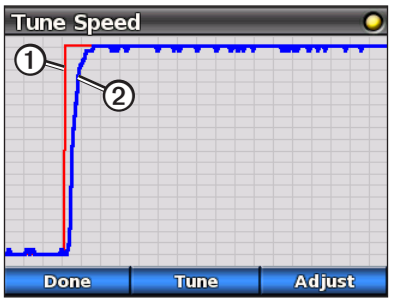
The speed of the drive unit determines how quickly it reacts to commands from the autopilot.

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

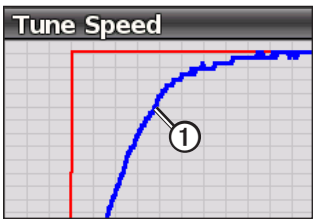
If you set the speed value too high, the drive unit will react too quickly and can force the rudder to the stops at a high rate of speed, potentially damaging the drive unit or rudder stops as well as draining your battery at a faster-than-normal speed.

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

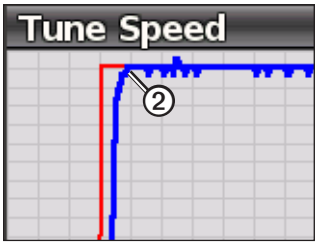
   A graph appears. The red line ① represents the intended position of the rudder. The blue line ② represents the actual position of the rudder.



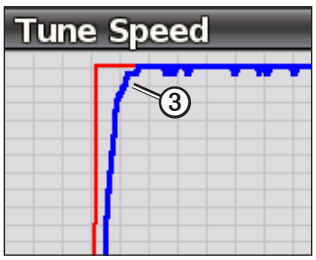
3. Select **Tune**, and observe the graph.
   - The intended rudder position (indicated by the red line) moves from +5° to -5° each time you select **Tune**, and the drive unit steers the rudder accordingly (indicated by the blue line).
   - If the drive unit speed is configured too slowly, it will react sluggishly. The blue line will draw a large slope ① to the red line after you select **Tune**.



   - If the drive unit speed is configured too quickly, it will react immediately and drive hard to the rudder stop. The blue line will draw a hard straight line that hits the red line without a slope ② after you select **Tune**.



   - If the drive unit speed is configured correctly, it will react quickly, then ease into the stop. The blue line will draw a straight line with a small slope ③ as it approaches the red line after you select **Tune**.



4. If necessary, select **Adjust**.
5. Select an option:
   - Increase the value if the drive unit speed is configured too slowly, and repeat step 3.
   - Decrease the value if the drive unit speed is configured too quickly, and repeat step 3.

6. When the drive-unit speed is tuned correctly, select **Done**.

Tuning the Error Tolerance on a non-Garmin Drive-Unit

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 will react 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 will 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 Configuration** > **Steering System Setup** > **Drive Unit Type**.
2. Select **Other** or **Solenoid**, according to what you set 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 and holds the rudder accordingly.
6. After the drive unit stops, observe the rudder error and power usage fields for 30 seconds.
   - If the power usage field fluctuates, then your error tolerance is set too low.
   - If the power usage field stays at 0%, but the rudder error field shows and unacceptable degree of error (1% or more), then your error tolerance is set too high.

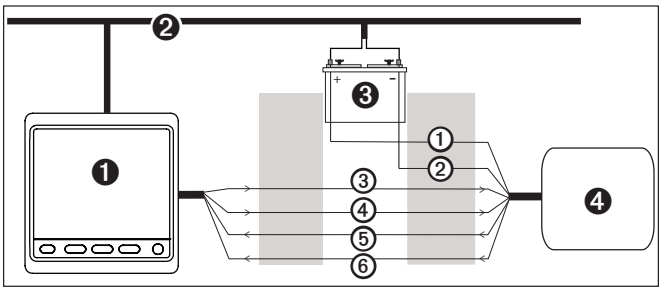
     TIP: An ideal error tolerance configuration holds the rudder at an acceptable degree of error (.5% or so) without unnecessarily adjusting the drive unit and wasting power (0% for 30 seconds or more).
7. If necessary, select **Adjust.**
8. Select an option:
   - Decrease the value if the error tolerance is too high, and repeat steps 3–5.
   - Increase the value if the error tolerance is set too low, and repeat steps 3–5.
9. When the drive-unit error tolerance is tuned correctly, select **Back**.

Appendix

NMEA 0183 Wiring Diagrams

The following three wiring diagrams are examples of different situations you may encounter when wiring your NMEA 0183 device to the GHC 20.

Example One of Three - Two-way NMEA 0183 Communication



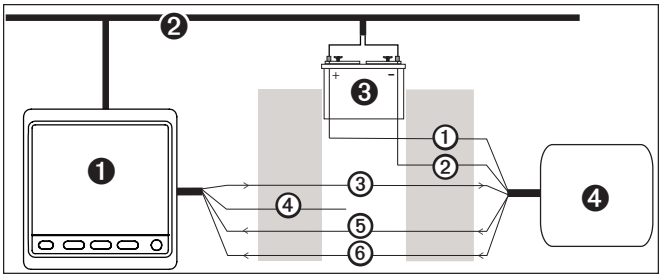
❶	GHC 20
❷	NMEA 2000 network (provides power to the GHC 20)
❸	12 Vdc power source
❹	NMEA 0183-compatible device

Wire	GHC 20 Wire Color - Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	N/A	NMEA 0183 ground
③	Blue - Tx/A (+)	Rx/A (+)
④	White - Tx/B (-)	Rx/B (-)
⑤	Brown - Rx/A (+)	Tx/A (+)
⑥	Green - Rx/B (-)	Tx/B (-)

NOTE: When connecting NMEA 0183 devices 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.

Example Two of Three - Only One Receiving Wire

If your NMEA 0183-compatible device has only one receiving wire (Rx), connect it to the blue wire (Tx/A) from the GHC 20, and leave the white wire (Tx/B) from the GHC 20 unconnected.



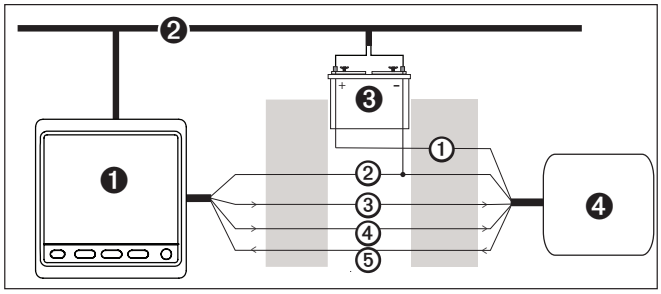
❶	GHC 20
❷	NMEA 2000 network (provides power to the GHC 20)
❸	12 Vdc power source
❹	NMEA 0183-compatible device

Wire	GHC 20 Wire Color - Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	N/A	NMEA 0183 ground
③	Blue - Tx/A (+)	Rx
④	White - unconnected	N/A
⑤	Brown - Rx/A (+)	Tx/A (+)
⑥	Green - Rx/B (-)	Tx/B (-)

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

Example Three of Three - Only One Transmitting Wire

If your NMEA 0183-compatible device has only one transmitting wire (Tx), connect it to the brown wire (Rx/A) from the GHC 20, and connect the green wire (Rx/B) from the GHC 20 to NMEA ground.



❶	GHC 20
❷	NMEA 2000 network (provides power to the GHC 20)
❸	12 Vdc power source
❹	NMEA 0183-compatible device

Wire	GHC 20 Wire Color - Function	NMEA 0183-Compatible Device Wire Function
①	N/A	Power
②	Green - Rx/B - connect to NMEA 0183 ground	NMEA 0183 ground
③	Blue - Tx/A (+)	Rx/A (+)
④	White - Tx/B (-)	Rx/B (-)
⑤	Brown - Rx/A (+)	Tx/A (+)

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

Specifications

Device	Specification	Measurement
ECU	Dimensions	(W×H×D) 6 19/32 × 4 19/32 × 2 in. (167.6 × 116.8 × 50.8 mm)
	Weight	1.5 lb. (0.68 kg)
	Temperature range	from 5°F to 140°F (from -15°C to 60°C)
	Case material	Fully gasketed, high-impact aluminum alloy, waterproof to IEC 529 IPX7 standards
	Power cable length	9 ft. (2.7 m)
	Input power	11.5–30 Vdc
	Fuse	40 A, blade-type
	Main power usage	1 A (not including the drive unit)
CCU	Dimensions	3 19/32 in. diameter (91.4 mm)
	Weight	5.6 oz. (159 g)
	Temperature range	from 5°F to 140°F (from -15°C to 60°C)
	Case material	Fully gasketed, high-impact aluminum alloy, waterproof to IEC 529 IPX7 standards
	CCU/ECU interconnect cable length	16 ft. (5 m)
	NMEA 2000 LEN	2 (100 mA)
Alarm	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)
GHC 20	Dimensions	4 21/64 × 4 17/32 × 1 3/16 in. (110 × 115 × 30 mm)
	Weight	8.71 oz. (247 g)
	Cables	NMEA 0183 data cable – 6 ft. (1.8 m)
		NMEA 2000 drop cable and power cable – 6 1/2 ft. (2 m)
	Temperature range	From 5°F to 158°F (from -15°C to 70°C)
	Compass-safe distance	8 1/4 in. (209 mm)
	Material	Case: fully-gasketed polycarbonate, waterproof to IEC 60529 IPX7 standards Lens: glass with an anti-glare treatment
	GHC 20 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
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
	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
Transmit	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
	127245	Rudder Data
	127250	Vessel Heading

GHC 20

Type	PGN	Description
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
	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

Type	PGN	Description
Transmit	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
	128259	Water Speed
	129025	Position - Rapid Update
	129026	COG & SOG - Rapid Update
	129283	Cross Track Error
	129284	Navigation Data
	129540	GNSS Sats in View
	130306	Wind Data

The GHP 12 and the GHC 20 are NMEA 2000 certified.

NMEA 0183 Information

When connected to optional NMEA 0183-compatible devices, the GHC 20 uses the following NMEA 0183 sentences.

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

GHP 12 Configuration Settings

Although all of the configuration is typically completed automatically through wizards, you can manually adjust any setting (page 19).

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, prior to performing the autotune procedure (page 17).

Category	Setting	Description
Dealer Autopilot Configuration	Vessel Type	Allows you to select the type of vessel on which the autopilot is installed.
Speed Source Setup (power boat only)	Speed Source	Allows you to select NMEA 2000 tachometer, GPS speed, or the engine (or engines) to which you connected the tachometer sensor from the CCU.
Speed Source Setup (power boat only)	Verify Tachometer	Allows you to compare the RPM readings on the GHC 20 with the tachometers on the dashboard of your boat.
Speed Source Setup (power boat only)	Planing RPM	Allows you to adjust the RPM reading on the GHC 20 at the point your boat transitions from displacement to planing speed. If the value does not match the value on the GHC 20, use the arrows to adjust the value.
Speed Source Setup (power boat only)	Planing Speed	Allows you to adjust the planing speed of your boat. If the value does not match the value on the GHC 20, use the arrows to adjust the value.
Speed Source Setup (power boat only)	Low RPM Limit	Allows you to adjust lowest RPM point of your boat. If the value does not match the value on the GHC 20, use the arrows to adjust the value.
Speed Source Setup (power boat only)	High RPM Limit	Allows you to adjust the highest RPM point of your boat. If the value does not match the value on the GHC 20, use the arrows to adjust the value.
Speed Source Setup (power boat only)	Max Speed	Allows you to adjust the maximum speed of your boat. If the value does not match the value on the GHC 20, use the arrows to adjust the value.
Autopilot Tuning > Rudder Gains (sailboat only)	Gain	Allows you to adjust how tightly the rudder holds a 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 cause excess wear and tear on the drive unit (page 18).
Autopilot Tuning > Rudder Gains (sailboat only)	Counter Gain	Allows you to adjust how tightly the rudder corrects turn overshoot. If you set this value too high, the autopilot can overshoot the turn again when attempting to counter the original turn (page 18).
Autopilot Tuning > Rudder Gains (power boat only)	Low Speed Gain	Allows you to set the rudder gain for low speeds. This setting applies to the vessel when operating below planing 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 cause excess wear and tear on the drive unit (page 18).
Autopilot Tuning > Rudder Gains (power boat only)	Low Speed Counter	Allows you to set the rudder gain counter-correction for low speeds. This setting applies to the vessel when operating below planing 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 cause excess wear and tear on the drive unit (page 18).
Autopilot Tuning > Rudder Gains (power boat only)	High Speed Gain	Allows you to set the rudder gain for high speeds. This setting applies to the vessel when operating above planing 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 cause excess wear and tear on the drive unit (page 18).

Category	Setting	Description
Autopilot Tuning > Rudder Gains (power boat only)	High Speed Counter	Allows you to set the rudder gain counter-correction for high speeds. This setting applies to the vessel when operating above planing 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 cause excess wear and tear on the drive unit (page 18).
Autopilot Tuning	Acceleration Limiter	Allows you to limit the speed of autopilot-controlled turns. Increase the percentage to limit the turn rate, and decrease the percentage to allow higher turn rates.
Navigation Setup	Fine Heading Adjustment	Allows you to set the lubber line (heading offset) for the autopilot.
Navigation Setup > NMEA Setup	NMEA Checksum	If the connected NMEA 0183 GPS unit incorrectly calculates checksums, you may still be able to use it if you turn this setting off. When set to off, data integrity is compromised.
Navigation Setup > NMEA Setup	Reversed XTE	If the connected NMEA 0183 GPS unit sends the incorrect steering direction with the cross track error signal, use this setting to correct the steering direction.
Navigation Setup	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 Setup	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.
Steering System Setup	Shadow Drive Connected	This setting lets the system know if a Shadow Drive (optional) is connected or not. (page 6)
Steering System Setup	Verify Steering Direction	This setting tells the autopilot which direction the rudder must move to turn the vessel to port and to starboard. You can test and reverse the steering direction if necessary.
Steering System Setup	Drive Unit Class	Allows you to specify the class of your drive unit (refer to www.garmin.com for more information). Select Other for non-Garmin drive units.
Steering System Setup > Drive Unit Class > Other or Solenoid	Drive Unit Voltage or Solenoid Voltage	Only applicable if the Drive Unit Class has been set to “Other” or “Solenoid”. This setting tells the autopilot the voltage it should supply to the drive unit motor. Refer to the documentation supplied by the manufacturer of your drive unit to determine motor voltage specification. An incorrect setting can cause damage to your drive unit motor.
Steering System Setup > Drive Unit Class > Solenoid	Bypass Valve Voltage	Only applicable if the Drive Unit Class has been set to “Solenoid”. This setting tells the autopilot the voltage it should supply to the solenoid bypass valve. Refer to the documentation supplied by the manufacturer of your solenoid drive to determine the bypass-valve-voltage specification. An incorrect setting can cause damage to your solenoid drive.
Steering System Setup > Drive Unit Class > Other	Max. Current Threshold	Only applicable if the Drive Unit Class has been set to “Other”. This setting tells the autopilot the maximum amount of current it can supply to the drive unit motor. Refer to the documentation supplied by the manufacturer of your drive unit to determine motor current specification. An incorrect setting can cause damage to your drive unit motor.

Category	Setting	Description
Steering System Setup > Drive Unit Class > Other	Clutch Voltage	Only applicable if the Drive Unit Class has been set to “Other”. This setting tells the autopilot the voltage it should supply to the drive unit clutch. Refer to the documentation supplied by the manufacturer of your drive unit to determine clutch voltage specification. An incorrect setting can cause damage to your drive unit clutch.
Steering System Setup > Drive Unit Class > Other	Generic Drive Unit Tune	Only applicable if the Drive Unit Class has been set to “Other”. This initiates an automatic tuning procedure which determines an appropriate gain value for the installed drive unit. While performing this tune the autopilot will temporarily take control of the rudder.
Steering System Setup > Drive Unit Class > Other > Advanced Drive Unit Tuning	Speed Tune	Only applicable if the Drive Unit Class has been set to “Other”. Allows you to adjusts how aggressively the drive unit responds to a given input (page 21). If this number is too high, the drive unit will overshoot and oscillate around its target position. If this number is too low, the drive unit will respond slowly to a commanded change in position.
Steering System Setup > Drive Unit Class > Other > Advanced Drive Unit Tuning	Error Tolerance Tune	Only applicable if the Drive Unit Class has been set to “Other”. Allows you adjusts the amount of acceptable rudder position error (page 21). If this number is too high, a large amount of rudder position error will be allowed, and could negatively affect the course during heading hold. If the number is too low, the drive unit will attempt to eliminate small errors, causing excess power consumption.
Steering System Setup > Rudder Sensor Setup	Max Port Angle	Allows you to enter the angle at which your rudder turns furthest port.
Steering System Setup > Rudder Sensor Setup	Max Starboard Angle	Allows you to enter the angle at which your rudder turns furthest starboard.
Steering System Setup > Rudder Sensor Setup	Calibrate Rudder Sensor	Initiates a procedure which establishes the maximum range of movement of the rudder and calibrates the rudder sensor. If an error appears during the calibration, the rudder feedback sensor has likely reached its limit. Make sure the feedback sensor has been correctly installed. If the problem persists, bypass this error by moving the rudder to the farthest position that does not report an error.
Steering System Setup > Rudder Sensor Setup	Calibrate Rudder Center	Initiates a procedure which establishes the center position of the rudder. Use this calibration if the on-screen rudder position indicator does not match the true rudder center on your boat.

NOTE: Advanced configuration settings are available when using Dealer Mode (page 19). Other settings are available during normal operation of the GHP 12. See the configuration section of the *GHC 20 Owner's Manual* for more information.

Error and Warning Messages

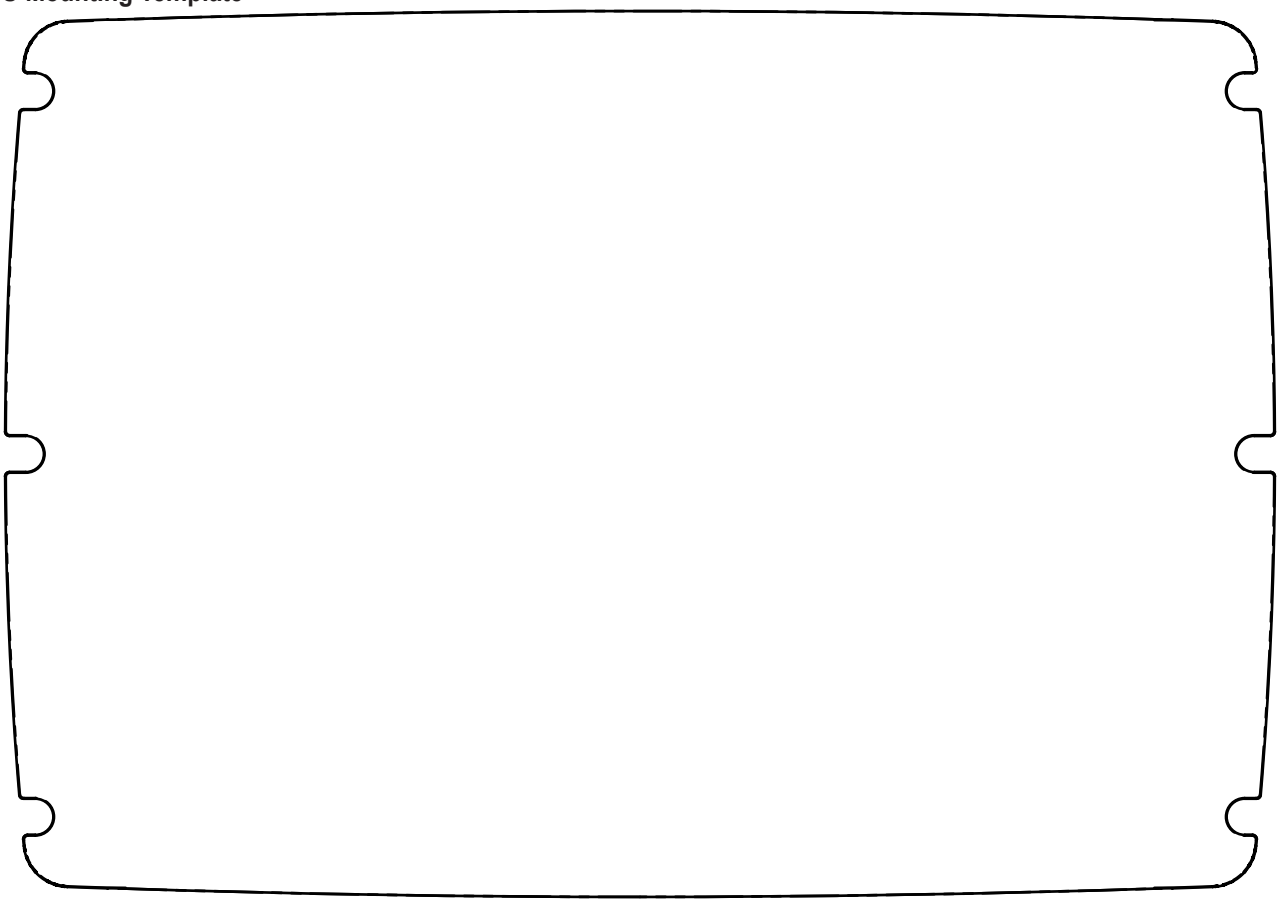
Error Message	Cause	Autopilot Action
ECU voltage is low	The ECU supply voltage goes below 10 Vdc for longer than 6 seconds.	• Alarm sounds for 5 seconds • Continues in normal operation
No rudder position feedback sensor detected	The autopilot can't detect a rudder feedback device or valid rudder position.	• Alarm sounds for 5 seconds • Drive unit is disabled • Autopilot transitions to Standby
Rudder position data is invalid.	The autopilot loses valid rudder position feedback data.	• Alarm sounds for 5 seconds • Drive unit is disabled • Autopilot transitions to Standby
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. This message will also be shown if navigation is stopped on a chartplotter prior to disengaging the autopilot.	• Alarm sounds for 5 seconds • Autopilot transitions to heading hold
Connection with autopilot lost	The GHC lost connection with CCU.	N/A
Lost wind data	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 is below the value specified in the low voltage alarm menu.	N/A

Error Message	Cause	Autopilot Action
Drive unit overload	The average drive unit current value goes above a specified threshold. • Class A: 8 amps • Class B: 16 amps • Other: user specified	• Alarm sounds for 5 seconds • The drive unit is disabled until the error is resolved • Continues in normal operation • For tips on reducing this load error message, see page 19
Rudder sensor is not calibrated.	The drive unit rudder sensor has not been calibrated. Calibrate the rudder (page 15).	• Alarm sounds for 5 seconds • Drive unit is disabled • Autopilot transitions to Standby
Rudder near limit. Center the rudder.	The rudder remains near its limit (rudder stop) for more than 5 seconds.	• Sounds alarm • Continues in normal operation
"Rudder near limit" flashes on the title bar	The autopilot has driven the rudder near its limit (rudder stop). The autopilot cannot drive the rudder further in this direction.	Continues in normal operation
Rudder miscalibration detected. Please re-calibrate the rudder.	The autopilot detects that the rudder sensor may not be calibrated correctly. Calibrate the rudder (page 15).	• Alarm sounds for 5 seconds • Drive unit is disabled • Autopilot transitions to Standby
Warning! A gybe has been initiated. Would you like to continue?	The autopilot has detected that the user has attempted to initiate a gybe.	• Sounds alarm • GHC10 prompts for user input. Selecting **Gybe** initiates the gybe, and selecting **Cancel** cancels the gybe.
Error: ECU high voltage	The ECU supply voltage goes above a certain threshold: • 12v system: 20 volts • 24v system: 36 volts	• Alarm sounds for 5 seconds • Drive unit is disabled • GHC10 begins a countdown timer that automatically powers off the autopilot after 60 seconds
Error: ECU high temperature	The ECU temperature rises above 212°F (100°C).	• Alarm sounds for 5 seconds • Drive unit is disabled • GHC10 begins a countdown timer that automatically powers off the autopilot after 60 seconds
ECU drive circuit overload	The average ECU current value rises above 16 A.	• Alarm sounds for 5 seconds • Drive unit is disabled • GHC10 begins a countdown timer that automatically powers off the autopilot after 60 seconds • For tips on reducing this load error message, see page 19
Error: ECU clutch fault	The current level in the ECU clutch circuitry is over 3 A.	• Alarm sounds for 5 seconds • Drive unit is disabled • GHC10 begins a countdown timer that automatically powers off the autopilot after 60 seconds
Error: Lost communication between ECU and CCU	Communication between the CCU and the ECU has timed out.	• Alarm sounds for 5 seconds • GHC10 begins a countdown timer that automatically powers off the autopilot after 60 seconds

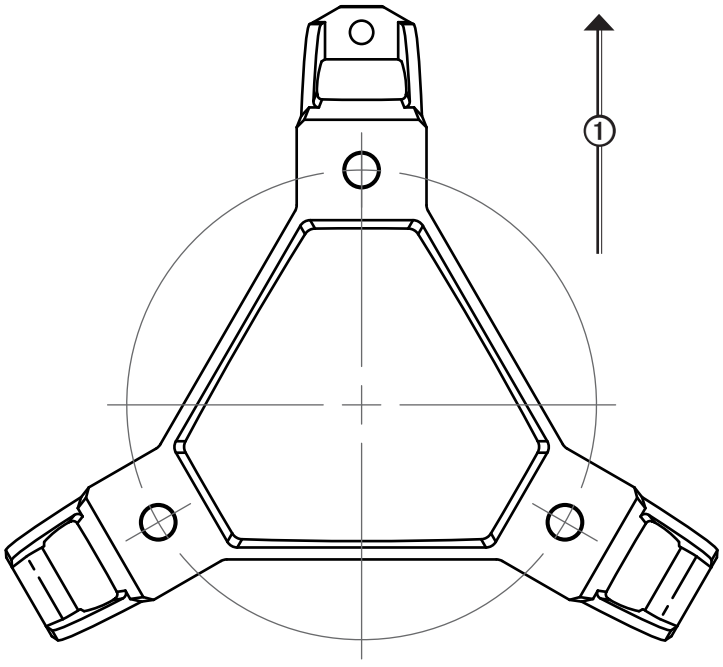
Mounting Templates

Use the following mounting templates during the mounting process.

ECU Mounting Template



CCU Mounting Template



①	Up, when installing on a vertical surface

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GHP 12 Installation Checklist

Detach this checklist from the installation instructions and use it during the GHP 12 installation process.

Read all installation instructions before installing the GHP 12. Contact Garmin Product Support if you have any questions during the installation process.

	Refer to the diagram on page 7 and notes on page 5 to understand the necessary electrical and data connections.
	Lay out all of the components and check the cable lengths. Obtain extensions if necessary.
	Install the drive unit according to the instructions provided with the drive unit.
	Mount the ECU (page 10). The ECU must be located within 19½ in. (0.5 m) of the drive unit.
	Connect the drive unit to the ECU.
	Mount the CCU (page 10) in a location free of magnetic interference. Use a handheld compass to test for magnetic interference in the area. **Mount the CCU in the bracket so that the wires hang straight down**.
	Mount the GHC 20 (page 11).
	Connect the yellow wire on the GHC 20 data cable to the yellow wire on the CCU/ECU interconnect cable, and connect the black wire on the GHC 20 data cable to ECU ground (page 12).
	Connect the GHC 20 and the CCU to a NMEA 2000 network (page 12).
	Connect any optional NMEA 2000-compatible devices to the NMEA 2000 network (page 14), or connect any optional NMEA 0183-compatible devices to the GHC 20 if a NMEA 2000-compatible GPS device is not available (page 14).
	Connect the ECU to the boat battery (page 10).
	Configure the GHP 12 system by completing the dockside wizard and the sea trial wizard (page 15).
	Test and adjust the autopilot configuration.

For the latest free software updates (excluding map data) throughout the life of your Garmin products, visit the Garmin Web site at www.garmin.com.

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