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System Components

Drive Components

**MerCathode power harness**—The MerCathode power harness provides power to the MerCathode system on the drive. Use of the MerCathode system minimizes galvanic corrosion of the drive.

**Drive application harness**—The drive application harness is an interface between the engine and the pod. This harness contains power and ground connections for solenoids on the pod. Pressure sensors, transmission speed sensors, and temperature sensors are also powered and grounded through this harness.

**Thrust vector module (TVM)**—The TVM monitors and controls the steering angle of the drive. TVM inputs include drive position, tab position, and various pressure sensors. The TVM sends commands to the steering coils and the tab coils.

VIP Components

**Vessel interface panel (VIP)**—The VIP contains the components that interact with the engine and controls at the helm, various circuit breakers, and start/stop buttons for cranking the engine. The VIP houses the system integration module (SIM).

**System integration module (SIM)**—The SIM processes inputs from the helm components and sends throttle commands to the engine and voltage to the transmission actuators on the pod. Engine and transmission data is read by the SIM and sent to display devices at the helm.

**VIP power harness**—The VIP power harness provides power from the battery to the vessel interface panel. The harness is protected by an in-line 30-amp fuse.

**T-harness**—The T-harness allows the 14-pin helm extension harness and thrust vector module (TVM) extension harness to be connected to the vessel interface panel.

**Vessel sensor harness**—The vessel sensor harness contains connection points for various sensors that are read by the engine. Some of these sensor inputs include tank levels, water-in-fuel, and fire suppression breakout.

**Engine-to-VIP extension harness**—The engine extension harness interfaces the engine with the VIP. This allows engine parameters to be read by the VIP and on system gauges at the helm. The engine extension harness comes in multiple lengths. Check with Mercury Diesel for specific length availability.

**Vessel sensor extension harness**—The vessel sensor extension harness connects between the vessel sensor harness and the VIP. This allows the vessel sensor harness to be extended beyond the VIP. The extension harness comes in multiple lengths. Check with Mercury Diesel for specific length availability.

**14-pin data harness**—The main station extension harness extends the CAN bus, power, ground, and switched power from the VIP to the helm. This allows control interfaces to interact with the rest of the system in the engine compartment.

Helm Harness Connectors

The Zeus helm harness contains all of the connectors required to interface the helm components with the engine and drive system. The specific connections are listed below.

- CAN X termination resistor (both port and starboard)
- Port and starboard CCM
- Switched load (for accessories)
- Port and starboard main power relay
- Main power relay connection/starboard power disconnect
- Port and starboard Lever 3 (not used)
- Port and starboard key switches (only at main station)
- Start/stop panel (required at second station)
- Steering motor (electronic feedback steering column)
- Electronic remote control (ERC)
- Joystick
- Skyhook activation warning harness
- Fire suppression system (installed with keyswitch adapter harness)

Helm Components

**Command control module (CCM)**—CCMs transmit and receive data on CAN buses H, P, and X. The CCM processes inputs created by vessel controls (joystick, steering wheel, electronic remote control) and sends commands to the appropriate system components. The CCM also interacts with navigation system components and contains the data necessary for autopilot functionality. One CCM is required per engine.

For multiple pod applications, CCMs are supplied mounted on a helm panel to simplify installation. The CCMs can be removed and mounted separately, if available space is not adequate to accommodate the panel.
**Multiwake junction box (J-box)**—The main function of the junction box (J-box) is to provide a multiwake connection point for CAN P and CAN H devices. The J-box also allows SmartCraft components to connect to the SmartCraft network via one box that is controlled by any key switch. The multiwake junction box serves as the connection point for the navigation system Y-harness (for the IMU and GPS antenna), the 10-pin yellow diagnostic connector, the ERC DTS trackpad, the VesselView harness, the autopilot trackpad, and the autopilot gateway. The J-box can also function as a service port. An 8-way J-box is required for single-helm configurations. Dual-helm installations require an additional, 6-way J-box for use at the second helm. Required J-boxes are included in the corresponding kits.

**Diagnostic connector**—The diagnostic connector provides a service port at the dash.

**Electronic remote control (ERC)**—The ERC provides engine throttle and shift input to the control system and houses the DTS trackpad.

**DTS trackpad**—The DTS trackpad allows the user to control the following system features: trolling mode, engine synchronization, helm control transfer, single-lever mode, throttle-only mode, and docking mode. The DTS trackpad is integrated into some ERCs, but is also available separately for those ERCs without it.

**Electronic steering**—Electronic steering is accomplished through a steering motor, sensor, and actuator assembly that mates with a steering wheel to provide directional input to the control system. The CCM translates these commands and sends them to the thrust vector modules (TVMs).
  - The steering motor is fully redundant between the port and starboard systems.
  - The steering motor provides resistive end stops.
  - The drop length for the steering motor cannot be extended.

**Joystick**—The joystick provides directional input to the control system, which in turn commands the engines. This control is provided on three axes; fore to aft, side to side, and yaw (by twisting the joystick). As with the electronic steering, the input is sent to the CCM and then on to the thrust vector modules (TVMs).

**Key switch**—The key switch provides switched power to the control system and can be used to start and stop an engine. There must be one key switch for each engine.

**Key switch extension harness**—In the event that the key switch is not located close to the helm harness, a key switch extension harness can be used. However, a start/stop panel is required when using a key switch extension harness because the key switch extension harness disconnects the cranking circuit from the key switches.

**Start/stop panel**—The start/stop panel is used to start and stop the engines with the press of a single button. Each engine is controlled independently. For the start/stop panel to function, the key switch must be in the on position.

**Autopilot trackpad**—The autopilot trackpad communicates on CAN H. It controls the following functions: Skyhook, waypoint sequencing, and auto-heading.

**Inertial measurement unit (IMU)**—The IMU is a solid-state, rate-gyro electronic compass that detects the direction of the earth’s magnetic field using solid-state magnetometers and indicates the vessel heading relative to magnetic north. Additionally, solid-state accelerometers and angular-rate sensors sense the vessel’s attitude and rate of turn.

**Global positioning system (GPS)**—The GPS antenna provides location, speed, and direction information to the system. This information comes from satellites that transmit radio signals to the GPS unit. This GPS unit cannot supply information to the chartplotter.

**CAN H extension harness**—The CAN H extension harness allows the navigation system components (the GPS antenna and the IMU) to be mounted further from the helm harness.

**Navigation system Y-harness**—The Y-harness (CAN H) connects the IMU and the GPS antenna to the SmartCraft network through a standard junction box.

**CAN H helm gateway**—The gateway allows the system to communicate with NMEA 2000 components, such as approved chartplotters.

**Lanyard stop switch**—The lanyard stop switch offers a redundant, emergency shutdown method in the event that the operator is moved away from the controls or if the key switch fails. The lanyard stop switch is mounted at the helm and connects to the helm harness.

**VesselView display**—The VesselView display is a SmartCraft-based digital display. Some of the data displayed by the VesselView display are engine information, trim position, drive position, tank levels, and navigational information. The VesselView display comes with an interface harness, bezel, sun cover, temperature sensor, operation manual, installation manual, and installation hardware. The vessel alarm horn is standard.

**Helm MPR harness**—This harness connects the helm harness to the circuit-protected, switched starboard battery power (labeled “STBD PWR DISCONNECT” on the dual-engine helm harness). The helm MPR harness supplies power to the starboard CCM main power relay. This power is primarily used for steering wheel centering. Contact your Mercury PAE for harness and connector design requirements, if not using Mercury harnessing.

**OEM Skyhook**—This connector is supplied for use by the OEM, and its use is not required by Mercury. It provides an isolated connection point to alert the OEM vessel systems when the Skyhook feature has been activated. Connection and harnessing to this point is the OEM’s responsibility.
14-pin data harness—There are two 14-pin data harnesses for each pod: a 14-pin data harness and a 14-pin extension harness. The 14-pin data harness is routed from the helm panel (CCM) to the 14-pin T-harness that splits the 14-pin data harness to the VIP and to the extension harness that is routed to the pod. Each 14-pin data harness contains multiple power and signal wires.

CAN X/P/H—The helm harnesses include connectors for each of the three CAN buses:

- **CAN X** transmits primary shift/steer/throttle data. There is one CAN X bus per pod. Each CAN X must be terminated at the pod and at the helm farthest from the pod.
- **CAN P** transmits gauge and redundant shift/steer/throttle data. There is one CAN P bus per vessel. For dual pod applications, a single CAN P link harness is used at the helm farthest from the pod to complete the bus.
- **CAN H** transmits autopilot and Zeus-specific helm-to-helm communication. There is one CAN H bus per vessel. For dual pod applications, a single CAN H link harness is used at the helm farthest from the pod to complete the bus.

All CAN buses must be terminated correctly. Refer to the appropriate architecture drawing for your configuration.

Port and starboard junction box—In addition to the multiwake J-box connection, there are independent wake connections for port and starboard. These connections are typically used for SC1000 Tach connections or other SmartCraft devices that are desired to operate with only a specific key switch. These connections contain CAN P and H, plus power.

Tab SMM harness—The tab SMM harness connects the tab SMM to the trim tab panel and to the standard junction box.

Trim tab smart multiplex module—The trim tab smart multiplex module (SMM) reads the switch settings from the Trim Tab Panel and converts these inputs to data that can be read by the SmartCraft network.

Trim tab panel—The trim tab panel consists of several switches which interlock to form a small panel. The switches allow for the manual setting/adjustment of the trim tabs as well as enabling an auto function that controls the tabs automatically.

E-stop switch—The E-stop switch offers a redundant emergency shutdown method in the event that the key switch fails. The E-stop switch is mounted at the helm, and connects to the helm harness.

Dual-Helm Systems—First Helm Selection

**IMPORTANT:** When deciding which helm station will be the first helm, consider that in the event of a major system or component failure, the system must be restarted by turning the key switch off, and the first helm will be active when the key switch is turned back on, regardless of which helm station was active when turned off. It is critical that the first helm be operational in all lighting, weather, and navigational conditions as it will always be the active helm station in the event of system restart.

Three dual-helm kits are available from Mercury for use with Zeus applications: one each for dual, triple, and quad configurations.

The first helm has the full complement of controls and accessories. The second helm, often at a flybridge or other elevated structure, will usually have an abbreviated set of controls and gauges, with the minimum being:

- Steering wheel
- ERC levers
- DTS trackpad
- Start/stop switches
- Joystick
- Autopilot trackpad
- VesselView display

The dual-helm kits also include other essential items for the installation, including:

- 14-pin T-harnesses and de-pinning tools
- Helm panels (mount under dash), each of which includes a CCM with harness and a 6-way J-box
- Navigation system Y-harness
- Clean power harness

The helm harness for the first helm must be directly connected to the 14-pin data harness by the use of the 14-pin dual-helm adapter T-harness. The helm harness for the second helm connects to the third junction of the dual helm adapter T-harness through an extension harness.

Both helms in a dual-helm installation must have the same features enabled in the personality in order to ensure safe transfer between stations. Chartplotters are optional at any or either station, but must be on the approved list to be integrated into the system.

If installing a dual-helm system, read the instructions and examine the architecture diagrams carefully before starting the installation. While the two helms are similar, they are also different in important ways. For example, besides the extra harnessing and controls, the CAN X termination resistor is moved from the first helm to the second helm, and the CAN H and CAN P link harnesses are moved to the second helm.

The instructions in this manual are for the installation of specific components at the first helm station. Use the guidelines and instructions to install the components on the second helm.
Additional Second Station Component Instructions

14-pin T-harnesses—The harnesses are used as a T-connection between the first helm harness, 14-pin data harness, and the second helm 14-pin data harness. One T-harness is required per pod, and each must be purchased separately. Each kit contains one 6-pin key switch weather cap and two 2-pin CAN weather caps. Follow the instructions included with the harnesses.

Low-loss 14-pin data harnesses—For dual-helm applications, especially for quad applications, the combined data harness length from the engine to the furthest helm panel/CCM can exceed 12.2 m (40.0 ft), resulting in significant voltage loss on the 12 volt and wake signal wires. If the combined length of the data harnesses from the pod to VIP, the VIP to the first helm, and the first helm to the second helm exceeds 12.2 m (40.0 ft), you must use low-loss data harnesses for all runs in place of the standard data and extension harnesses.

Low-loss data harnesses appear identical to the standard data harnesses, but use larger gauge (10 AWG) wire for pin A (+12 V), pin B (ground), and pin C (wake). Low-loss data harnesses are available in lengths from 1.5 m (5.0 ft) to 36.6 m (120 ft). Contact Mercury Marine or your engine manufacturer’s authorized representative for assistance with part numbers.

Key switches—Key switches are not allowed at the second helm. These connections must be weather capped. Weather caps are provided in the 14-pin T-harness kits. Start/stop switches must be used at upper stations.

2-Pin CAN link—When relocating the CAN H and CAN P 2-pin CAN link harnesses to the second helm, the connections at the primary helm must be weather capped. One weather cap is included in each of the 14-pin T-harness kits, covering only the CAN P link. Additional weather caps must be purchased for CAN H.

IMPORTANT: In certain dual-helm applications, especially for quad applications, the normal system architecture will result in CAN P/H bus lengths that exceed the maximum. For these special circumstances, you must use the alternate system architecture described in Single-Trunk CAN P/H.

2-pin CAN X resistor—When relocating the CAN X resistor to the second helm, the 2-pin connector at the primary helm must be weather capped for all pods. These weather caps are provided in the 14-pin T-harness kit.

GPS and IMU—In order to minimize the CAN H drop lengths, Mercury suggests that the GPS antenna and the IMU be mounted at separate helms. The GPS antenna should be mounted at the helm highest in the vessel to ensure a clear view of the sky while adhering to the other requirements listed in the GPS antenna installation section of this manual. The IMU should be mounted at the helm lowest in the vessel, to ensure that it experiences the least amount of horizontal movement that can result in calibration failure. Second helms are typically compact, and finding a mounting location that is clear of electronic and magnetic interference can be difficult.

When mounting the IMU and the GPS antenna at separate helms, the spare 5-pin connection of the navigation system Y-harness must have a weather cap installed. Weather caps are supplied in the dual-helm kit.

Chartplotter—Refer to the Approved Chartplotters procedure for dual-helm chartplotter information.

Triple and Quad CAN Link Harness Connections

Most helm components function identically in triple and quad applications as they do in dual pod applications. Differences—including additional components—are listed below.

CAN X/P/H—Identical to dual pod applications, although the link harness placement differs:

• For triple applications:
  • The 2-pin CAN link harnesses must be disconnected from the dual pod helm harness CAN P and CAN H port connectors and connected instead to the center pod helm harness CAN P and CAN H connectors.
  • Blue CAN terminators must be installed on the unused CAN P and CAN H port connectors on the dual pod helm harness.
  • A single CAN P/H link harness must be connected between the port and center pods, with a red terminator on the starboard pod CAN P/H connector.

• For quad applications:
  • Two 2-pin CAN link harnesses (supplied) each are required for CAN P and CAN H.
  • The link harnesses supplied with the dual pod helm harness must be disconnected from the CAN P and CAN H port connectors and connected instead to the starboard inner connectors on the quad application helm harness, linking the starboard inner to the starboard outer.
  • The link harnesses supplied with the quad application helm harness must be connected to the dual pod helm harness CAN P and CAN H port connectors, linking the port inner to the port outer.
  • A single 10-pin P/H CAN link harness must be connected between the port inner and starboard inner pods, with one red terminator each on the port outer and starboard outer pod CAN P/H connectors.

All CAN buses must be terminated correctly. Refer to the appropriate architecture drawing for your configuration.

Junction box (J-box) harness—A J-box harness is required for triple and quad applications. The J-box itself functions identically to dual pod applications.

Shadow resistor pack—A shadow resistor pack is required for the lever connectors for each center/inner pod.
**Inner/center J-box**—Identical function to the port and starboard junction box connections, except that they are for the inner port and starboard pods and are found on the triple and quad application helm harnesses.

**Vessel Interface Panel (VIP)**

VIPs are engine-specific. Care should be taken to keep individual continuity through the harness connections. At this point the engine connections should be made. Refer to the icons printed on the front of the VIP for the proper connections.

1. Connect the helm extension harness to the T-harness that already connects the drive to the VIP.
2. Confirm the following port and starboard harness connections:
   - Appropriate vessel sensor harness
   - Appropriate engine harness
   - Appropriate 14-pin T-harness
   - Power supply harness

![VIP diagram](image)

One VIP shown, all similar
- a - Vessel sensor harness
- b - Engine harness
- c - T-harness
- d - Unswitched power harness

**Main Station Extension Harness**

The main station extension harness extends the CAN bus data, power, ground, and switched power from the T-harness on the VIP to the helm. It comes in various lengths to facilitate installation.

One main station extension harness is required per engine, per station.

![Main station extension harness diagram](image)

**Installation**

1. Connect the main station extension harness to the remaining connection on the 14-pin T-harness at the VIP. Tighten the connector collars. Ensure connector collars are fully engaged and secure.
2. Route the main station extension harness to the helm. The station extension harness will connect to the helm harness, covered later.
3. If a second helm is being installed, install the second helm to the station extension harness with a T-harness.

**Second Station T-Harness**

The second (2nd) station T-harness is used only on dual helm installations. The T-harness contains all of the connections necessary to connect a second station to the main station extension harness.
One 14-pin T-harness is required per pod at the lower helm station when the vessel is equipped with a second station.

![Diagram showing T-harness connections]

**Helm Harness**

The helm harness contains all the connectors to connect all control interfaces to the control system. The specific connections are listed below.

One helm harness is required per station and is premounted on the helm board. Refer to: Section 4B - System Harnessing Diagrams for helm layout and specific helm harness information.

**Installation**

*NOTE: Ensure that the helm components are laid out with respect to the helm harness breakouts. Some breakouts are extremely short, and require components to be mounted in close proximity with each other.*

**Helm Connections**

The following connections will be made to the helm harness.

- CAN X termination resistor (both port and starboard)
- Port and starboard CCM
- Switched load (for accessories)
- Port and starboard main power relay
- Starboard clean power and starboard power disconnect
- Port and starboard lever 3
- Port and starboard key switches (only at main station)
- Start and stop panel (required at second station)
- Steering motor (electronic feedback steering column)
- Control head
- Joystick
- Standard junction box

**Standard 6-way or 8-way Junction Box**

A standard junction box provides a multiwake connection point for CAN P and CAN H devices.

**Installation**

*IMPORTANT: Make careful considerations when deciding where to mount the standard junction box:*

- Ensure approximately 102 mm (4 in.) of unobstructed access to all connections on the junction box
- A location free of excessive moisture and heat

*NOTE: The standard junction box must be mounted near the other helm components to allow harness connections.*
1. Using the dimensions provided, mark and drill the holes necessary to install the 6-way or 8-way standard junction box depending upon your application.

2. Mount the appropriate standard junction box to the predetermined location. Do not overtighten the mounting screws.

Precision Pilot Trackpad

Precision Pilot (Pilot) functions are controlled through the Pilot trackpad. The trackpad is comprised of multiple buttons that control features such as: Skyhook, Auto Heading, and Waypoint. Install the Precision Pilot trackpad appropriately for your application.

Installation with Supplied Nut

*NOTE:* You can secure the Precision Pilot trackpad assembly to the helm in two ways, with the nut supplied with the kit, or with four screws (not supplied). For helms with a thickness less than 5 mm (0.197 in.), secure the Precision Pilot trackpad with four screws. Review the installation instructions to determine which mounting is best suited for your application.

1. Use the dimensions provided to identify a suitable location for the Precision Pilot trackpad. Ensure the area behind the selected location is clear of obstructions and wires.
2. Using the dimension provided, mark and drill the 54 mm (2.125 in.) center mounting hole.
3. Install the gasket onto the Precision Pilot trackpad assembly.
4. Insert the assembly into the helm cutout.
5. Ensure that the Precision Pilot trackpad is positioned correctly. Thread the supplied nut onto the assembly and tighten the nut securely.
6. Install the bezel cover onto the Precision Pilot trackpad. The bezel cover will snap into place.
7. Connect the Precision Pilot trackpad connector to the standard junction box.

**Installation with Four Mounting Screws**

1. Use the provided dimensions to identify a suitable location for the Precision Pilot trackpad assembly. Ensure the area behind the selected location is clear of obstructions and wires.

2. Mark the center location of the 63.5 mm (2.5 in.) hole onto the helm with a marker or awl. Mark the center location of the four mounting screws onto the helm with a marker or awl.

   **NOTE:** The four mounting screws are not included with this kit. Use an appropriate size drill bit for the mounting hardware used.

3. Drill the 63.5 mm (2.5 in.) hole with a hole saw.

   **IMPORTANT:** Do not drill mounting holes for use with screws larger in diameter than 5 mm (0.197 in.).

4. Drill the four mounting screw holes with an appropriate size drill bit for the mounting hardware used.

5. Install the gasket onto the Precision Pilot trackpad assembly.

6. Insert the assembly into the helm cutout.

   **IMPORTANT:** Do not use screws larger in diameter than 5 mm (0.197 in.).

7. Ensure the Precision Pilot trackpad is positioned correctly. Align the screw holes and secure the assembly to the helm with four screws. Do not overtighten the screws.

8. Install the bezel cover onto the assembly. The bezel cover snaps into position.
9. Connect the Precision Pilot trackpad connector to the standard junction box.

Command Control Module (CCM)

CCM

The CCM processes inputs created by vessel controls (joystick, steering wheel, electronic remote control) and sends these commands to the necessary system components.

One CCM is required for each engine.

IMPORTANT: CCMs are no longer specific to port or starboard.

IMPORTANT: Dimensions are for reference only. Do not use as a mounting template.

Installation

One set of CCMs (2, 3, or 4 depending on number of pods) are required for each helm. If installing two helms, install the second helm first.

NOTE: To minimize vibration, mount the command module with the supplied rubber grommets/bushings according to the following guidelines and template:

- Mount in an area that is accessible
- Mount in an area where the wiring connections will not be stepped on or disturbed
- Mount in an area that stays relatively dry
- Fasten the harness to prevent flexing at the CCM connection
- Do not overtighten mounting screws
- Use standoffs as required to avoid bending the module

Do this for all CCMs.

NOTE: Due to the breakouts on the helm harness, the CCMs are required to be mounted within a certain distance of the helm harness and standard junction box.

Single or Main Helm Installation

1. Mount the CCMs in the predetermined location using the dimensions provided.
2. Plug connectors A, B, and C, on the helm harness, into the corresponding CCM. Do this for all CCMs.
3. Connect the 14-pin connector on the helm 1 harness to the 14-pin data harness, or dual helm T-harness if equipped with a second helm.

**Helm Component Board**

To assist in the installation of the helm components, a helm component board is available as an assembly with the helm components mounted to an appropriately sized board. Installation of the helm components is simplified using this helm component board. Included with the board is the necessary hardware for mounting at the helm of the boat.
If your installation is using the helm component board in place of the installation of individual helm components, refer to the installation instructions provided with the helm board and mount accordingly.

**Second Helm Installation, if Equipped**

1. Mount the CCMs to the predetermined location using the dimensions provided. **IMPORTANT:** Dimensions are for reference only. Do not use as a mounting template.

2. Plug connectors A, B, and C, on the helm harness, into the corresponding CCM. Do this for all CCMs.
3. Connect one T-harness to each 14-pin data harness coming from the VIP.
4. Connect the 14-pin connector on the helm 1 harnesses to the 14-pin T-harnesses.
5. Remove the CAN X terminator resistor and the 2-pin CAN link harnesses from the helm 1 harness. Seal the unused connectors with weather caps.
6. Connect the “ENGINE” end of a second data harness to each T-harness, and route the station extension harnesses to the second helm.
7. Connect the 14-pin connectors on the helm 2 harness to the respective station extension data harnesses coming from the 14-pin T-harnesses installed at the lower station.
8. Ensure that the CAN X connectors at helm 2 have terminator resistors installed.
9. Ensure that the 2-pin CAN link harnesses at helm 2 are installed.

Guidance Equipment Installation

SmartCraft Inertial Measurement Unit (IMU)

The inertial measurement unit (IMU) is a solid state, rate gyro electronic compass that detects the direction of the earth’s magnetic field using solid state magnetometers and indicates the vessel heading relative to magnetic north. Additionally, solid state accelerometers and angular rate sensors indicate the vessel’s attitude and rate of turn.

The IMU is treated as a drop on the SmartCraft CAN H bus and must not exceed the maximum drop length. If the mounting requirement dictates that the drop length exceed this requirement, contact your application engineer for application approval. For applications where the IMU will exceed the SmartCraft architecture drop length specification in order to be mounted at the center of gravity, the IMU will be relocated near the helm. When mounting the IMU at the helm it must be mounted as close to the centerline of the vessel as possible.

IMU Location and Orientation Requirements

The selection of a suitable mounting location and the orientation of the IMU are important for optimal performance. Mounting location and orientation requirements include:

- Mount the IMU as close to the centerline of the vessel as possible.
- The centerline of the IMU aligned within ±5° of the keel of the vessel with the arrow on the top decal pointing toward the bow. Although the IMU can be calibrated in the vessel to compensate for heading installation-offset, it is recommended that the IMU points toward the bow and is parallel to the vessel centerline as specified.
- As level as possible (±3° from earth level while the boat is on plane) to maximize its pitch and roll operational range.
- Exposure to minimal vibration. Although the IMU is more tolerant of vibration than a flux gate compass, it is best to mount the IMU on a rigid surface free of vibration.
- Protecting the unit from the sun and elements.

IMU Clearance Requirements

The IMU is a solid-state, rate-gyro electronic compass that detects the direction of the earth’s magnetic field using solid-state magnetometers, and indicates the vessel heading relative to magnetic north. Additionally, solid-state accelerometers and angular rate sensors indicate the vessel’s attitude and rate of turn. However, these sensors are also sensitive to other electronic and magnetic waves.

IMPORTANT: Do not mount the IMU within 100 cm (40 in.) of electrical components that are not shielded, not wired with the forward and return conductors as neighboring pairs, or are not a twisted pair.

To avoid interference the IMU must have the following clearances:

- 46 cm (18 in.) minimum from any electromechanical or magnetic-field producing device, including:
IMU Installation

IMPORTANT: Ensure that the IMU location you have selected meets the mounting, clearance, and CAN H drop length limits specified.

NOTE: Mercury requires the builder to use a decal or other signage to identify the IMU mounting location for service. Identification need only state “Navigational/Propulsion Device Service Location.”

The G3 service tool provides additional orientations for locations where the IMU connector may not face forward without hitting an obstruction or the brackets cannot be secured to the vessel. The preferred and recommended orientation is "Normal." The possible orientations are:

- Normal—connector forward
- Upside down—connector forward
- Backward—connector backward
- Upside down and backward—connector backward

The OEM is required to make a note in the product Operation, Maintenance, and Warranty manual about the location and orientation of the IMU for installations other than "Normal."

Horizontal Surface

The preferred method of mounting the IMU is on the top of a horizontal surface. The IMU comes preassembled with brackets in this orientation.

1. Using the dimensions provided, mark and drill the holes necessary to mount the IMU to a horizontal surface.

2. Attach the mounting brackets to the bottom of the IMU using the provided brass flat head screws, if not already attached. Do not overtighten.
3. Attach the IMU to the horizontal surface using the four mounting screws provided with the unit.

4. Connect the navigation system extension harness to the IMU 5-pin connector.

5. Ensure that the unused ethernet port is weather-capped.

**Vertical Surface**

The usual way of mounting the IMU to a vertical surface is attaching the unit to the forward side of a vertical surface, so that the side of the compass with the connectors is facing the bow of the boat. It may be mounted to a vertical surface, so the side of the compass with the connectors is facing the stern of the boat. Ensure that the IMU is programmed to recognize that it is mounted in this way.

1. Remove the brackets from the bottom of the IMU and mount them in the vertical position as shown.
2. Using the dimensions provided, mark and drill the holes necessary to mount the IMU to a vertical surface.

3. Attach the mounting brackets to the side of the IMU using the provided brass flat head screws.
4. Attach the IMU to the vertical surface using the four mounting screws provided with the unit. Refer to the figure below. Do not overtighten the mounting screws.

![IMU Mounting Diagram](image)

- a - Brass flat head screws
- b - Mounting brackets
- c - Mounting screws
- d - IMU

5. Ensure that the unused ethernet port is weather-capped.

Global Positioning System (GPS)

The global positioning system (GPS) provides the location, speed, and direction of the vessel.

GPS Antenna Mounting Considerations

The selection of a suitable antenna mounting location is important for optimal GPS performance. The mounting location and orientation of the GPS antenna should be:

- Level with the earth’s horizontal plane. This gives the GPS antenna the optimal view of satellites from all directions.
- High enough to have a clear view of the sky to the horizon in all directions unblocked by masts or antennas. The GPS provides the best readings when it has access to as many satellites as possible.
- As far as possible from VHF, satellite, or radar antennas. Radio frequency transmissions from these antennas can interfere with the proper reception of the GPS satellite signals.

Installation

Locate the GPS antenna in clear view of the sky. Hardtop or radar arch mounting is typical. The antenna can be mounted either flush to the surface or on a 25.4 mm (1.0 in.) 14 threads per inch standard marine pole mount.

Horizontal Surface

1. Using the dimensions provided, mark and drill the necessary holes for mounting the GPS antenna to a horizontal surface.

![GPS Antenna Mounting Dimensions](image)

- a - Connector for harness
- b - Holes for fasteners (3)
2. Attach the GPS antenna to the horizontal surface using the included brass mounting screws and lockwashers.

Marine Pole Mount
1. Screw the included GPS antenna mount base to the standard marine mount pole.
2. Thread the navigation system extension harness through the standard marine mount and the antenna mount base from the bottom to the top.
3. Connect the navigation system extension harness to the GPS antenna connector.
4. Attach the GPS antenna to the antenna base (bracket) using the included brass mounting screws and lockwashers.

Navigation System Extension Harness
The navigation system extension harness allows the GPS antenna and the IMU to be mounted in remote locations. Extension harnesses for the IMU and GPS antenna are available from Mercury Diesel.
Installation

Observe the following installation guidelines:

• Do not route harness near sharp edges, hot surfaces, or moving parts. Fasten cables away from sharp edges, fasteners, or objects that could wear into the harness.
• Avoid sharp bends in the harness.
• Fasten and support the harness with clamps or cable ties along the routing path at least every 45.7 cm (18 in.).
• Do not modify harness.
• Hand-tighten barrel nut connectors.

IMU Connection

**NOTE:** The navigation system extension harness comes in three lengths. The shortest length is intended for the IMU. The other two are used for the GPS antenna. The navigation system extension harnesses used for the GPS antenna can be daisy chained together to form a longer length.

Connect the navigation system extension harness to the 5-pin circular connector on the IMU. The other end of the navigation system extension harness will connect to the navigation system Y-harness.

![IMU 5-pin connection](image)

GPS Antenna Connection

Connect the navigation system extension harness to the 5-pin circular connector on the GPS antenna. The other end of the navigation system extension harness connects to the navigation system Y-harness.

**NOTE:** In a dual station application, connect a second navigation system Y-harness to the standard J-box at the second station, and connect an extension harness and the GPS antenna to this Y-harness. It is not necessary to connect the GPS antenna to the standard J-box at the main station, except in single station applications.

![GPS Antenna connection](image)

Trim Tab

Trim Tab Panel

The trim tab panel consists of several switches which interlock to form a small panel. These switches are up/down controls for port and starboard, and an auto tab enable. The switches allow for manually setting/adjusting the port and starboard trim tabs, and enabling the auto tab function that controls the trim tabs automatically.

The individual trim tab control switches will also be able to make tab adjustments when in automatic trim control mode. The tabs can be adjusted independently to allow for external conditions or personal preferences.

The trim tab panel, when used, should be mounted on the helm within easy reach of the operator. Manual trim tab control overrides the automatic system.
The manual trim tab control also makes offset adjustments when the boat is in automatic trim control mode. Tabs can be adjusted independently.

Typical automatic and manual trim tab panel
a - Port trim switch
b - Starboard trim switch
c - Automatic trim override

In triple applications, manual control of the center pod will be incorporated into the port and starboard switches. Use the panel available through the appropriate accessories guide.

1. Cut the appropriate size mounting hole for the trim tab panel using the dimensions or template found in the trim tabs installation sheet.
2. Snap the trim tab panel into the mounting hole.
3. Connect the trim tab panel harness to the breakout harness on the helm harness.
4. If using a trim tab panel other than that provided, contact a Mercury Diesel applications engineer for wiring diagrams to properly connect all wires to the harness.

**Trim Tab Smart Multiplex Module (SMM)**

**Description and Standard Installation**

The trim tab smart multiplex module (SMM) reads the switch settings from the trim tab panel and converts them to data that can be read by the SmartCraft network.

**Installation**

1. Using the dimensions below, carefully locate a mounting location for the SMM.
2. Insert the supplied rubber grommets into the three openings of the SMM.
3. Insert the supplied metal standoffs into the rubber grommets.
4. Mount the SMM in the predetermined location, being careful not to overtighten the mounting screws.
5. Connect the trim tab panel harness to the J-box. Ensure that the connectors are securely seated.
Key Switch and Start/Stop Panel

Key Switch

The key switch provides switched power to the control system, and can be used to start and/or stop an engine. There will be one key switch, for each engine and they are only installed at the main station. For a boat that is equipped with two stations, the main station will have the key switches and the other station will have a start/stop panel. In the event that a key switch extension harness is used, a start/stop panel will have to be used at the main station due to the crank circuit being absent from the key switch extension harness.

Preparation

![Diagram of key switch and start/stop panel]

### WARNING
Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

1. Ensure battery cables are disconnected.

### CAUTION
Avoid injury or product damage. Obstructions, such as braces and wiring, may be unseen when looking at the front of the dashboard. Before drilling or cutting any holes in the dashboard, check the area behind the dashboard for obstructions. Do not drill or cut when obstructions are present.

**IMPORTANT:** To ensure that water does not collect at the key switch and drains from the housing, install the key switch a minimum of 10° from vertical.

2. Select a location for the key switch on the dashboard that meets the following requirements:
   - unobstructed behind the dashboard
   - within harness length limits
   - able to orient the switch a minimum of 10° from a vertical position
   - adequate clearance between the components to install bezels, if equipped

3. If the dashboard is fiberglass, prevent the dashboard from chipping by applying masking tape to the area that is to be drilled or cut.

4. If the dashboard is vinyl covered, keep the vinyl from tearing by removing the vinyl from the area to be drilled or cut.

5. The key switches can also be mounted in a remote panel, such as in the salon, using optional extension harnesses available from Mercury Diesel. Follow the instructions included with your key switch.
Standard Mounting - With Housing

1. Cut or drill a 54 mm (2.125 in.) diameter hole through the dashboard at the selected location.

2. Install the key switch housing assembly onto the key switch assembly.
   IMPORTANT: There are two notches in the key switch assembly. The notch with white plastic showing is a drain opening. To properly drain the key switch, this notch must point down when installed.

3. Align the upper notch of the key switch assembly and housing. Ensure that the drain opening notch, with the white plastic showing, points down for proper draining after installation.

4. Install and torque the key switch nut.

<table>
<thead>
<tr>
<th>Description</th>
<th>Nm</th>
<th>lb-in.</th>
<th>lb-ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key switch nut</td>
<td>2.2</td>
<td>20</td>
<td>–</td>
</tr>
</tbody>
</table>

5. Install the cover and the bezel onto the key switch housing.
6. Install the gasket onto the key switch housing.
7. Insert the key switch electrical connector, wiring, and key switch housing through the dash opening.

![Key switch housing](image)

*a - Key switch housing*

**NOTE:** *The ring mounting nut is threaded so that it can be installed to fit a thick or thin dashboard.*

8. Install the ring mounting nut, depending on dash thickness, so that the most threads are engaged when threaded onto the key switch housing.

![Thin dashboard and ring mounting nut orientation](image)

*a - Thin dashboard
b - Ring mounting nut orientation*

![Thick dashboard and ring mounting nut orientation](image)

*a - Thick dashboard
b - Ring mounting nut orientation*

9. Position the key switch properly in the dash.

**NOTE:** *The ring mounting nut must be tight so the assembly will not rotate during use.*

10. Tighten the ring mounting nut securely.

11. Connect the key switch electrical connector to the appropriate port/starboard key switch connectors on the helm harness.

**Optional Mounting - Without Housing**

1. Cut a 22.5 mm (0.875 in.) oblong shaped hole that matches the key switch assembly threaded end with the opposing top and bottom flat surfaces. This hole shape will keep the assembly from rotating during use.

![Distance between flat surfaces and hole diameter](image)

*a - Distance between the flat surfaces - 20 mm (0.787 in.)
b - Diameter of the hole - 22.5 mm (0.875 in.)*

2. Install one nut onto the key switch assembly with the flat flange of the nut toward the key end of the switch. Thread this nut on as needed until the key switch will extend through the dashboard with enough threads exposed for the second nut to be installed.

**IMPORTANT:** *There are two notches in the key switch assembly. The notch with white plastic showing is a drain opening. To properly drain the key switch, this notch must point down when installed.*
3. Install the key switch assembly into the dashboard oblong hole. Ensure that the drain opening notch, with the white plastic showing, points down for proper draining after installation.

![Drain opening notch with white plastic showing](image)

4. Install and torque the remaining key switch nut.

<table>
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</tbody>
</table>

5. Connect the key switch electrical connector to the command module harness.

### Key Switch Extension Harness

If the key switches are not located close to the helm harness, use key switch extension harnesses. Various lengths of extension harnesses are available to extend the key switch circuits. When using a key switch extension harness a start/stop panel is required to operate the engine because the key switch extension harness removes the start circuit from the key switches.

![Key switch extension harness](image)

**Installation**

1. Connect one end of the key switch extension harness to the appropriate key switch connector on the helm harness.
2. Connect the other end of the key switch extension harness to the appropriate key switch.

### Start/Stop Panel

The start/stop panel allows the operator to start and/or stop the engines with the press of a single button. Each engine is controlled independently. For the start/stop panel to function, the key switch must be in the on position. This is an optional component at the main station, if key switches are installed within the operator's reach. Otherwise, this is a mandatory component on secondary stations where no key switches are installed (i.e. second station).

![Start/Stop Panel](image)
Preparation

**WARNING**
Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

1. Ensure that the battery cables are disconnected.

**CAUTION**
Avoid injury or product damage. Obstructions, such as braces and wiring, may be unseen when looking at the front of the dashboard. Before drilling or cutting any holes in the dashboard, check the area behind the dashboard for obstructions. Do not drill or cut when obstructions are present.

2. Select a location for the start/stop panel on the dashboard that meets the following requirements:
   - Unobstructed access behind the dashboard
   - Within harness length limits
   - With enough clearance between the components to install bezels, if equipped

3. If the dashboard is fiberglass, prevent the dashboard from cracking by applying masking tape to the area that is to be drilled or cut.

4. If the dashboard is vinyl covered, keep the vinyl from tearing by removing the vinyl from the area to be drilled or cut.

Installation

1. a. Cut or drill a 54 mm (2.125 in.) diameter hole through the dashboard at the selected location.
   b. Insert the start/stop panel electrical connector, wiring, and start/stop panel housing through the dash opening.

   **Start/stop components—triple shown, duals and quads similar**
   a - Bezel
   b - Start/stop switch, triple engine
   c - Cable tie
   d - Screw (4)
   e - Gasket
   f - Ring nut

   **NOTE:** The ring mounting nut is threaded so that it can be installed to fit a thick or thin dashboard.

c. Install the gasket and ring nut so that most threads are engaged when threaded onto the key switch housing. The amount of engaged threads will depend on the thickness of the dash.

d. Position the start/stop panel in the correct orientation on the dash.

   **NOTE:** The ring mounting nut must be tight so the assembly will not rotate during use.

e. Tighten the ring mounting nut securely.

f. Connect the start/stop panel electrical connectors to the respective "START/STOP" connections on the helm harness.

2. Insert the start/stop panel electrical connector, wiring, and start/stop panel housing through the dash opening.

   **Behind the dashboard or panel—dual shown, triple and quad similar**
   a - Port connector
   b - Starboard connector
   c - Back of switch housing

3. Install the ring mounting nut so that most threads are engaged when threaded onto the key switch housing. The amount of engaged threads will depend on the thickness of the dash.
Emergency Stop (E-Stop) Switch

An E-stop switch is required in order to simultaneously stop all engines in the event of an emergency. The E-stop switch component is:

- An optional component at the main station, if key switches are installed within the operator’s reach.
- A mandatory component at other stations including auxiliary joystick stations where no key switches are installed.

Installation recommendations include:

- Locate the E-stop switch in a readily accessible area.
- Install the E-stop switch so that unintended contact is unlikely even though the switch is provided with a push-lock mechanism to avoid accidental activation.

Typical E-stop switch

a - 6-pin harness connector  
b - Switch with push-lock  
c - Bezel

1. Install the required E-stop switch in the dash using the dimensions provided.

   Cut out dimensions (reference only—not to scale)
   a - Without bezel  
   b - With bezel

2. Connect the 6-pin connector on the E-stop switch harness labeled "STBD HELM" to the connector on the helm harness labeled "E-STOP."

   The harnesses for the helm stations and the auxiliary joystick stations have a 6-pin plug for connecting an E-stop switch where required. Refer to Key Switch, Start/Stop, and E-Stop—Connections.

Key Switch, Start/Stop, and E-Stop—Connections

Triple application helm harness shown, all similar

a - Helm harness  
b - Key switch (3)  
c - Key switch connector (3)  
d - Start/stop switch  
e - Start/stop switch connector (3)  
f - E-stop switch 6-pin connector  
g - E-stop switch