EEC4
Electronic Engine Controls
by Glendinning

Installation Manual

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Chapters at a Glance

A word about the Symbols used in the Manual

When driving from one destination to another, road signs prove to be invaluable. Road signs are an important source of information. For example, road signs can warn you about potential problems ahead to help divert certain disaster or they can let you know where to turn off for a rest or a meal.

In an effort to help you navigate your way through this manual we will from time to time use the following symbols:

Throughout the manual the NOTES symbol will appear to support what has been mentioned in the text. A note can be used where further explanation is needed or where something needs highlighting. BE CAREFUL to read all NOTES.

Sometimes it is helpful to take a break and really absorb what you just read. The WARNING symbol will alert the reader to information that needs to be completely understood before you continue on in the reading of the manual. ALWAYS STOP and READ these points.

The TIP symbol will be used when something mentioned in the text need more “light” shed on it. The tip could explain or be a list of do’s and don’ts. Whatever the TIP is, you do not want to miss out on the information it contains.

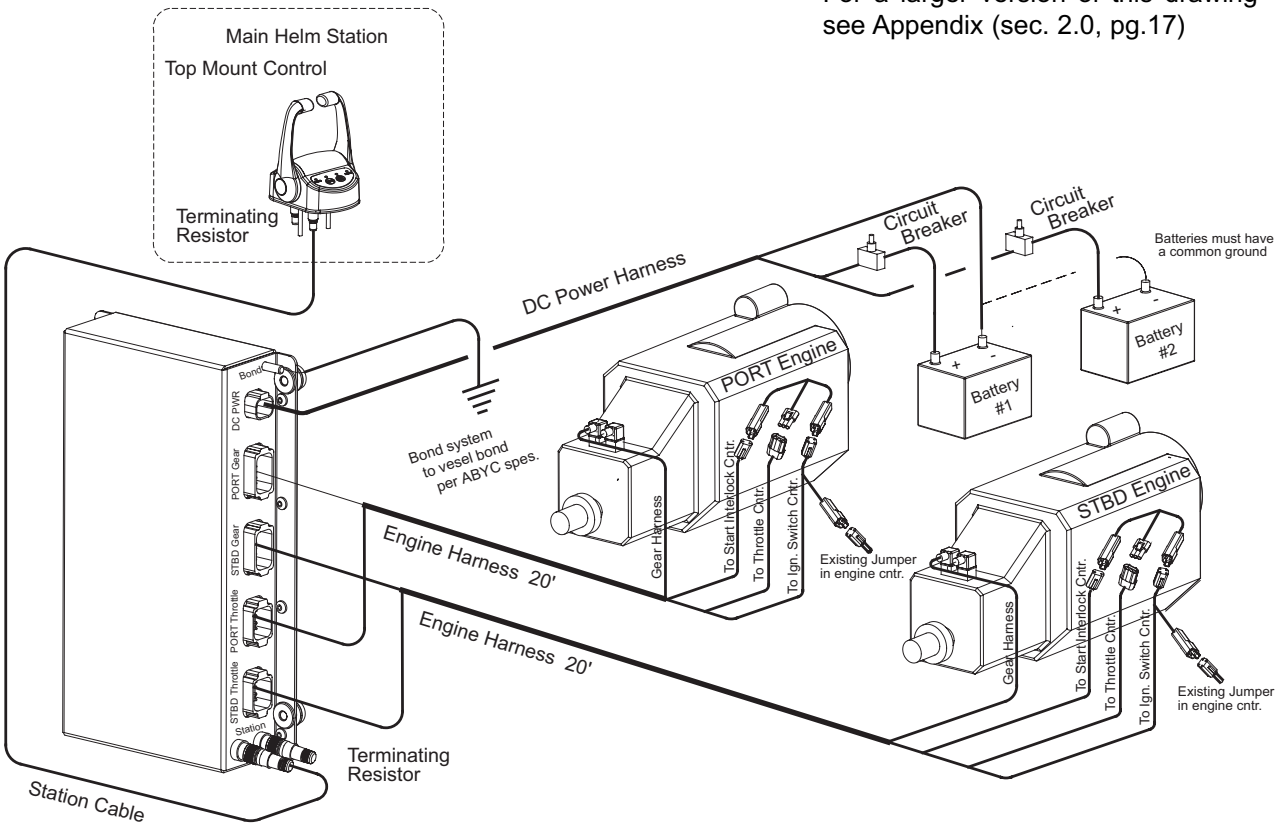
1.0 Installing the EEC4

The installation process includes the following six steps:

STEP 1: Pre-installation planning (the most important part of the process)
STEP 2: Mount the EEC4 Control Processor
STEP 3: Control Head(s) Installation
STEP 4: Station Communication Cable Routing
STEP 5: Engine Compartment Wiring
STEP 6: Operational Test

Installation Preview

For a larger version of this drawing see Appendix (sec. 2.0, pg.17)



1.1 Pre-Installation Planning

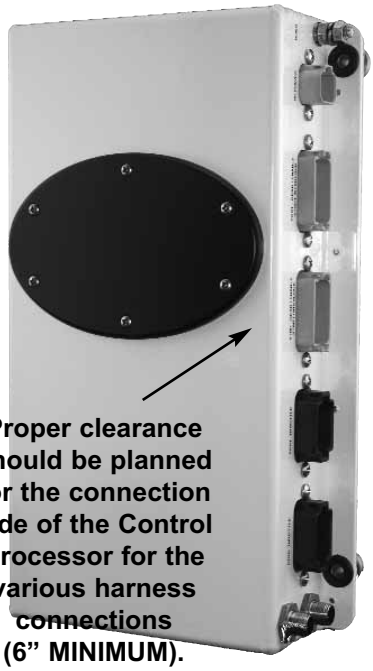
Before beginning the installation of the Glendinning EEC4 System, it is very important that some thought be given to the overall installation. The following should be considered:

— Control Processor location
— Power / Battery supply
— Station Communication Cable routing

• Control Processor Location

Environmental conditions—The CP is designed to be located in the engine compartment of a typical boat. It can be mounted in any position — horizontally on the overhead or deck or on one of the engine compartment walls. Although the CP has been designed to operate in ambient temperature conditions of up to 70 C (158 F), as far as possible, the CP should not be exposed to extreme temperature conditions (ie, touching any part of the engine exhaust). The CP is not designed for direct water impingement and therefore should not be located where it may be sprayed with water or with connectors facing upward.

Accessibility—Approximately 15 cm (6 inches) of clearance should be maintained at the side of the CP where the connection plugs are located to provide for plug installation and removal.

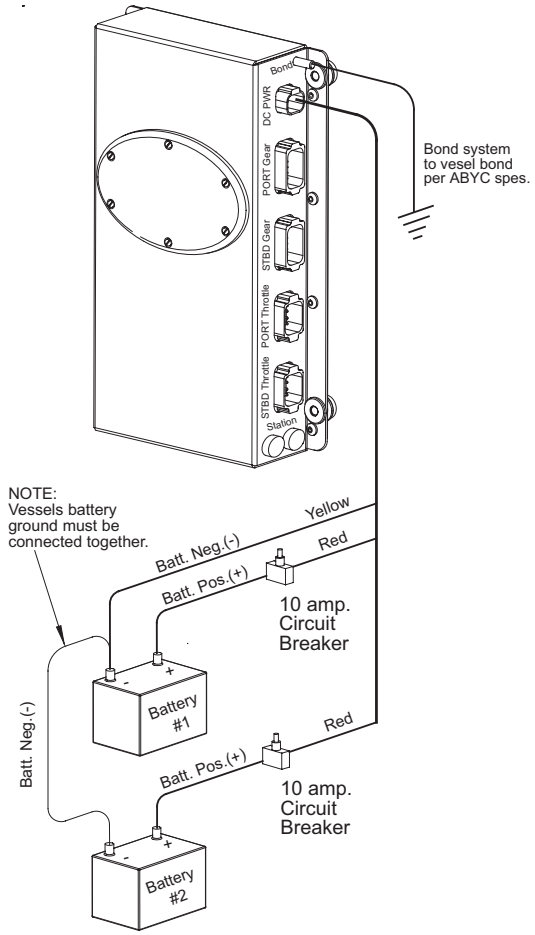


Proper clearance should be planned for the connection side of the Control Processor for the various harness connections (6" MINIMUM).

• Power Supply

In the installation of any electronic device, the source of power is one of the most important factors to consider during the installation. The EEC4 has been designed to be connected to two (2) 12 VDC power sources, although it can operate on only a single power source.

IMPORTANT! — Although the EEC4 system can operate on a single battery power source, connecting to two (2) separate battery sources is STRONGLY RECOMMENDED. If the EEC4 system is only connected to a single battery power source, intermittent drops in battery voltage — perhaps during engine start — can cause intermittent failures of the EEC4 system.



Ensure that the power supply to the control system includes the following:

— Battery sources should be independent, not 2 batteries connected in parallel.

— Circuit protection (fuse or circuit breaker) should be installed at the point where the CP power harness is connected to the battery / power source. Use 10 amp circuit protection.

— The battery ground wire should be connected to one of the batteries. Verify that the battery ground wires are connected together elsewhere on the vessel.

• Station Communications Cable — CANbus Network Design

The EEC4 system utilizes a CANbus digital communications system to link the components in the control system — Control Processor (CP) and Control Heads (CH). There are various ways in which the Station Communications cable can be connected depending on the application.

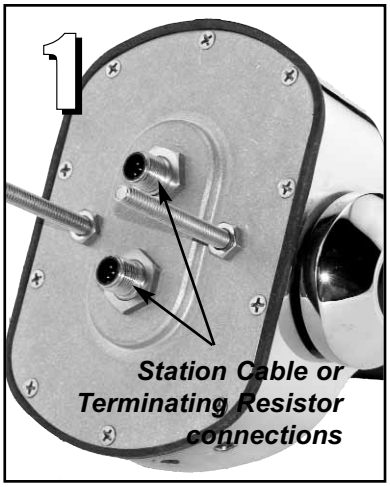


Photo 1
Control Head connection points (bottom view of control head). Connect another control head station cable or a terminating resistor to the proper plug on the bottom of the Control Head.

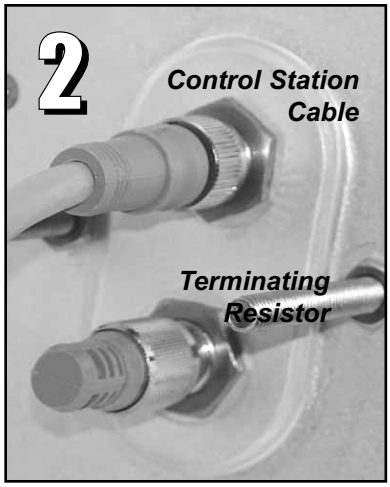


Photo 2
Correct installation of station cable and terminating resistor. It does not matter which connection receptacle you use for either the control station cable or the terminating resistor.

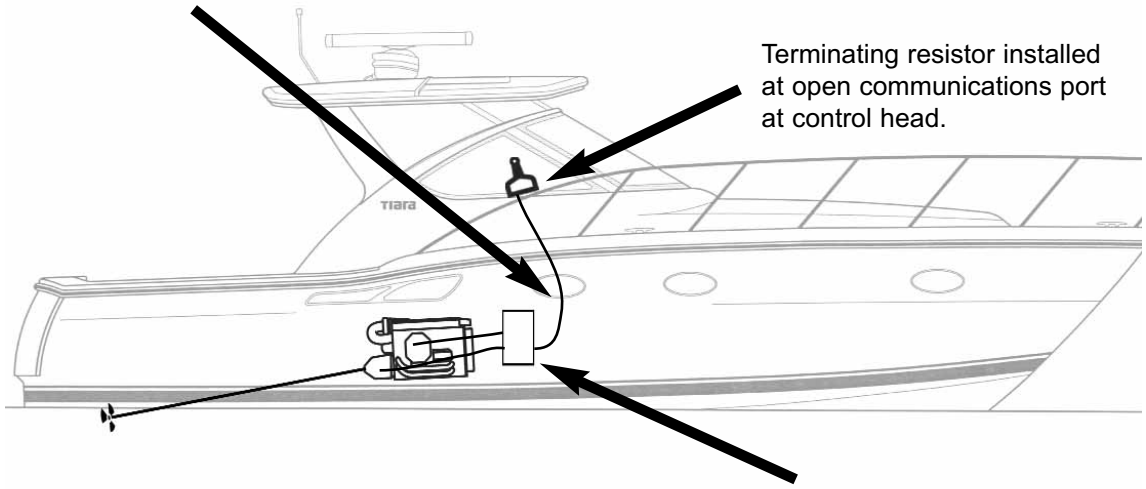
Photo 3
Control Processor station connection points. Connect control head station cables or a terminating resistor to the proper plug receptacles at the bottom of the Control Processor.

Photo 4
Terminating resistor is needed at either end of the CANbus network in order for the system to operate properly. The terminating resistor can be installed on the Control Head or the Control Processor.

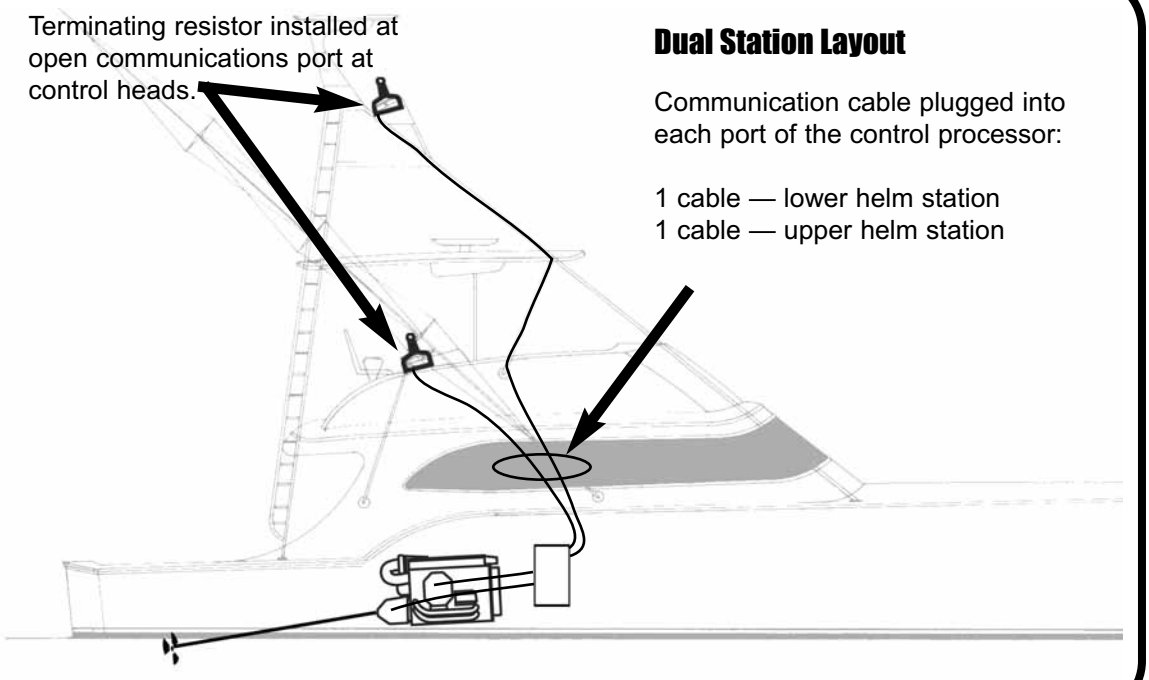
The **Single Station Layout** (see illustration on the next page) is straight-forward and easy to understand. A single Station Communications cable connects the CP and the CH — cables are available in 20, 30, 40, or 60 foot lengths. A terminating resistor is plugged into the other CANbus connector at both the CP and CH.

Single Station Layout

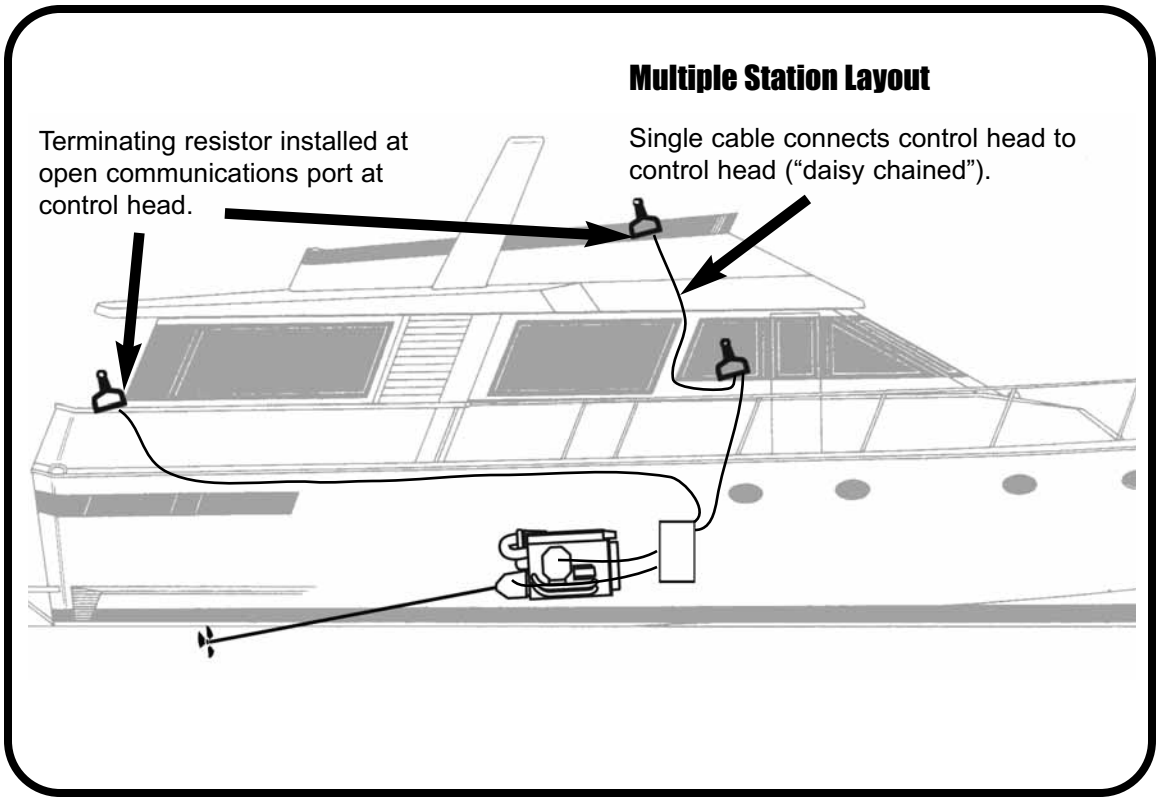
Single cable connects control head to control processor.



The **Dual Station Layout** illustrates how both control stations are connected to the control processor by separate cables. An alternative installation would be to connect the station communication cable for the upper Control Head to the lower Control Head instead of the Control Processor (as shown). A terminating resistor is plugged into the open CANbus connections that do not have a Station Communications cable connected to them.



The **Multiple Station Layout** illustrates the concept of "daisy-chaining" control stations to reduce the length of station communication cable runs to the Control Processor.



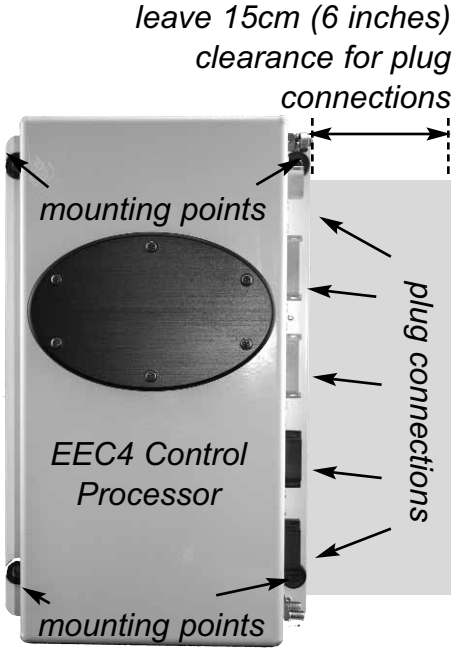
Failure to install the terminating resistors correctly will result in "poor communication" between the control station and the Control Processor causing the system to respond erratically. This could result in loss of property or life. Install terminating resistors and station cables carefully (pp. 3, 7)

REMEMBER:

— Each of the components must be linked by the Station Communications Cable — the order in which they are connected is not important.

— At each end of the CANbus network, a terminating resistor must be installed.

— When complete, all of the CANbus connections on the CP and the CH must have something connected — either a station communications cable or a terminating resistor.



1.2 Mount the Control Processor

Follow these steps to install the EEC4 Control Processor:

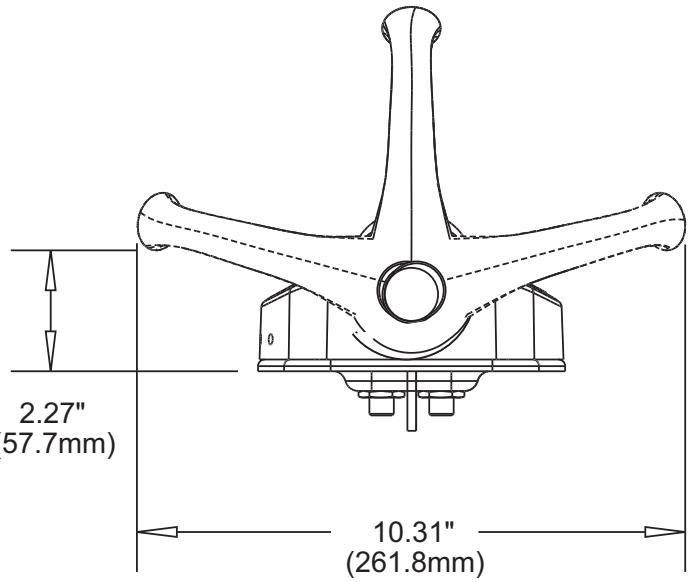
STEP 1: The Control Processor can be mounted anywhere in the engine room providing that the Processor is reasonably accessible

so that inspection and/or repairs to the unit may be performed. The Control Processor should NOT be installed in adverse locations subject to saltwater exposure or excessive heat.

STEP 2: Mount the Control Processor using 1/4" (7mm) machine bolts or lag screws. If using lag screws, screw length should be no less than 1" (25mm). If using machine bolts, lockwashers or locknuts MUST be used *(figure 1)*.

1.3 Mount the Control Head

One of the most important factors in selecting control head locations is the ability to control the vessel by allowing FULL movement of the control head handles. The area around the control head should have proper drainage to eliminate standing water. Although the control heads are sealed to withstand damage from exposure to moisture, they are not designed to be submerged.



STEP 1: Mark the location for the Control Head using the template provided (see pg. 53). Cut the 3" diameter hole.

STEP 2: Place the Control Head assembly into the cutout.

STEP 3: Install Control Head clamps and tighten wing nuts provided. Make sure Control Head is firmly mounted to console.

Top Mount Control Head

• Station ID (multiple station applications)

A total of six (6) control stations may be added to the EEC4 system. In a multi-station control system, all of the control handles are identical from a hardware point of view. However, there is a software configuration that must be completed to designate the "Station Identifier (ID) for each station.

— The basic EEC4 kit includes a control head that is configured for ID#1.

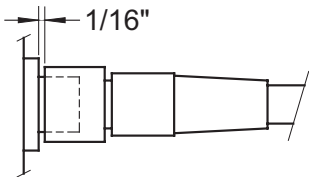
— A part number is available for a "second station" Control Head where the Control Head is factory configured for ID#2.

— If an additional Control Head is required beyond 2 stations, obtain a "second station" Control Head and then configure the Station Identifier during system startup.

1.4 Station Communication Cable Installation

Install the Station Communication cables between the Control Processor and Control Head(s) as previously discussed in Section 3.1. Station communication cables are available in 20, 30, 40. or 60 foot lengths.

It is VERY IMPORTANT that the Station Communication cable nut be connected tightly. The nut requires 6-7 turns to completely connect it, and there should be no more than a 2mm (1/16 inch) gap between the nut and the connector — see diagram below.



— when fully seated, connector is 1/16” away from nut (max)
— Connector requires 6 full turns to be fully engaged

WARNING: Failure to follow the instructions above will result in erratic system performance.

When routing and connecting station communication cables, BE SURE TO:

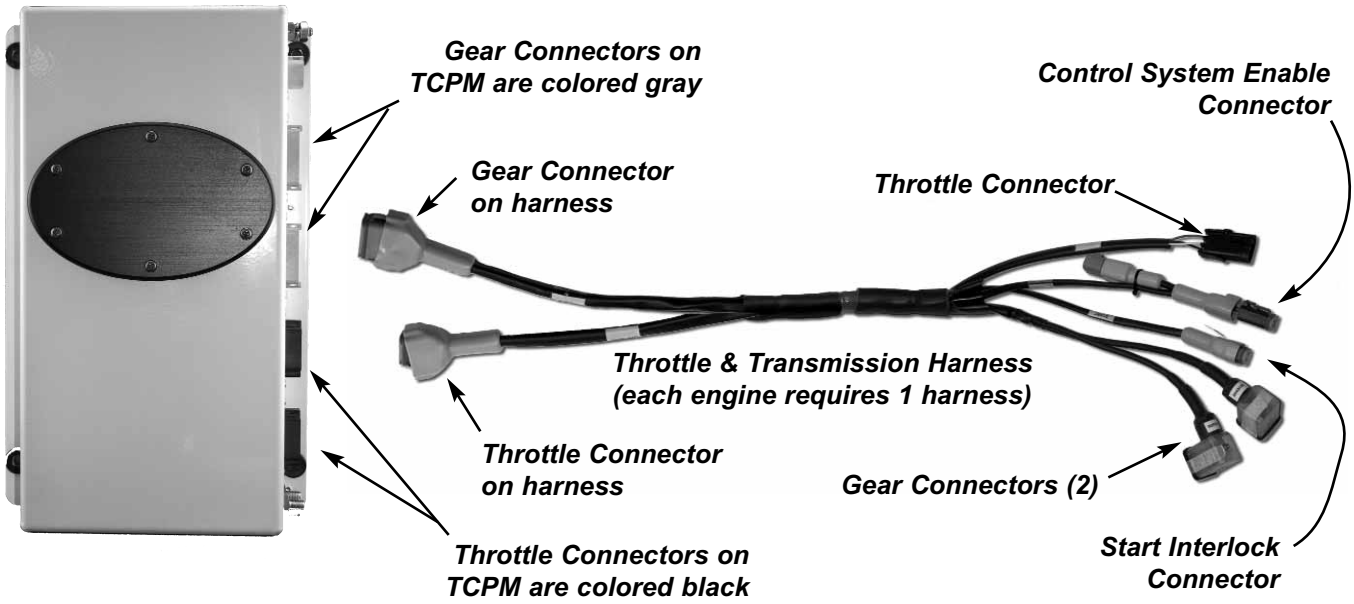
- DO use a terminating resistor at each end of the network.
- DO align the station communication cables before connecting them to the connector on the Control Head and/or Control Processor. DO NOT force the cable plug into it’s connector.
- DO NOT route cables past any sharp edges!
- DO NOT CUT THE CABLE OR SPLICE IT. If the cable is damaged during installation, it must be completely replaced!
- DO NOT use pliers or other tools to tighten the cable nut — handtight is sufficient.

1.5 Throttle and Transmission Harness Installation

A single cable harness connects the Control Processor to each engine. To install this harness:

1) At the Control Processor, plug the harness into the appropriate receptacle for the specific engine (either PORT or STBD). There are two plugs — one for throttle control and the other for gear control — the color coding on the plug will identify which plug is for which connector (see pg. 10).

2) At the engine, plug the harness plugs into the appropriate connectors, as follows:

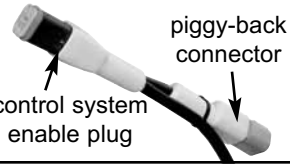


ENGINE CONNECTION	DESCRIPTION	ILLUSTRATION
Throttle	Connect the 3 pin plug into the appropriate connection on the vessel adapter harness.	
Gear	Connect the 2 DIN Gear connectors on the transmission solenoids. Note that each plug is marked “forward” or “reverse” — connect this to the correct solenoid on the transmission.	 *make sure rubber gasket is intact when connecting*
	Or . . . Connect the 2 FI Gear connectors on the transmission solenoids. Note that each plug is marked “forward” or “reverse” — connect this to the correct solenoid on the transmission.	
Start Interlock	Connect the 2 pin start interlock plug to the appropriate connection on the engine (near the transmission).	

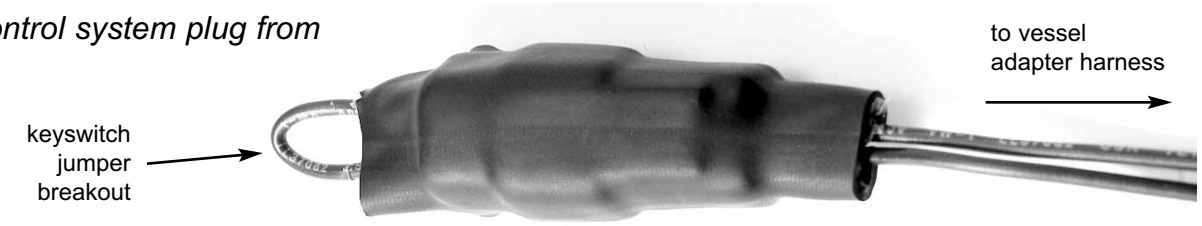
IMPORTANT — When routing and connecting the throttle and gear harness, BE SURE TO:

- ***Insert the plug completely into the receptacle on the control processor and the engine. You should hear a "click" when the plug is fully inserted.***
- ***DO NOT route cables past any sharp edges!***

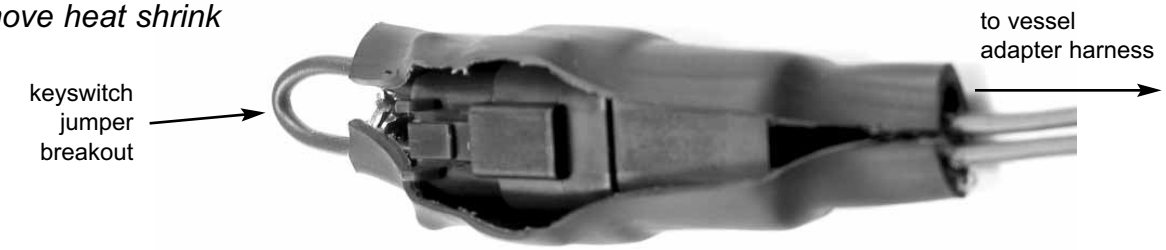
See the photos below and on the next page for step-by-step instructions for connecting the Control System Enable connections.

ENGINE CONNECTION	DESCRIPTION	ILLUSTRATION
Control System Enable	Connect the 4 pin control system enable plug to the appropriate connection on the vessel adapter harness. In order to do this you will need to **follow the steps below:**	

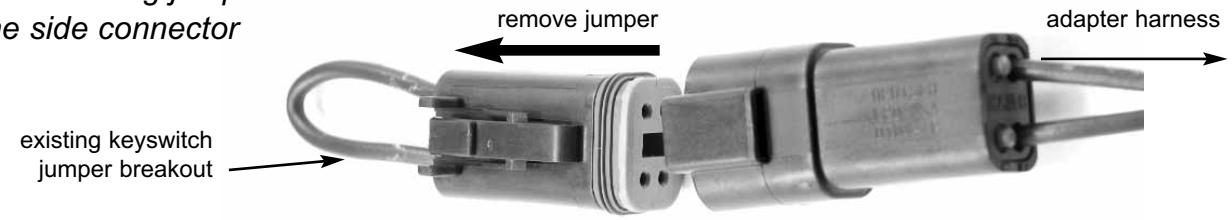
1 *Locate control system plug from engine*



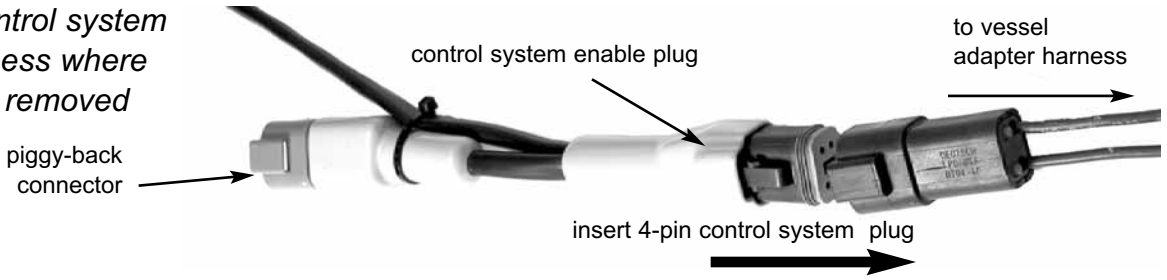
2 *Cut & remove heat shrink tubing*



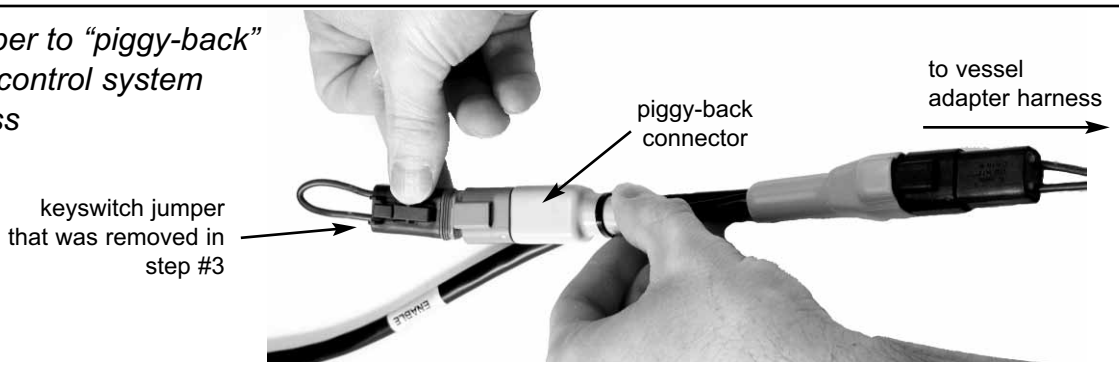
3 *Remove existing jumper from engine side connector*



4 *Connect control system enable harness where jumper was removed*



5 *Connect jumper to "piggy-back" connector on control system enable harness*



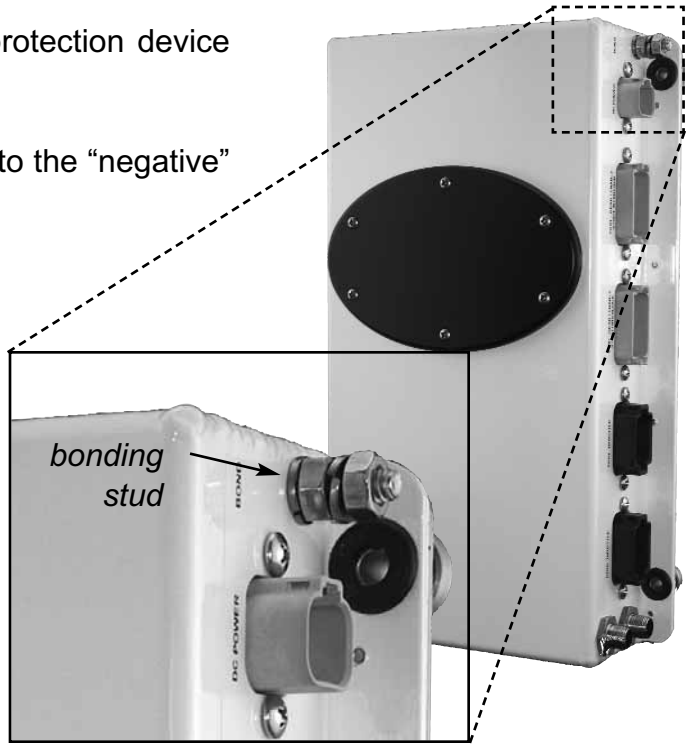
1.6 Power Harness - DC Power Input

1) Connect the two (2) RED wires of the CP Power Harness to the "positive" of two (2) independent 12 VDC battery sources, (normally the PORT and STBD engine start batteries). At the point where the CP Power Harness is connected to the positive power source, install a 10amp circuit breaker as close as possible to the power source.

a. NOTE: ABYC standards require a circuit protection device within 7" of the wire connection to the power source.

2) Connect the YELLOW wire of the Power Harness to the "negative" connection of either battery source.

a. Verify that the negatives of the independent battery sources are connected elsewhere on the boat.



1.7 Bonding Wire

Run a bonding wire (#12 AWG, green jacket) from the bonding stud (1/4") located top right on the connector side of the Control Processor to the bonding strip provided by the boat manufacturer

1.8 System Test & Checkout

System test and checkout consists of 2 steps:

1) ***Component installation checks*** — verify that the components appear to be correctly mounted and installed.

2) ***Operational tests*** — make sure the system is operating correctly.

Component Installation Checks

A. Control Processor

1.1	Verify Control Processor is securely fastened to boat structure.
1.2	Verify electrical power connections: *Battery Negatives*—Negatives from both batteries should be connected (not at Control Processor. It is vital that there be zero voltage potential between battery negative terminals. Battery negative terminals should be connected to Bonding system also. *Negative Lead*—Negative wire from EEC4 system is connected to single battery negative. *Positive Leads*—Power should be connected from Battery positive terminal or disconnect switch (battery side of switch) to CP via 10 amp fuse / circuit breaker. Check that all battery connections are tight. Verify that Bonding Wire is properly connected to Bonding stud (see sec. 1.7, pg. 9).
1.3	Engine / Gear Harness Connections — Verify that all connectors are properly and tightly inserted into their receptacles. Verify that the harnesses are connected to the appropriate plug for each engine (example: STBD engine / gear harness plugged into STBD engine plugs on Control Processor).
1.4	Station Communication Cable Connections — make sure that the cable nuts are tightened and that the maximum gap between the nut and connector is 2 mm (1/16 inch) — see diagram on page ??
1.5	Verify that all harness connections at each engine are tight and that connectors are fully engaged.

B. Control Head(s)

2.1	Verify Control Head(s) are securely fastened to boat structure.
2.2	Verify that Control Handles have an unobstructed freedom of movement (full ahead and full reverse). Make sure that all control heads are in the neutral position.
2.3	Station Communication Cable Connections — Make sure that the cable nuts are tightened and that the maximum gap between the nut and connector is 2 mm (1/16 inch) — see diagram on page 7.

Operational Checks

A. General Functions

3.1	Turn ON System by turning ON one of the engine ignition switches. The Control Head ACTIVE light and the Neutral gear indicating lights should immediately illuminate. — If the Control Head lights DO NOT come on immediately, but all the lights flash after about 20 seconds, the system is in alarm mode and the problem is most likely due to a network communications problem. Verify the proper connection of the station communication cables on all stations and the Control Processor. Verify that 2 termination resistors are installed in the network. — If all of the Control Head lights begin to flash immediately after the ignition switch is turned ON, the problem is most likely due to a Station Identifier configuration. Verify that none of the Control Heads in the system have the same identifier (check label on the bottom of the control heads). — If none of the Control Head lights come on after 20-30 seconds, the problem is probably due to lack of power available at the DC power harness. Disconnect the harness from the Control Processor and use a meter to verify that voltage exists at the harness. There should be 12 VDC present between the yellow wire and each red wire.
3.2	Verify the Start Interlock capability as follow: a) Verify that the system is in “cruise mode” by verifying that the “Neutral” light on the Control Head is OFF. b) Move the STBD Control Handle out of NEUTRAL position. Attempt to start the STBD engine. (IMPORTANT: If start interlock circuit does not function, engine will startup in gear. Be prepared to immediately shutdown engine!). c) Engine should NOT start. Move STBD Control Handle back to NEUTRAL position. d) With handle in NEUTRAL position, try to start engine. Engine should start as normal. e) Repeat step b) through d) on PORT engine.
3.3	Verify correct gear direction: a) With both engines running, place either engine (one engine only) in gear for approximately 2-3 seconds. Return control handle immediately to NEUTRAL. Check response of propeller to control handle input. b) For twin engine applications, verify gear response on other engine: — If boat moves in the wrong direction, reverse gear connection plugs at transmission. — If the wrong engine is engaged (example: PORT engine goes into gear when STBD handle is moved, change plug connections for PORT and STBD engine.
3.4	Verify throttle response: a) IMPORTANT — Place system in “WARM” mode by pressing and releasing the WARM / SYNC button. Verify that system is in WARM mode by verifying the WARM light is ON before moving control handles into gear. b) Move both engine control handles into gear at idle. c) Verify engine idle speed — should be 600 RPM (or as specified by engine installation manual). d) If engines are at an appropriate temperature, move both engines to full throttle position. e) Verify that correct no load WOT speed is achieved. f) If either engine does not reach WOT, verify throttle harness plug connection at each engine.

Sea Trials

At the conclusion of the Operational Tests described above, the EEC4 system is ready for operation. There are no functional tests that need to be completed at sea trial to validate correct system installation. However, if the opportunity is available to provide product operational training to the boat owner, the following outline is suggested.

DO THE FOLLOWING . . .	OBSERVE THE FOLLOWING . . .
System Startup — Demonstrate the startup of the control system by turning ON either engine ignition switch.	The EEC4 system is operational when ACTIVE light is ON at the main station.
WARM Mode (Gear Lockout) — Place system in WARM Mode by pressing and releasing the WARM button. Advance the control handles past idle ahead gear detent and throttle up engines.	The WARM light should come on to confirm that the gear operation is locked out — verify that this is correct before moving control handles. The engines are able to be throttled up ("warmed" up) at the dock while the gear is locked in NEUTRAL.
Normal / Cruise Mode — With the control handles in NEUTRAL, press and release the WARM button — the WARM light should go out to indicate that the control system is in the normal "cruise" operating mode. Move the control handles in and out of gear to gain familiarity with gear response.	Observe the rate of gear response — gain familiarity with the feel of control system.
Station Transfer (multi-station applications) — Before the boat gets underway, follow the station transfer described in the Operators Manual and transfer control from one control station to another. Repeat the process until the boat owner / operator is comfortable with the process.	After the first button press but before pressing the ACTIVE button a second time, observe the quick blinking or slow blinking ACTIVE station light corresponding to whether the control handle is in an "appropriate" position.
Automatic Synchronization — After the boat is underway and is in a safe area that will allow maneuvering, enable the automatic synchronization capability by pressing and releasing the WARM / SYNC button. Both control handles must be in ahead gear and within 10% of each other in order to enable synchronization.	While in the Automatic Synchronization mode, the SYNC light will be illuminated. While in Automatic Synchronization mode, the system will automatically match the PORT engine speed to the STBD engine.

Move the STBD engine handle by itself — both STBD and PORT engines will respond simultaneously.	
Bump Mode — While the boat is underway and is in a safe area that will allow maneuvering, and while the control handles are both in gear and above the engine idle speed, demonstrate the “bump up” (speed increment) by pressing and releasing the ACTIVE button. Repeat several times. Demonstrate the “bump down” (speed decrement) by pressing and releasing the ACTIVE and WARM / SYNC buttons together. Repeat several times.	Each time that the control head buttons are pressed — either speed increment or decrement — the engine RPM will increase or decrease approximately 10 RPM.
Control Head Dimmer — To demonstrate the dim light capability of the control head lights, press and hold the ACTIVE and WARM / SYNC buttons simultaneously for about 4 seconds. Restore the control head lights to normal brightness by pressing and holding the ACTIVE and WARM / SYNC buttons simultaneously once again, for about 4 seconds.	The different control head light settings and the method of changing that setting.
Station Transfer (multi-station applications) — While the boat is underway and is in a safe area that will allow maneuvering, follow the station transfer described in section 2.5 and transfer control from one control station to another. Try transferring control from one station to another while at cruising speed, in order to obtain a minimum speed change.	

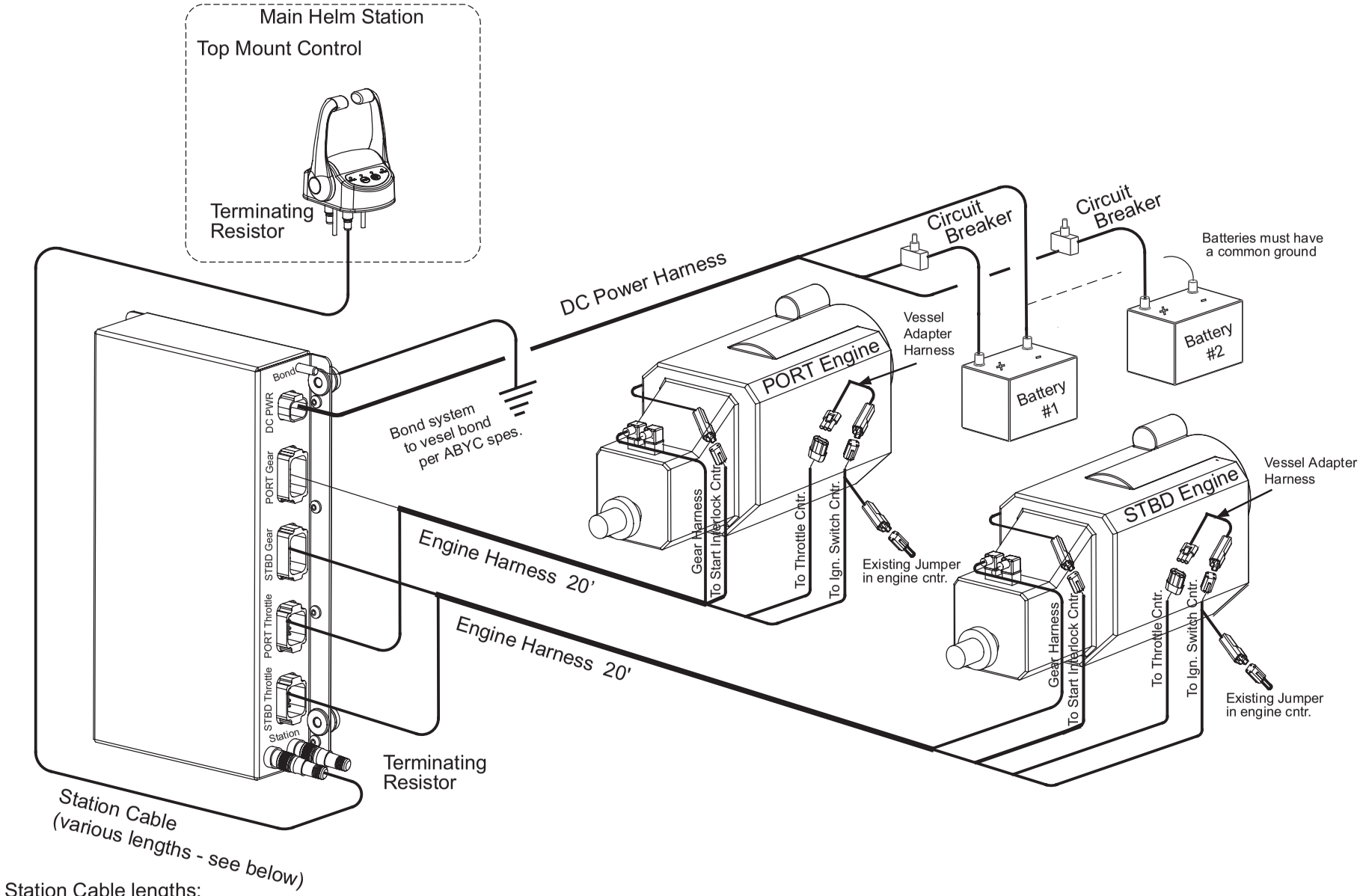
2.0 Appendix / Reference

The Appendix / Reference section is divided as follows:

2.1 Wiring Diagrams (many other engine layouts available, contact GMP)

2.2 Dimensional Drawings / Cutout Templates

ETS Control System Wiring Diagram - Cummins QSB/QSC

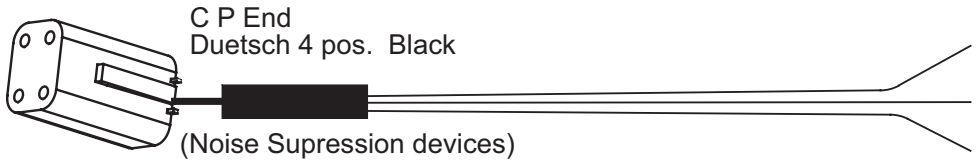


Station Cable lengths:

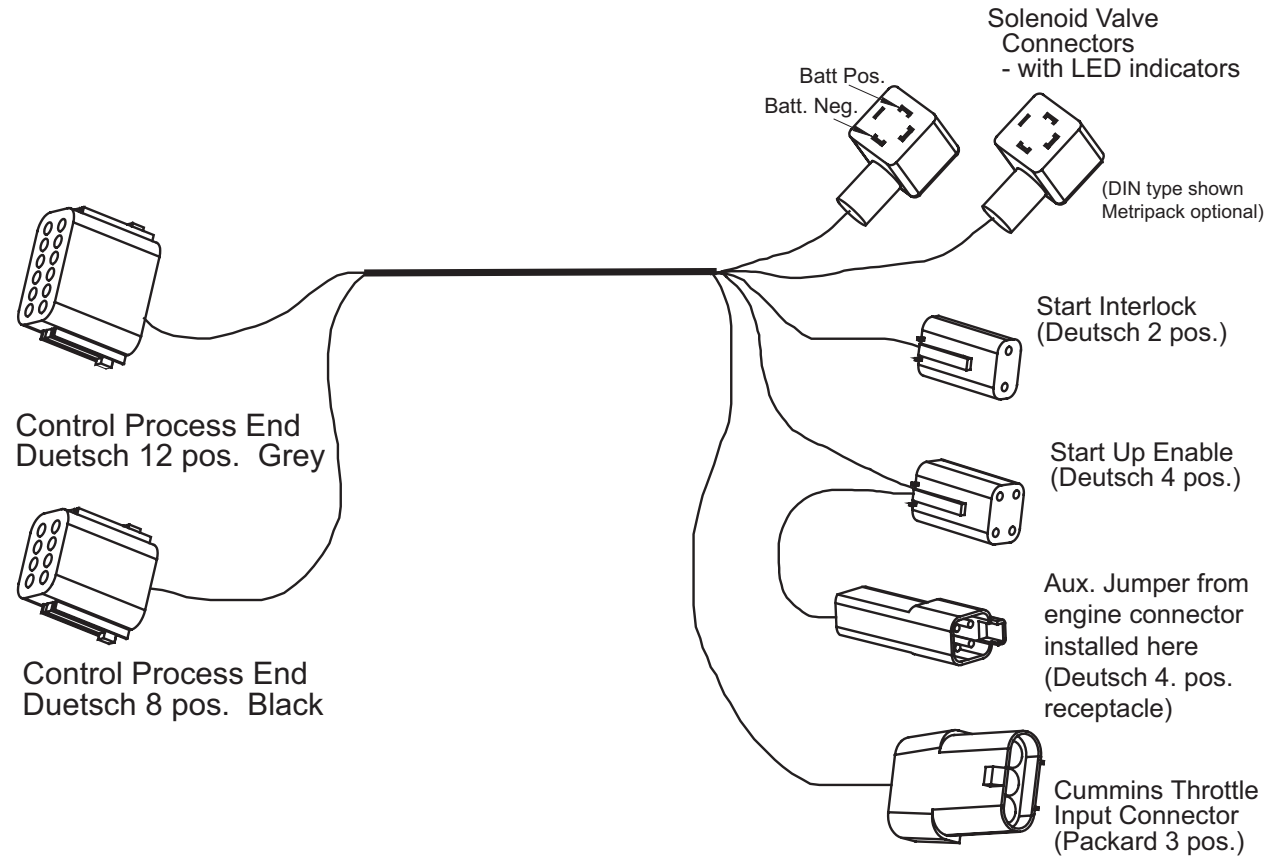
- 20' long
- 30' long
- 40' long
- 60' long

ETS Control System Harnesses - Cummins

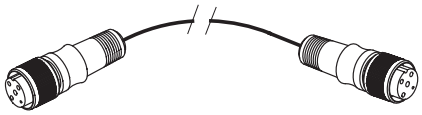
DC Power Harness 30' long (9 meters)



Throttle/ Gear / Start Interlock / CP Enable Harness 20' long (6 meters)

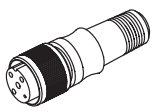


Station Cable	20ft. long	6 meters
Station Cable	30ft. long	9 meters
Station Cable	40ft. long	12.2 meters
Station Cable	60 ft. long	18.3 meters



Connector is the same on both ends

Terminating Resistor



Control Processor Pinout Description

DC Power Connector (4 pin-Gray)

(1) Battery Positive 1
(2) Battery Positive 2
(3) Battery Ground 1
(4) Battery Ground 2 (optional, if required)

PORT Gear / Start Interlock / CP Enable Connector (12 pin-Gray)

(1) PORT Ahead gear Positive (+)
(2) PORT Astern Gear Positive (+)
(3) PORT Start Interlock 1
(4) PORT Ignition/CP Enable Switch Input
(5) Enable Switch Power
(6) Spare Output (Com)
(7) Spare Output (N.O.)
(8) Not Used
(9) PORT Ignition Output
(10) PORT Start Interlock 2
(11) PORT Astern gear Negative (-)
(12) PORT Ahead gear Negative (-)

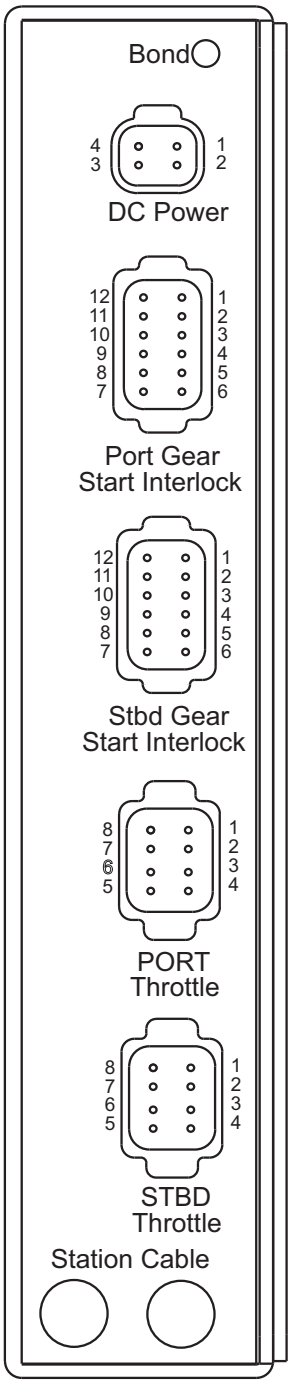
NOTE: Jumper #4 to #5 for Dry Contact CP Enable OR Apply 12v DC positive to #4 for ignition power CP enable.

STBD Gear / Start Interlock / CP Enable Connector (12 pin-Gray)

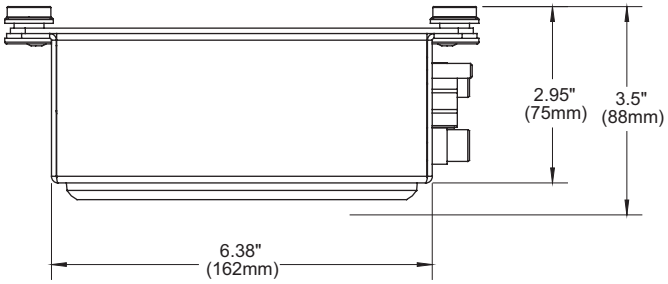
(1) STBD Ahead gear Positive (+)
(2) STBD Astern Gear Positive (+)
(3) STBD Stat Interlock 1
(4) STBD Ingnition/CP Enable Switch Input
(5) Enable Switch Power
(6) Not Used
(7) Not Used
(8) Not Used
(9) STBD Ignition Output
(10) STBD Start Interlock 2
(11) STBD Astern gear Negative (-)
(12) STBD Ahead gear Negative (-)

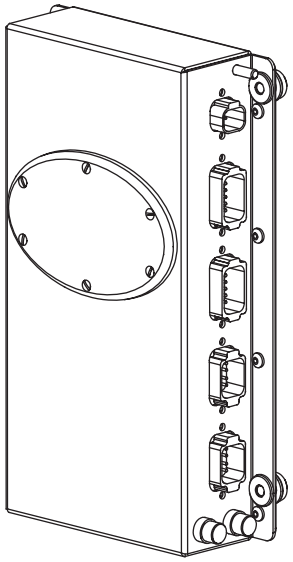
PORT/STBD Throttle Connectors - Voltage Type (8 pin-Black)

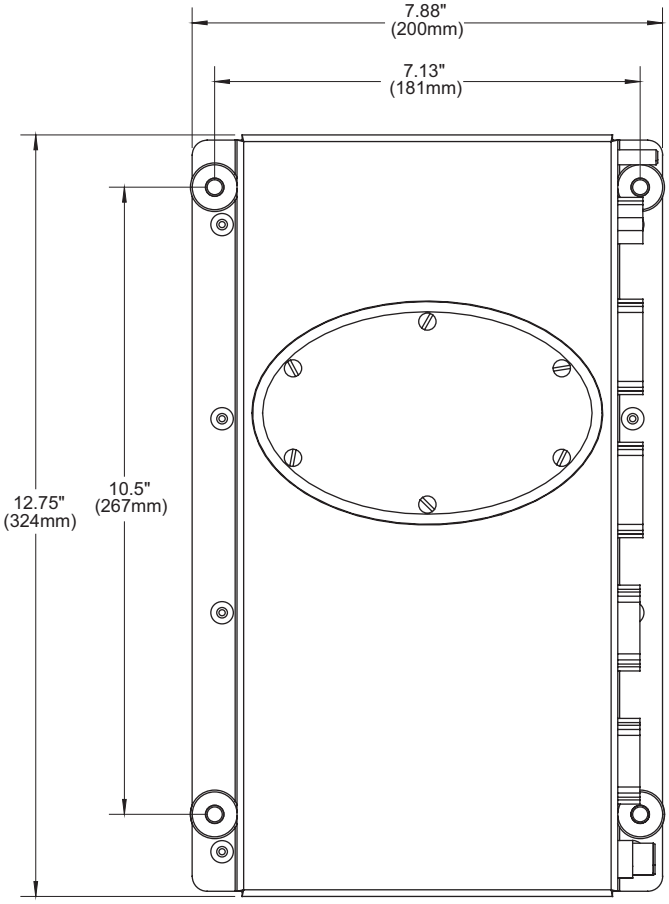
(1) Not used
(2) Ref. voltage Pos.+
(3) Ref. voltage Neg.-
(4) Voltage Output Signal
(5) Not Used
(6) Not Used
(7) Not used
(8) Chassis ground

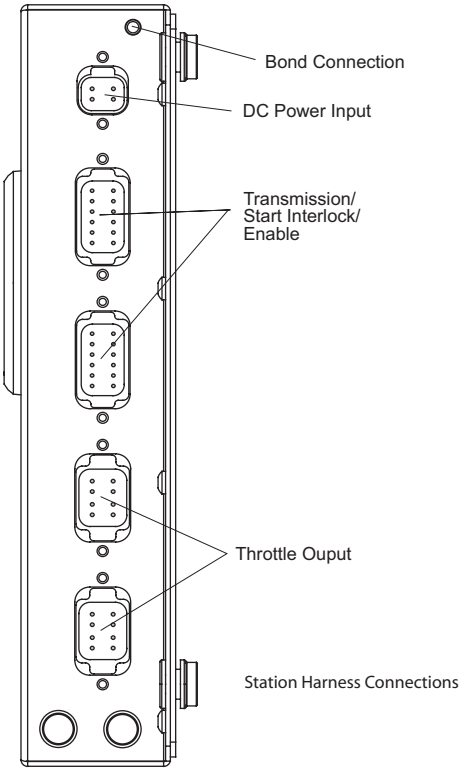


Control Processor Dimensions

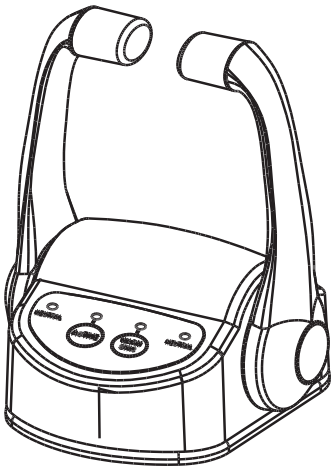


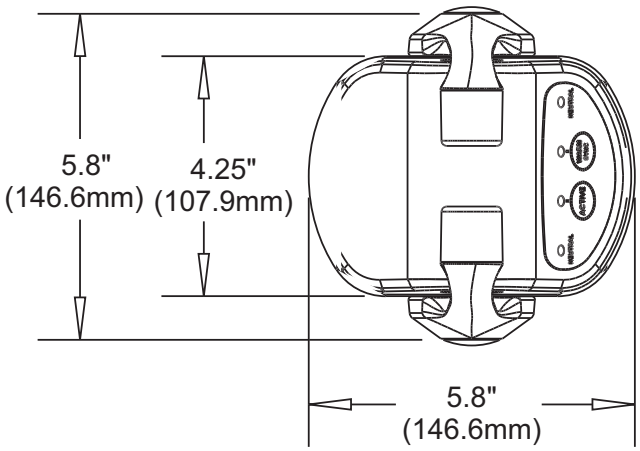


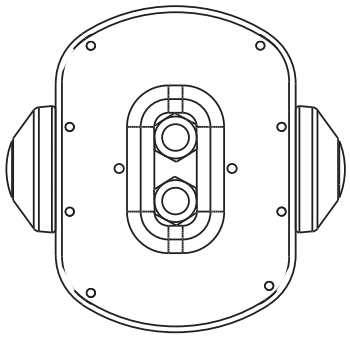


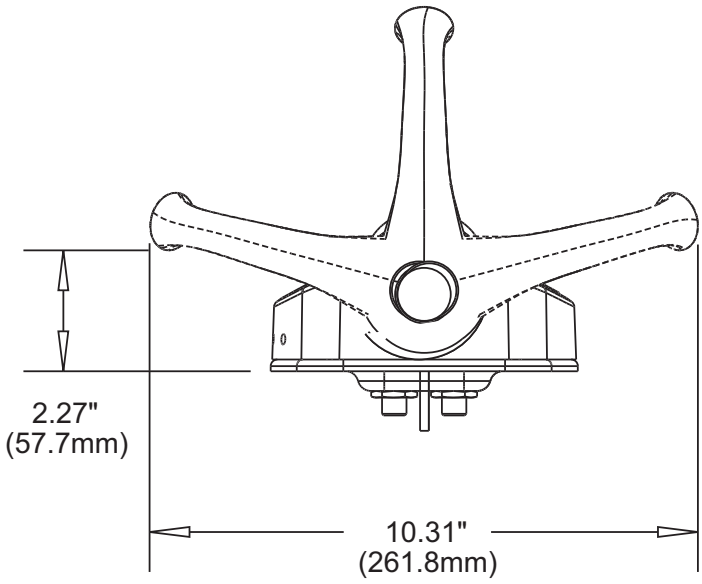


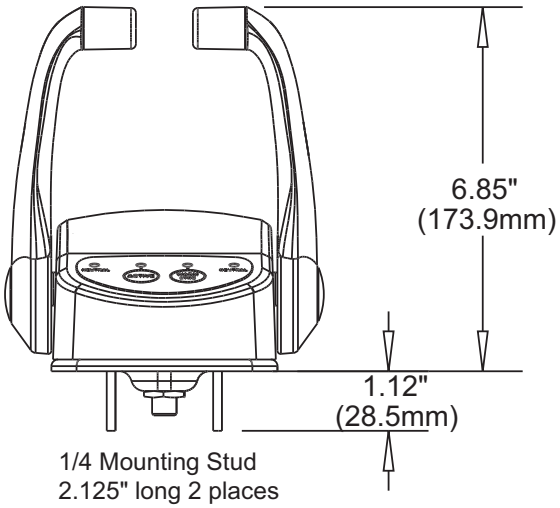
Control Head Dimensions (Top Mount)











NOTE: 2.0" [51mm] required below connector for cable connector

Cutout Template for Control Head (Top Mount)