

**TWIN DISC
INCORPORATED**



Installation Manual

Marine Control System

Model:
EC300

Document Number: 1024168

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April, 2008

Marine Control System Installation Manual

TWIN DISC, INCORPORATED
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PLEASURE CRAFT MARINE TRANSMISSION,
SURFACE DRIVE, and ELECTRONIC CONTROL SYSTEMS

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of thirty six (36) months from the date of original shipment by Twin Disc, Incorporated to the original customer, but not to exceed twenty four (24) months or one thousand (1,000) hours of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated. This warranty applies only to private, non commercial (non revenue earning) marine pleasure craft applications.**

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3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

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E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

December 14, 2007

TDWP10099 rev 2008

FLAT RATE SCHEDULE FOR MARINE PLEASURE CRAFT TRANSMISSION

(Hourly Labor Rate Must be Acceptable to Twin Disc, Incorporated.)

Product Code / Model Series	R&R	Unit Rebuild	Clutch Repair (both packs)	R&R Pump	R&R Valve	Rebuild Valve
0450 - MG340 SERIES * Part Only	*	*	*	*	*	*
0451 - MG360 SERIES * Part Only	*	*	*	*	*	*
0432 - MG5010 & MG5011 SERIES	10	8	2	1	1	0.5
0401 - MG506 SERIES	10	11	4	1	1	0.5
0435 - MG5050 SERIES	10	11	4	1	1	0.5
0437 - MG5061 & MG5062V SERIES	10	11	4	1	1	0.5
0453 - MG5055A SERIES	10	11	4	1	1	0.5
1706 - MG5065A SERIES	10	11	4	1	1	0.5
1707 - MG5065SC SERIES	10	11	4	1	1	0.5
0425 - MG5085 SERIES	10	12	4	1	1	0.5
0442 - MG5075A SERIES	10	12	4	1	1	0.5
0443 - MG5075SC SERIES	10	12	4	1	1	0.5
0476 - MG5082 SERIES	10	12	4	1	1	0.5
0419 - MG5114 SERIES	10	17	5	1	1	0.5
0433 - MG5090 SERIES	10	17	5	1	1	0.5
0489 - MGX5114A SERIES	10	17	5	1	1	0.5
0490 - MGX5114SC SERIES	10	17	5	1	1	0.5
0491 - MGX5114IV SERIES	10	17	5	1	1	0.5
1719 - MGX5095A SERIES	10	17	5	1	1	0.5
1728 - MG5095A SERIES	10	17	5	1	1	0.5
1729 - MG5095SC SERIES	10	17	5	1	1	0.5
0405 - MG514 SERIES	10	25	6	1	1	0.5
0447 - MG5145A SERIES	10	25	6	1	1	0.5
0448 - MG5145SC SERIES	10	25	6	1	1	0.5
0492 - MGX5135A SERIES	10	25	6	1	1	0.5
0494 - MGX5145SC SERIES	10	25	6	1	1	0.5
1704 - MG-5135A SERIES	10	25	6	1	1	0.5
0426 - MG516 & MG5170 SERIES	10	28	8	1	1	0.5
0477 - MG5170 SERIES	10	28	8	1	1	0.5
0412 - MG5200 SERIES	10	32	10	1	1	0.5
0416 - MG518 SERIES	10	32	10	1	1	0.5
0459 - MG6557SC SERIES	10	32	10	1	1	0.5
0461 - MG6557RV SERIES	10	32	10	1	1	0.5
0465 - MG-6619A SERIES	10	32	10	1	1	0.5
0473 - MG-520-1HP SERIES	10	32	10	1	1	0.5
0441 - MG-6650-00-SC SERIES	12	32	16	1	1	0.5
0446 - MG-6848-00-SC SERIES	12	32	16	1	1	0.5
0478 - MG-6690SC SERIES	12	32	16	1	1	0.5
0484 - MGX-61500SC SERIES	12	32	16	1	1	0.5
0485 - MGX-6650 SERIES	12	32	16	1	1	0.5
0487 - MGX-6690SC SERIES	12	32	16	1	1	0.5
0488 - MGX-6848SC SERIES	12	32	16	1	1	0.5
1721 - MGX-6620SC SERIES	12	32	16	1	1	0.5
1737 - MGX-6599A SERIES	12	32	16	1	1	0.5

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FLAT RATE HOUR ALLOWANCE
MARINE PLEASURE CRAFT SURFACE DRIVE

(Hourly Labor Rate Must be Acceptable to Twin Disc, Incorporated.)

Description of Flat Rate Labor	ASD6	ASD8	ASD10	ASD11	ASD12	ASD14	ASD15	ASD16
Removal and Reinstallation	2	3	3	3	4	6	8	8
Recondition complete unit and test for leaks	5	6	6	6	6	6	8	8
Replace front oil seal	1	1	1	1	1	1	1	1
Replace input shaft	1	3	3	3	3	4	4	4
Replace input gear/sprocket	1	3	3	3	-	-	-	-
Replace Chain	1	4	4	4	-	-	-	-
Replace H-Joint	2	2	2	2	3	3	3	3
Replace thrust ball	2	2	2	2	3	3	3	3
Replace retainer ring	2	2	2	2	2	2	2	2
Replace propeller shaft	2	3	3	3	3	4	4	4
Replace thrust tube	2	3	3	3	4	5	6	6
Replace rear oil seal	1	1	1	1	1	1	1	1
Replace steer cylinder	1	1	1	1	1	1	1	1
Replace power steer pump	1	1	1	1	1	1	1	1
Replace trim pump	1	1	1	1	1	1	1	1
Replace Ball Boot	2	2	2	2	2	2	2	2
Replace and align driveline	1	2	2	2	2	3	3	3

FLAT RATE HOUR ALLOWANCE
MARINE PLEASURE CRAFT ELECTRONIC CONTROL SYSTEMS

(Hourly Labor Rate Must be Acceptable to Twin Disc, Incorporated.)

*** Travel and related expenses are not included as a part of Twin Disc Electronic Control Warranty.**

Description of Flat Rate Labor (hours allowed for function to the right =>)	EC200	EC250	EC300	External Sensor
Removal and Reinstallation and Test	3	3	3	1
Electronic Control Repair * * there are no serviceable internal components	0	0	0	0

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Introduction

Preface

The Twin Disc Incorporated product line of electronic Marine Control Systems provides remote operation of engine throttle and transmission engagement. The model EC300 Marine Control System is designed for use with current Electronic Throttle and/or Electric Shift propulsion systems used within the pleasure and work-boat markets. The EC300 Control has many special features which provide flexibility and adaptability for use with the vast majority of engine/transmission combinations including options such as Engine Sync, Trolling, Shaft Brake, Mechanical Actuator Output, Transmission Oil Pressure and Oil Temperature Monitoring, and Helm Display.

The following installation instructions provide the necessary information on Component Installation, Electrical Installation, and Configuration. Review the entire manual for the options specific to your application, and become familiar with all Customer Supplied materials and tools that may be required. In addition, while the manual is outlined for the general sequence of installation from setup through troubleshooting, a good understanding of all aspects of the installation will help make for a smoother installation process.

The installation procedure is as follows:

1. Read and understand this manual. Contact the supplier of the system, your local Twin Disc Distributor, or the Twin Disc Incorporated website for help: <http://www.twindisc.com>
2. Locate desired positions for Control Heads, Controls and general routing of interconnecting harnessing.
3. Identify locations for vessel interconnections such as Ignition, Power Wiring, Electronic Throttle, Electric Shift, Speed Sensing etc. The engine manual, transmission manual, and vessel wiring diagrams may be needed for reference.
4. Purchase/fabricate any necessary "Customer Supplied" items or tools.
5. Install system components.
6. Install harnessing and wiring.

7. Inspect and compare the installation against this manual and applicable system drawings. Correct any discrepancies.
8. Record all component part numbers and serial numbers. Document all customer supplied and connected wiring. Include wire colors and location in document.
9. Test the system. Complete any necessary troubleshooting and adjustments. (See configuration Manual)
10. Sea trial the vessel.

General Information

This publication provides the information necessary for the installation of the Twin Disc Model EC300 Control System.

The components as supplied with the order meet the codes and standards that were applicable when the order was placed. Applicable codes and standards include:

- ☐ American Boat & Yacht Council (ABYC) Direct Current (DC) Electrical Systems on Boats Standard E-9.
- ☐ American Bureau of Shipping's (ABS) Rules for Building and Classing Steel Vessels 2002.
- ☐ American Bureau of Shipping's (ABS) Rules for Building and Classing Steel Vessels Under 90 Meters (295 Feet) 2001.
- ☐ Russian Maritime Registry Service's (RMRS) Rules for the Classification and Construction of Sea-Going Ships. Part XI. Electrical Equipment, Part XV. Automation
- ☐ Russian Maritime Registry Service's (RMRS) Rules for Technical Supervision During Construction of Ships and Manufacture of Materials and Products for Ships. Part IV. Technical Supervision During Manufacture of Products

The customer is responsible for meeting all currently applicable code and standard requirements for the component installation at the time of installation. The following instructions cover the typical installation of a single or twin-engine system with one, two, or three control stations as standard equipment. Additionally, these instructions cover installation of up to eight engine systems with optional accessories and cables.

The EC300 Control System is supplied in response to customer specific applications. Based upon the details of the order, certain features and options that are described in this manual will not be applicable. For specific component information, refer to the system installation drawing supplied for your application.

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Replacement Parts

Parts List

Engineering assembly drawings are provided in appropriate sections of this manual to facilitate ordering spare or replacement parts. Current system drawings are available from Twin Disc Incorporated or the nearest authorized Twin Disc Incorporated Distributor.

Ordering Parts

⚠WARNING

All replacement parts or products must be of Twin Disc Incorporated origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment. Twin Disc Incorporated absolves itself of any responsibility resulting from any external, internal or installation changes made in the field without the express written approval of Twin Disc Incorporated.

Renewal parts and service parts kits may be obtained from an authorized Twin Disc Incorporated distributor or service dealer.

Safety

All people installing and operating this unit must employ safe operating practices. Twin Disc Incorporated is not responsible for any personal injury resulting from any unsafe and careless use of hand tools, power tools, lifting equipment, or from any unsafe practices during installation and operation.

Because of the possible danger to people or property from accidents that may result from the use of manufactured products, it is important that correct procedures be followed. Products must be used in accordance with the information specified.

Proper installation procedures must be used. Proper safety devices, such as guards, may be required as specified in applicable codes. Safety devices are not provided by Twin Disc Incorporated nor are they the responsibility of Twin Disc Incorporated.

Source of Service Information

All information, illustrations and specifications in this manual are based on the latest information at the time of publication. The right is reserved to make changes at any time without notice.

Individual product service bulletins are issued to provide Twin Disc distributors with immediate notice of new service information. These service bulletins are distributed to all Twin Disc EC300 Control distributors throughout the United States and many foreign countries.

For the latest service information on Twin Disc Incorporated products, contact any Twin Disc distributor or service dealer. For a complete list of Twin Disc Distributors or Service Dealers, please see our Corporate website at <http://www.twindisc.com>. For additional information you may contact Twin Disc Incorporated Product Service by e-mail at service@twindisc.com or phone at (800) 558-3208 ext 2727.

Required Tools

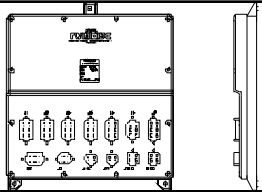
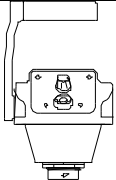
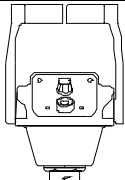
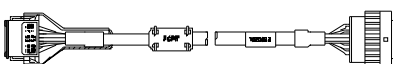
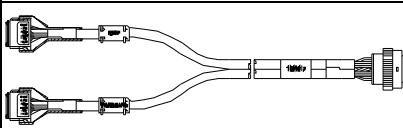
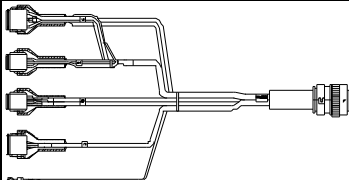
Installation and Set-up may require the following tools:

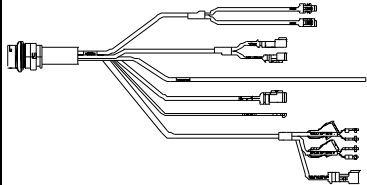
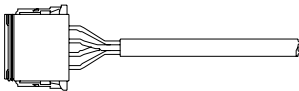
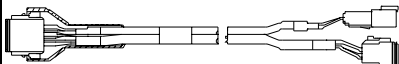
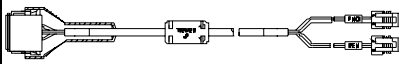
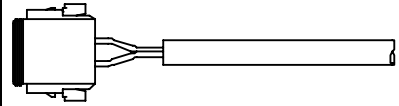
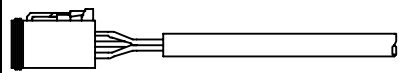
- ☐ Electric or pneumatic drill
- ☐ Assorted drill bits
- ☐ Center punch
- ☐ #1 Phillips screwdriver
- ☐ Screwdriver with a 1/8 in. blade
- ☐ Wire terminal crimpers
- ☐ Wire strippers
- ☐ DC voltmeter or multimeter
- ☐ Watch with a seconds hand
- ☐ Tachometer, oscilloscope, or frequency counter for troubleshooting dual engine applications
- ☐ 3/32 in. hex key (Allen) wrench
- ☐ 1/8 in. hex key (Allen) wrench
- ☐ Deutsch crimp tool (P/N HDT 48-00) for 12 to 24 AWG wire sizes
- ☐ Torque wrench capable of measuring 4.52 Nm (40 lb-in.) for installing a speed sensor in the flywheel housing and for mounting components
- ☐ File, rasp, or sandpaper to smooth cut surfaces
- ☐ 500 VDC Megohmmeter for testing power wiring as per ABS requirements.
- ☐ Laptop with latest MFST software updates
- ☐ EC300 Communication Kit (Twin Disc p/n 1021108)
- ☐ EC300 Display Harness and Display (Twin Disc p/n 1018791)

Basic System Components

This section serves as a guide for your pre-installation parts check. Be sure that you have ordered and received all of the basic components necessary for this system installation.

Table 1. Required Components for Typical Applications

Required Components for Typical Applications		Supplied by:		Single Engine with One Station	Single Engine with Two Stations	Twin Engine with One Station	Twin Engine with Two Stations
		Twin Disc	Customer				
				Qty	Qty	Qty	Qty
EC300 Control		☒	☐	1	1	2	2
Single Lever Control Head (J1, J2, J3)		☒	☐	1 ¹	2 ¹	N/A	N/A
Dual Lever Control Head (J1, J2, J3)		☒	☐	N/A	N/A	1 ²	2 ²
Single Lever Station Harness (J1, J2, J3)		☒	☐	1	2	N/A	N/A
Dual Lever Station Harness (J1, J2, J3)		☒	☐	N/A	N/A	1	2
Transmission Harness (J5, J6, J7, J8) EC300 Control to Bracket		☒	☐	1 ³	1 ³	2 ³	2 ³

Transmission Harness (J5, J6, J7, J8) Bracket to Transmission		☒	☐	1 ⁴	1 ⁴	2 ⁴	2 ⁴
J5 Engine Control Harness		☐	☒	1	1	2	2
J5 Speed Sensor Harness		☒	☐	1	1	2	2
J6 Engine Room Analog Harness		☒	☐	1	1	2	2
Speed Sensors	(See Table 3)	☒	☒	2 ⁵	2 ⁵	4 ⁵	4 ⁵
J7 PWM Driver Harness		☒	☐	1	1	2	2
J8 Misc Bridge Harness		☐	☒	1	2	1	2
J10 Communication Harness	(See Table 4)	☒	☐	N/A	N/A	1	1
J13 Power Harness		☐	☒	1	2	1	2

¹ The Control Head can be ordered with the lever on the left or right side.

² The Dual Lever Control Head can be replaced with optional Split Single Lever Control Heads, or a Side Mount Control Head Assembly.

³ Harness Assembly, eliminating the need for individual harnesses. Various harness options are available to accommodate different transmission and control system options.

⁴ Harness Assembly, eliminating the need for individual harnesses. Various harness options are available to accommodate different transmission and control system options.

⁵ Quantity indicated is based on the requirement for an input and output speed sensor.

Table 2. Optional Components

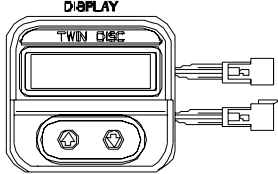
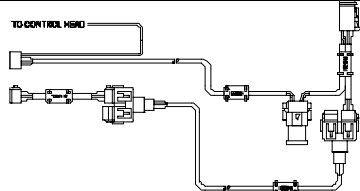
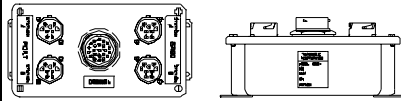
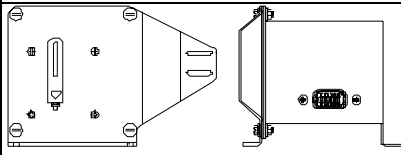
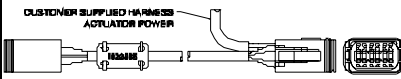
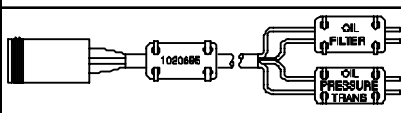
Optional Components		Supplied by:		Single Engine with One Station	Single Engine with Two Stations	Twin Engine with One Station	Twin Engine with Two Stations
		Twin Disc	Customer				
				Qty	Qty	Qty	Qty
Display		☒	☐	1 ¹	1 ¹	2 ^{1,2}	2 ^{1,2}
J9 Display Harness		☒	☐	1 ¹	1 ¹	2 ¹	2 ¹
Station Doubler		☒	☐	**	**	**	**
Servo Actuator		☒	☐	1 ³	1 ³	2 ³	2 ³
J11 Servo Harness		☒	☐	1 ³	1 ³	2 ³	2 ³
J12 Engine Room Switch Harness		☒	☐	1 ⁴	1 ⁴	2 ⁴	2 ⁴
¹ Optional Display. The use of a display will require the installation of a J9 Display Harness. ² One Per station. ** Optional Station Doublers are required in applications requiring more then 3 control stations per EC300 Control (maximum of 5). J1 connection will not support a Station Doubler. ³ Optional Servo Actuator is required for the operation of mechanical control. Installation of a Servo Actuator will require the installation of a J11 Servo Harness ⁴ Optional Oil Filter Differential and Oil Pressure Switches - used to trigger a fault condition when active.							

Table 3. Typical Speed Sensor Types

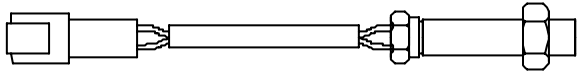
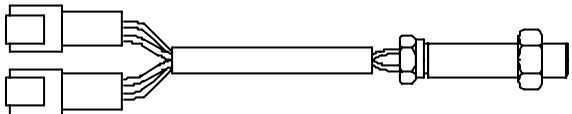
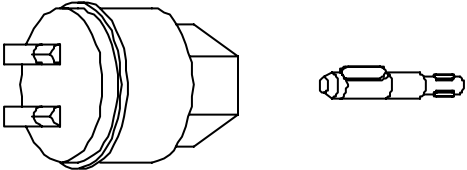
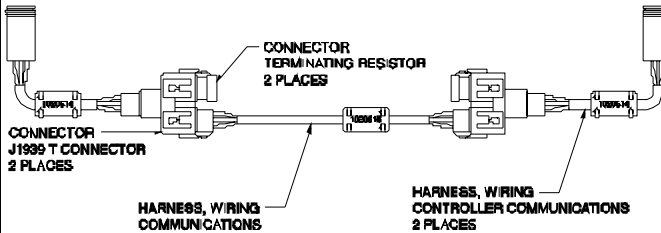
	Single Output Magnetic Pickup Sensors are available with various thread sizes and connectors.
	Dual Output Magnetic Pickup Sensors are available with various thread sizes and connectors.
	Tachometer Generator with Drive Tang.
One input speed sensor is required for each engine and one shaft speed sensor is required per transmission. On a dual output speed sensor, one output can be used for EC300 input and the other output can be used for instrumentation. The dual-output pickup can be installed in place of existing pickups if both are electrically compatible.	
Note: On multiple engine vessels, each engine must use speed sensors of the same type, model, and part number.	

Table 4. Communications Harness Components for Twin Engine Basic Systems

Communications Harness Components *				Twin Engine Qty
General Drawing	Component Name	Supplied by		
		Twin Disc	Customer	
 Diagram labels: CONNECTOR J1939 T CONNECTOR 2 PLACES, CONNECTOR TERMINATING RESISTOR 2 PLACES, HARNESS, WIRING COMMUNICATIONS, HARNESS, WIRING CONTROLLER COMMUNICATIONS 2 PLACES.	Controller Communications Harness	☒	☐	2 ¹
	Communications Harness	☒	☐	1 ¹
	J1939 T-Connector Receptacle	☒	☐	2 ¹
	Terminating Resistor Plug	☒	☐	2 ²

* Required for multiple engine systems

¹ Add one (1) additional component for each additional engine (more than two).

² Quantity does not change, regardless of the number of engines.

Additional Materials

Installation requires the following supplies that are not furnished with the basic control system:

- ☐ Brackets, fasteners, and other hardware for mounting the components

Note: Use 6.35 mm (0.25 in.) maximum fastener diameter to mount the control(s).

- ☐ Wire terminal lugs, cable ties, cable clamps, insulating materials, and other electrical hardware (Refer to General Installation Guidelines for more information about the electrical hardware requirements.)
- ☐ Hook-Up Wire, stranded copper (19 strands or more); 14 AWG (15 amps max.) unless otherwise specified; rated for 50 VDC, conforming to UL 1426 Cables for Boats or other applicable standards; marked with type/style, voltage, size, and dry temperature rating; color coded as shown in Table 5.

Note: Table 5 provides color code requirements for those vessels subject to American Boat & Yacht Council (ABYC) Standard E-9 requirements.

Table 5. Power Wire Color Codes as per ABYC Standard E-9

Color Code	Function
Yellow w/Red Stripe	Neutral Start Relay Contacts (J5 pins 9 & 10)
Purple	Ignition Switch (J8 pin 1)
Yellow (preferred) or Black	Battery Negative (-) (J13 pin 3)
Red	Battery Positive (+) (J13 pin 1) Auxilliary Battery Positive (+) (J13 pin 2)
Green w/Yellow Stripe (preferred) or Green	DC Grounding Conductors or Bonding Only

Starter Solenoid Circuits Greater Than 5 Amps

- ☐ Relay, Normally Open (NO) Single Pole Single Throw (SPST), coil voltage rating equal to the starter solenoid voltage, contact current rating greater than the starter solenoid current, one (1) required per control, customer supplied.

Component Installation

General Component Installation Guidelines

Ensure a suitable location is chosen for mounting the EC300 Control(s), Control Head(s), Twin Disc Display(s), and any other components. EC300 Controls should be mounted near the engines in a location reasonably free from direct splash and spray, and protected from mechanical abuse. See Appendix - A for Environmental Specifications. When selecting the location for mounting the components, consideration should be given to any push-pull cable routing in order to avoid sharp bends or excessive lengths. The mounting surface should be flat, or shimmed so that the control enclosure is secured without distortion to the bottom plate. Controls should not be mounted on the engines unless they are protected by a heat shield and mounted to a vibration-damped plate.

Choose a location that meets the following criteria:

- ☐ It is not on any drivetrain component.
- ☐ It is away from heat sources.
- ☐ It is clear of service and access areas.
- ☐ It is away from AC power and high current conductors.
- ☐ It is protected from submersion or splash.
- ☐ It will not provide a “step” for personnel.
- ☐ It is a minimum of 1 m (3.3 ft) away from alternators, generators, communications equipment, and associated wiring.
- ☐ It is away from high vibration.
- ☐ It provides easy access for routing, connecting, and adjusting the push-pull cable, if used.
- ☐ It is convenient for accessing the electrical connections.
- ☐ Control equipment and displays are to be so placed or protected as to minimize the likelihood of sustaining damage from the condensation of moisture, accumulation of dust, oil vapors, steam, dripping liquids, or from activities around their location.

There are other factors to consider when choosing a mounting location for the EC300 Controls and Servo Actuators.

Push-pull cable installation should meet the following criteria:

- ☐ Cables should be minimum length possible.
- ☐ Any cable bends should have no sharp bends. Install with the maximum possible bend radius. Refer to cable manufacturer's specifications.
- ☐ Cables must be located away from hot surfaces.
- ☐ Cables must be clear of service or access areas.
- ☐ Cables must be Morse Series 33 RED JAKET® Supreme or equivalent.

Electrical wiring and routing should meet the following criteria:

- ☐ Wiring must be minimum practical length.
- ☐ Wiring must be located away from high current conductors and devices.
- ☐ Wiring must be located away from hot surfaces.
- ☐ Wiring must be clear of service and access areas.
- ☐ Wiring should be at least 1 m (3.3 ft) away from communications equipment, antennas, and associated leads.
- ☐ Wiring should be at least 1 m (3.3 ft) away from alternators, generators, and ignition systems.
- ☐ Wiring should have drip loops where required, especially at the controls.

Use the correct fasteners and mounting hardware as follows:

- ☐ Use any fasteners and mounting hardware as supplied from Twin Disc Incorporated with the component.
- ☐ Use stainless steel fasteners unless otherwise specified.
- ☐ Use lock washers as specified.

EC300 Control Installation

Note: The EC300 Control can be mounted in any orientation on a flat surface.

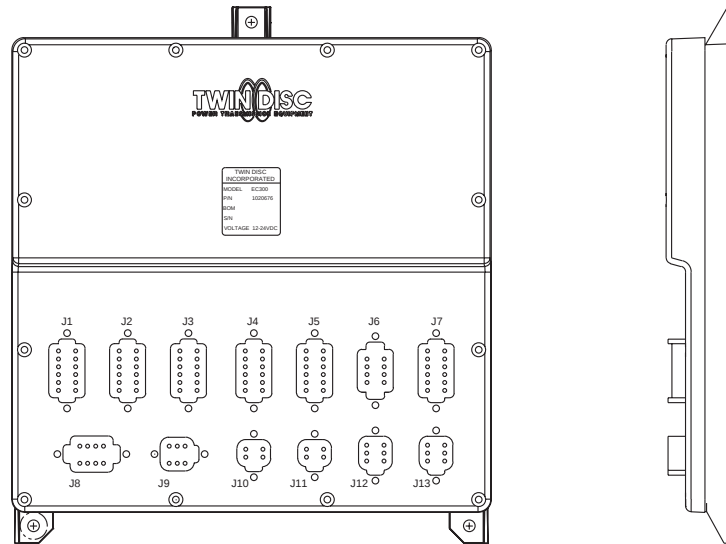


Figure 1. Preferred Mounting Arrangement for EC300 Control

1. Locate a solid, flat surface where the three enclosure mounting feet contact and are parallel to the mounting surface.

Note: All mounting hardware must be corrosion resistant.

2. If required, fabricate brackets, shims, or spacers in order to provide a flat surface.

Note: Refer to the EC300 Control Mounting Dimensions drawing (1020676) in Engineering Drawings.

3. Mark and drill three (3) mounting holes for the 6.35 mm (0.25 in.) mounting hardware.
4. Mount the control using three (3) sets of fasteners and lock washers.

Note: Place lock washers under the mounting screw heads.

5. Tighten fasteners up to 1.13 Nm (10 lb-in.) maximum.

Control Head Installation

A control station is a location from which the boat can be operated. A control station will consist of one or more Control Heads. Each control station requires the installation of a Control Head and associated wiring harnesses. The control station may consist of a single or dual lever Control Head, multiple Control Heads, or a side mount Control Head Assembly. There are separate instructions for the single/dual lever Control Head and the side mount Control Head Assemblies.

Note: Only EC300 Control Heads will work with the EC300 Control. The EC200/250/251 Control Heads are not compatible.

Note: Locate the Control Head(s) where they will not be in direct spray, splash, or submerged.

Note: Chrome plated Control Heads should be polished periodically using a chrome polish to help retard corrosion.

The following subsections make up this section:

- ☐ Single/Dual Lever Control Head Assembly
- ☐ Side Mount Control Head Assembly
- ☐ Drag Adjustment Procedures

Single/Dual Lever Control Head Assembly

The Control Head may be either a single or dual lever version. This installation procedure applies to both versions.

Note: If this is a new installation, ensure that all required components are properly located before cutting the first hole. Other components that may require installation include a display, an ignition switch or instrumentation gauges.

Note: At least 25.4 mm (1 in.) of clearance is required at both ends of the lever travel for the operator's hands (see Figure 3). Clearance must be provided beneath the Control Head to accommodate the base, an electrical connector and a harness. The Control Head should be installed at least 1 m (3.3 ft) away from any communications equipment and associated leads.

1. Select a mounting location that is flat, readily accessible, permanent, and solid.

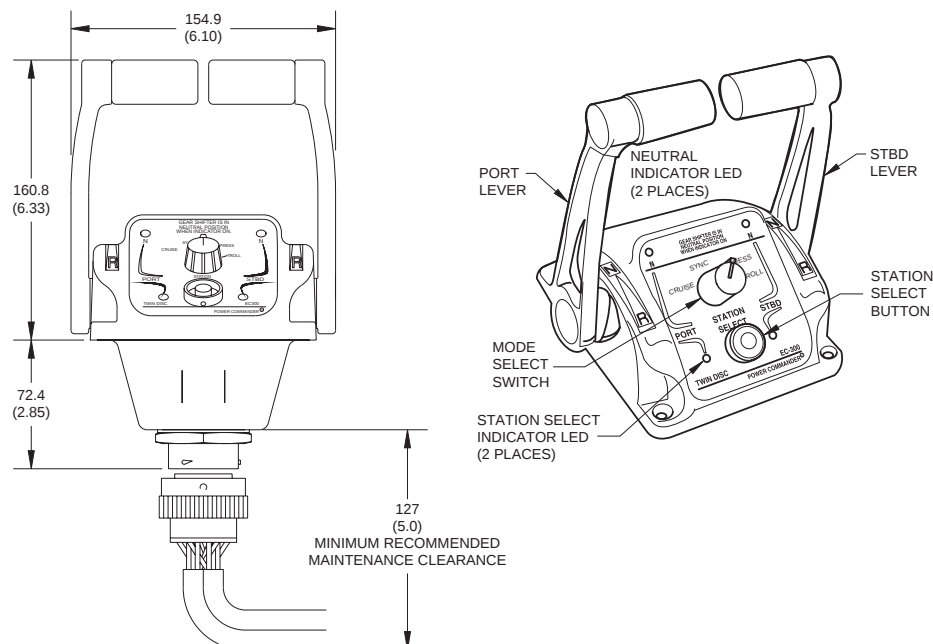


Figure 2. Front View of Dual Lever Control Head With Levers in Neutral

2. Cut out the Control Head Mounting Template in Engineering Drawings in the back of this manual, and tape it in the desired location.

Note: The template provided with the control is direction specific. Ensure that the “ahead” direction on the template is pointing toward the bow in order to ensure that the forward motion of the lever is directed ahead.

3. Ensure that the control head location provides clearance for the operator’s hands over the full range of lever travel.

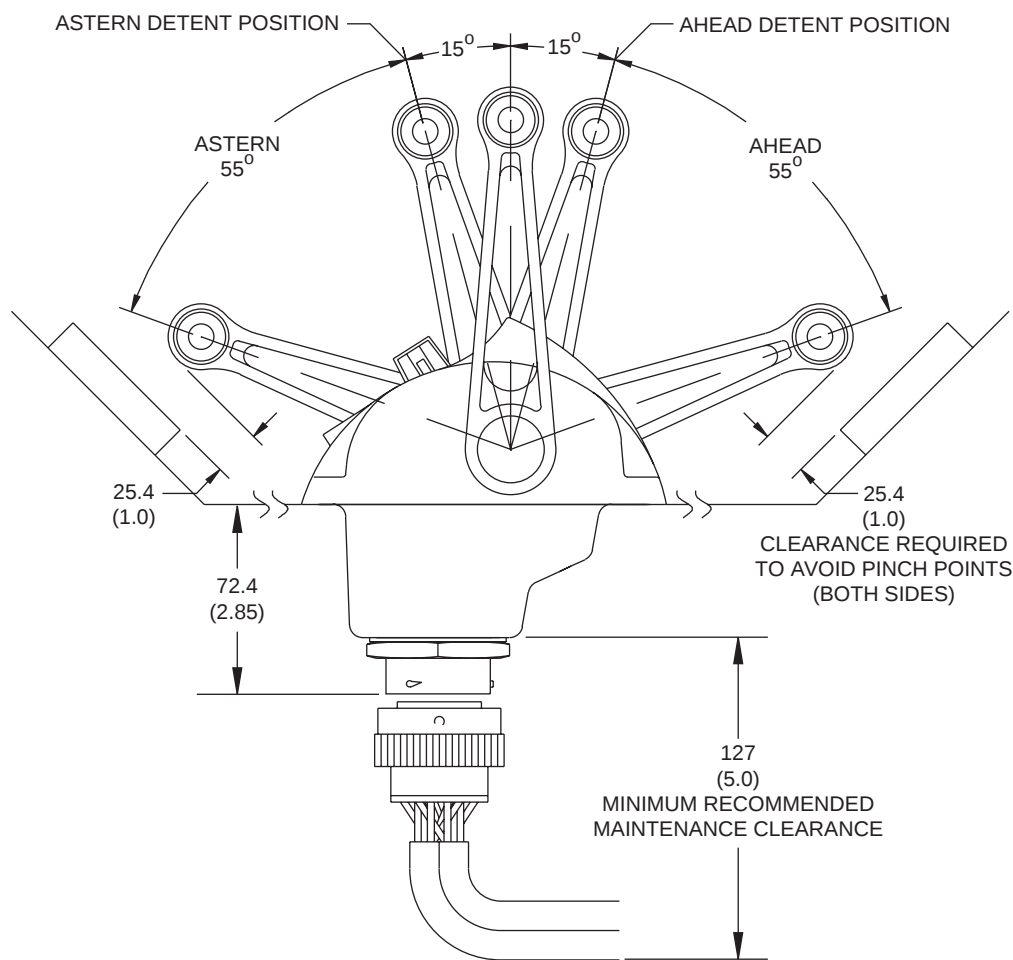


Figure 3. Side View of Control Head With Lever Clearance Shown

4. Center punch the four (4) mounting holes and scribe the base cutout outline.

5. Remove the template.

Note: The hole cannot be smaller than shown on the template and must be properly aligned with the mounting holes.

6. Drill and cut the holes using the template markings.
7. Check the hole locations with the template.
8. Remove any splinters or sharp edges from the holes.
9. Check the fit by carefully placing the Control Head in the hole.
10. Remove the Control Head from the cutout.
11. Correct the fit as necessary.
12. Set drag per Control Head Lever Drag Adjustment. See Control Head Lever Drag Adjustment.

Note: Drag adjustment is provided at each lever. Proper adjustment is necessary to ensure that the lever remains in the intended position without operator assistance.

13. Install and mount the Control Head using the supplied gasket and four (4) oval head #10 screws or equivalent.

Note: All fastening hardware must be corrosion resistant.

Note: The type of fastener to be used depends on material used for the support. Each Control Head is supplied with stainless steel 38 mm (1.5 in.) screws suitable for mounting in a dash up to 19 mm (0.75 in.) thick. Use the appropriate fastener for the specific installation.

14. Torque the fasteners to 1.13 Nm (10 lb-in.) maximum.
15. Install and mount the Control Head using the supplied gasket and four (4) oval head #10 screws or equivalent.
16. Torque the fasteners to 1.13 Nm (10 lb-in.) maximum.

Reference Control Head Harness (J1, J2, or J3) Installation for cable installation.

Side Mount Control Head Assembly (Binnacle/Console Station)

The side mount Control Head Assembly consists of a Lever, Interface Assembly, Interface harness and Selector Assembly. The lever may be supplied by Twin Disc or other sources. Specific lever attachment instructions should be supplied with the lever and the lever must be capable of attaching to the 15.87 mm (0.625 in.) diameter shaft of the Interface Assembly. The Interface Assembly comes with a mounting plate for sandwiching the console wall between the assembly and the mounting plate. The Selector Assembly mounts directly to the surface of the console.

1. Locate a position on the side of the console which provides the operator with unrestricted access to the lever(s), while providing full range (70 degrees either side of neutral) of lever motion.
2. Locate a position on the top or front surface of the console which provides unrestricted access to the Selector Assembly. Confirm that the desired location will allow the Interface Harness to reach between the Interface Assembly and the Selector Assembly.

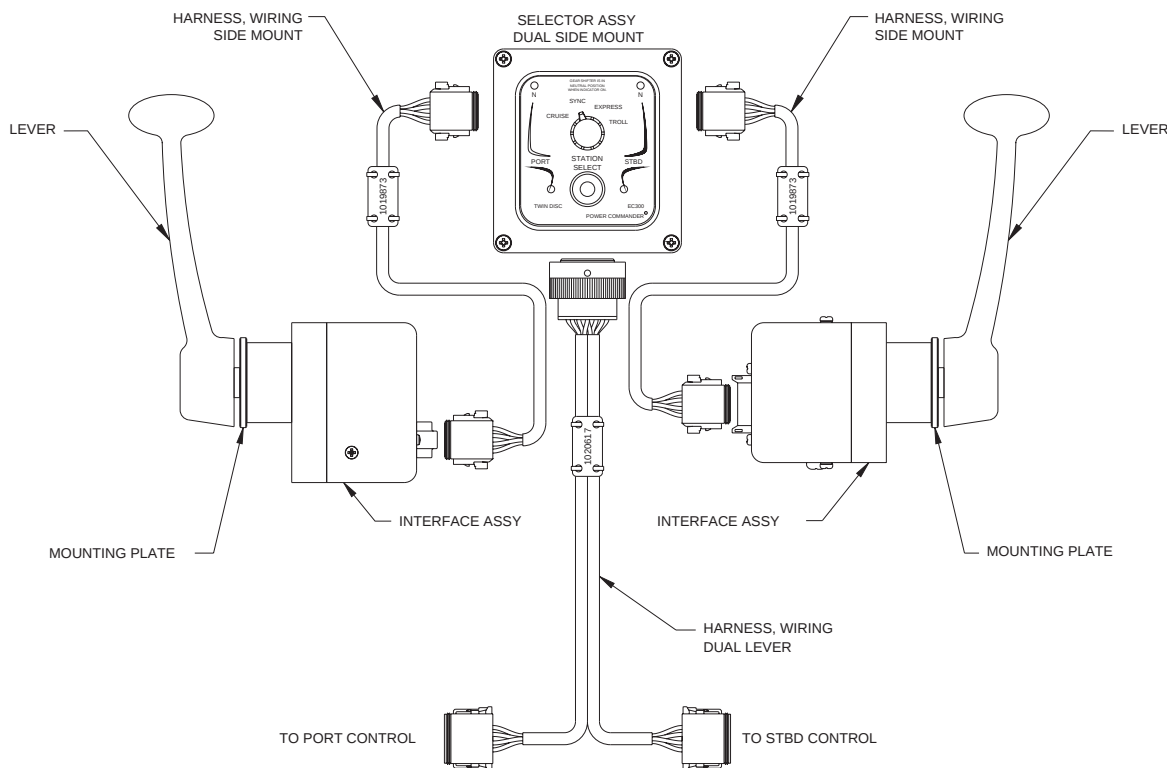


Figure 4. Side Mount Control Head Assembly

3. Cut out the Interface Assembly Mounting Template and Selector Assembly Mounting Template from the Engineering Drawings and tape in the selected positions.

Note: For twin engine applications, the template to mount the Starboard Interface Assembly is flipped over and then rotated 90 degrees counterclockwise from the Port Interface Assembly. See Figure 5.

4. Use the scale marks on the template to verify that the template is the correct size. (Scale = 1:1)
5. Using the templates, mark all necessary holes and cutouts.

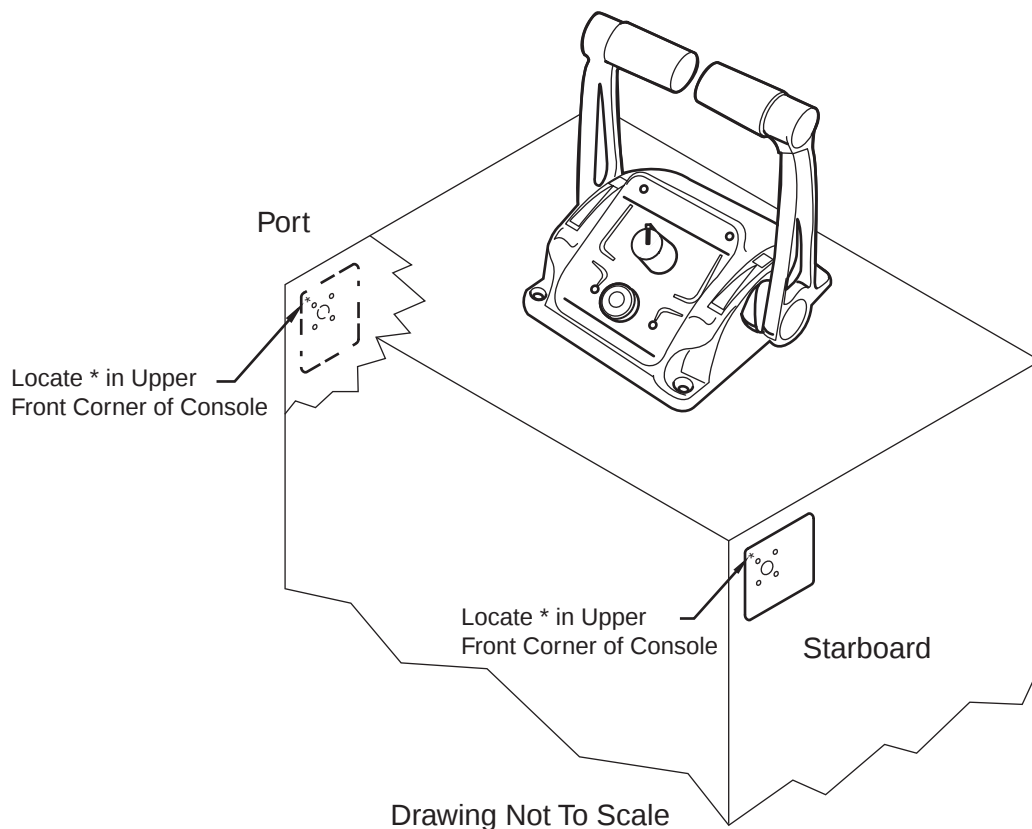


Figure 5. Side Mount Interface Assembly Mounting Template Position

6. Drill and cut the holes using the template markings.
7. Check the hole locations with the template.
8. Remove any splinters or sharp edges from the holes.

9. Check the fit of the holes by carefully inserting the Interface and Selector assemblies.
10. Correct the fit as necessary.

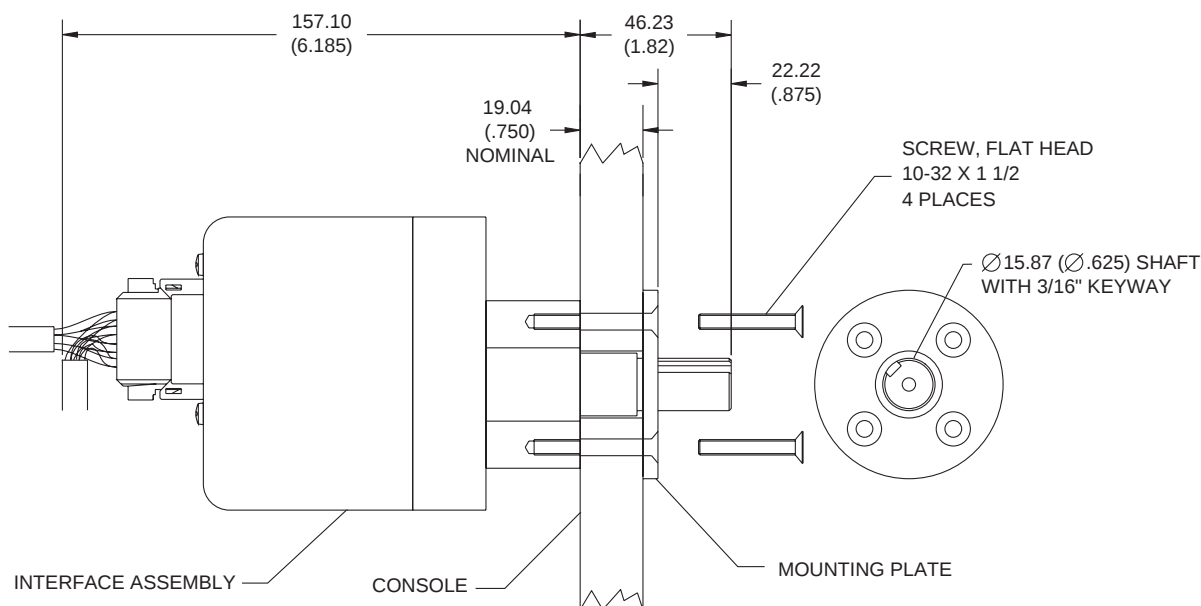


Figure 6. Side Mount Interface Mounting

11. Install the Selector Assembly using the gasket and stainless steel hardware provided with the unit.
12. Set drag per Control Head Lever Drag Adjustment. See Control Head Lever Drag Adjustment on page 33.

Note: Drag adjustment is provided at each lever. Proper adjustment is necessary to ensure that the lever remains in the intended position without operator assistance.

13. Install the Interface Assembly/Assemblies using the mounting plate and stainless hardware provided.
14. Connect the Interface Harness between the Interface Assembly and the Selector Assembly and secure/strain relieve as necessary.
15. Attach the Lever to the 15.87 mm (0 .625 in.) diameter shaft of the Interface Assembly, following the instructions provided with the lever.

Control Head Lever Drag Adjustment

1. Adjust drag as needed. Refer to Figure 7 and 8 for drag adjustment screw locations.
2. Access the drag adjustment screw and insert an 1/8 in. hex key wrench into the opening for each lever. Remove the access screw on side mount control heads. See Figure 7 and Figure 8.
3. Tighten the drag adjustment screw(s) until the desired drag is obtained over the full lever travel.

Note: 0.45 to 0.91 kg (1 to 2 lb) average drag is normally desirable.

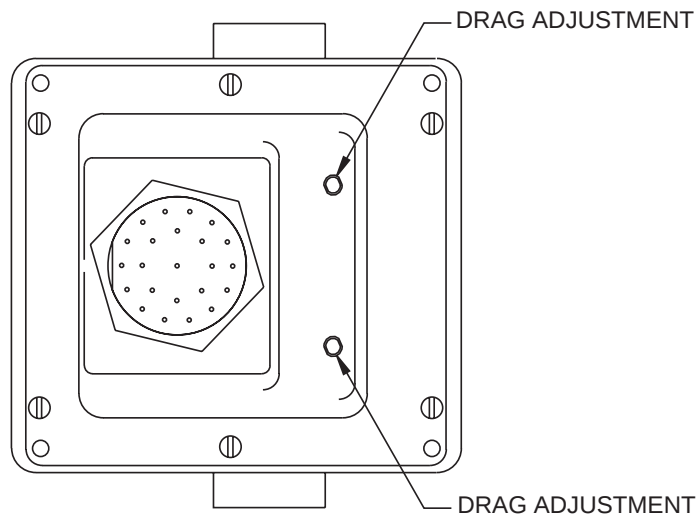


Figure 7. Drag Adjustment Screws for Single/Dual Lever Control Head

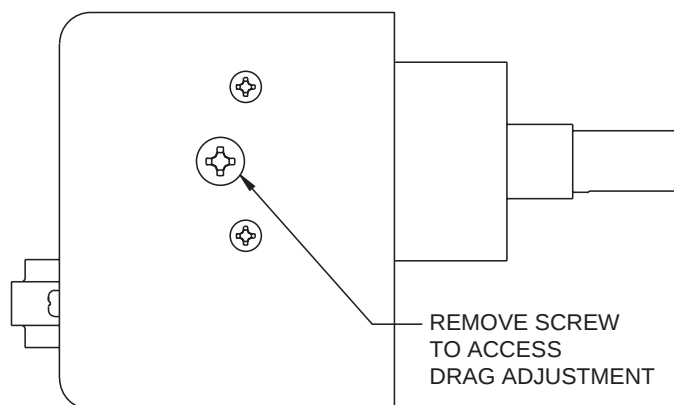


Figure 8. Drag Adjustment Screws for Side Mount Control Head Assembly

Twin Disc Display Installation

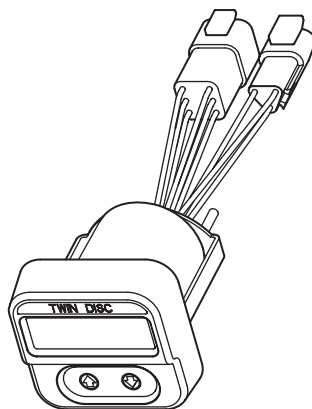


Figure 9. Twin Disc Display

Note: Ensure that all items are located for installation on the dash or control panel before cutting the first hole.

Note: One (1) display is provided as an option for each EC300 Control. Multiple displays may be provided to support multiple control stations.

Note: The Twin Disc Display is designed to mount from the front through a 3.2 to 19 mm (0.125 to 0.75 in.) thick panel or dash. See Twin Disc Display Mounting Dimensions (1018791) in Engineering Drawings. The mounting bracket is installed from the rear. Wiring should be connected while the display is accessible.

1. Locate a position on the dash or control panel for the display.
2. Using the appropriate cutting tools, cut a 54 mm (2.125 in.) hole.
3. Round off any sharp edges and remove any burrs.
4. Remove the mounting bracket and nuts from the rear of the display.
5. Ensure that the display will fit in the hole.

6. Install gasket on display. (See Twin Disc Display Harness (J9) installation for wiring instructions.)
7. Insert the display in the dash or control panel.
8. Attach the mounting bracket and tighten the nuts until the display is firmly secured in the dash.
9. If applicable, repeat steps 1 through 8 for each additional display.

Refer to Twin Disc Display Harness (J9) Installation for display harness wiring installation.

Speed Sensor Installation

Applications with options such as Sync Mode (engine synchronization), Express Mode, and Troll Mode require the installation of an engine speed sensor and/or transmission output speed sensor. Engine speed sensors (transmission input) are most often installed on the marine transmission, however in some cases the engine speed sensor is installed on the engine flywheel. The output speed sensor may be installed directly into the transmission or on a bracket near the output shaft with a speed pick-up wheel connected to the output flange. Only Twin Disc speed sensors are acceptable for the output shaft speed.

There are many types of engine speed sensors available and many will work with the EC300 Control System. This section outlines the installation of the sensors available from Twin Disc Incorporated. Contact Twin Disc, or the nearest distributor, for the possible use of other sensors.

The Speed Sensor is a cylindrical-threaded component that screws into either the engine flywheel housing; the transmission housing; or into a bracket on the output side to sense transmission output speed. It is triggered by the crown of the gear teeth when they pass in close proximity to the end of the speed sensor. The Speed Sensor produces an output signal of one pulse per gear tooth. The EC300 Control software converts the individual pulse signals into revolutions per minute (rpm). The number of teeth on the gear must be known in order for the software to be properly configured. This information is either supplied by the engine supplier if flywheel mounted, or Twin Disc Incorporated if connected to transmission.

Single output speed sensors are preferred over dual output (See Figure 10); however dual output speed sensors are acceptable if the outputs are electrically isolated from each other and have the required electrical characteristics.

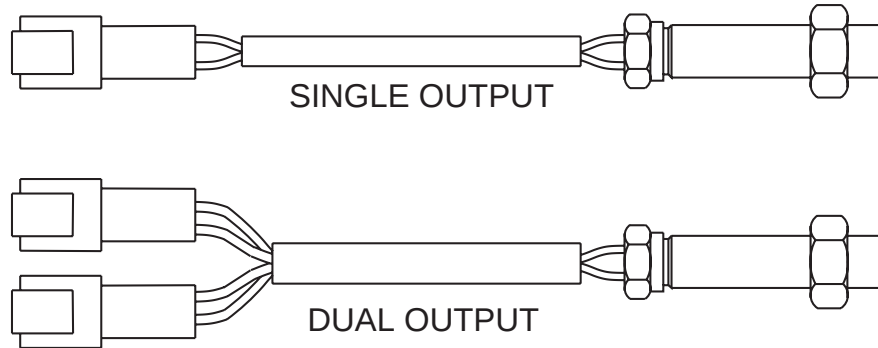


Figure 10. View of Typical Single and Dual Output Speed Sensors

The following sub-sections make up this section.

- ☐ Installation – Magnetic Pick-up Engine Speed Sensor
- ☐ Installation – Hall Effect Pick-up Output Speed Sensor
- ☐ Installation – Tachometer Signal Generator

Installation – Magnetic Pick-up Engine Speed Sensor

Note: Some transmissions have pre-drilled and plugged sensor holes above the primary or secondary shaft transfer gear.

Note: Some engines have pre-drilled and plugged sensor mounting plates in the flywheel housing. Consult the engine manufacturer if a mounting hole must be added. Additionally, some engines may already have Speed Sensors installed in the flywheel housings for the engine tachometers. An existing single output sensor may be replaced with a dual output sensor in order to eliminate the need to add additional holes.

1. Bump the engine starter until the crown (top) of a gear tooth is visible in the center of the hole. See Figure 11.

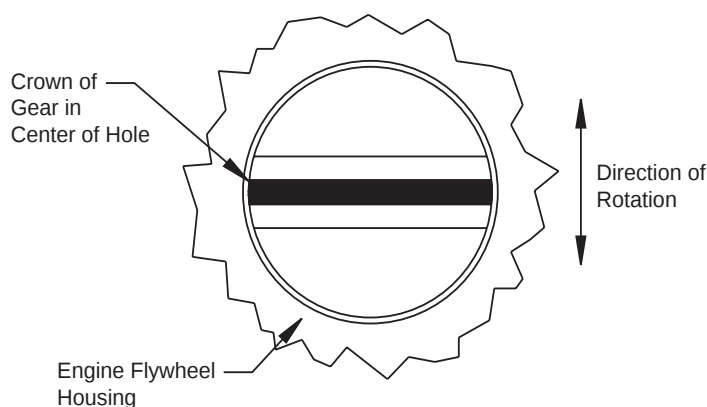


Figure 11. View of Tooth Crown through Speed Sensor Mounting Hole

2. Thread the lock nut onto the sensor and apply anaerobic sealant equivalent to MA908 (Loctite 242) to the threads of the engine speed sensor near the end away from the wires. See Figure 12.

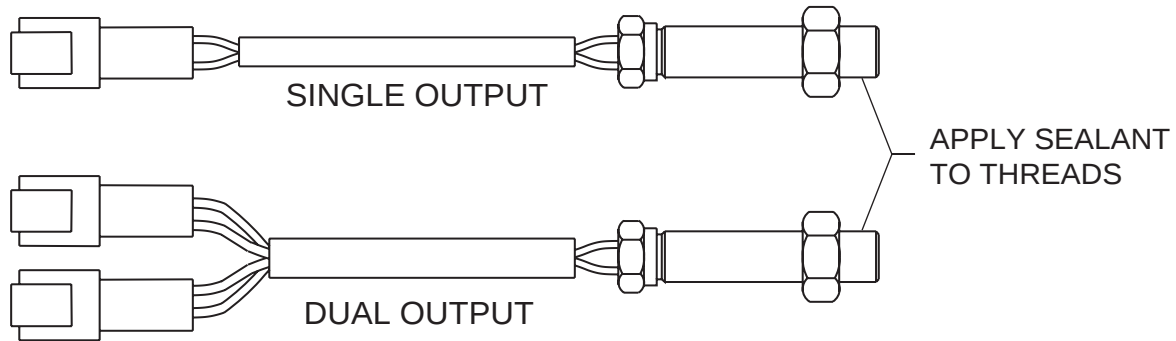


Figure 12. View of Typical Single and Dual Output Speed Sensors

3. Thread the sensor into the sensor opening until it just contacts tip of the gear tooth then back sensor out one full turn.
4. Tighten the lock nut to 4.52 Nm (40 lb-in.) maximum while holding the Speed Sensor body in place.
5. If using a dual-output Speed Sensor, reconnect the original signal cable to one of the sensor outputs.

Installation – Hall Effect Pick-up Output Speed Sensor

Note: Some transmissions have predrilled and plugged sensor holes for the purpose of installing output speed sensors.

Note: Some transmissions may need an output speed pick-up wheel installed on the output flange and an output speed bracket installed on the transmission housing to facilitate the installation of an output speed sensor. See Figure 13.

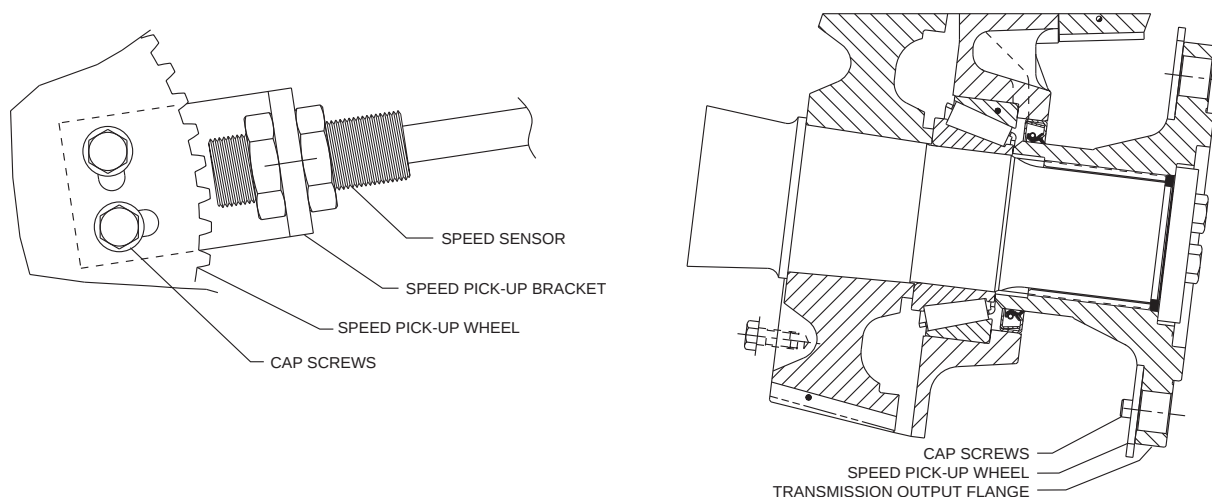


Figure 13. Output Speed Sensor, Pick-Up Bracket, and Speed Wheel

1. Turn the output shaft until the crown of the gear tooth or speed wheel tooth is centered in the sensor hole. See Figure 11.
2. Thread the lock nut onto the sensor. Apply anaerobic sealant equivalent to MA908 (Loctite 242) to the threads of the engine speed sensor near the end away from the wires. See Figure 12.
3. Install sensor until contacts tip of gear tooth and back sensor out two full turns.
4. Tighten the lock nut to 4.52 Nm (40 lb-in.) maximum while holding the Speed Sensor body in place.

⚠ CAUTION

The Hall Effect Pick-Up output speed sensor used for the EC300 Marine Control System cannot be used to provide signals to other devices on the vessel. The output signal must be connected directly to the EC300 Control.

Installation – Tachometer Signal Generator

Tachometer signal generators will also work with the EC300 Control System. See Figure 14. The tachometer signal generator must be capable of generating an AC signal with a frequency that is proportional to speed. Use a generator that provides the highest frequency possible. A minimum of 15 cycles per crankshaft revolution is required. Twin Disc, Incorporated has a 30 pulse per revolution tachometer signal generator available. The output amplitude of the tachometer signal generator must be a minimum of 1.5 volts RMS AC.

Note: The number of pulses per revolution must be known in order for the EC300 control software to be properly configured.

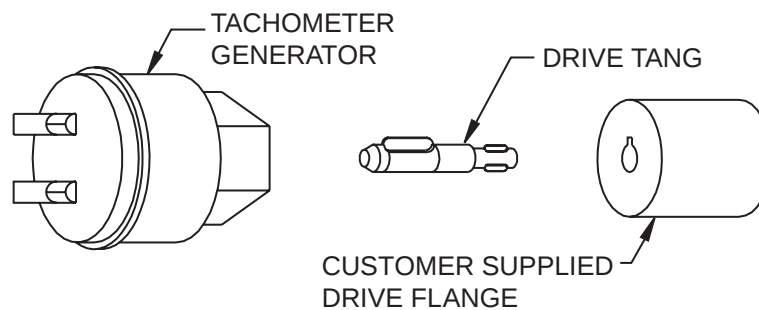


Figure 14. View of Tachometer Signal Generator

Note: Mechanical drive components that are necessary to convert an existing tachometer sender drive to a dual tachometer sender drive must be ordered from the accessory supplier identified on the existing tachometer sender.

⚠ CAUTION

The tachometer signal generator output used for the EC300 Marine Control System cannot be used to provide signals to other devices on the vessel. The signal generator output used must be connected directly to the EC300 Control.

Install the tachometer signal generator as per the manufacturer's instructions.

Reference Engine Control Harness (J5) Installation and Engine Room Harness (J6) Installation in the Electrical Installation Section of this manual for complete speed sensor wiring information.

Station Doubler Installation

Station Doublers are used for installations requiring four (4) or five (5) Control Heads per control. One (1) Station Doubler is required if four (4) Control Heads are used. Two (2) are required for five (5) Control Heads.

Note: The J1 connection will not support a station doubler and must be connected directly to a Control Head.

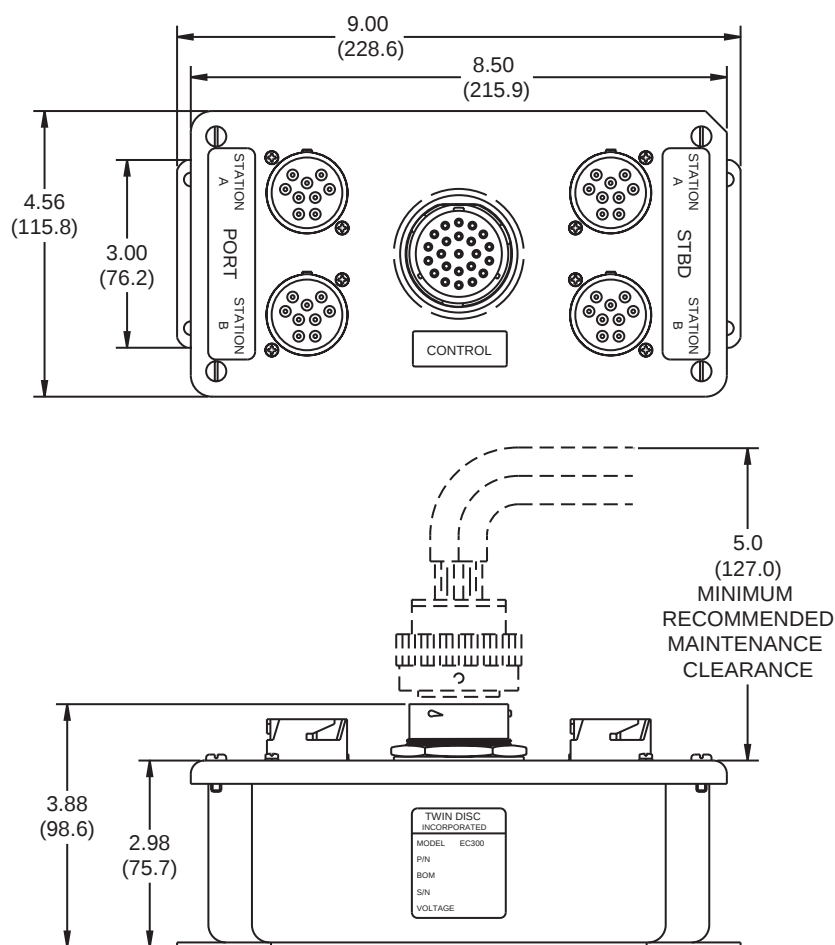


Figure 15. Station Doubler Top and Side Views

1. Locate a solid, flat surface where the mounting pads contact and are parallel to the mounting surface.

Note: All mounting hardware must be corrosion resistant.

2. If required, fabricate brackets, shims or spacers in order to provide a flat surface.
3. Mark and drill four (4) mounting holes for the 6.35 mm (0.25 in.) mounting hardware.
4. Mount the Station Doubler using four (4) sets of fasteners and lock washers.

Note: Place lock washers under the mounting screw heads.

5. Tighten the fasteners to 1.13 Nm (10 lb-in.) maximum.

Reference Multiple Station Dual Lever Control Head Wiring Installation for harness installation.

Servo Actuator Installation

The EC300 Control System supports one servo actuated device per control. The EC300 Control Systems can control either a mechanically shifted transmission, a mechanically controlled throttle, or a mechanically controlled troll valve.

The Servo Actuator can be mounted in any orientation on a flat surface. See Figure 16 for preferred mounting orientation. The Servo Actuator should be located within the reach of the supplied harness and as close to the engine/transmission as practical.

Note: The Servo Actuator and Push-Pull Cable Installation process should be read and understood prior to installation of Servo Actuator and related components, to ensure all component mounting positions are located properly and all necessary materials are available for the complete installation.

This section contains the following sub-sections:

- ☐ Servo Actuator Mounting
- ☐ Push-Pull Cable Installation Guidelines
- ☐ Push-Pull Cable Installation Kits for Conductive Vessels
- ☐ Push-Pull Cable Installation Kits for Nonconductive Vessels
- ☐ Push-Pull Cable Installation
 - Mechanically Shifted Transmission
 - Mechanically Controlled Throttle
 - Mechanically Controlled Troll Valve
- ☐ Push-Pull Cable Final Adjustment

Servo Actuator Mounting

The Servo Actuator will accommodate a total push-pull cable stroke of 41 to 84 mm (1.6 to 3.3 in.). It will provide a maximum of 24 kg (53 lb) of force at the innermost point on the lever and a maximum of 11.3 kg (25 lb) of force at the outermost point on the lever.

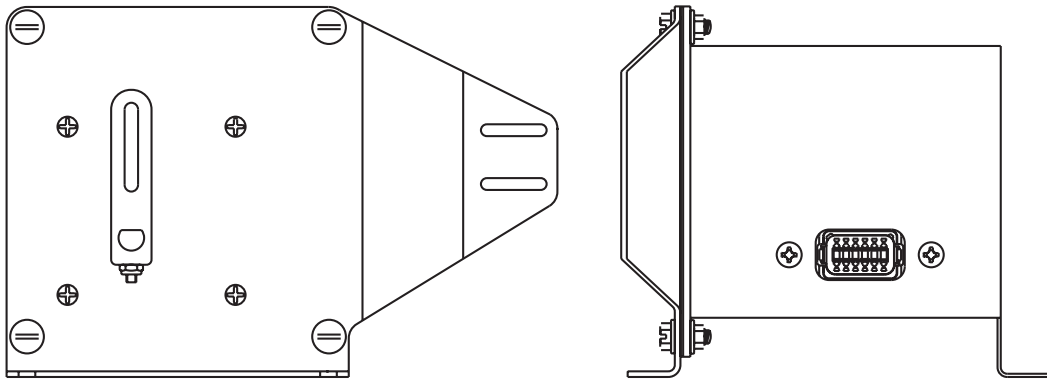


Figure 16. Preferred Mounting Arrangement for Servo Actuator

1. Locate a solid, flat surface where the mounting rails contact and are parallel to the mounting surface.

Note: Refer to Servo Actuator Dimensional Drawing in Engineering Drawings for mounting dimensions for your specific actuator.

Note: All mounting hardware must be corrosion resistant.

Note: Neither the engine nor the transmission push-pull cable clamp and bracket are supplied.

Note: Fabricate brackets, shims or spacers as required to provide a flat surface.

2. Mark and drill the four mounting holes for the 6.35 mm (0.25 in.) mounting hardware.
3. Mount the Servo Actuator using four sets of fasteners and lock washers.

Note: Use 6.35 mm (0.25 in.) diameter fasteners and place lock washers under the mounting screw heads.

4. Install the push-pull cable. Refer to Push-Pull Cable Installation for cable installation.

Push-Pull Cable Installation Guidelines

Correct push-pull cable installation will aid in trouble-free operation of the control system. Different installation kits are available. Where possible, quick-disconnect ball joints should be used to assist in push-pull cable adjustments.

Push-pull cable installation should meet the following guidelines:

- ☐ Cables must be Morse 33 Series RED JAKET® Supreme or equivalent.
- ☐ A minimal number of bends should be used.
- ☐ Bends should use the maximum possible radius where bends are required. Refer to cable manufacturer specifications.
- ☐ Cables should not be routed near hot surfaces.
- ☐ Cables should not be routed in service or access areas.

Push-Pull Cable Installation Kits for Conductive Vessels

Quick-disconnect ball joint kits or terminal eye pins with cable clamps for Morse 33 series push-pull cables are available from Twin Disc Incorporated. See Figure 17 and Figure 18. The dual kit accommodates one end of two cables. The single kit accommodates one end of one cable. Each Servo Actuator requires a single kit to connect the cable to the Servo Actuator. Refer to Morse 33 Series Cable Mounting Dimensions in Engineering Drawings for additional information.

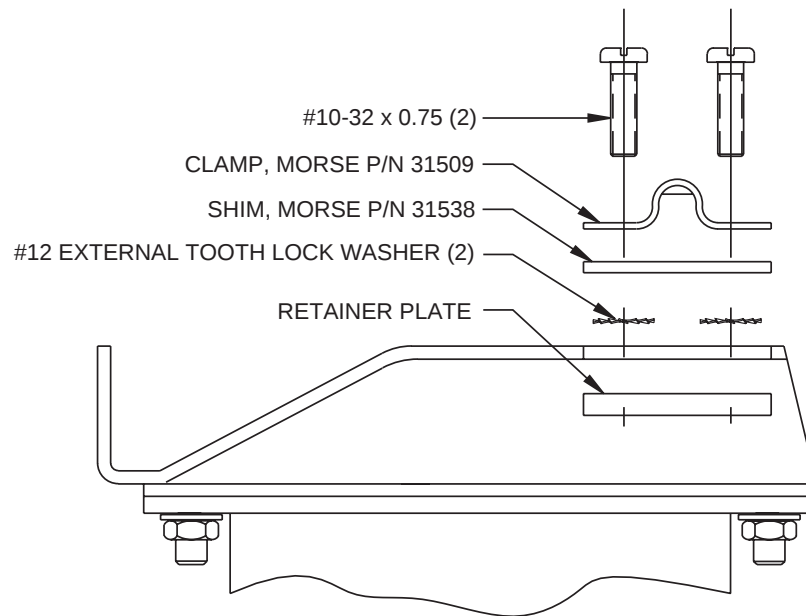


Figure 17. Installing Cable Clamp on Servo Actuator for Conductive Vessels

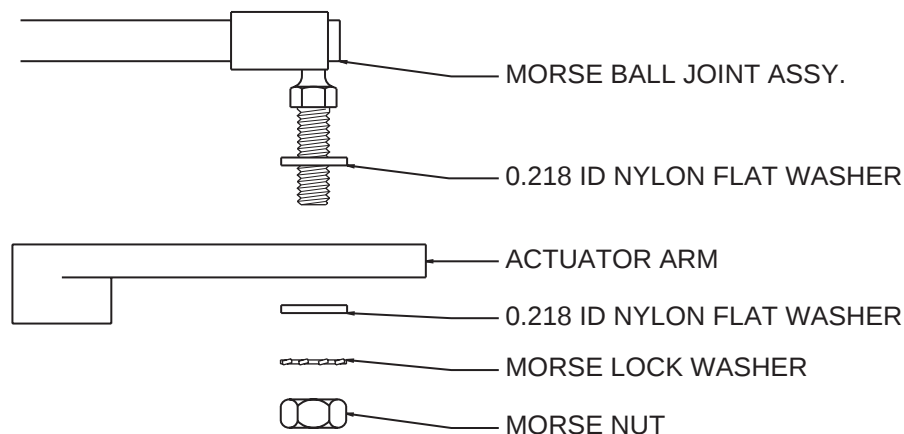


Figure 18. Installing Ball Joint Assembly for Conductive Vessels

Push-Pull Cable Installation Kits for Nonconductive Vessels

There is a possibility that high-powered electronic equipment used on vessels built in glass reinforced plastic (fiberglass), wood, or other nonconductive material can produce electrical interference that may affect the operation of the servo actuator or EC300 Control. Most secondary current path sources of interference can be eliminated by insuring there are no “loops” through the engine block or transmission via push-pull cables.

⚠ CAUTION

If isolation components are used on any component of the EC300 Control System, they must be used on all components.

For nonconductive vessels, isolating installation kits with cable clamps and terminal eye pins must be used to isolate the Servo Actuator from push-pull cables. See Figure 19 and Figure 20. One kit is required to attach the cable to each Servo Actuator. Consult Twin Disc Incorporated or a local distributor for substitutions or alterations. Refer to Morse 33 Series Cable Mounting Dimensions in Engineering Drawings for additional information.

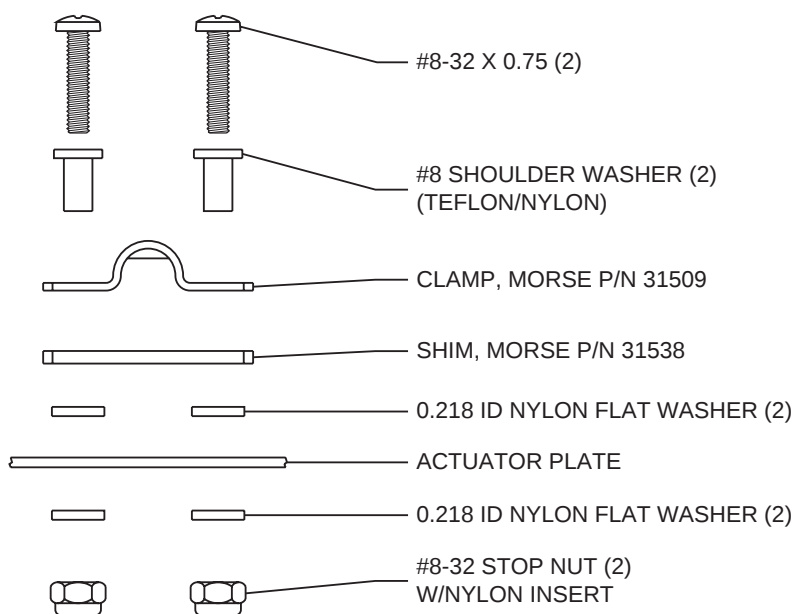


Figure 19. Installing Cable Clamp on Servo Actuator for Nonconductive Vessels

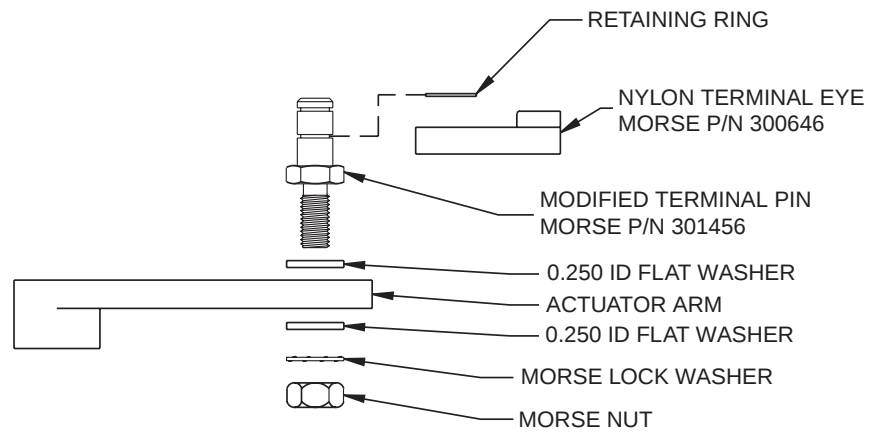


Figure 20. Installing Terminal Eye Pin for Nonconductive Vessels

Push-Pull Cable Mounting Bracket and Cable Installation

This section describes how to install the push-pull cable for a mechanically shifted transmission, for a mechanically controlled throttle, and for a mechanically controlled troll valve. See Figures 21 - 25.

Note: Use either a Conductive or Nonconductive Push-Pull Cable Installation Kit as required by the vessel.

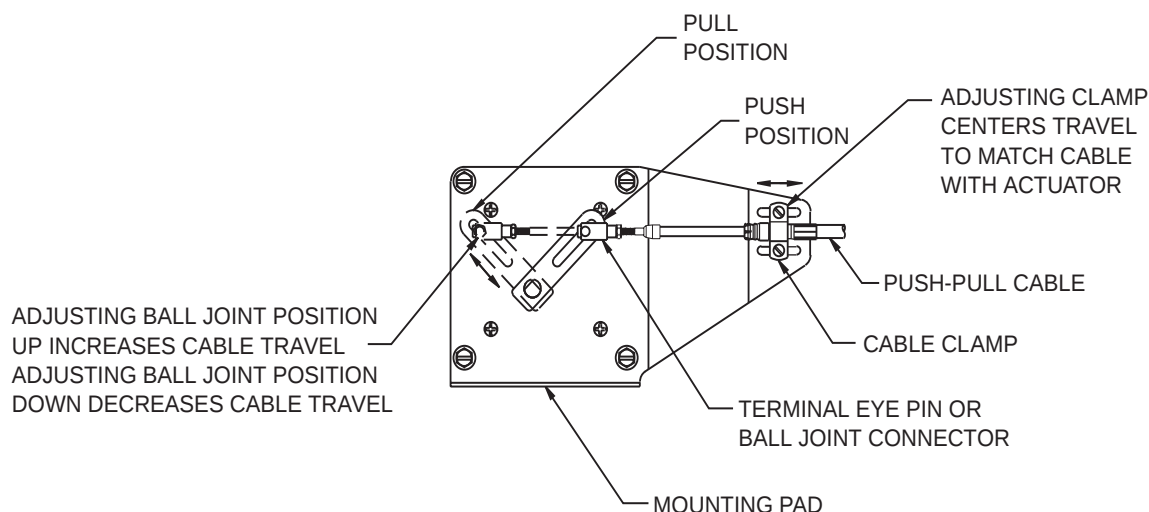


Figure 21. Servo Actuator Push-Pull Cable Installation

1. Fabricate a push-pull cable mounting bracket as needed, to attach/clamp the cable to the engine or transmission. The critical dimension is 7.25 inches from centerline of the clamp mounting holes to centerline of the engine/transmission lever. See Figure 22. Secure the bracket to engine/transmission.

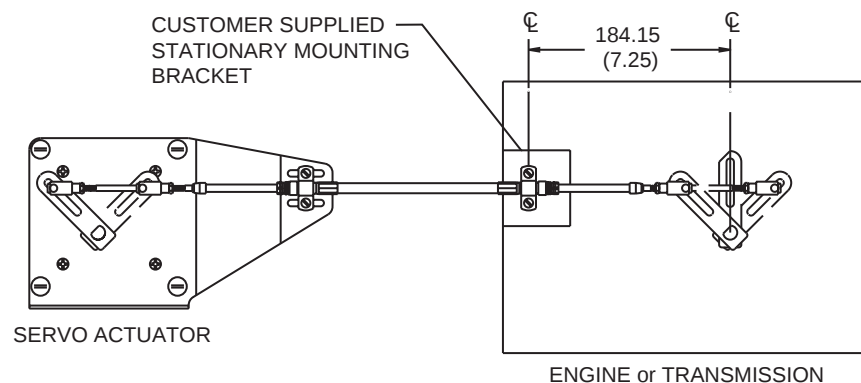


Figure 22. Push-Pull Cable Mounting Bracket

⚠ CAUTION

Brackets must be located to allow the most direct and unrestricted movement of push-pull cable. Bends, kinks, and tight or multiple radii will cause premature wear and undesirable engine/transmission response.

2. The Servo Actuator end of the push-pull cable may be adjusted for a range of travel from 1.5-3.5 inch. Loosely attach the cable at the engine/transmission using a mounting arrangement which allows for a cable travel within the 1.5-3.5 inch range. In rare instances, modifications to the engine/transmission lever are required to meet this range of travel. (For example: If the travel is less than the 1.5 inch, then the engine/transmission lever may need to be lengthened, or an additional hole added to the existing lever.) Loosely attach the other end of the push-pull cable to the Servo Actuator. Confirm that the cable travel is within the 1.5-3.5 inch range and tighten the engine/transmission end. Leave the Servo Actuator end loose.

Proceed to the push-pull cable adjustment section for either the mechanically shifted transmission, mechanically controlled throttle, or mechanically controlled troll valve to perform the initial push-pull cable adjustment.

Push-Pull Cable Adjustment for Mechanically Shifted Transmission

The transmission's gear select actuator is a three-position device: 45 degree left, center, and 45 degree right. See Figure 23. The control will drive the Servo Actuator to these positions as commanded by ahead, neutral, or astern commands from the control head. The push-pull cable positions the gear select lever in the desired position.

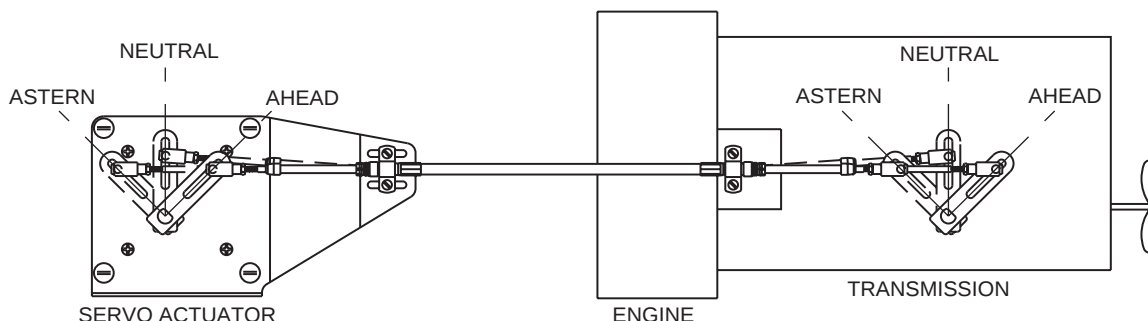


Figure 23. Transmission Gear Select Actuator

1. Position Control Head lever at the Forward Detent. The Servo Actuator lever will move to the Forward position.
2. Position the transmission lever to Forward Detent. The attached push-pull cable will move accordingly.
3. Make note of the push-pull cable position at the Servo Actuator end, comparing the location of the cable to the Servo Actuator lever. Using a piece of tape and pen/marker, mark the Servo Actuator with the position of the cable end.
4. Repeat with the Control Head lever at the Reverse Detent. The Servo Actuator will move to the Reverse position.

Note: When you adjust the push-pull cable travel for Forward and Reverse positions, Neutral will automatically be centered. However, you cannot adjust the push-pull cable for Neutral and then assume the Forward and Reverse positions will be aligned.

Proceed to Push-Pull Cable Final Adjustment.

Push-Pull Cable Adjustment for Mechanically Controlled Throttle

The engine's throttle actuator is a two-position device with continuous control between the two end positions. The nominal end positions are at 45 degrees left and 45 degrees right. See Figure 24. The control will drive the Servo Actuator between these positions as commanded by the lever position at the Control Head. The push-pull cable positions the throttle actuator in the corresponding position.

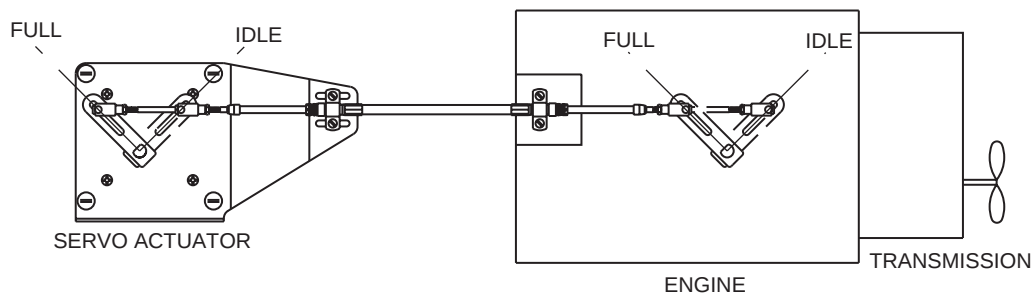


Figure 24. Engine Throttle Actuator

1. Position Control Head lever at the Neutral Detent. The Servo Actuator lever will move to the idle position.
2. Position engine lever to Idle. The attached push-pull cable will move accordingly.
3. Make note of the push-pull cable position at the Servo Actuator end, comparing the location of the cable end to the Servo Actuator lever. Using a piece of tape and pen/marker, mark the Servo Actuator with the position of the cable end.
4. Repeat with the Control Head lever in Full Throttle position. The Servo Actuator lever will move to the full throttle position.

Proceed to Push-Pull Cable Final Adjustment.

Push-Pull Cable Adjustment for Mechanically Controlled Troll Valve

The transmission's troll valve is a two-position device with nominal positions at 45 degree left and 45 degree right rotation. See Figure 25. The Control will drive the Servo Actuator to these positions as commanded by lever position at the Control Head. The push-pull cable positions the troll valve in the desired position.

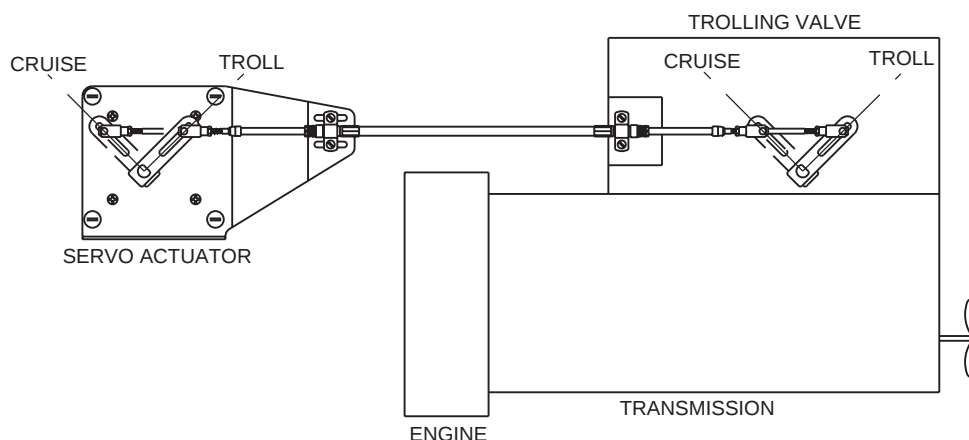


Figure 25. Transmission Troll Valve Actuator

1. Position the Control Head lever at the Neutral Detent and the Mode Select Switch to TROLL. The Servo Actuator will move to the Full Slip/Troll position.
2. Position the transmission trolling lever to Full Slip/Troll. The attached push-pull cable will move accordingly.
3. Make note of the push-pull cable position at the Servo Actuator end, comparing the location of the cable end to the Servo Actuator lever. Using a piece of tape and pen/marker, mark the Servo Actuator with the position of the cable end.
4. Repeat steps 1 - 3 with the Control Head Mode Select Switch in CRUISE. The Servo Actuator will move to the Lockup/Cruise position.

Proceed to Push-Pull Cable Final Adjustment.

Push-Pull Cable Final Adjustment

⚠ CAUTION

Final adjustments/alignment of the push-pull cable must be completed with power applied to a functioning control system. All power wiring and Control System checks must be made prior to proceeding with the final adjustments/alignment of the push-pull cable. Disconnect the quick connect on the push-pull cable from the Servo Actuator lever to perform the power wiring and Control System checks.

1. Power up the Control System and take command at a Control Head. Use the Control Head closest to where the Servo Actuator is located, or have one person operate the Control Head while another monitors and adjusts the push-pull cable at the Servo Actuator. Move the Control Head levers and the Mode Select Switch to shift the component the Servo Actuator is connected to. Mark the travel distance of the Servo Actuator lever and the engine/transmission troll lever.
2. Compare your marks of the positions of the push-pull cable to the Servo Actuator, with the following diagrams. Use these diagrams and the associated instructions to adjust/align the cable attachment at the Servo Actuator lever. As adjustments are made, repeat step 1 to confirm results of adjustments. Several adjustments and checks may be necessary before achieving final alignment. Final alignment should be when the Servo Actuator lever is unrestricted to move to its positions, while moving the engine/transmission/troll lever to its proper positions without coming bottoming out against the engine/transmission/troll lever end stops. When the final alignment is complete, tighten all clamps and associated hardware.

A: When the travel of the Servo Actuator lever is wider than the travel of the push-pull cable, adjust by moving the attachment for the cable on the Servo Actuator lever down towards the shaft of the actuator. See Figure 26.

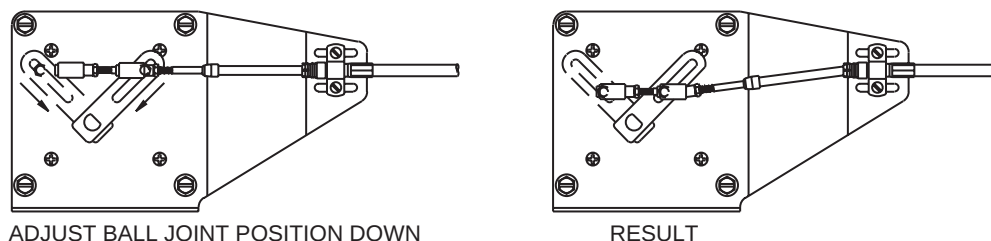


Figure 26. Adjustment of Cable Attachment

- B: When the travel of the Servo Actuator lever is narrower than the travel of the push-pull cable, adjust by moving the attachment for the cable on the Servo Actuator lever up and away from the shaft of the actuator. See Figure 27.

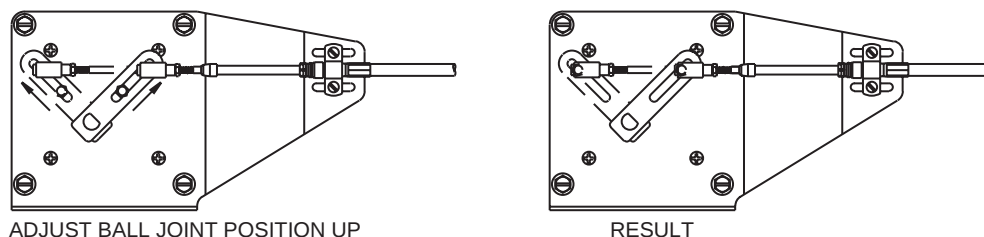


Figure 27. Adjustment of Cable Attachment

- C: When the travel of the Servo Actuator lever and push-pull cable matches closely, but the cable will not reach to attach to the Servo Actuator Lever at both ends of travel, move the cable clamp inwards towards the actuator lever. See Figure 28.

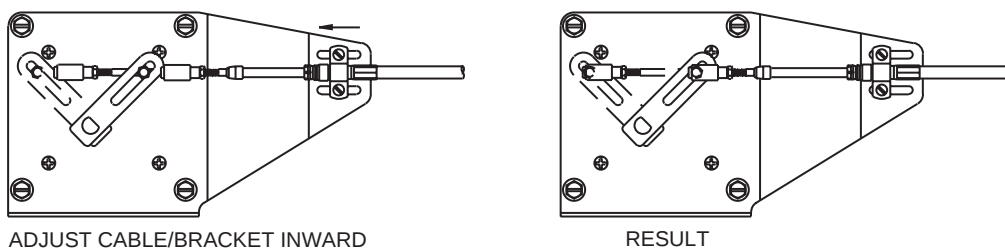


Figure 28. Adjustment of Cable Clamp - Short

- D: When the travel of the Servo Actuator lever and push-pull cable matches closely, but the cable overshoots the Servo Actuator lever at both ends of travel, moving the cable clamp outwards away from the actuator lever. See Figure 29.

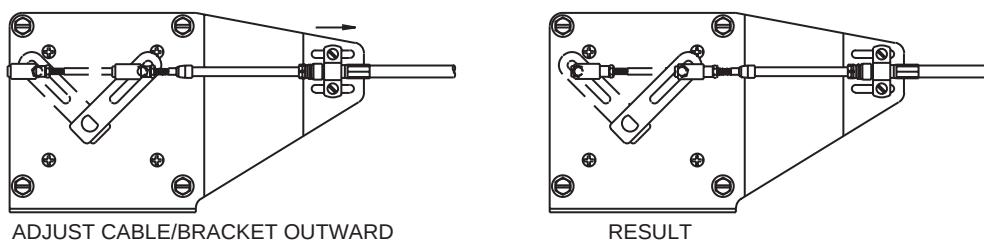


Figure 29. Adjustment of Cable Clamp - Overshoot

Note: Electrical harness installation for the Servo Actuator is completed in Electrical Installation.

Electrical Installation

General Electrical Harness Information

The EC300 Control System is provided with 13 wiring harness connections (example J1, J2, or J3). All 13 connections are not used in all applications. Each of these connections is described separately within this manual. Most harnesses provided by Twin Disc Incorporated are supplied in 609 mm (2 ft) increments.

Note: If a harness needs to be shortened, refer to the installation diagram provided for the system. Shorten the harness on the end identified by the scissors icon.

Twin Disc Incorporated provides harnesses in the following configurations:

- ☐ Fully prefabricated wiring harnesses with connectors installed on both ends.
- ☐ Prefabricated wiring harnesses with connectors installed only on the EC300 end of the harness. The equipment end of the harness is fabricated by the installer at the time of installation with components provided by the customer.
- ☐ Prefabricated wiring harnesses with connectors installed on the equipment end and terminals installed on the EC300 end of the harness. The terminals on these harnesses will be installed into the EC300 connector provided by Twin Disc Incorporated.
- ☐ For Non-Twin Disc components, the wiring harness and equipment end connectors are supplied by the customer with the EC300 connector being supplied by Twin Disc Incorporated. Kits are available from Twin Disc Incorporated which provide the contact sockets and sealing plugs used in the EC300 connectors.

General Electrical Installation Guidelines

⚠ CAUTION

Ensure that the EC300 Control Power and Grounding Harness (J13) connector is disconnected before proceeding with the installation of all other harnesses. When making the electrical connections described in this section, ensure that the associated power source is turned off.

The following general electrical installation points apply to all electrical installations.

Read the following guidelines before making any installations and connections.

- ❑ The installer must follow the EC300 installation diagram provided for the system.

The following guidelines must be met when fabricating electrical harnesses:

- ❑ Electric harness are to be flame retardant and must comply with the following requirements, as applicable:
 - Harnesses constructed to IEC Publication 60092 standards are to comply with the flammability criteria of IEC Publication 60332-3, Category A/F or A/F/R.
 - Harnesses constructed to IEEE 1580-2001 are to comply with the flammability criteria contained therein.
 - Harnesses constructed to other standards, where accepted by ABS, are to comply with the flammability criteria of IEC Publication 60332-3, category A/F or A/F/R (depending on the intended installation), or other acceptable standards.
 - Flame retardant marine harnesses which have not passed the bunched harness flammability criteria as per IEC Publication 60332-3 may be considered, provided that the harness is treated with approved flame retardant material or the installation is provided with approved fire stop arrangements.

- Maximum current carrying capacities of harnesses conforming to IEC Publication 60092-353 are to be in accordance with the values given in 4-8-3/Table 6 of ABS Rules for Building and Classing Steel Vessels 2002. These values are applicable for harnesses installed double-banked on cable trays, in cable conduits or cable pipes. The values, however, are to be reduced for installations where there is an absence of free air circulation around the harnesses. See 4-8-2/7.7.1 and Note 4 of 4-8-3/ Table 6 in the ABS document.
- The rated temperature of the harness's insulating material is to be at least 10°C (18°F) higher than the maximum ambient temperature likely to be in the space where the harness is installed.
- Harness constructions shall use stranded copper (19 strands or more); rated for 50 VDC, conforming to UL 1426 Cables for Boats or other applicable standards; should not be more than 3.6 m (12 ft) long; should be marked with type/style, voltage, size, and dry temperature rating; and should be color coded as shown in Table 6.

Table 6. Power Wire Color Codes as per ABYC Standard E-9

Color Code	Function
Yellow w/Red Stripe	Neutral Start Relay Contacts (J5 pins 9 & 10)
Purple	Ignition Switch (J8 pin 1)
Yellow (preferred) or Black	Battery Negative (-) (J13 pin 3)
Red	Battery Positive (+) (J13 pin 1) Auxilliary Battery Positive (+) (J13 pin 2)
Green w/Yellow Stripe (preferred) or Green	DC Grounding Conductors or Banding Only

The following guidelines must be met when routing electrical wiring harnesses:

⚠ CAUTION

Keep the EC300 system harnesses away from antenna wires and AC power wires. Do not route the EC300 control harnesses in the same trough or conduit as antenna or AC power wires.

- ☐ Wiring harnesses must be located away from high current conductors and devices. Harnesses must be at least 1 m (3.3 ft) away from communications equipment, antennas and associated wiring.
- ☐ Wiring harnesses must be located away from hot surfaces or high-risk fire areas.
- ☐ Wiring harnesses must be clear of service areas, access areas, or other spaces where it may be exposed to mechanical damage. Where this cannot be avoided, special measures are to be made for effective protection of the harnesses.

⚠ CAUTION

Do not add additional wire to any harness. Longer harnesses may require thicker conductors.

- ☐ Do not splice or substitute different types of wire into the harnesses. Increased length may require increased wire size.
- ☐ Any splices must meet the requirements of the applicable standards or specifications.
- ☐ Harnesses are available in varying lengths in 0.6 m (2 ft) increments. Wiring harnesses must be the minimum practical length. Wiring harnesses should never be installed in a manner which results in more than 609 mm (24 in.) of excess length.
- ☐ Wiring harnesses should have service/drip loops at each connection point as required to minimize water drainage toward the connector. Loops should be tied down so that they do not move freely when the boat is in motion. Excess motion can cause the harnesses to fatigue and break.
- ☐ Wiring harness bend radius should be at least eight harness-diameters unless otherwise permitted. RMRS requires greater than ten harness-diameters.
- ☐ Wiring harnesses are to be secured in such a manner that stresses are not transmitted to the connector terminal.

- ❑ Wiring harnesses must be supported or secured every 406 mm (16 in.) maximum with the appropriate hardware except if the harness is enclosed in rigid duct, conduit, or other enclosure. The distance between harness supports are to be suitably chosen according to the type of harness and the degree of vibration the installation is likely to be subjected to. For horizontal runs where harnesses are laid on tray plates, individual support brackets or hanger ladders, the distance between the fixing points may be up to 914 mm (36 in.), provided that there are supports with maximum spacing as specified above. Increased support will be required for wiring harness runs on weather decks where forces from sea water washing over the deck is expected. Alternatively, harness support systems complying with a recognized standard other than IEC 60092-352 may be used where the installed harness must also comply with that standard. Specifically, harness support systems meeting the requirements of IEEE 1580-2001 may be used where IEEE 1580-2001 harnesses are installed. Some applicable codes and standards (notably RMRS) require different spacing for harness supports. The following table shows RMRS spacing requirements.

Table 7. RMRS Wire Fastening Points

External diameter of cable, mm		Distance between fastening points for cables, mm		
Over	Up to	Without armour	With armour	With mineral insulation
---	8	200	250	300
8	13	250	300	370
13	20	300	350	450
20	30	350	400	450
30	---	400	450	450

- ❑ Metallic wire harness clamps or supports are required if the failure of the support could cause a hazardous condition in the engine room, machinery rooms, or passageways.
- ❑ Clamps and supports shall not have sharp edges or rough surfaces that could damage the insulation. Special protective measures such as tape or other wrapping are required for metallic clamps or supports. Clips, saddles, and straps are to have surface area and sufficient width as to not cause damage to the insulation.
- ❑ Non-metallic clamps and supports must be resistant to oil, gasoline, and water and shall have a temperature range of -34 to 121°C (-30 to 250°F). They shall be flame retardant in accordance with IEC Publication 60092-101. Where used for wire harnesses that are not routed on top of horizontal cable trays, suitable metal clips or straps are to be added at regular intervals not exceeding 2 m (6.6 ft) in order to prevent the release of wire harnesses during a fire.
- ❑ Do not use wire staples.

- ❑ Where wire harnesses pass through watertight or fire-rated bulkheads or decks, the penetrations are to be made through the use of approved stuffing tubes, transit devices, or pourable materials in order to maintain the watertight or firetight integrity of the bulkheads or decks. These devices or materials must not damage the harness. Where cable conduit pipe or equivalent is carried through decks or bulkheads, arrangements are to be made to maintain the integrity of the water or gas tightness of the structure.
- ❑ Wiring harnesses are not to be installed behind, or imbedded in, structural insulation. They may, however, pass through such insulation at right angles. Wiring conduit or recesses integral with B or C class fire-walls may be used for installing harnesses if the fire-walls are of an approved type and the installation prevents the propagation of smoke through the conduit.
- ❑ When harnesses pass through non-watertight bulkheads, decks or structural members, the length of the bearing surface for the harness is to be at least 6.4 mm (0.25 in.). All burrs and sharp edges are to be removed.
- ❑ No harness is allowed to penetrate the collision bulkhead.
- ❑ To avoid possible signal interference, signal wire harnesses occupying the same wireway or conduit with power harnesses are to be effectively shielded.

The following guidelines must be met when making wiring connections:

- ❑ All electrical connections must be made within waterproof enclosures or shall be watertight. Connections must be watertight if they can be immersed in water.
- ❑ The connectors have a resilient insert that seals to the insulation of each wire in the connector. Do not attempt to fit two wires into any of the connector positions. Sealing plugs are provided for unused positions of the connector in order to insure the sealed nature of the connected harness assembly. Do not discard these white plastic plugs since they must be inserted into the unused positions.
- ❑ For harness kits that require field termination by the installer, tape and secure the ends of any unused wires.

Note: Wire harnesses supplied by Twin Disc Incorporated will not include any unused wires.

- ☐ Terminals must not damage the conductor.
- ☐ Metals used for connections shall be corrosion resistant.
- ☐ Terminal lugs shall be ring lug or captive spade styles and shall be sized to match the terminal and the conductor. Shanks shall be insulated unless used on a grounded conductor. Crimp lugs must be of equal or greater current rating than the wire.
- ☐ Wire harnesses stripped of insulation are to be sealed using heat shrink tubing in combination with insulating compound or sealing devices.
- ☐ The installer must provide suitable wire harness and crimping tools. An appropriate tool for Deutsch contacts is the Deutsch crimper (P/N HDT 48-00). Use all tools and materials in accordance with manufacturer's instructions.
- ☐ Crimps must be made with a tool designed to operate with the lug/contact. Crimps shall be able to hold 13.6 kg (30 lb) for one minute.
- ☐ Aluminum or unplated steel shall not be used for fasteners.
- ☐ Twist-on connectors, such as wire nuts, shall not be used.
- ☐ Solder may not be the only means of connection between two or more conductors or between a conductor and a connector.
- ☐ Any friction connectors or soldered connectors at components must meet the component manufacturer's requirements as well as the applicable standards.
- ☐ No more than four conductors may be terminated at any single stud.
- ☐ Wires shall have sufficient freedom of movement to allow for removal, dressing, and tension relief.
- ☐ To avoid electromagnetic interference caused by circulating currents, the conductive shield and wire harness armor of signal harnesses is to be grounded only at one end of the wire harness.
- ☐ To connect a harness to an EC300 Control, align the plug orientation keys with the EC300 Control's receptacle and push the plug in until it snaps in place.

Control Head Harness (J1, J2, or J3) Installation

The Control Head Harness (J1, J2, and J3) provides the main interface between the Control Head and the EC300 Controller. The vessel will have one or more Control Heads located at the vessel control stations with either single lever or dual lever heads.

The Control Head Harnesses (J1, J2, and J3) are fully pre-fabricated and plug into the J1, J2, and J3 connector at the EC300 or the station doubler if used. The J1, J2, or J3 connectors contain all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

Refer to General Electrical Installation Guidelines for harness routing criteria prior to proceeding with this section.

This section contains the following sub-sections:

- ☐ Multi-Station Single Lever Control Head Wiring Installation
- ☐ Multi-Station Dual Lever Control Head Wiring Installation
- ☐ Split Single Lever Control Heads in Twin Engine Installations
- ☐ Multi-Station Dual Lever Control Head Wiring Installation Using Station Doublers

Multi-Station Single Lever Control Head Wiring Installation

This section is applicable to single engine applications with up to three Single Lever Control Heads. See Figure 30.

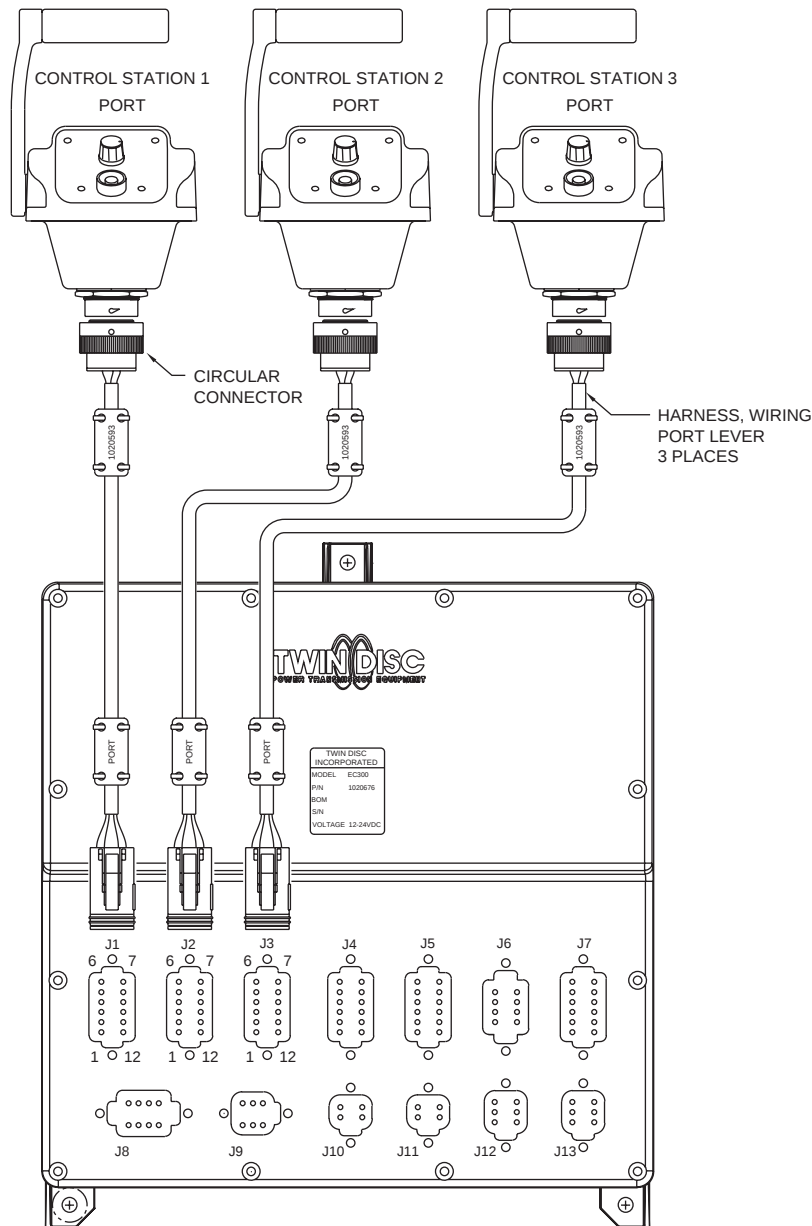


Figure 30. Single Engine Single Lever Control Head Wiring

Each single lever harness is designed to connect to the Control Head at one end, and to the EC300 Control's J1, J2, or J3 connector at the other end. Use Connector J1 if only one Single Lever Control Head is used. Use Connectors J1 and J2 if two Single Lever Control Heads are used.

Install the Control Head harness as follows:

Note: The Control Head may be removed from the dash if this facilitates making the connection. If it is removed, then reinstall it after the connections have been made.

Note: Provide enough length in the harness to allow removal of the Control Head in the future.

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Connect the circular connector end of the Control Head harness to the Control Station 1 (main/most used) Single Lever Control Head.

Note: Align the large connector key with the large keyway and push the connector into place. Then, turn the connector's collar until the engagement snap is felt.

2. Ensure that the Single Lever Control Head is firmly mounted.
3. Route the Control Head harness to the EC300 Control.
4. Connect the Control Head Harness plug to the J1 receptacle of the EC300 Control.
5. If applicable, repeat Steps 1 through 4 for connecting additional Control Stations using J2 for the second Control Head and J3 for the third Control Head.
6. If J2 and/or J3 are not used, install a connector kit into these receptacles to seal the connector. See System Drawing for Connector Plug Kit p/n.
7. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Multi-Station Dual Lever Control Head Wiring Installation

This section is applicable to dual engine applications with up to three Dual Lever Control Heads. See Figure 31.

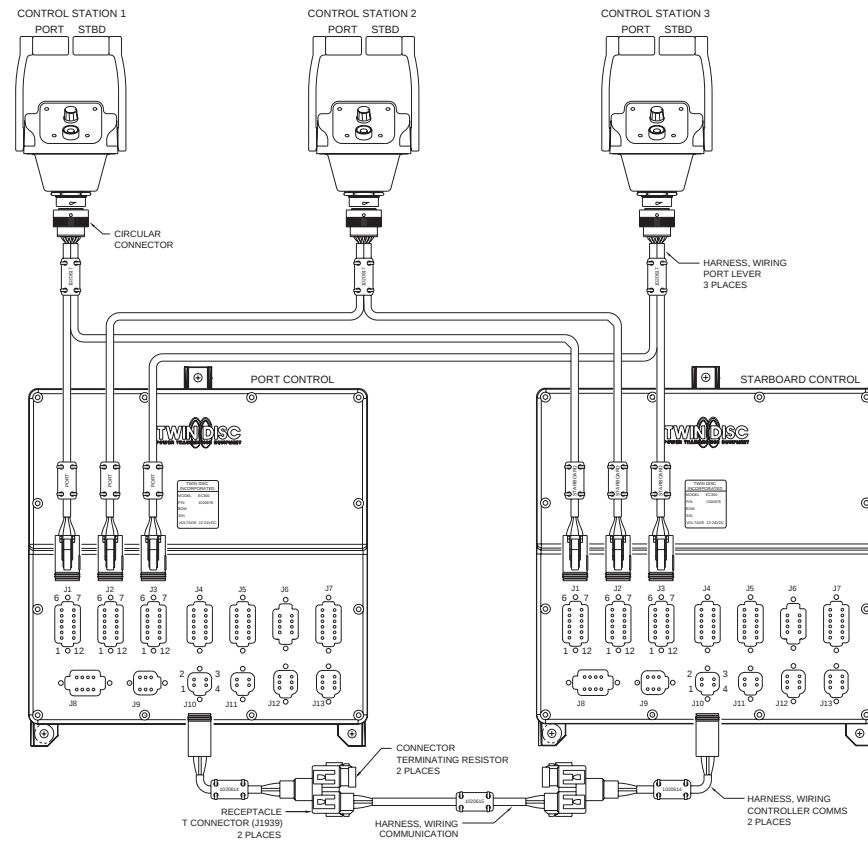


Figure 31. Dual Engine Dual Lever Control Head Wiring

Install the Control Head harnesses as follows:

Note: Each dual lever harness consists of two separate harnesses joined together at the Control Head end. At the EC300 end, one harness end is marked PORT and the other harness end is marked STARBOARD. The harness end(s) marked PORT must route to the port control. The STARBOARD harness end(s) must route to the starboard control. Use receptacle J1 at both controls if only one Dual Lever Control Head is used. Use receptacles J1 and J2 if two Dual Lever Control Heads are used. Use the same “J” number receptacles from each Dual Lever Control Head at both the port and the starboard controls.

Note: The Control Head may be removed from the dash if this facilitates making the connection. If it is removed, then reinstall it after the connections have been made.

Note: Provide enough length in the harness to allow removal of the Control Head in the future.

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Connect the circular connector end of the dual lever harness to the Control Station 1 (main/most used) Dual Lever Control Head.

Note: For each Control Head connector, align the large connector key with the large keyway and push the connector into place. Then, turn the connector's collar until the engagement snap is felt.

2. Ensure that the Dual Lever Control Head is firmly mounted.
3. Route the harness marked "PORT" to the EC300 Port Control.
4. Connect the Dual Lever Control Head Harness plug to the J1 receptacle of the "PORT" EC300 Control.
5. Route the harness marked "STARBOARD" to the EC300 Starboard Control.
6. Connect the Dual Lever Control Head Harness plug to the J1 receptacle of the "STARBOARD" EC300 Control.
7. If applicable, repeat steps 1 through 6 for connecting additional Control Stations using J2 for the second Control Head and J3 for the third Control Head.
8. If J2 and/or J3 are not used, install a connector kit into these receptacles to seal the connector. See System Drawing for Connector Plug Kit p/n.
9. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It is desirable, especially on single station vessels, to route the port and starboard harnesses as far apart as possible. This minimizes the odds of both harnesses being accidentally damaged at the same time allowing continued, but reduced, control of the vessel.

Split Single Lever Control Head Stations in Twin Engine Installations

Some dual-engine installations use split Single Lever Control Heads at control stations rather than Dual Lever Control Heads. For such installations, one split lever harness and one dual lever harness are used. See Figure 32.

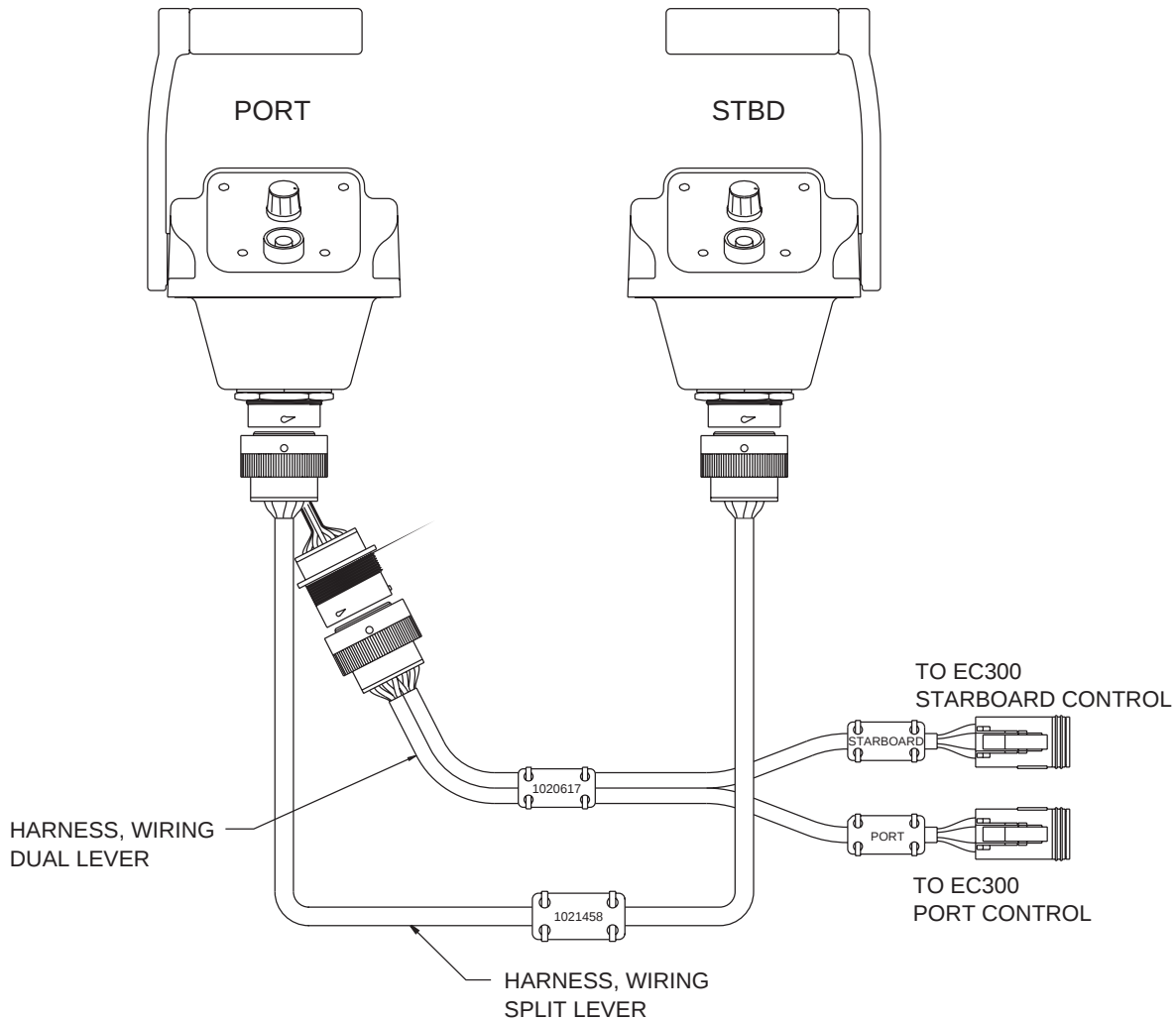


Figure 32. View of Split Single Lever Harness Wiring

Install the Control Head harnesses as follows:

Note: The Control Heads may be removed from the dash if this facilitates making the connection. If they are removed, then reinstall them after the connections have been made.

Note: Provide enough length in the harness to allow removal of the Control Heads in the future.

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Connect the female circular connector end of the Split Lever harness with the two circular connectors to the port Single Lever Control Head.

Note: For each Control Head connector, align the large connector key with the large keyway and push the connector into place. Then, turn the connector's collar until the engagement snap is felt.

2. Route the Split Lever harness to the Starboard Control Head.
3. Connect the circular connector end of the Split Lever harness to the starboard Single Lever Control Head.
4. Connect the circular connector end of the Dual Lever harness to the male circular connector of the Split Lever harness at the Port Single Lever Control Head.
5. Ensure that the port and starboard single lever Control Heads are firmly mounted.
6. Route the Dual Lever harness to the EC300 Port Control and Starboard Control.

Note: It is desirable, especially on single station vessels, to route the port and starboard harnesses as far apart as possible. This minimizes the odds of both harnesses being accidentally damaged at the same time allowing continued, but reduced, control of the vessel.

7. Connect the Dual Lever Harness plug labeled "Port" to the J1 receptacle of the Port EC300 Control.
8. Connect the Dual Lever Harness plug labeled "Starboard" to the J1 receptacle of the Starboard EC300 Control.
9. If applicable, repeat steps 1 through 6 for connecting additional Control Stations using J2 for the second Control Head and J3 for the third Control Head.
10. If J2 and/or J3 are not used, install a connector kit into these receptacles to seal the connector. See System Drawing for Connector Plug Kit p/n.
11. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Multi-Station Dual Lever Control Head Wiring Installation Using Station Doublers

This section is applicable to multiple engine applications with more than three (3) Dual Lever Control Heads per EC300 Control. Each EC300 Control can directly accept up to three Control Head inputs. Using Station Doublers, a total of five Control Head inputs can be supported. Each Station Doubler combines the signals from two separate Control Heads and routes the combined signals to each of the EC300 Controls at J2 or J3. See Figures 33 and 34.

Figure 33 shows five Control Heads and two Station Doublers. The control head not connected to a station doubler must be connected to J1.

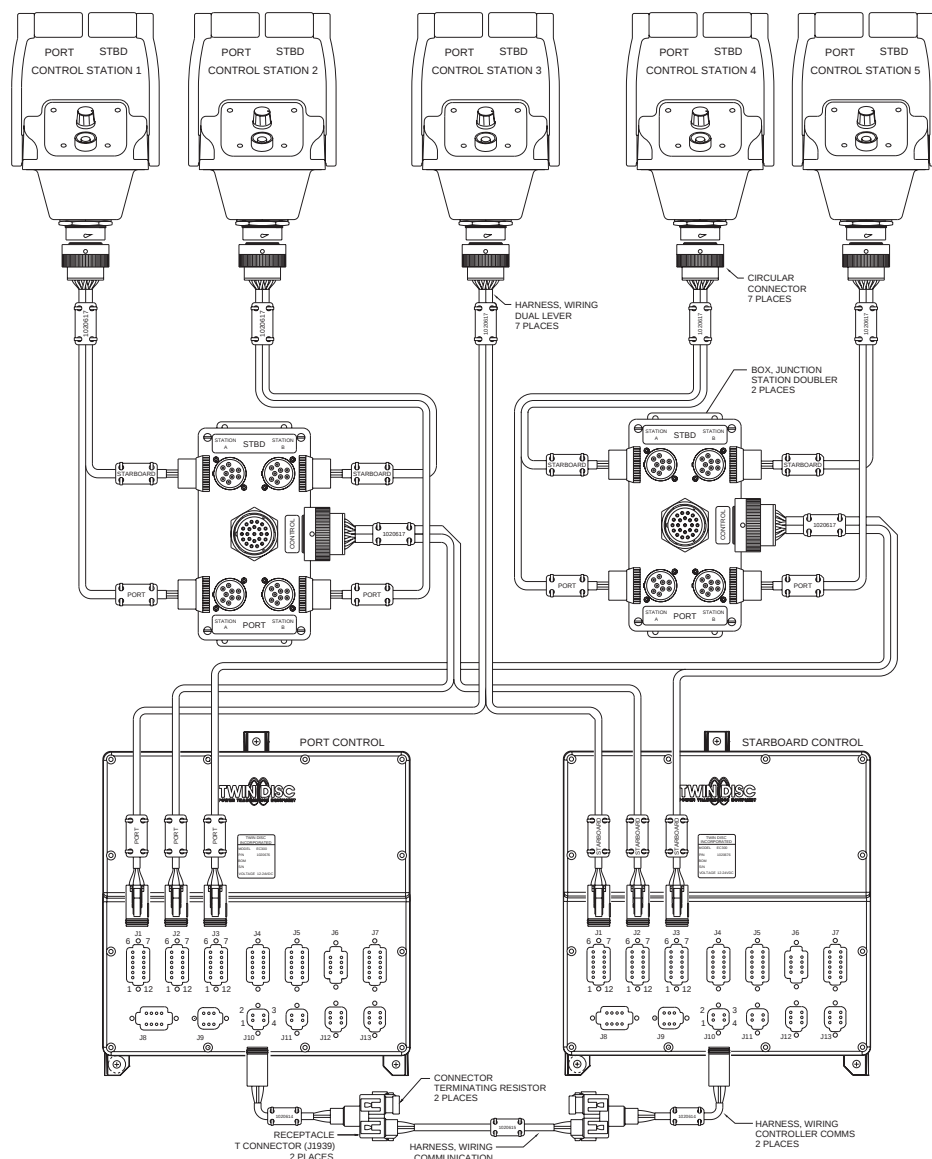


Figure 33. Typical Five Station Dual Lever Control Head Wiring

Note: Station Doublers may also be used on single-engine Single Lever Control Head applications if more than three Control Heads are required. Single Lever Control Head Station-to-Doubler harnesses are used in place of the dual lever station-to-doubler harnesses. A port station-to-doubler harness is used with a Port Control Head. A starboard station-to-doubler harness is used with a Starboard Control Head.

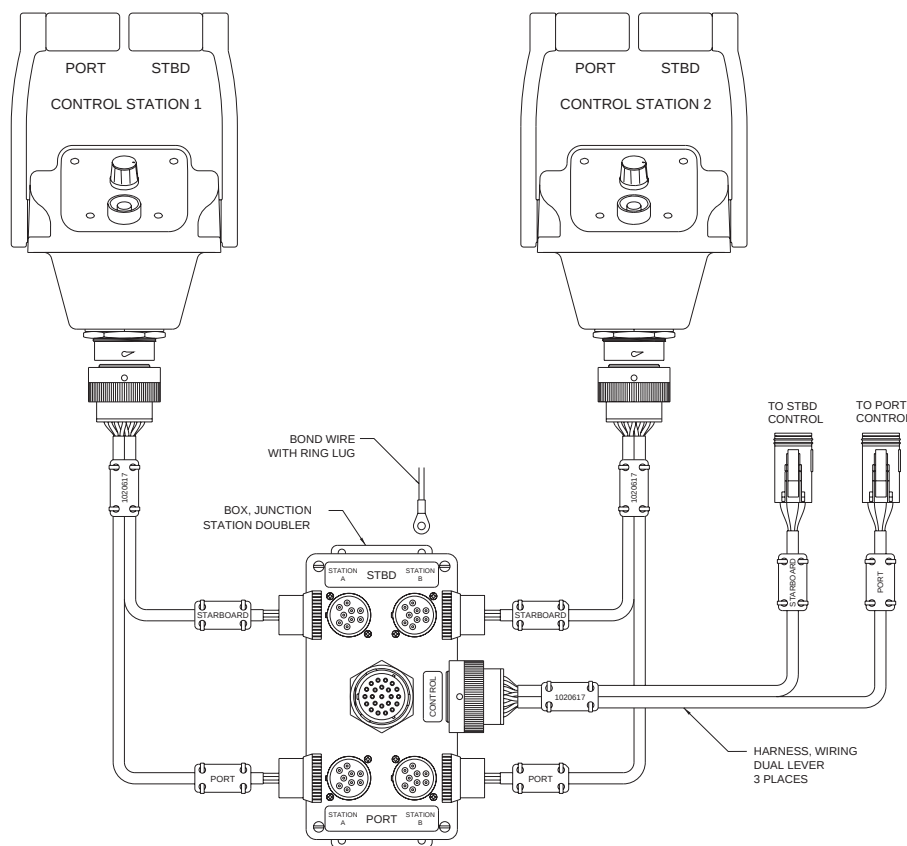


Figure 34. Station Doubler Connection Using Dual Lever Control Heads

Install the Control Head harnesses as follows:

Note: The Doubler-to-Station Harness routes between the Control Head and the Station Doubler. The Doubler-to-Control Harness routes between the Station Doubler and the EC300 Control (J2 or J3).

Note: The Control Head may be removed from the dash if this facilitates making the connection. If it is removed, then reinstall it after the connections have been made.

Note: Provide enough length in the harness to allow removal of the Control Head in the future.

Refer to General Electrical Installation Guidelines for harness routing criteria.

Control Station 1

1. Connect the circular connector end of a Doubler-to-Station harness to the Dual Lever Control Head.

Note: For each Control Head connector, align the large connector key with the large keyway and push the connector into place. Then, turn the connector's collar until the engagement snap is felt.

2. Ensure that the Dual Lever Control Head is firmly mounted.
3. Route the Doubler-to-Station harness to the Station Doubler.
4. Connect the Doubler-to-Station harness plug marked "PORT" into the receptacle marked "STATION A" on the "PORT" end of the Station Doubler.
5. Connect the Doubler-to-Station harness plug marked "STARBOARD" into the receptacle marked "STATION A" on the "STBD" end of the Station Doubler.

Control Station 2

6. Connect the circular connector end of a Doubler-to-Station harness to the Dual Lever Control Head.
7. Ensure that the Dual Lever Control Head is firmly mounted.
8. Route the Doubler-to-Station harness to the Station Doubler.
9. Connect the Doubler-to-Station harness plug marked "PORT" into the receptacle marked "STATION B" on the "PORT" end of the Station Doubler.
10. Connect the Doubler-to-Station harness plug marked "STARBOARD" into the receptacle marked "STATION B" on the "STBD" end of the Station Doubler.

Doubler to EC300 Control

11. Connect the circular connector end of a Doubler-to-Control harness to the receptacle on the Station Doubler marked "CONTROL".
12. Route the harness marked "PORT" to the EC300 Port Control.

Note: It is desirable, especially on single station vessels, to route the port and starboard harnesses as far apart as possible. This minimizes the odds of both harnesses being accidentally damaged at the same time allowing continued, but reduced, control of the vessel.

13. Connect the Doubler-to-Control Harness plug to the J2 receptacle of the Port EC300 Control.
14. Route the harness marked "STARBOARD" to the EC300 Starboard Control.
15. Connect the Doubler-to-Control Harness plug to the J2 receptacle of the Starboard EC300 Control.
16. If applicable, repeat steps 1 through 15 to connect two additional Dual Lever Control Heads through a second Station Doubler to the J3 receptacles of the EC300 Port and Starboard Controls.
17. If J2 and/or J3 are not used, install a connector kit into these receptacles to seal the connector. See System Drawing for Connector Plug Kit p/n.
18. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Bonding Wire

19. Route a bond wire from the vessel bonding system to the selected mounting pad on each Station Doubler. See Figure 33.

Note: The bonding conductor must be 14 AWG stranded copper wire. It must be colored green with a yellow stripe (preferred) or green in order to comply with ABYC standards.

20. Install a ring lug on the doubler end of the wire.

Note: The ring lug must be properly sized for both the wire and the mounting fastener.

21. Remove the mounting fastener at the bonding connection.
22. Remove any paint at the mounting connection in order to ensure electrical contact.
23. Insert the bonding wire's ring lug on the Station Doubler.
24. Reinstall and tighten fasteners up to 1.13 Nm (10 lb-in.) maximum.

Service Connector (J4)

Factory Use Only

Transmission Harness (J5, J6, J7 J8, and J12) Installation

Note: The J5, J6, J7, J8, and J12 wiring harnesses may be installed as one harness (standard) or individual harnesses. If your installation includes individual harnesses, proceed to the installation instructions for each harness. When completed with the Transmission Harness installation proceed to the J9 Harness installation procedure and omit the J12 installation procedure.

The Transmission Harness is a fully prefabricated harness that combines the wiring for the J5, J6, J7, J8 and J12 harnesses and connections. It consists of 2 separate harness assemblies. A Control to Bracket Harness (Figure 35) and a Bracket to Transmission Harness (Figure 36). Various harness options are available to accommodate different transmission and control system options. The Control to Bracket harness connects to the EC300 and is routed to the mating circular connector mounted on the transmission bracket. The transmission is supplied with the Bracket to Transmission harness prewired. The J5 wiring for engine throttle is available at the bracket and must be fabricated and wired by the customer. The Transmission Harness connectors contain all contacts and sealing plugs that are required to fill the connector contact positions. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

Refer to General Electrical Installation Guidelines for harness routing criteria before proceeding with this section.

This section contains the following sub-sections:

- ☐ Control to Bracket Wiring Installation
- ☐ Bracket to Transmission Wiring Installation
 - Neutral Start Interlock Wiring Installation
 - Engine Throttle Wiring Installation
 - Prewired Connection Inspection

Control to Bracket Wiring Installation

The Control to Bracket wiring provides wiring connections to interface the transmission and engine with the EC300 Control. See Figure 35.

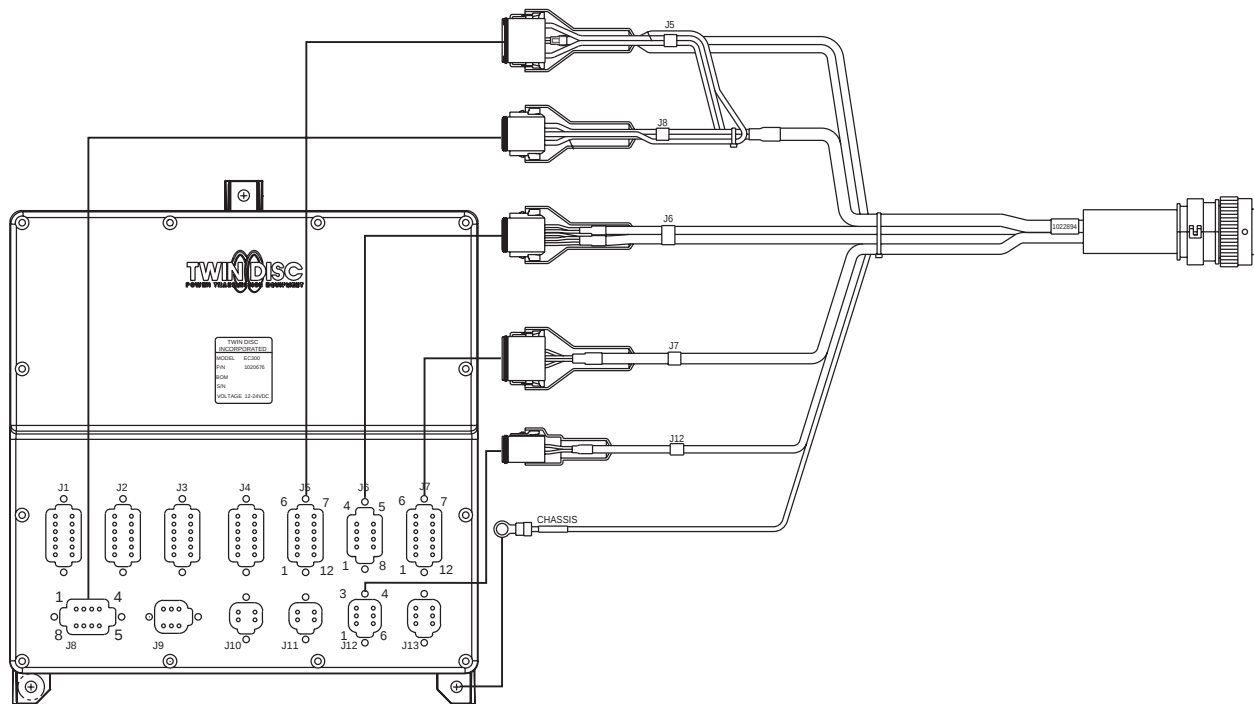


Figure 35. Control to Bracket Harness Assembly

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Align the J5 harness connector with the J5 receptacle of the EC300 Control and push it in until it snaps into place.
2. Align the J6 harness connector with the J6 receptacle of the EC300 Control and push it in until it snaps into place.
3. Align the J7 harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
4. Align the J8 harness connector with the J8 receptacle of the EC300 Control and push it in until it snaps into place.
5. Align the J12 harness connector with the J12 receptacle of the EC300 Control and push it in until it snaps into place.
6. Ensure that sealing plugs are installed in all empty connector positions of each connector.
7. Route the Control to Bracket Harness to the transmission.
8. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Bracket to Transmission Wiring Installation

Marine transmissions with this option will come from the factory with the Bracket to Transmission harness prefabricated and installed. The installer will need to fabricate and install the J5 Neutral Start Interlock and Engine Throttle wiring. The Neutral Start Interlock connector is supplied by Twin Disc Incorporated. The installer will need to provide the wires and terminate them to the connector and to the neutral start interlock connections on the engine. The Bracket to Transmission harness provides the wires (approximately 3 m [10 ft] long) which the installer will need to terminate to the Engine Throttle Input. See Figure 36.

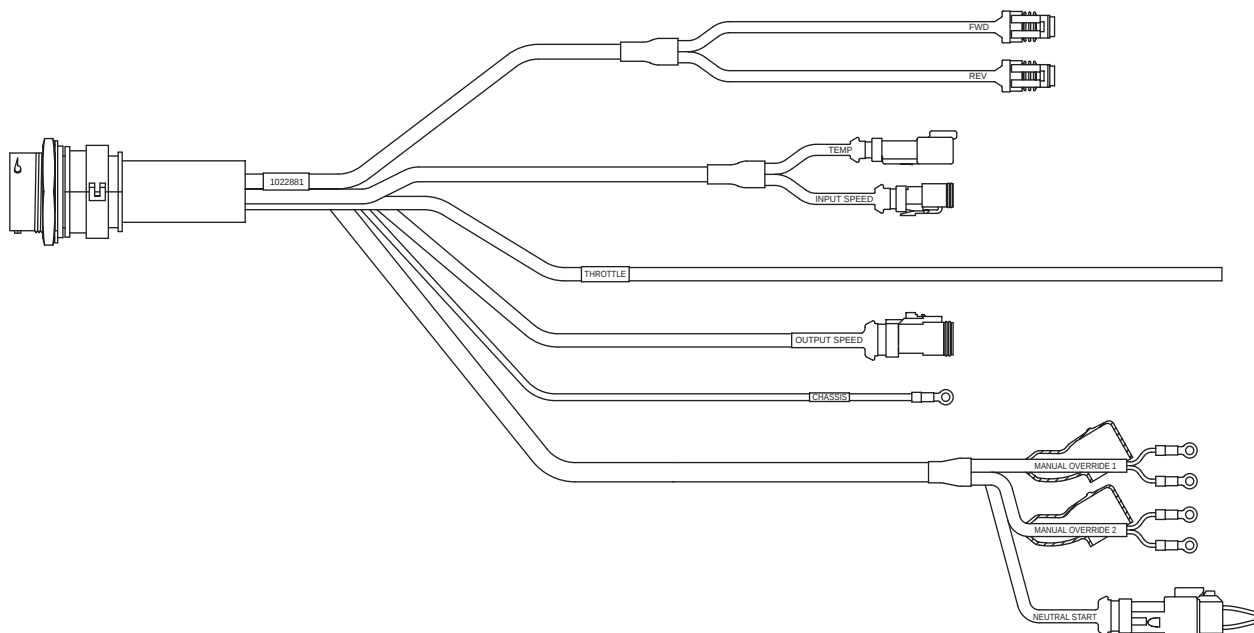


Figure 36. Bracket to Transmission Harness Assembly

The following criteria must be met when installing engine control harness wiring:

- ☐ The Neutral Start Interlock wires must be 14 AWG stranded copper wire. All other wires must be a minimum of 18 AWG stranded copper wire.
- ☐ Before installing the Neutral Start Interlock Wiring, plan if the Engine Throttle harnesses and/or the Engine Speed Sensor Harness are to be installed. Consider the harness routing for each component to consolidate wire routing.
- ☐ Refer to General Electrical Installation Guidelines for harness routing criteria prior to proceeding with this section.

Neutral Start Interlock Wiring Installation

The EC300 Control is designed to ensure that a control head is in command and that the lever is in the neutral detent position before an engine can be started. All EC300 Control Systems include a Neutral Start Interlock feature for prevention of start-in-gear situations. The Neutral Start Interlock is a relay contact inside of the EC300 Control. The relay contact closes only when the system ignition is turned on, a Control Head is selected, and the lever for the selected Control Head is in the neutral position.

Neutral Start Interlock Wiring Requirements

Normally, the boat wiring routes the start command wire from the key switch or engine control panel through the EC300 Control's Neutral Start Interlock. If a bypass or override switch is desired, contact Twin Disc Incorporated or a local distributor for information related to specific installation requirements. Damage or injury that is caused by improper installation is not the responsibility of Twin Disc Incorporated or its distributors.

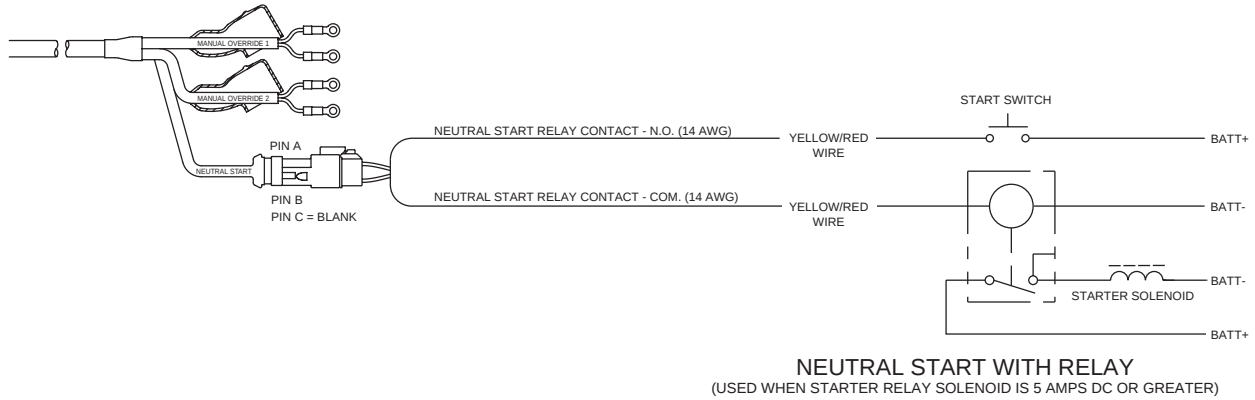
⚠ CAUTION

Bypassing of the neutral start interlock may cause damage or injury. Twin Disc Incorporated and its distributors are not responsible for the results of any improper wiring. Contact Twin Disc Incorporated or a local distributor for recommendations related to any engine-room start switch.

Two contacts are provided in the Transmission harness connector kit for the neutral start interlock wiring. The Neutral start connector pins A and B are for use with commonly available DC engine system voltages (12/24 VDC nominal). Pin C is blank and will have a sealing plug installed to maintain the integrity of the connector.

Install the Neutral Start Interlock portion of the Transmission harnesses as follows
(See Figure 37):

BRACKET TO TRANSMISSION HARNESS



BRACKET TO TRANSMISSION HARNESS

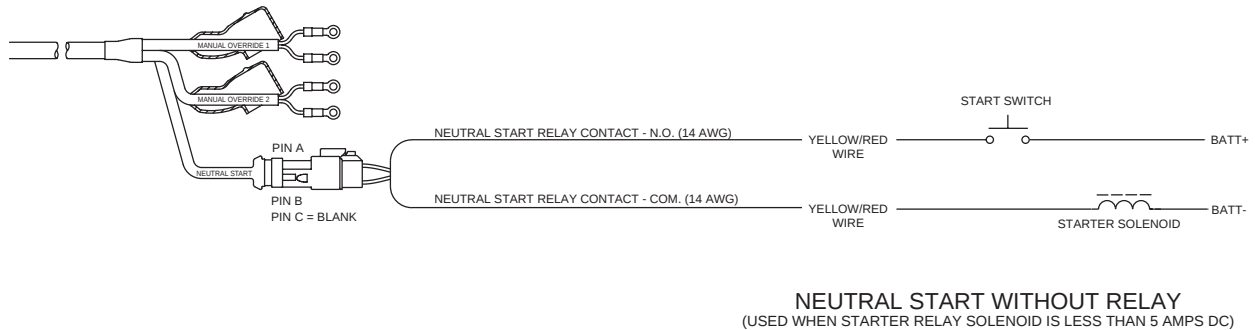


Figure 37. Neutral Start Interlock Schematic Bracket to Transmission Harness

A Neutral Start Interlock Relay must be used for isolation if the starter relay/solenoid current exceeds 5 amps DC. Use an isolation relay if the starter solenoid/relay current is unknown or if no means to measure the current is available.

Note: The EC300 Control's neutral start interlock contacts and any hardwired transmission neutral interlock must be wired in series with the vessel's starting circuit. If a hardwired transmission neutral start switch is present, then modify the following installation procedures to accommodate the switch.

The exact nature of the customer wiring will depend upon whether or not a relay is required. It will also depend upon the nature of the customer's existing wiring. The following steps assume that the Ignition Switch (start switch), the Starter Solenoid, and the Neutral Start Relay (if used) are already installed.

Refer to General Electrical Installation Guidelines for harness routing criteria.

This section assumes an existing connection between the engine starting switch at the helm and the engine starting circuit. If a connection does not exist, it may be desirable to install this circuit before continuing.

1. Remove the locking wedge from the Neutral Start Deutsch connector.

Note: The Neutral Start connector is provided in the Transmission harness connector kit.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

2. Disconnect the wire coming from the start switch at the helm from the start relay/solenoid.

- A. Remove any existing terminals from the end of the wire and crimp the supplied Deutsch contact (P/N 0462-209-16141) using the Deutsch HDT crimp tool (P/N HDT 48-00).

Note: The Deutsch 14 AWG contact (P/N 0462-209-16141) can be identified by a green band.

- B. Route the wire from the start relay/solenoid to the Neutral Start connector of the Bracket to Transmission harness and insert it into pin A of the connector.

3. Using 14 AWG wire, make a connection from pin B of the Neutral Start connector to the start relay/solenoid.

- A. Crimp a supplied Deutsch contact (P/N 0462-209-16141) using the Deutsch HDT crimp tool (P/N HDT 48-00) and insert it into pin B of the Neutral Start connector.

- B. Route this wire to the start relay/solenoid and terminate it at the start relay/solenoid using an appropriate connector.

4. When both pins and the seal plug have been inserted in the connector body, then insert the locking wedge.

5. Align the harness connectors and push it in until it snaps into place.

6. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Engine Throttle Wiring Installation

These signals interface with the engine Electronic Control Module's (ECM's) throttle input. The engine control module can also be referred to as the Electronic Control Unit (ECU), Electronic Engine Control (EEC), or other similar names. The engine manufacturer provides specific engine control manuals that detail the requirements for the throttle signal and power supply connections. The Bracket to Transmission Harness has three pins for throttle control. Table 8 lists the pin functions.

Table 8. Engine Control Pin Functions

Pin	Signal Name	Function
J5 Pin 1	ECM Power Supply	Power supply for the Throttle Signal. It is most often a power supply coming from J8 pin 2. In some cases it may be power coming from the ECM. This signal is to be used as the power source for the throttle signal output.
J5 Pin 2	Throttle Signal	The throttle position output signal. Depending upon the engine manufacturer, this signal can be a programmed voltage or current. The throttle signal is directed by the position of the lever at the active control head. It can also be a pulse train with programmable low and high levels with variable frequency or pulse widths. This is configured by the Twin Disc distributor or at the factory.
J5 Pin 3	ECM Power Supply Common	The common return path and reference point for engine throttle circuit.
J5 Pin 4	Transmission State 1	A solid-state switch output that goes active when the transmission is in neutral. This wire is used only for specific engines. See page B-12 in Appendix B for additional information
J5 Pin 5	Transmission State 2	A solid-state switch output that goes active when the transmission is not in neutral. This wire is used only for specific engines. See page B-12 in Appendix B for additional information
J5 Pin 6	Transmission State Return	The return signal for the transmission state signal. This wire is used only for specific engines. See page B-12 in Appendix B for additional information

The EC300 Control System currently supports the following types of electronic engine controls:

Table 9. Engines Supported

Engine Manufacturer	Engine Name in MFST	Carrier	Modulation
Caterpillar	Caterpillar	Voltage	PWM
Cummins	Cummins Centry/Celect	Current	Amplitude
Cummins	Cummins Quantum	Voltage	Amplitude
Detroit Diesel	Detroit Diesel Voltage	Voltage	Amplitude
Detroit Diesel	Detroit Diesel Frequency	Current	Frequency
Deutz	Deutz Type 1	Voltage	PWM
Deutz	Deutz Type 2	Voltage	Amplitude
Iveco	Iveco PWM	Voltage	PWM
Iveco	Iveco Voltage	Voltage	Amplitude
John Deere	John Deere	Voltage	Amplitude
MAN	MAN Current	Current	Amplitude
MTU	MTU	Current	Amplitude
Scania	Scania	Voltage	Amplitude
Volvo Penta	Volvo Penta EVC B	Current	Amplitude
Volvo Penta	Volvo Penta EVC C	Current	Amplitude

If the specific engine is not listed, contact Twin Disc Incorporated or a local distributor for custom information and support.

Note: All EC300 Control configuration is performed by Twin Disc Incorporated or its local distributor.

Refer to Appendix - B for detailed electrical installation requirements for the engines listed.

Install the Engine Throttle Wiring portion of the Bracket to Transmission harnesses as follows:

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Identify the wiring requirements from the installation drawing and from appendix -B for the specific engine installation.
2. Locate the necessary connecting points on the engine control module or engine control wiring circuits.
3. Route the throttle harness portion of the Bracket to Transmission harness to the engine.
4. Connect the throttle harness wires at the engine end.
5. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Prewired Connection Inspection

The transmission is supplied with the Bracket to Transmission harness prewired for all connections other than the the neutral start and engine throttle circuits. The remaining connections have been completed at the factory based upon the options ordered.

Verify that the connections are securely connected and have not been damaged during transmission installation. See Figure 38.

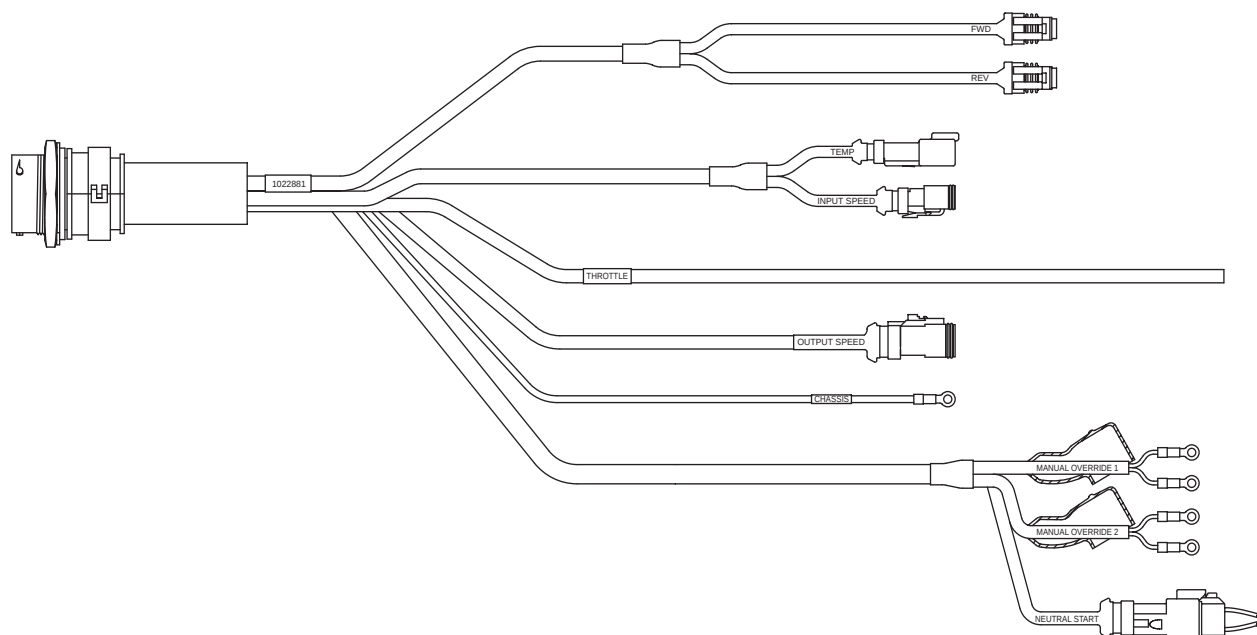


Figure 38. Bracket to Transmission Harness Assembly

To complete the wiring harness installation proceed to the Twin Disc Display Harness (J9) Installation, Communication Harness (J10) Installation, Servo Actuator Harness (J11) Installation, and EC300 Control Power and Grounding Harness (J13) Installation. Skip only those procedures that do not apply to your installation.

Engine Control Harness (J5) Installation

The Engine Control Harness (J5) provides wiring connections for the Neutral Start Interlock, Engine Throttle (if applicable), and Engine Speed Sensor. The EC300 J5 12 pin Deutsch connector, as well as the Engine Speed Sensor harness, are supplied by Twin Disc Incorporated. The Neutral Start Interlock and Engine Throttle harness are customer supplied, field fabricated, and plug into the J5 connector when not using the Twin Disc transmission harness. The J5 connector kit contains all contacts and sealing plugs that are required to fill the connector contact positions. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

The Neutral Start Interlock wiring and Engine Throttle wiring (if applicable) should be fabricated and routed to the EC300 Control prior to installing the Engine Speed Sensor Harness. See Figure 39 and Figure 40.

The following criteria must be met when installing engine control harness wiring:

- ☐ The Neutral Start Interlock wires must be 14 AWG stranded copper wire. All other wires must be a minimum of 18 AWG stranded copper wire.
- ☐ Before installing the Neutral Start Interlock Wiring, plan if the Engine Throttle harnesses and/or the Engine Speed Sensor Harness are to be installed. Consider the harness routing for each component to consolidate wire routing.
- ☐ Refer to General Electrical Installation Guidelines for harness routing criteria prior to proceeding with this section.

This section contains the following sub-sections:

- ☐ Neutral Start Interlock Wiring Installation
- ☐ Engine Throttle Wiring Installation
- ☐ Engine Speed Sensor Wiring Installation

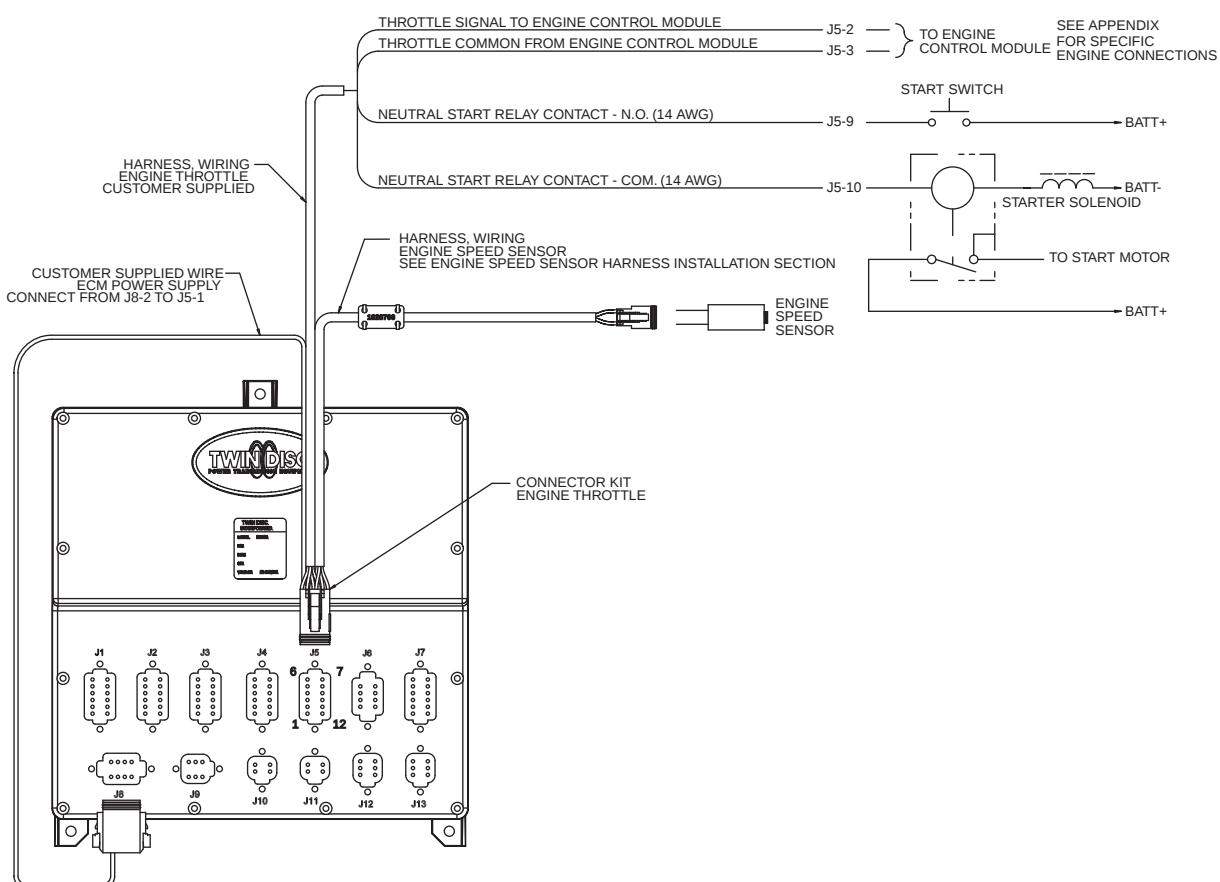


Figure 39. Engine Control Harness (J5)

Neutral Start Interlock Wiring Installation

The EC300 Control is designed to ensure that a control head is in command and that the lever is in the neutral detent position before an engine can be started. All EC300 Control Systems include a Neutral Start Interlock feature for prevention of start-in-gear situations. The Neutral Start Interlock is a relay contact inside of the EC300 Control. The relay contact closes only when the system ignition is turned on, a Control Head is selected, and the lever for the selected Control Head is in the neutral position.

Neutral Start Interlock Wiring Requirements

Normally, the boat wiring routes the start command wire from the key switch or engine control panel through the EC300 Control's Neutral Start Interlock. If a bypass or override switch is desired, contact Twin Disc Incorporated or a local distributor for information related to specific installation requirements. Damage or injury that is caused by improper installation is not the responsibility of Twin Disc Incorporated or its distributors.

⚠ CAUTION

Bypassing of the neutral start interlock may cause damage or injury. Twin Disc Incorporated and its distributors are not responsible for the results of any improper wiring. Contact Twin Disc Incorporated or a local distributor for recommendations related to any engine-room start switch.

Two contacts are provided in the Engine throttle connector kit (J5) for the neutral start interlock wiring. Connector J5 pin 9 and connector J5 pin 10 are for use with commonly available DC engine system voltages (12/24 VDC Nominal).

Install the Neutral Start Interlock portion of the Engine Control harnesses as follows (See Figure 40):

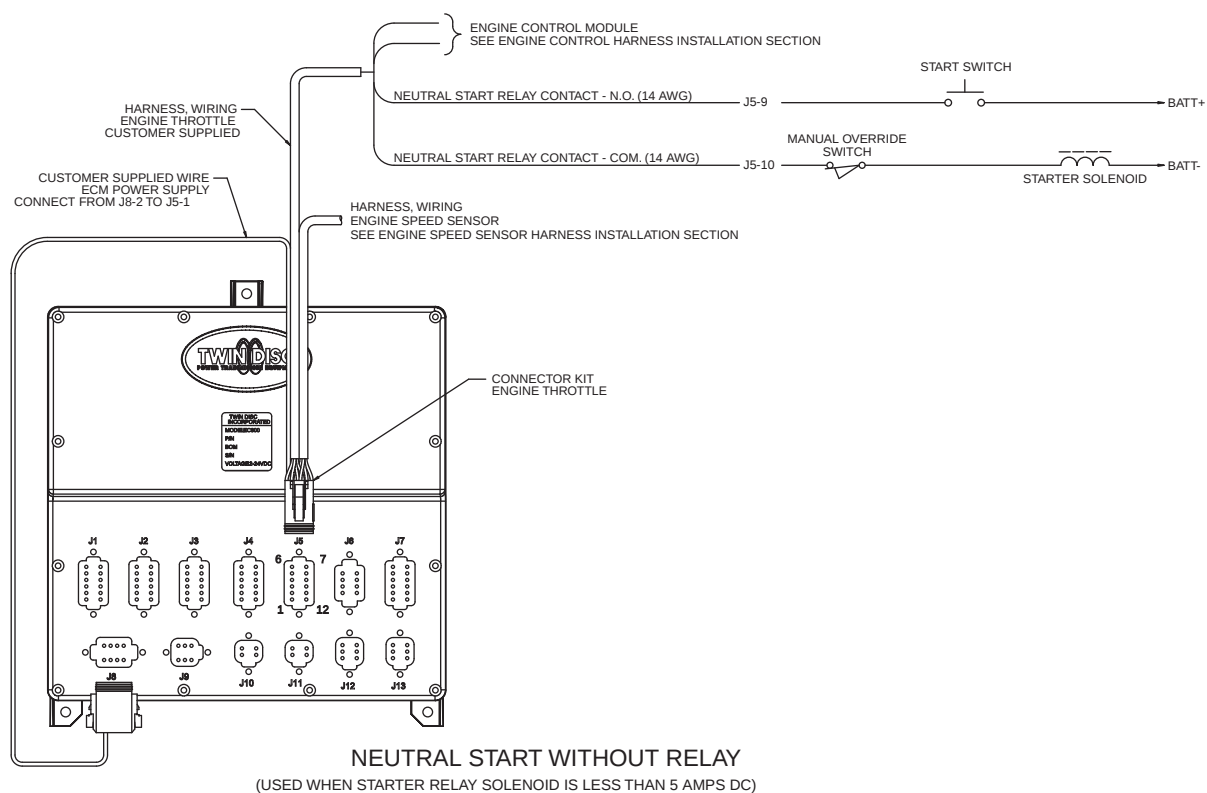
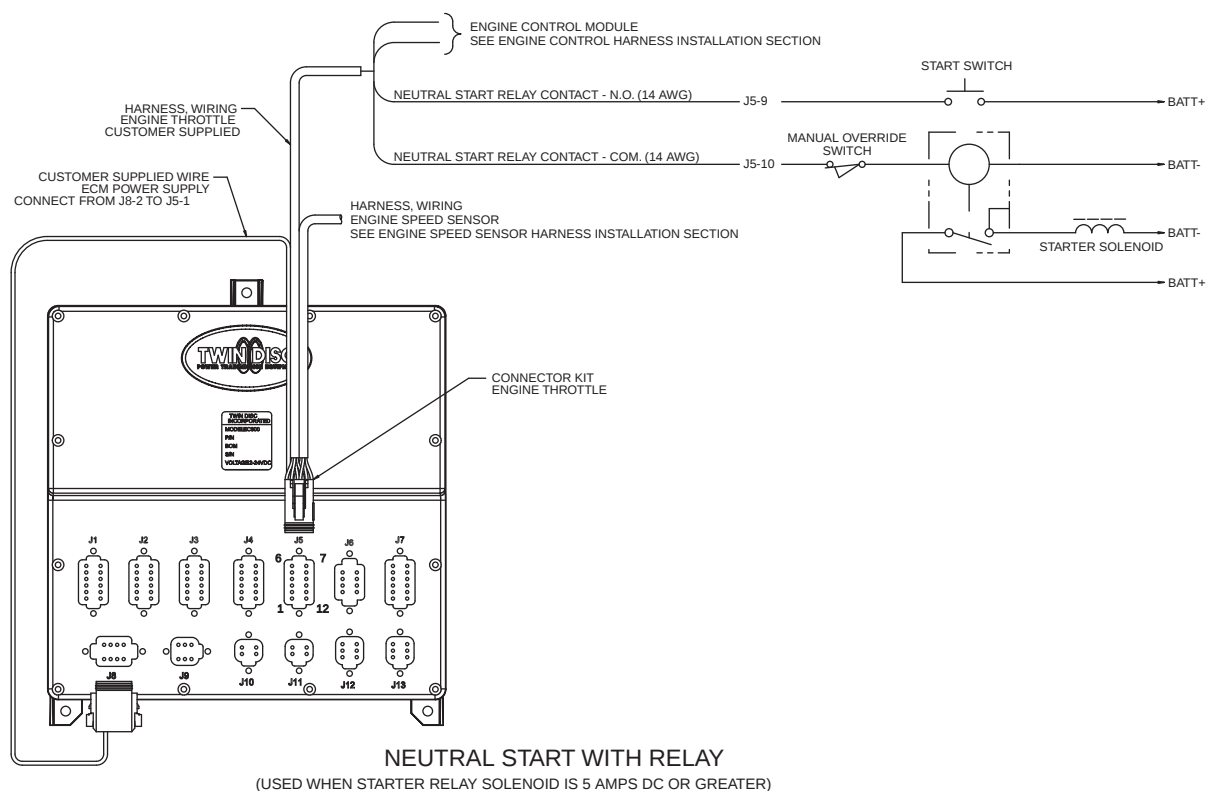


Figure 40. Neutral Start Interlock Schematic J5 Harness

A Neutral Start Interlock Relay must be used for isolation if the starter relay/solenoid current exceeds 5 amps DC. Use an isolation relay if the starter solenoid/relay current is unknown or if no means to measure the current is available.

Note: The EC300 Control's neutral start interlock contacts and any hardwired transmission neutral interlock must be wired in series with the vessel's starting circuit. If a hardwired transmission neutral start switch is present, then modify the following installation procedures to accommodate the switch.

The exact nature of the customer wiring will depend upon whether or not a relay is required. It will also depend upon the nature of the customer's existing wiring. The following steps assume that the Ignition Switch (start switch), the Starter Solenoid, and the Neutral Start Relay (if used) are already installed.

Refer to General Electrical Installation Guidelines for harness routing criteria.

This section assumes an existing connection between the engine starting switch at the helm and the engine starting circuit. If a connection does not exist, it may be desirable to install this circuit before continuing.

1. Disconnect the wire coming from the start switch at the helm from the start relay/solenoid and connect it to J5 pin 9.
2. Make a connection from J5 pin 10 to the start relay/solenoid using 14 AWG wire.
3. Route both yellow with a red stripe wires to the EC300 Control.
4. For the yellow with a red stripe wire from the start switch at the helm, crimp the supplied Deutsch contact (P/N 0462-209-16141) using the Deutsch HDT crimp tool (P/N HDT 48-00).

Note: The Deutsch 14 AWG contact (P/N 0462-209-16141) can be identified by a green band.

5. Remove the locking wedge from the Deutsch connector.

6. Insert the wire coming from the start switch at the helm into pin 9 of the J5 connector.

Note: The J5 connector is provided in the Engine throttle connector kit.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

7. For the yellow with a red stripe wire from the starter relay/solenoid, crimp the supplied Deutsch contact (P/N 0462-209-16141) using the Deutsch HDT crimp tool (P/N HDT 48-00).
8. Insert the wire coming from the start relay/solenoid into pin 10 of the J5 connector.
9. When all pins have been inserted in the connector body, then insert the Deutsch locking wedge.
10. Ensure that sealing plugs are installed in all empty connector positions.
11. Align the harness connector with the J5 receptacle of the EC300 Control and push it in until it snaps into place.
12. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Electronic Control Module Throttle Wiring

These signals interface with the engine Electronic Control Module's (ECM's) throttle input. The engine control module can also be referred to as the Electronic Control Unit (ECU), Electronic Engine Control (EEC), or other similar names. The engine manufacturer provides specific engine control manuals that detail the requirements for the throttle signal and power supply connections. The Engine Control Harness (J5) has six pins for throttle control. Table 10 lists the pin functions.

The engine control output can consist of three signals as follows:

- ☐ The throttle control signal
- ☐ An optional signal indicating the transmission is in neutral
- ☐ An optional signal indicating the transmission is not in neutral

Table 10. Engine Control Pin Functions

Pin	Signal Name	Function
J5 Pin 1	ECM Power Supply	Power supply for the Throttle Signal. It is most often a power supply coming from J8 pin 2. In some cases it may be power coming from the ECM. This signal is to be used as the power source for the throttle signal output.
J5 Pin 2	Throttle Signal	The throttle position output signal. Depending upon the engine manufacturer, this signal can be a programmed voltage or current. The throttle signal is directed by the position of the lever at the active control head. It can also be a pulse train with programmable low and high levels with variable frequency or pulse widths. This is configured by the Twin Disc distributor or at the factory.
J5 Pin 3	ECM Power Supply Common	The common return path and reference point for engine throttle circuit.
J5 Pin 4	Transmission State 1	A solid-state switch output that goes active when the transmission is in neutral. This wire is used only for specific engines. See page B-12 in Appendix B for additional information
J5 Pin 5	Transmission State 2	A solid-state switch output that goes active when the transmission is not in neutral. This wire is used only for specific engines. See page B-12 in Appendix B for additional information
J5 Pin 6	Transmission State Return	The return signal for the transmission state signal. This wire is used only for specific engines. See page B-12 in Appendix B for additional information

The EC300 Control System currently supports the following types of electronic engine controls:

Table 11. Engines Supported

Engine Manufacturer	Engine Name in MFST	Carrier	Modulation
Caterpillar	Caterpillar	Voltage	PWM
Cummins	Cummins Centry/Celect	Current	Amplitude
Cummins	Cummins Quantum	Voltage	Amplitude
Detroit Diesel	Detroit Diesel Voltage	Voltage	Amplitude
Detroit Diesel	Detroit Diesel Frequency	Current	Frequency
Deutz	Deutz Type 1	Voltage	PWM
Deutz	Deutz Type 2	Voltage	Amplitude
Iveco	Iveco PWM	Voltage	PWM
Iveco	Iveco Voltage	Voltage	Amplitude
John Deere	John Deere	Voltage	Amplitude
MAN	MAN Current	Current	Amplitude
MTU	MTU	Current	Amplitude
Scania	Scania	Voltage	Amplitude
Volvo Penta	Volvo Penta EVC B	Current	Amplitude
Volvo Penta	Volvo Penta EVC C	Current	Amplitude

If the specific engine is not listed, contact Twin Disc Incorporated or a local distributor for custom information and support.

Note: All EC300 Control configuration is performed by Twin Disc Incorporated or its local distributor.

Refer to Appendix - B for detailed electrical installation requirements for the engines listed.

Harness Fabrication and Wiring Procedure

Note: The connector kit supplied for Engine Control Harness J5 has enough contacts and plugs necessary to fill the connector. Use only the contacts that are needed. Unused connector positions must have a sealing plug inserted in order to maintain the environmental integrity of the connector.

Install the Engine Throttle Wiring portion of the Engine Control harnesses as follows:

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Identify the wiring requirements from the installation drawing and from appendix -B for the specific engine installation.
2. Locate the necessary connecting points on the engine control module or engine control wiring circuits.
3. Make a suitable interface harness containing the necessary conductors.

Note: The throttle signal wires must be 18 AWG stranded copper wire. All other wires must be a minimum of 18 AWG stranded copper wire.

4. Connect the engine harness at the engine end.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

5. Route the engine harness to the associated EC300 Control.
6. Crimp the supplied Deutsch pin (P/N 0462-209-16141) using the Deutsch HDT crimp tool (P/N HDT 48-00) for the Engine Control Harness J5 connector on the wires.
7. Remove the locking wedge from the Deutsch connector.
8. Insert the wires into the proper position in the J5 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J5 connector is provided in the Engine throttle connector kit.

Note: Ensure that the pin to wire crimp is uniform and complete. Ensure that the pin is locked into in the connector.

9. When all pins have been inserted in the connector body, then insert the Deutsch locking wedge.
10. Ensure that sealing plugs are installed in all empty connector positions.
11. Align the harness connector with the J5 receptacle of the EC300 Control and push it in until it snaps into place.
12. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Engine Speed Sensor Harness Installation

The Engine Speed Sensor Harness is a prefabricated wiring harnesses with connectors installed on the equipment end and terminals installed on the EC300 end of the harness. The terminals on these harnesses will be installed into the EC300 connector (J5) provided by Twin Disc Incorporated. The Neutral Start Interlock wiring and Engine Throttle wiring (if applicable) should be fabricated and routed to the EC300 prior to installing the Engine Speed Sensor Harness.

⚠ CAUTION

The engine speed sensor signal must connect only to the EC300 Control. If another speed sensor signal is required, use engine speed sensor doublers or dual output engine speed sensors. Note that a tachometer output is available from the EC300 Control.

Install the Engine Speed Sensor Harness Wiring portion of the Engine Control harnesses as follows (See Figure 41):

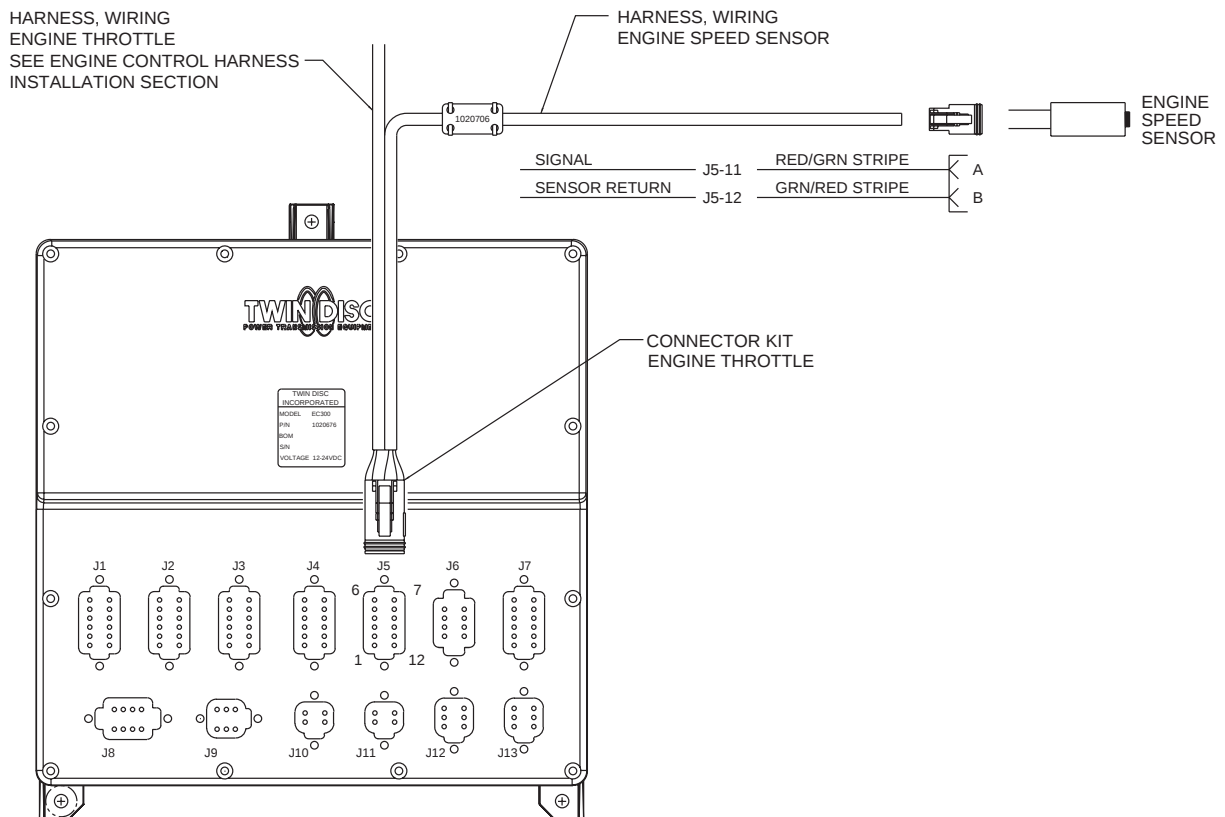


Figure 41. Engine Speed Sensor Harness Wiring

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Remove the locking wedge from the J5 Deutsch connector.
2. Insert the red with a green stripe wire into position 11 of the J5 connector.
3. Insert the green with a red stripe wire into position 12 of the J5 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

4. When both pins have been inserted in the connector body, then insert the Deutsch locking wedge.
5. Ensure that sealing plugs are installed in all empty connector positions.
6. Align the harness connector with the J5 receptacle of the EC300 Control and push it in until it snaps into place.
7. Route the Engine Speed Sensor Harness to the Engine Speed Sensor.
8. Plug the 2-pin connector of the Engine Speed Sensor Harness into the Engine Speed Sensor receptacle.
9. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Engine Room Analog Harness (J6) Installation

The Engine Room Analog Harness Connector (J6) provides analog inputs from a transmission oil temperature sensor and a transmission output speed sensor. The oil temperature sensor is not applicable in all installations. The Engine Room Analog harness is fully pre-fabricated and plugs into the J6 connector at the EC300 Control and directly into the temperature sensor and output speed sensor at the other end. The J6 connector contains all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

This section contains the following sub-sections:

- ☐ Transmission Oil Temperature Sensor Wiring Installation
- ☐ Transmission Output Speed Sensor Wiring Installation

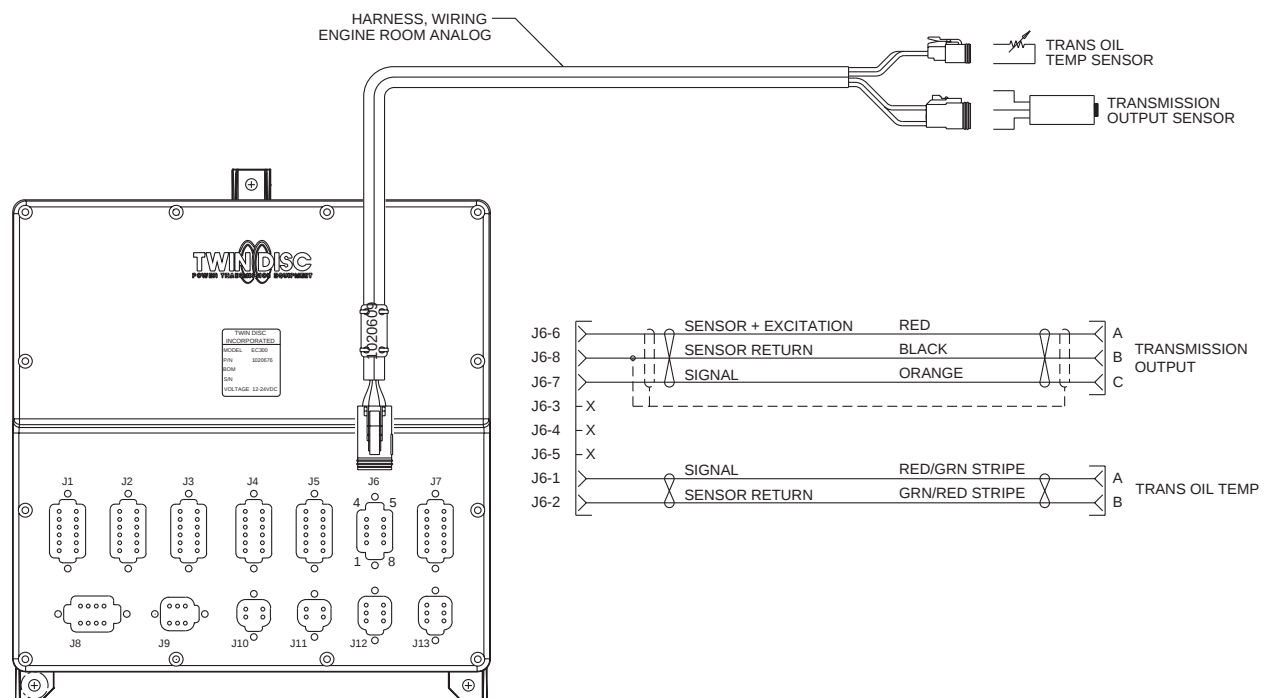


Figure 42. Engine Room Analog Harness (J6) Wiring Diagram

Transmission Oil Temperature Sensor Wiring Installation

Install the wiring for a Transmission Oil Temperature Sensor as follows (See Figure 42):

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Align the Engine Room Analog Harness connector with the J6 receptacle of the EC300 Control and push it in until it snaps into place.
2. Route the Engine Room Analog Harness to the associated transmission.

Note: The Transmission Oil Temperature Sensor cable is part of the Engine Room Analog harness. Cable ties may be removed for routing purposes.

3. Install the Transmission Oil Temperature Sensor cable's receptacle onto the transmission oil temperature sensor's plug.
4. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

Transmission Output Speed Sensor Wiring Installation

Install the wiring for a Transmission Output Speed Sensor as follows (See Figure 42):

Refer to General Electrical Installation Guidelines for harness routing criteria.

1. Align the Engine Room Analog Harness connector with the J6 receptacle of the EC300 Control and push it in until it snaps into place.
2. Route the Engine Room Analog Harness to the associated transmission.

Note: The Transmission Output Speed Sensor cable is part of the Engine Room Analog harness. Cable ties may be removed for routing purposes.

3. Install the Transmission Output Speed Sensor cable's plug into the Transmission Output Speed Sensor's receptacle.
4. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Tooth Count

Note: The EC300 Control must be configured with the correct tooth count for the specific transmission installed. Obtain the correct tooth count information from the manufacturer's literature or count the teeth.

PWM Driver Harness (J7) Installation

The PWM Driver Harness (J7) provides solenoid driver outputs for transmission gear selection and other functions. Not all of these outputs are used in any specific application. The following sections provide instructions for the installation of the PWM Driver Harness.

The PWM Driver harness is fully pre-fabricated and plugs into the J7 connector at the EC300 Control and directly into the solenoid connectors at the other end. The J7 connector contains all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

This section contains the following sub-sections:

- ☐ Two Solenoid Transmission Clutch Control Wiring Installation
- ☐ Three Solenoid Transmission Clutch Control Wiring Installation
- ☐ Shaft Brake Wiring Installation
- ☐ Stabilizer Disable Wiring Installation
- ☐ Troll Enable Wiring Installation

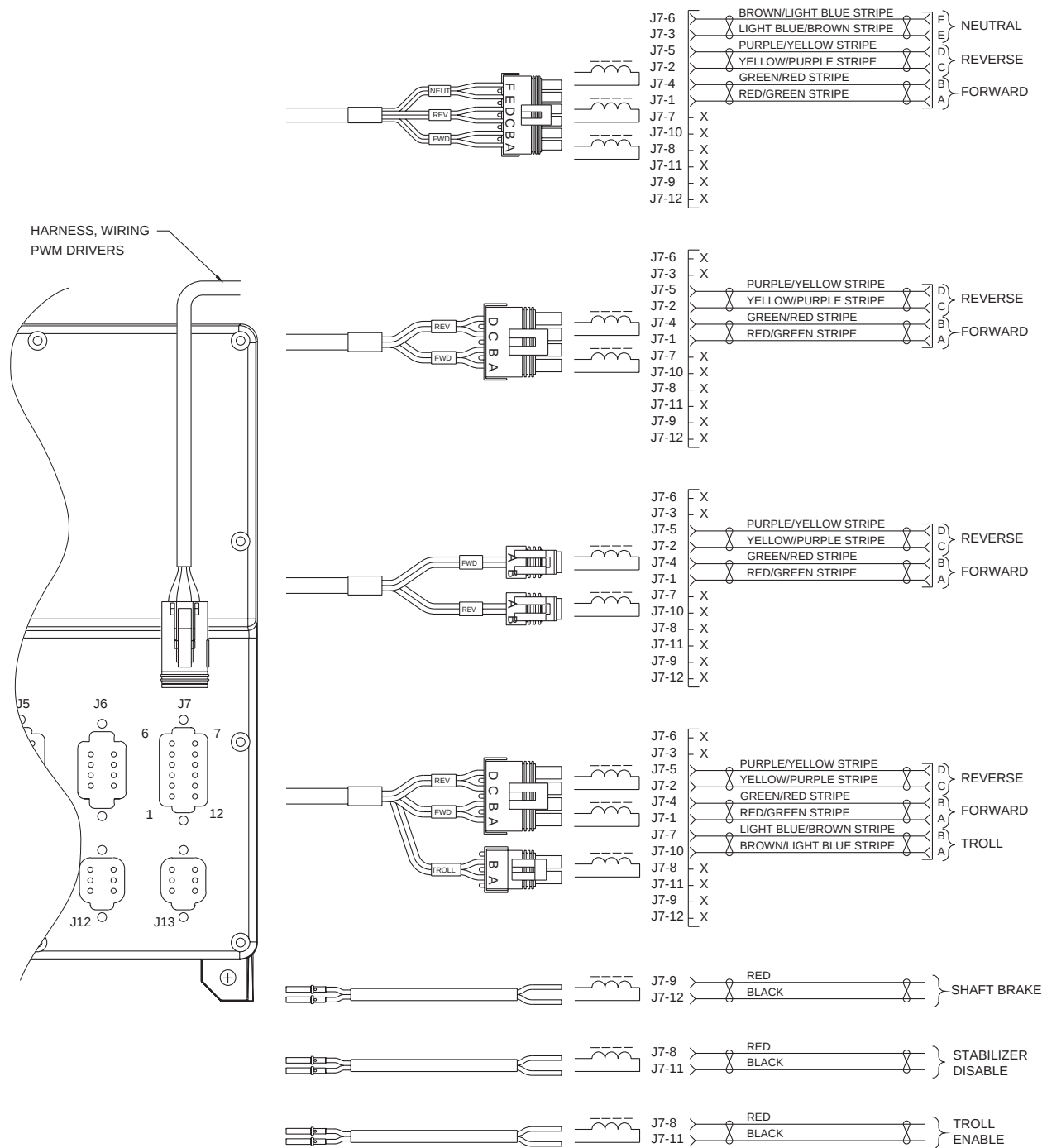


Figure 43. PWM Driver Harness Wiring Diagram

Two Solenoid Transmission Clutch Control Wiring Installation

Install the wiring for a two-solenoid transmission as follows (See Figure 43):

Note: Refer to the transmission manufacturer's technical manual as required to identify the solenoids. If the solenoids are not clearly identified, make the connections on a temporary basis until testing can confirm the selection.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the PWM Driver harness to the forward and reverse solenoid connectors.
2. Route the PWM Driver harness to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

3. Ensure that sealing plugs are installed in all empty connector positions.
4. Align the harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
5. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Three Solenoid Transmission Clutch Control Wiring Installation

Install the wiring for a three-solenoid transmission as follows (See Figure 43):

Note: Refer to the transmission manufacturer's technical manual as required to identify the solenoids. If the solenoids are not clearly identified, make the connections on a temporary basis until testing can confirm the selection.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the PWM Driver harness to the forward, neutral, and reverse solenoid connectors.
2. Route the PWM Driver harness to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

3. Ensure that sealing plugs are installed in all empty connector positions.
4. Align the harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
5. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Shaft Brake Wiring Installation

Install the wiring for a shaft brake solenoid as follows (See Figure 43):

Note: The connector kit supplied for the PWM Driver Harness has enough contacts and plugs necessary to fill the connector. Use only the contacts that are needed. Unused connector positions must have a sealing plug inserted in order to maintain the environmental integrity of the connector.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the red wire to the signal lead for the Shaft Brake Solenoid.
2. Connect the black wire to the return lead for the Shaft Brake Solenoid.
3. Route the red and black wires to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

4. Remove the locking wedge from the Deutsch connector.
5. Insert the red wire into position 9 of the J7 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J7 connector is part of the PWM Driver Harness.

6. Insert the black wire into position 12 of the J7 connector.
7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
10. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Stabilizer Disable Wiring Installation

Install the wiring for a stabilizer disable solenoid as follows (See Figure 43):

Note: The connector kit supplied for the PWM Driver Harness has enough contacts and plugs necessary to fill the connector. Use only the contacts needed. Unused connector positions must have a sealing plug inserted to maintain the environmental integrity of the connector.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the red wire to the signal lead for the Stabilizer Disable input.
2. Connect the black wire to the return lead for the Stabilizer Disable input.
3. Route the red and black wires to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

4. Remove the locking wedge from the Deutsch connector.
5. Insert the red wire into position 8 of the J7 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J7 connector is part of the PWM Driver Harness.

6. Insert the black wire into position 11 of the J7 connector.
7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
10. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Troll Enable Wiring Installation

Install the wiring for a troll enable solenoid as follows (See Figure 43):

Note: The connector kit supplied for the PWM Driver Harness has enough contacts and plugs necessary to fill the connector. Use only the contacts that are needed. Unused connector positions must have a sealing plug inserted in order to maintain the environmental integrity of the connector.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the red wire to the signal lead for the Troll Enable Solenoid.
2. Connect the black wire to the return lead for the Troll Enable Solenoid.
3. Route the red and black wires to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

4. Remove the locking wedge from the Deutsch connector.
5. Insert the red wire into position 8 of the J7 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J7 connector is part of the PWM Driver Harness.

6. Insert the black wire into position 11 of the J7 connector.
7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J7 receptacle of the EC300 Control and push it in until it snaps into place.
10. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Bridge Signals Harness (J8) Installation

The Bridge Signals Harness (J8) provides wiring connections for the Ignition Switch, Manual Override Switch, and Tachometer. Not all of these features may be used in any specific application. The Bridge Signals Harness (J8) is field fabricated. The J8 connector kit is provided by Twin Disc Incorporated and consists of the EC300 J8 connector and all contacts and sealing plugs for the connector. The equipment end of the harness is fabricated by the installer at the time of installation with components provided by the customer. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

Note: EC300 Bridge Signals Harness (J8) also may contain wiring for other features. Route the harness to the most convenient location serving all the applicable connections.

This section contains the following sub-sections:

- ☐ Ignition Switch Wiring
- ☐ Manual Override Switch Wiring
- ☐ Tachometer Output Wiring Installation

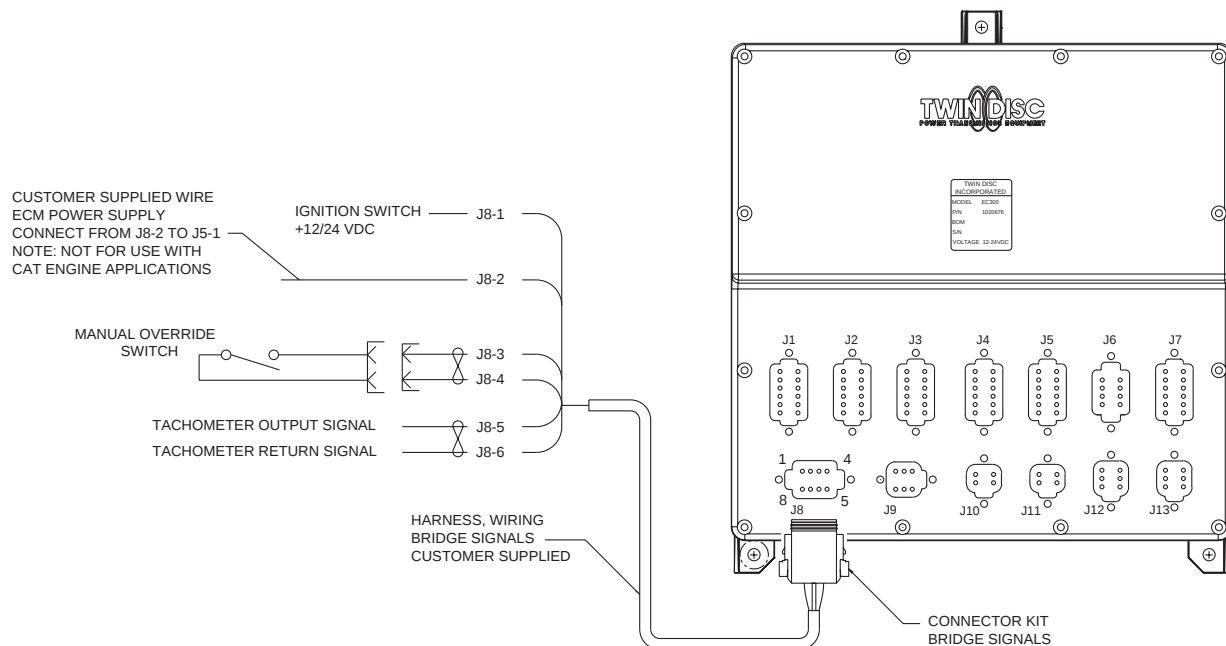


Figure 44. Bridge Signals Harness (J8) Connections

Ignition Switch Wiring

Ignition switch wiring is accomplished through the Bridge Signals Harness (J8) that connects to the J8 receptacle at the EC300 Control. The ignition signal turns on power to the EC300 Control. The control will not function unless this terminal is connected to a DC signal source from the load side of the ignition switch.

Note: The following instructions refer to a combination ignition switch which has an ON position and a START position. For this type of ignition switch installation, power to the EC300 Control must not be interrupted when starting the engine. If a common master power switch is used to enable separate START push-buttons, then use this master ON switch as this signal source.

Install the Ignition Switch Wiring portion of the Bridge Signals harnesses as follows (See Figure 44):

CAUTION

The DC voltage from the ignition switch to J8, Pin 1 must be from the same source as the voltage used by the EC300 Control. It must not be interrupted when the engine is started.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the wire to be used for the ignition wiring to the load side of the ignition switch.
2. Route the wire to the EC300 Control.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

3. Remove the locking wedge from the Deutsch connector.

4. Insert the wire into position 1 of the J8 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J8 connector is part of the Bridge Signals Harness.

5. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
6. Ensure that sealing plugs are installed in all empty connector positions.
7. Align the harness connector with the J8 receptacle of the EC300 Control and push it in until it snaps into place.
8. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Manual Override Switch Wiring

The Manual Override switch is used to disable the forward and reverse solenoid drivers when the manual override valve is open. The Manual Override switch is a normally closed contact. In the event the manual override valve is manually activated, the switch contacts will open and the EC300 control will go into a controller neutral condition and no longer power the forward and reverse solenoids. If used, the Manual Override Switch should be installed per Manual Override Switch Installation.

Install the Manual Override Switch input wiring portion of the Bridge Signals harnesses as follows (See Figure 44):

⚠WARNING

Twin Disc Incorporated strongly recommends that the Manual Override Switch is properly wired if the transmission is equipped with a manual override valve. Failure to properly wire the Manual Override Switch may cause catastrophic gear failure if the Manual Override Valve and the forward or reverse solenoid are inadvertently activated at the same time.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Connect the customer supplied wire to either screw terminal on one of the manual override valve switches.
2. Connect the other customer supplied wire to the other screw terminal on the manual override valve switch.

Note: The manual override valve has screw terminals on both sides for two separate connections. One side is for the J8 Manual Override switch connection and the other side for the J5 neutral start switch connection.

3. Route the two wires to the EC300 Control.

Note: EC300 Bridge Signals Harness (J8) also may contain wiring for other features. Route the harness to the most convenient location serving all the applicable connections.

4. Remove the locking wedge from the Deutsch connector.

5. Insert one of the wires into position 3 of the J8 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J8 connector is part of the Bridge Signals Harness.

6. Insert the other wire into position 4 of the J8 connector.
7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J8 receptacle of the EC300 Control and push it in until it snaps into place.
10. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

Tachometer Output Wiring Installation

The tachometer output circuit is used to drive a tachometer indicator. This signal can be used to drive a tachometer at the helm indicating either engine or propeller speed.

Install the tachometer output wiring portion of the Bridge Signals harnesses as follows (See Figure 44):

Refer to General Electrical Installation Guidelines before proceeding with this section.

Note: EC300 Bridge Signals Harness (J8) also may contain wiring for other features. Route the harness to the most convenient location serving all the applicable connections.

1. Connect one customer supplied wire to the signal input connection on the tachometer.
2. Connect the other customer supplied wire to the return connection on the tachometer.
3. Route the two wires to the EC300 Control.
4. Remove the locking wedge from the Deutsch connector.
5. Insert the wire connected to the tachometer signal input into position 5 of the J8 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

Note: The J8 connector is part of the Bridge Signals Harness.

6. Insert the wire connected to the tachometer signal return into position 6 of the J8 connector.

7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.
8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J8 receptacle of the EC300 Control and push it in until it snaps into place.
10. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

Twin Disc Display Harness (J9) Installation

The Twin Disc Display Harness Assembly consists of a communication harness, two adapter harnesses, two J1939 T-Connectors, and two J1939 terminating resistors. The J1939 CAN Harness adapts the Communications Harness to the display's 3-pin receptacle via a J1939 T-Connector. The Multiple Display Adapter Harness adapts the Communications Harness to the control's J9 receptacle via a J1939 T-Connector. The Communication Harness has identical T-Connectors at each end. Each end is supplied with a pre-installed terminating resistor. Do not remove the J1939 terminating resistors.

The Display Power Harness connects between the 8 - pin receptacle of the Multiple Display Adapter Harness and the 6 - pin receptacle of the display. The black wire at the display end of the harness connects to the circular connector of the Control Head.

This section contains the following sub-sections:

- ❑ Twin Disc Display Harness Wiring

Note: The purchase and installation of the Twin Disc Display is an option. If physical installation is impractical, the display may be stored and only used temporarily during configuration and troubleshooting. The following assumes that the display has been installed.

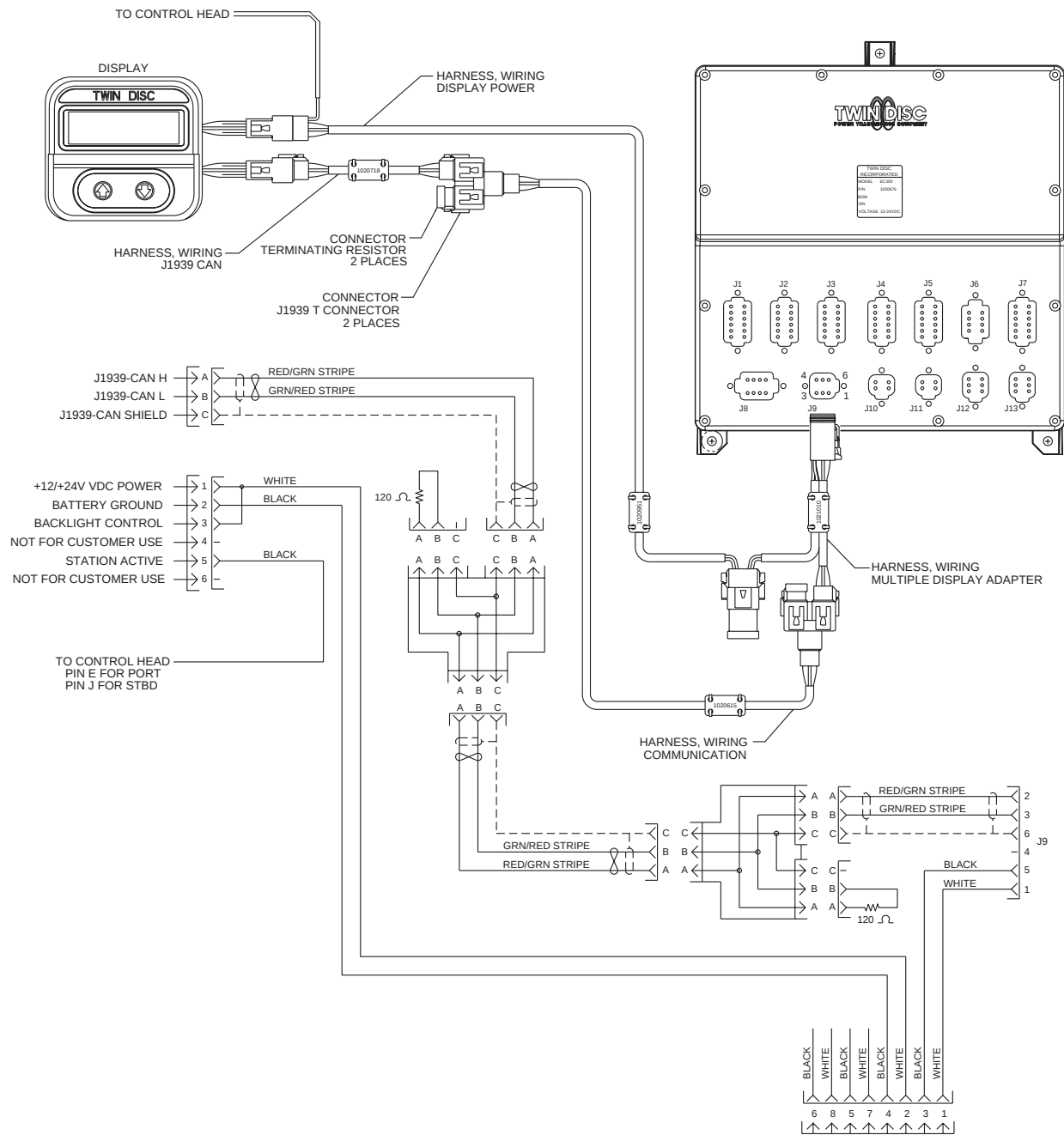


Figure 45. Display Harness J9 Installation

Twin Disc Display Harness Wiring

Install the Twin Disc Display Harness Assembly and the Display Power Harness as follows (See Figure 45):

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Align the 3-pin plug of the J1939 Can harness with the 3-pin receptacle of the Twin Disc Display and push together until the lock snaps into place.
2. Install a J1939 T-Connector into the remaining 3-pin plug of the J1939 Can harness.
3. Install a 3-pin plug of the Communications harness into the J1939 T-Connector.
4. Align the 6-pin plug of the Display Power harness with the 6-pin receptacle of the Twin Disc Display and push together until the lock snaps into place.
5. Route the short black wire to the Control Head.
6. Access the Control Head connector.

Note: The Control Head may be removed from the dash if this facilitates making the connection. If it is removed, then reinstall it after the connections have been made.

7. Disconnect the Control Head harness from the Control Head.
8. Install the short black wire of the Display Power harness into the Control head receptacle (position E for a port lever application, position J for a starboard lever application).
9. Route the Display Power harness and the Communications harness to the EC300 Control.
10. Install a J1939 T-Connector into the 3-pin plug of the Multiple Display Adapter harness.
11. Install the 3-pin plug of the Communications harness into the J1939 T-Connector

12. Remove the 8-pin receptacle from the Multiple Display Adapter harness located near the J9 connector at the EC300 Control.
13. Remove the locking wedge from the Multiple Display Adapter harness's plug.
14. Install the white wire of the Display Power harness into position 2, 7, or 8 of the 8-pin plug of the Multiple Display Adapter harness.
15. Install the black wire of the Display Power harness into position 4, 5, or 6 of the 8-pin plug of the Multiple Display Adapter harness.
16. Install a J1939 terminating resistor into the J1939 T-Connector receptacle located at each end of the Twin Disc Display Communications Harness Assembly.

Note: Terminating resistors must be installed at each end of the Twin Disc Display Communication Harness Assembly for the communications to work properly.

17. Repeat steps 1 through 16 for each additional Twin Disc Display.
18. When all pins have been inserted in the connector body, install the locking wedge into the Multiple Display Adapter harness 8-pin plug.
19. Install the 8-pin receptacle onto the Multiple Display Adapter harness's 8-pin plug.
20. Align the Multiple Display Adapter harness 6-pin connector with the J9 receptacle of the EC300 Control and push it in until it snaps into place.
21. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Communication Harness (J10) Installation

The Communications Harness (J10) provide the main interface between two or more EC300 Controllers. The vessel may have one or more EC300 Controllers located in or near the engine room. The Communication Harnesses (J10) are fully pre-fabricated and plug into the J10 connector at each EC300. The J10 connectors contains all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

Cruise mode and Express mode support a feature in which the speed of all engines in the system can be synchronized. For the synchronization feature to function, information must be passed between all controllers in the system. A communication harness assembly is required to be connected between all EC300 Controls. A typical harness assembly consists of 2 controller harnesses; 1 communication harness; 2 T-connector receptacles; and 2 terminating resistors. The harnesses are available in various lengths and are terminated with the proper connectors.

This section contains the following sub-sections:

- ☐ Dual Engine Communication Harness Installation
- ☐ Multiple Engine Communication Harness Installation

Dual Engine Communication Harness Installation

A Communication Harness Assembly is required to connect the two EC300 Controllers on a dual engine installation. This prefabricated harness assembly comes with connectors at both ends. Connect the communication harness to the EC300 Controller at each end. The main communications harness must be terminated at each end. The terminators are installed in the T-Connectors as part of the prefabricated harness assembly.

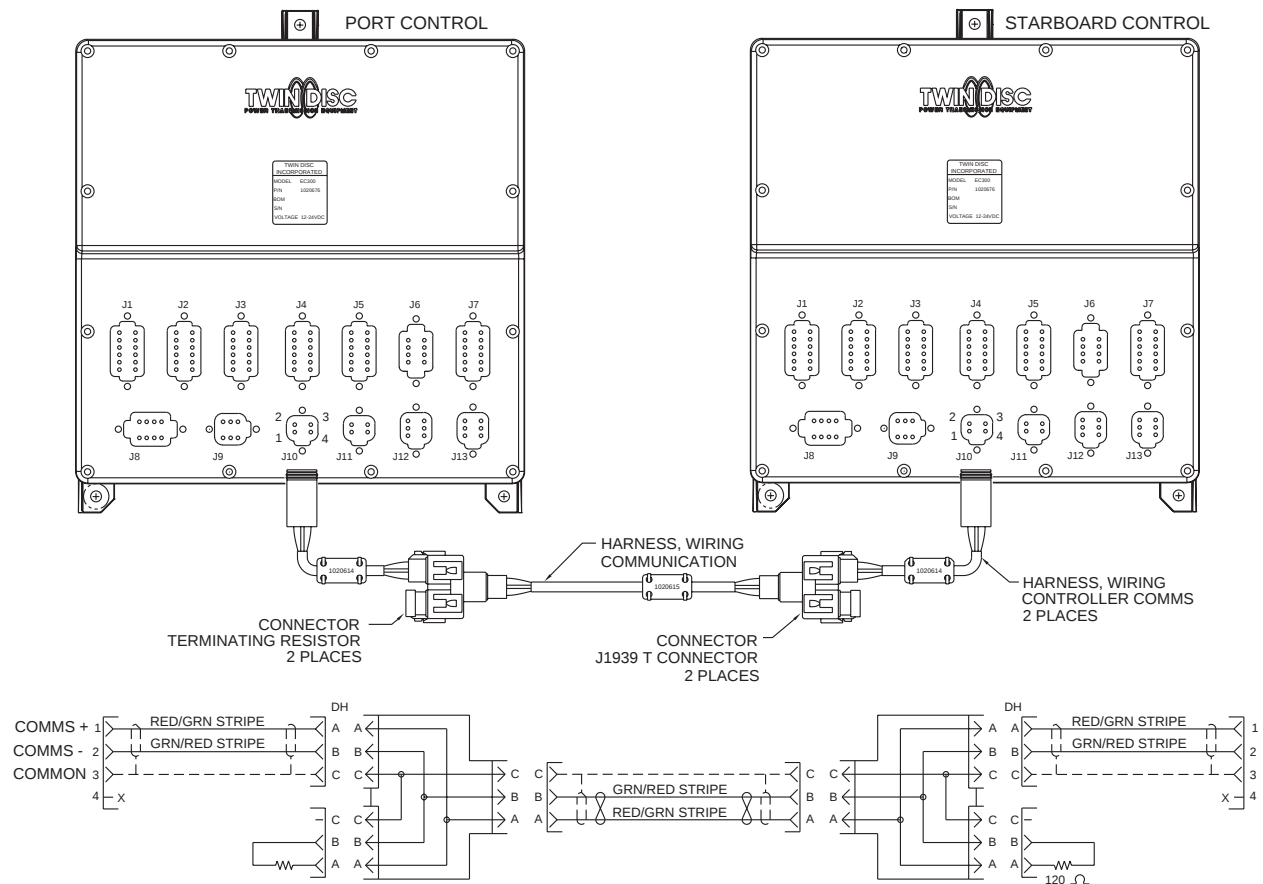


Figure 46. Dual Engine Communication Harness Assembly J10 Installation

Install the Communication Harness Assembly as follows (See Figure 46):

Note: The specific application may have different lengths for each segment of communication harness. Use the correct segments.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Install a J1939 T-Connector receptacle on the 3-pin plug of each Controller Comms Harness.
2. Align the Controller Comms Harness connector with the J10 receptacle of each EC300 Controller and push it in until it snaps into place.
3. Connect the Communication Harness between the EC300 Controllers by installing the 3-pin plugs into the J1939 T-Connector receptacles located on the Controller Comms Harness at each EC300 Controller.
4. Install a J1939 Terminating Resistor into the J1939 T-Connector receptacle located at each end of the Communication Harness Assembly.

Note: Terminating resistors must be installed at each end of the communication harness assembly for the communications to work properly.

5. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Multiple (more than two) Engine Communication Harness Installation

For installations that contain three or more engines, multiple communications harnesses and multiple J1939 T-Connectors are required. The T-connector allows daisy chaining to the J10 connector at each EC300 Controller. Each communications harness is connected to the EC300 Controller through a short controller communications harness. The main communications harness must be terminated at each end. The terminators are installed in the T-Connectors as part of the prefabricated harness assembly.

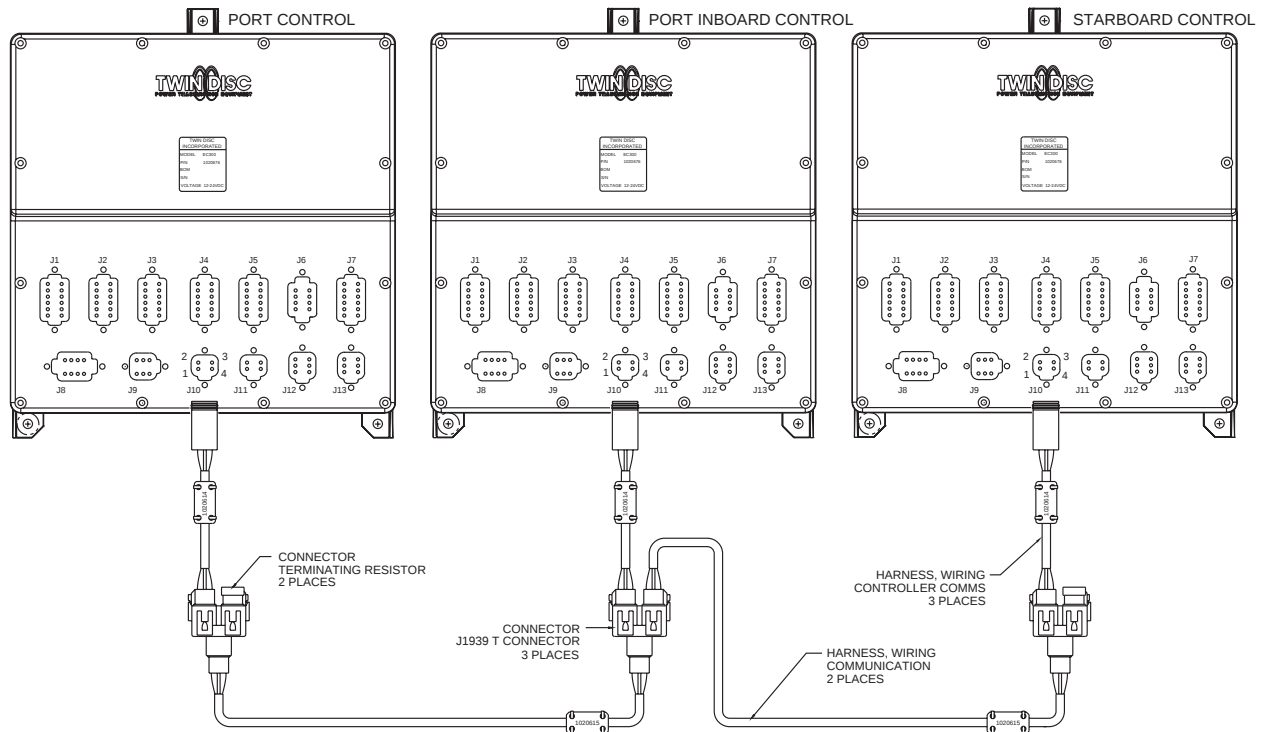


Figure 47. Multiple (more than two) Engine Communication Harness Assembly J10 Installation

Install the Communication Harness Assembly as follows (See Figure 47):

Note: The specific application may have different lengths for each segment of communication harness. Use the correct segments.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Install a J1939 T-Connector receptacle on the 3-pin plug of each Controller Comms Harness.
2. Align the Controller Comms Harness connector with the J10 receptacle of each EC300 Controller and push it in until it snaps into place.
3. Connect the Communication Harness between the EC300 Controllers by installing the 3-pin plugs into the J1939 T-Connector receptacles located on the Controller Comms Harness at each EC300 Controller.
4. Install a J1939 Terminating Resistor into the J1939 T-Connector receptacle located at the far ends of the routing path for the Communication Harness Assembly.

Note: Terminating resistors must be installed at each end of the communication harness assembly for the communications to work properly.

5. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Servo Actuator Harness (J11) Installation

Note: The Station Transfer Signal feature will not be available for EC300 Control Installations with Servo Actuators.

The Servo Actuator Harness (J11) provides the interface between the EC300 Controller and the Servo Actuator. The Servo Actuator Harness is pre-fabricated and plugs into the J11 Connector at the EC300 and into the 12-pin connector at the servo actuator. The Servo Actuator Power Harness is fabricated by the installer at the time of installation with components provided by the customer. The J11 Connector contains all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

This section contains the following sub-sections:

- ☐ Servo Actuator Harness Wiring

The following criteria must be met when installing Servo Actuator harness wiring:

- ☐ Battery positive and negative power wires must be 14 American Wire Gauge (AWG) minimum (15 amps max.).

Note: A fuse or circuit breaker is required at the battery or power distribution point for cable protection. The Servo Actuator is internally protected.

- ☐ Refer to General Electrical Installation Guidelines for harness routing guidelines.
- ☐ Power distribution wiring must be insulated. Caps or boots are required at all terminals in order to prevent accidental shorts.
- ☐ The main power wires to the power/interface connector (battery + and battery -) must be routed directly to the battery or a primary distribution panel within 1 m (3.3 ft) of the battery, but not the starter feed.
- ☐ Special requirements apply to vessels with gasoline, liquid petroleum gas (LPG), or Marine Compressed Natural Gas (CNG) engines or to vessels with hazardous areas. Power routing and wiring must meet all applicable codes and standards. Circuit components may have to be rated as Ignition Protected as per SAE J1171 External Ignition Protection of Marine Electrical Devices, UL 1500 Ignition Protection Test to Marine Products, and the electrical system requirements for boats in Title 33 CFR 183.410(a).

- ❑ Do not connect the Servo Actuator's battery + or - power input directly to the engine or any of its electrical components.
- ❑ Connect the servo power wires to the battery for the engine controlled by the Servo Actuator. Port engine servos should be connected to the "port" battery. Starboard engine servos should be connected to the "starboard" battery.
- ❑ Use a good quality connector to connect the power wires to the battery or bus bar and check the wires to be sure they are secure. Do not use simple spring-loaded connectors.
- ❑ DC Distribution must be a two-wire system. Battery return wiring must be routed to the battery and not to the bonding system or the metallic hull. The negative side of the battery must be connected to ground if the system is to be grounded.
- ❑ The electrical load added by the Servo Actuator System is not large. Current is limited to 15 amps at either 12 or 24 VDC. However, in some circumstances, this may require an increase in the capacity of the power distribution system, larger batteries, and/or larger grounding conductors. The customer is responsible for meeting the applicable code and standard requirements.

Servo Actuator Harness Wiring

Install the Servo Actuator Harness as follows (See Figure 48):

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Align the Servo Actuator harness connector with the J11 receptacle of the EC300 Controller and push it in until it snaps into place.
2. Route the Servo Actuator harness to the Servo Actuator.
3. Remove the locking wedge from the Servo Actuator connector.
4. Make a suitable interface harness containing the necessary conductors.

Note: The wires must be a minimum of 14 AWG stranded copper wire.

5. Install the primary battery positive wire into pin 4 of the servo actuator connector.
6. If used, install the auxiliary battery positive wire into pin 5 of the servo actuator connector.
7. Install the ground wire into pin 6 of the servo actuator connector.
8. When all pins have been inserted in the connector body, reinsert the locking wedge into the front of the connector body.
9. Ensure that sealing plugs are installed in all empty connector positions.
10. Align the harness connector with the connector on the Servo Actuator and push it in until it snaps into place.
11. Route the primary positive and the ground wires to the Port battery and connect to the battery.
12. If used, route the auxiliary positive wire to the Starboard battery and connect to the battery.
13. Repeat Steps 1 through 12 for any remaining Servo Actuators that may be used on other EC300 Controllers.

14. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

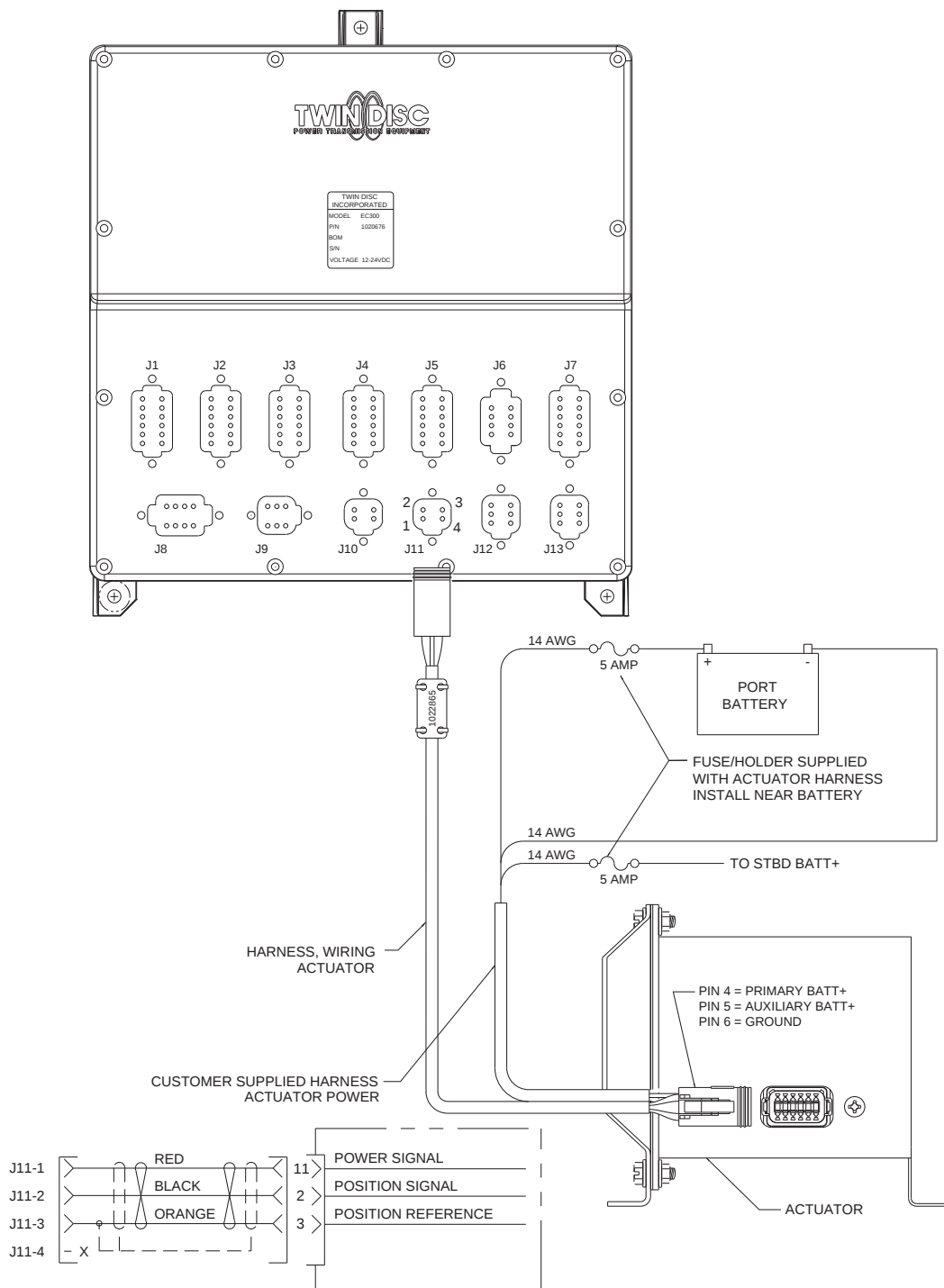


Figure 48. Wiring the Servo Actuator

Station Transfer Signal Wiring Installation

Note: The Station Transfer Signal feature will not be available for EC300 Control Installations with Servo Actuators.

The station transfer signal output circuit is used to alert ships personnel that control of the ship's propulsion system is being transferred from one control station to another via an audible device.

The EC300 station transfer signal output can drive up to one amp of current at a voltage approximately equal to the controller power supply. If the audible device requires higher current or a different voltage, an appropriately sized, customer supplied relay must be used.

Install the station transfer signal output wiring harnesses as follows (See Figure 49).

Note: this installation guide covers only direct connection of the audible device to the EC300 controller.

1. Connect one customer supplied wire to the positive signal input of the audible device.
2. Connect the other customer supplied wire to the negative signal input of the audible device.
3. Route the two wires to the EC300 Control.
4. Remove the locking wedge from the J11 Deutsch connector.
5. Insert the wire for the positive signal input of the audible device into pin 1 of the J11 connector.
6. Insert the wire for the negative signal input of the audible device into pin 4 of the J11 connector.

Note: Refer to the EC300 System Installation Drawings in the Engineering Drawings Section for pin numbering information.

7. When all pins have been inserted in the connector body, reinsert the Deutsch locking wedge into the front of the connector body.

8. Ensure that sealing plugs are installed in all empty connector positions.
9. Align the harness connector with the J11 receptacle of the EC300 Control.
10. Secure all harnesses to a supporting structure with clamps or cable ties per applicable codes and standards.

Note: It may be desirable to complete any other terminations of this harness before securing the harness.

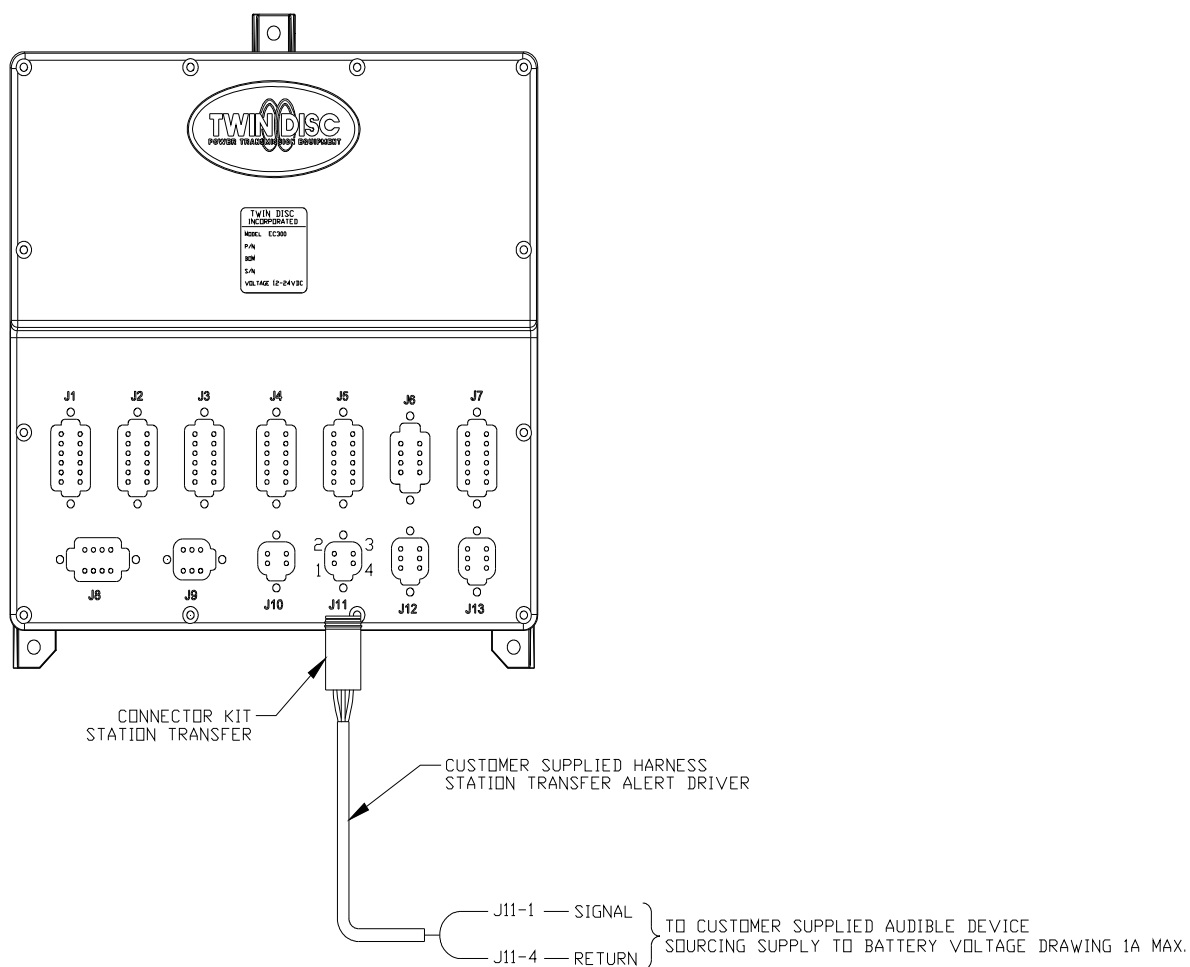


Figure 49. Wiring the Station Transfer Signal

Engine Room Switch Harness (J12) Installation

The Engine Room Switch Harness (J12) provides digital inputs from a transmission oil filter switch, and a transmission oil pressure switch. Not all of these available inputs may be used in any specific application. This instruction does not cover the physical installation of these sensors. Refer to the applicable manufacturer's literature if it is necessary to install these components.

The Engine Room Switch Harness (J12) is pre-fabricated and plugs into the J12 connector at the EC300 Control. The equipment end of the harness is fabricated by the installer at the time of installation with components provided by the customer. The J12 connector contains all contacts and sealing plugs that are required to fill the connector. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

This section contains the following sub-sections:

- ☐ Transmission Oil Filter Differential Pressure Switch Wiring
- ☐ Transmission Oil Pressure Switch Wiring

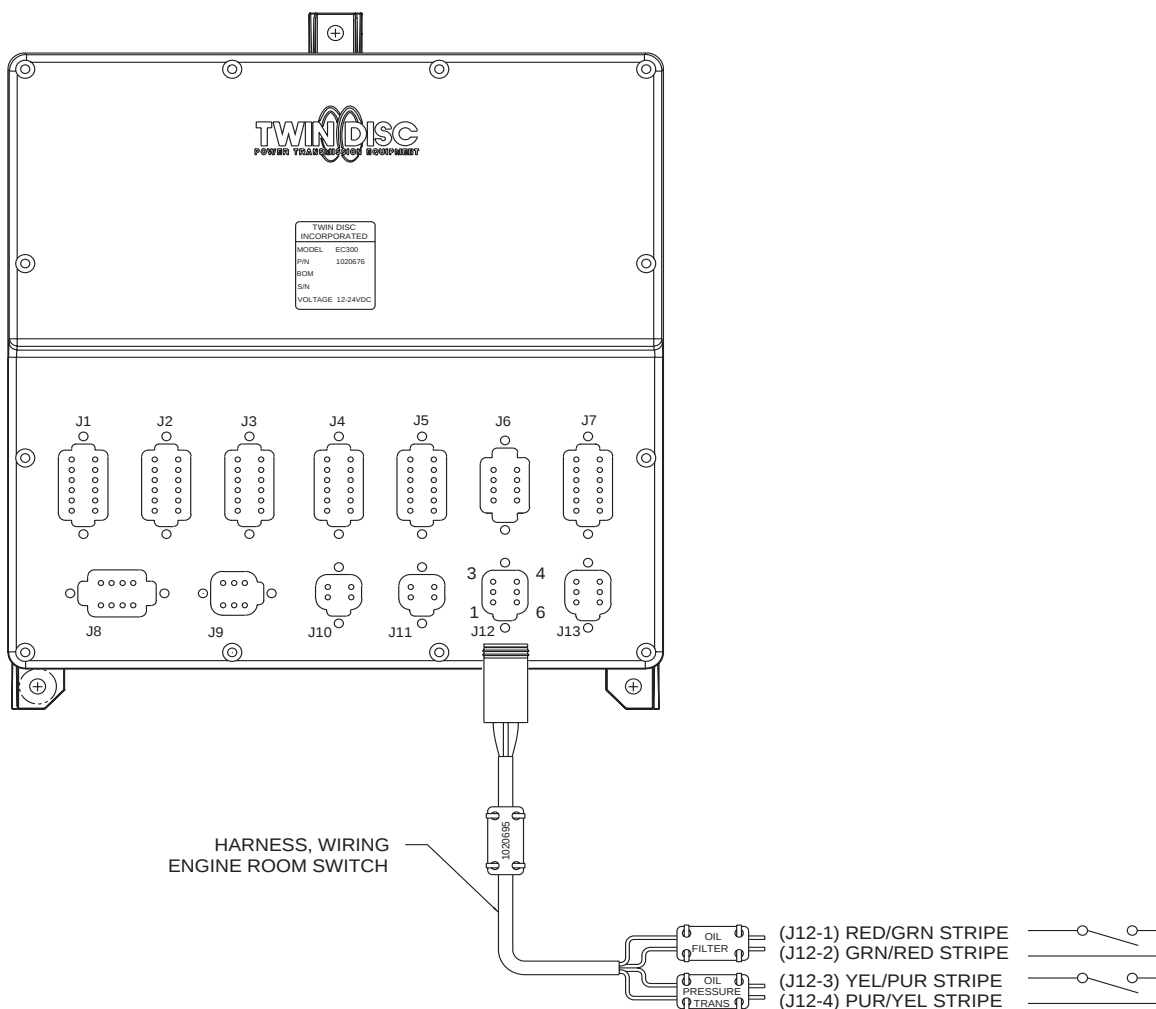


Figure 50. Transmission Switch Harness Wiring Diagram

Transmission Oil Filter Differential Pressure Switch Wiring Installation

Install the wiring connections for a Transmission Oil Filter Differential Pressure Switch as follows (See Figure 49):

Note: The Transmission Oil Filter Differential Pressure Switch Cable is part of the Engine Room Switch harness. Cable ties may be removed for routing purposes.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Align the harness connector with the J12 receptacle of the EC300 Control and push it in until it snaps into place.
2. Route the Engine Room Switch Harness to the Transmission Oil Filter Differential Pressure Switch area.
4. Terminate the red with green stripe "OIL FILTER" J12 pin 1 wire to either screw terminal for the Transmission Oil Filter Differential Pressure Switch.
5. Terminate the green with red stripe "OIL FILTER" J12 pin 2 wire to the other screw terminal for the Transmission Oil Filter Differential Pressure Switch.

Note: Refer to Figure 50 for detailed information about the conductors. Refer to the transmission manufacturer's technical manual for any recommendations for terminating the wires. Refer to Wire Connections for other requirements.

6. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

Transmission Oil Pressure Switch Wiring Installation

Install the wiring connections for a Transmission Oil Pressure Switch as follows (See Figure 49):

Note: The Transmission Oil Pressure Switch cable is part of the Engine Room Switch harness. Cable ties may be removed for routing purposes.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. If not already completed, align the harness connector with the J12 receptacle of the EC300 Control and push it in until it snaps into place.
2. If not already completed, route the Engine Room Switch Harness to the Transmission Oil Pressure Switch area.
4. Terminate the light blue with brown stripe "OIL PRESSURE SWITCH" J12 pin 3 wire to either screw terminal on the Transmission Oil Pressure Switch.
5. Terminate the brown with light blue stripe "OIL PRESSURE SWITCH" J12 pin 4 wire to the other screw terminal on the Transmission Oil Pressure Switch.
6. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: It may be desirable to complete any other terminations for this harness before securing the harness.

EC300 Control Power and Grounding Harness (J13) Installation

The Control Power and Grounding Harness (J13) provides operating power for the EC300 Controller. This harness is field fabricated and plugs into the J13 connector at the EC300 Controller via the 6-pin Deutsch connector. The EC300 J13 connector is supplied by Twin Disc Incorporated and the wiring harness and equipment end connectors are supplied by the customer. The J13 connector kit (6-pin Deutsch connector) contains all contacts and sealing plugs that are required to fill the connector contact positions. Sealing plugs must be installed into all unused connector contact positions in order to maintain the integrity of the connector.

This section contains the following sub-sections:

- ☐ EC300 Control Power Wiring
- ☐ EC300 Control Bonding Installation

EC300 Control Power Wiring

Note: Using switched power to the EC300 Control is not recommended. However, if standards or agencies require that all electronic circuits have on-off control, then use the same switched power that also feeds the engine controller.

⚠ CAUTION

Controller power or grounding connections can not be made at any conductor through which motor starting current flows. Do not use a connection directly on the engine or starter. Locate the connection as close to the battery as practical.

⚠ CAUTION

Use the same source of power for the EC300 Control as used for the electronically controlled engine, if applicable. Ensure that the circuit current rating is adequate for combined load of the EC300 Control and the engine controller.

⚠ CAUTION

Obtain power either from primary distribution for the engine or directly from the batteries. Primary distribution is the first location to which the heavy-duty battery wires connect. Do not connect downstream of any secondary circuit breaker or fuse.

Power Wiring Requirements

The following criteria must be met when installing power distribution wiring for US installations:

- ☐ Low voltage conductors must comply with SAE standards J1127 Battery Cable or J1128 Low Tension Primary Cable. The insulation temperature rating must meet the requirements of SAE J378 Marine Engine Wiring or UL 1426 Cables for Boats.
- ☐ Electric cables must be constructed of stranded copper conductors, thermoplastic, elastomeric or other insulation, moisture-resistant jackets, and, where applicable, armor and outer-sheathing are to be in accordance with IEC Publication 60092-353, IEEE 1580-2001 or other marine standards acceptable to the American Bureau of Shipping (ABS). All electrical cables for power circuits are to have insulation suitable for a conductor temperature of not less than 60°C (140°F).

- ❑ Battery positive and negative power wires must be 14 American Wire Gauge (AWG) minimum (15 amps max.).
- ❑ Approved fuses or manual-reset trip-free circuit breakers must be used for the EC300 Control System power distribution wiring as per the applicable codes or standards. The fuse or circuit breaker rating must be 15 amps.

Note: A fuse or circuit breaker is required at the battery or power distribution point for cable protection. The EC300 Control is internally protected.

- ❑ A 15A fuse and fuse holder are supplied in the Power Connector Kit (J13).
- ❑ All fuses must meet the general provisions of Article 240 of the National Electrical Code or IEC 92-202, as appropriate, and have an interrupting rating sufficient to interrupt the maximum asymmetrical RMS short-circuit current at the point of application. Each fuse must provide for ready access to test the condition of the fuse.
- ❑ Unless otherwise permitted, the fuse or circuit breaker must be located within 178 mm (7 in.) of the point at which the power conductor is connected.

Note: If the wire is continually sheathed or enclosed and if connected directly to a battery terminal, the distance may be up to 1,829 mm (72 in.).

- ❑ Power distribution wiring must be insulated. Caps or boots are required at all terminals in order to prevent accidental shorts.
- ❑ Special requirements apply to vessels with gasoline, liquid petroleum gas (LPG), or Marine Compressed Natural Gas (CNG) engines or to vessels with hazardous areas. Power routing and wiring must meet all applicable codes and standards. Circuit components may have to be rated as Ignition Protected as per SAE J1171 External Ignition Protection of Marine Electrical Devices, UL 1500 Ignition Protection Test to Marine Products, and the electrical system requirements for boats in Title 33 CFR 183.410(a).
- ❑ The main power wires to the power/interface connector (battery + and battery -) must be routed directly to the battery or a primary distribution panel within 1 m (3.3 ft) of the battery, but not the starter feed.

- ❑ Do not connect the EC300 Control's battery + or - power input directly to the engine or any of its electrical components.
- ❑ Connect the EC300 control power wires to the battery for the engine controlled by the EC300 Control. Port engine controls should be connected to the "port" battery. Starboard engine controls should be connected to the "starboard" battery.
- ❑ Use a good quality connector to connect the power wires to the battery or bus bar and check the wires to be sure they are secure. Do not use simple spring-loaded connectors.
- ❑ DC Distribution must be a two-wire system. Battery return wiring must be routed to the battery and not to the bonding system or the metallic hull. The negative side of the battery must be connected to ground if the system is to be grounded.
- ❑ The electrical load added by the EC300 Control System is not large. Current is limited to 15 amps at either 12 or 24 VDC. However, in some circumstances, this may require an increase in the capacity of the power distribution system, larger batteries, and/or larger grounding conductors. The customer is responsible for meeting the applicable code and standard requirements.

Install the control power wiring as follows (See Figure 51 and Figure 52):

The EC300 Control operates on voltages between 10 and 28 VDC. DC to DC converters must be used for other system voltages. Power wiring must be a twisted pair of 14 AWG stranded copper wire.

Note: Figure 51 and Figure 52 show auxiliary batteries as is required by certain codes and standards. If redundant (port and starboard) batteries are present, then use the port battery for the port controller's main battery connection on J13 pin 1. Use the starboard battery for the auxiliary connections on J13 pin 2. Reverse the connector assignments for the starboard EC300 Control.

Note: Figure 51 and Figure 52 both show two single batteries. This is typical for 12 VDC systems using 12 VDC batteries. The 24 VDC system typically connects two 12 VDC batteries in series to obtain 24 VDC. 6 VDC batteries can also be connected in series to achieve either 12 VDC or 24 VDC. Batteries can also be connected in parallel in order to increase the available battery current. Using a multimeter, test the voltage of each battery and across all batteries if multiple batteries are used so as not to exceed the voltage limits for the EC300 Control.

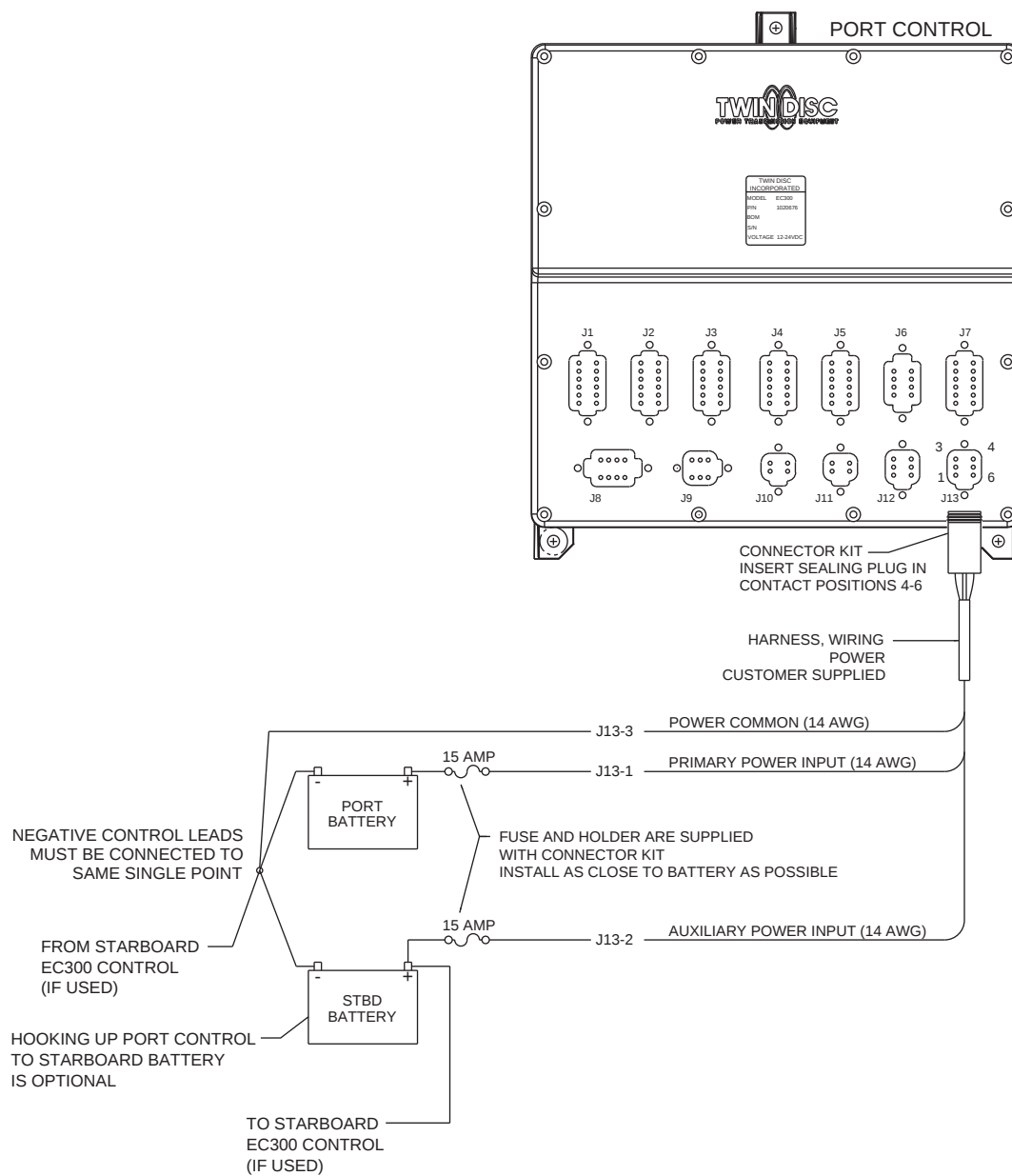


Figure 51. Power Wiring Diagram for Unswitched Engine Powering Applications

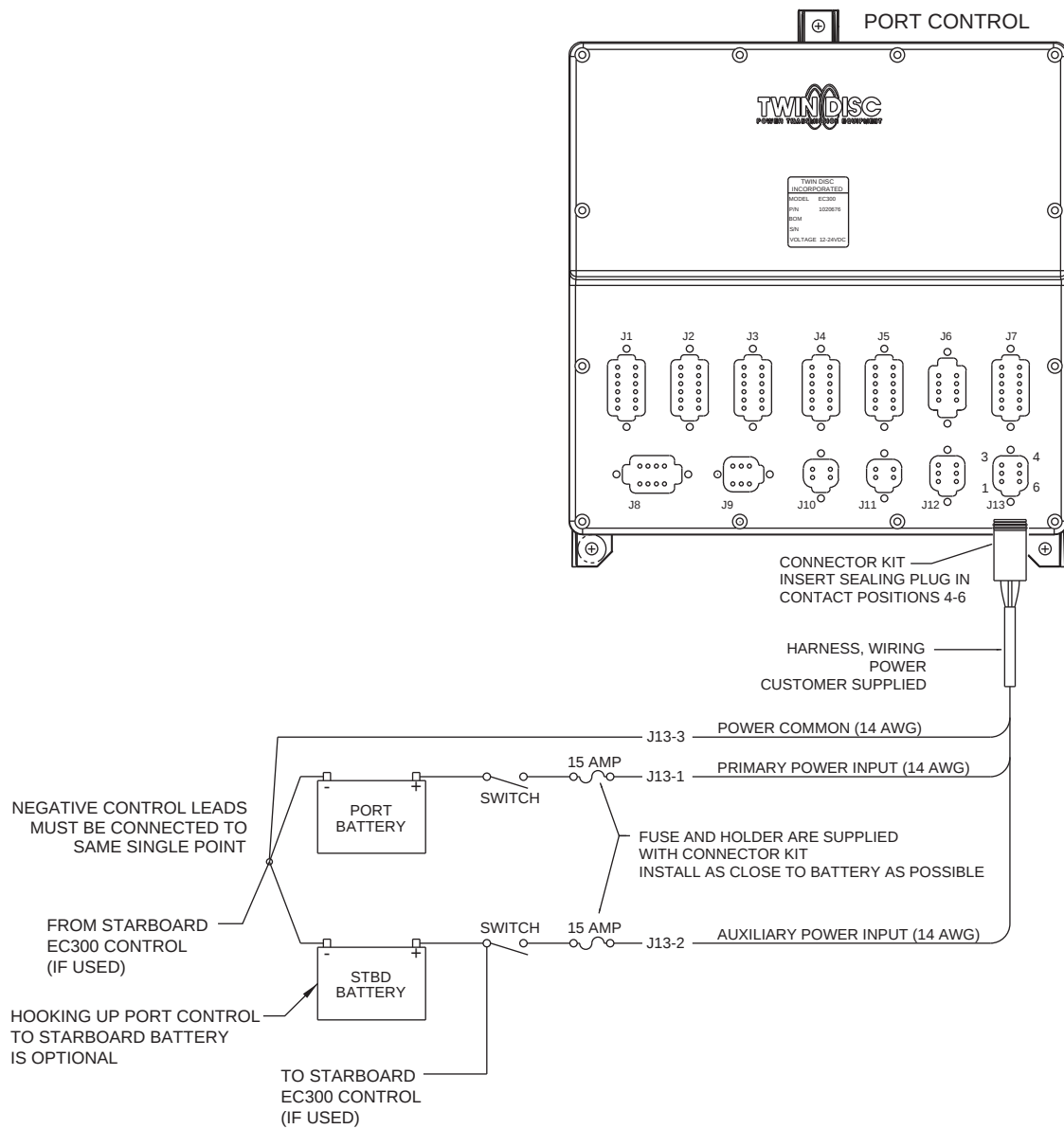


Figure 52. Power Wiring Diagram for Switched Engine Powering Applications

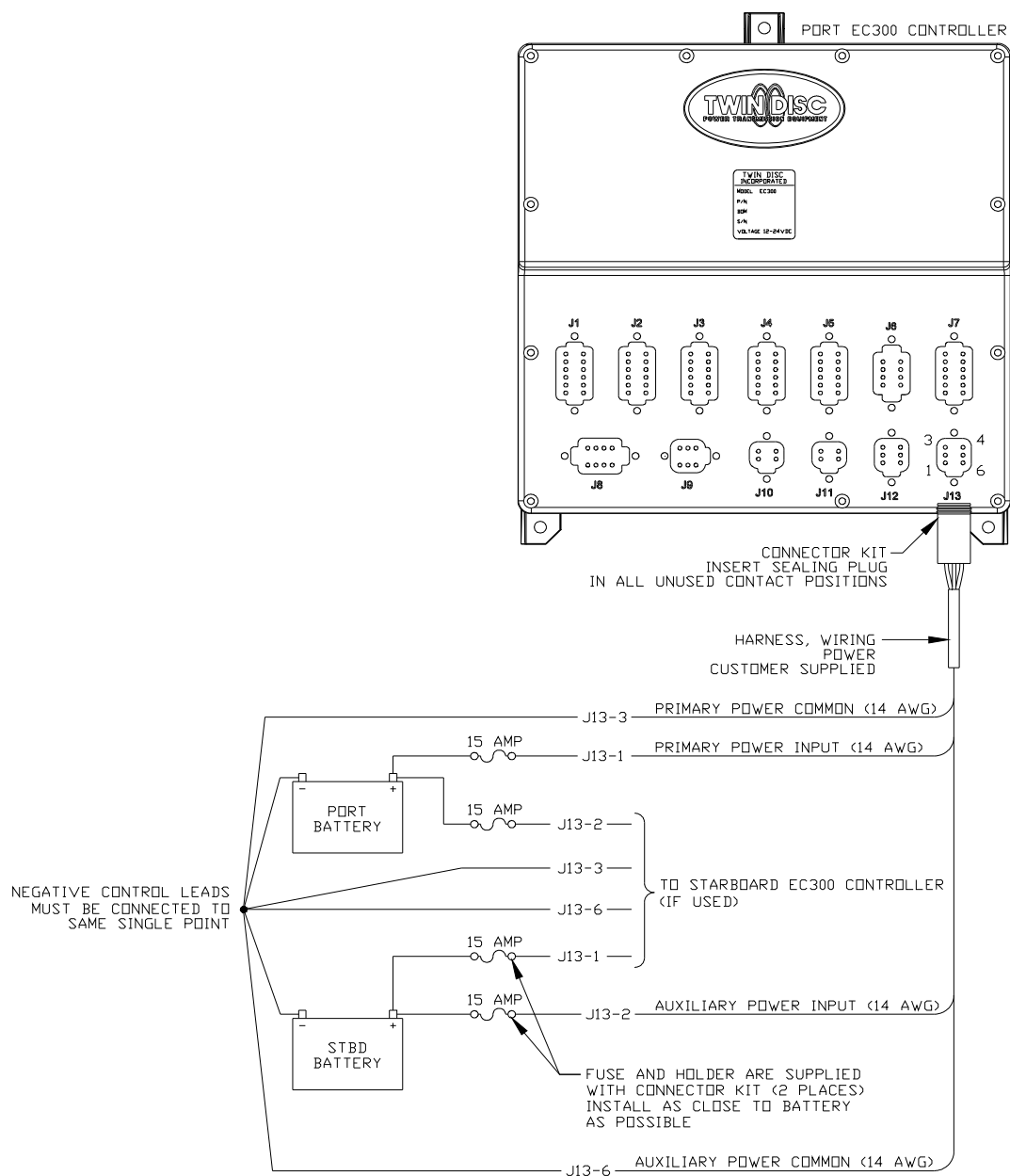


Figure 53. Redundant Power Distribution

Note: Some applicable codes and standards (notably RMRS) require completely redundant wiring between the EC300 controller and the auxiliary power supply. Figure 53 shows the connections for redundant power distribution.

Refer to General Electrical Installation Guidelines before proceeding with this section.

1. Install two fuses or circuit breakers at the battery positive or engine controller power distribution connections.
2. Route power wiring to the fuses or circuit breakers.
3. Temporarily remove the fuses or open the circuit breakers.

Note: Power wiring must be a twisted pair of 14 AWG stranded copper wire.

⚠ CAUTION

Ensure that the EC300 Control power wiring is electrically identical to that used for any associated engine controller.

4. Connect the first red wire going to EC300 Control Connector J13 Pin 1 to the load side of Main Battery fuse or circuit breaker.

Note: If no auxiliary battery is present, do not install a wire to J13 Pin 2. Pin 2 should be plugged.

5. Connect the second red wire going to EC300 Control Connector J13 Pin 2 to the load side of the Auxiliary Battery fuse or circuit breaker.

⚠ CAUTION

The two batteries and the EC300 Controller's negative power connection must be made at the same point.

6. Connect the yellow (preferred) or black wire going to EC300 Control Connector J13 Pin 3 to the DC Grounding Bus or the DC Negative Bus as is applicable.
7. Route the EC300 Control Power and Grounding Harness (J13) to the associated EC300 Control.

Note: The Deutsch contacts (14 AWG) (P/N 0462-209-16141) have a green band.

8. Using the Deutsch crimping tool (P/N HDT 48-00), crimp the wires to the Deutsch contacts (14 AWG) (P/N 0462-209-16141).

9. Assemble the J13 Deutsch Mating Connector (P/N DT06-6S-P012). See Figure 51 and Figure 52.
10. Ensure that sealing plugs are installed in all empty connector positions.
11. Secure all harnesses to a supporting structure with clamps or cable ties at 406 mm (16 in.) intervals.

Note: For vessels complying with American Bureau of Shipping (ABS) Rules for Building and Classing Steel Vessels 2002 or Rules for Building and Classing Steel Vessels Under 90 Meters (295 Feet) 2001, insulation resistance of power and lighting cables is to be measured. Appliances connected to the circuits may be disconnected for this test. Each power and each lighting circuit is to have an insulation resistance between conductors and between each conductor and earth of not less than 0.4 Megohms for loads less than 25 amps.

12. Ensure that the power harness conductors for J13 pin 1 through J13 pin 6 are disconnected at both ends.
13. Using a 500 VDC Megohmmeter or equivalent, measure the resistance between each of the following sets of conductors:
 - J13 pin 1 and Earth or Bonding System
 - J13 pin 2 and Earth or Bonding System
 - J13 pin 3 and Earth or Bonding System
14. Verify that all measurements are greater than or equal to 0.4 Megohms.

Note: Leave EC300 Control Power and Grounding Harness (J13) disconnected from the EC300 Control until all wiring has been completed.

EC300 Control Bonding Installation

The EC300 Control enclosure connects directly to the surface on which it is mounted. For both conductive and nonconductive vessels, the bonding connection is also made in order to ensure that the metallic enclosure is bonded. Bonding provides a means of making a controlled path for the removal of electrical noise that could be introduced to the EC300 Control through the wiring by inductive interference from motors or generators or by electromagnetic interference from radar or radios. Applicable codes may prevent bonding connections to the battery negative. Some codes do require that the bonding connection and battery negative are connected at one point only. Other codes require that there be no connection between the bonding system and the battery negative. Install the bonding system as per the applicable code.

⚠ CAUTION

The bonding wire used for the EC300 Control must be connected to the same bonding system as used for the engine. Ground the EC300 Control bonding wire to the negative battery terminal only if the engine is grounded to the negative battery terminal.

Bonding Requirements

The EC300 Control must be bonded. If used, the Servo Actuator and accessories must also be bonded.

Note: EC300 Control System components including Controllers, Servo Actuators, and Accessories that have designated bond points should be mounted on isolating platforms like plywood, starboard, PVC boxes, etc.

Note: Insulated push-pull cable mounting hardware may be necessary to satisfy bond/isolation requirements, especially if the engine block is not grounded to the battery negative. See Push-Pull Cable Installation Kits for Nonconductive Vessels.

The following criteria must be met when making bonding connections:

- ☐ The EC300 Control must be directly bonded to battery negative, bond rails, or hull plates. If the engine is grounded to the battery negative terminal, then the EC300 Control's bond connection should also be to the battery negative. If the vessel or engine has an independent bonding system, then the control should be bonded to the independent bonding system.

- ❑ Bond wires must be connected to one of the unpainted mounting surfaces of the EC300 Control, the Station Doubler, and the Servo Actuator. Any paint must be removed in order to make the bonding connection. The bond wire must be terminated with a ring lug that fits the fastener used to mount the component.
- ❑ The bonding conductor must be 14 AWG stranded copper wire with insulation that is colored green with yellow stripe (preferred) or green to comply with ABYC standards.

Install the EC300 Control bonding connection as follows (See Figure 54 and Figure 55):

1. If EC300 is used with Twin Disc Transmission and the Transmission Harness Series, connect green chassis wire from the transmission harness to one of the unpainted mounting feet of the EC300.

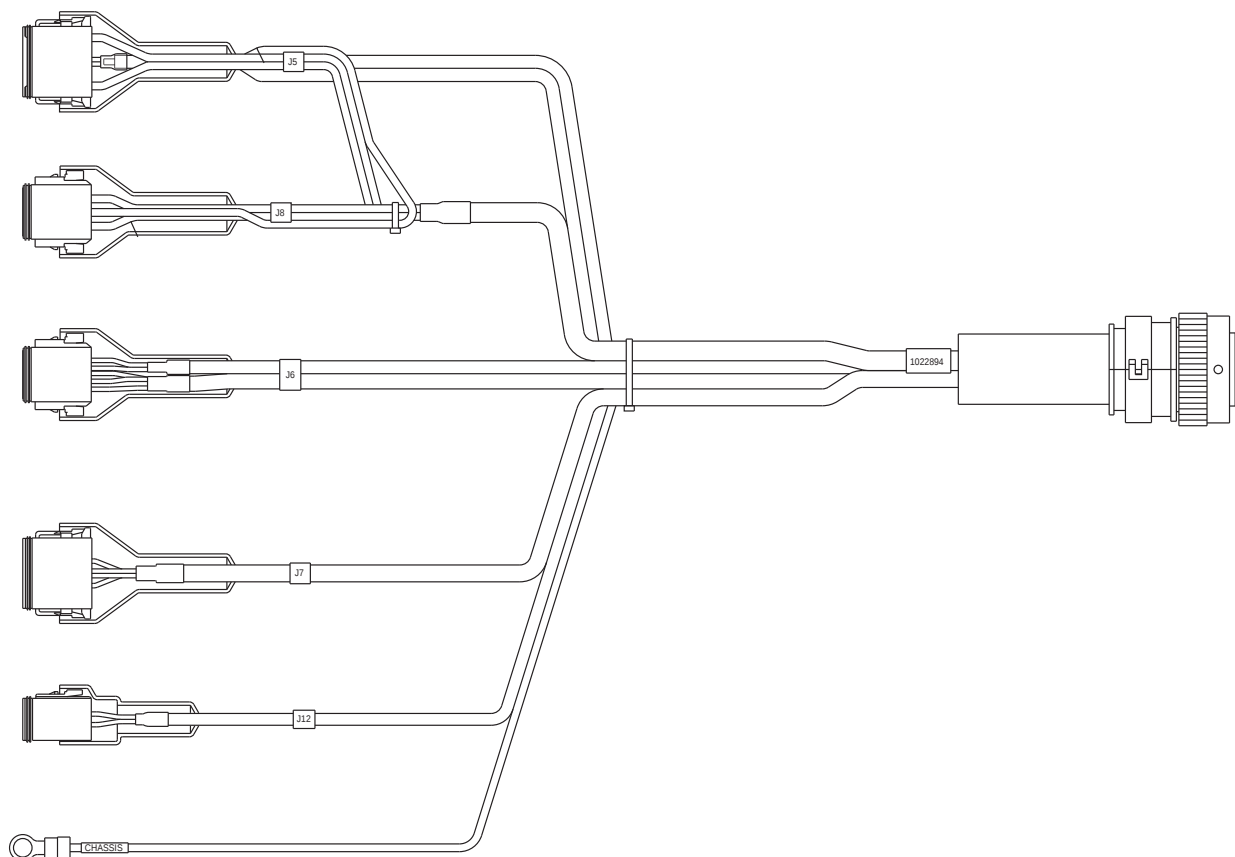


Figure 54. Master Control Harness (J5, J6, J7, J8, J12, and Chassis Wire) Diagram

2. If the EC300 is not wired with transmission harness series, route a bond wire, connected to the vessel bonding system, to one of the unpainted mounting feet of each of the EC300 controls.

Note: If no vessel bonding system is present, the EC300 must be grounded to the engine block.

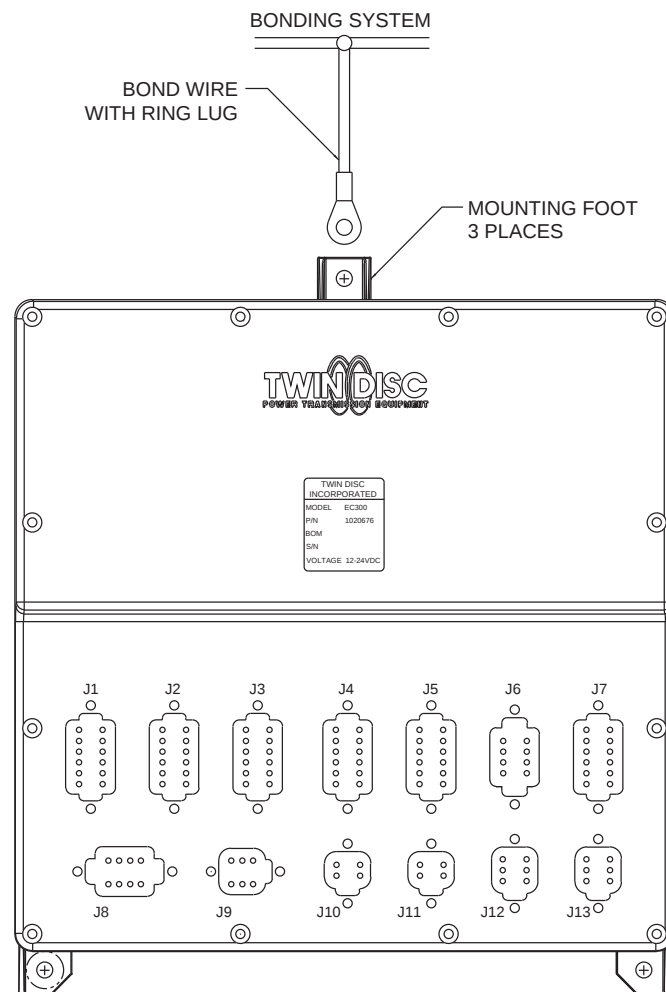


Figure 55. EC300 Control Bond Connection Diagram

3. Install a ring lug on the control end of the wire.

Note: The ring lug must be properly sized for both the wire and the mounting fastener.

4. Remove the mounting fastener at the bonding connection.
5. Remove any paint at the mounting connection in order to ensure electrical contact.
6. Insert the bonding wire's ring lug on the EC300 Control.
7. Reinstall and tighten fasteners up to 1.13 Nm (10 lb-in.) maximum.

Engineering Drawings

List of Engineering Drawings

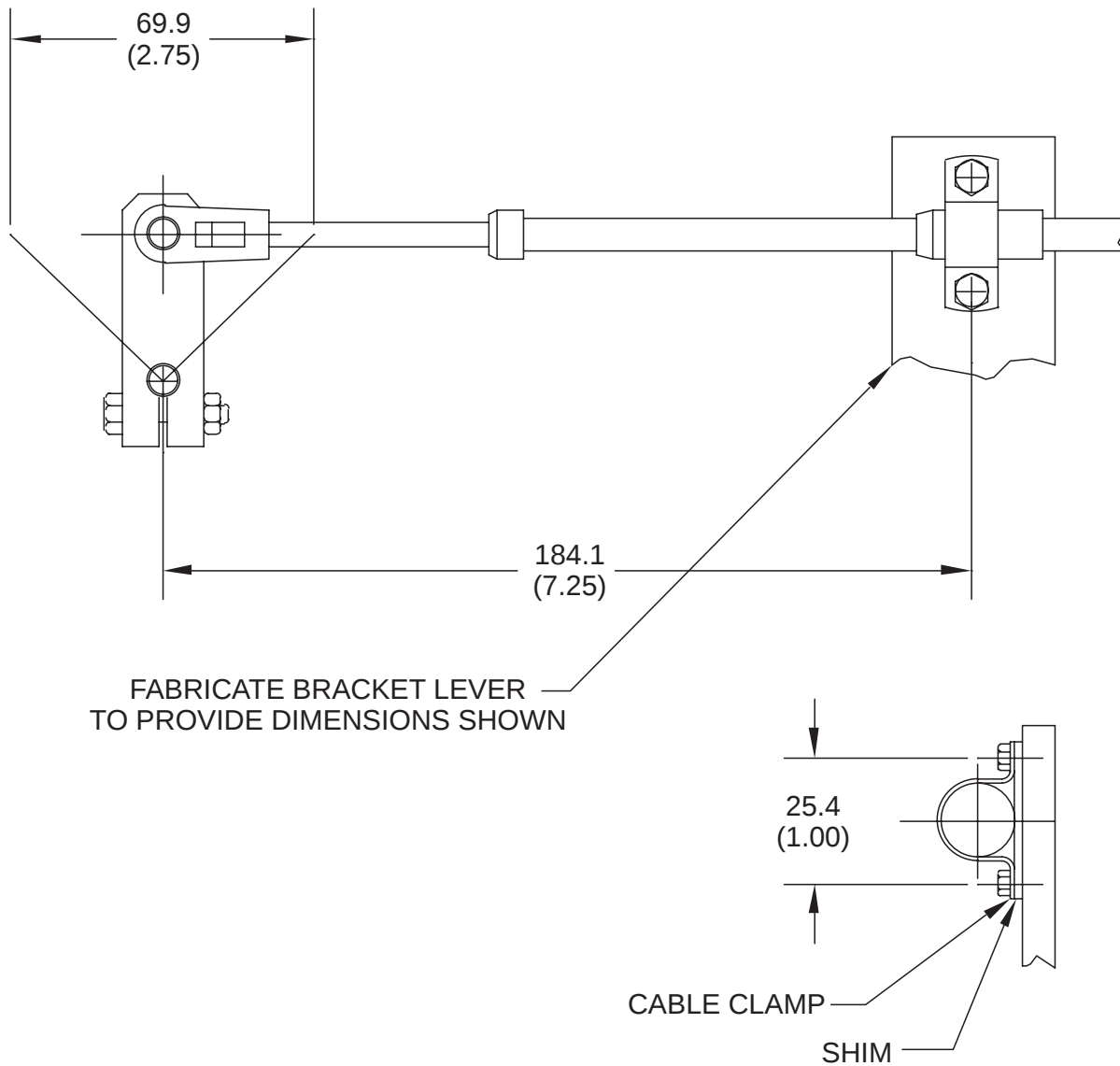
The following pages include the generic engineering drawings that are applicable to the EC300 Control System. These generic drawings are listed below. Application specific drawings may also be applicable and are supplied separately.

Note: Any part numbers listed in the following engineering drawings are for reference only. Please refer to your bill of materials for part numbers specific to your application.

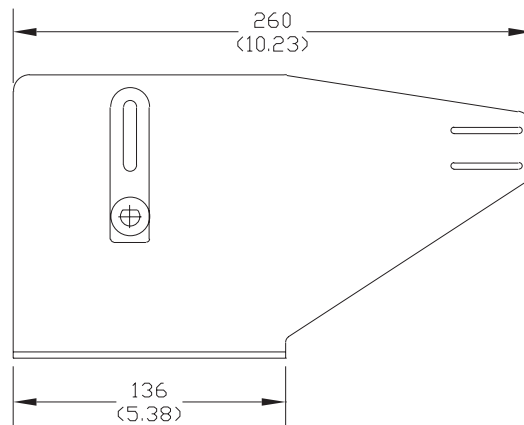
☐		Morse 33 Series Cable Mounting Dimensions
☐		Servo Actuator Mounting Dimensions
☐	1018791	Twin Disc Display Mounting Dimensions
☐		Control Head Mounting Template
☐		Side Mount Lever Mounting Template
☐		Side Mount Selector Assembly Mounting Template

- ☐ 1020676 EC300 Control Mounting Dimensions
Sheet 1
- ☐ 1020676 EC300 Control Mounting Dimensions
Sheet 2
- ☐ System 1 - SingleEngine, 1 Station
- ☐ System 2 - Twin Engine, 2 Stations
Sheet 1 - Port Control
- ☐ System 2 - Twin Engine, 2 Stations
Sheet 2 - Starboard Control
- ☐ System 3 - Twin Engine, 1 Station with
Mechanical Actuators
Sheet 1 - Port Control
- ☐ System 3 - Twin Engine, 1 Station with
Mechanical Actuators
Sheet 2 - Starboard Control
- ☐ 1024103 (page 1 of 2) System Control - EC300 with MAN Engine,
Sheet 1
- ☐ 1024103 (page 2 of 2) System Control - EC300 with MAN Engine,
Sheet 2
- ☐ Wiring Diagram
Sheet 1 - Port Control
- ☐ Wiring Diagram
Sheet 2 - Starboard Control

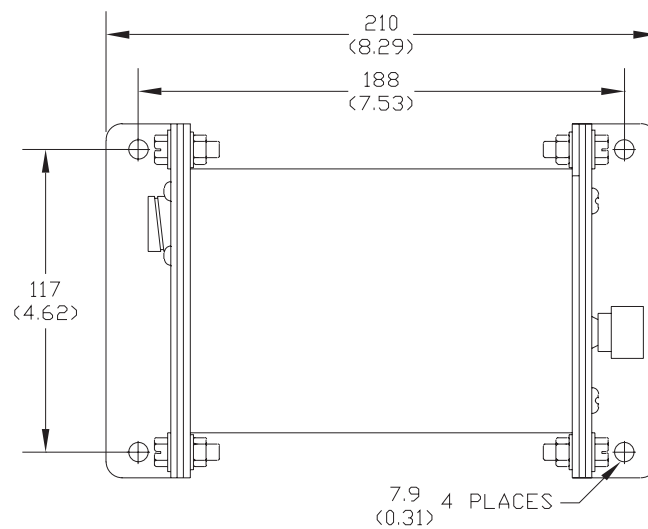
Morse 33 Series Cable Mounting Dimensions



Servo Actuator Mounting Dimensions

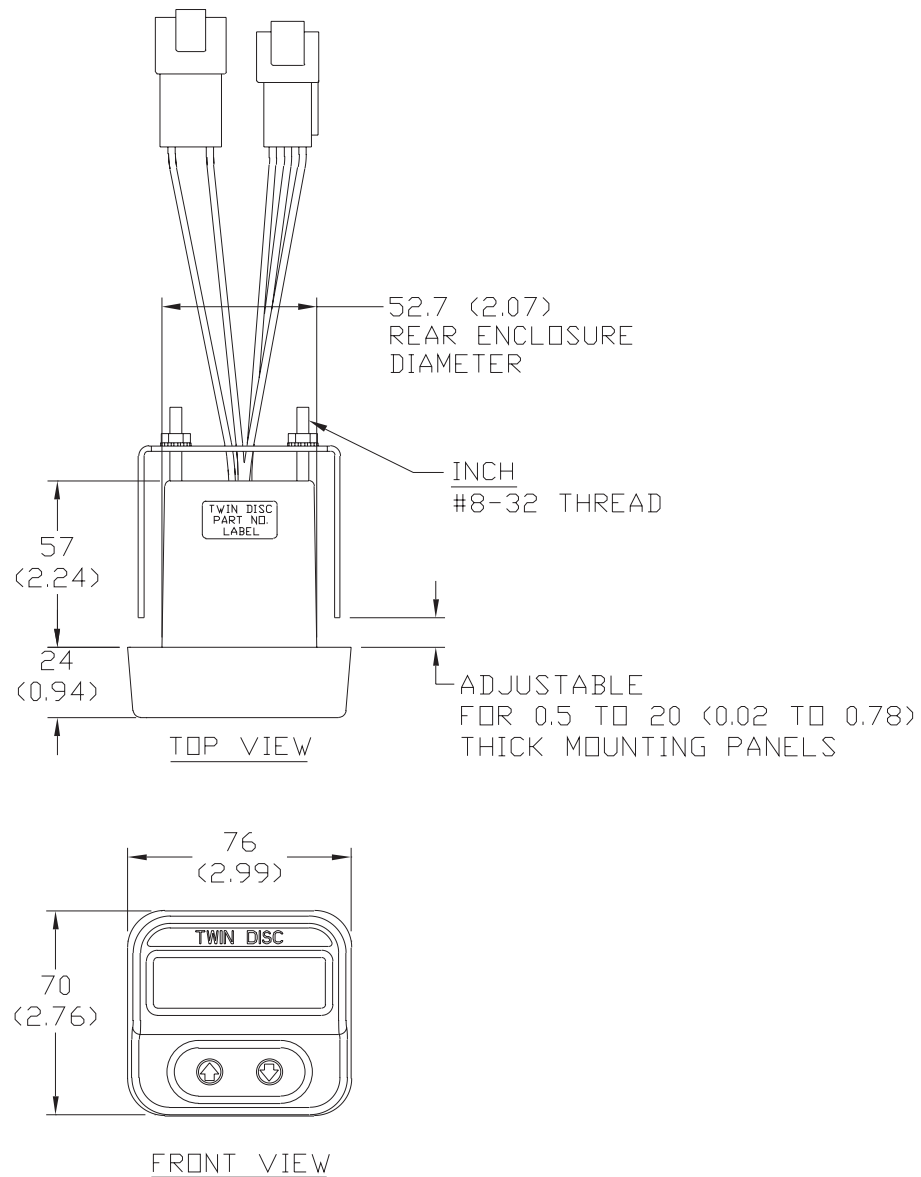


RIGHT SIDE VIEW

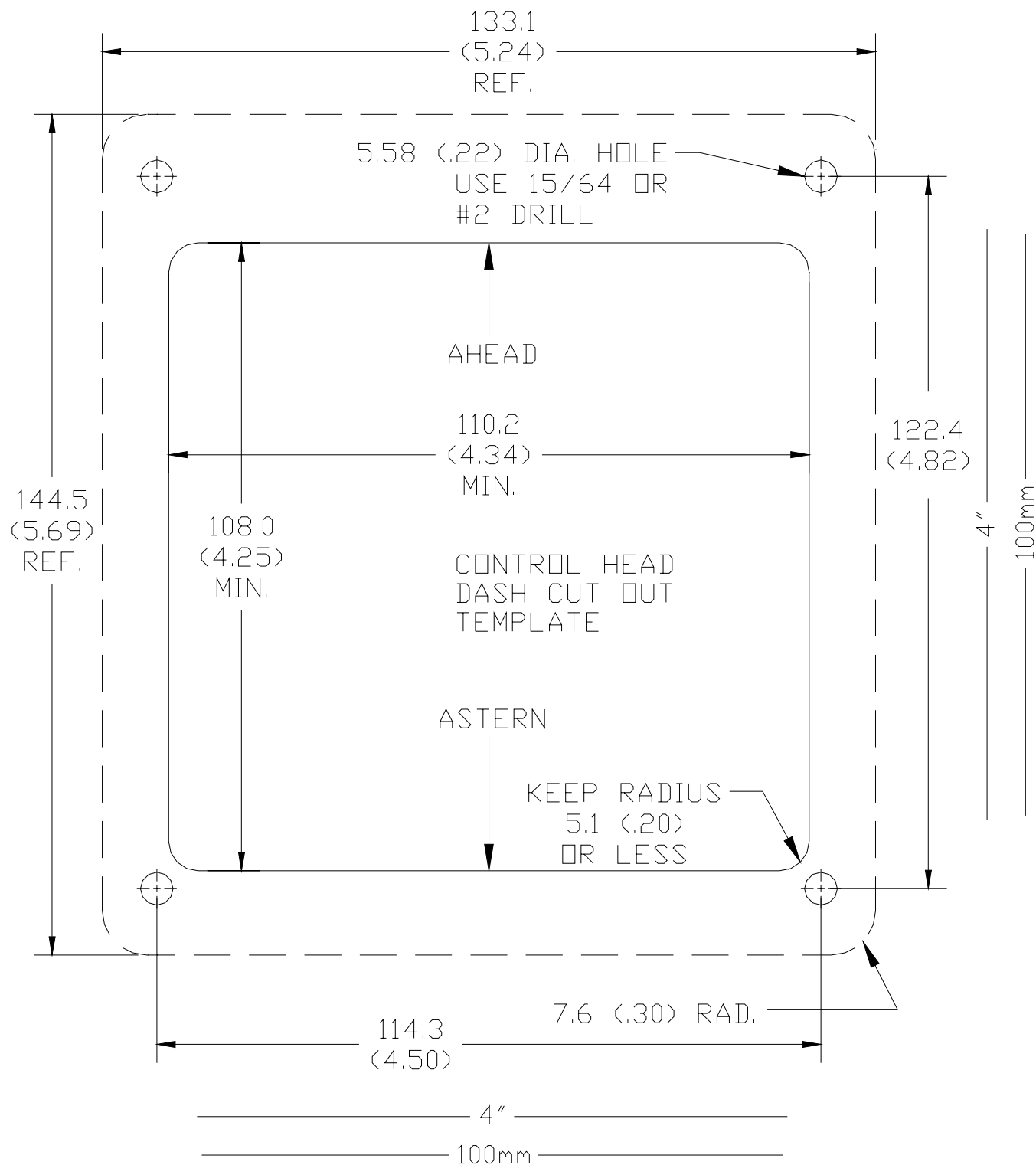


TOP VIEW

Twin Disc Display Mounting Dimensions (1018791)

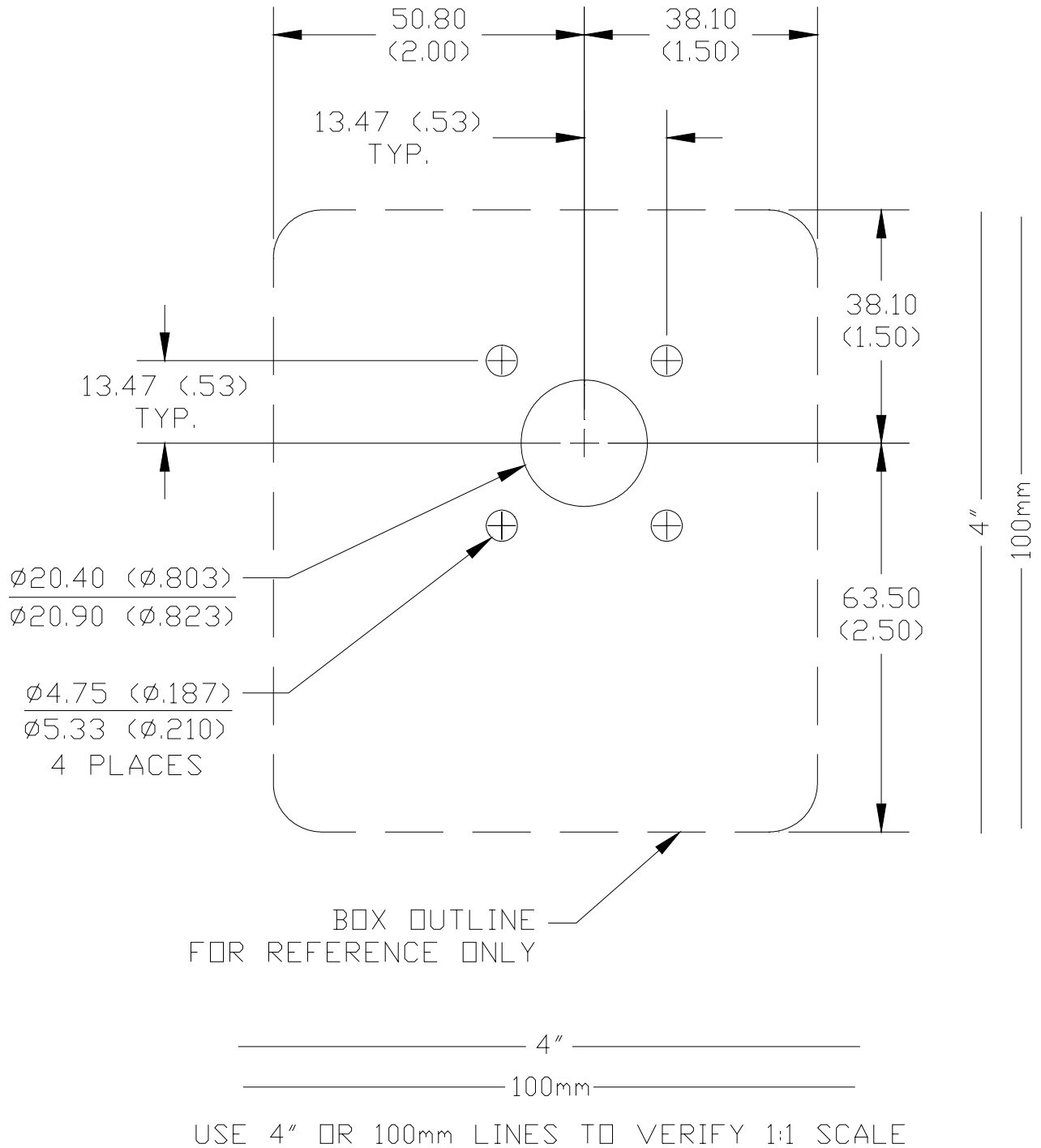


Control Head Mounting Template

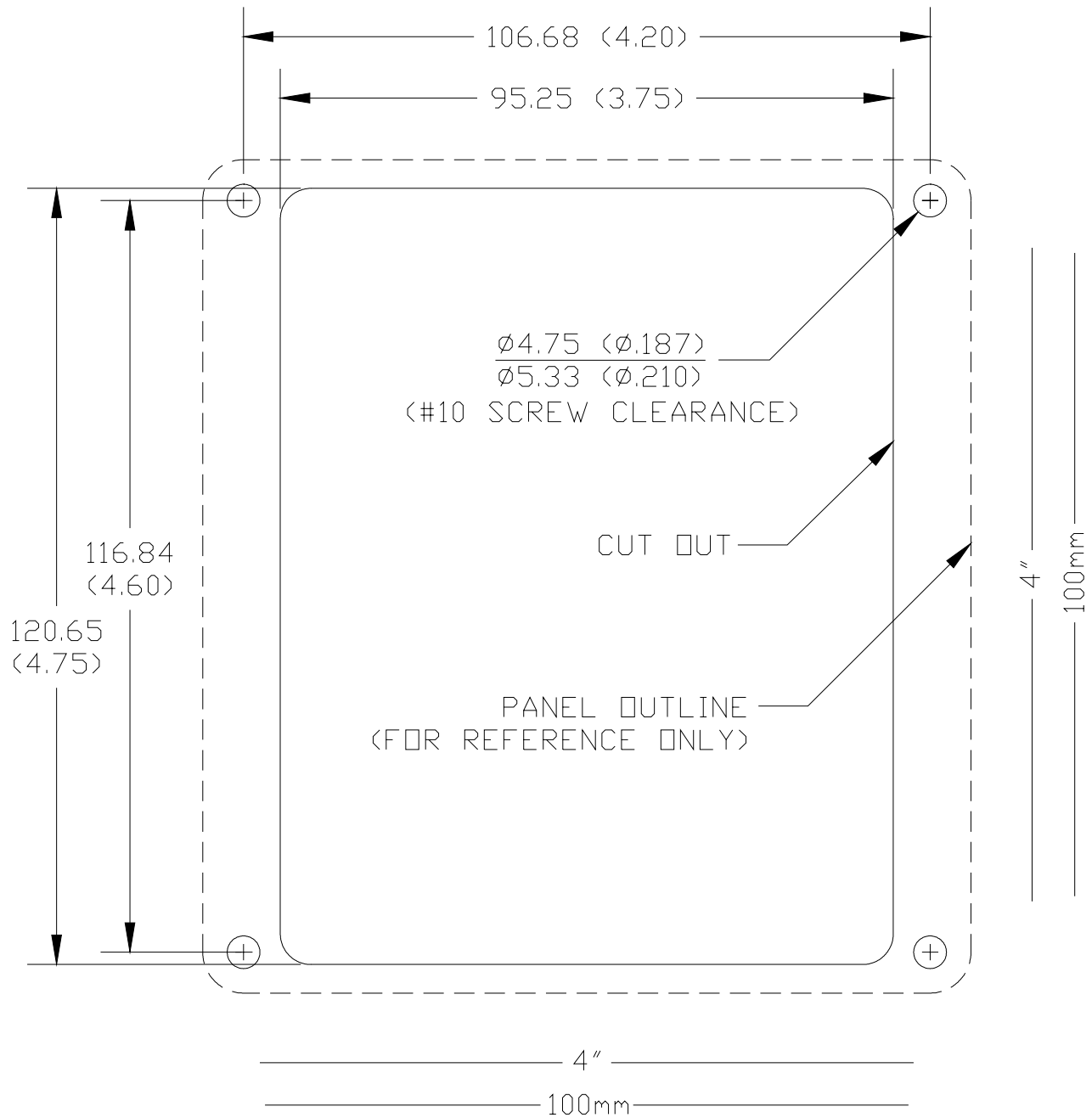


USE 4" OR 100mm LINES TO VERIFY 1:1 SCALE

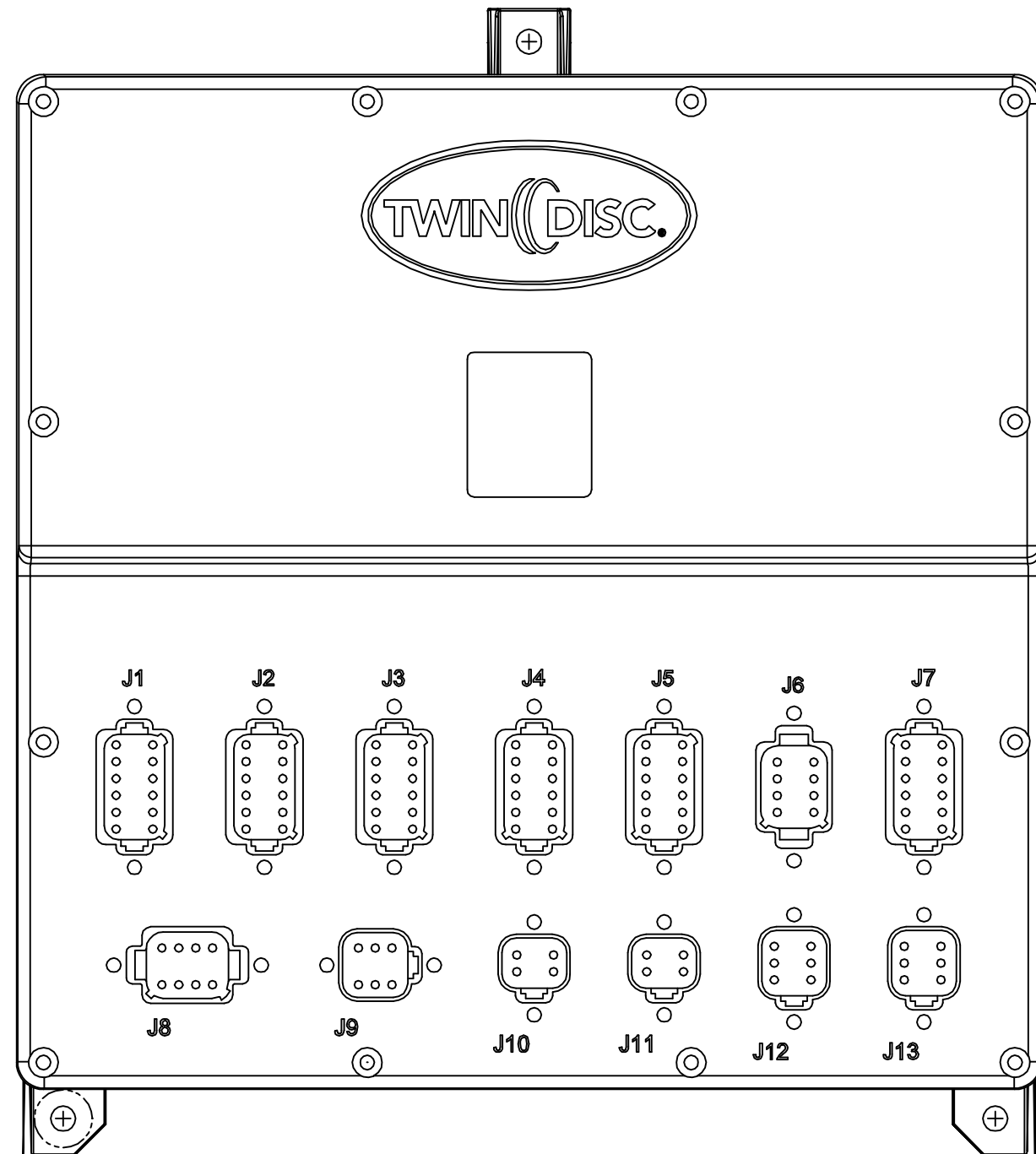
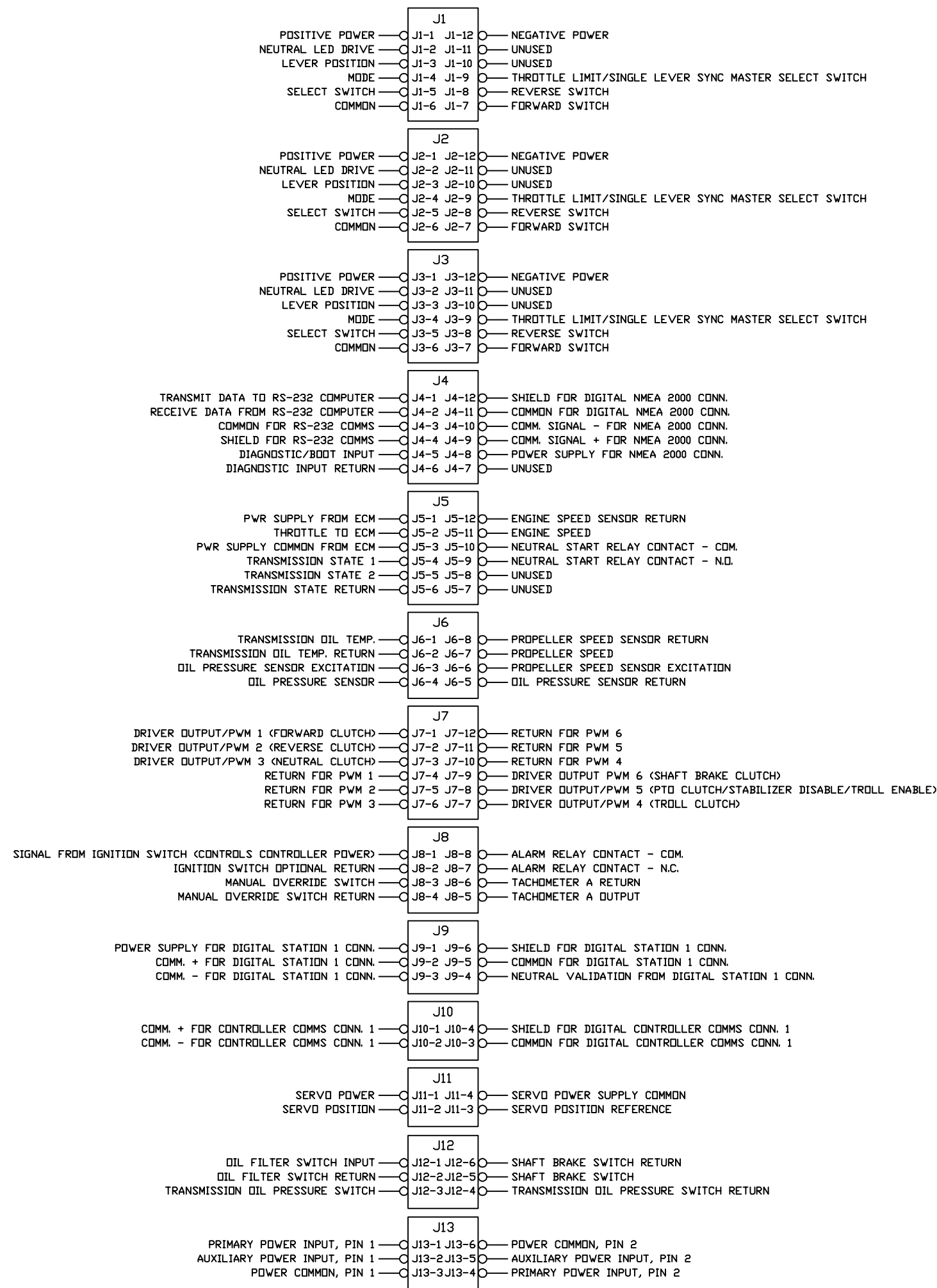
Side Mount Lever Mounting Template

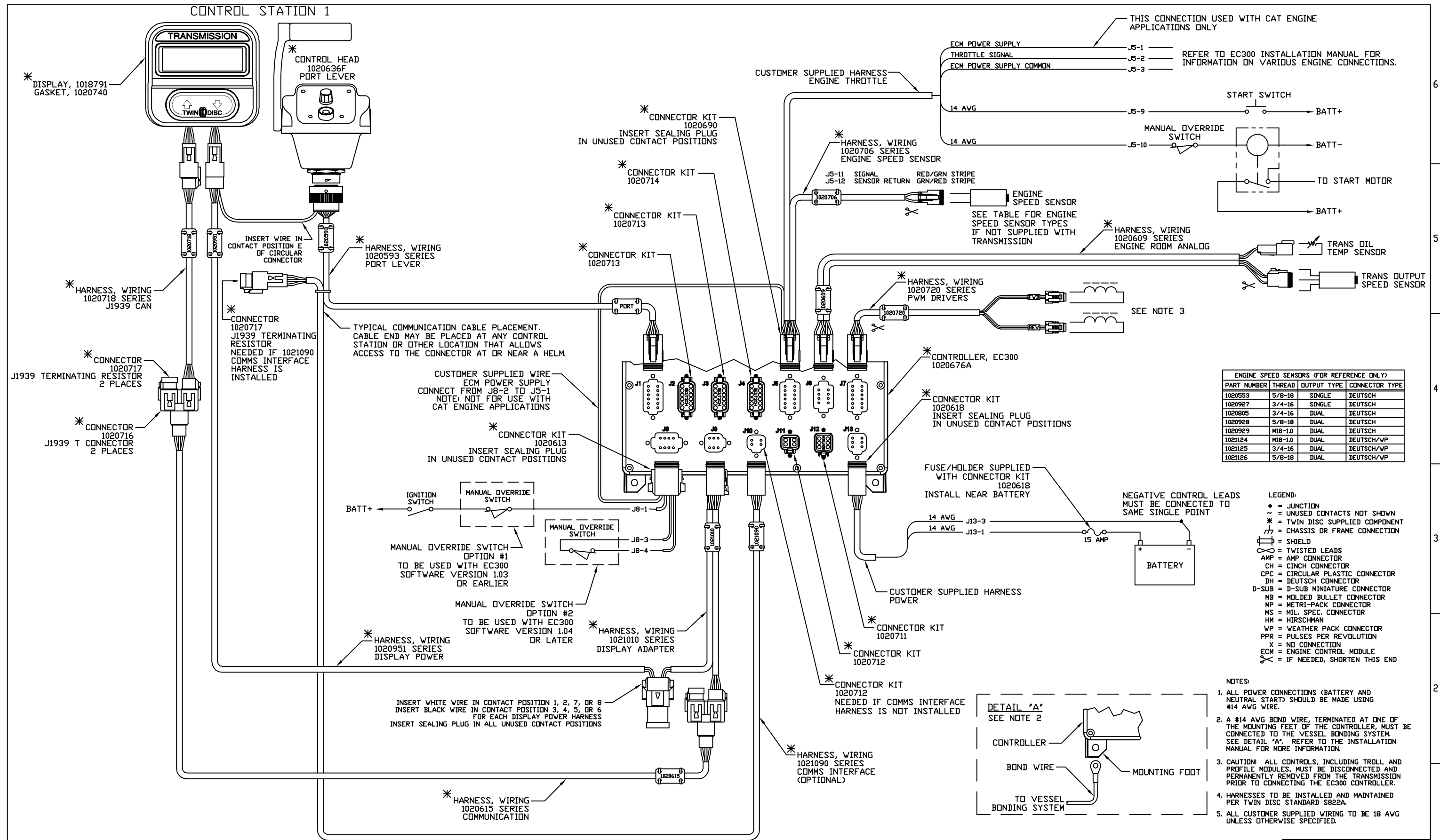


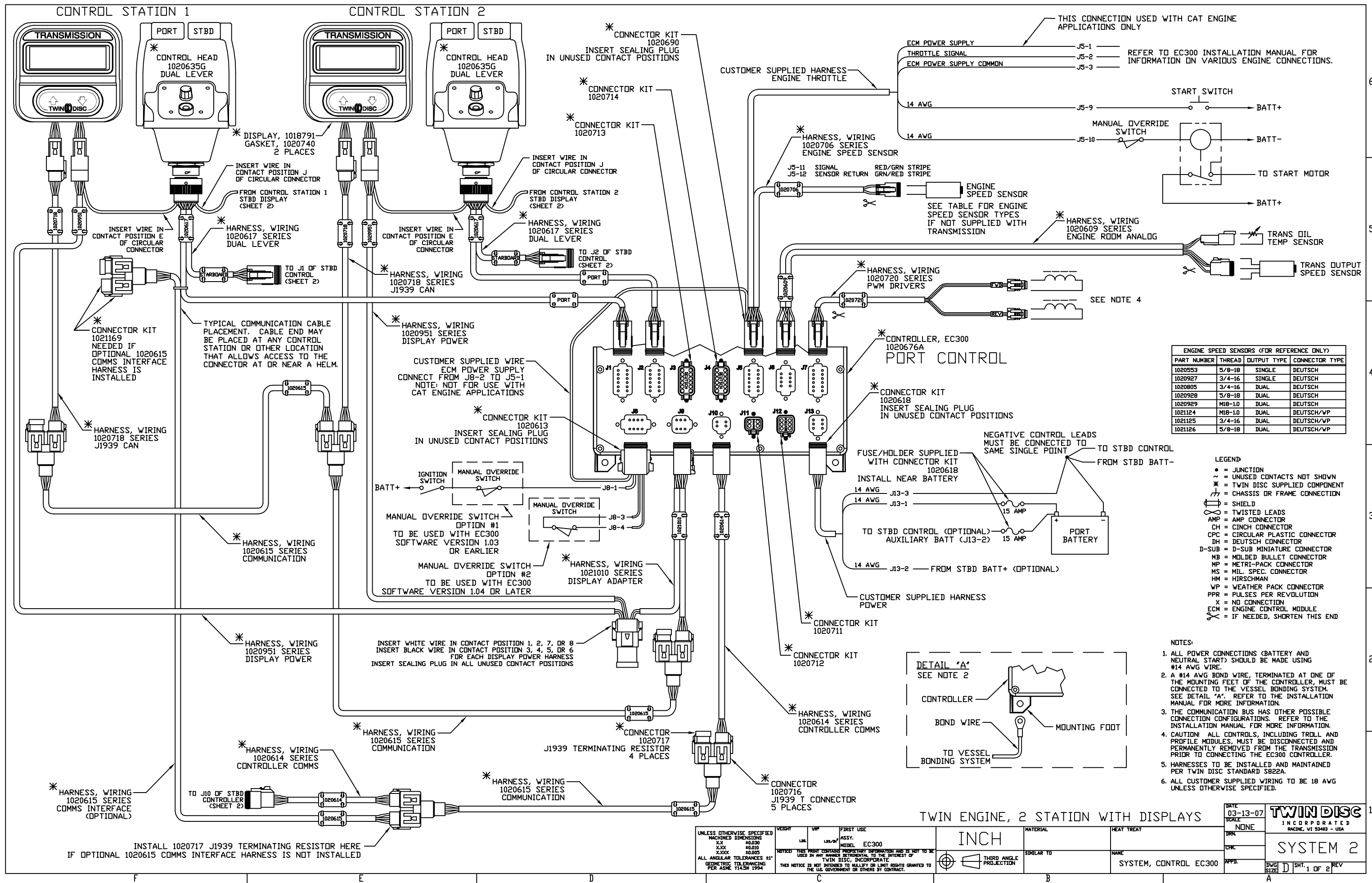
Side Mount Selector Assembly Mounting Template



USE 4" OR 100mm LINES TO VERIFY 1:1 SCALE

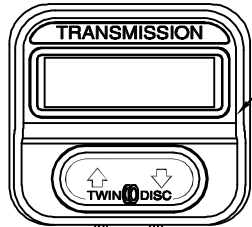
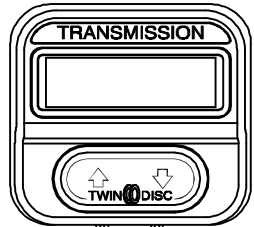






CONTROL STATION 1

CONTROL STATION 2



* DISPLAY, 1018791
GASKET, 1020740
2 PLACES

TO CONTROL STATION 1
CONTROL HEAD
(SHEET 1)

TO CONTROL STATION 2
CONTROL HEAD
(SHEET 1)

* HARNESS, WIRING
1020718 SERIES
J1939 CAN

* HARNESS, WIRING
1020718 SERIES
J1939 CAN

* HARNESS, WIRING
1020615 SERIES
COMMUNICATION

* HARNESS, WIRING
1020951 SERIES
DISPLAY POWER

* HARNESS, WIRING
1020615 SERIES
COMMUNICATION

* CONNECTOR KIT
1020690
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

* CONNECTOR KIT
1020714

* CONNECTOR KIT
1020713

J2 HARNESS SHOWN
ON SHEET 1

J1 HARNESS SHOWN
ON SHEET 1

CUSTOMER SUPPLIED WIRE
ECM POWER SUPPLY
CONNECT FROM J8-2 TO J5-1
NOTE: NOT FOR USE WITH
CAT ENGINE APPLICATIONS

* CONNECTOR KIT
1020613
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

IGNITION SWITCH
MANUAL OVERRIDE SWITCH

MANUAL OVERRIDE SWITCH
OPTION #1
TO BE USED WITH EC300
SOFTWARE VERSION 1.03
OR EARLIER

MANUAL OVERRIDE SWITCH
OPTION #2
TO BE USED WITH EC300
SOFTWARE VERSION 1.04 OR LATER

* HARNESS, WIRING
1020951 SERIES
DISPLAY POWER

* HARNESS, WIRING
1021010 SERIES
DISPLAY ADAPTER

* CONNECTOR
1020716
J1939 TERMINATING RESISTOR
2 PLACES

INSERT WHITE WIRE IN CONTACT POSITION 1, 2, 7, OR 8
INSERT BLACK WIRE IN CONTACT POSITION 3, 4, 5, OR 6
INSERT SEALING PLUG IN ALL UNUSED CONTACT POSITIONS

CUSTOMER SUPPLIED HARNESS
ENGINE THROTTLE

* HARNESS, WIRING
1020706 SERIES
ENGINE SPEED SENSOR

J5-11 SIGNAL RED/GRN STRIPE
J5-12 SENSOR RETURN GRN/RED STRIPE

ECM POWER SUPPLY J5-1
THROTTLE SIGNAL J5-2
ECM POWER SUPPLY COMMON J5-3

THIS CONNECTION USED WITH CAT ENGINE
APPLICATIONS ONLY

REFER TO EC300 INSTALLATION MANUAL FOR
INFORMATION ON VARIOUS ENGINE CONNECTIONS.

START SWITCH

MANUAL OVERRIDE SWITCH

BATT+

BATT-

TO START MOTOR

BATT+

* HARNESS, WIRING
1020609 SERIES
ENGINE ROOM ANALOG

TRANS OIL
TEMP SENSOR

TRANS OUTPUT
SPEED SENSOR

* HARNESS, WIRING
1020720 SERIES
PWM DRIVERS

SEE NOTE 4

* CONTROLLER, EC300
1020676A
STBD CONTROL

* CONNECTOR KIT
1020618
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

FUSE/HOLDER SUPPLIED
WITH CONNECTOR KIT
1020618
INSTALL NEAR BATTERY

14 AWG J13-3
14 AWG J13-1

TO PORT CONTROL (OPTIONAL)
AUXILIARY BATT (J13-2)

14 AWG J13-2 FROM PORT BATT+ (OPTIONAL)

CUSTOMER SUPPLIED HARNESS
POWER

* CONNECTOR KIT
1020711

* CONNECTOR KIT
1020712

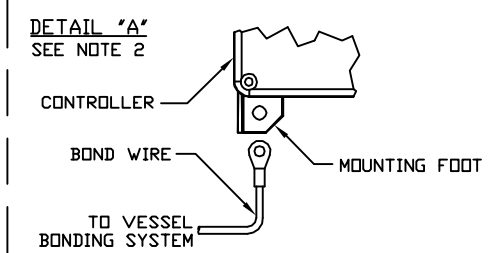
J10 HARNESS SHOWN ON SHEET 1

* CONNECTOR
1020717
J1939 T CONNECTOR
3 PLACES

ENGINE SPEED SENSORS (FOR REFERENCE ONLY)			
PART NUMBER	THREAD	OUTPUT TYPE	CONNECTOR TYPE
1020553	5/8-18	SINGLE	DEUTSCH
1020927	3/4-16	SINGLE	DEUTSCH
1020805	3/4-16	DUAL	DEUTSCH
1020928	5/8-18	DUAL	DEUTSCH
1020929	M18-10	DUAL	DEUTSCH
1021124	M18-10	DUAL	DEUTSCH/VP
1021125	3/4-16	DUAL	DEUTSCH/VP
1021126	5/8-18	DUAL	DEUTSCH/VP

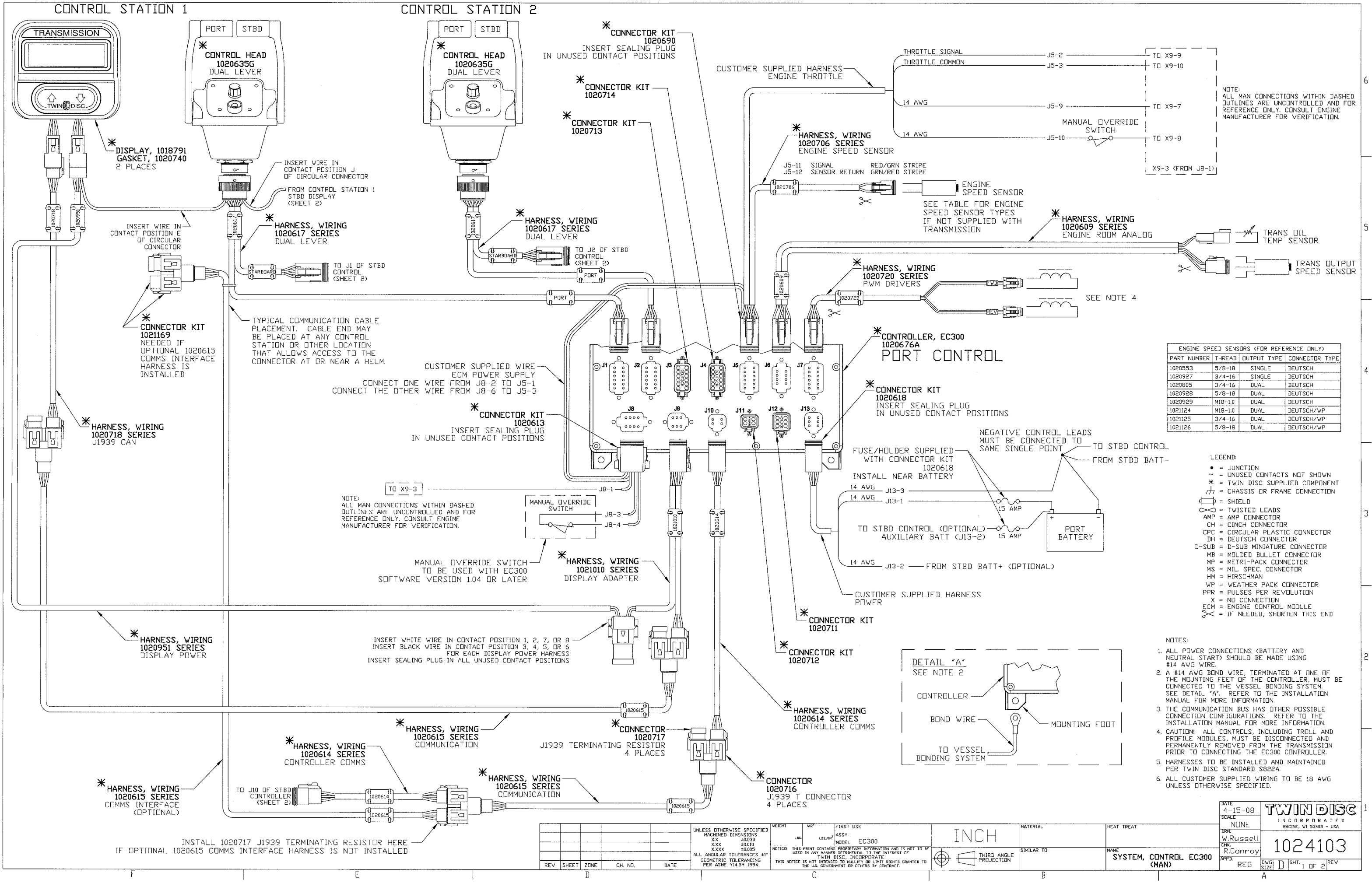
LEGEND:
• = JUNCTION
~ = UNUSED CONTACTS NOT SHOWN
* = TWIN DISC SUPPLIED COMPONENT
CH = CHASSIS OR FRAME CONNECTION
SH = SHIELD
AMP = AMP CONNECTOR
CH = CINCH CONNECTOR
CPC = CIRCULAR PLASTIC CONNECTOR
DH = DEUTSCH CONNECTOR
D-SUB = D-SUB MINIATURE CONNECTOR
MB = MOLDED BULLET CONNECTOR
MP = METRI-PACK CONNECTOR
MS = MIL. SPEC. CONNECTOR
HM = HIRSCHMAN
VP = WEATHER PACK CONNECTOR
PPR = PULSES PER REVOLUTION
X = NO CONNECTION
ECM = ENGINE CONTROL MODULE
= IF NEEDED, SHORTEN THIS END

- NOTES:
1. ALL POWER CONNECTIONS (BATTERY AND NEUTRAL START) SHOULD BE MADE USING #14 AWG WIRE.
 2. A #14 AWG BOND WIRE, TERMINATED AT ONE OF THE MOUNTING FEET OF THE CONTROLLER, MUST BE CONNECTED TO THE VESSEL BONDING SYSTEM. SEE DETAIL "A". REFER TO THE INSTALLATION MANUAL FOR MORE INFORMATION.
 3. THE DISPLAY COMMUNICATION BUS HAS OTHER POSSIBLE CONNECTION CONFIGURATIONS. REFER TO THE INSTALLATION MANUAL FOR MORE INFORMATION.
 4. CAUTION! ALL CONTROLS, INCLUDING TROLL AND PROFILE MODULES, MUST BE DISCONNECTED AND PERMANENTLY REMOVED FROM THE TRANSMISSION PRIOR TO CONNECTING THE EC300 CONTROLLER.
 5. HARNESSES TO BE INSTALLED AND MAINTAINED PER TWIN DISC STANDARD SB22A.
 6. ALL CUSTOMER SUPPLIED WIRING TO BE 18 AWG UNLESS OTHERWISE SPECIFIED.

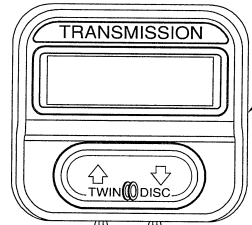


TWIN ENGINE, 2 STATION WITH DISPLAYS

UNLESS OTHERWISE SPECIFIED MACHINED DIMENSIONS XX ±0.030 XX ±0.010 XX ±0.005 ALL ANGULAR TOLERANCES ±1° GEOMETRIC TOLERANCING PER ASME Y14.5M 1994		WEIGHT LBS	VP LBS/IN	FIRST USE ASSY. MODEL EC300	INCH THIRD ANGLE PROJECTION	MATERIAL SIMILAR TO	HEAT TREAT	DATE 03-13-07 SCALE NONE	TWIN DISC INCORPORATED RACINE, WI 53403 - USA	
SYSTEM, CONTROL EC300									SYSTEM 2	
									DWG SIZE D	SHT. 2 OF 2



CONTROL STATION 1



* DISPLAY, 1018791
GASKET, 1020740

TO CONTROL STATION 1
CONTROL HEAD
(SHEET 1)

* HARNESS, WIRING
1020718 SERIES
J1939 CAN

CUSTOMER SUPPLIED WIRE
ECM POWER SUPPLY
CONNECT ONE WIRE FROM J8-2 TO J5-1
CONNECT THE OTHER WIRE FROM J8-6 TO J5-3

* CONNECTOR KIT
1020613
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

NOTE:
ALL MAN CONNECTIONS WITHIN DASHED
OUTLINES ARE UNCONTROLLED AND FOR
REFERENCE ONLY. CONSULT ENGINE
MANUFACTURER FOR VERIFICATION.

MANUAL OVERRIDE SWITCH
TO BE USED WITH EC300
SOFTWARE VERSION 1.04 OR LATER

* HARNESS, WIRING
1020951 SERIES
DISPLAY POWER

INSERT WHITE WIRE IN CONTACT POSITION 1, 2, 7, OR 8
INSERT BLACK WIRE IN CONTACT POSITION 3, 4, 5, OR 6
FOR EACH DISPLAY POWER HARNESS
INSERT SEALING PLUG IN ALL UNUSED CONTACT POSITIONS

* HARNESS, WIRING
1020615 SERIES
COMMUNICATION

* CONNECTOR KIT
1020690
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

* CONNECTOR KIT
1020714

* CONNECTOR KIT
1020713

J2 HARNESS SHOWN
ON SHEET 1

J1 HARNESS SHOWN
ON SHEET 1

* CONNECTOR KIT
1020618
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

* CONTROLLER, EC300
1020676A
STBD CONTROL

* CONNECTOR KIT
1020618
INSERT SEALING PLUG
IN UNUSED CONTACT POSITIONS

FUSE/HOLDER SUPPLIED
WITH CONNECTOR KIT
1020618
INSTALL NEAR BATTERY

14 AWG J13-3
14 AWG J13-1

TO PORT CONTROL (OPTIONAL)
AUXILIARY BATT (J13-2)

14 AWG J13-2 FROM PORT BATT+ (OPTIONAL)

CUSTOMER SUPPLIED HARNESS
POWER

* CONNECTOR KIT
1020711

* CONNECTOR KIT
1020712

J10 HARNESS SHOWN ON SHEET 1

* CONNECTOR
1020717
J1939 T CONNECTOR
2 PLACES

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
X.X ±0.030
X.XX ±0.010
X.XXX ±0.005
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING
PER ASME Y14.5M 1994

WEIGHT
LBS
LBS/IN

FIRST USE
ASSY.
MODEL EC300

INCH
THIRD ANGLE
PROJECTION

MATERIAL

HEAT TREAT

NAME
SYSTEM, CONTROL EC300
(MAN)

DATE
4-15-08
SCALE
NONE
DRN
W.Russell
CHK
R.Conroy
APPD
REG
DWG
SIZE
D
SHT
2 OF 2
REV

TWIN DISC
INCORPORATED
RACINE, WI 53403 - USA

1024103

NOTE:
ALL MAN CONNECTIONS WITHIN DASHED
OUTLINES ARE UNCONTROLLED AND FOR
REFERENCE ONLY. CONSULT ENGINE
MANUFACTURER FOR VERIFICATION.

ENGINE SPEED SENSORS (FOR REFERENCE ONLY)			
PART NUMBER	THREAD	OUTPUT TYPE	CONNECTOR TYPE
1020553	5/8-18	SINGLE	DEUTSCH
1020927	3/4-16	SINGLE	DEUTSCH
1020805	3/4-16	DUAL	DEUTSCH
1020928	5/8-18	DUAL	DEUTSCH
1020929	M18-1.0	DUAL	DEUTSCH
1021124	M18-1.0	DUAL	DEUTSCH/VP
1021125	3/4-16	DUAL	DEUTSCH/VP
1021126	5/8-18	DUAL	DEUTSCH/VP

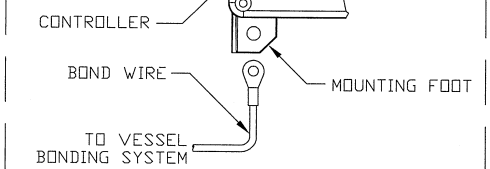
LEGEND:

- = JUNCTION
- ~ = UNUSED CONTACTS NOT SHOWN
- * = TWIN DISC SUPPLIED COMPONENT
- = CHASSIS OR FRAME CONNECTION
- = SHIELD
- = TWISTED LEADS
- AMP = AMP CONNECTOR
- CH = CINCH CONNECTOR
- CPC = CIRCULAR PLASTIC CONNECTOR
- DH = DEUTSCH CONNECTOR
- D-SUB = D-SUB MINIATURE CONNECTOR
- MB = MOLDED BULLET CONNECTOR
- MP = METRI-PACK CONNECTOR
- MS = MIL. SPEC. CONNECTOR
- HM = HIRSCHMAN
- VP = WEATHER PACK CONNECTOR
- PPR = PULSES PER REVOLUTION
- X = NO CONNECTION
- ECM = ENGINE CONTROL MODULE
- = IF NEEDED, SHORTEN THIS END

NOTES:

- ALL POWER CONNECTIONS (BATTERY AND NEUTRAL START) SHOULD BE MADE USING #14 AWG WIRE.
- A #14 AWG BOND WIRE, TERMINATED AT ONE OF THE MOUNTING FEET OF THE CONTROLLER, MUST BE CONNECTED TO THE VESSEL BONDING SYSTEM. SEE DETAIL "A", REFER TO THE INSTALLATION MANUAL FOR MORE INFORMATION.
- THE DISPLAY COMMUNICATION BUS HAS OTHER POSSIBLE CONNECTION CONFIGURATIONS. REFER TO THE INSTALLATION MANUAL FOR MORE INFORMATION.
- CAUTION! ALL CONTROLS, INCLUDING TROLL AND PROFILE MODULES, MUST BE DISCONNECTED AND PERMANENTLY REMOVED FROM THE TRANSMISSION PRIOR TO CONNECTING THE EC300 CONTROLLER.
- HARNESSES TO BE INSTALLED AND MAINTAINED PER TWIN DISC STANDARD S822A.
- ALL CUSTOMER SUPPLIED WIRING TO BE 18 AWG UNLESS OTHERWISE SPECIFIED.

DETAIL "A"
SEE NOTE 2



Appendix - A

Environmental Specifications

Table 13. Environmental Specifications

Parameter	Minimum Value	Maximum Value
Supply Voltage	10.5 Volts	30.0 Volts
Operating Temperature	-18° C (0° F)	70° C (158° F)
Storage Temperature	-40° C (-40° F)	80° C (176° F)
Vibration		7.5g (20-20,000 Hz)

The EC300 meets or exceeds ABS requirements and ABYC recommendations for electrical transients, electromagnetic compatibility, chemical resistance, flame resistance, corrosion resistance, submersion in liquids, dust tolerance and electrostatic discharge.

Appendix - B

Engine Connection Requirements

Caterpillar Engine Connection Requirements

This throttle signal configuration is known as a PWM or Duty Cycle. The EC300 sets the throttle signal duty cycle to approximately 9% at idle and 92% at full throttle. Generally, the EC300 is connected to the engine control at the connections designated for the “Primary Throttle Position Sensor” or “TPS”. Depending on the model and harnessing provided, the EC300 Engine Harness (J5) will either be connected to the “Primary Throttle Position Sensor” connector, or directly to the Customer Connector. See Table 14 and Table 15. Refer to the engine manufacturer’s literature to resolve any discrepancies.

Table 14. Engine Connections at Caterpillar’s TPS Connector

EC300 Engine Harness J5	EC300 Signal Description	TPS Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	A (note 1)	Switched Positive (ECM Power)
J5 Pin 2	Throttle Signal	C	Primary Throttle Position Signal
J5 Pin 3	ECM Power Supply Common	B (note 1)	Negative Battery (ECM Power)
1) The battery positive connection to J5-1 should be switched and from ECM wiring. 2) The battery negative connection to J5-3 should be from ECM wiring - not battery bus.			

Table 15. Engine Connections at Caterpillar’s Customer Connector

EC300 Engine Harness J5	EC300 Signal Description	Customer Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	Pin 30	Battery Positive (switched)
J5 Pin 2	Throttle Signal	Pin 10	Primary Throttle
J5 Pin 3	ECM Power Supply Common	Pin 2	Battery Negative

Cummins Engine Connection Requirements

Vary with Type (Series) of Engine

Cummins Centry Engine Connection Requirements

The EC300 supports the Cummins Centry Type 8 engine controller. This controller is used on QSK, QSM-11, 485, 480C, and KTA type engines. The KTA engine is configured for a current loop interface. All other types are voltage interfaces. The EC300 supplies approximately 1.1 volts at idle and 3.95 volts at full throttle when configured as a Cummins voltage output and 5.5 ma at idle and 19.8 ma at full throttle when configured as a Cummins current loop output. All Cummins installations require pin one of J5 on the EC300 controller to be connected to J8, pin 2. A three pin GM Packard Weather Pack connector (12010717) mates with the Cummins OEM throttle connector.

Table 16. Engine Connections at Cummins 50 pin Connector

EC300 Engine Harness J5	EC300 Signal Description	Customer OEM Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	Pin B	Throttle Position (Throttle)
J5 Pin 3	ECM Power Supply Common	Pin A	V Throttle Return (GND)

Cummins Quantum Voltage Type Engine Connection Requirements

This throttle signal configuration is a DC voltage. The EC300 throttle signal is set to approximately 0.1.1 VDC at idle and 3.95 VDC at full throttle. This configuration is typically used with Cummins QSM-11, 485C and QSK models with Quantum series engine controls. Generally, the EC300 is connected to the engine control at the connections designated for the throttle or throttle pot. Depending on the model and harnessing, the EC300 wiring will connect to the "Throttle" or the "OEM" connector. See Table 17 and Table 18. Refer to the engine manufacturer's literature to resolve any discrepancies.

Table 17. Engine Connections at the Cummins Throttle Harness Stub

EC300 Engine Harness J5	EC300 Signal Description	Customer OEM Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	DD Pin B	Throttle Position (Throttle)
J5 Pin 3	ECM Power Supply Common	DD Pin A	V Throttle Return (GND)
Note: Not all QSK Throttle Pot Connectors are "DD".			

Table 18. Engine Connections at the Cummins Quantum QSM-11 Engine with Voltage Control

EC300 Engine Harness J5	EC300 Signal Description	OEM Connector QSM-11	Engine Signal Description
J5 Pin 1	ECM Power Supply	DD Pin C	V Throttle (VTP)
J5 Pin 2	Throttle Signal	DD Pin B	Throttle Position (Throttle)
J5 Pin 3	ECM Power Supply Common	DD Pin A	V Throttle Return (GND)

Detroit Diesel Frequency Engine Connection Requirements
for Frequency Control

Table 19. Engine Connections at the Detroit Diesel Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	MIM Plug DRC 16-24S Pin 14	Series 60 Wiper
J5 Pin 3	ECM Power Supply Common	MIM Plug DRC 16-24S Pin 15	Series 60 RTN

Detroit Diesel Voltage Engine Connection Requirements
for Voltage Control

Table 20. Engine Connections at the Detroit Diesel Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	MIM Plug DRC 16-24S Pin 14	Series 60 Wiper
J5 Pin 3	ECM Power Supply Common	MIM Plug DRC 16-24S Pin 15	Series 60 RTN

Deutz Type 1 Engine Connection Requirements
for Voltage Control

Table 21. Engine Connections at the Deutz Type 1 Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description DSC 1005 60V
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	B8	X4 Pin 81 (note 1) Signal
J5 Pin 3	ECM Power Supply Common	A7	X4 Pin 82 (note 1) Ground
1) Remove wiring from signal input range transformer.			

Deutz Type 2 Engine Connection Requirements
for 4-20mA Loop Control

Table 22. Engine Connections at the Deutz Type 2 Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description W/RSC 671
J5 Pin 1	ECM Power Supply	Terminal F of Gov	From 5550/5570 Governor via Diode
J5 Pin 2	Throttle Signal	Terminal 4 of Speed Control	From 671 Speed Control
J5 Pin 3	ECM Power Supply Common	Terminal 5 of Speed Control	From 671 Module Speed Control
Note: Verify that terminal F of the speed control is switched power (battery +) that will be turned off when the boat is not in use.			

Iveco PWM Engine Connection Requirements
for Pulse Width Modulation Control

Table 23. Engine Connections at the Iveco Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	A (note 1)	Switched Positive (ECM Power)
J5 Pin 2	Throttle Signal	C	Primary Throttle Position Signal
J5 Pin 3	ECM Power Supply Common	B (note 1)	Negative Battery (ECM Power)
1) The battery positive connection to J5-1 should be switched and from ECM wiring. 2) The battery negative connection to J5-3 should be from ECM wiring - not battery bus.			

Iveco Voltage Engine Connection Requirements
for Voltage Control

Table 24. Engine Connections at the Iveco Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	S1 Pin B	Throttle Pot Wiper
J5 Pin 3	ECM Power Supply Common	S1 Pin A	Sensor Return
Note: Connections should be made as close to the Engine Control Unit (ECU) as possible.			

John Deere Engine Connection Requirements

This throttle signal configuration is a DC voltage. The EC300 throttle signal is set to approximately 0.50 VDC at idle to 4.50 VDC at full throttle. This configuration is similar to the voltage types explained above; however, see the engine manual for complete details on interconnections for throttle input to the engine harness/engine control.

Table 25. Engine Connections at the John Deere Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector W/SE4/ECU	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8, Pin 2	
J5 Pin 2	Throttle Signal	S1 Pin B	Throttle Pot Wiper
J5 Pin 3	ECM Power Supply Common	S1 Pin A	Sensor Return
Note: Connections should be made as close to the Engine Control Unit (ECU) as possible.			

MAN Current Engine Connection Requirements

for 4-20mA Loop Control

This throttle configuration is a current loop and is set to approximately 3.8 mA at idle and 20.3 mA at full throttle. See the MAN engine manual for complete details on interconnections for throttle input to the engine harness/engine control.

Table 26. Engine Connections at the MAN Engine with Current Control

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description
J5 Pin 1	ECM Power Supply	J8 Pin 2	Ignition Return
J5 Pin 2	Throttle Signal	X9 Pin 9	4-20 MA (+)
J5 Pin 3	Throttle Common	X9 Pin 10 and to J8 Pin 6	4-20 MA (-) Battery (-) from T531
J5 Pin 9	Neutral Start Relay Contact (normally open)	X9 Pin 7	Neutral Start Interlock
J5 Pin 10	Neutral Start Relay Contact (common)	X9 Pin 8	Neutral Start Interlock

Table 27. Previous Engine Connection Diagram (NOW OBSOLETE)

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector (note 1)	Engine Signal Description
J5 Pin 1	ECM Power Supply	X9 Pin 7	Battery from T515
J5 Pin 2	Throttle Signal	X9 Pin 9	4-20 MA (+)
J5 Pin 3	ECM Power Supply Common	X9 Pin 10 and Pin 8	4-20 MA (-) Battery (-) from T531
Note: Wiring may be required inside MAN engine control to get switched battery (+) (terminal 15) to wiring side of connector X9 Pin 7.			

Note: The connections shown in table 27 are OBSOLETE and should NOT be used. They are shown only for reference.

MAN has indicated the engine warranty will become void if controller connections use MAN power or common references.

MTU Engine Connection Requirements

for 4-20mA Loop Control

This throttle signal configuration is a current loop and is set to approximately 3.8 mA at idle and 20.3 mA at full throttle. This configuration is similar to the Cummins current loop explained above; however, see the engine manual for complete details on interconnections for throttle input to the engine harness/engine control.

Table 28. Engine Connections at the MTU Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description W/EL55 (MOEL)
J5 Pin 1	ECM Power Supply	LOP 1 Terminal 91	+ 24 VDC
J5 Pin 2	Throttle Signal	LOP 1 Terminal 83	I in 4-20 MA
J5 Pin 3	ECM Power Supply Common	LOP 1 Terminal 84	GRND
Note: Connections are for MDEC (ECS 5) version only. Check wiring diagram for engine to verify connection terminal numbers for other controls.			

Scania Engine Connection Requirements

This throttle signal configuration is a DC voltage and is set to approximately 0.35 VDC at idle and 3.10 VDC at full throttle. This configuration is similar to the voltage types explained above; however, see the engine manual for complete details on interconnections for throttle input to the engine harness/engine control.

Table 29. Engine Connections at the Scania Engine

EC300 Engine Harness J5	EC300 Signal Description	Engine Connector	Engine Signal Description W/DEC 2
J5 Pin 1	ECM Power Supply	J8, Pin 2	TPSE
J5 Pin 2	Throttle Signal	C36-12	TPSS
J5 Pin 3	ECM Power Supply Common	C36-11	TPSR Ye
+24V	Switched Power	C36-9	Remote Throttle Validation
Note: The +24V signal to C36-9 must be provide to prevent "set" Throttle Limp Home mode.			

Transmission State Signals

The EC300 provides complimentary transmission state signal outputs. These are optically isolated outputs capable of sinking or sourcing 50 mA of current, depending on the wiring configuration. The transmission in neutral output allows current to flow when the EC300 is commanding the transmission to neutral; the transmission in gear output is off in this state. Likewise, the transmission in gear output allows current to flow when the EC300 has engaged either the forward or reverse clutch; the transmission in neutral output is off in this state. The options below depict the various wiring options for these outputs.

Refer to your engine throttle interface specifications to see if these functions are compatible with your engine. These functions are set up by an Authorized Twin Disc Distributor or at the factory.

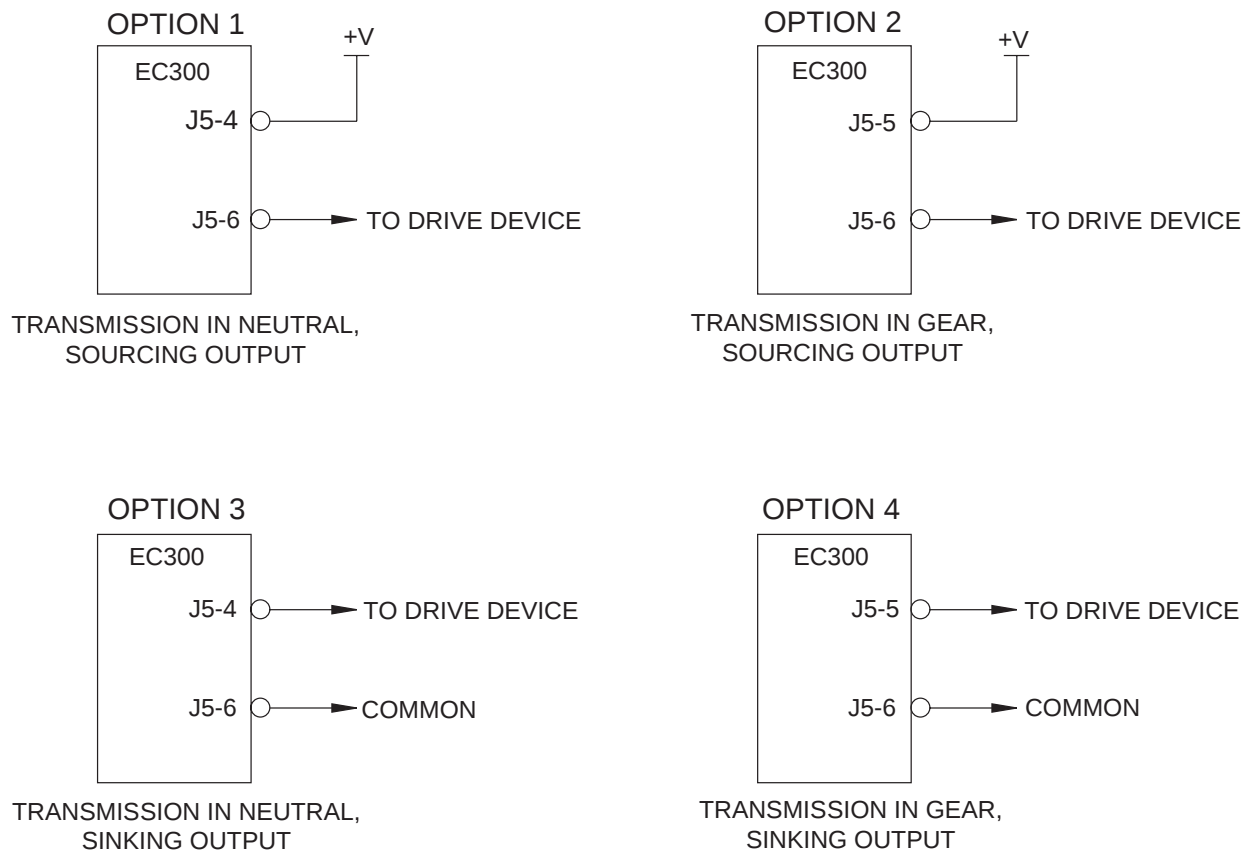


Figure 91. Transmission State Signal Output Diagram

