CAT® MULTI–STATION CONTROL SYSTEM

Installation Guide

CATERPILLAR®

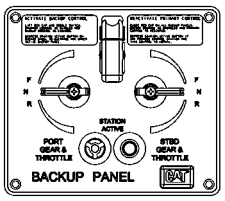
TABLE OF CONTENTS

Contained in this document are installation instructions, required parts, wiring schematics, and pin out information for the Multi-Station Control System components.

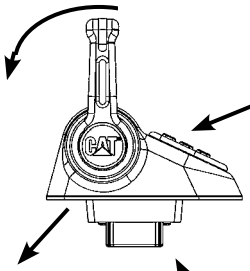
MSCS OVERVIEW

The Multi Station Control System (MSCS) is available in two versions. The full version MSCS and reduced component version MSCS II. This document covers the installation of both versions with most examples being of MSCS. MSCS II has the same functionality as MSCS with these exceptions:

1. No backup panel capability
2. No Marine Junction Box (MJB)
3. Two control station limit
4. Three display station limit
5. Smaller diameter cabling
6. Installer must provide power, ground, and keyswitch distribution to the 70-pin customer connection and PCP



Not used with MSCS II.

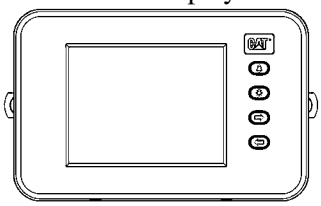


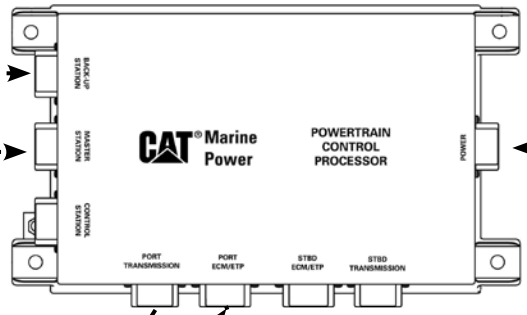
The ICH or CSP reads in the movement (desired engine speed) from the control head levers or button actuation. The ICH or CSP then sends a data link message via the proprietary CAN data link, to the PCP. This is a data link message, not a PWM signal or a switched input.

The ICH could be replaced with a CSP, control head and a button panel.

When the Backup Panel activates, the PCP sends the throttle signal to the ECU on the ECU Secondary Throttle input. Anti-stall strategy is disabled.

J1939 Displays





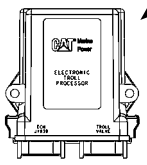
2 Primary and 2 Secondary positive and minus battery inputs to the PCP.

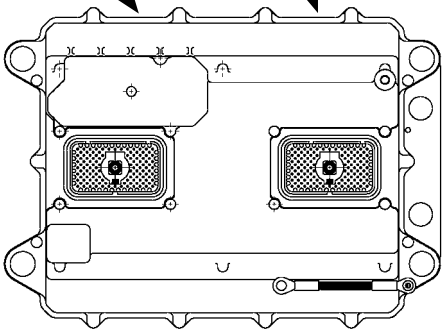
MJB is used to route the various signals and data link communications to their destinations.

J1939 Communications to and from ETP, ECU, and displays.

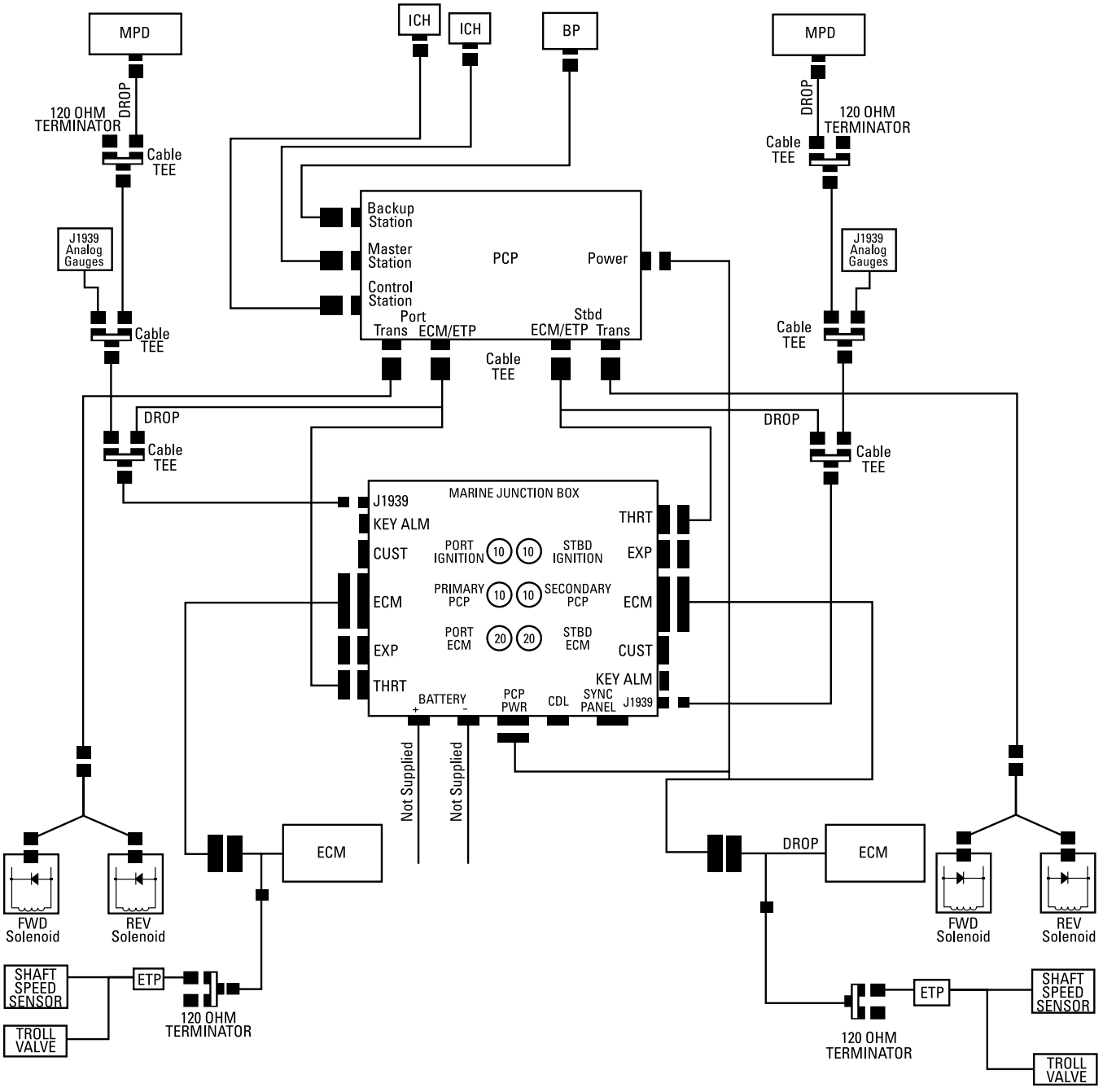
Switched inputs and throttle PWM signal to Port ECU

Drive circuit to Port gear for Ahead, Neutral, or Astern positions.





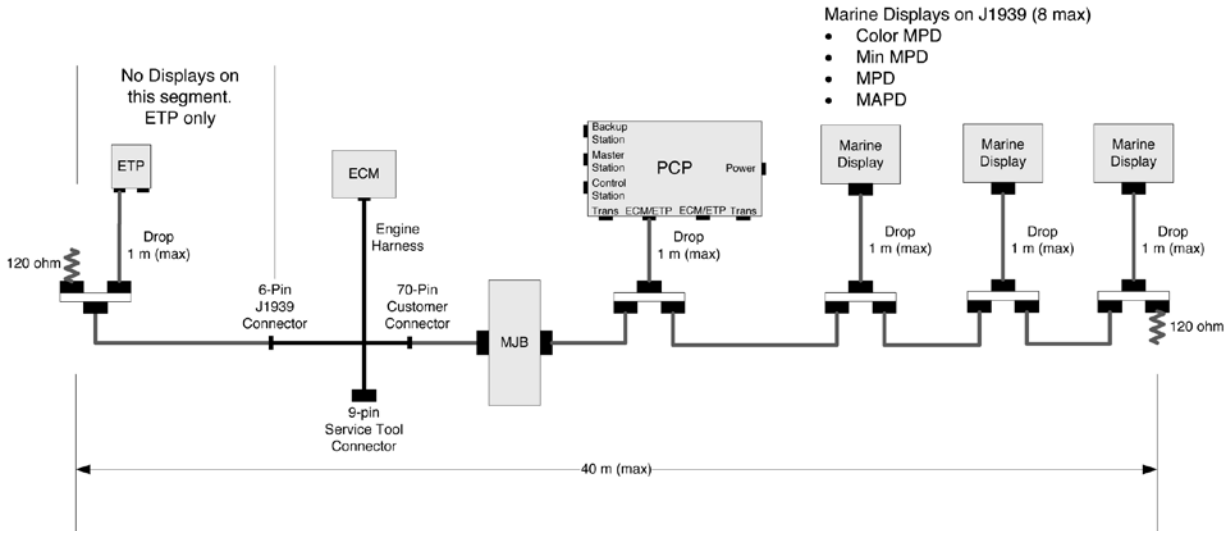
ETP is an optional component. The ETP controls trolling operations through an electrical signal to the trolling valve. Calculates shaft speed with shaft speed sensor.


MPD
120 OHM TERMINATOR
DROP
Cable TEE
J1939 Analog Gauges
ICH
ICH
BP
Backup Station
Master Station
Control Station
PCP
Power
Port Trans
ECM/ETP
Stbd ECM/ETP
Trans
Cable TEE
MPD
DROP
120 OHM TERMINATOR
Cable TEE
J1939 Analog Gauges
Cable TEE
DROP
Cable TEE
DROP
Cable TEE
MARINE JUNCTION BOX
J1939
KEY ALM
CUST
ECM
EXP
THRT
PORT IGNITION
STBD IGNITION
PRIMARY PCP
SECONDARY PCP
PORT ECM
STBD ECM
THRT
EXP
ECM
CUST
KEY ALM
BATTERY
PCP PWR
CDL
SYNC PANEL
J1939
Not Supplied
Not Supplied
ECM
DROP
ECM
FWD Solenoid
REV Solenoid
SHAFT SPEED SENSOR
ETP
TROLL VALVE
120 OHM TERMINATOR
FWD Solenoid
REV Solenoid
ETP
SHAFT SPEED SENSOR
120 OHM TERMINATOR
TROLL VALVE

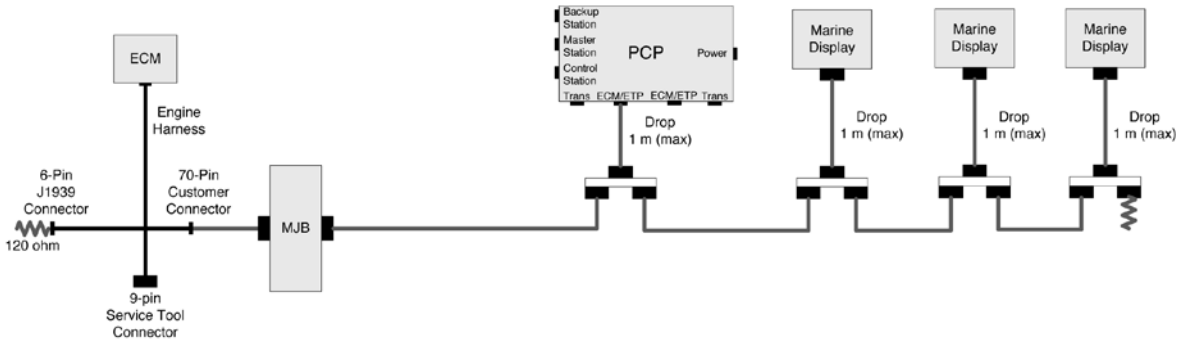
A J1939 CAN network is required for each engine to operate the MSCS. These J1939 CAN networks must conform to the J1939-71 standard for installation and topology. Improper installation can cause intermittent or complete failure of the MSCS. See typical J1939 CAN network layouts.

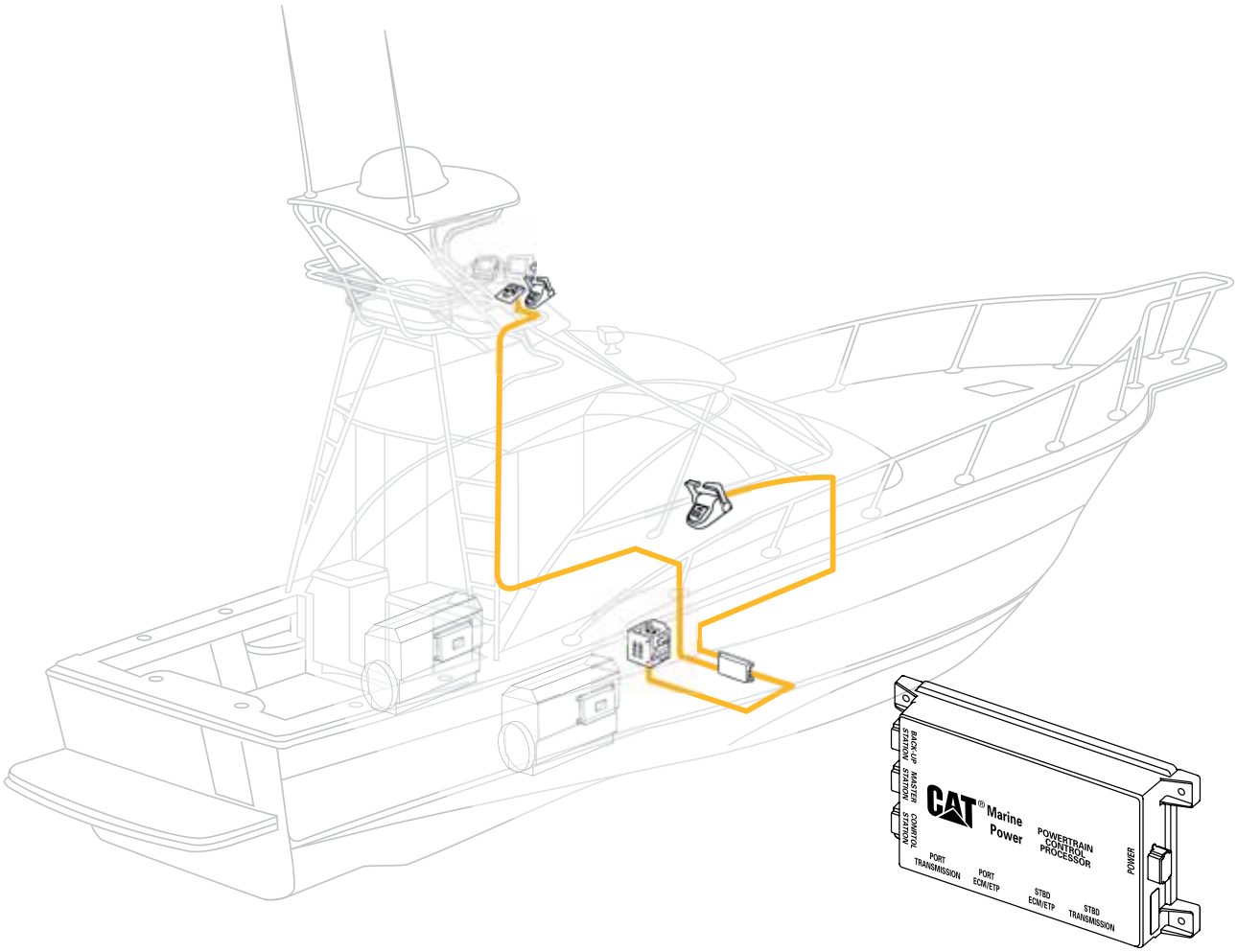
The J1939 CAN networks must be installed in a trunk configuration of 40 meters or less with 120 ohm terminating resistor installed at the far ends. Drops off of this trunk must be 1 meter or less.

TYPICAL MSCS J1939 NETWORK (WITH TROLL)



TYPICAL MSCS J1939 NETWORK (NO TROLL)





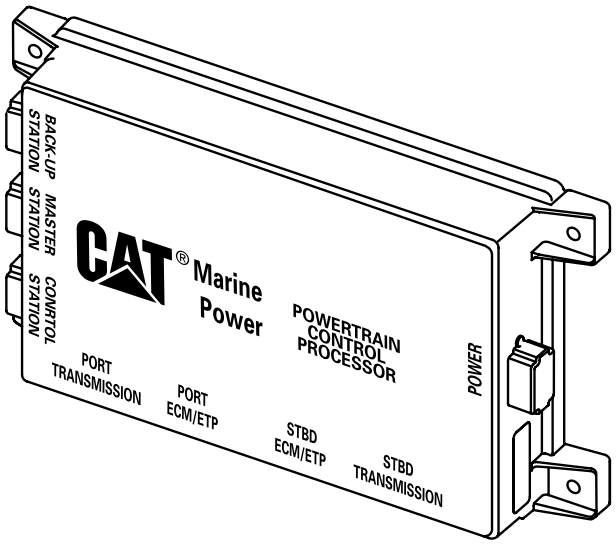
POWERTRAIN CONTROL PROCESSOR
219-8020
MSCS II
311-8400

The **Powertrain Control Processor (PCP)** is the main control processor of the Multi-Station Control System (MSCS). The PCP is responsible for the interface between the control stations, the engine Electronic Control Unit (ECU), and the transmission solenoids.

The master station and control station CAN data links are used to communicate with the control stations, either Integrated Control Head or Control Station Processor utilizing the proprietary communication data link. There may be only one control station on the master control station data link and up to seven control stations on the control station data link. MSCS II may have only one control station on the control station data link. The control stations will communicate with the PCP the throttle position (0 – 100%), gear select (ahead, neutral, astern), and button states, via the proprietary CAN data link.

There are five buttons available at the control station; Station Active, Throttle Sync, Slow Vessel Mode, Gear Lockout, and Troll. The Troll feature is an optional feature depending upon the presence of an Electronic Troll Processor (ETP). Each button has a corresponding indicator lamp; the PCP will turn on each lamp via the proprietary data link when the button function is active.

The port and starboard SAE J1939 communication links are the public data links used for serial data communications with the engine ECU, Marine Power Displays, Electronic Troll Processor, and Cat® ET or WinFlash service tools. Each data link is separate and independent from the other.

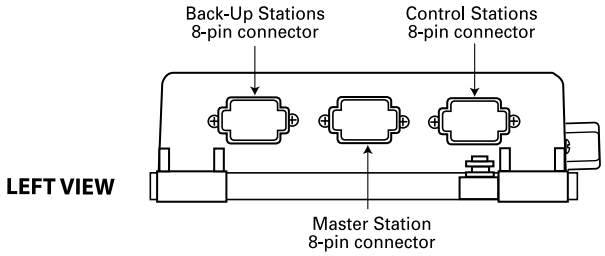


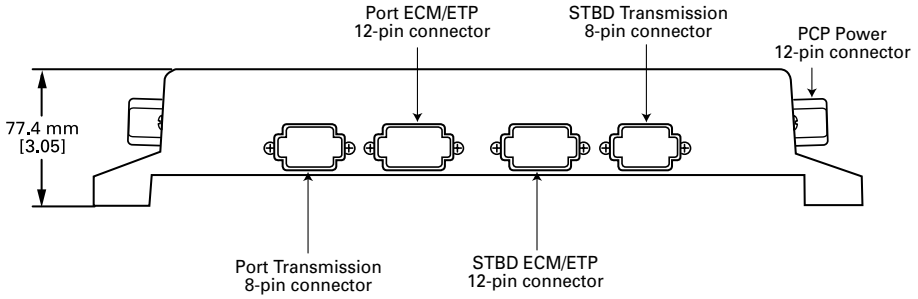
Engine speed is controlled via a PWM signal from the PCP to the ECU throttle input. Speed is controlled linearly from low idle at 0% throttle to max engine speed or Wide Open Throttle (WOT) at 100% throttle.

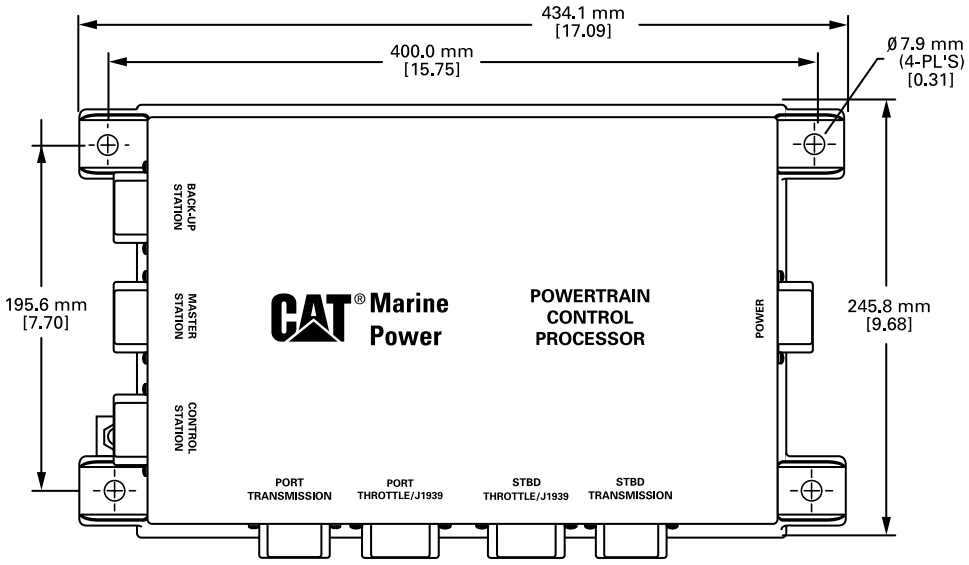
The “Backup System Active” is a digital signal from the backup processor that indicates throttle and gear shift control by the PCP is no longer active. When the backup system is active a diagnostic alarm will be activated. The alarm can be acknowledged and silenced by pressing the Marine Power Display (MPD) alarm silence button.

Each control station provides engine throttle control and transmission gear control through the use of a mechanical lever (this may be separate throttle and gear levers or a combined throttle/gear lever). Additional operator control/feedback is accomplished via input buttons and indicator lamps for station activation, engine throttle sync, slow vessel mode, troll activation (optional), and gear lockout. This data is transmitted to the PCP by the active station via the master control station CAN data link or the control station CAN data link.

MOUNTING DIMENSIONS







MOUNTING INSTRUCTIONS

The PCP must be mounted in a location that is free from direct exposure to moisture such as an inside bulkhead wall in the engine room. For ease of installation and to reduce wire lengths the PCP should be mounted close to the Marine Junction Box (MJB). Mount the PCP on the bulkhead wall so that the Throttle/J1939 and transmission connectors are pointing down.

CAT ET PCP CALIBRATION PARAMETERS

Parameter/Description		Minimum Value	Maximum Value	Units	Default Value
Troll Mode Configuration	Transmission Type	ZF 220, ZF 2000, ZF2500, ZF 2555, TD MG Current TD MG Voltage, TD MGX Series			ZF220
	Shaft Speed Pulses*	0	250	p/rev	4
	Troll Mode	Traditional Advanced		N/A	Traditional
	Troll Mode Activation Maximum Engine Speed	Programmed Low Idle	1200	rpm	700
	Troll Mode Maximum Engine Speed	Programmed Low Idle	1200	rpm	1000
	Traditional Troll Percent Slip @ Idle	20	100	% slip	100
	Advanced Troll Percent Slip @ Idle	20	100	% slip	84.8
	Advanced Troll Maximum Engine Speed @ Full Engage	550	1200	rpm	900
Engine Configuration	Number of Engines	1	2	N/A	2
	Maximum Engine Speed Limit at Full Throttle	0	4000	rpm	0
Slow Vessel Mode Configuration	Slow Vessel Mode Maximum Idle Engine Speed	550	1000	rpm	750
	Slow Vessel Mode Shift Protection Enable Time	0	20	sec	5.0
	Slow Vessel Mode Shift Protection Set Speed	550	1000	rpm	700
	Slow Vessel Mode Shift Protection Hold Time	0	20	sec	2.0
	Slow Vessel Mode Shift Protection Disable Time	0	20	sec	5.0
	Low Speed Shift Protection Enable Idle Speed	550	1000	rpm	700
	Max Engine Speed During Shift	500	to Shift – 50	rpm	750
Sync Mode Configuration	Auto Synchronous Exit	Off/On		N/A	Off
Wheel Drag Down Configuration	Wheel Drag Down Enable Maximum Engine Speed	550	2000	rpm	950
	Wheel Drag Down Enable Delay Time	0	20	sec	4.0
	Shift in Progress Hold Time	0	25	sec	3.0
	Max Engine Speed to Shift	550	1000	rpm	800
	Transmission Disengaged Pressure Limit	0	4000	kPa	1376
	Wheel Drag Down Shift Out of Gear Time	0	20	sec	1.0
	Transmission Pressure Neutral Limit**	0	4000	kPa	1024
	Wheel Drag Down Shift to Neutral Time	0	20	sec	1.0
	Wheel Drag Down Hold Minimum Engine Speed	550	1500	rpm	800
	Wheel Drag Down Hold Time	0	20	sec	3.2
	Transmission Engaged Pressure Limit	0	4000	kPa	1712
	Wheel Drag Down Shift Into Gear Time	0	20	sec	2.0
	Wheel Drag Down Exit Speed	550	2000	rpm	600
	Wheel Drag Down Disable Delay Time	0	20	sec	4.0
Third Engine Arrangement	Third Engine Activation Speed Threshold	Programmed Low	Maximum Engine	rpm	1500
	Third Engine Deactivation Speed Threshold	Programmed Low Idle	Third Engine Activation Speed Threshold	rpm	1200
	Third Engine Activation Delay Time	0	6000	sec	30.0
	Third Engine Activation Maximum Throttle Differential	0	100	%	10.0
	Third Engine Throttle Source	Port/Starboard		N/A	Port
	Engine Controller Mode	Two Engine Three Engine – Port/Starboard Three Engine – Center		N/A	Two Engine

*Number of magnets on band divided by 2.

**MGX Gears — set transmission neutral pressure limit to ∅ in order to turn off the Transmission Not Responding diagnostic code

CAT ET PARAMETER DESCRIPTIONS

	Configuration Parameter	Configuration Parameter Description
Troll Mode Configuration	Transmission Type	The transmission type used to determine troll mode output
	Shaft Speed Pulses	The number of shaft speed magnets divided by two
	Troll Mode	Sets the troll mode for MSCS operation. This parameter can also be changed on the Marine Display.
	Troll Mode Activation Maximum Engine Speed	Upon activation of traditional troll mode, the engine speed shall be commanded to Troll Set Engine Speed. This parameter can also be changed on the Marine Display or the button panel on the MSCS.
	Troll Mode Maximum Engine Speed	Sets the maximum engine speed for traditional troll mode.
	Traditional Troll Percent Slip @ Idle	Sets the amount of transmission slip in traditional troll mode when the throttle is at idle forward or reverse.
	Advanced Troll Percent Slip @ Idle	Sets the amount of transmission slip in traditional troll mode when the throttle is at idle forward or reverse.
	Advanced Troll Maximum Engine Speed @ Full Engage	Sets the engine speed in advanced troll mode when the transmission is fully engaged (0% slip).
	Number of Engines	The number of engines connected to this PCP
Engine Configuration Parameters	Maximum Engine Speed Limit @ Full Throttle	This parameter will override the Max Engine Speed parameter from the ECU if this parameter is less than Max Engine Speed. Setting this parameter to Zero will disable this feature.
Slow Vessel Mode Configuration	Slow Vessel Mode Maximum Idle Engine Speed	The maximum speed that SVM will adjust to using button panel or MPD inputs
	Slow Vessel Mode Shift Protection Enable Time	The amount of time that the engine speed must exceed the *Low Speed Shift Protection Enable Idle Speed* for SVM protection to be enabled.
	Slow Vessel Mode Shift Protection Set Speed	Upon detection of a shift, the engine speed shall be held at or above *Slow Vessel Mode Shift Protection Set Speed* for *Slow Vessel Mode Shift Protection Hold Time* after the shift occurs or until the transmission pressure is greater than *Transmission Engaged Pressure Limit.*
	Slow Vessel Mode Shift Protection Hold Time	
	Slow Vessel Mode Shift Protection Disable Time	
	Low Speed Shift Protection Enable Idle Speed	The minimum engine speed at which SVM protection is enabled
	Max Engine Speed During Shift	The maximum engine speed that the engines are held at during a shift
Sync Mode Configuration	Auto Synchronous Exit	Automatically turns off SYNC mode if the gears are shifted from forward or reverse
Wheel Drag Down Configuration	Wheel Drag Down Enable Maximum Engine Speed	WDD shift protection is enabled when the transmission is in gear and the engine speed is greater than *Wheel Drag Down Enable*.
	Wheel Drag Down Enable Delay Time	*Maximum Engine Speed* for a length of time greater than *Wheel Drag Down Enable Delay Time*
	Shift in Progress Hold Time	The amount of time that transmission gear pressure is greater than *Transmission Engaged Pressure Limit* before completing the shift
	Max Engine Speed to Shift	Maximum engine speed at which the shift sequence will begin.

CAT ET PARAMETER DESCRIPTIONS

	Configuration Parameter	Configuration Parameter Description
Wheel Drag Down Configuration (continued)	Transmission Disengaged Pressure Limit	Maximum transmission pressure at which the shift sequence will begin
	Wheel Drag Down Shift Out of Gear Time	Delay before activating WDD
	Transmission Pressure Neutral Limit**	Limit for detecting Transmission Not Responding alarm condition. Setting this parameter to Zero will disable this alarm.
	Wheel Drag Down Shift to Neutral Time	The maximum time at which WDD is in Neutral
	Wheel Drag Down Hold Minimum Engine Speed	Engine speed command during WDD to WDD exit
	Wheel Drag Down Hold Time	Maximum time for WDD to WDD exit
	Transmission Engaged Pressure Limit	Used during shifting in Advanced Troll Mode to indicate the transmission is engaged
	Wheel Drag Down Shift into Gear Time	Maximum time to wait for engine speed to reach Exit Speed
	Wheel Drag Down Exit Speed	Engine Speed to indicate WDD complete
	Wheel Drag Down Disable Delay Time	The WDD check shall be disabled when the conditions for WDD are not met for *Wheel Drag Down Disable Delay Time.*
Third Engine Arrangement	Third Engine Activation Speed Threshold	When operating in Non Sync mode, the center engine will follow the *Third Engine Throttle Source* when all these conditions are true: If both engine set speeds are above the *Third Engine Activation Speed Threshold* for *Third Engine Activation Delay Time* and both throttles are within *Third Engine Activation Maximum Throttle Differential* of each other and both throttles are in the same gear.
	Third Engine Activation Delay Time	
	Third Engine Activation Maximum Throttle Differential	
	Third Engine Throttle Source	
	Third Engine Deactivation Speed Threshold	When operating in Non Sync mode, the center engine will go to Idle/Neutral if either throttle drops below this parameter.
	Engine Controller Mode	Used to select the mode of operation for this PCP

MASTER CONTROL/ CONTROL STATION/ BACKUP PANEL CONNECTOR PINOUT

MASTER CONTROL STATION CONNECTOR PINOUTS
1 + Power
2 –Power
3 +CAN Data Link
4 –CAN Data Link
5 CAN Shield
6 CAN Termination Loop-
7 CAN Termination Loop+
8 Station Lockout

CONTROL STATION CONNECTOR PINOUTS
1 + Power
2 –Power
3 +CAN Data Link
4 –CAN Data Link
5 CAN Shield
6 CAN Termination Loop-
7 CAN Termination Loop+
8 Station Lockout

BACKUP CONTROL STATION CONNECTOR PINOUTS
1 + Power
2 –Power
3 +CAN Data Link
4 –CAN Data Link
5 CAN Shield
6 CAN Termination Loop-
7 CAN Termination Loop+
8 Not Used

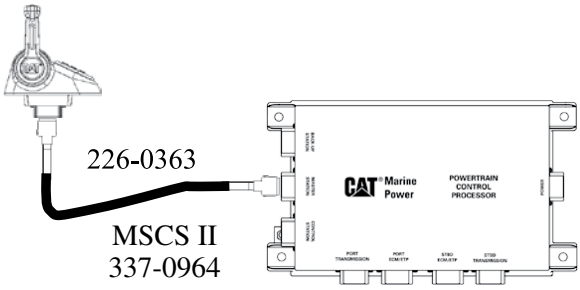
Power (pins 1 & 2)
Provides a regulated power supply to the station throttle/gear devices.

CAN Data Link (pins 3, 4, & 5)
The communication data link between the PCP and the Integrated Control Head (ICH) or Control Station Processor (CSP) or Backup Panel (BP).

CAN Termination Loop (pins 6 & 7)
When pin 6 is connected to pin 7, the internal termination resistors are linked into the circuit. The CAN termination loop is only to be used when one control station is connected to the cable harness.

Station Lockout (pin 8)
See Page 16

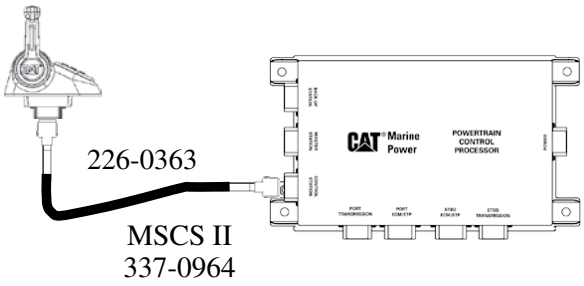
MASTER CONTROL STATION DATA LINK



Where Used: Connects the master control station to the PCP. The maximum distance the master control station can be from the PCP is 213 m (700 ft.). The maximum distance assumes the use of an ICH and using the Caterpillar supplied wiring harness.

Requires: 226-0363 or 337-0964 harness
Termination resistors and tee connectors are not required.

CONTROL STATION DATA LINK



Where Used: Connects the control station (2nd station on vessel) to the PCP. The maximum distance the control station can be from the PCP is 213 m (700 ft.). The maximum distance assumes the use of an ICH and using the Caterpillar supplied wiring harness.

Requires: 226-0363 or 337-0964 harness
Termination resistors and tee connectors are not required.

The maximum distance the control stations can be from the PCP is defined in the chart below, assuming even spacing and using the Caterpillar supplied wiring harness.

Number of Stations	Maximum Distance evenly spaced control stations (14-gauge wire)
1	213 m (700 ft)
2	114 m (475 ft)
3	106 m (350 ft)
4	76 m (250 ft)
5	61 m (200 ft)
6	53 m (175 ft)
7	45 m (150 ft)

As the number of stations increases, the load on the data link increases, this extra data link load is the limiting factor to the length. Fewer loads equals greater data link distance, more load equals shorter data link distance.

Wiring Considerations (2 or more stations on the control station data link)
There are two ways to route the cables to the PCP and control stations. The first option is to run the cables from the PCP to the first control station, then up to the second station as shown in Figure 1.

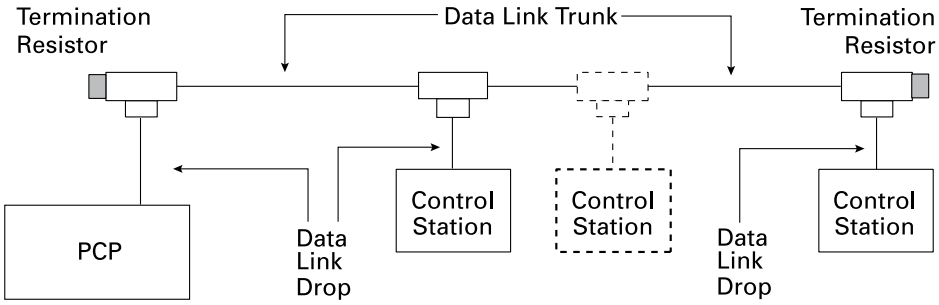


FIGURE 1

The second option is to use the PCP as a drop in the data link and run each cable directly to the stations, as shown in Figure 2. Wiring the vessel as shown in Figure 2 may allow the vessel to be wired using less cable than what is used in Figure 1.

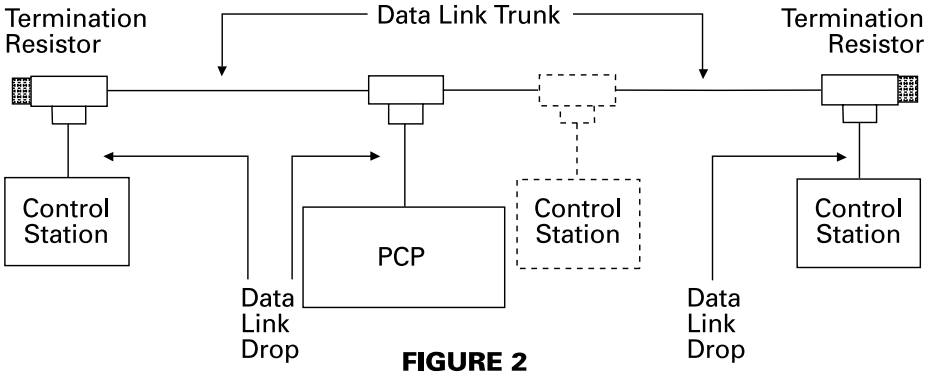
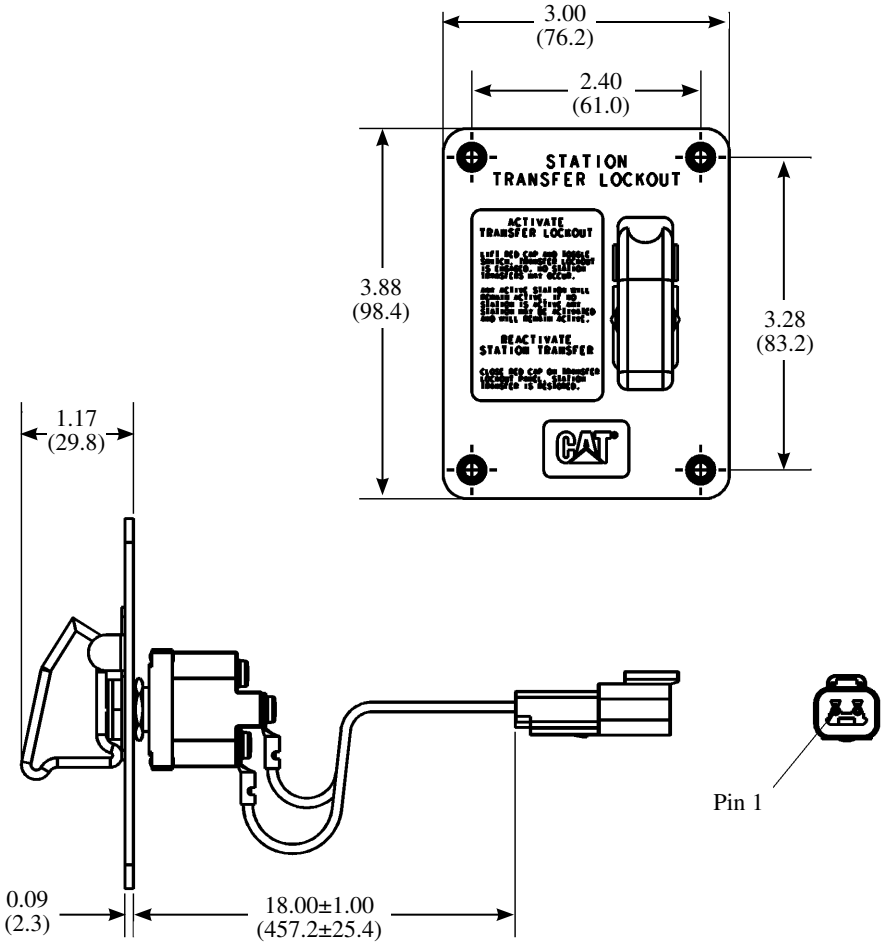


FIGURE 2

Control Station Wiring Harness Diagram (2 or more stations on the control station data link) These cables should be used with 2 or more control stations on the control station data link.

Part Name	Part Number	Qty.	Description	Length
PCP to Tee	226-0365	1	12-pin to 6-pin cable used to connect the PCP into the data link bus	0.6m (1.96 ft)
Tee to Control Station	226-0366	Installation Dependent	6-pin to 12-pin cable used to connect the control station into the data link bus	0.6m (1.96 ft)
Tee to Tee	225-6107	Installation Dependent	6-pin to 6-pin cable used to connect from tee to tee	Order to length
Tee Connector	221-9506	Installation Dependent	Used to connect the controls and PCP into the data link trunk The installation will require 1 tee connector more than the number of control stations	N/A
Termination Resistor	208-0432	2	One termination resistor is required at each end of the control station data link	N/A

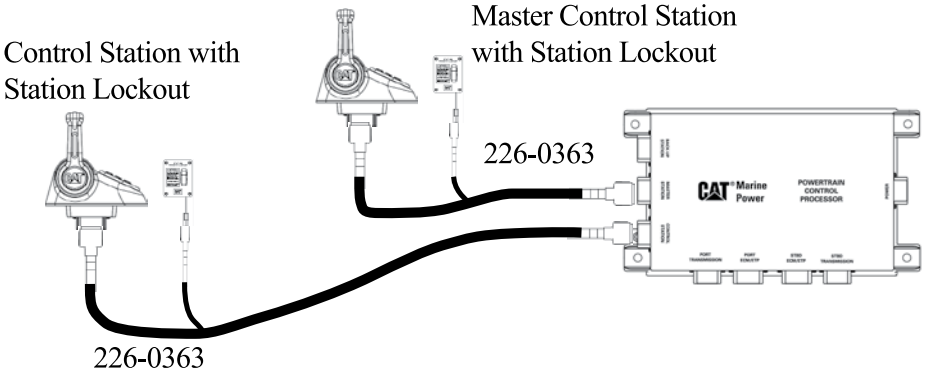
STATION LOCKOUT PANEL 248-7494



STATION LOCKOUT FOR MASTER CONTROL STATION AND CONTROL STATION DATA LINK

Station Lockout (SL) is an optional feature that is designed to lockout transferring control from the active station to another station. While the station lockout switch is enabled, the station transfer function is disabled within the PCP. The station lockout switch will be disabled after a power cycle (keyswitch ON-OFF-ON) or until the SL switch has been set in the OFF (disabled) position.

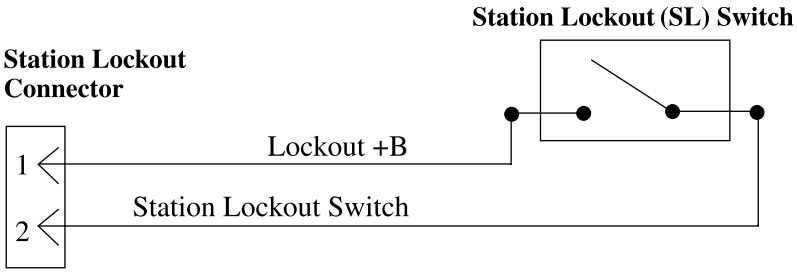
STATION LOCKOUT PANEL



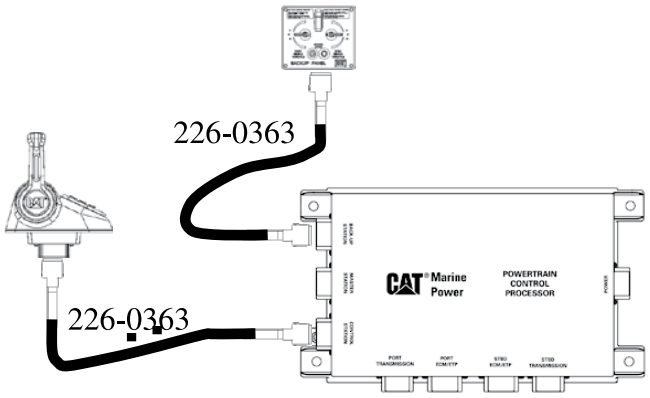
Requires: 226-0363 harness

CUSTOMER INSTALLED STATION LOCKOUT

- Connect from pin 1 on the station lockout connector to the N/O contact on an SPST switch.
- Connect from pin 2 of the station lockout connector to the switch contact on the SPST switch.



BACKUP CONTROL STATION DATA LINK



Where Used: Connects the backup control station (single backup control station on vessel) to the PCP. The maximum distance the backup control station can be from the PCP is 305m (1000 ft.). The maximum distance assumes the use the Caterpillar supplied wiring harness.

Requires: 226-0363 harness
Termination resistors and tee connectors are not required.

BACKUP CONTROL STATIONS

The maximum distance the backup panels can be from the PCP is defined in the chart below, assuming even spacing and using the Caterpillar supplied wiring harness.

Number of Stations	Maximum Distance evenly spaced (14-gauge wire)
1	305 m (1000 ft)
2	305 m (1000 ft)
3	305 m (1000 ft)
4	243 m (800 ft)
5	213 m (700 ft)
6	182 m (600 ft)
7	152 m (500 ft)
8	122 m (400 ft)

Wiring Considerations (2 or more backup stations)

There are two ways to route the cables to the PCP and backup control stations. The first option is to run the cable from the PCP to the first backup control station, then up to the second backup control station as shown in Figure 3.

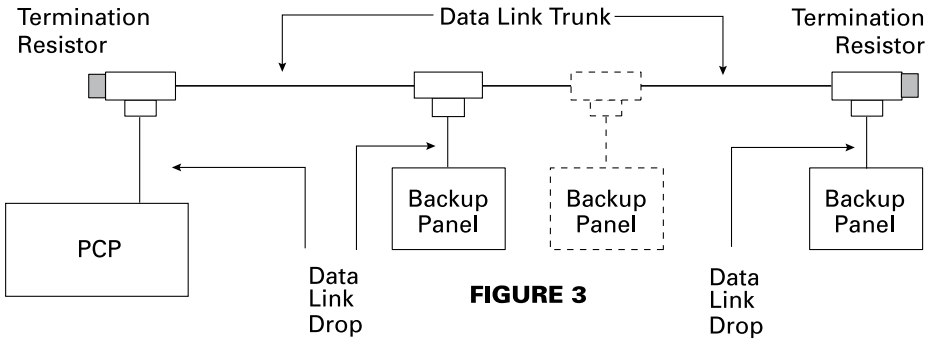


FIGURE 3

The second option is to use the PCP as a drop in the data link and run each cable directly to the stations, as shown in Figure 4. Wiring the vessel as shown in Figure 4 may allow the vessel to be wired using less cable than what is used in Figure 3.

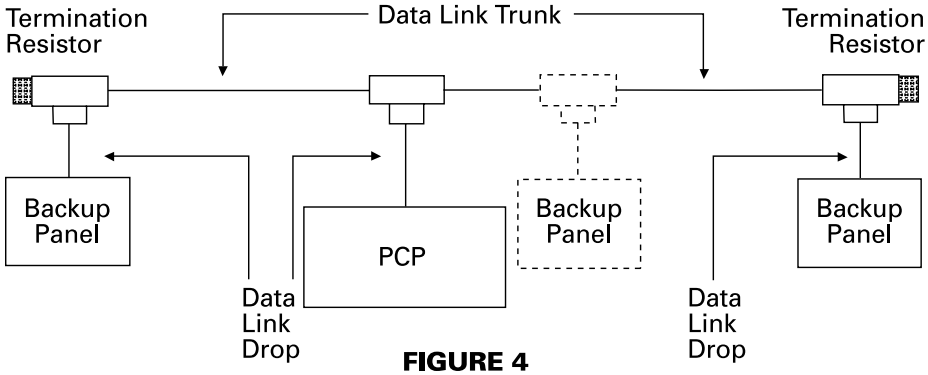


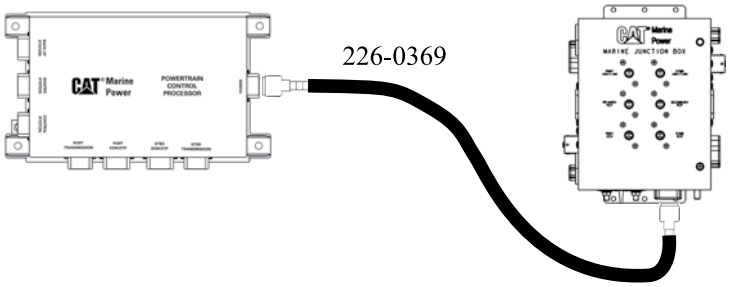
FIGURE 4

Backup Control Station Wiring Harness Diagram (2+ Backup Stations)
These cables should be used with 2 or more backup stations on the backup station data link.

Part Name	Part Number	Qty.	Description	Length
PCP to Tee	226-0365	1	12-pin to 6-pin cable used to connect the PCP into the data link bus	0.6 m (1.96 ft)
Tee to Control Station	226-0366	Installation Dependent	6-pin to 12-pin cable used to connect the control station into the data link bus	0.6 m (1.96 ft)
Tee to Tee	225-6107	Installation Dependent	6-pin to 6-pin cable used to connect from tee to tee	Order to length
Tee Connector	221-9506	Installation Dependent	Used to connect the controls and PCP into the data link trunk The installation will require 1 tee connector more than the number of control stations	N/A
Termination Resistor	208-0432	2	One termination resistor is required at each end of the control station data link	N/A

PCP POWER SUPPLY WIRING

Note: See Appendix for MSCS II wiring connections.



Where Used:
Connects the primary and secondary power supply wires to the PCP. The maximum distance the MJB can be from the PCP is 7.6 m (25 ft.).

Requires: 226-0369 harness

Power to the PCP is supplied from the MJB. The MSCS II system does not use an MJB. The customer is responsible for connections using 337-0971 harness. (See Appendix page 112). There are four +Battery wires going to the PCP that are used for system power and to actuate the gear solenoids. The system voltage select jumper, pins 2 and 4, are used to tell the PCP what the system voltage is. If the jumper is not installed, it indicates to the PCP that the system voltage is 12 VDC. If the jumper is installed the system voltage is 24 VDC.

PCP POWER CONNECTIONS

PCP Power 12-pin Connector

1 Port Ignition
2 Select Rtn
3 Stbd Ignition
4 System Voltage Select Jumper
5 External Alarm Common
6 External Alarm Contact (NC contact)
7 – Battery
8 +Battery 1 (Primary)
9 +Battery 2 (Primary)
10 +Battery 2 (Secondary)
11 +Battery 1 (Secondary)
12 - Battery

Ignition (pins 1 & 3)
Used to turn on the PCP and the control stations and displays.

System Voltage Select Jumper (pins 2 & 4)
The system select jumper and the select return are used to configure the system for 12 or 24 VDC.

System Voltage Select and Select Return Connection	System Voltage
Shorted (pin 2 connected to pin 4)	24 Volt System
Open No Connection	12 Volt System

External Alarm (pins 5 & 6)
The external alarm normally closed signal and external alarm common signal are two normally closed relays connected in parallel that will open during operation. A fault on either the primary or secondary system will cause a contact closure on these pins. The contacts are rated at 0.3A @ 24VDC.

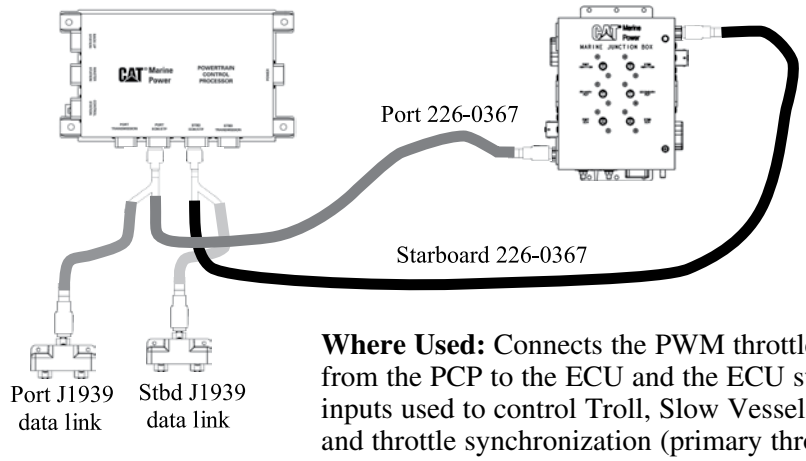
+Battery Primary (pins 8 & 9)
These inputs provide the primary control system with battery power and are used to drive the transmission solenoids.

+Battery Secondary (pins 10 & 11)
These inputs provide the secondary control system with battery power and are used to drive the transmission solenoids.

-Battery (pins 7 & 12)
Connects the PCP to the common minus battery bus. The MSCS requires that the negative side of the battery banks to be tied together for the system to operate properly.

THROTTLE / J1939 CABLE

Note: See Appendix for MSCS II wiring connections.



Where Used: Connects the PWM throttle signal from the PCP to the ECU and the ECU switch inputs used to control Troll, Slow Vessel Mode, and throttle synchronization (primary throttle or backup control panel throttle operation). Also connects the PCP into the J1939 data link. The maximum cable length for the throttle connections is 6.6 meters (21 ft.). The PCP J1939 data link drop is 0.6 meters (1.9 ft.).

Requires: 226-0367 harness and 221-9506 Tee Connectors

The ECU/ETP cable is used to supply the Pulse Width Modulated (PWM) signal from the PCP to the ECU and the ECU switch inputs used to control Troll, Slow Vessel Mode (SVM) and throttle sync. This cable also has a J1939 data link drop used to add the PCP into the J1939 data link.

J1939 Data Link (pins 1, 2 & 12)
J1939 data link connections from the PCP to the engine ECU. The J1939 data link is connected to the J1939 bus that is used by the MPD displays and is routed to the ECU through the MJB.

Troll Enable (pin 3)
Switch input to the ECU to activate trolling mode. This input is used in conjunction with the ETP.

-Battery (pin 4)
Common ground reference for the PCP and ECU. This is a common reference point for both the primary and secondary control within the PCP.

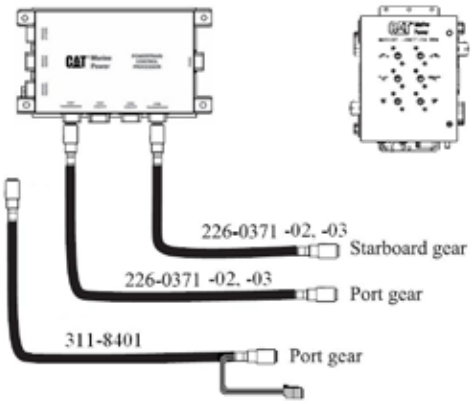
Primary Throttle PWM (pin 5)
The primary throttle signal is read by the engine ECU to determine desired engine speed.

Sync Switch 2 (pin 6)
Switch input to the ECU to activate the secondary throttle. This input is only used when the Backup Control Panel is enabled.

Secondary Throttle (pin 7)
The secondary throttle signal to the ECU. When the backup control panel is not active the ECU will ignore the secondary throttle signal. When a backup control panel becomes the active station, the secondary throttle select input will be switched (internally in the PCP) to minus battery, activating the ECU input and causing the engine speed to be controlled using the backup control panel.

Slow Vessel Mode (pin 8)
Switch input to the ECU to activate Slow Vessel Mode.

PCP TO GEAR HARNESS



GEAR CABLE CONNECTIONS

Where Used: Connects the PCP into the marine gear. Maximum length can not exceed 39.6 meters (130 ft.).

Requires: 226-0371 harness or 311-8401 harness. The gear cable is used to connect the PCP to the various gear solenoids used in the MSCS. These harnesses may not be compatible with all marine transmissions. Some rewiring and/or repinning may be necessary for correct operation.

PCP to Gear Harness Connections — 226-0371-02, -03. and 311-8401.

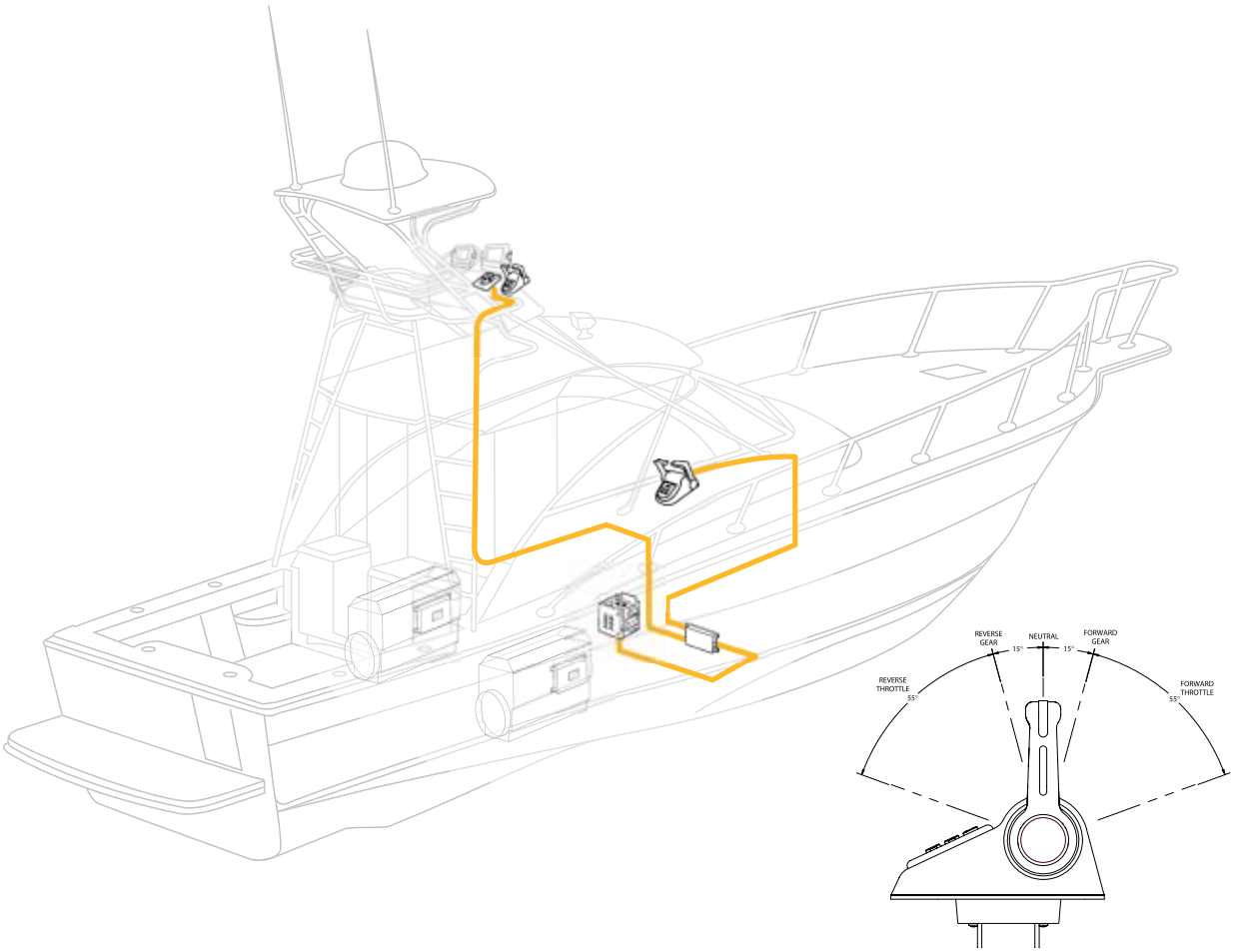
PCP Connection		Gear Connection				Color
		226-0371		311-8401		
		02	03	00	Brk Out	
1	+V FWD	1	1	2		RD
2	Not Used			1		N/C
3	Not Used			6		N/C
4	+V REV	4	2	3		OR
5	-V REV	5	3	10		GN
6	Neutral Return	6	4	4		WH
7	Neutral Signal	2	5	9		BU
8	-V FWD	3	6	11		BK
				7		N/C
				12		N/C
	Troll On			8	1	RD
	Troll Return			5	2	BK

FWD Signal (pins 1 & 8)
The +V FWD and -V FWD provide the drive for the forward solenoid 1.5 amp continuous drive signal to the solenoid.

Not Used (pins 2 & 3)

REV Signal (pins 4 & 5)
The +V REV and -V REV provide the drive for the reverse solenoid 1.5 amp continuous drive signal to the solenoid.

Neutral Signal (pins 6 & 7) Not Required
The neutral signal provides the feedback to the PCP on the position of the transmission.



INTEGRATED CONTROL HEAD

CHROME
219-8022

BLACK CHROME
220-2313

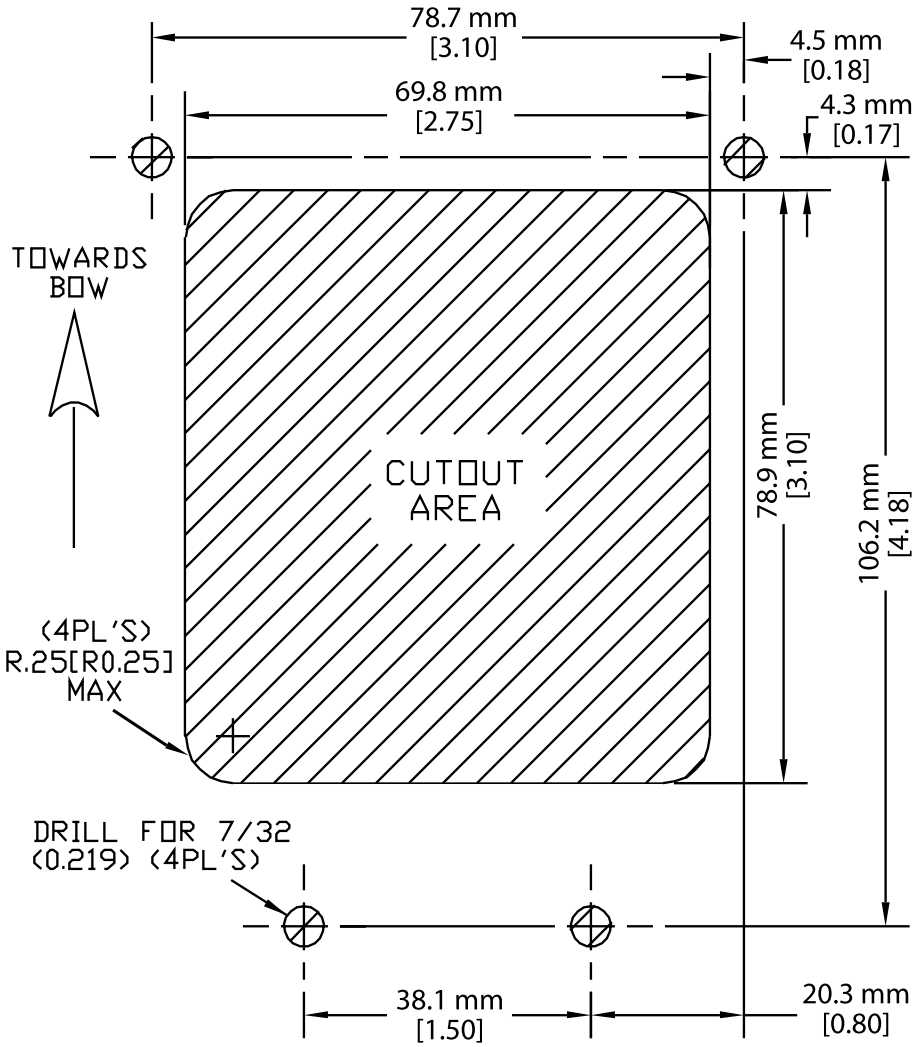
GOLD
220-2315

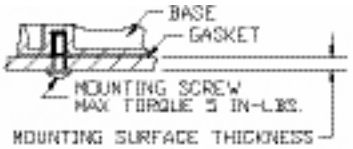
The Integrated Control Head (ICH) provides engine throttle control and transmission gear control through the use of a single mechanical lever for each engine and provides operator input switches for station activation, engine throttle sync, slow vessel mode (user defined idle speed), troll activation, and gear lockout.

The ICH has a visual indication of switch status using Light Emitting Diodes (LED). The ICH also contains the electronics (hardware and software) that interface between the ICH and the PCP. The ICH communicates with the PCP via a proprietary CAN data link.

MOUNTING

ICH CUTOUT TEMPLATE AND MOUNTING SCREW CHART

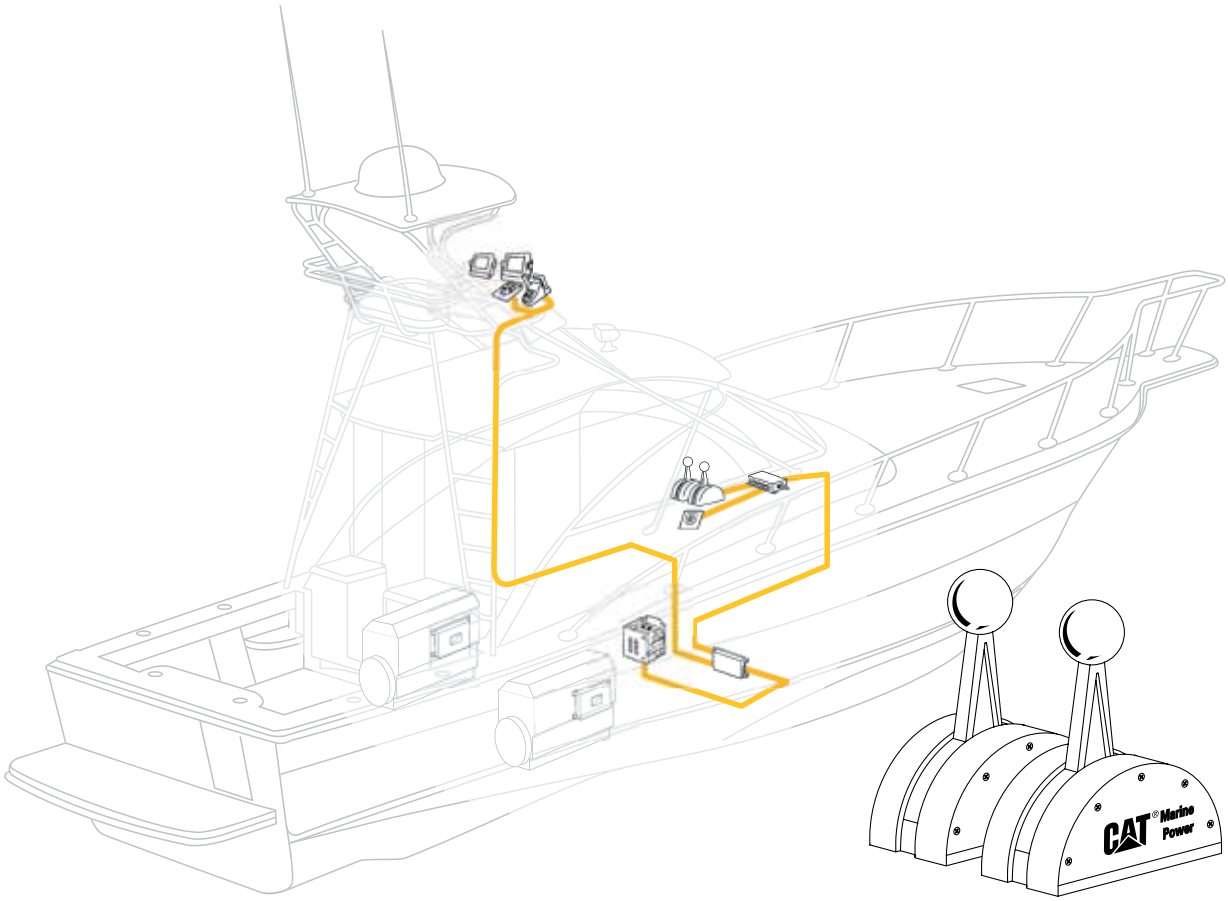




CAUTION:

TO ENSURE PROPER INSTALLATION AND WATER SEAL OF THE CONTROL STATION BLANK CABLE, USE THE SCREW SIZE CHART BELOW FOR THE CORRECT SCREW LENGTH

MOUNTING SCREW LENGTH CHART (MAX TORQUE 5 IN-LBS.)			
#10-32 SCREW LENGTH	MOUNTING SURFACE THICKNESS	#10-32 SCREW LENGTH	MOUNTING SURFACE THICKNESS
1/2"	1/8" TO 1/4"	2"	1-5/8" TO 1-3/4"
5/8"	1/4" TO 3/8"	2-1/8"	1-3/4" TO 1-7/8"
3/4"	3/8" TO 1/2"	2-1/4"	1-7/8" TO 2"
7/8"	1/2" TO 5/8"	2- ,'	2" TO 2-1/8"
1"	5/8" TO 3/4"	2-1/2"	2-1/8" TO 2-1/4"
1-1/8"	3/4" TO 7/8"	2-5/8"	2-1/4" TO 2-3/8"
1-1/4"	7/8" TO 1"	2-3/4'	2-3/8" TO 2-1/2"
1-3/8"	1" TO 1-1/8"	2-7/8	2-1/2" TO 2-5/8"
1-1/2"	1-1/8" TO 1-1/4"	3"	2-5/8" TO 2-3/4"
1-5/8"	1-1/4" TO 1-3/8"	3-1/8"	2-3/4" TO 2-7/8"
1-3/4"	1-3/8" TO 1-1/2"	3-1/4'	2-7/8 TO 3"
1-7/8"	1-1/2" TO 1-5/8"	3-3/8"	3"

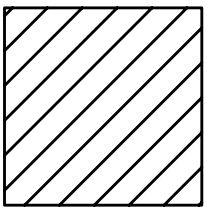


SLIM LINE CONTROL HEAD

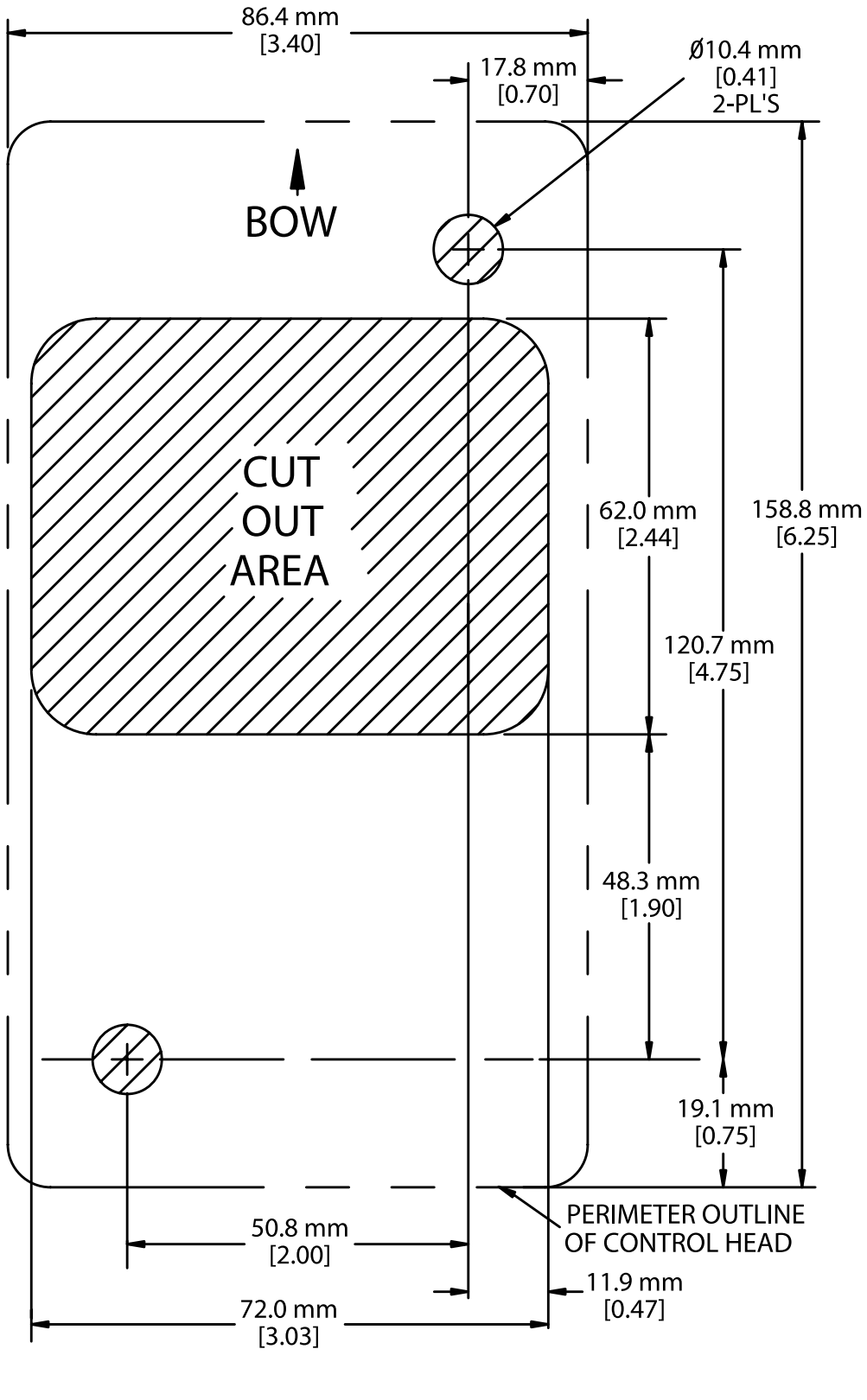
223-8214

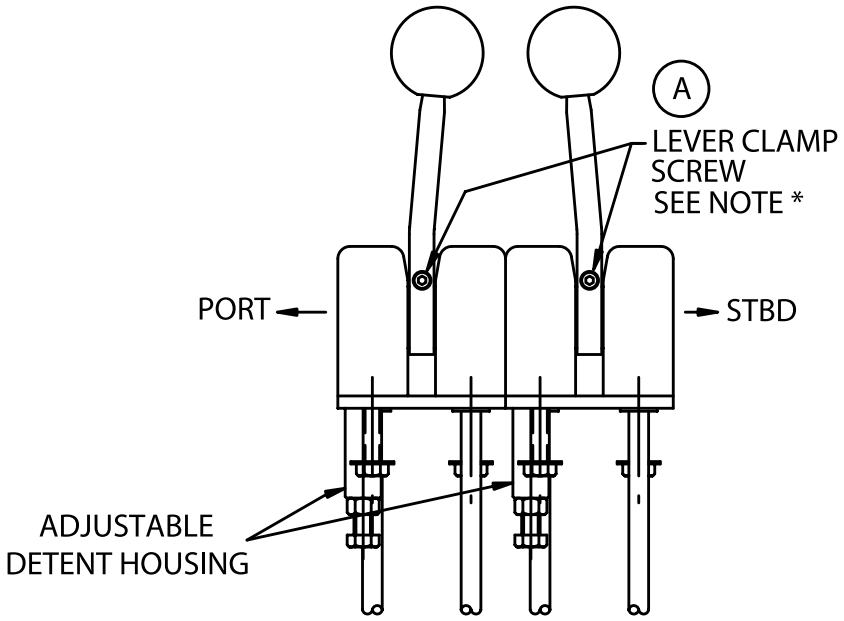
223-8219

The **Slim Line Control Head** provides engine throttle control and transmission gear control. The Slim Line control head is available in both combined lever (throttle and gear on one lever) and single lever (throttle and gear on separate levers) configurations. Operator input switches for station activation, engine throttle sync, slow vessel mode, troll activation, and gear lockout are provided on a separate button panel. The integrated harness on the Slim Line control head must be connected to a Control Station Processor (CSP) to interface with the Powertrain Control Processor (PCP).



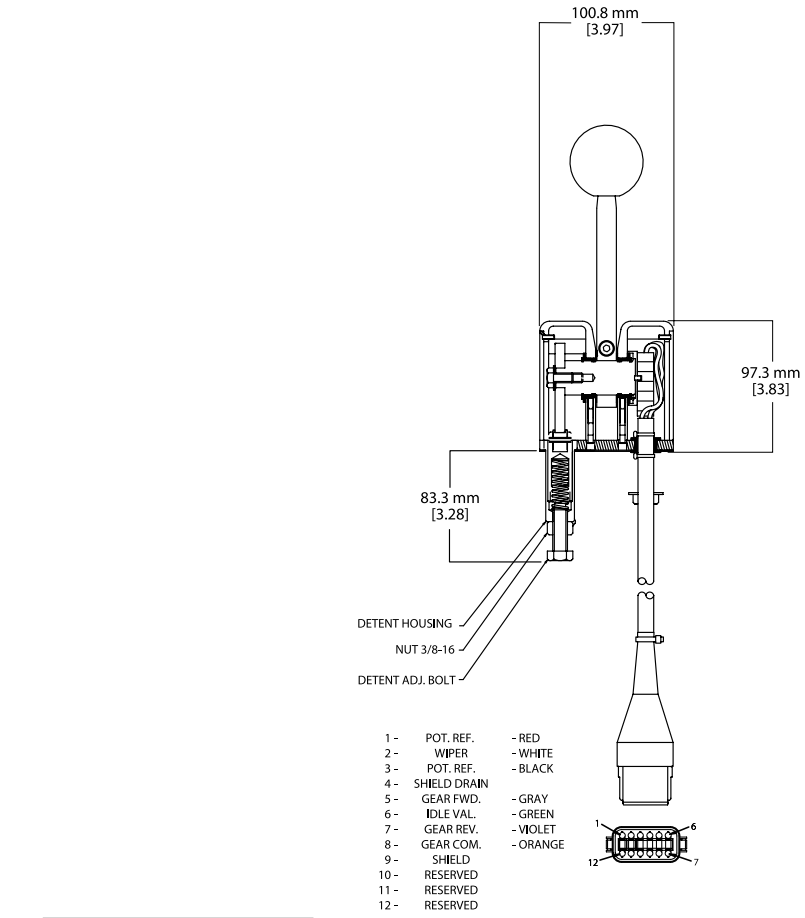
MINIMUM
PANEL
CUT OUT
AREA

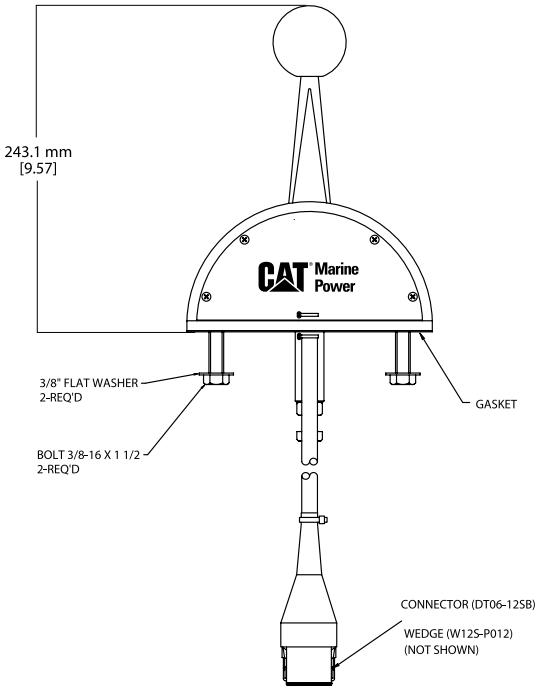




*IMPORTANT- CONTROLS MUST BE MOUNTED WITH THE ADJUSTABLE DETENT HOUSING TOWARD THE PORT SIDE FOR PROPER OPERATION.

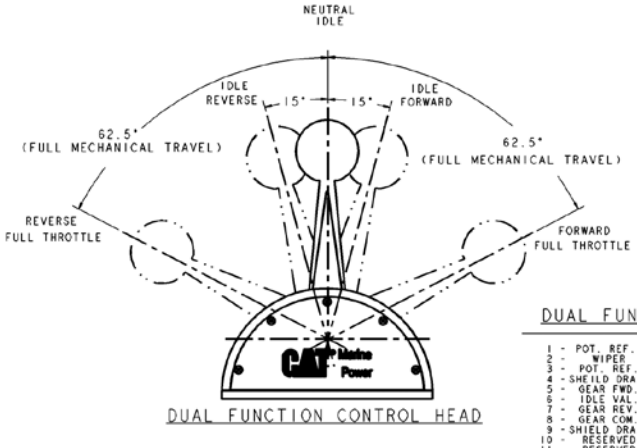
(A) SCREW IN LEVER MUST BE TORQUED TO 75 IN-LBS MINIMUM IF LEVER IS ADJUSTED DURING INSTALLATION.

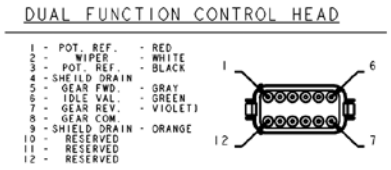

100.8 mm
[3.97]
97.3 mm
[3.83]
83.3 mm
[3.28]
DETENT HOUSING
NUT 3/8-16
DETENT ADJ. BOLT
1 - POT. REF. - RED
2 - WIPER - WHITE
3 - POT. REF. - BLACK
4 - SHIELD DRAIN
5 - GEAR FWD. - GRAY
6 - IDLE VAL. - GREEN
7 - GEAR REV. - VIOLET
8 - GEAR COM. - ORANGE
9 - SHIELD
10 - RESERVED
11 - RESERVED
12 - RESERVED
1
6
12
7


243.1 mm
[9.57]
CAT Marine Power
3/8" FLAT WASHER
2-REQ'D
BOLT 3/8-16 X 1 1/2
2-REQ'D
GASKET
CONNECTOR (DT06-12SB)
WEDGE (W12S-P012)
(NOT SHOWN)

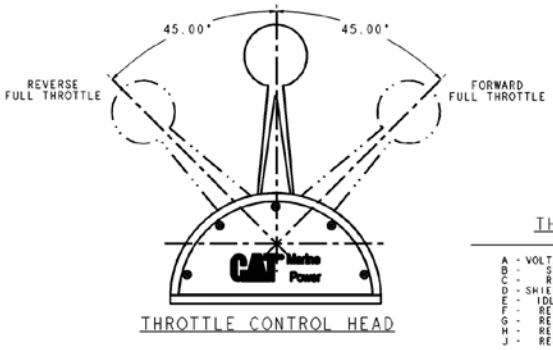
SLIM LINE CONTROL HEAD

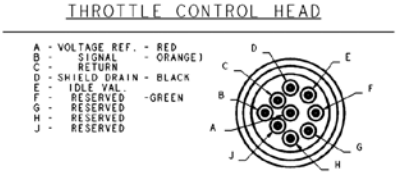
Dual Function and Connector View



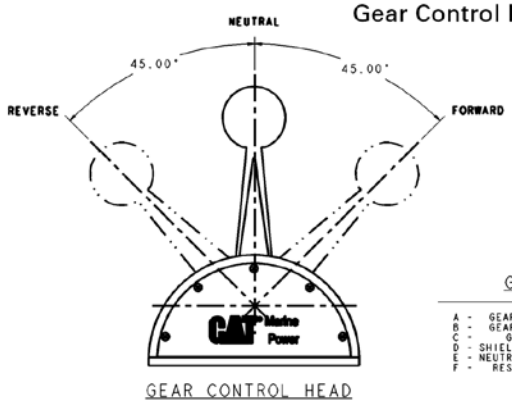


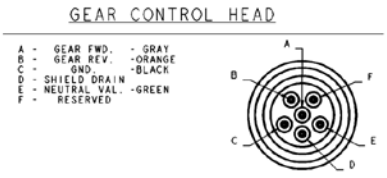
Throttle Control Head and Connector View





Gear Control Head and Connector View

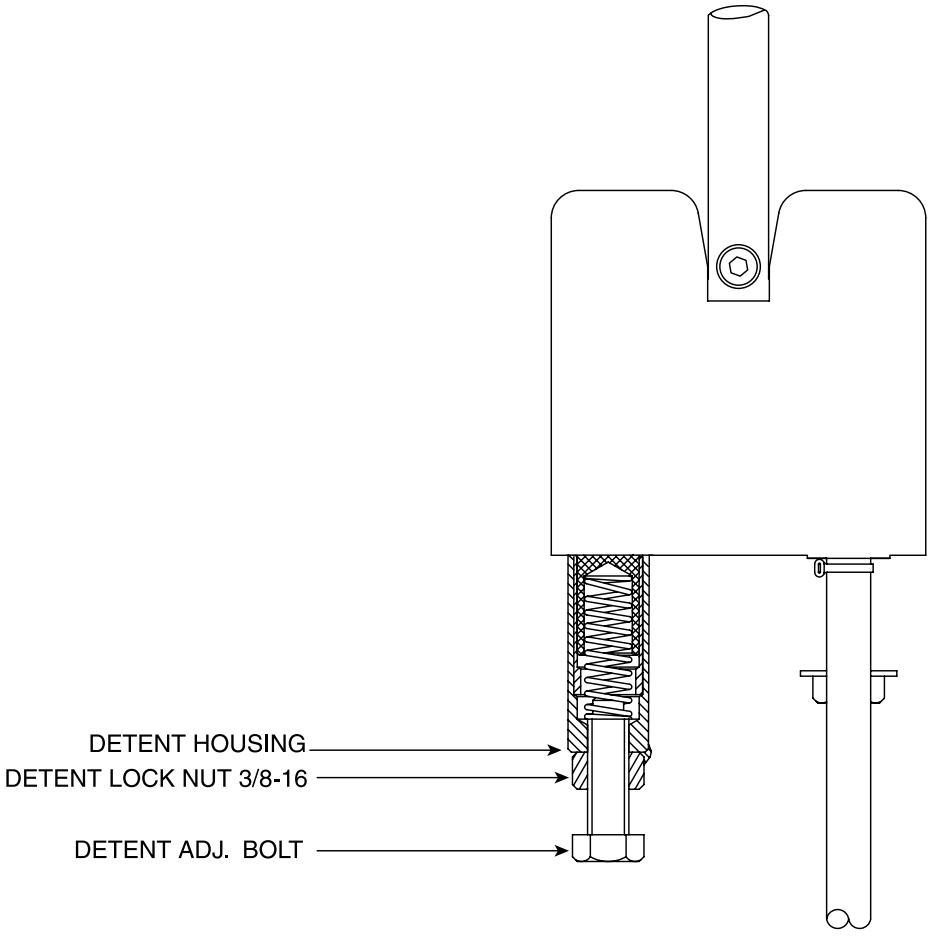


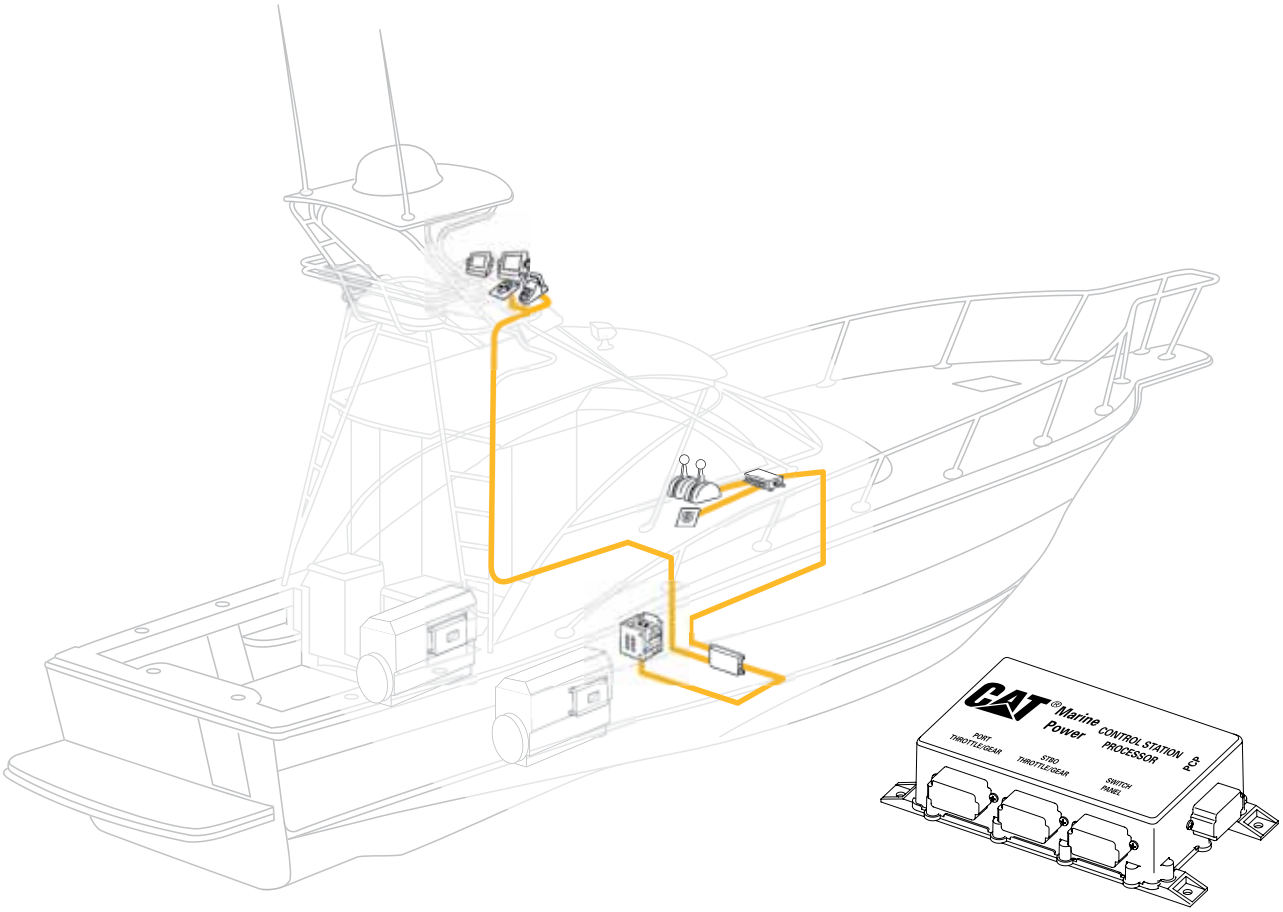


SLIM LINE CONTROL HEAD DETENT ADJUST

The detent load is factory set and should not need adjustment. If adjustment is necessary follow these steps:

1. Loosen detent lock nut.
2. Turn detent adjustment bolt in detent housing to increase or decrease the feel until it is at the desirable level.
3. Tighten detent lock nut and adjustment is complete.



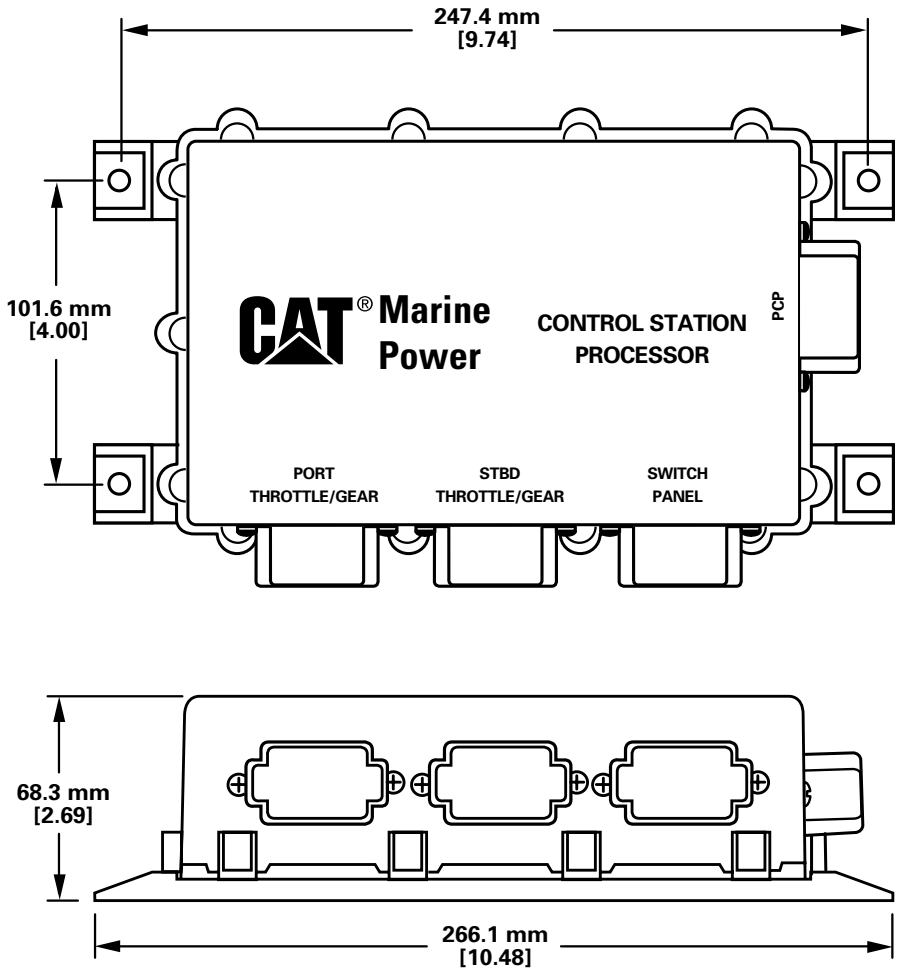


CONTROL STATION PROCESSOR 219-8021

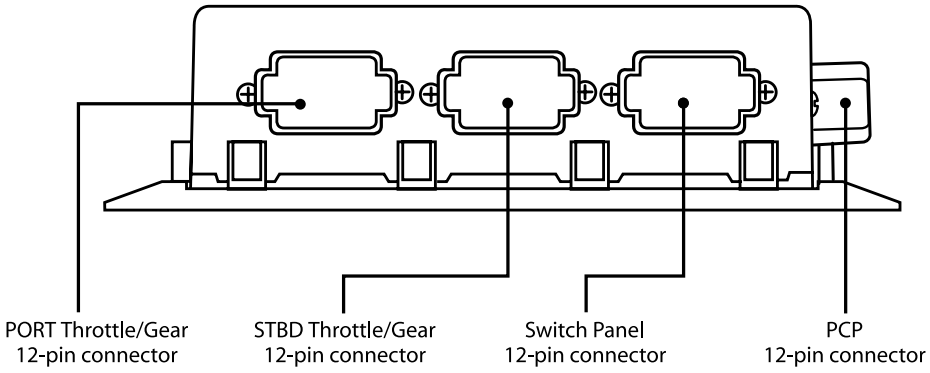
The **Control Station Processor (CSP)** provides the interface between the PCP and Slim Line control head or the Side Mount control heads. The CSP processes the analog signals from the Slim Line control head or Side Mount control head and the digital signals from the button panel. The CSP transmits this information via the proprietary communication data link. One CSP is required for each station.

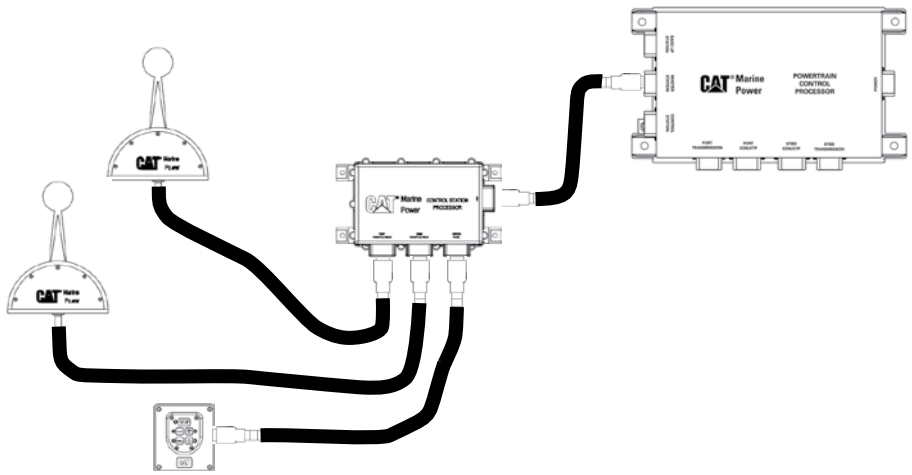
The button panel provides operator input switches for use with the Slim Line or Side Mount control heads. The button panel has buttons for station activation, engine throttle synchronization, slow vessel mode, troll activation, and gear lockout. The button panel provides a visual indication of switch status (LED).

MOUNTING DIMENSIONS



CONNECTOR PINOUTS





SLIM LINE CONTROL HEAD WIRING HARNESS DIAGRAM

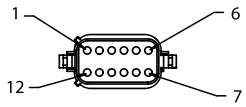
The maximum distance the Slim Line control head can be from the CSP is 3 m (10 ft).

SIDE MOUNT CONTROL HEAD

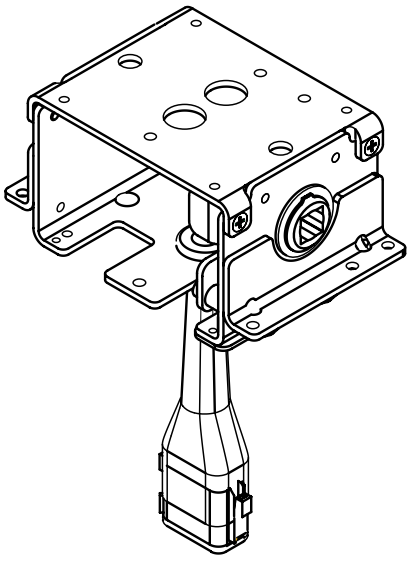
Port 229-3689

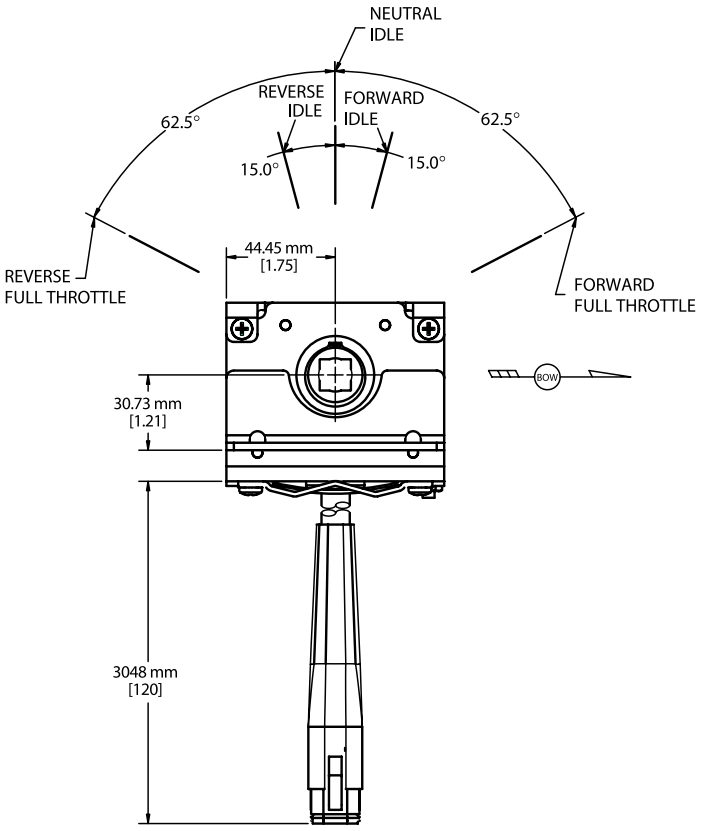
Starboard 229-3690

1 - POT. REF - RED
2 - WIPER - WHITE
3 - POT. REF. - BLACK
4 - SHIELD DRAIN
5 - GEAR FWD. - VIOLET
6 - IDLE VAL. - GREEN
7 - GEAR REV. - GRAY
8 - GEAR COM. - ORANGE
9 - SHIELD DRAIN
10 - RESERVED
11 - RESERVED
12 - RESERVED



CONNECTOR END VIEW

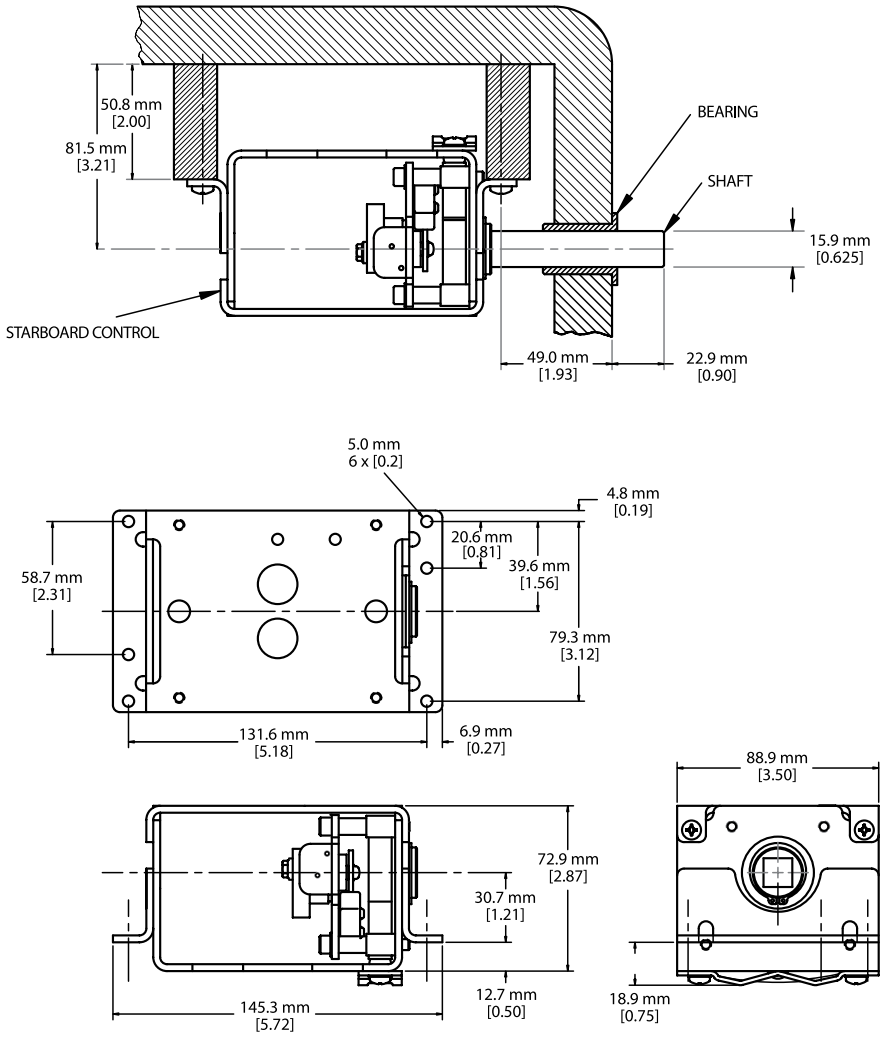




For single engine installations connect the Side Mount control head into the port connector on the CSP.

TYPICAL INSTALLATION

Starboard Throttle Installation Shown



The installation of the side mount controls must not place any static side load on the shaft.

Mounting Instruction:

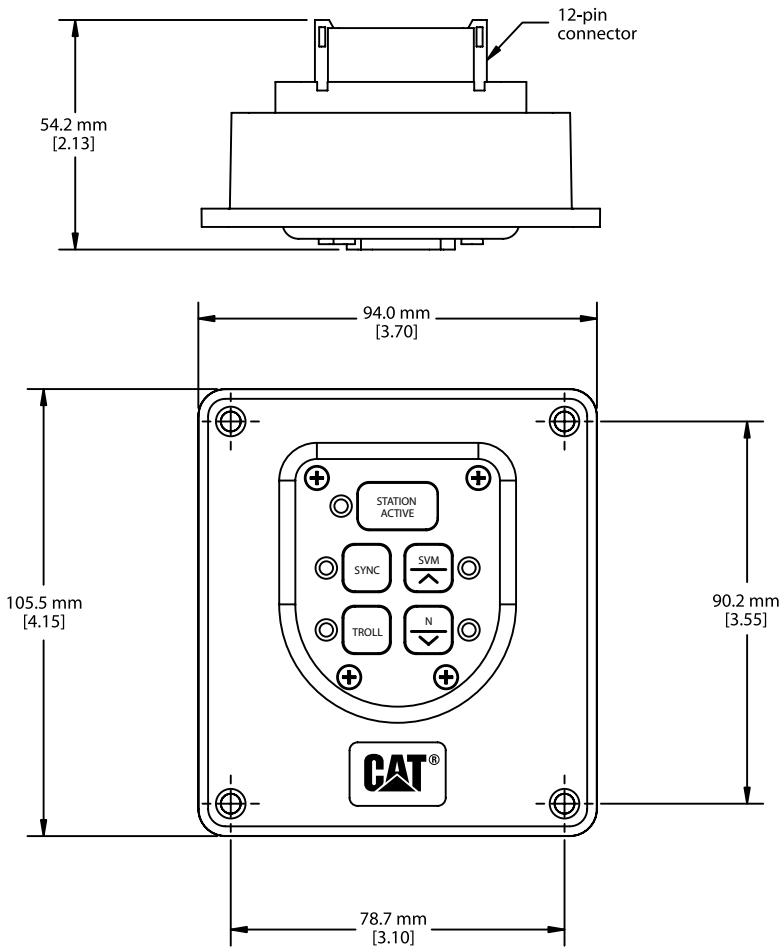
1. Determine the center line of the shaft location.
2. Drill a 7/8" (0.875") hole centered on the shaft location and parallel to the shaft center line.
3. Insert the shaft in the side mount control. Tighten the primary set screw (long) against the shaft and then install the secondary set screw (short) to lock the primary set screw.
4. Mount the side mount control in place and verify that all mounting points are tight.
5. Visually inspect the 7/8" hole and verify the hole is centered and parallel to the shaft.
6. Place the bearing over the shaft and slide it into the 7/8" hole. The bearing should fit snugly into the hole, but it should not place any side load on the shaft.

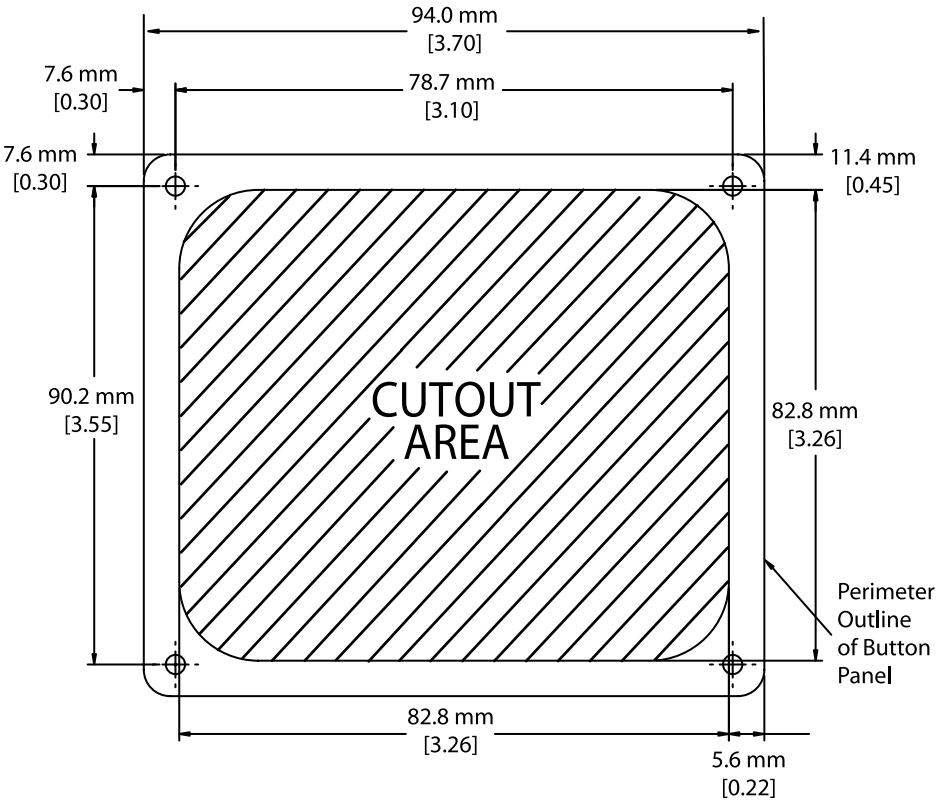
BUTTON PANEL AND TEMPLATE

CHROME
221-9507

BLACK CHROME
224-9873

GOLD
224-9874

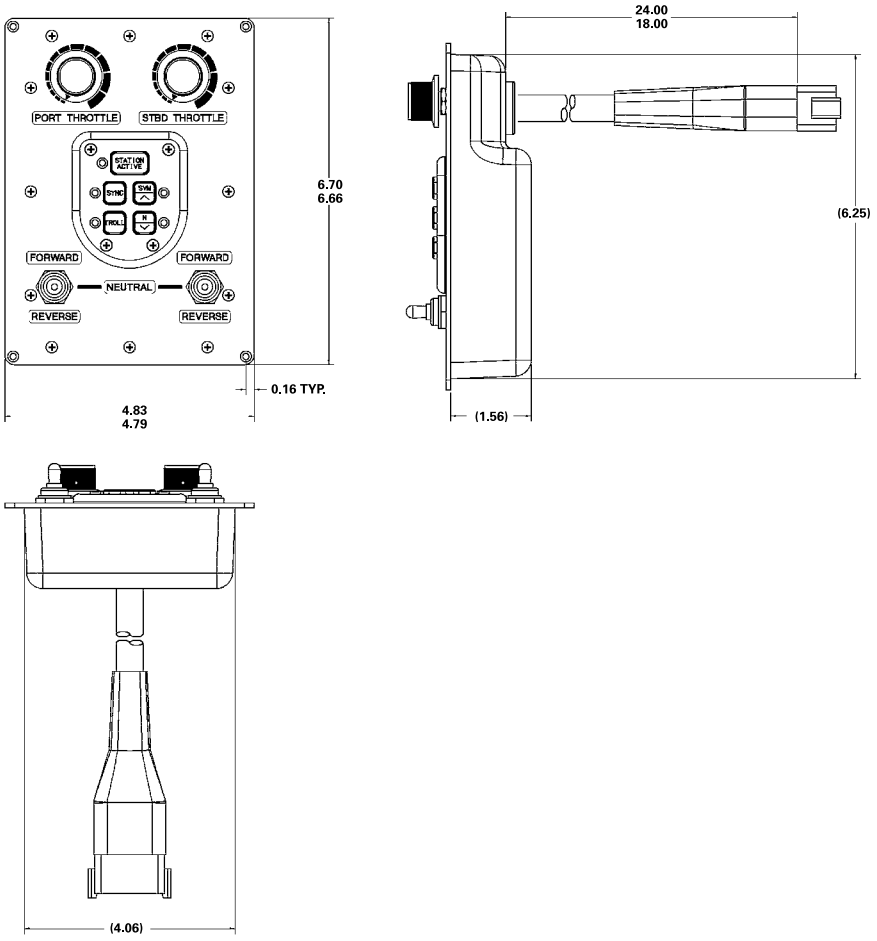



94.0 mm
[3.70]
7.6 mm
[0.30]
78.7 mm
[3.10]
7.6 mm
[0.30]
11.4 mm
[0.45]
90.2 mm
[3.55]
CUTOUT
AREA
82.8 mm
[3.26]
Perimeter
Outline
of Button
Panel
82.8 mm
[3.26]
5.6 mm
[0.22]

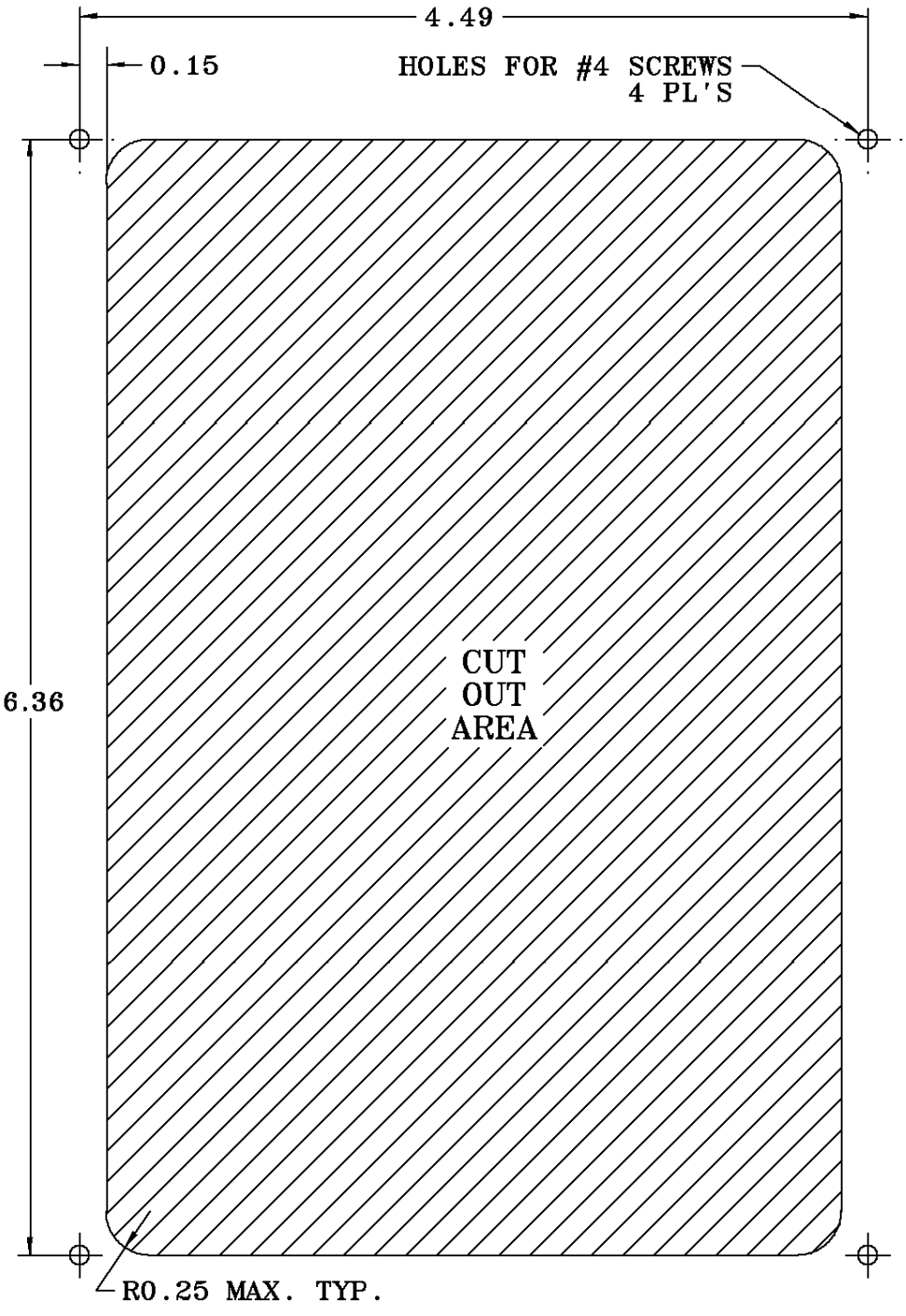
WING STATION 255-8006

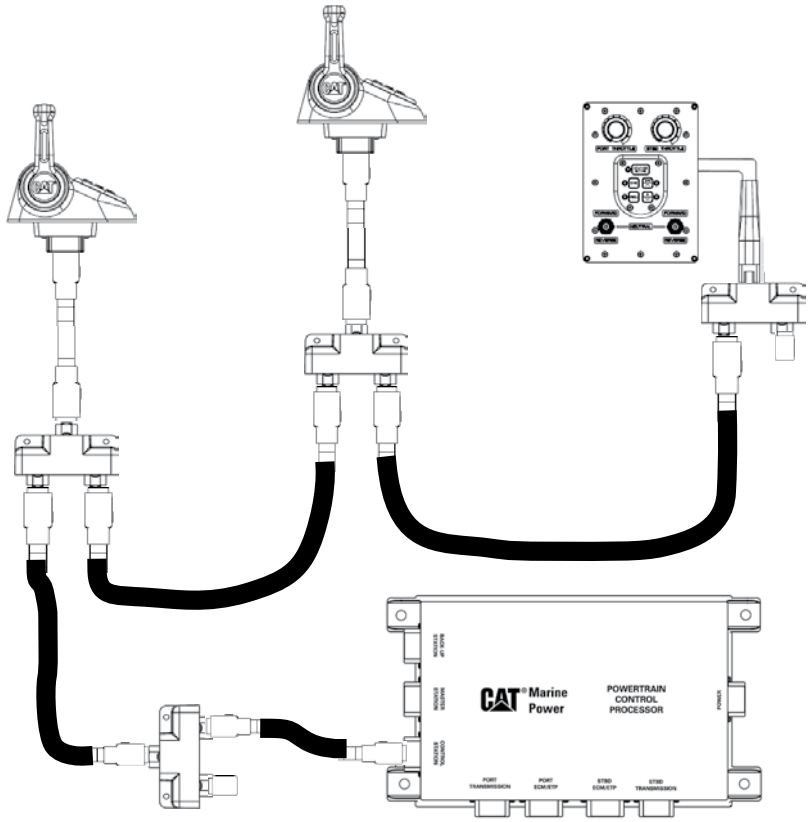
The Wing Station can be installed on a flat panel or in a swing-open door. The control head is fully protected from sea and weather elements. This control head is designed for installation in wing stations and aft stations that are used for docking of the vessel. With the exception of the throttle and gear controls, the functionality is similar to the Integrated Control Head button panel.

Wing Station provides engine throttle control through the use of port and starboard rotary throttle controls. Transmission control is provided through the use of toggle switches for forward, neutral, and reverse. A button panel also provides operator input switches for station activation, throttle synchronization, slow vessel, trolling, and gear lockout. Wing Station provides a visual indication of switch status (LED) and is available for a dual engine configuration. It communicates directly with the Powertrain Control Processor (PCP) via the control station data link.



WING STATION





Where Used: Provides engine and gear control similar to the ICH. Can be used in any location where an ICH or similar control would be installed.

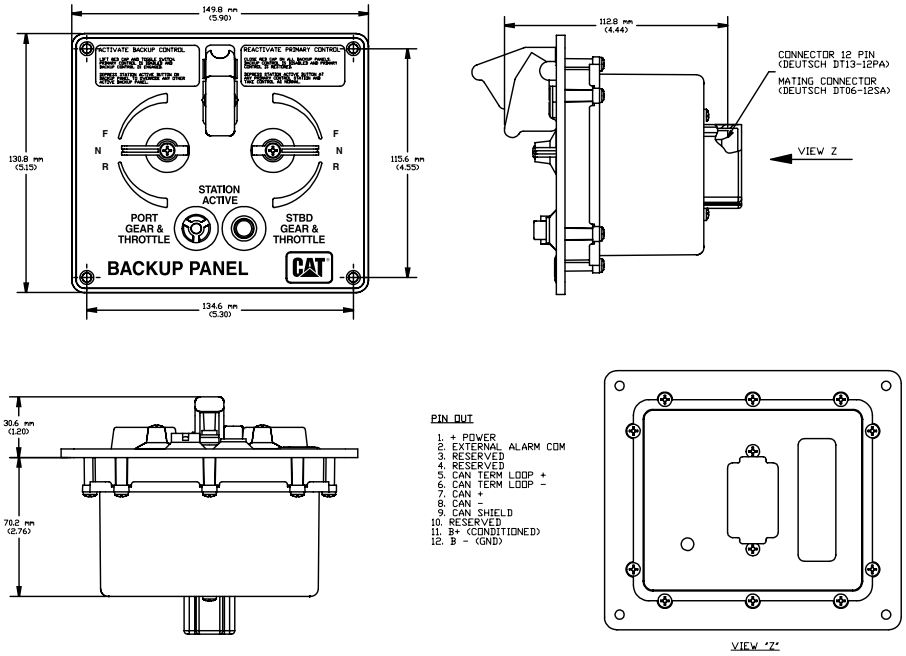
Requires: Cable will depend on the system configuration. Refer to ICH installation. Does not require a CSP or button panel.

BACKUP PANEL INSTALLATION 219-8023

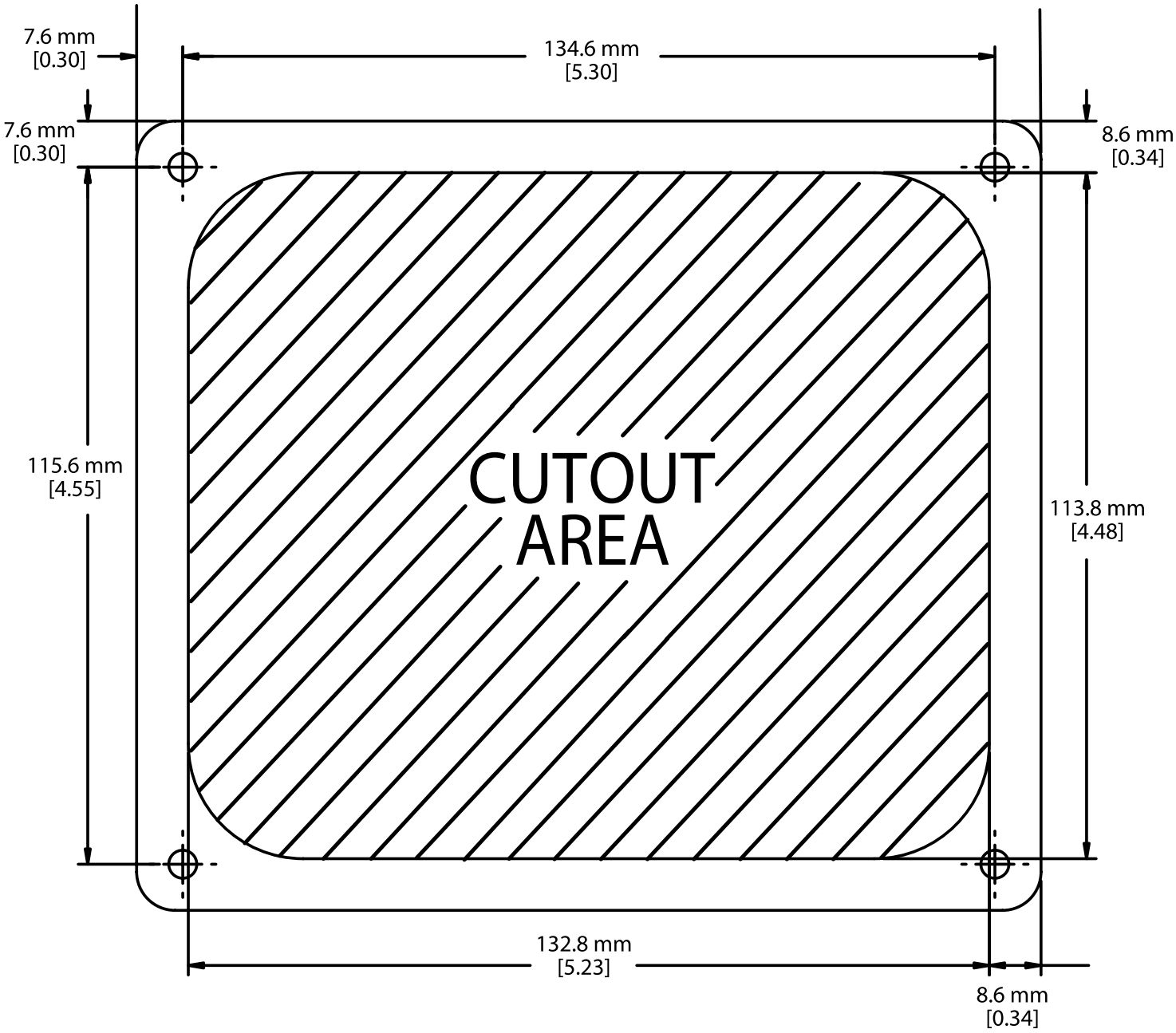
The Backup Panel provides secondary (backup) vessel operator control of the powertrain (engine and transmission). The Backup Panel has a protected operator input switch for transferring vessel control from the primary operator controls to the secondary (backup) operator control panel. The Backup Panel provides engine throttle control and transmission gear control via a proprietary CAN data link to the Backup System Processor. The backup panel (for a twin engine installation) consists of a single backup enable switch, a station active button, an active lamp, and two throttle/gear controls.

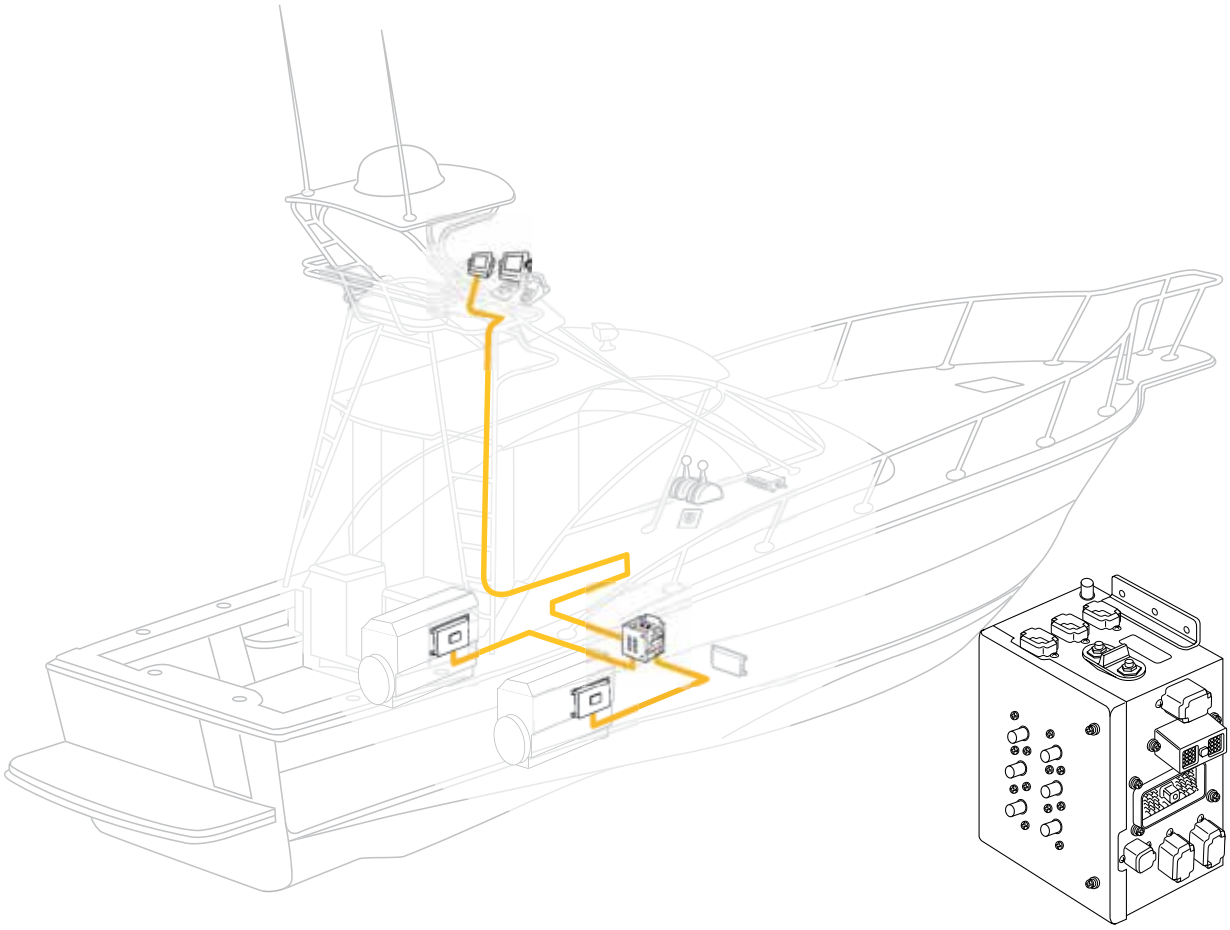
⚠ WARNING

When using the gear lockout feature with the backup panel, be sure that both throttle/gear levers are moved into the forward position. If only one lever is moved into the forward position, then the opposing gear will engage.



BACKUP PANEL





MARINE JUNCTION BOX

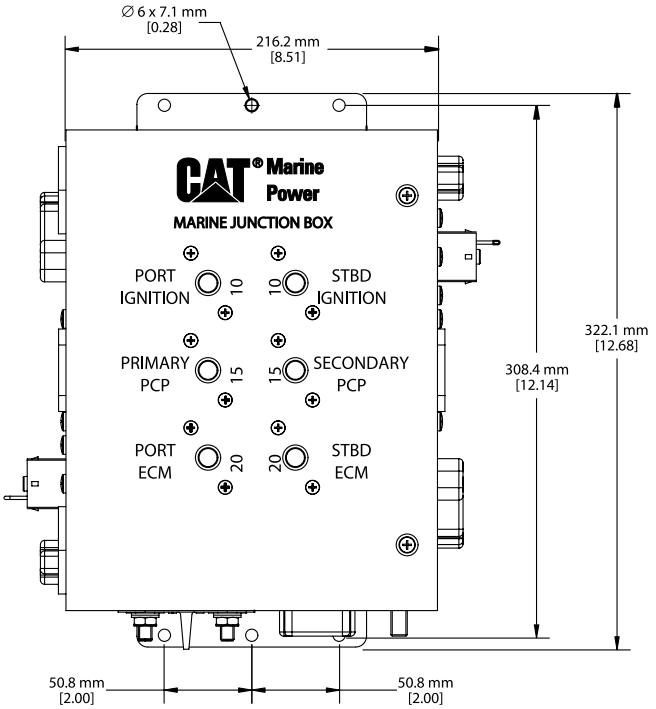
SINGLE 225-6122

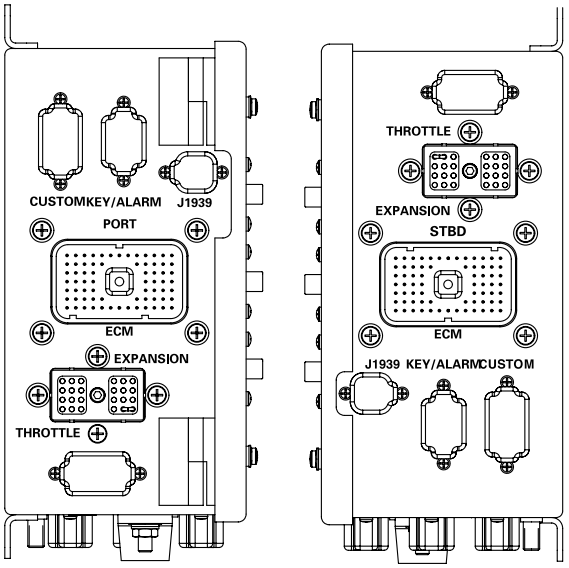
DUAL 225-6123

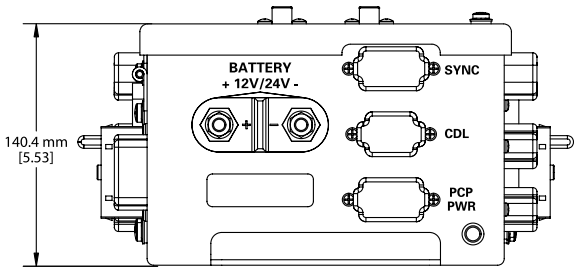
The **Marine Junction Box (MJB)** performs two functions. The first function the MJB can be used for is a stand-alone junction box for any marine application. The MJB can be used with the custom “made to length” wiring harness to make installation easier and less time consuming.

The MJB is also used in the MSCS to provide the interconnection between the engine ECU and PCP. Inside the PCP there are two separate wiring sections, one for the port system and a second for the starboard system. These sections provide the interconnection points for engine power and vessel control and monitoring. The MJB also provides circuit protection for the PCP, ECU, and the other components connected to the MSCS.

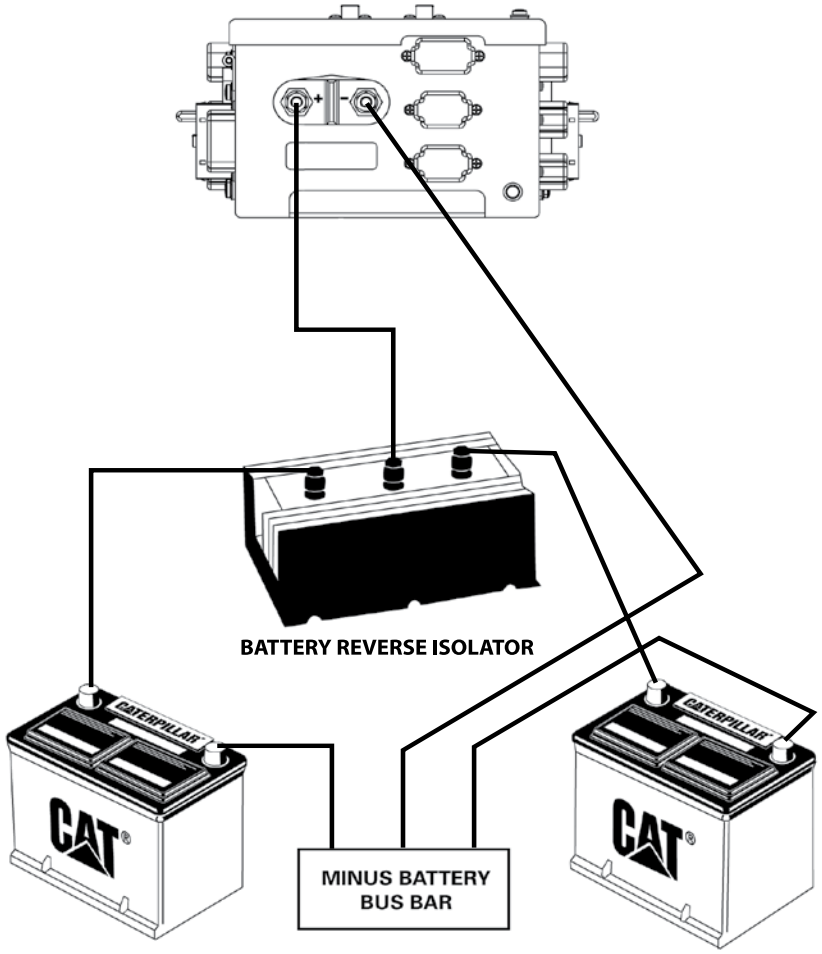
MOUNTING DIMENSIONS







POWER CONNECTIONS



CABLE LENGTH*	4 STATIONS		8 STATIONS	
	12 Volt	24 Volt	12 Volt	24 Volt
5 ft. (1.52 m)	10 AWG	12 AWG	6 AWG	10 AWG
10 ft. (3.05 m)	10 AWG	12 AWG	6 AWG	10 AWG
15 ft. (4.57 m)	8 AWG	10 AWG	4 AWG	8 AWG
25 ft. (7.62 m)	6 AWG	8 AWG	2 AWG	6 AWG
30 ft. (9.14 m)	4 AWG	8 AWG	1 AWG	4 AWG

*Refer to ABYC rules E-11 for AC & DC Electrical Systems on Boats for more details.

NOTE: Caterpillar recommends installing two +battery and two -battery cables from the reverse isolator to the MJB and from the reverse isolator to the batteries.

CURRENT REQUIREMENTS 12 or 24 VDC SYSTEM

The typical current draw for the MSCS with a twin engine installation with 4 control stations is 30 amps. The current draw for a twin engine installation with 8 control stations is 62 amps.

ECU PORT OR STARBOARD INTERFACE CONNECTORS

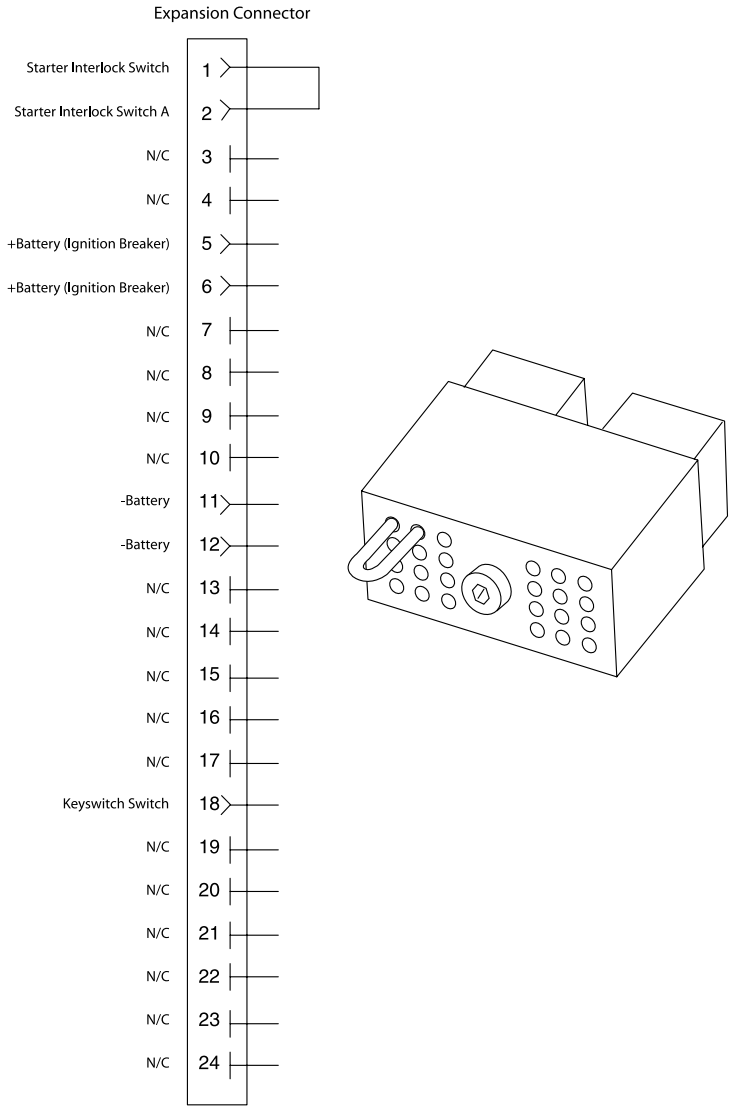
The MJB provides two interface connectors, one for port and one for starboard, which connect to the J61 customer connector. The connections are to interface with the ECU customer connector and provide battery power, switched inputs and data link signals to and from the ECU. The pin out is the same for both the port and starboard connectors.

Note: The Multi-Station Control System (MSCS) “plug & run” wiring system is designed for engines that have a 70-pin customer connector. Engines with 40-pin customer connectors require an adapter harness to connect the main trunk harness from the MJB to the customer connector on the engine.

Engine	Adapter Harness
C9, C-12, 3126B	9E-6178
3176B, 3196, 3406E	9E-6179
3412E, C30, C32	9E-6180

PORT OR STARBOARD EXPANSION CONNECTORS

The MJB provides two connectors, one for port and one for starboard, which will be used for future expansion. The pin out is the same for both the port and starboard connectors.

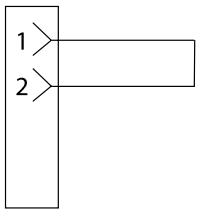


PORT OR STARBOARD EXPANSION CONNECTORS

Starter Interlock (A3 and A4 Controls) pins 1 & 2
The starter interlock provides a means of preventing the engine from starting through a switched circuit. The starter interlock may be wired through a neutral safety switch or other similar device. If no such device is installed, a jumper wire should be installed between pins 1 and 2.

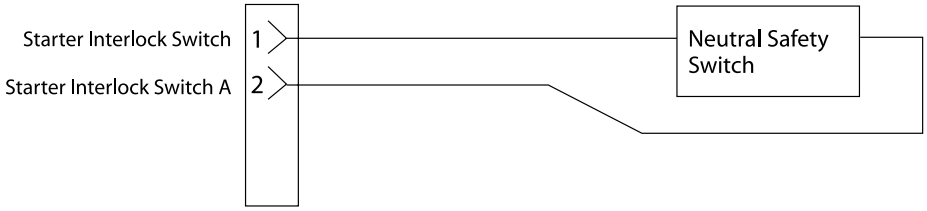
Installation without neutral safety switch or similar device.

Expansion Connector



Installation with neutral safety switch or similar device.

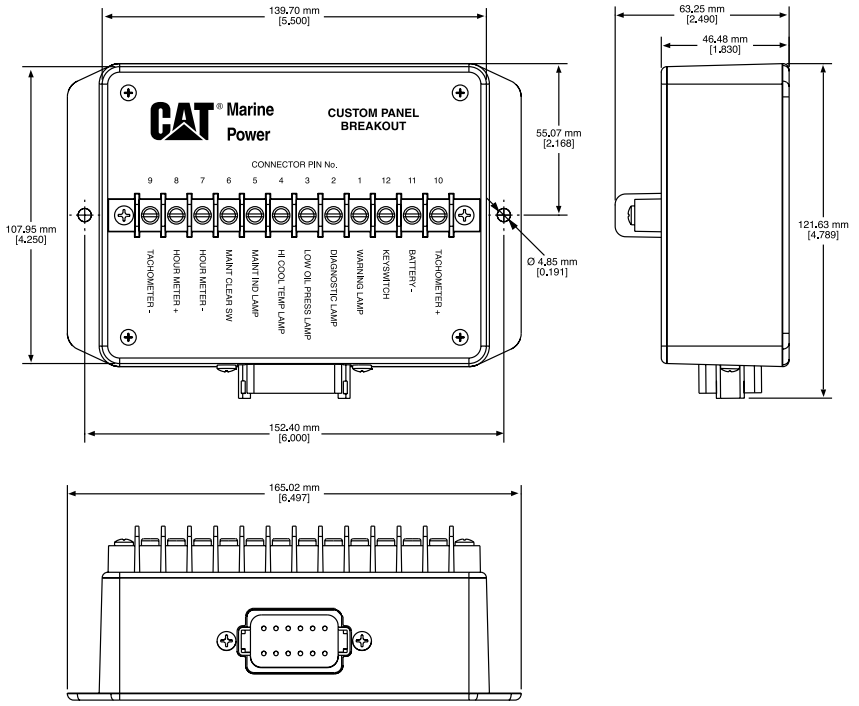
Expansion Connector



Installation Note:
The MSCS does not provide any Stater Interlock function. The Starter Interlock Switch and Starter Relay Return signals are passed through the MJB for customer convenience. The customer is responsible for providing and wiring of the Neutral Safety Switch to the MJB or the 70-pin customer connector.

PORT OR STARBOARD CUSTOM PANEL CONNECTIONS 226-3422

The MJB provides two connectors, one for port and one for starboard, which could be used to wire in a Cat custom panel or an OEM designed panel. The pin out is the same for both the port and starboard connectors.



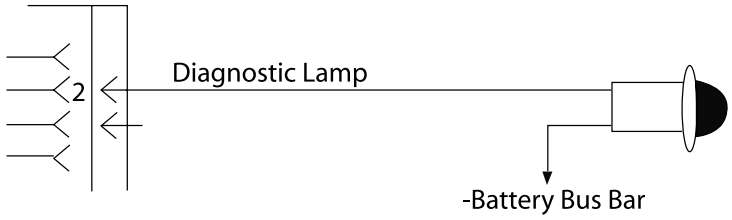
Requires: 225-6102 harness or OEM supplied wiring

DIAGNOSTIC LAMP

The diagnostic lamp alerts the operator to the presence of an active diagnostic code. A diagnostic code indicates a fault condition in the electronic control system. The operator uses this indication to help diagnose component failures in the electronic control system.

The diagnostic flash codes should only be used to indicate the nature of the occurrence of a diagnostic condition. The flash codes should not be used to perform detailed troubleshooting. Troubleshooting should be performed using diagnostic codes that are displayed by using an electronic service tool.

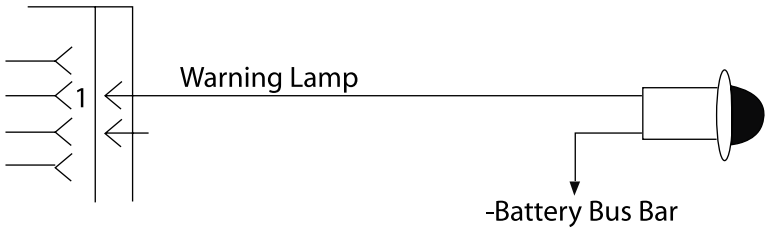
Diagnostic Lamp (Pin 2)



WARNING LAMP

The warning lamp is used to alert the operator that an engine event has occurred.
A warning event code is active; the warning lamp is on solid.
A derate event code is active; the warning lamp will flash.
When the ECU is energized (keyswitch turned ON), the warning lamp will turn on for five seconds. Then the lamp will turn off unless the ECU detects a warning condition. Refer to the Engine Installation Guide for more details.

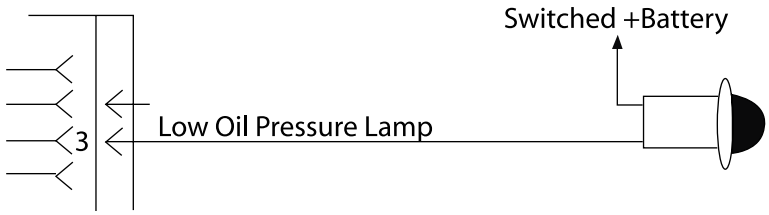
Warning Lamp (Pin 1)



LOW OIL PRESSURE LAMP

The low oil pressure lamp indicates the occurrence of a low oil pressure event. This diagnostic code becomes active based on the relationship between the engine speed and actual oil pressure. When the ECU is energized (keyswitch turned ON), the low oil pressure lamp will turn on for five seconds. Then the lamp will turn off unless the ECU detects a low oil pressure condition. Refer to the Engine Installation Guide for more details.

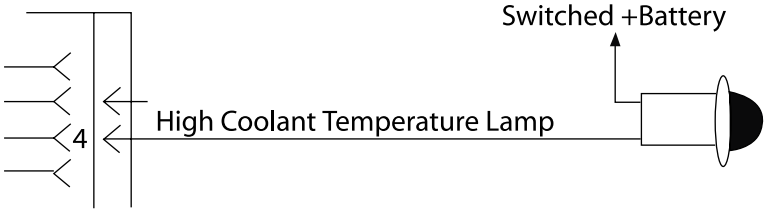
Low Oil Pressure Lamp (Pin 3)



LOW OIL PRESSURE LAMP

The low oil pressure lamp indicates the occurrence of a low oil pressure event. This diagnostic code becomes active based on the relationship between the engine speed and actual oil pressure. When the ECU is energized (keyswitch turned ON), the low oil pressure lamp will turn on for five seconds. Then the lamp will turn off unless the ECU detects a low oil pressure condition. Refer to the Engine Installation Guide for more details.

High Coolant Temperature Lamp (Pin 4)



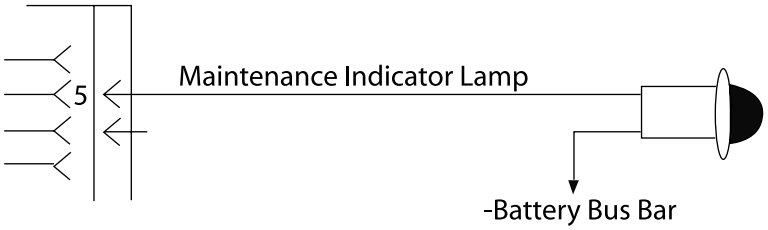
MAINTENANCE INDICATOR LAMP

When the preventive maintenance interval occurs, such as PM Level 1, the maintenance lamp will turn on.

When running against the fuel to air ratio control map, the lamp will turn on for 90 seconds.

When the ECU is energized, the maintenance indicator lamp will turn on for five seconds. Then the lamp will turn off unless the ECU detects that a maintenance interval has occurred.

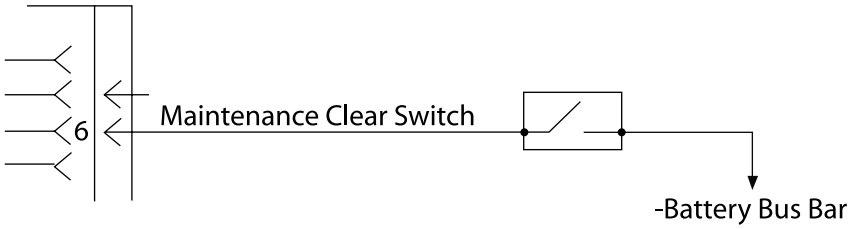
Maintenance Indicator Lamp (Pin 5)



MAINTENANCE CLEAR SWITCH

The maintenance clear switch is required to reset the PM1 interval after maintenance has been performed on the engine. The maintenance clear switch is standard equipment on the engine mounted control panel. If the engine mounted control panel is installed on the engine then the maintenance clear switch is not required. Refer to the Engine Installation Guide for more details. **Note:** A momentary contact switch is preferred.

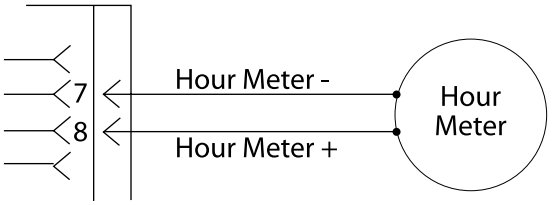
Maintenance Clear Switch (Pin 6)



HOUR METER –
HOUR METER +

The engine ECU provides a signal for an hour meter. When the ECU reads an engine speed greater than 500 rpm, the ECU turns on the hour meter. The signal is actual engine hours. Refer to the Engine Installation Guide for more details.

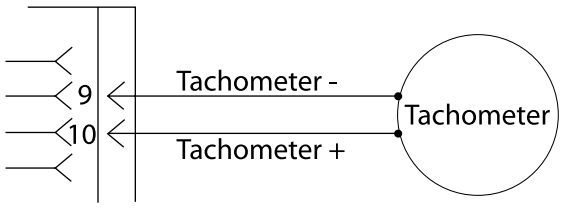
Hour Meter – (Pin 7) and Hour Meter + (Pin 8)



TACHOMETER +
TACHOMETER –

The engine ECU provides a signal for a remote mounted tachometer. The tachometer must meet SAE J1809 signal requirements and the ECU must be programmed to the tachometers signal value. Refer to the Engine Installation Guide for more details. Note: The tachometer output in not available on 3406E, 3412E, C30, and C32 ECUs.

Tachometer + (Pin 9) and Tachometer – (Pin 10)



Part No.	Description	Quantity
7C1072 or 7E3156	Digital Tachometer or Digital Tachometer w/backlight	1

Tachometer Requirements

The optional tachometer driver provided by the ECU (Custom Panel Connector pins 9 and 10) is a zero crossing square wave with an amplitude (no-load) of ± 10 VDC, refer to Figure 28. The amplitude of the signal will be ± 5VDC when the load current is less than 4 mA, refer to Figure 29. For those tachometers that require two signal lines, use both pin 9 and pin 10. The output at pin 9 is the complement (equal signal but travels in the opposite direction) of the output from pin 10. Connect either pin 9 or pin 10 from the Custom Panel Connector for tachometers that require one signal wire. Leave the other wire disconnected. When the ECU detects engine speed, the tachometer driver will provide the following output signal voltage (no load signal shown).

TACHOMETER +
TACHOMETER –

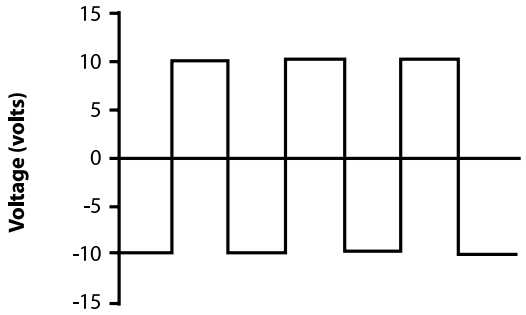


Figure 28 — Unloaded Speedometer/Tachometer Signal

The tachometer output signal is programmable from 12.0 to 500 ppr (pulses per revolution, selectable in 0.1 increments through Customer Programmable Parameters in ET). Caterpillar requires twisted pair wiring for the connections from the Custom Panel Connector to the tachometer. This will help eliminate radiated noise problems. Do not connect the tachometer output to more than one tachometer.

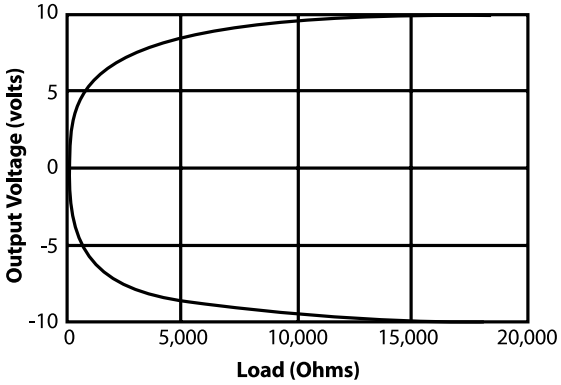


Figure 29 — Speedometer/Tachometer Signal vs. Load

-BATTERY (PIN 11)

The minus battery input from the minus battery bus bar.

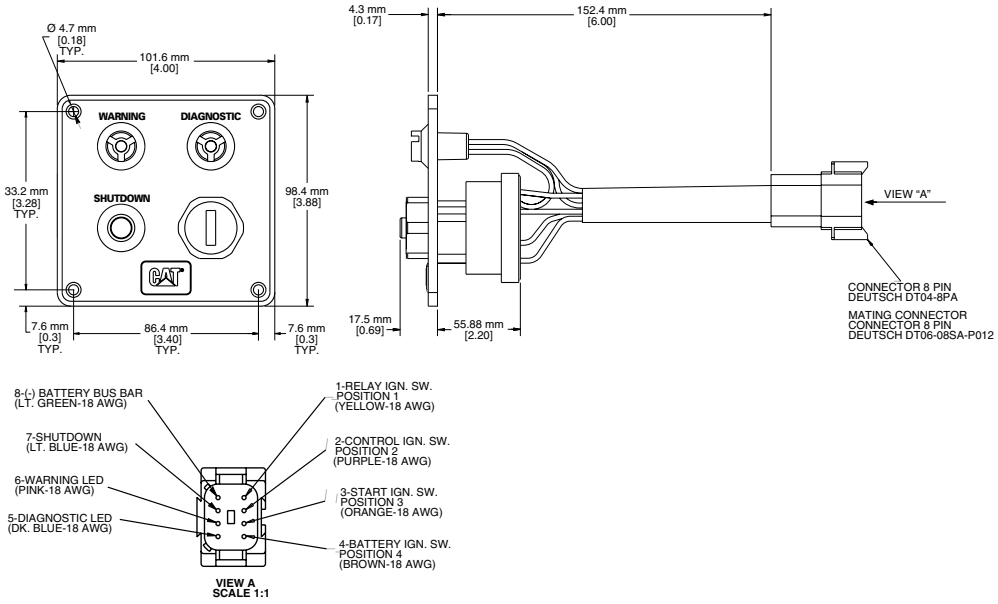
KEYSWITCH PIN 12)

The switched battery input from the keyswitch, used to supply +battery to the components connected to the custom panel connector.

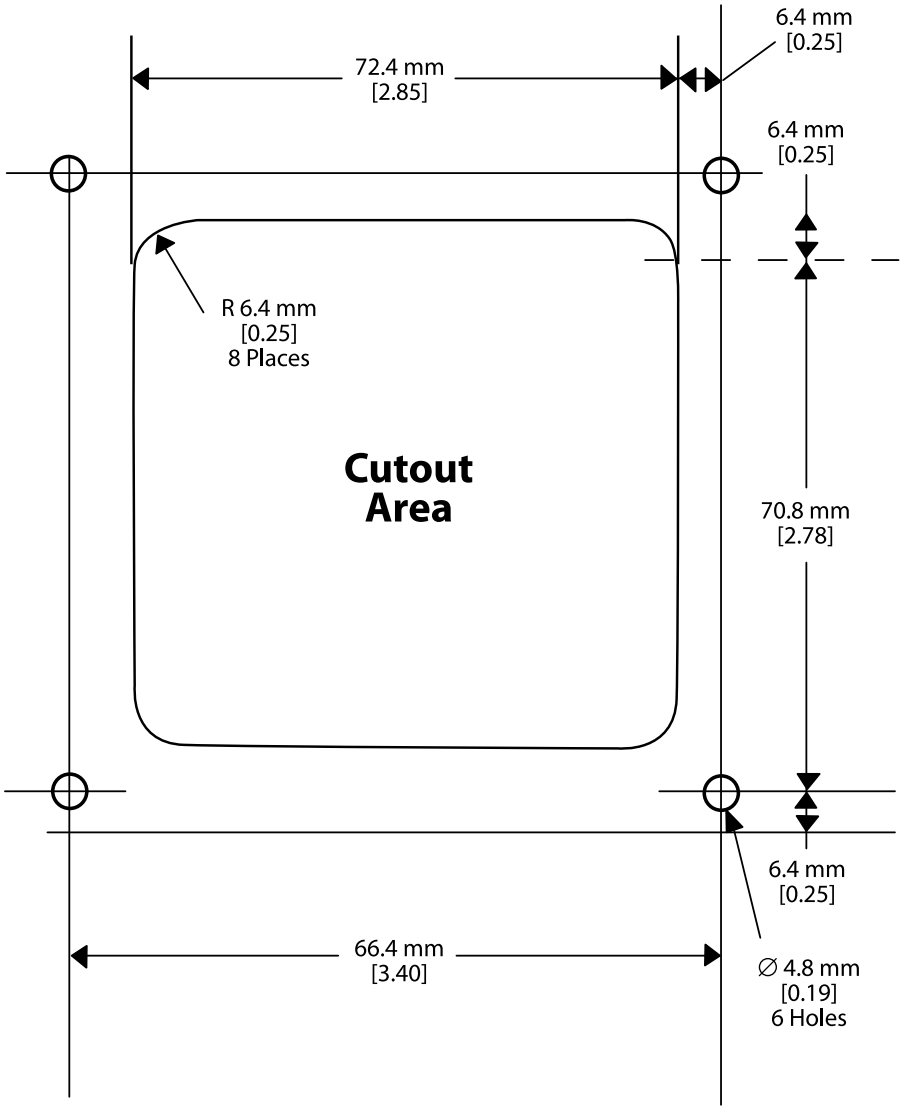
PORT OR STARBOARD KEYSWITCH PANEL 217-3865

The MJB provides two connectors, one for port and one for starboard, which were specifically designed to be used with 217-3865 and 217-8191 panel assemblies. The pin out is the same for both the port and starboard connectors.

Use the 210-8772 gasket if using the 217-3865 and 217-8191 panel assemblies. Use the 210-8773 gasket if using the 217-3865 panel assembly.



Start Panel Cutout Dimensions

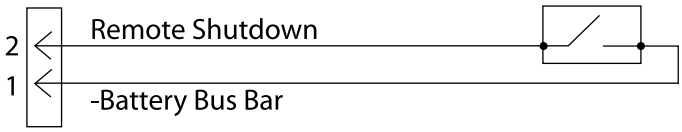


KEYSWITCH/ALARM CABLE 226-0361

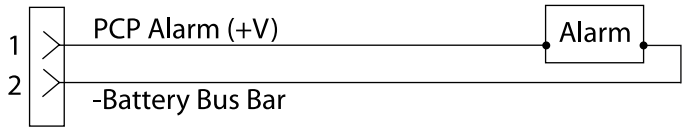
The Keyswitch/Alarm cable has been modified to include two additional engine shutdown connections. One two-pin connector has been included on each end of the harness. The additional engine shutdown input can be connected to an Engine Shut Down Switch or wired into the vessel fire suppression system

Remote Shutdown Switch
When this input is connected to minus battery, the ECU will set the fuel to 0 (off).

Remote Shutdown Switch or vessel fire suppression system.

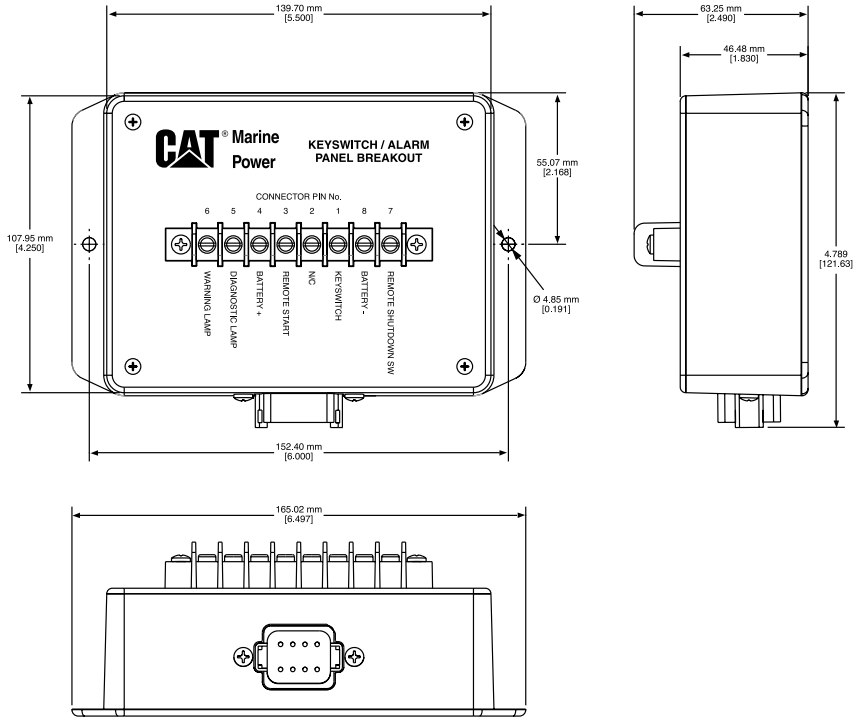


PCP Alarm — only available with MSCS
The PCP Alarm output will turn on in the event of a PCP failure.



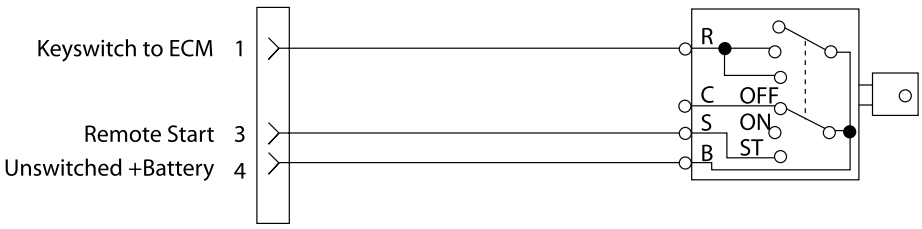
KEYSWITCH/ALARM PANEL BREAKOUT CONNECTIONS 226-3423

Port or Starboard Alarm Panel Connector



Requires: 226-0361 harness or OEM supplied wiring

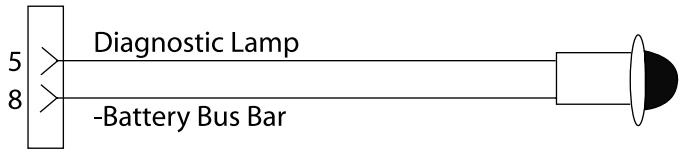
Keyswitch (pin 1)
Remote Start (pin 3)
Unswitched + Battery (pin 4)
Provides the positive switched battery to the ECU.
Provides the positive switched battery to energize the starter motor mag switch (SMMS).



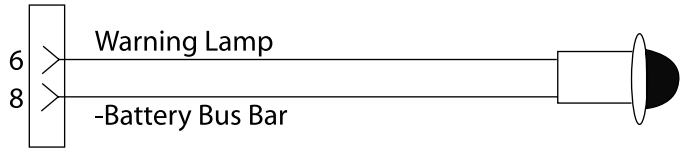
Requires: 110-7887 keyswitch and 598500 key

Diagnostic Lamp (pin 5)
The diagnostic lamp alerts the operator to the presence of an active diagnostic code. A diagnostic code indicates a fault condition in the electronic control system. The operator uses this indication to help diagnose component failures in the electronic control system.

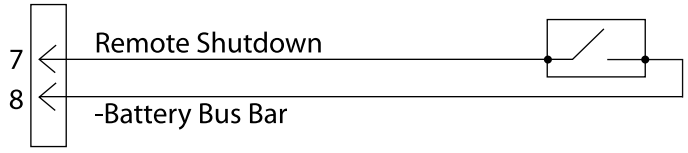
The diagnostic flash codes should only be used to indicate the nature of the occurrence of a diagnostic condition. The flash codes should not be used to perform detailed troubleshooting. Troubleshooting should be performed using diagnostic codes that are displayed on an electronic service tool.



Warning Lamp (pin 6)
The warning lamp is used to alert the operator that an engine event has occurred.
A warning event code is active; the warning lamp is on solid.
A derate event code is active; the warning lamp will flash.
When the ECU is energized (keyswitch turned ON), the warning lamp will turn on for five seconds. Then the lamp will turn off unless the ECU detects a warning condition. Refer to the Engine Installation Guide for more details.

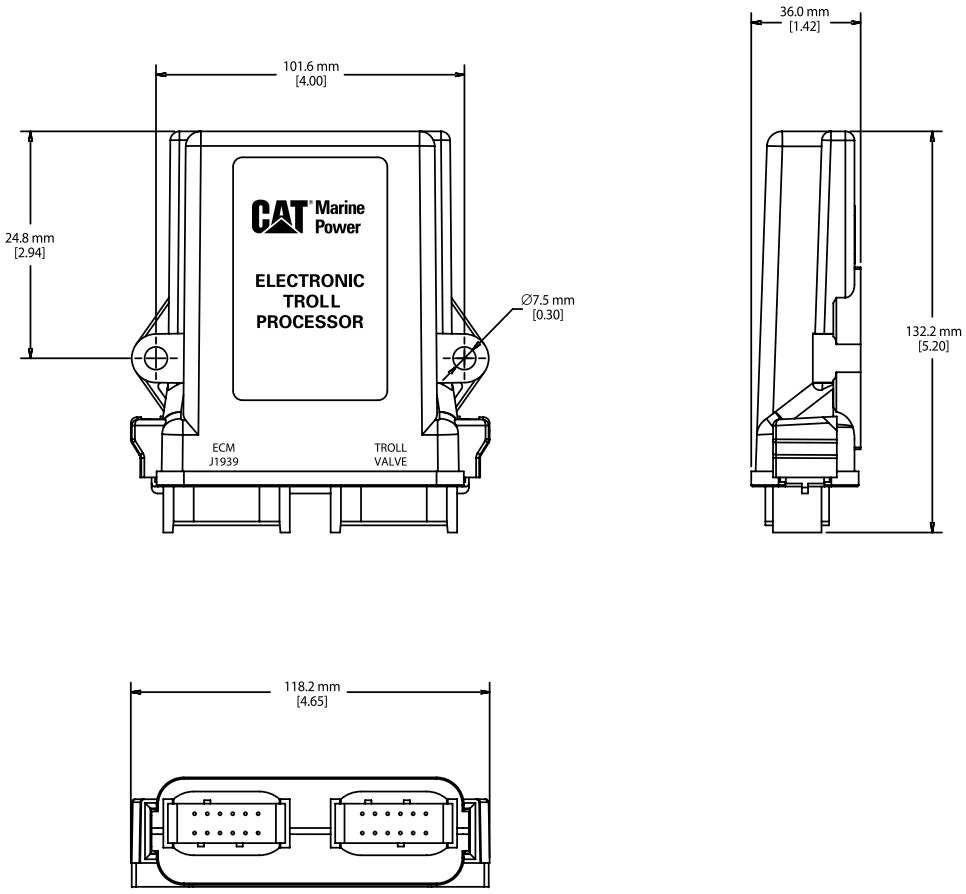


Remote Shutdown Switch (pin 7)
When this input is connected to minus battery, the ECU will set the fuel to 0 (off).



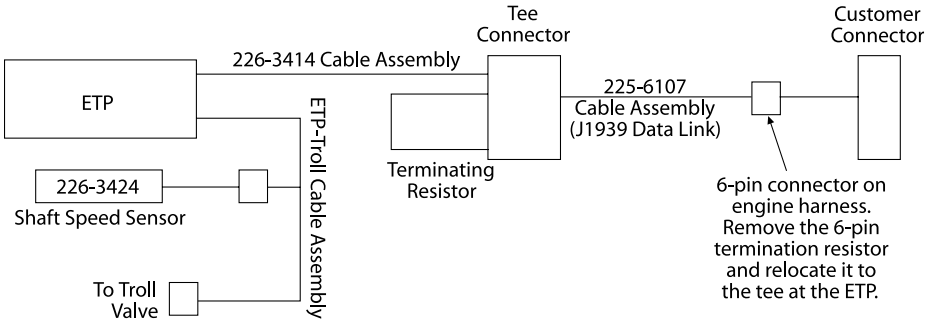
Minus Battery (pin 8)
The minus battery input from the minus battery bus bar.

ELECTRONIC TROLL PROCESSOR (ETP) INSTALLATION 256-4883



When the transmission is equipped with an optional electronic troll valve, the ETP will provide the trolling interface between the Powertrain Control Processor (PCP) and the electronic transmission. The ETP is responsible for providing the trolling signals to either Twin Disc or ZF electronic transmissions. The ETP receives the troll command (% slip) from the PCP, converts the message into a current/voltage and controls the transmission troll valves accordingly. The ETP also measures the shaft speed and transmits it on the J1939 data link to be displayed on the MPD.

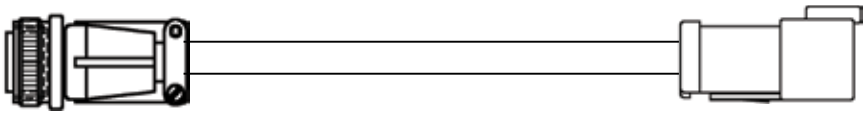
ETP CONNECTIONS



	Signal Requirements		Troll On/Off	Part Number
	Max Slip	Min Slip		
Twin Disc	5 V	0V	yes	243-4211 or 243-4212
Reintjes	2 V	4 V	yes	243-4211 or 243-4212
ZF-325, 350, 550, 655	200 mA	300 mA	no	226-0417
ZF 2555	200 mA	300 mA	no	226-0417
ZF-2000	150 mA	300 mA	yes	226-0417
ZF-1900/2500	450 mA	160 mA	yes	226-0417
ZF-4500...750	450 mA	160 mA	yes	226-0417
ZF-2000	1.2 V	3.8 V	yes	243-4211
ZF-1900/2500	1.2 V	3.8 V	yes	243-4211
ZF-4500...750	1.2 V	3.8 V	yes	243-4211
ZF-2060 A	150 mA	300 mA	yes	226-0417

ZF Troll Valve
ZF 1900, ZF 2500, ZF 4600

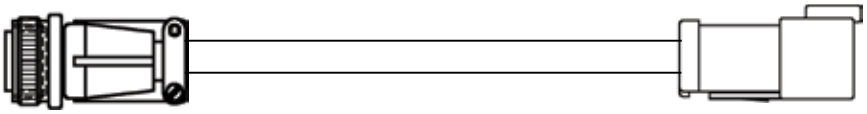
Requires: 102-8804 Receptacle Kit (includes 3E3376 receptacle and 3E3377 wedge)
1Q5094 Plug Assembly — inline connector
or
8T9605 Plug Assembly — right angle connector



ZF Connector	Wire Name	4-pin Deutsch
A	Proportional Valve B+	1
B	Solenoid ON/OFF B+	4
C	Solenoid ON/OFF B+	3
D	N/C	
E	N/C	
F	Proportional valve B-	2

ZF Gear Connection
ZF 1900, ZF 2500, ZF 4600

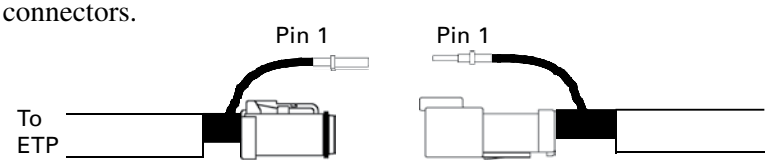
Requires: 102-8805 Receptacle Kit (includes 3E3382 receptacle and 3E3383 wedge)
1Q5094 Plug Assembly — inline connector
or
8T9605 Plug Assembly — right angle connector



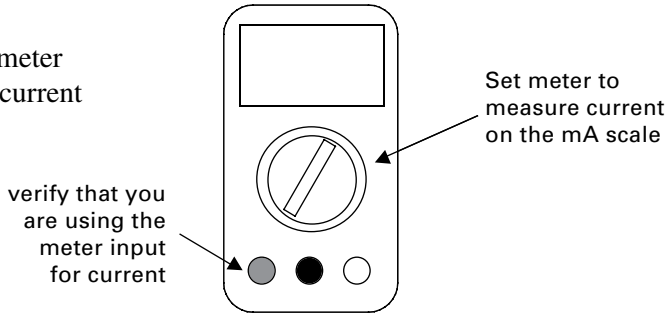
ZF Connector	Wire Name	6-pin Deutsch
A	FWD +	1
B	REV +	2
C	N/C	
D	N/C	
E	N/C	
F	Common	3 and 6

Measuring Troll Valve Current

Step 1 Disconnect the troll 4-pin connector and remove pin one from both connectors.



Step 2 Set the voltmeter to measure current



Step 3 Connect the meter

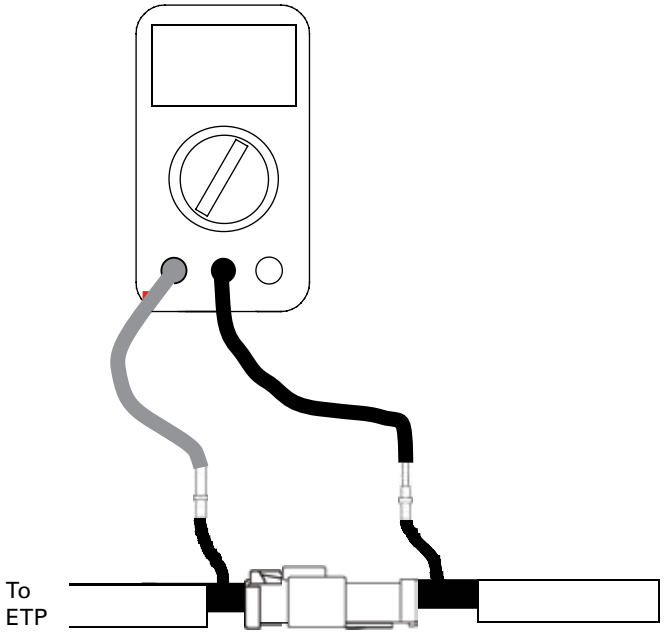
Keep pin one out from both connectors and connect the 4-pin connector together.

Connect the red probe from the meter to the socket wire from ETP).

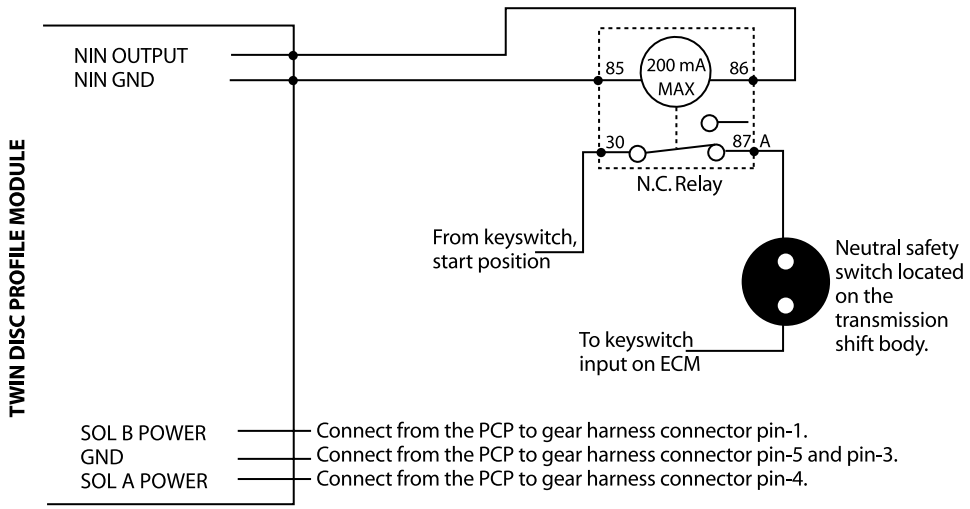
Connect the black probe to the pin (Harness to Troll Valve).

Turn the system on, engine off.

Activate troll and move the throttles while measuring the current.

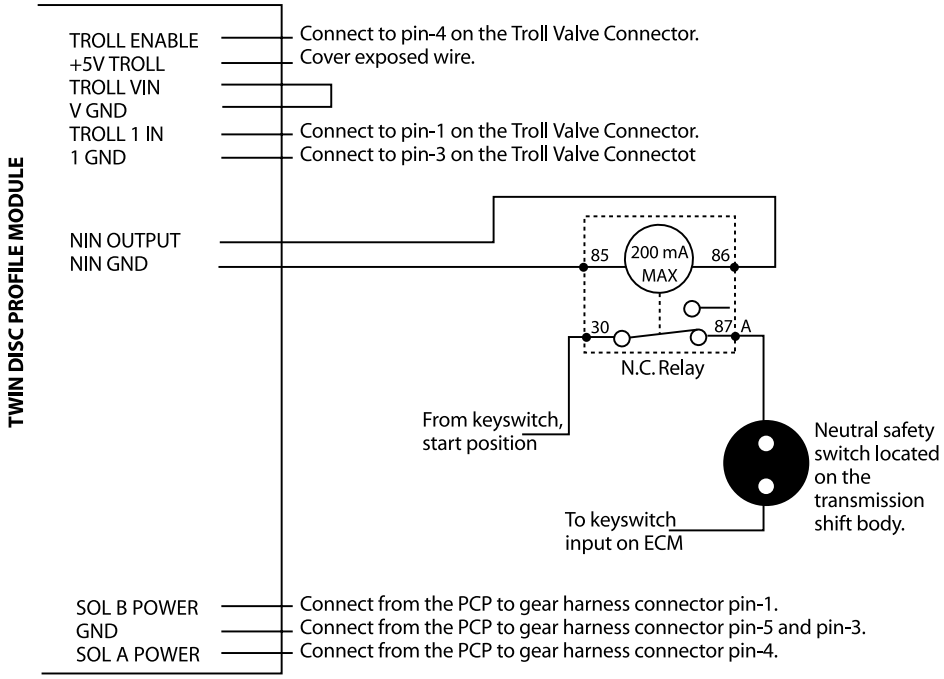


TWIN DISC PROFILE INSTALLATION



TWIN DISC MGX/ETROLL & MG GEARS ETROLL INSTALLATION

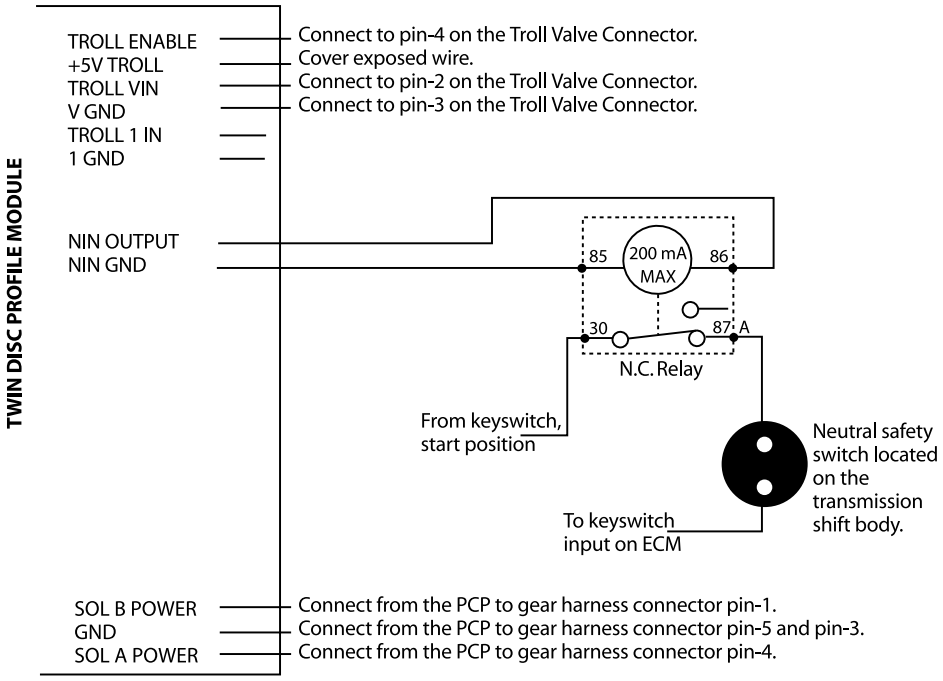
4-20 mA Troll Command



NIN = Not In Neutral

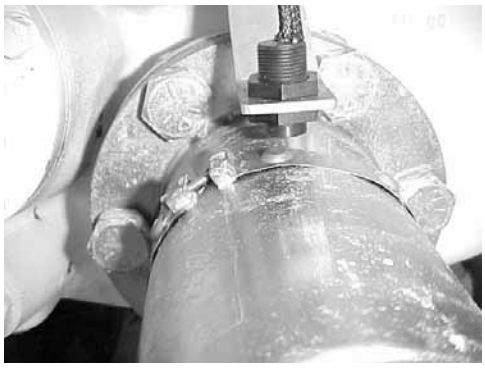
TWIN DISC MGX/ETROLL INSTALLATION

0-5 VDC Troll Command



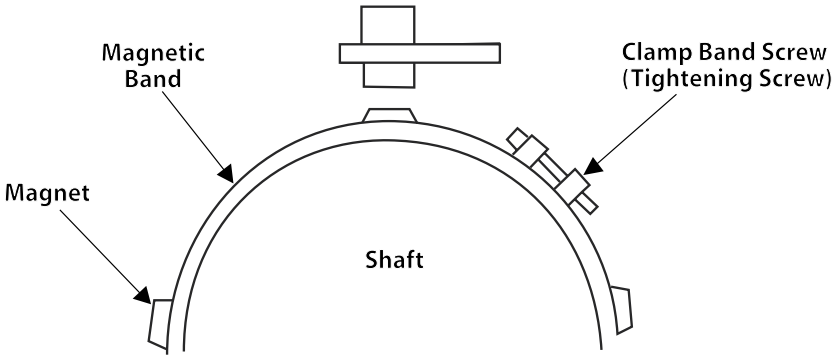
SHAFT SPEED SENSOR INSTALLATION 226-3424

The ETP provides an input to monitor shaft speed. Shaft speed can be displayed on MPD. Use the MPD Builder program to customize the MPD screen to display Shaft Speed.

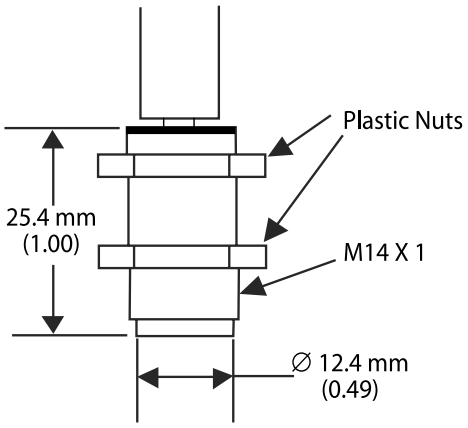


Magnetic Band Installation

Install the magnetic band around the propeller shaft. Tighten the magnetic band so that it does not slide or move around he shaft. Do not exceed 8 in/lbs on the tightening screw.

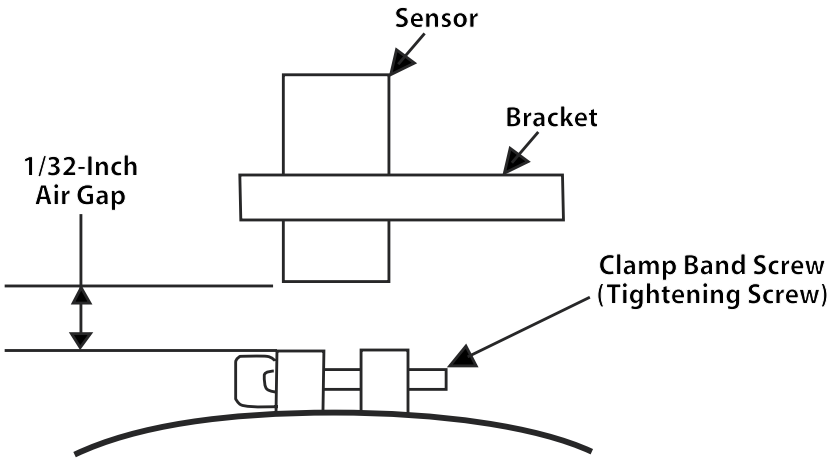


Shaft Speed Sensor



SHAFT SPEED SENSOR INSTALLATION (CONT)

Fabricate a bracket to secure the shaft speed sensor above the magnetic band. The bracket should be installed radially in line with the magnets on the magnetic band. Position the clamp band under the shaft speed sensor and adjust the sensor so that it is touching the clamp. Loosen the speed sensor 1/4 turn to create an air gap (1/32") between the shaft speed sensor and the tightening screws of the magnetic band.



Shaft Speed Pulses Per Revolution

Number of shaft speed sensor pulses per shaft revolution. This number is dependent on the number of magnets installed on the shaft speed magnetic band. The standard value is 4. This value should be programmed to number of magnets divided by 2.

Options	Default
0 to 250 pulses per revolution	4 pulses per revolution

ETP CALIBRATION (USING ET)

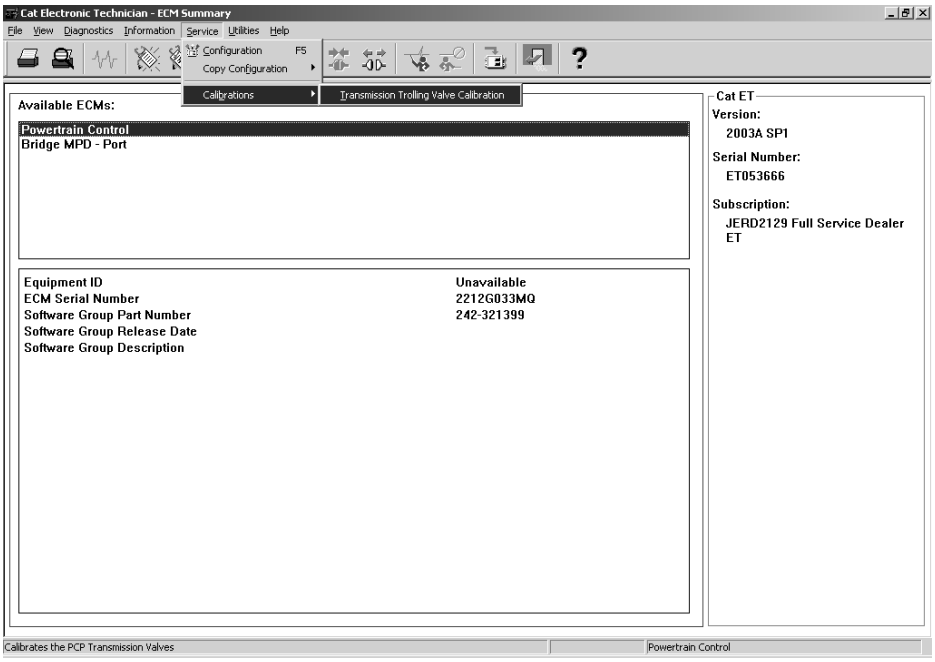
⚠ WARNING

Do not proceed with this calibration unless you have read and understand the following instructions and warnings. Failure to follow the instructions or heed the warning could result in injury or death.

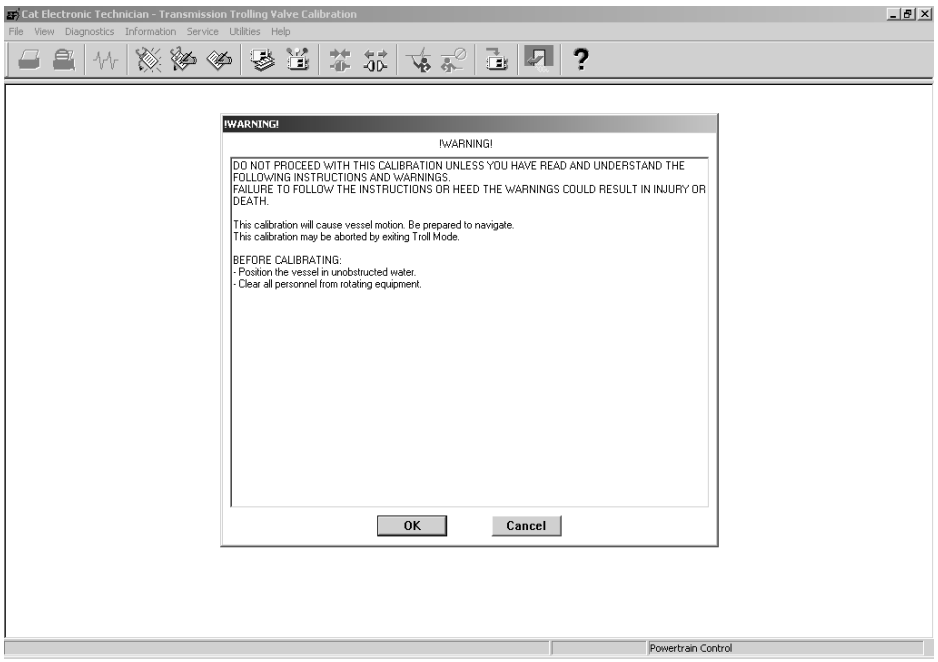
This calibration will cause vessel motion, be prepared to navigate. This calibration may be aborted by exiting Troll mode.

Before Calibrating:
Position the vessel in unobstructed, navigatable water.
Clear all personnel from rotating equipment.

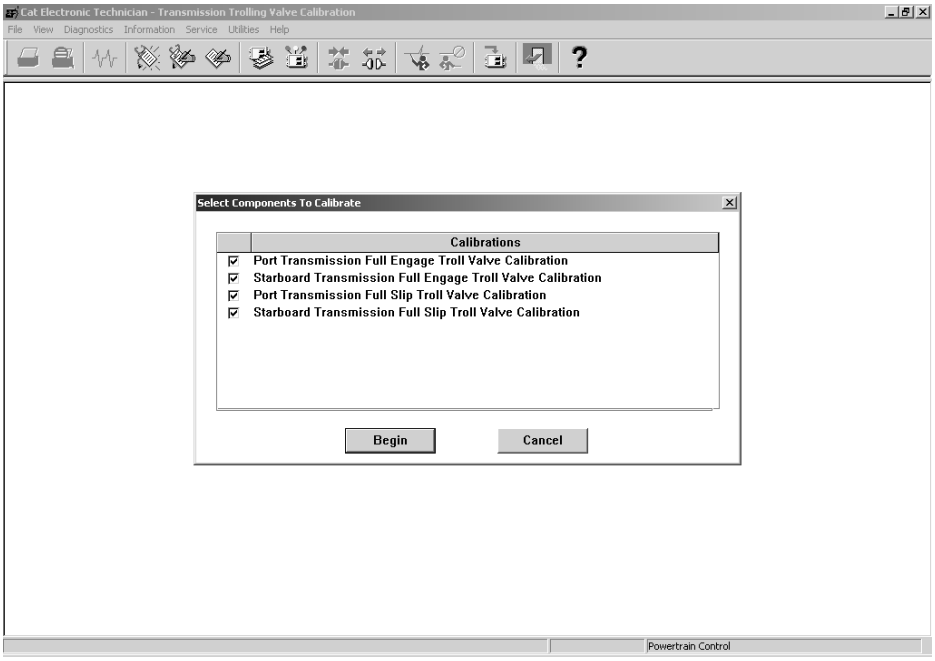
1. Turn the keyswitch ON engine OFF. Boot up ET and access Service > Calibrations > PCP Transmission Valve Calibration.



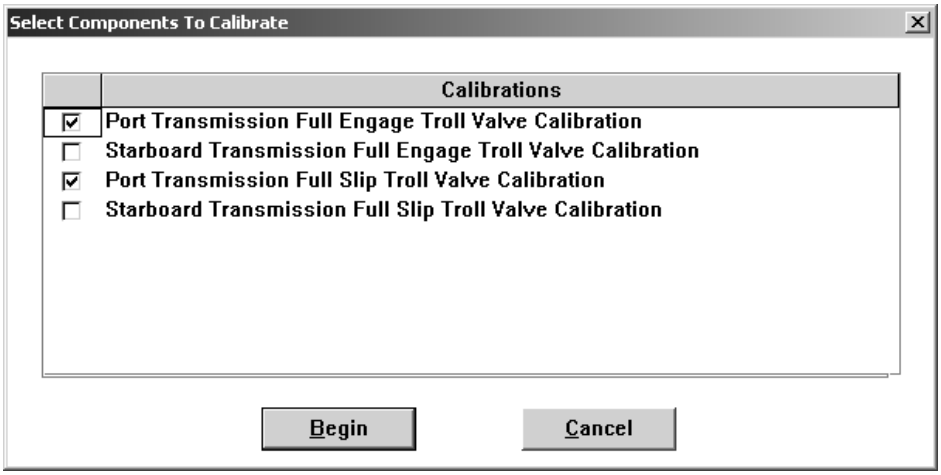
2. The warning screen will appear. Read the warning carefully and notify any passengers that the vessel will be moving while the calibration procedure is performed. Then click OK.



3. The Select Components To Calibrate Screen will appear. Click on the appropriate calibrations needed for the vessel. If the vessel is equipped with a single engine, click on the Port calibrations and verify that the engine location is programmed to PORT.

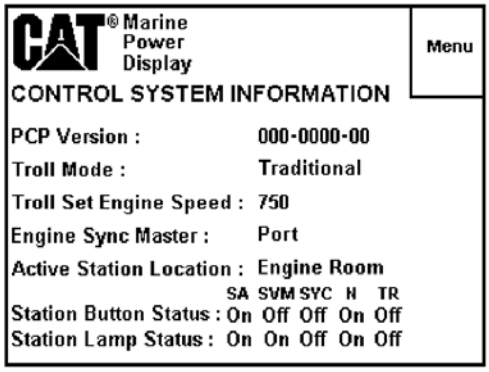


Single engine vessel

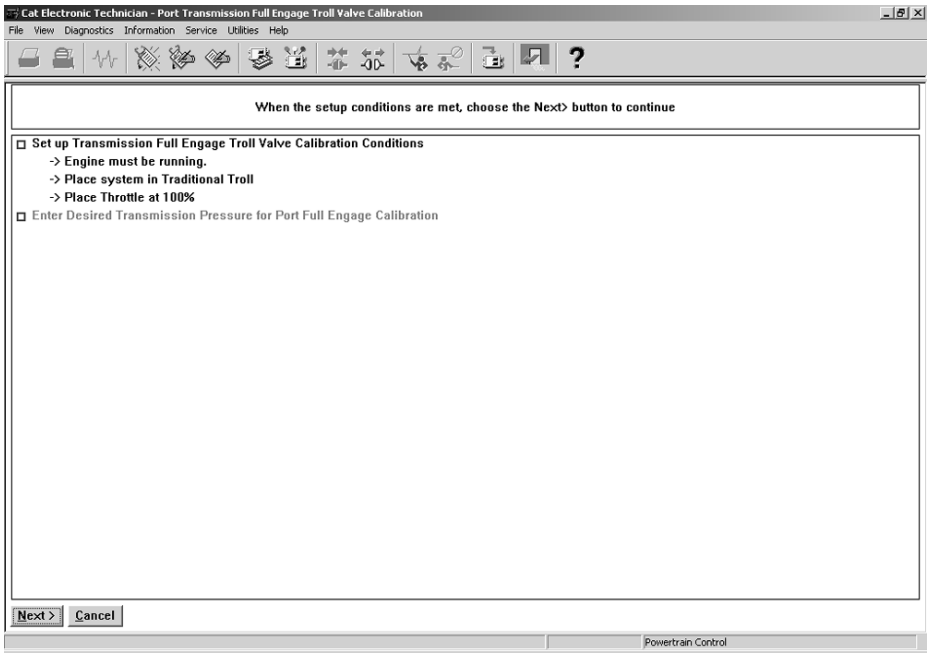


4. Select the parameters to calibrate and click on Begin.

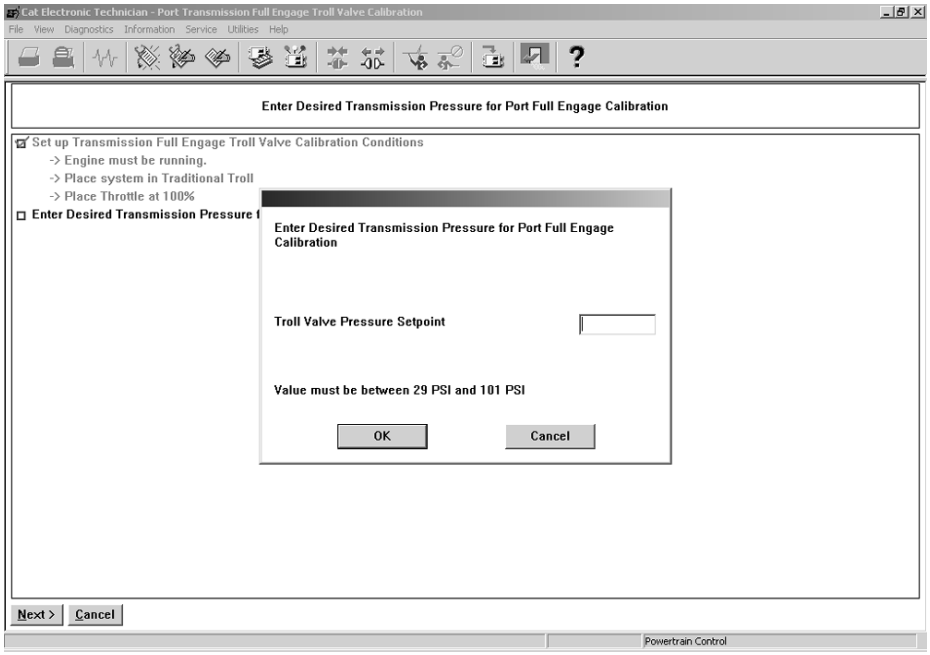
5. To begin the calibration sequence;
   - Turn the keyswitch ON and start the engine. Allow the engine and transmission to reach normal operating temperatures.
   - Turn on Traditional Troll. This can be done using the MPD. Scroll to the Control System Information Screen and change Troll Mode to Traditional.



   - Place the throttles at 100% or W.O.T.
   - Click on Next

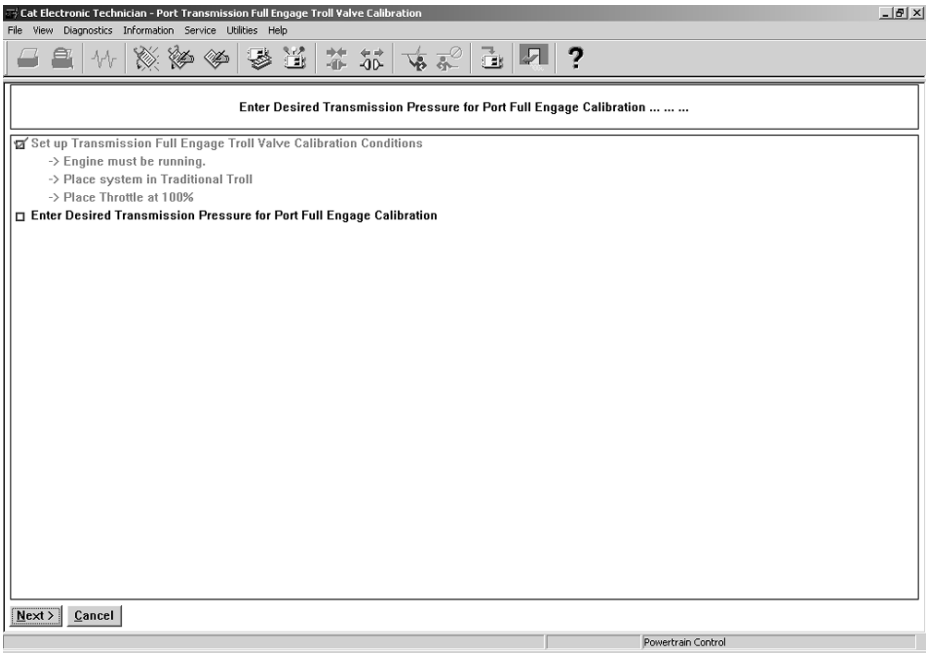


6. Enter the pressure set point for full engagement for the Port engine. This value can be found on the transmission information plate, operator's manual, or by using ET while monitoring transmission pressure during transmission lock-up.

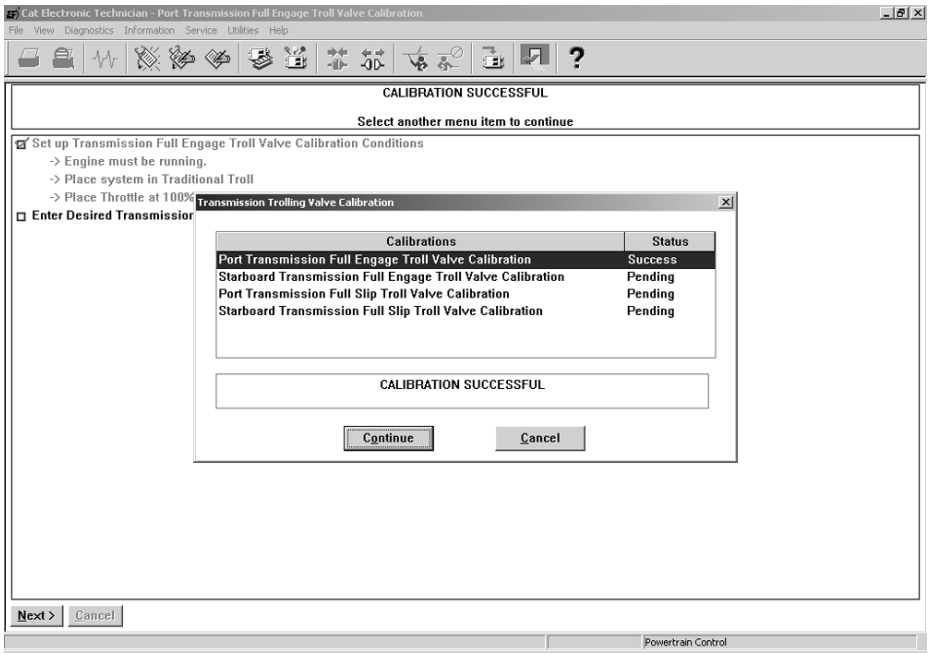


7. Click OK.

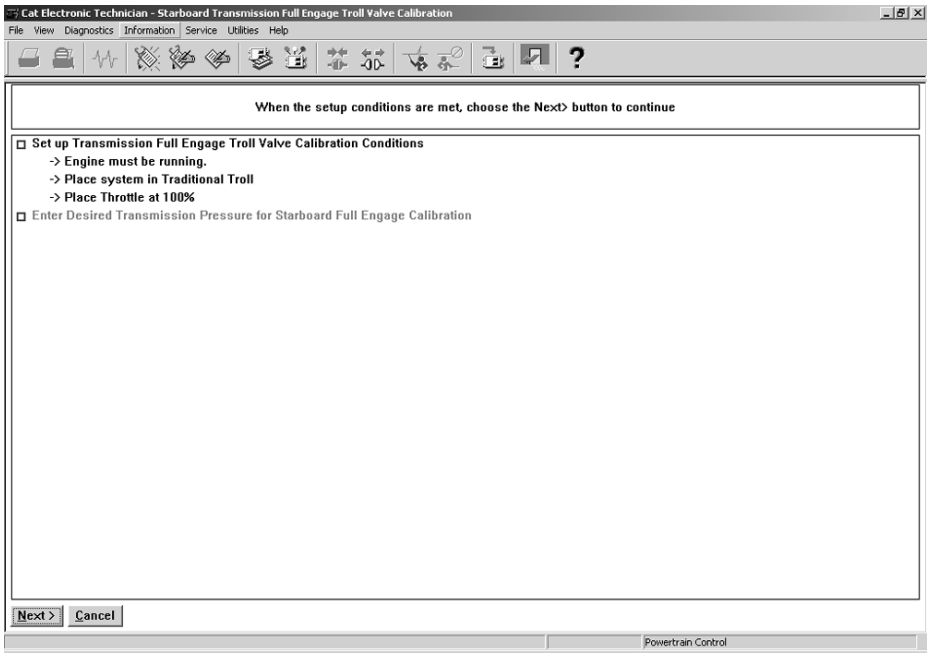
8. ET will calibrate the Port Transmission full engage value.



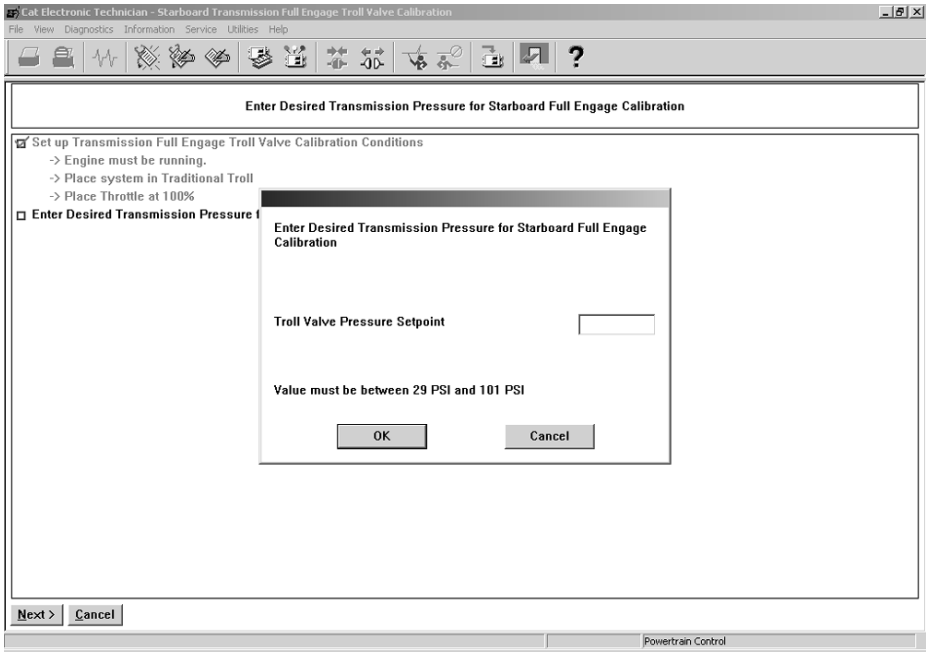
9. The Successful Calibration Screen will appear. Click on Continue.



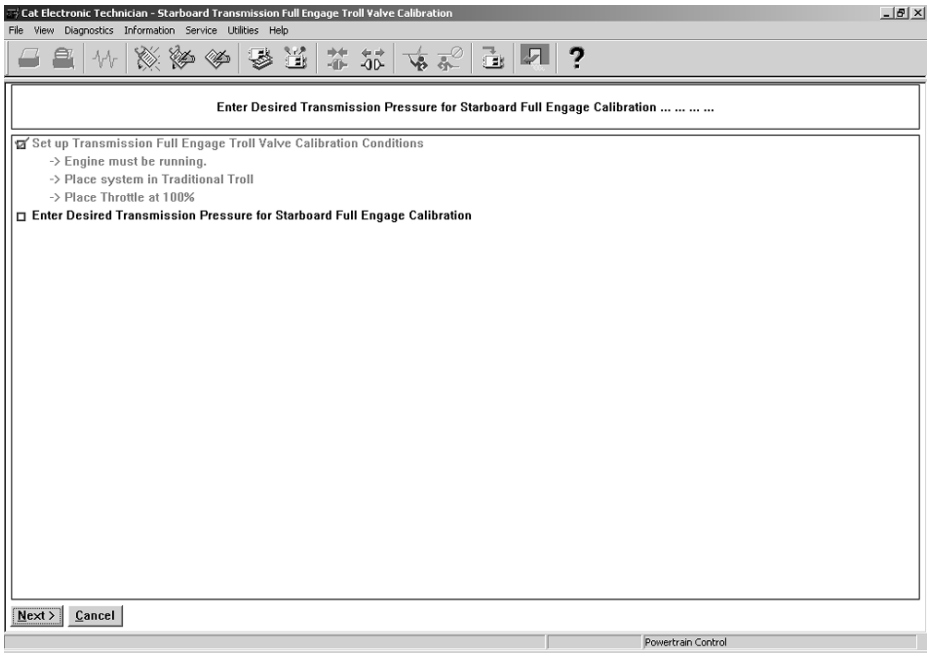
10. Allow the Starboard engine and transmission to reach normal operating temperatures.
    • Place the throttles at 100% or W.O.T.
    • Click on Next



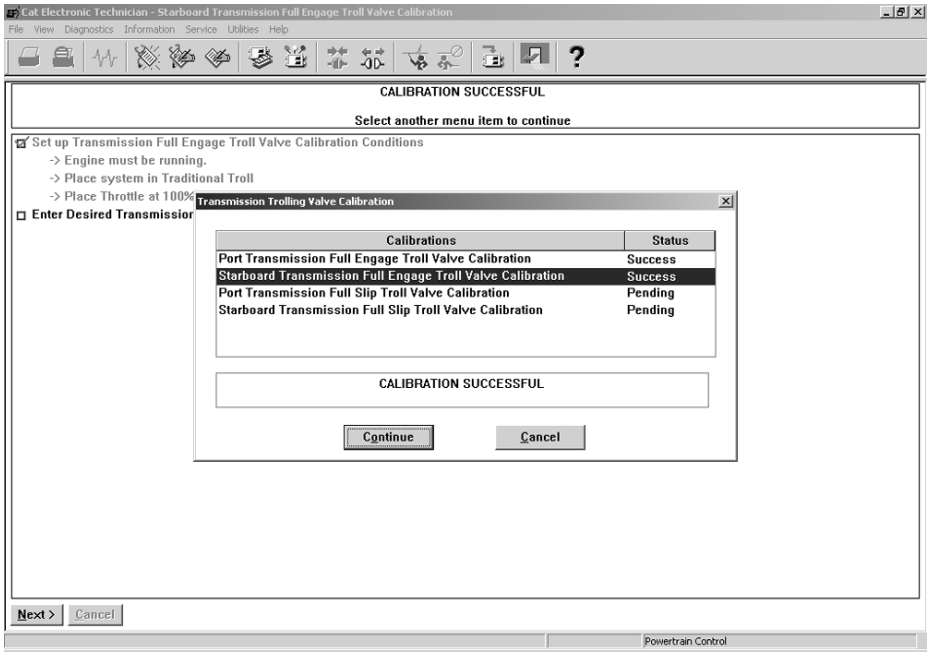
11. Enter the pressure set point for full engagement for the Starboard engine. This value can be found on the transmission information plate, operator's manual, or by using ET while monitoring transmission pressure during transmission lock-up.



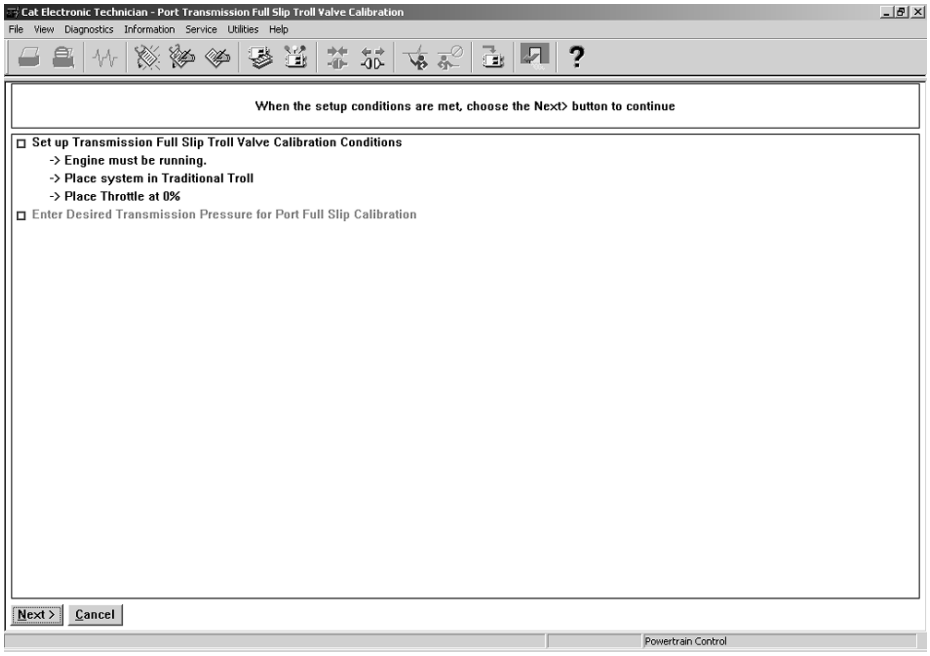
12. ET will calibrate the Starboard Transmission full engage value.



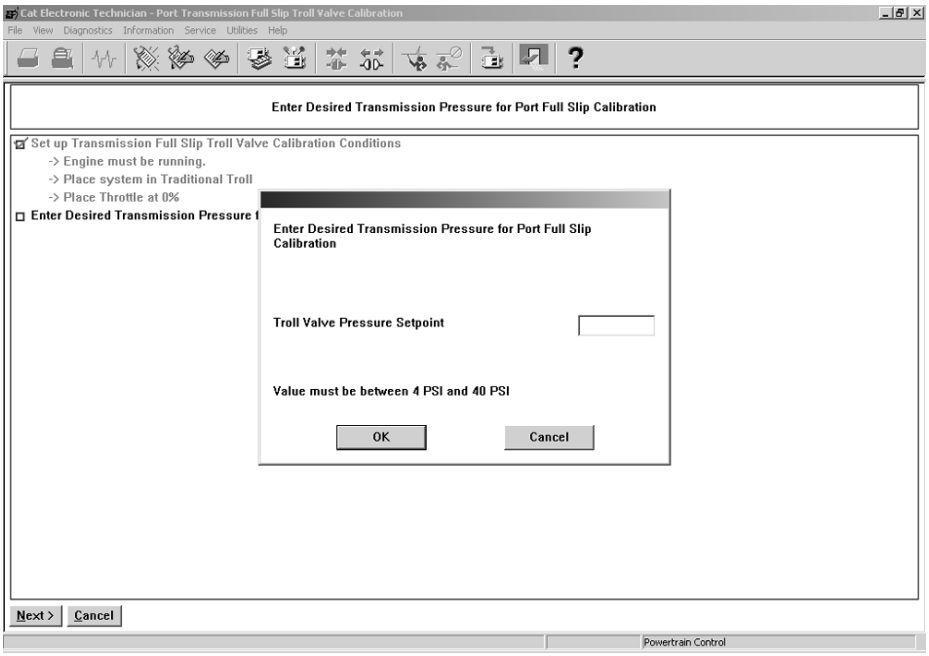
13. The Successful Calibration Screen will appear. Click on Continue.



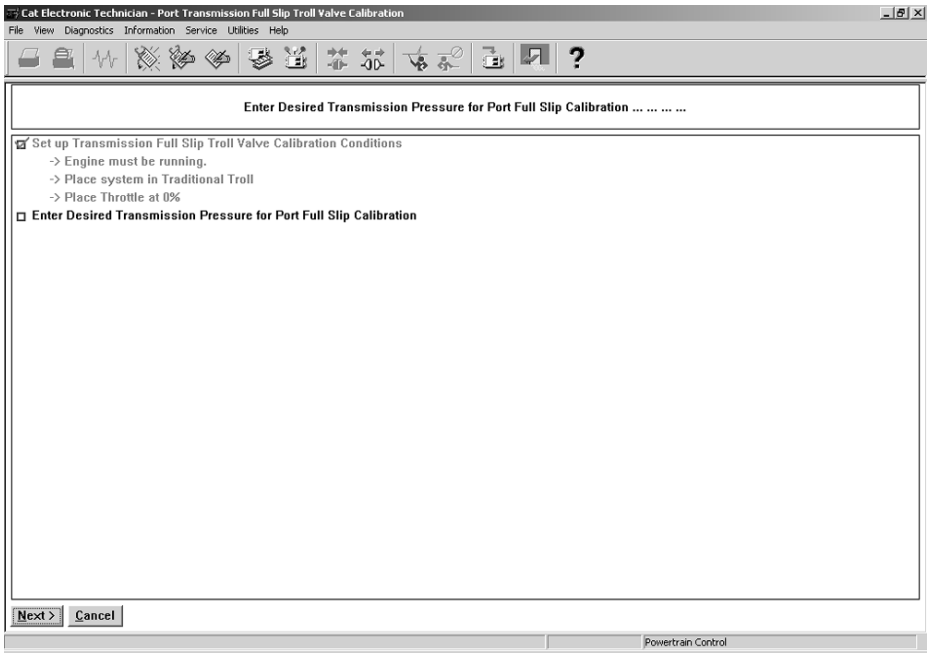
14. Allow the Port engine and transmission to reach normal operating temperatures.
    - Place the throttles at 0% throttle or low idle.
    - Click on Next



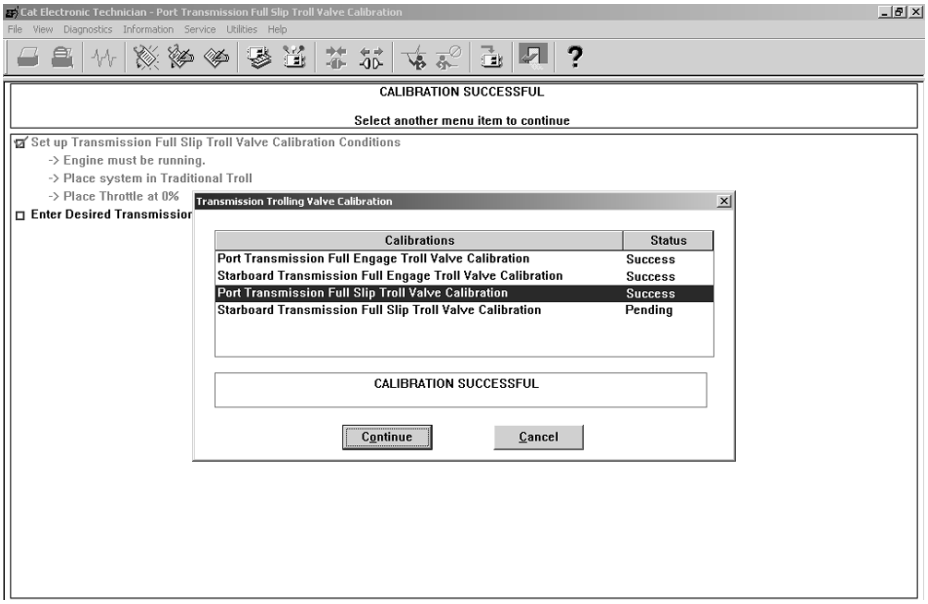
15. Enter the pressure set point for full slip for the Port engine. This value can be found on the transmission information plate, operator's manual, or by using ET while monitoring transmission pressure during full slip. Click on OK.



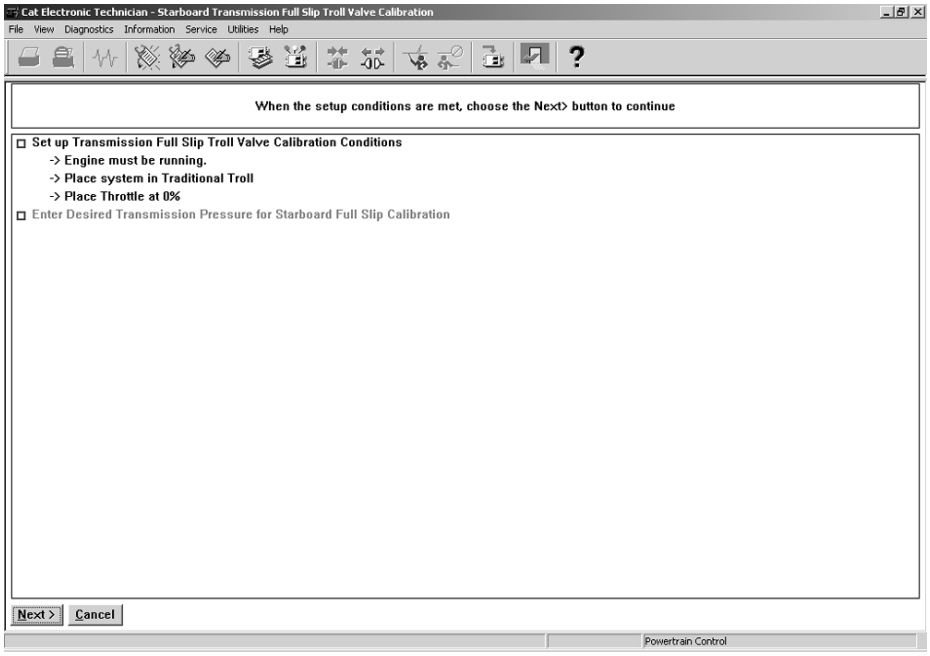
16. ET will calibrate the Port Transmission full slip value.



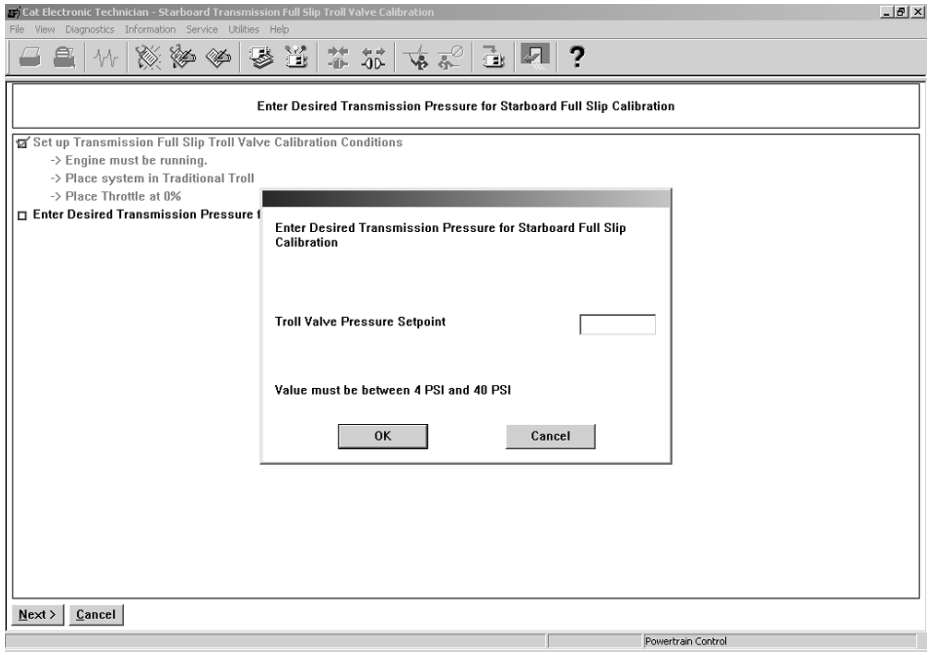
17. The Successful Calibration Screen will appear. Click on Continue.



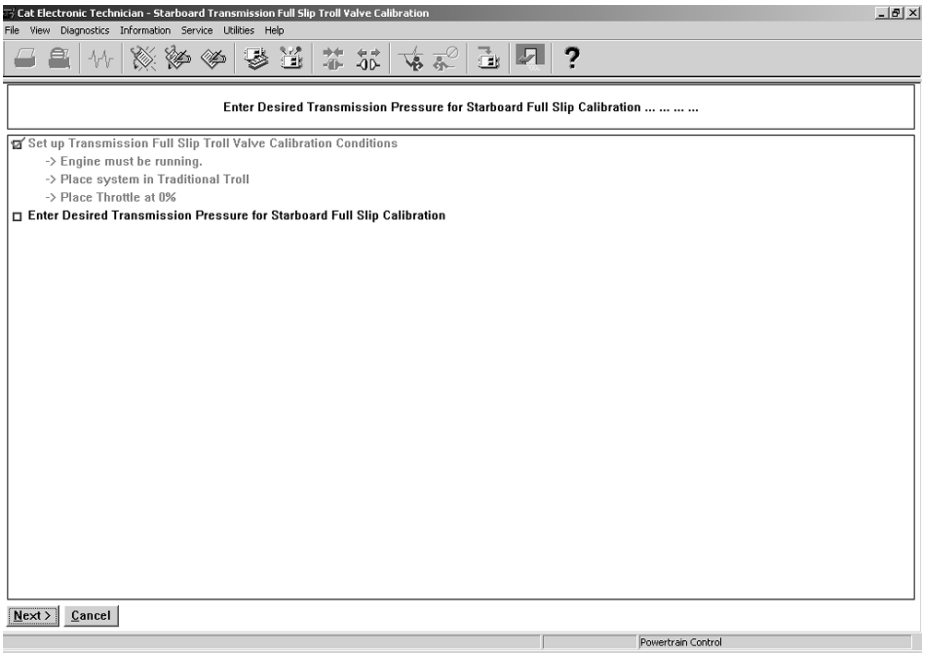
18. Allow the Starboard engine and transmission to reach normal operating temperatures.
    - Place the throttles at 0% throttle or low idle.
    - Click on Next



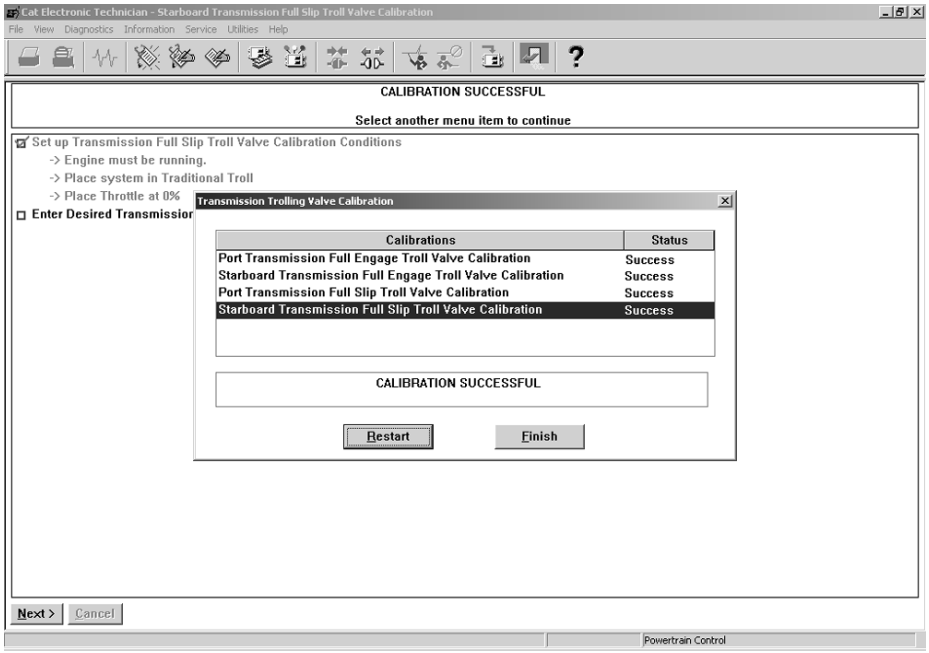
19. Enter the pressure set point for full slip for the Starboard engine. This value can be found on the transmission information plate, operator's manual, or by using ET while monitoring transmission pressure during full slip. Click on OK.



20. ET will calibrate the Starboard Transmission full slip value.

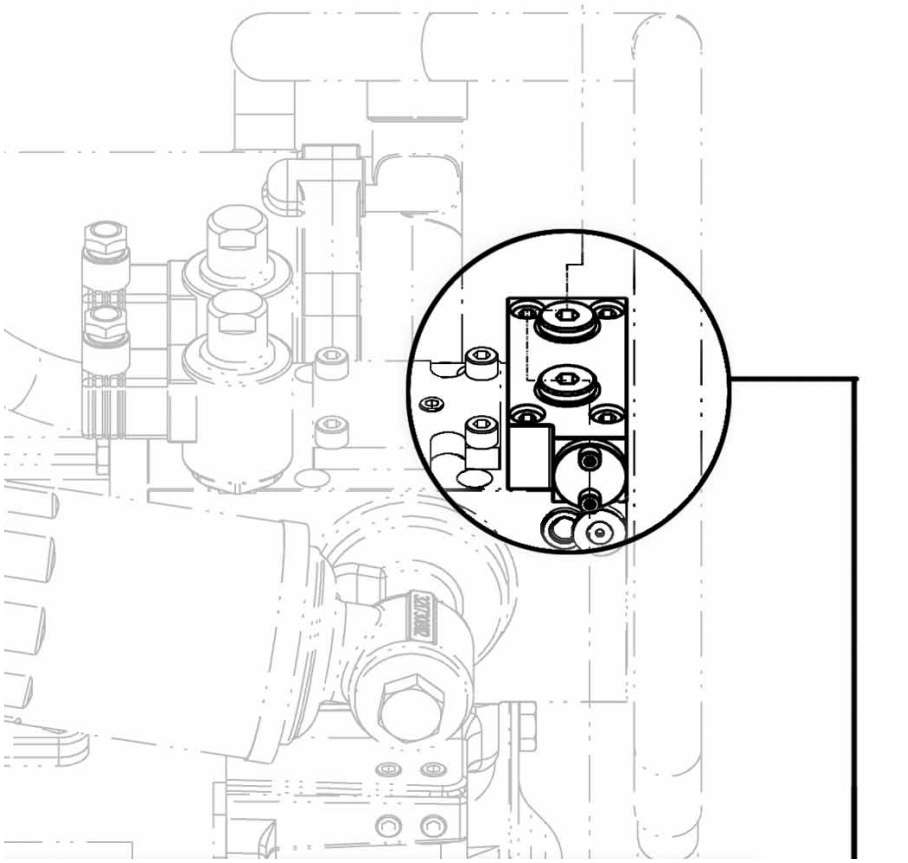


21. The Successful Calibration Screen will appear. Click on Finish.



TRANSMISSION PRESSURE SENSOR INSTALLATION

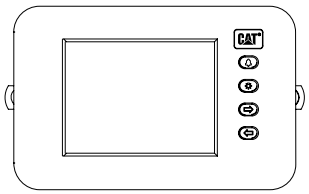
Installation on the ZF Supershift transmission

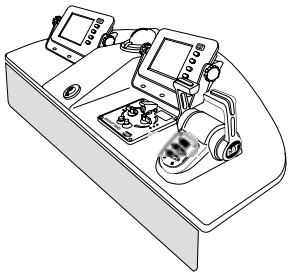


Optional adapter block, 18 mm threads. The adapter block can be used to install the transmission pressure sensor. This location will read clutch applied pressure for forward and reverse and 0 pressure when the gear is in neutral.

MARINE POWER DISPLAYS

COLOR MPD 309-3001
MINI MPD 222-2222
MPD 333-3333



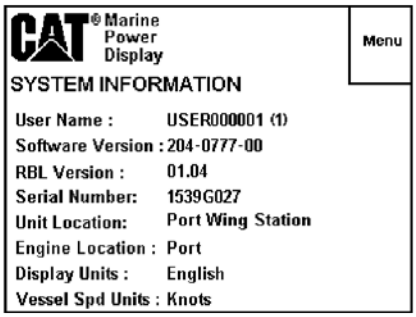


The Marine Power Displays are available in three different models, the Color MPD, the Mini MPD and the MPD. All three units can display the information in this section. The MPD will be used for all examples. The Marine Power Display (MPD) provides current engine and transmission operating data. The screens can be customized to display various engine parameters and MSCS information. The MPD software has been redesigned to include MSCS functions.

INFORMATION SCREENS

There are two information screens available, the System Information screen and the Control System Information screen. Pressing the button labeled **Menu** will display the System Information screen or the control system Information screen.

The System Information screen is the first screen displayed by default, however the MPD will retain which information screen was displayed last until a power-off/reset.



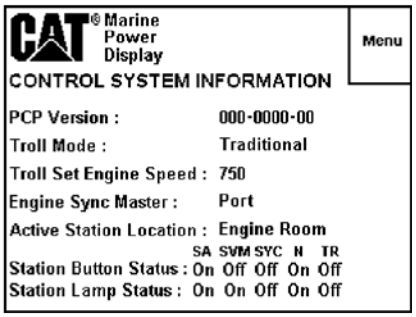


Figure 2 – Information Screens

SYSTEM INFORMATION SCREEN

The System Information screen will display the current User Name, Software Version, ROM Bootloader Software Version, Unit Serial Number, Unit Location, Engine Location, Display Units, and Vessel Speed Units. Pressing the button labeled ***Menu*** will display the System Information menu screen. On this screen, the button functionality is re-defined as shown on the right side of the screen, see figure 3. If a diagnostic code is active and the diagnostic code window is on screen, the button actions return to their normal definitions. Pressing the up or down arrow button will cause the top menu item (labeled Change Screen) to scroll through the items to be changed (Change Screen, Change User, Change Unit Location, Change Display Units, and Change Vessel Speed Units) and cause the selected data to be displayed in reverse video. Pressing the alarm button will cause the specified parameter to scroll through each available value (i.e. Change Vessel Speed would scroll through Knots, MPH, and KPH). Pressing the button labeled ***Exit*** will return the display to the System Information screen and save any changed data to non-volatile memory.

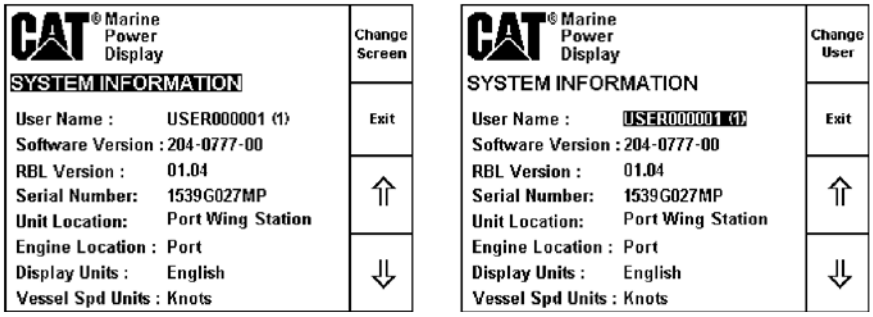


Figure 3
System Information Menu Screens

CHANGE SCREEN

Pressing the alarm button will cause the Control System Information screen to be displayed. This option is only available if the MPD has detected a Powertrain Control Processor (PCP) on the CAN data link.

CHANGE USER

Pressing the alarm button will cause the displayed User Name text to scroll through the available user names.

CHANGE UNIT LOCATION

Pressing the alarm button will cause the displayed Unit Location text to scroll through the available location selections.
The vessel locations that are available are: Bridge, Port Wing, Starboard Wing, Tower, Engine Room, Aft Station, Fly Bridge, and Bow Station.

CHANGE DISPLAY UNITS

Pressing the alarm button will cause the displayed Display Units text to scroll through the available units selections (English and Metric).

CHANGE VESSEL SPEED UNITS

Pressing the alarm button will cause the displayed Vessel Speed Units text to scroll through the available units selections (Knots, MPH, and KPH).

CHANGE SYSTEM INFORMATION SCREEN

The Control System Information screen will only be displayed if a Powertrain Control Processor (PCP) is detected on the data link. This screen will display the PCP software part number, Troll Mode, Troll Set Engine Speed, Engine Sync Master, Active Station Location, active Station Button Status, and Active Station Lamp Status. Pressing the button labeled ***Menu*** will display the screen shown in Figure 4. On this screen the button functionality is re-defined as shown on the right side of the screen. However, in the presence of a diagnostic code window button actions return to their normal definitions. Pressing the up or down arrows will cause the top menu item (labeled Change Screen) to scroll through the items to be modified (Change Screen, Change Troll Mode, Change Set Speed, Change Sync Master, and Change Station Location) and cause the selected data to be displayed in reverse video. Pressing the alarm button will cause the specified parameter to scroll through each available value. Pressing the button labeled ***Exit*** will return the display to the Control System Information screen and transmit any changed data items to the PCP.

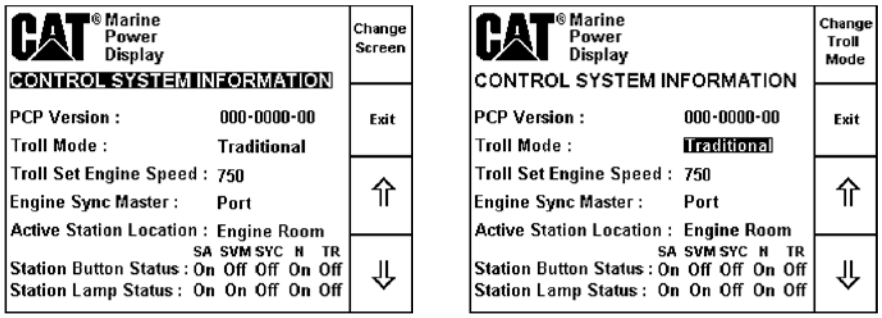


Figure 4
Control System Information Menu Screens

CHANGE SCREEN

Pressing the alarm button will cause the System Information screen to be displayed.

CHANGE TROLL MODE

Pressing the alarm button will cause the displayed Troll Mode to scroll through the available troll modes (Traditional and Intelli-Troll).

CHANGE TROLL SPEED

Selecting Change Troll Set Speed will display the following screen. Pressing + will increase the set speed by 1 rpm and pressing – will decrease the set speed by 1 rpm. Pressing Save will cause the MPD to send the data to the PCP (and exit the screen), and pressing Cancel will cause the MPD to exit the screen without sending any data to the PCP.

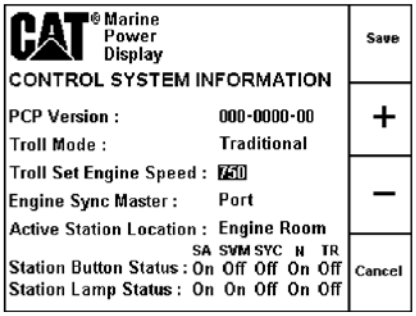


Figure 5
Change Troll Set Speed Menu

CHANGE ENGINE SYNC MASTER

Pressing the alarm button will cause the displayed Engine Sync Master to scroll through the available sync master selections (PORT and STBD).

ACTIVE STATION LOCATION

Displays the Active Station Location (Bridge, Port Wing, Starboard Wing, Tower, Engine Room, Aft Station, Fly Bridge, and Bow Station). If the PCP reports that there is no active station, then the MPD will display NONE in the Active Station Location field.

BUTTON STATUS INDICATOR

The Station Button Status indicators display the button status as read by the active control station.

- SA – Activate Station Button Status
- SVM – Slow Vessel Mode Button Status
- SYC – Engine Synchronization Button Status
- N – Idle (Neutral) Lockout Button Status
- TR – Trolling Mode Button Status

LAMP STATUS INDICATOR

The Station Lamp Status indicators display the commanded lamp status from the active control station.

- SA – Activate Station Lamp Status
- SVM – Slow Vessel Mode Lamp Status
- SYC – Engine Synchronization Lamp Status
- N – Idle (Neutral) Lockout Lamp Status
- TR – Trolling Mode Lamp Status

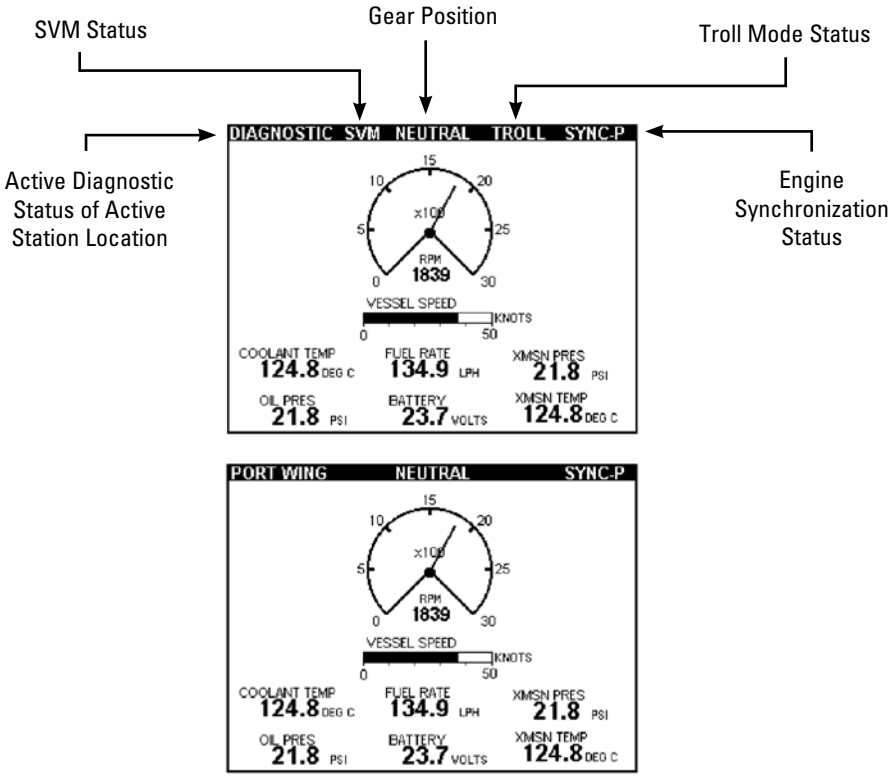


Figure 6
CMPD Status Bar Screen

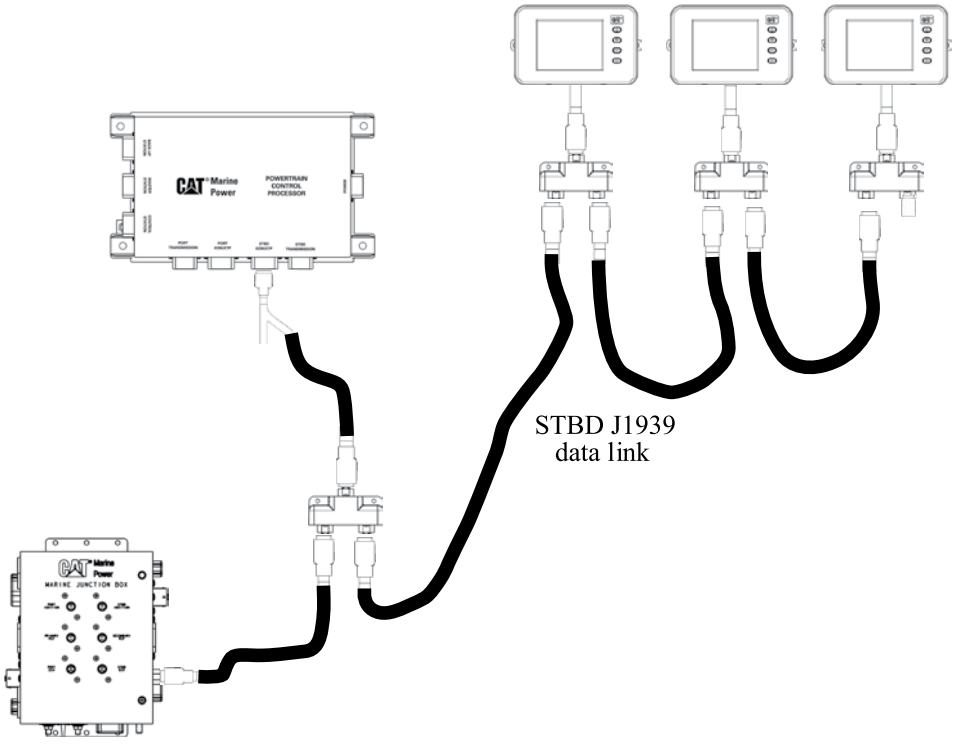
VESSEL STATUS BAR

The status indicators are shown across the top of the screen in reverse video and are only available on parameter screens, except for the diagnostic icon, which is shown on all screens. The following status items are displayed: Diagnostic, Active Station Location, Slow Vessel Mode, Gear Position, Troll Mode, and Sync Mode. The Diagnostic icon overrides the Active Station Location when there is an active diagnostic condition.

Parameter	Status	Display Text
Slow Vessel Mode	SVM Active	SVM
	SVM Inactive	No Text Displayed
Gear Position	Forward	AHEAD
	Neutral	NEUTRAL
	Reverse	ASTERN
	Gear Lockout Active	Gear L/O
Troll Mode	Troll Active	TROLL
	Troll Inactive	No Text Displayed
Engine Sync Mode	Synchronized PORT	SYNC-P
	Synchronized STBD	SYNC-S
	PORT Master Sync Cruise Active	CRUISE-P
	STBD Master Sync Cruise Active	CRUISE-S
	Sync Not Active	No Text Displayed
Active Station*	Bridge	BRIDGE
	PORT Wing	PORT WING
	STBD Wing	STBD WING
	Tower	TOWER
	Engine Room	ENG ROOM
	Aft Station	AFT STATION
	Fly Bridge	FLY BRIDGE
	Bow Station	BOW STATION

*If there is an active diagnostic, the word DIAGNOSTIC will be displayed in place of the active station location.

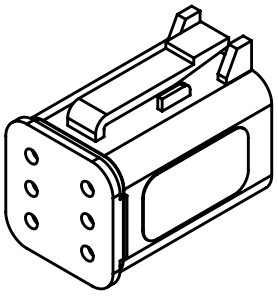
CABLES REQUIRED



Where Used: Connects the PCP and MPD displays into the J1939 data link. The J1939 data link can not exceed 40 meters (131 ft.).

Requires:
MPD drop cable – 225-6112
Tee to Tee cable – 225-6107
6-pin Tee – 221-6506
Termination resistor – 208-0432

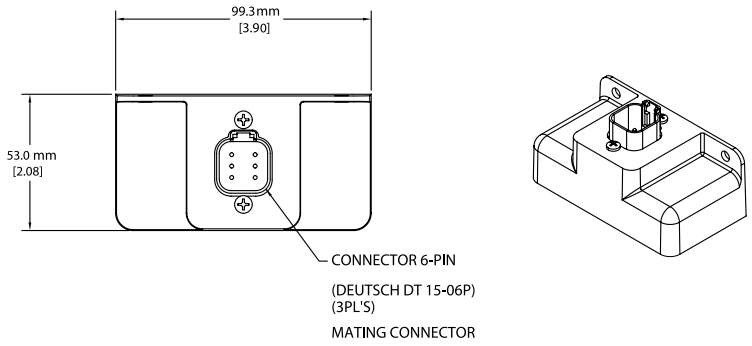
208-0432 TERMINATION RESISTOR

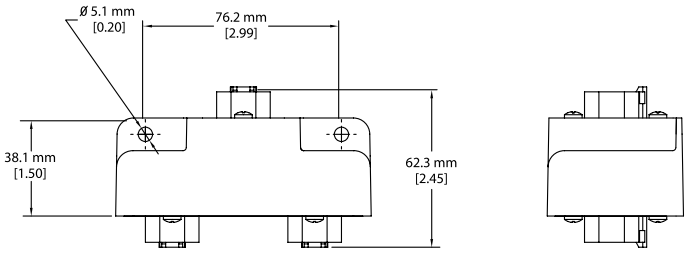


6-pin Termination Resistor

- Used to terminate the ends of a data link run. Two termination resistors required.

221-9506 TEE CONNECTOR

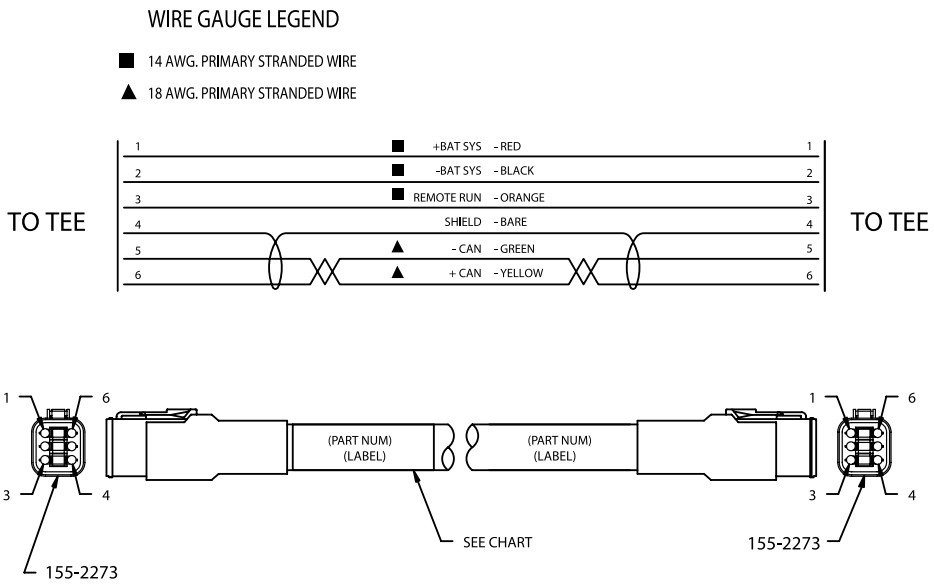




- Used to connect 225-6107 tee to tee cables.

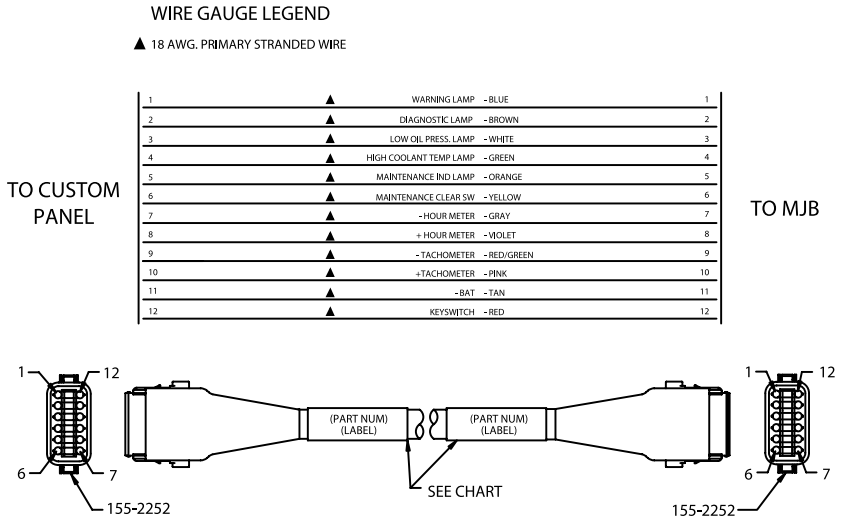
225-6107
TEE TO TEE CABLE

337-0962 FOR
MSCS II SYSTEM



- Port or starboard J1939 tee to tee connections.
- J1939 data link connection from ECU to tee connector at ETP.
- Tee to tee connections on the control station data link when there are two or more control stations on the data link.
- Tee to tee connections on the backup control station data link when there are two or more backup control stations on the data link.
- Port or starboard ECU J1939 connector (termination resistor) to ETP tee connector.

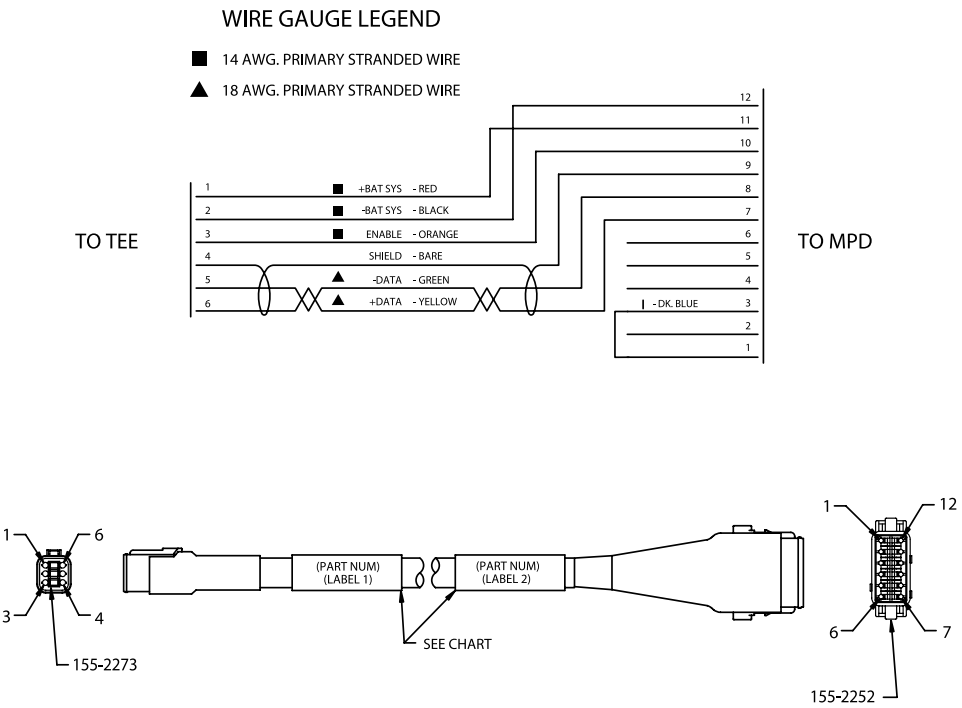
225-6102
CUSTOM PANEL
HARNESS



- Connects the custom panel into the MJB.

225-6112 MPD DROP HARNESS

337-0959 & 337-0958 FOR MSCS II SYSTEM

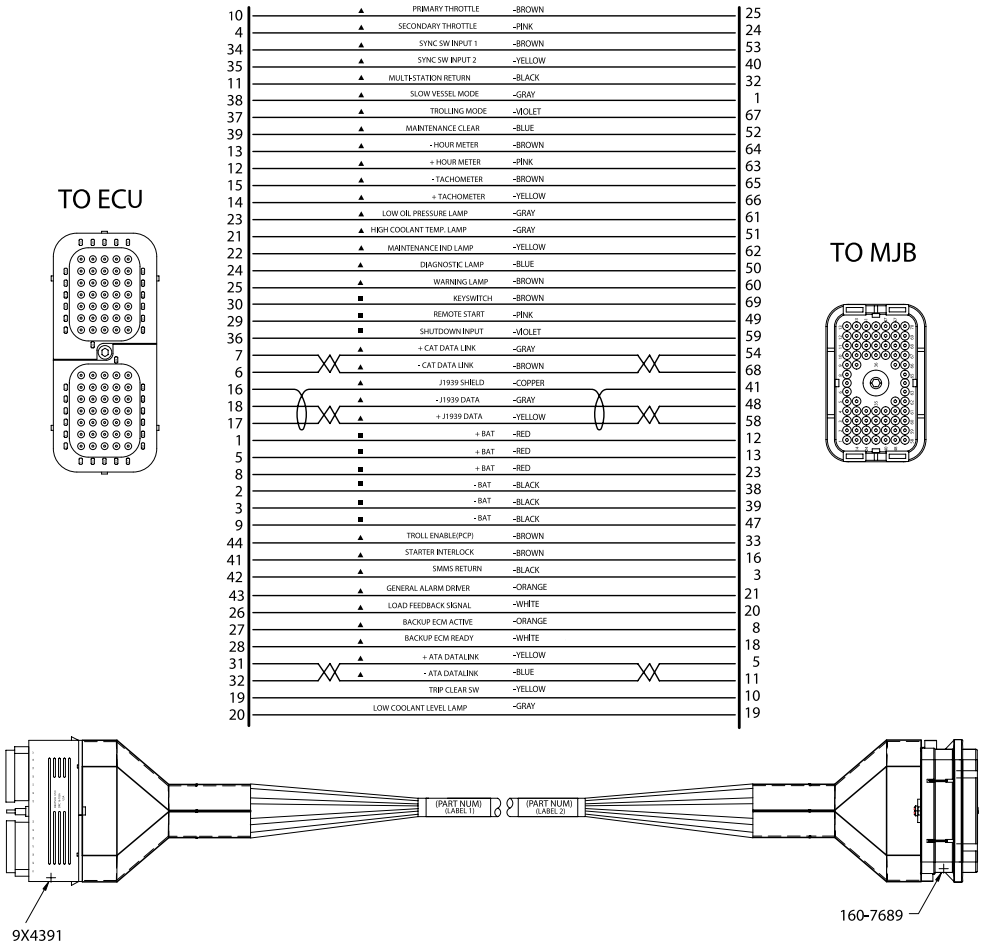


- Connects MPD display into the J1939 datalink.
- Requires 221-9506 tee connector.

225-6116
TRUNK HARNESS

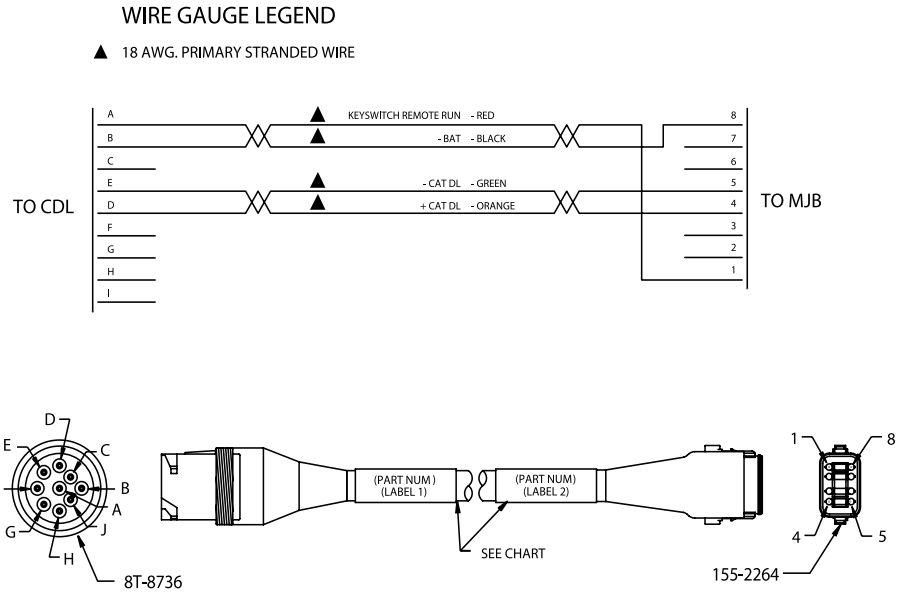
▲ 18 AWG. PRIMARY STRANDED WIRE

■ 14 AWG. PRIMARY STRANDED WIRE



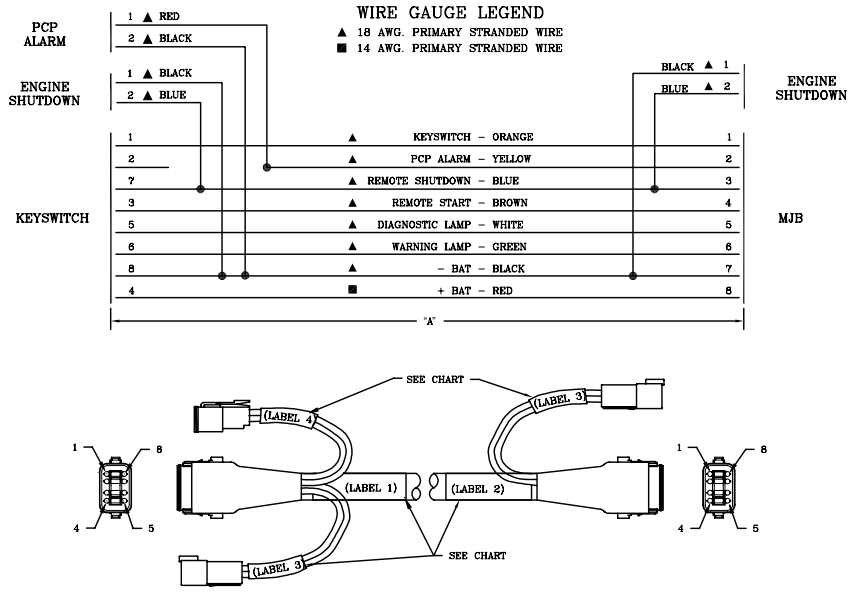
- Connects the MJB to the ECU 70-pin connector.

225-6118 CDL INTERFACE CONNECTOR



- Provides + and - battery and CDL + and CDL - to the helm station.
- Used to connect Engine Vision, EMS, or Cat ET into the Caterpillar electronic system.

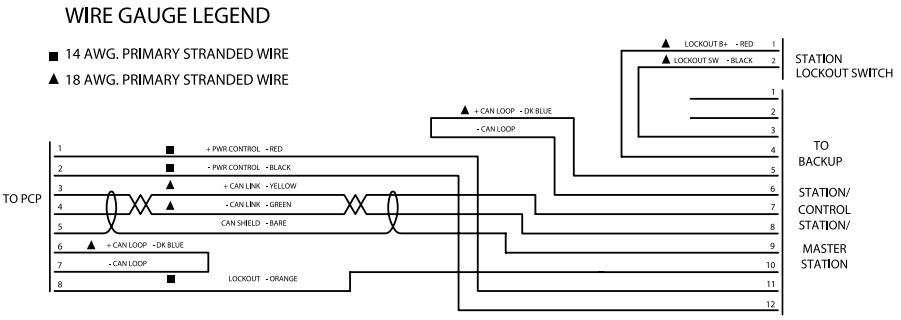
226-0361 KEYSWITCH ALARM HARNESS

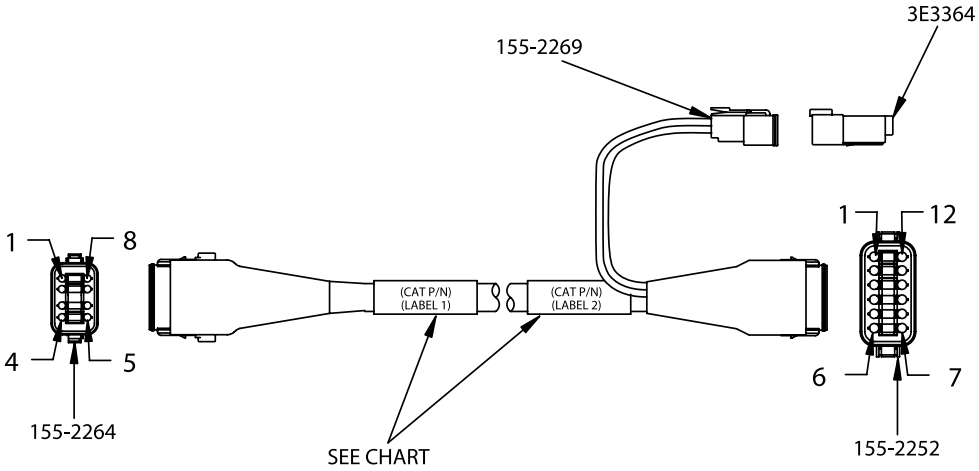


- Connects 217-3865 keyswitch panel to the MJB.

226-0363
CONTROL STATION
HARNESS

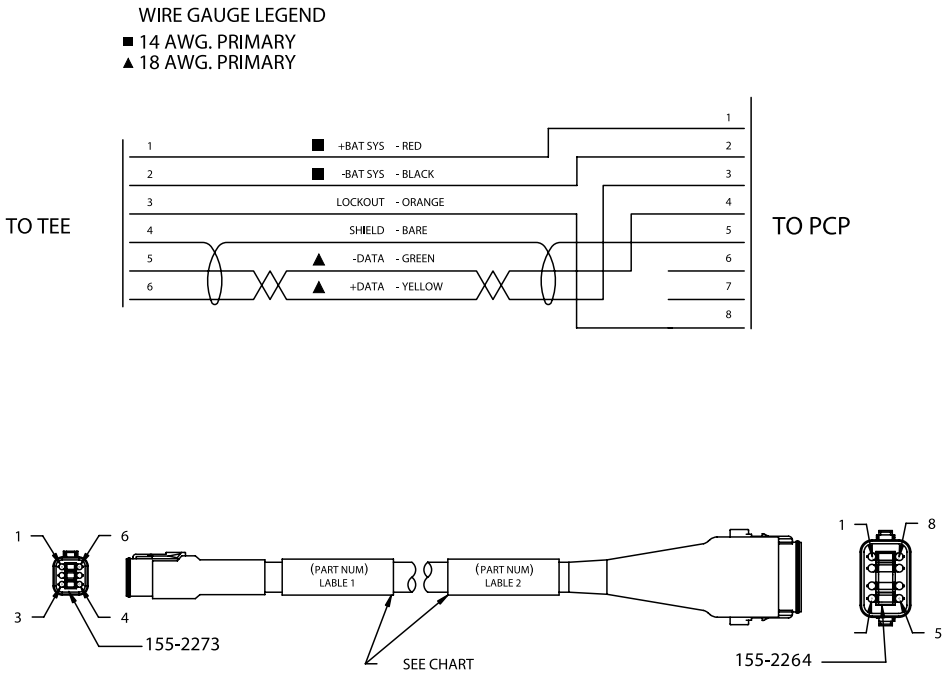
337-0964
FOR MSCS II
SYSTEM





- Connects the master control station to the PCP.
- Connects a single control station to the control station data link.
- Connects a single backup control station to the backup control station data link.
- Termination resistors **are not** required.

226-0365 PCP STATION DROP

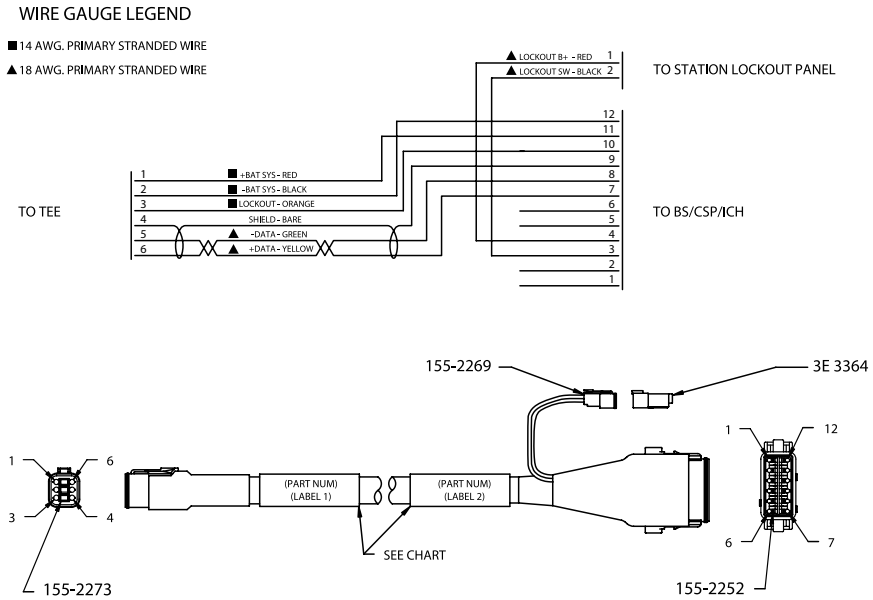


PART NUM	LABEL 1	LABEL 2
226-0365-01	TEE	PCP

- Connects the PCP into the control station data link and/or the backup control station data link when there are two or more control stations on the data link.

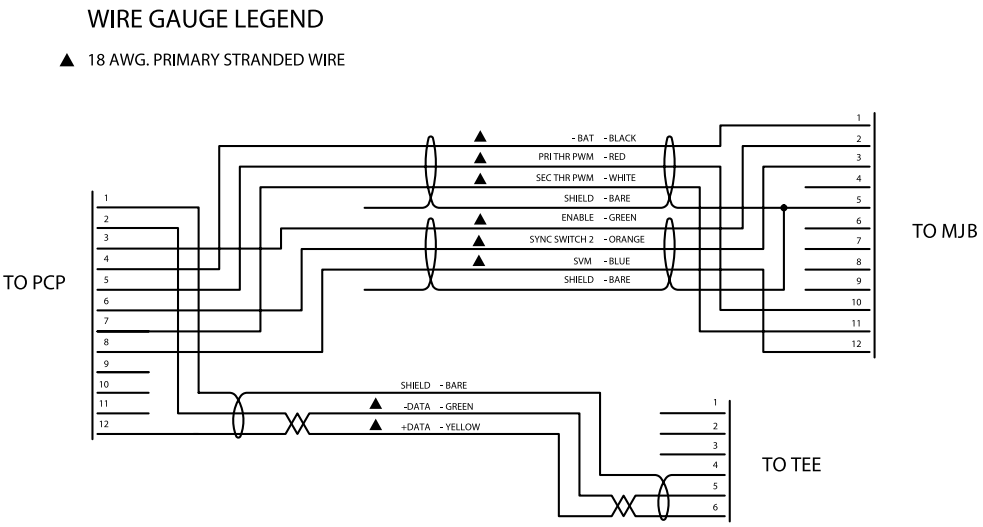
226-0366 CONTROL STATION DROP HARNESS

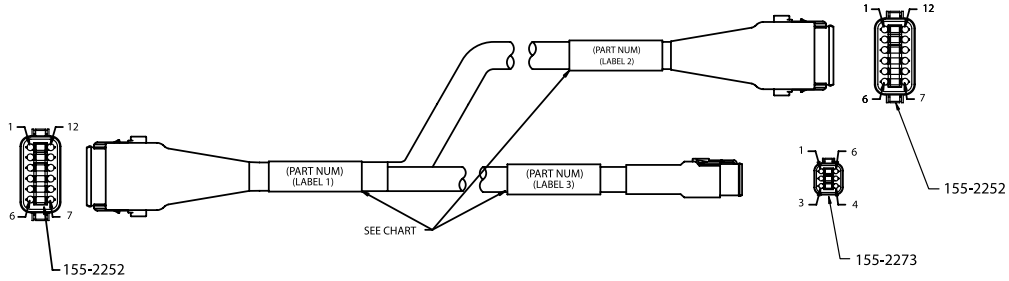
BACKUP CONTROL STATION DROP HARNESS



- Used to connect the control stations into the control station data link when there are two or more control stations on the data link.
- Used to connect the backup control stations into the backup control station data link when there are two or more control stations on the data link.

226-0367 THROTTLE/J1939 HARNESS

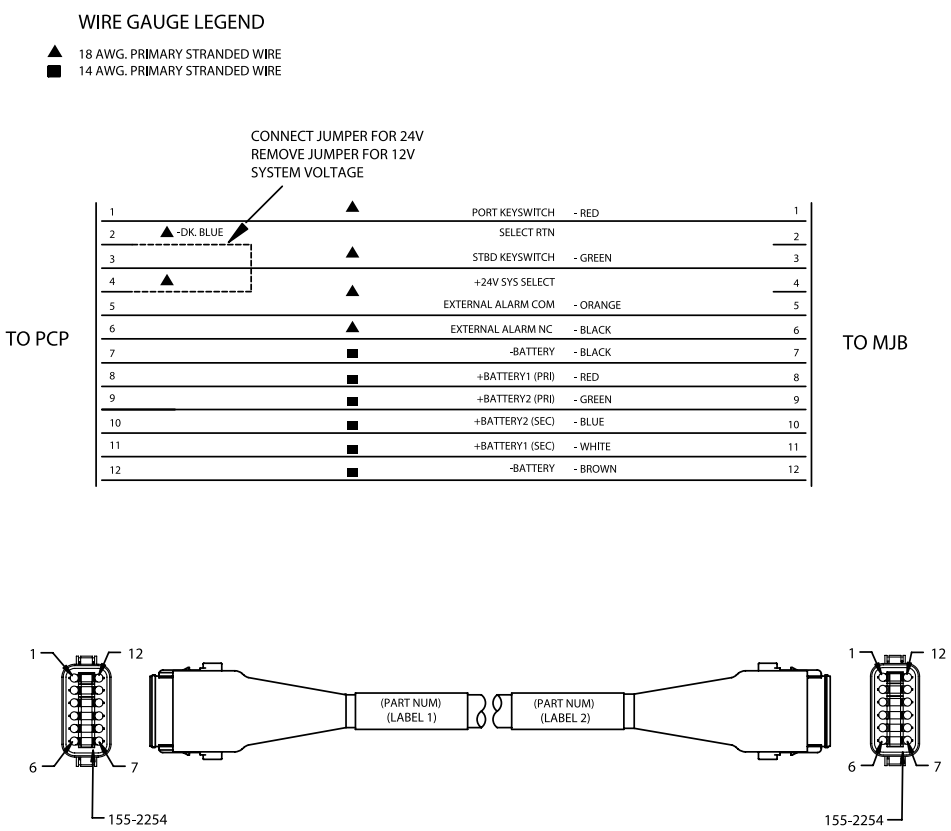




PART NUM	LABEL 1	LABEL 2	LABEL 3
226-0367-01	PCP	MJB	TEE

- Connects the PCP into the J1939 data link.
- Connects the throttle signal to the MJB where it is then routed to the ECUs.

226-0369 PCP POWER SUPPLY CABLE



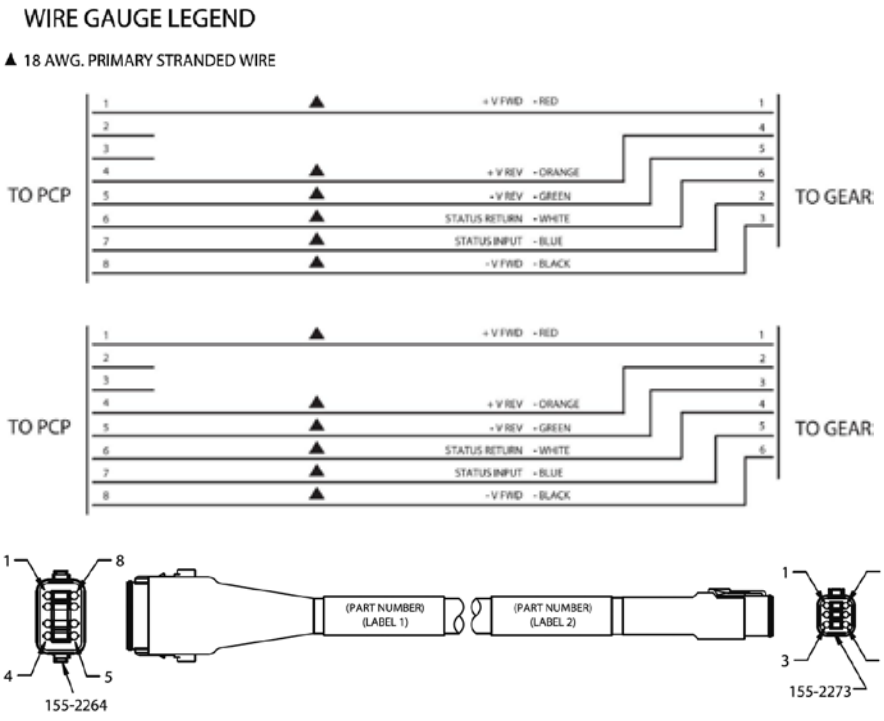
PART NUM	LABEL 1	LABEL 2
226-0369-01	PCP-POWER	MJB-PCPPWR

- Routes the battery connections from the MJB to the PCP.

Note: Special attention should be given to the power connector orientation when plugging the power cable into the PCP and MJB.
The power connector is keyed, but can be inserted into the connector upside down.

226-0371 TRANSMISSION HARNESS

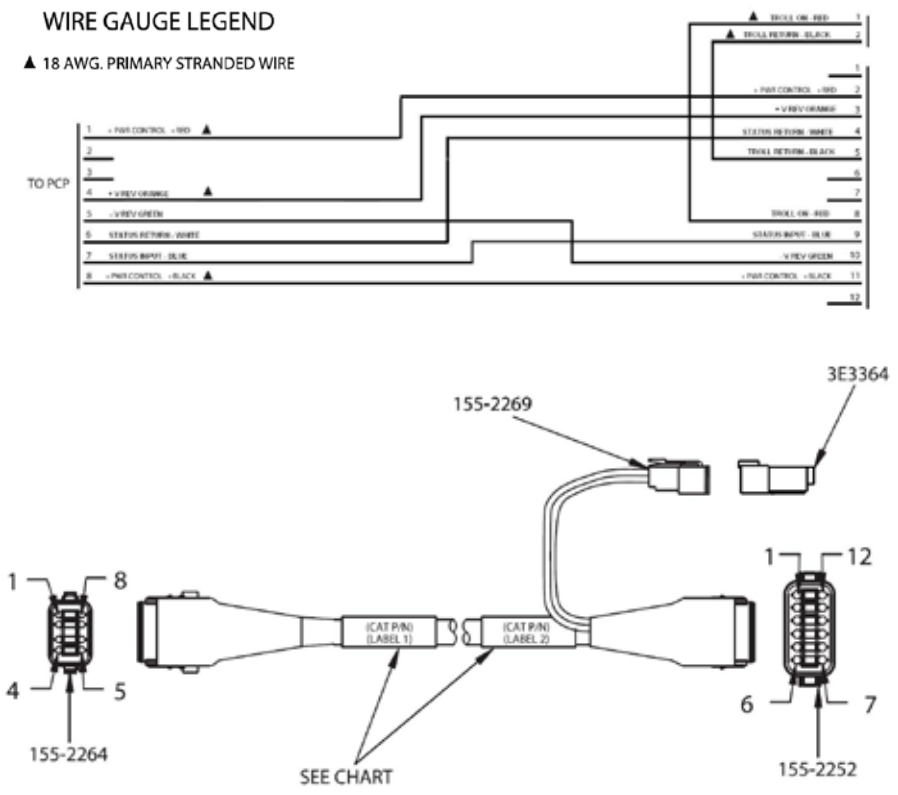
REVISION -02



REVISION -03

- Connects the PCP gear signals to the marine gear.

311-8401 TRANSMISSION HARNESS



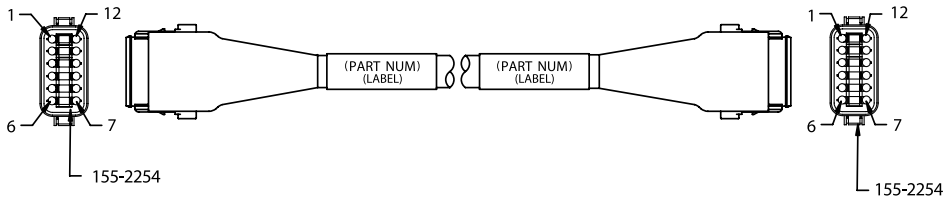
226-0411 CSP TO BUTTON PANEL HARNESS

WIRE GAUGE LEGEND

▲ 18 AWG. PRIMARY STRANDED WIRE

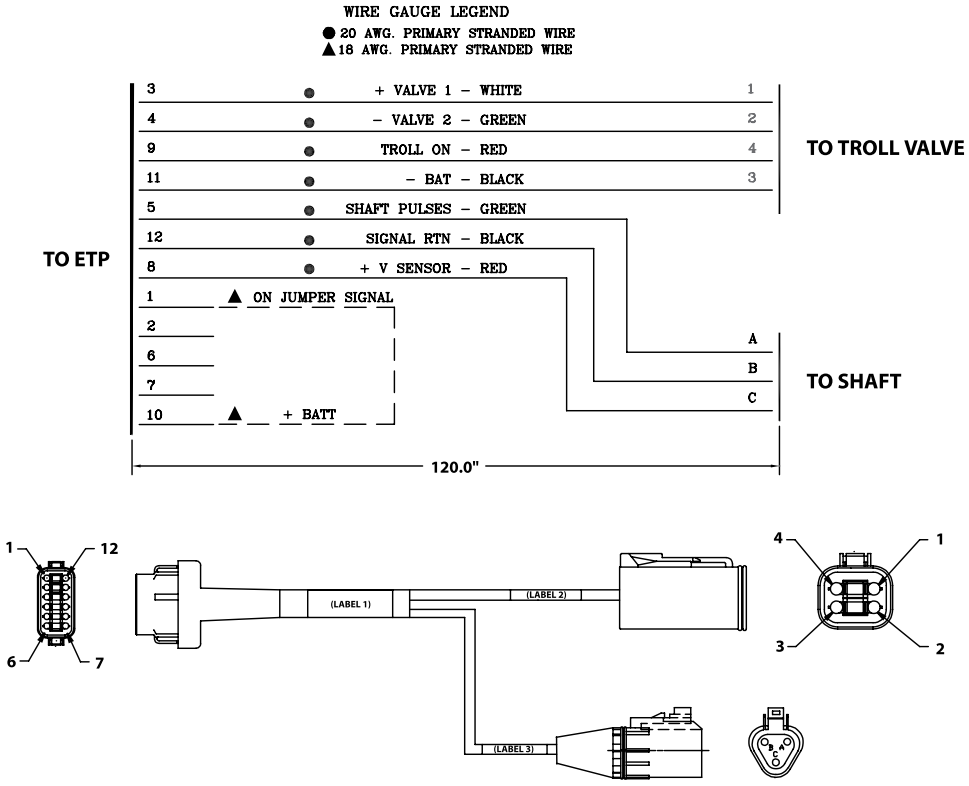
TO SWITCH PANEL	1	▲	+ V LED - RED	1
	2	▲	STATION ACTIVE LED - WHITE	2
	3	▲	SVM/UP LED - GREEN	3
	4	▲	LED - ORANGE	4
	5	▲	TROLL LED - BLUE	5
	6	▲	N/DOWN LED - BROWN	6
	7	▲	STATION ACTIVE SW - YELLOW	7
	8	▲	SVM/UP SW - VIOLET	8
	9	▲	SYNC SW - GRAY	9
	10	▲	TROLL SW - PINK	10
	11	▲	N/DOWN SW - TAN	11
	12	▲	SW RTN - RED/GREEN	12

TO CSP



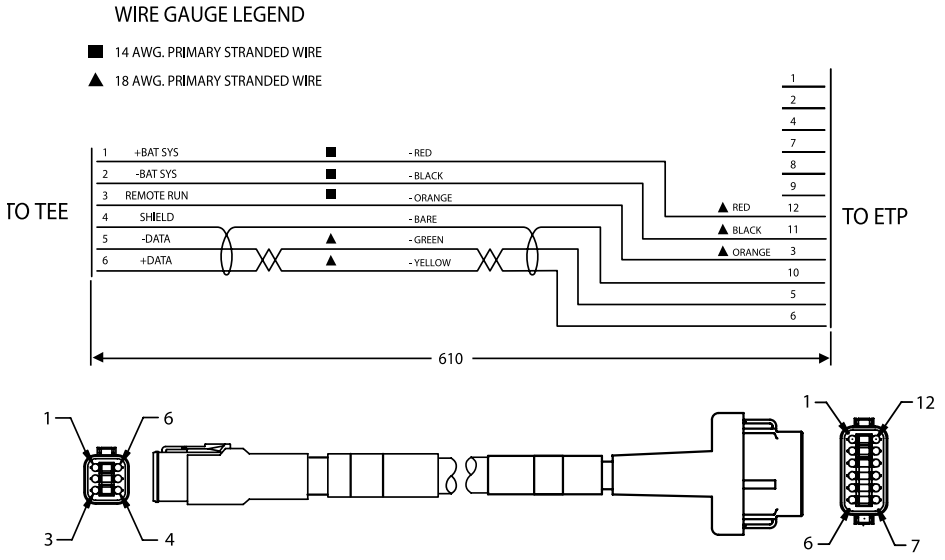
- Connects the button panel to the CSP.
- For use with sidemount control heads and/or slim line control heads.

226-0417 ETP TO TROLL VALVE AND SHAFT SPEED SENSOR For PWM control of the trolling valve



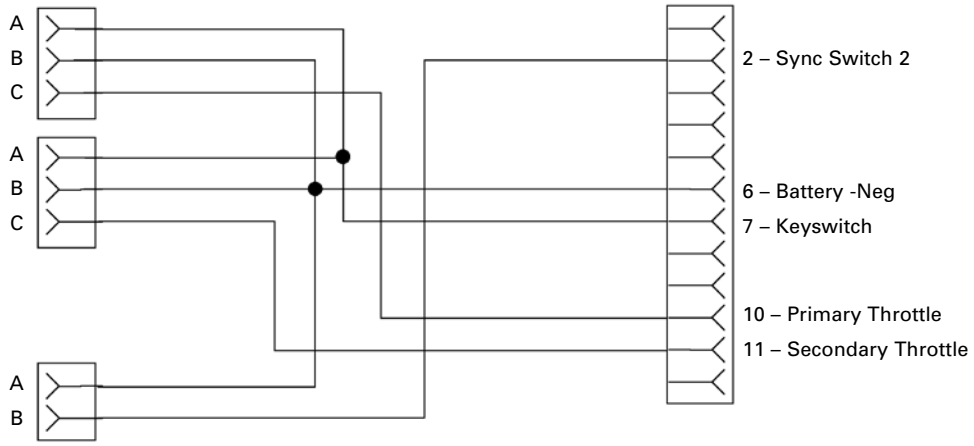
- For use with all compatible marine gears to display shaft speed on Marine Power Display

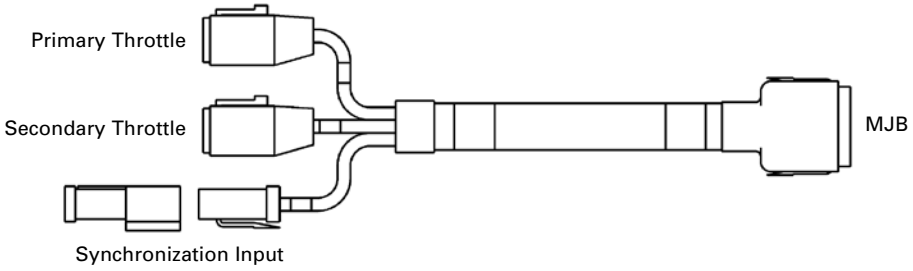
226-3414 ETP TO J1939 DATA LINK CABLE



- Connects the ETP into the J1939 data link.
- Requires 221-9506 tee connector.

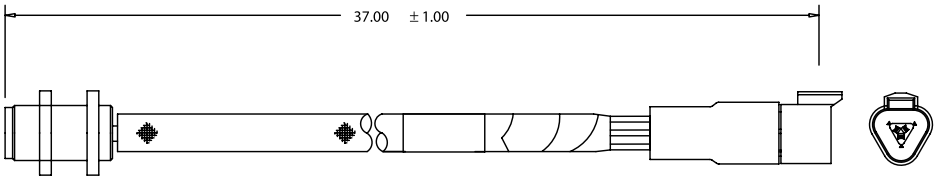
226-3415 THROTTLE POSITION SENSOR HARNESS

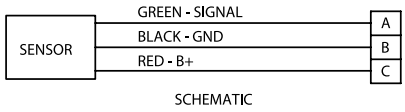




- For use with MJB and mechanical throttle controls and sync switch.
- Requires 121-7029 (or similar) throttle position sensor, customer installed synchronization switch, marine junction box

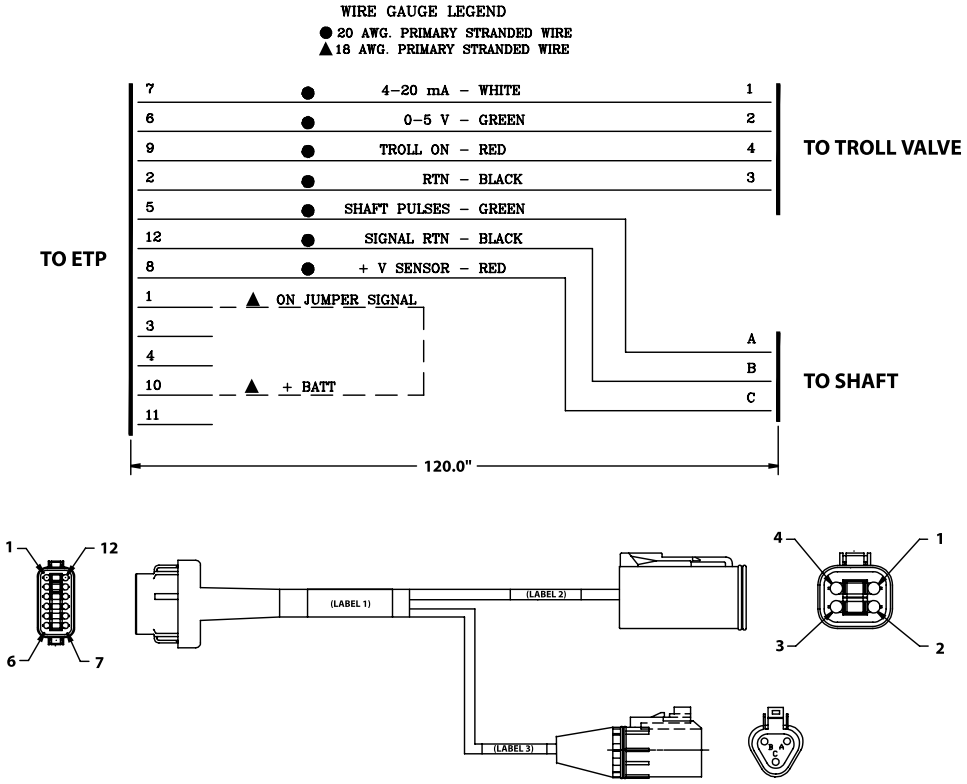
226-3424 SHAFT SPEED SENSOR (OPTIONAL)





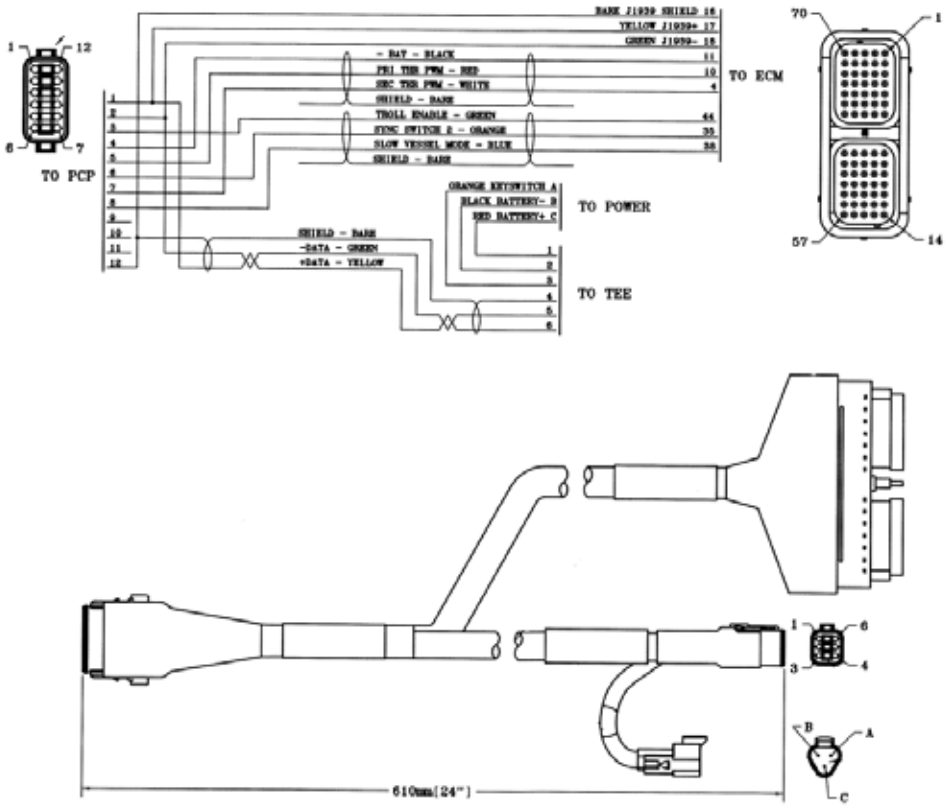
- Provides the shaft speed signal to the ETP.
- Requires 226-0417, 226-4211, or 226-4212 ETP troll valve harness.

243-4211
ETP TO TROLL VALVE AND SHAFT SPEED SENSOR
For voltage or current control of trolling valve. Jumper set to pull Troll On to (+) positive battery.



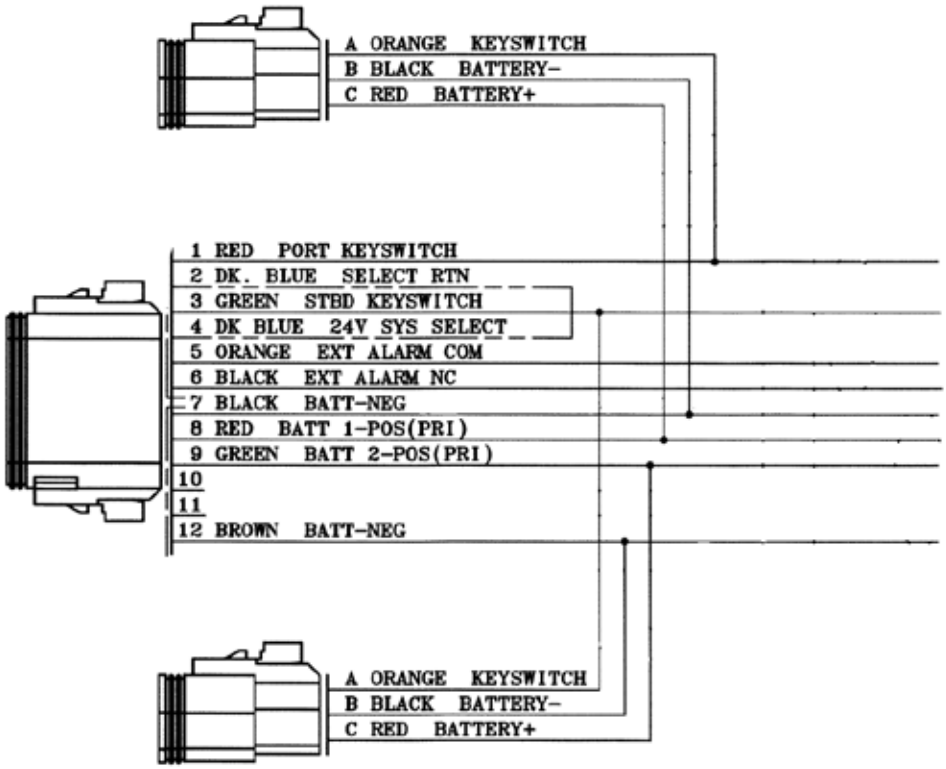
- For use with Twin Disc Reintjes and 1900/2500 and 4500 . . . 750 series gears

337-0973
ECU/PCP HARNESS



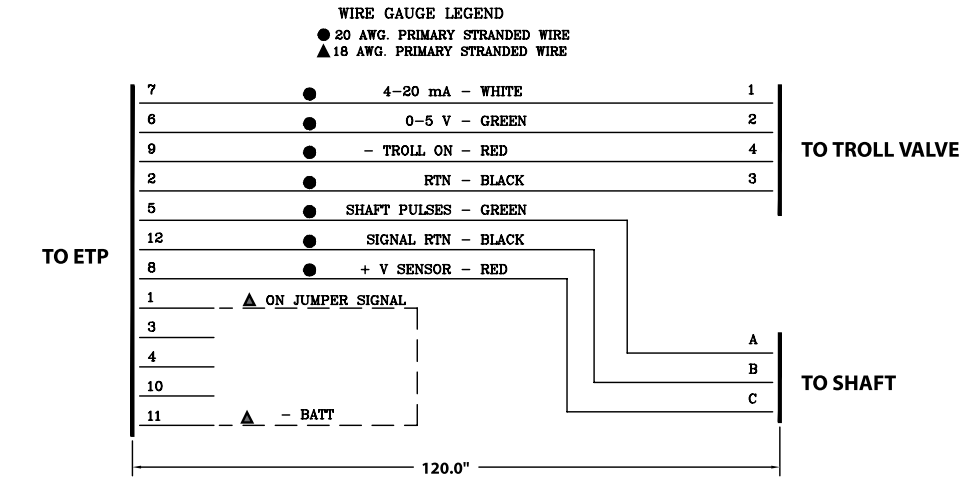
- Used in MSCS II applications
- Connects ECU to the PCP with J1939 to Tee and power.
- The customer will be required to provide POWER, GROUND, and KEYSWITCH to the 70-pin connector. (See appendix for MSCS II customer wiring.

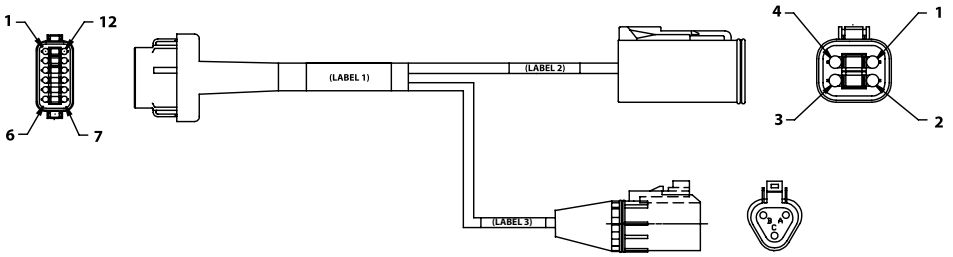
337-0971 PCP POWER HARNESS



- Used in MSCS II applications
- Provides POWER, GROUND, and KEYSWITCH to the PCP.
- The customer will be required to terminate POWER, GROUND, and KEYSWITCH. (See appendix for MSCS II customer wiring.)

243-4212
ETP TO TROLL VALVE AND SHAFT SPEED SENSOR
For voltage or current control of trolling valve. Jumper set to pull Troll On to (–) negative battery.

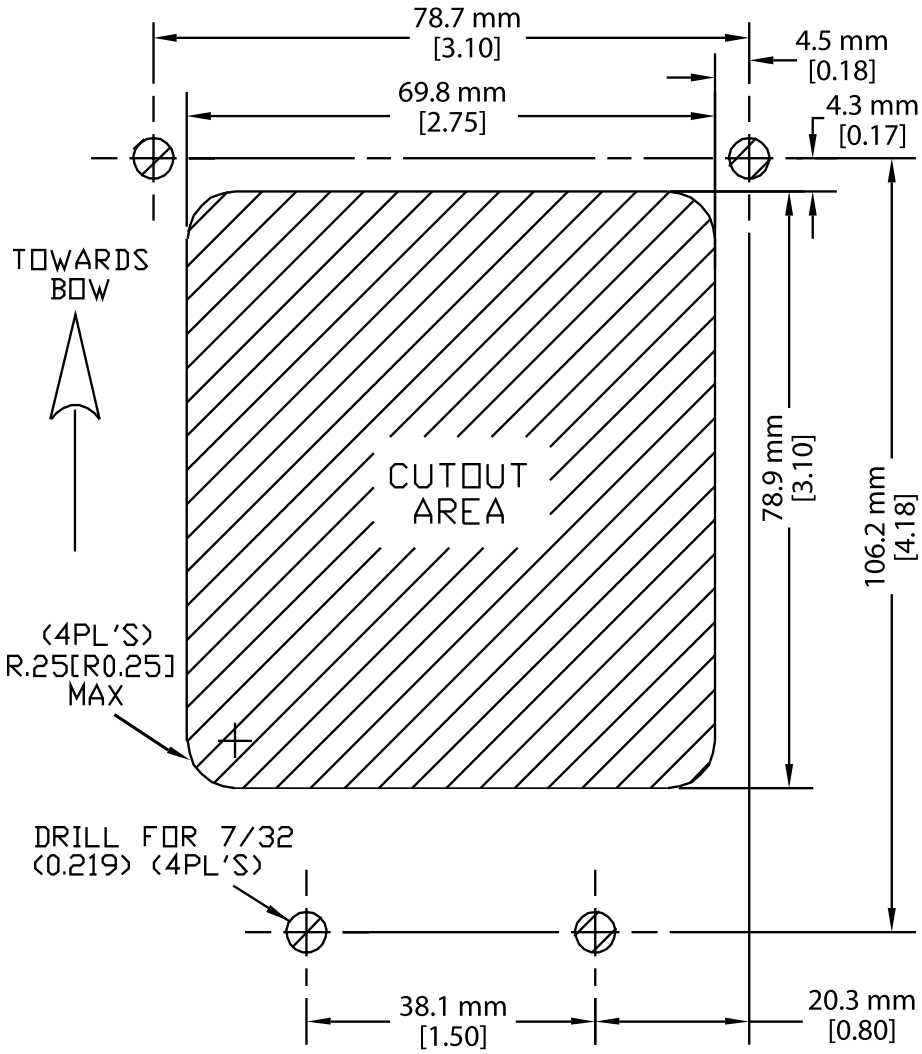




- For use with Twin Disc and Reintjes gears

MOUNTING

ICH CUTOUT TEMPLATE AND MOUNTING SCREW CHART



CAUTION:

TO ENSURE PROPER INSTALLATION AND WATER SEAL TO THE CONTROL STATION, PLEASE CONSULT THE SCREW SIZE CHART BELOW FOR THE CORRECT SCREW LENGTH.

MOUNTING SCREW LENGTH CHART (MAX TORQUE 5 IN-LBS.)			
#10-32 SCREW LENGTH	MOUNTING SURFACE THICKNESS	#10-32 SCREW LENGTH	MOUNTING SURFACE THICKNESS
1/2"	1/8" TO 1/4"	2"	1-5/8" TO 1-3/4"
5/8"	1/4" TO 3/8"	2-1/8"	1-3/4" TO 1-7/8"
3/4"	3/8" TO 1/2"	2-1/4"	1-7/8" TO 2"
7/8"	1/2" TO 5/8"	2- ,'	2" TO 2-1/8"
1"	5/8" TO 3/4"	2-1/2"	2-1/8" TO 2-1/4"
1-1/8"	3/4" TO 7/8"	2-5/8"	2-1/4" TO 2-3/8"
1-1/4"	7/8" TO 1"	2-3/4"	2-3/8" TO 2-1/2"
1-3/8"	1" TO 1-1/8"	2-7/8	2-1/2" TO 2-5/8"
1-1/2"	1-1/8" TO 1-1/4"	3"	2-5/8" TO 2-3/4"
1-5/8"	1-1/4" TO 1-3/8"	3-1/8"	2-3/4" TO 2-7/8"
1-3/4"	1-3/8" TO 1-1/2"	3-1/4"	2-7/8 TO 3"
1-7/8"	1-1/2" TO 1-5/8"	3-3/8"	3"

MSCS II

The MSCS II system does not use the MJB for power distribution and therefore requires some terminations to be made by the customer. Refer to Fig. 03 for a typical layout of the cables.

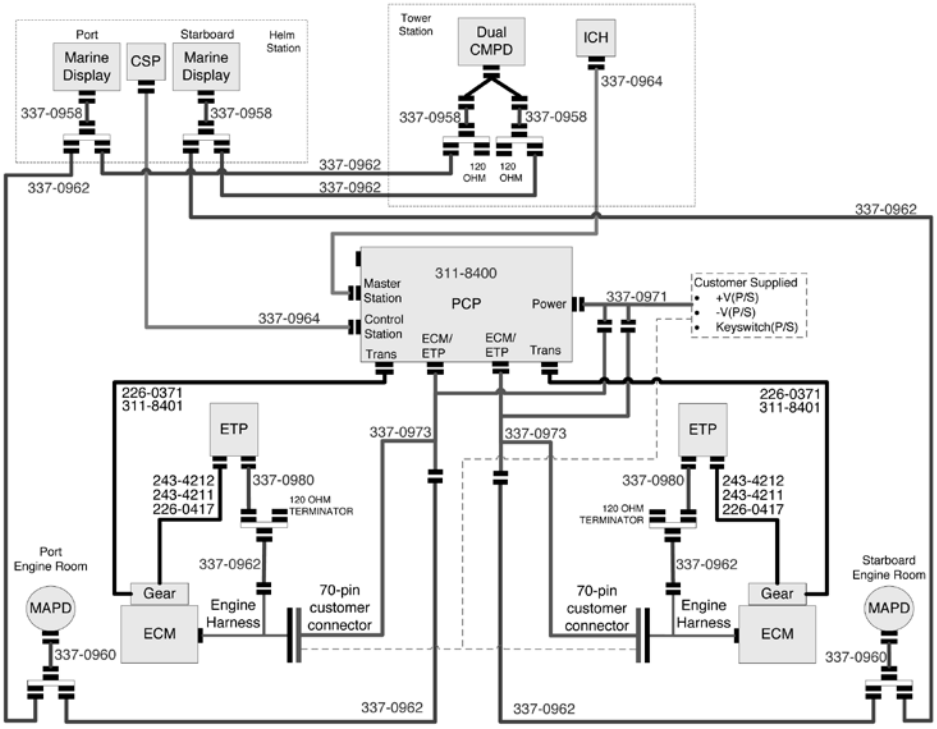


Fig. 03 MSCS II
Dual Engine example

The MSCS II system does not use the MJB for power distribution and therefore requires the customer to supply Power, Ground and Keyswitch to the engine 70-pin customer connector and the PCP. Fig. 04 shows a typical example for a dual engine application. The batteries, circuit breakers, terminal blocks, wires, and switches are supplied by the customers.

Fig 05 shows a typical example of customer terminations for cable 337-0971. The batteries, circuit breakers, terminal blocks, wires, and switches are supplied by the customers.

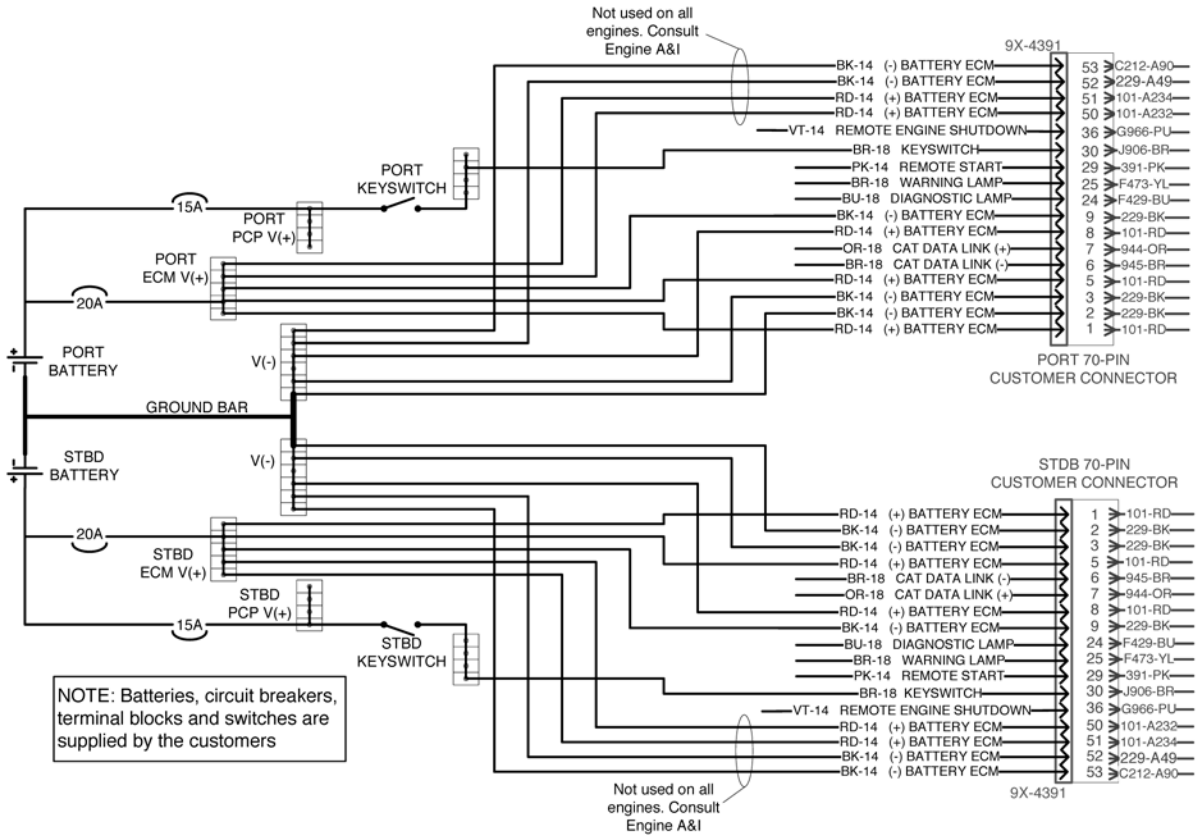


Fig. 04 MSCS II
Dual Engine Customer Wiring Example: Power, Ground, and Keyswitch

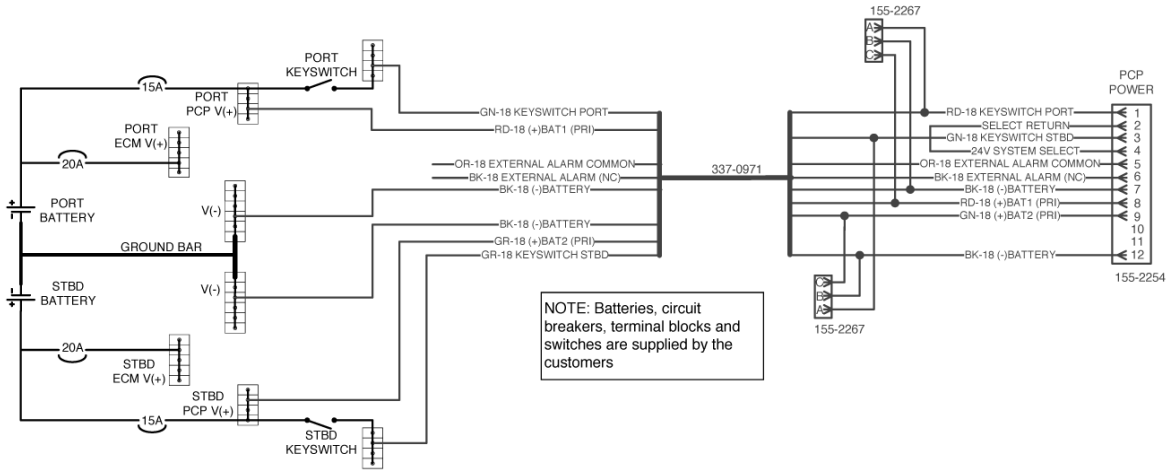
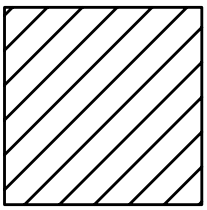
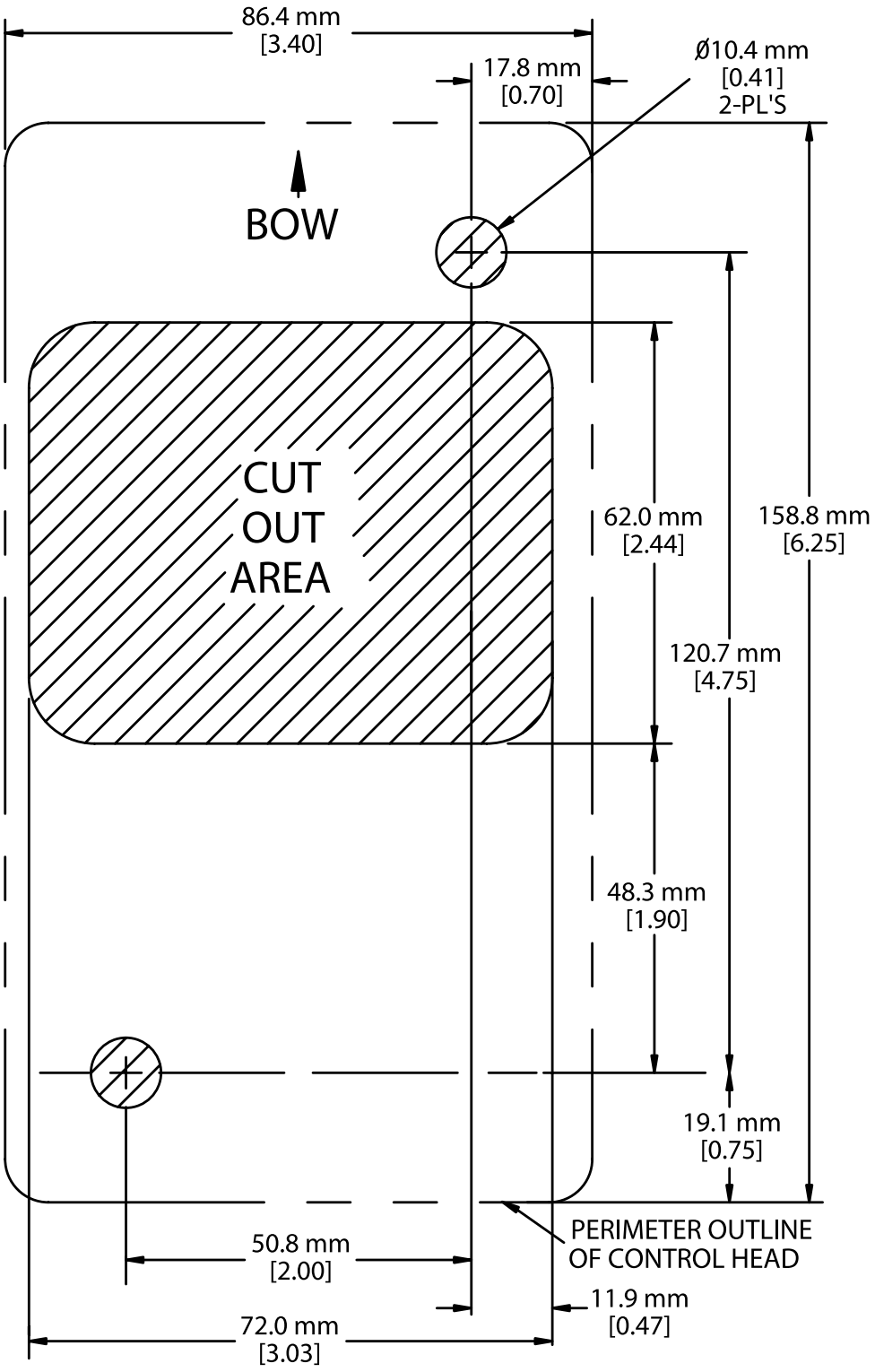


Fig. 05 MSCS II
Dual Engine PCP Power Termination Cable 337-0971



MINIMUM
PANEL
CUT OUT
AREA



Part Name	Part Number	Description
Marine Junction Box – Twin Engine	225-6123	Twin Engine Marine Junction Box
Marine Junction Box – Single Engine	225-6122	Single Engine Marine Junction Box
Trunk Harness	225-6116	Made-to-length harness that connects the ECU customer connector to the MJB. One cable is required per engine. Length 225-6117
Start Stop Control Panel	217-3865	Start/stop panel with keyswitch, remote shutdown switch, and warning and diagnostic lamps. Requires 210-8772 or 210-8773 (for use with 217-8191) gaskets
Sync Switch Panel	217-8191	Sync switch panel, sync and slow vessel mode functions. Requires 217-3865 and 210-8773.
Keyswitch/Alarm Breakout Panel	226-3423	Keyswitch/alarm breakout panel – connects keyswitch, PCP alarm, remote shutdown switch, remote start, diagnostic lamp, warning lamp, minus battery, and plus battery. Requires 226-0361 or OEM supplied wiring.
Keyswitch/Alarm Breakout Panel Wiring	226-0361	Made-to-length cable that connects the keyswitch/alarm breakout panel to the MJB. Length 226-0362
Marine Power Display	267-8623 259-2171	MPD display with application code
Marine Power Display	259-2170	MPD display without application code (blank display)
Marine Power Display Mounting Kit	291-4310	MPD mounting kit
Marine Power Display Bracket	208-0590	MPD mounting kit – gimbal mount
6-Pin Termination Resistor	208-0432	Termination resistor
6-Pin Tee Connector	221-9506	Six-pin tee connector – connects components and drop harnesses into the CAN or J1939 data link harness
MPD Drop Harness	225-6112	Made-to-length MPD drop harness to connect the MPD display into the J1939 data link trunk harness. Length 225-6114.
MAPD Interface Module	274-8068	Used to convert the J1939 into the gauge data link.
MAPD Harness	212-8259	Cable to connect from the 3-pin tee to the 6-pin MAPD interface module connector. Cable has 155-2273 plug assembly.

Part Name	Part Number	Description
3-pin Termination Resistor	174-3016	Termination resistor to be used with the 3-pin tee (133-0970). Not used in MSCS.
3-pin Tee	133-0970	3-pin tee connector to be used with 3-pin termination resistor. Not to be used with MSCS.
MAPD Harness Extension 3 ft.	212-8258	MAPD 3-foot extension harness
MAPD Harness Extension 5 ft.	212-8257	MAPD 5-foot extension harness
MAPD Harness Extension 30 ft.	212-8256	MAPD 30-foot extension harness
MAPD Harness	221-0777	Cable to connect from the 3-pin tee to the 6-pin MAPD interface module connector. Cable has 3E3382 receptacle.
MAPD Drop Harness	227-3514	Made-to-length MAPD drop harness for MSCS. To connect the MAPD display into the J1939 trunk harness. Length 227-3515.
Messenger Display	201-8867	Marine Messenger display
J1939 Trunk Harness	225-6107	Made-to-length J1939 display trunk harness. Requires the 6-pin tee (221-9506). Length 229-0292.
Engine Vision Display	212-7481	163-3972 mounting kit 163-3973 data cable 163-3974 power supply cable
EVIM	225-0774	Engine Vision Interface Module
GPSIM	130-6191	GPS Interface Module
Diode Block	7C2668	Used to connect multiple switched battery wires to the EVIM and Engine Vision display
Cat Data Link Harness for MSCS	225-6118	Made-to-length CDL harness to connect from the MJB to the Engine Vision display or a remote service tool connector. Length 225-6119.
Custom Panel Wiring	225-6102	Made-to-length custom panel harness. Connects the custom breakout panel to the MJB. Length 225-6103.
Custom Breakout Panel	226-3422	Warning lamp, diagnostic lamp, low oil pressure lamp, high coolant temperature lamp, maintenance indicator lamp, hour meter -, hour meter +, tachometer -, tachometer +, battery minus, switched battery
PCP	219-8020	Powertrain Control Processor

Part Name	Part Number	Description
PCP Power Cable	226-0369	Made-to-length power cable. Connects power from the MJB to the PCP. Length 226-0370.
PCP throttle and J1939 data link cable	226-0367	Made-to-length cable that connects the PCP into the J1939 data link and connects the throttle signals to the MJB. Length 226-0368.
Backup Panel	219-8023	Backup panel for MSCS
Backup Panel Wiring – One Backup Control Station	226-0363	Provides made-to-length terminated cable wiring harness for a single control station on the master control station data link, control station data link, or the backup control station data link. Proprietary CAN data link trunk harness. Length 226-0364.
Backup Panel Wiring – Two or more Backup Control Stations	225-6107	Provides made-to-length non-terminated cable wiring harness for multiple controls on the control station data link or the backup control station data link. Proprietary CAN data link trunk harness. Length 229-0292.
PCP to Tee Wiring Harness	226-0365	PCP station drop into the CAN proprietary data link for control station or backup station data links. Cable has a fixed length of 2 ft.
Station Drop Harness	226-0366	Control station drop harness into proprietary CAN data link. Backup control station drop harness into backup control station data link. Cable has a fixed length of 2 ft.
Dual Control Harness Assembly	226-3419	Used to connect a single slimline throttle control head and a single slimline gear control head to the control station processor. Cable has a fixed length of 2 ft.
Control Station Processor (CSP)	219-8021	Interfaces with the slimline control head or sidemount control head and the button panel.
Slimline Control Head – Dual Function (Brushed Aluminum)	223-8214	Combined throttle and gear in one lever. Control has a brushed aluminum base and straight lever arm.
Slimline Control Head – Throttle Lever (Brushed Aluminum)	223-8211	Lever actuation only controls engine speed. Control has a brushed aluminum base and straight lever arm.
Slimline Control Head – Gear Lever (Brushed Aluminum)	223-8213	Lever actuation controls gear position. Control has a brushed aluminum base and straight lever arm.

Part Name	Part Number	Description
Slimline Control Head – Dual Function (Black Chrome)	223-8219	Combined throttle and gear in one lever. Control has a black chrome base and straight lever arm.
Slimline Control Head – Throttle Lever (Black Chrome)	223-8216	Lever actuation only controls engine speed. Control has a black chrome base and straight lever arm.
Slimline Control Head – Gear Lever (Black Chrome)	223-8218	Lever actuation controls gear position. Control has a black chrome base and straight lever arm.
Port Sidemount Control Head	229-3689	Sidemount control head for port controls. Mounts under dash, gear and throttle combined OEM to supply lever.
Shaft Kit	296-7828	Contains: 1 – shaft for side mount control head, 2 – set screws, 1 – nylon bearing
Starboard Sidemount Control Head	229-3690	For starboard controls. Mounts under dash, gear and throttle combined OEM to supply lever.
Integrated Control Head – Chrome	219-8022	Chrome ICH
Integrated Control Head – Black Chrome	220-2313	Black chrome ICH
Integrated Control Head – Gold	220-2315	Gold ICH
ICH Cat Decal	276-4054	Round decal on the side of ICH
Chrome Bezel Kit	276-4055	Replacement parts for the chrome bezel on the ICH or button panel.
Black Chrome Bezel Kit	287-0564	Replacement parts for the black chrome bezel on the ICH or button panel.
Gold Bezel Kit	287-0563	Replacement parts for the gold bezel on the ICH or button panel.
Slimline Control Head – Dual Function (Brushed Aluminum)	223-8204	Combined throttle and gear in one lever. Control has a brushed aluminum base and right slant handle.
Slimline Control Head – Dual Function (Brushed Aluminum)	223-8222	Combined throttle and gear in one lever. Control has a brushed aluminum base and left slant handle.
Slimline Control Head – Throttle Lever (Brushed Aluminum)	223-8200	Lever actuation only controls engine speed. Control has a brushed aluminum base and right slant handle.

Part Name	Part Number	Description
Slimline Control Head – Gear Lever (Brushed Aluminum)	223-8201	Lever actuation controls gear position. Control has a brushed aluminum base and right slant handle.
Slimline Control Head – Throttle Lever (Brushed Aluminum)	223-8220	Lever actuation only controls engine speed. Control has a brushed aluminum base and left slant handle.
Slimline Control Head – Gear Lever (Brushed Aluminum)	223-8221	Lever actuation controls gear position. Control has a brushed aluminum base and left slant handle.
Slimline Control Head – Dual Function (Black Chrome)	223-8208	Combined throttle and gear in one lever. Control has a black chrome base and right slant handle.
Slimline Control Head – Dual Function (Black Chrome)	223-8225	Combined throttle and gear in one lever. Control has a black chrome base and left slant handle.
Slimline Control Head – Throttle Lever (Black Chrome)	223-8205	Lever actuation only controls engine speed. Control has a black chrome base and right slant handle.
Slimline Control Head – Gear Lever (Black Chrome)	223-8218	Lever actuation controls gear position. Control has a black chrome base and right slant handle.
Master Control Station Harness	226-0363	Provides made-to-length terminated cable wiring harness for a single control station on the master control station data link, control station data link, or the backup control station data link. Proprietary CAN data link trunk harness. Length 226-0364.
Control Station Wiring – One Control Station on Data Link	226-0363	Provides made-to-length terminated cable wiring harness for a single control station on the master control station data link, control station data link, or the backup control station data link. Proprietary CAN data link trunk harness. Length 226-0364.
Control Station Wiring – Two or more Control Stations	225-6107	Provides made-to-length non-terminated cable wiring harness for multiple controls on the control station data link or the backup control station data link. Proprietary CAN data link trunk harness. Length 229-0292.

Part Name	Part Number	Description
Button Panel – Chrome	221-9507	Button panel to interface with the control station processor.
Button Panel – Black Chrome	224-9873	Button panel to interface with the control station processor.
Button Panel – Gold	224-9874	Button panel to interface with the control station processor.
Button Panel Wiring	226-0411	Provides made-to-length wiring to connect the button panel to the CSP. Length 226-0412.
PCP to Gear Harness	226-0371	Made-to-length wiring harness to connect the PCP to the marine gear shift solenoids. Length 231-6615.
Electronic Troll Processor (ETP)	256-4883	Provides the interface to the marine transmission electronic trolling valve for the PCP to control trolling functions.
Troll Harness	226-0417	For use with ZF 350, 2000, 1900/2500 and 4500… 750 series gears
Troll Harness	243-4211	For use with Twin Disc, Reintjes, ZF2000, 1900/2500, 4500… 750
Troll Harness	243-4212	For use with Twin Disc, Reintjes gears.
ETP Shaft Speed Sensor	226-3424	ETP Shaft speed pick-up.
Shaft Speed Pickup Band	226-0413	Provides a custom length band for detection of transmission shaft speed. Length 226-0414.
ETP Data Link Harness	226-3414	ETP drop into the display J1939 data link. Cable has a fixed length of 2 ft.
Wing Station Control	255-8006	Panel mount wing station control
Auxiliary Pressure	275-2077	2-inch gauge/ 0-500 psi
Auxiliary Temperature	275-2078	2-inch gauge/ -40-120° F
Boost Pressure	275-2079	2-inch gauge/ 0-50 psi
Boost Pressure	275-2080	3-inch gauge/ 0-50 psi
Engine Coolant	275-2081	2-inch gauge/ 0-250° F
Engine Coolant	275-2082	3-inch gauge/ 0-250° F
Exhaust Temperature	275-2083	2-inch gauge/ 120-1600° F
Exhaust Temperature	275-2084	3-inch gauge/ 120-1600° F
Fuel Level	275-2085	2-inch gauge/ 0 -4/4

Part Name	Part Number	Description
Fuel Pressure	275-2086	2-inch gauge/ 0-125 psi
Fuel Pressure	275-2087	3-inch gauge/ 0-125 psi
Fuel Rate	275-2088	2-inch gauge/ 0-80 gph
Fuel Rate	275-2089	2-inch gauge/ 0-50 gph
Fuel Rate	275-2090	2-inch gauge/ 0-200 gph
Fuel Rate	275-2091	3-inch gauge/ 0-200 gph
Fuel Temperature	275-2092	2-inch gauge/ 0-250° F
Fuel Temperature	275-2093	3-inch gauge/ 0-250° F
Inlet Manifold Temperature	275-2094	2-inch gauge/ 0-250° F
Inlet Manifold Temp.	275-2095	3-inch gauge/ 0-250° F
Oil Pressure	275-2096	2-inch gauge/ 0-100 psi
Oil Pressure	275-2097	3-inch gauge/ 0-100 psi
Oil Temperature	275-2098	2-inch gauge/ 0-250° F
Oil Temperature	275-2099	3-inch gauge/ 0-250° F
Percent Load	275-2100	2-inch gauge/ 0-100%
Percent Load	275-2101	3-inch gauge/ 0-100%
Speed	275-2102	3-inch gauge/ 0-60 knots
Tachometer w/LCD	275-2103	3-inch gauge/ 0-4000 rpm
Tachometer w/LCD	275-2104	3-inch gauge/ 0-3000 rpm
Tachometer w/LCD	275-2105	3-inch gauge/ 0-3600 rpm
Transmission Oil Pressure	275-2106	2-inch gauge/ 0-500 psi
Transmission Oil Pressure	275-2107	3-inch gauge/ 0-500 psi
Transmission Oil Temperature	275-2108	2-inch gauge/ 0-250° F
Transmission Oil Temperature	275-2109	3-inch gauge/ 0-250° F
Volt	275-2110	2-inch gauge/ 9-32 VDC
Volt	275-2111	3-inch gauge/ 9-32 VDC
Volt	275-2112	2-inch gauge/ 0-16 VDC
Tachometer w/LCD	262-4919	3-inch gauge/ 0-3600 rpm (white face)
Speed	262-4920	3-inch gauge/ 0-60 knots (white face)
Oil Pressure	262-4921	2-inch gauge/ 0-100 psi (white face)
Engine Coolant	262-4922	2-inch gauge/ 0-250° F (white face)
Volt	262-4923	2-inch gauge/ 0-16 VDC (white face)

Part Name	Part Number	Description
Volt	262-4924	2-inch gauge/ 9-32 VDC (white face)
Transmission Oil Pressure	262-4925	2-inch gauge/ 0-500 psi (white face)
Transmission Oil Temperature	262-4926	2-inch gauge/ 0-250° F (white face)
Fuel Level	262-4927	2-inch gauge/ 0 -4/4 (white face)
MAPD Panel	214-1731	Includes a start/stop keyswitch, emergency stop button, warning lamp, diagnostic lamp, and a dimmer button. The gauges include 3" tachometer, 2" coolant temperature, 2" oil pressure, 2" voltmeter, and 2" inlet manifold temperature. They have a black face and black chrome bezel. The panel has capacity for two additional 2" gauges.
PL1000T	256-7511	PL1000T, 279-6664 software, 258-4550 PL1000T
PL1000T Harness Assembly	270-1732	Harness assembly for PL1000T
PL1000E	256-7512	PL1000E, 256-6806 software, 258-4548 PL1000E
PL1000E Cable	228-6559	Cable assembly for PL1000E
PL1000T Harness Assembly	276-0785	Harness assembly for PL1000T
Twisted Pair Cat Data Link Cable	143-5018	Twisted pair CDL wire (pink and white)
J1939 Cable	153-2707	J1939 standard wire (yellow/green and shield)
Keyswitch	110-7887	Stand-alone keyswitch. For use with key 5P8500.
ZF Gear Connector	1Q5094	Inline connector
ZF Gear Connector	8T9605	Right angle connector
6-Pin Deutsch Receptacle Kit	102-8805	6-pin receptacle to connect to the PCP gear harness. Includes 3E3382 receptacle and 3E3383 wedge.
4-Pin Deutsch Receptacle Kit	102-8804	4-pin receptacle to connect to the ETP to troll valve cable. Includes 3E3376 receptacle and 3E3377 wedge.
External Alarm	9G-9813	External alarm that can be used with the MPD.

NOTES

NOTES

Installation Guide

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