ClearCommand MS564-13547
Installation Manual
MM13547 Rev.E 6/03

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Appendix A.1

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Revisions List

Rev	Date	Revision Description
A	6/02	Brought entire manual up to current ZF Standards. Incorporating any NCAR/ELR's.
B	7/02	1. Revised Sections 2.7.3 and 6.5 . 2. Removed duplicate Adjustments and Tests [At Dock] section. 4. Appendix A replaced S-214 with RvC.
C	8/02	1. Updated Cover. 2. Moved: Trolling Valve Control section; Engine Stop Switches Test (Engines Running) section. 3. Revised Sections 4.2, 7.5.3. 4. Appendix A replaced MMC-279 with RvB.
D	11/02	1. Software revised to .2. 2. Revised Sections: 1.2.1, 2.6, 2.7, 3.5, 5.3.1, 5.3.5, 5.7.1, 3. Added Sections: 7.6 and 8.2. 4. Appendix A.1 added MM13821 43C Cable Conversion Kit Manual. 5. Appendix B.1 revised Troubleshooting Section and added Section 2.0 13. Appendix C.1 drawing revised to E. Please see drawing for changes.
E	6/03	1. Appendix C.1 drawing revised to F.

1.0 INTRODUCTION

1.1 THIS MANUAL

The purpose of the ClearCommand System manual is:

- Operation (Section 2.0)
- Installation (Section 5.0)
- Set up Procedure (Section 6.0)
- Adjustments (Section 7.0 and 8.0)
- Trouble Shooting Reference (Appendix B.1)

Keep this Manual on the vessel for future reference.

Throughout the manual special attention should be paid to the following boxes:

NOTE: Contains Helpful Information

CAUTION: Damage to equipment may result if the Caution is ignored.

WARNING: Injury may result if the Warning is ignored.

Appendix A.1 contains the Service Sheets created by ZF Mathers to aid in servicing, set up, warranty, and documenting of this vessels parameters.

Appendix B.1 contains a brief Trouble Shooting. If you cannot find a solution within the Trouble Shooting, contact ZF Mathers Service Department.

Appendix C.1 contains the system drawing and Bills of Material. During installation and testing, take special care to verify all wiring is to specifications, terminations are correct, and that all Notes in the system drawing are followed.

1.2 CLEARCOMMAND SYSTEM

The Control Processor (hereafter referred to as Processor) is designed specifically for:

- Engines that require either voltage, mA, or PWM speed command signal
- Transmissions that require mechanical clutch selection
- Transmissions that require mechanical troll selection

During Installation and Testing, take special care to verify all wiring is to specifications, terminations are correct, and that all Notes in Appendix C.1 Drawing Notes are followed.

1.2.1 Features

- Sequencing of Clutch and Engine Speed (Section 2.1)
- Start Interlock (Section 2.2)
- Station-in-Command Indication (Section 2.3)
- Warm-up Mode (Section 2.4)
- Engine Synchronization (Section 2.5)
- ClearCommand System Fault Indication (Section 2.6)
- Integrated Trolling Valve (Section 2.7)
- Proportional Pause on through Neutral Shifts (Section **6.4** and **6.5**)
- ClearCommand Failure Alarm Contact (optional) (Section 9.1)
- Clutch Oil Pressure Interlock (optional) (Section 9.2)
- One to Five Stations (Appendix C.1 Drawing)

1.2.2 Requirements

Refer to Section 3.

- One Processor per engine
- One Control Head per station
- One Engine Stop Switch per Station
- One 33C or 43C Push-Pull cable for Clutch transmission connection
- One 33C or 43C Push-Pull cable for Troll transmission connection
- One Eight-conductor electric cable for each Control Head connection
- One Two-conductor electric cable for power connection
- One Two-conductor electric cable for Start Interlock connection
- One Throttle Wire Harness for Processor throttle connection
- One Serial Communication Wire Harness Twin Screw or more Systems
- One Tachometer Sensor Cable for Processor engine tachometer sensor connection (OPTIONAL)

2.0 OPERATION

2.1 INITIALIZATION

When control system DC power is turned ON:

- Processor will move to the Neutral/Idle position.
- Low repetition tone will sound at all Stations indicating that no Station has command. (refer to the Control Head Tones Section).

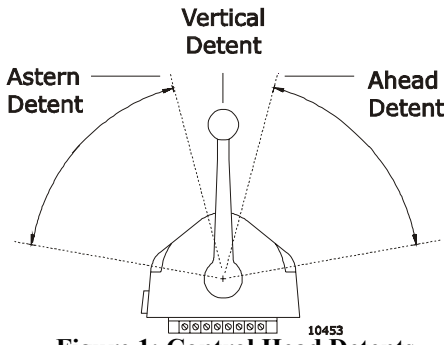


Figure 1: Control Head Detents

To take command at a Station:

- Control Head lever(s) must be in the Neutral (vertical) detent.
- Operator must depress the transfer button for at least 1/2 second.

The tone will stop at all Stations and the red indicator light will be lit at the Station-in-Command.

NOTE: Only one Station has command at a time.

2.2 ENGINE START INTERLOCK

Features related to main engine start:

Start Interlock to block the engine start signal if the DC power has not been turned ON.

Start Interlock to block the engine start signal if no Station has command.

Start Interlock to block the engine start signal if clutch is engaged.

Start Interlock will block the engine start signal if the Set Up Mode jumper is Closed ⊂⊃ on the main circuit board.

The Processor is interlocked to prevent engine Start until power is ON and the transmission is in Neutral. The engine Start signal will be connected through the Processor to the starter solenoid or relay.

2.3 STATION TRANSFER

When transferring command from one Station to another (refer to Figure 2:)

A) Leave the Control Head lever(s) of the Station-in-Command in any position.

B) Place the Control Head lever(s) of the Station taking command in the Neutral (vertical) detent position.

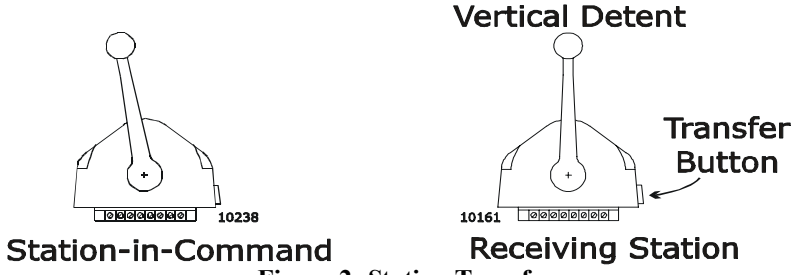


Figure 2: Station Transfer

C) At the Station taking command depress and hold for one second the transfer button.
- The red indicator will light indicating the Station has taken command.
- The Control System will remain unchanged for one second after the red indicator lights to allow the operator time to move the Control Head lever(s) to a position approximately matching the last command setting.

2.4 WARM-UP MODE

At the Station-in-Command, ensure that the Control Head lever is in the Neutral (vertical) position (refer to Figure 3:):

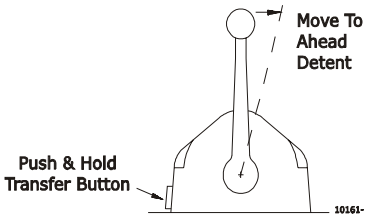


Figure 3: Warm-up Mode

A) Depress and hold the transfer button.

B) After one second move the Control Head lever to the Ahead detent position.

C) Now release the transfer button.
- The red indicator light will blink slowly indicating Warm-up Mode and the clutch has stayed in Neutral. The operator can now start and warm-up the engine while moving the Control Head lever through the throttle ranges.

D) When the Control Head lever is returned to Neutral (vertical) detent, ClearCommand will reset to Normal Operating Mode after one second.

2.5 SYNCHRONIZATION (MULTI SCREW ONLY)

This ClearCommand System utilizes dual lever synchronization. The advantage of this is that the Control Head levers are active at all times, which eliminates the possibility of shifting when the engine RPM's are not at Idle.

The Control Head levers are in the synchronization range when the Processors are commanding:
- At least 10% of the throttle range
- Commanded throttles are within 10% of equal RPM

The Processor's throttle signals are compared and then matched. The Processors then send an identical signal to the engines. The engines are now synchronized.

A green indicator light located on the Control Head of the Station-in-Command indicates engine synchronization:
- When the green light is NOT LIT, no synchronization.
- When the green light is LIT, synchronization.

When in the Synchronization Mode:
- Control Head levers have full command of throttle
- Synchronization can be **disabled** while in the synchronization range by depressing for one-second the transfer switch of the Control Head at the Station-in-Command.
- Synchronization can be **re-enabled** by matching the Control Head levers and then depressing the transfer switch for one-second again.

2.6 CONTROL HEAD TONES

Refer to Appendix B.1 Trouble Shooting for further explanation.

2.6.1 Low Repetition Rate Tone

Figure 4: Low Repetition Rate Tone

- This tone is normal when DC power is first applied to ClearCommand. This tone indicates the Processor is in Neutral and Idle, and that no station has command. The operator can now take command at a Station.
- This tone is heard when exiting Set Up Mode. The operator can now take command at a Station and continue in Normal Operating Mode.

2.6.2 Steady Tone

Figure 5: Steady Tone

- This tone signals a voltage problem or a component has failed. Confirm the voltage is steady between 12 and 24 volts DC, and that there is not a momentary voltage drop.
- This tone is heard when the transfer switch is depressed to gain command at a Station during Set up Mode to aid in the adjustment setting for certain parameters that require the use of a Control Head.
- This tone is heard when there has been a Software Failure.

2.6.3 High Repetition Rate Tone

Figure 6: High Repetition Rate Tone

This tone is used to signal a jam condition of a push-pull cable. The Processor has stopped when this tone is heard.

Moving the Control Head lever away from the position that the tone was encountered should move the push-pull cable out of the jam condition and stop this tone. The cause of the excessive push-pull cable load MUST be found. If this does not correct the problem, refer to the Troubleshooting Section Appendix B.1

2.6.4 Repetitive Signal: One Long - One Short Tone

Figure 7: Repetitive Signal: One Long - One Short Tone

This tone is used to show a clutch position feedback error.

2.6.5 Repetitive Signal: One Long - Two Short Tones

Figure 8: Repetitive Signal: One Long - Two Short Tones

This tone is used to show a troll position feedback error.

2.6.6 Repetitive Signal: One Long - Three Short Tones

Figure 9: Repetitive Signal: One Long - Three Short Tones

This tone is used to indicate a Control Head is malfunctioning due to loose or unconnected cable connections.

2.7 TROLLING VALVE CONTROL

2.7.1 Operating Modes

This system has two Modes of Operation: **Troll** and **Non-Troll**. When the control system is initially powered up, the default Mode of Operation is the Non-Troll Mode.

- Refer to Section 2.7.2 for Non-Troll Operation.
- Refer to Section 2.7.3 for Troll Operation.

The Control Head lever degrees of movement dedicated to the Troll Range command of the trolling valve can be set at 20 degrees or 35 degrees.

- Refer to Section 2.7.3 for Operation in Troll Mode.
- Refer to Section 6.9 for Troll Range setting.

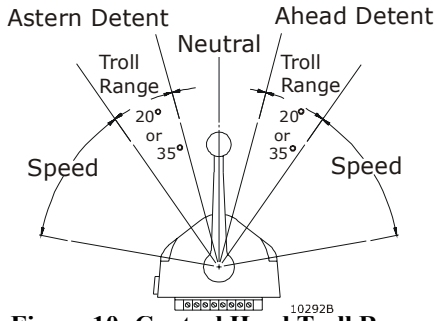


Figure 10: Control Head Troll Range

Trolling valve operation can be toggled **ON** (Troll)/**OFF** (Non-Troll) at the Control Head in command. Refer to Section 2.7.3 for more information on Troll toggle ON/OFF with transfer button.

2.7.2 Operation in Non-Troll Mode

During Non-Troll Mode the Trolling Valve will remain at the "lock-up", or maximum oil pressure position. The Control System will be in Normal Operation Mode.

2.7.3 Operation in Troll Mode

Troll Mode is a feature that must be turned **On** and **Off** at the Control Head.

TO TURN TROLL MODE ON:

A) Place the Control Head lever in the Ahead, Neutral, or Astern Detent.

B) Depress and hold the transfer button for one second.
- The solid red indicator light on the Control Head will begin blinking rapidly, indicating the system is now in **Troll Mode**.
- If the red indicator light does not blink rapidly:

1. Ensure the Control Head lever(s) is in the Ahead, Neutral, or Astern Detent.

NOTE: If system is set for multiple screw operation, ensure all Control Head levers are in the Ahead, Neutral, or Astern detent.

2. Ensure that the transfer button is held for at least one second.

C) The system has now been placed into **Troll** Mode.

D) Moving the Control Head lever Ahead or Astern into the Troll Range: (Refer to Figure 10:)
- **20 degrees** Troll Range leaves the engine at Idle RPM; **35 degrees** Troll Range increases engine speed in proportion to the Control Head

lever movement from Idle RPM to maximum speed set during Troll Throttle Limit Set Up.

NOTE: During Troll adjustments, there is a Jumper setting that allows the choice of engaging the trolling gear before shifting into Ahead or Astern or to shift the gear then engage the trolling gear.

- the transmission Clutch selector lever remains in Ahead or Astern
- the push-pull cable will move the trolling valve lever to increase oil pressure through the range of less than 50% shaft RPM to approximately 70% shaft RPM;
- Control Head red indicator light blinking rapidly.

E) Continued Control Head lever movement Ahead or Astern beyond the end of Troll Range will:
- Move the trolling valve to maximum oil pressure
- **20 degrees** engine speed increases in proportion to the Control Head lever movement from Idle RPM to Full Speed; **35 degrees** engine speed will increase from the maximum speed set during Troll Throttle Limit Set Up to Full Speed in proportion to the Control Head lever movement.
- Clutch selector lever remains in Ahead or Astern.
- The Control Head LED will become a steady light

TO DISABLE TROLL MODE:

A) Place the Control Head lever in the Ahead, Neutral, or Astern Detent.

B) Depress and hold the transfer button for one second.
- The rapidly blinking red indicator light will become a solid red, indicating the system is now in **Non-Troll** Mode.
- If the red indicator light does not become solid:

1. Ensure the Control Head lever is in the Ahead, Neutral, or Astern Detent
2. Ensure that the transfer button is held for at least one second

C) The system has now been placed in **Non-Troll** Mode and will operate in Normal Operating Mode.

3.0 REQUIRED PARTS AND TOOLS

3.1 PROCESSOR

One Processor required per engine (refer to Figure 11:)

Mounting Hardware is installer supplied.

Included with the Processor:

- Wago Tool
- Anti-Static Wrist Strap
- Spare Fuse

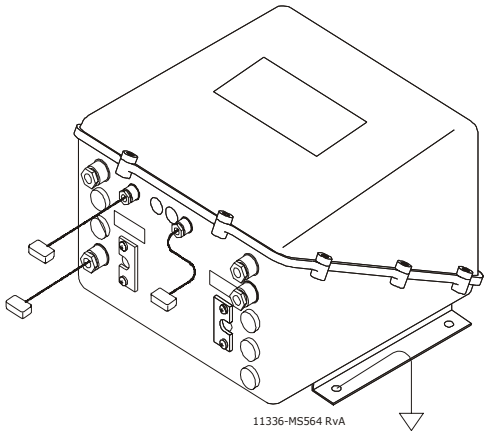


Figure 11: Control Processor

3.2 CONTROL HEAD

Refer to Appendix A.1 for Control Head Variations and Dimensions Sheets.

One Control Head required per Station.

Included with the Control Head:

- Gasket (400 Series Control Head only)
- Terminals
- Mounting screws
- Watertight cable grip for the cable entrance on the Processor
- Control Head Dimensions Variations & Installation Sheets

NOTE: Retrofit applications may require planning for an adapter pad to cover the old Control Head cutout. A variety of adapter and cover pads are available from ZF Mathers, LLC.

3.3 ELECTRIC CABLE

Eight-Conductor Cable (Control Head to Control Processor)
Shielded 20 AWG, 300V, PVC Insulated: -20 degrees C to +80 degrees C.
UL VW-1 PVC Jacket. Color Coded.

Two Conductor Power Cable (Processor to DC Power Supply)
14 AWG, 300V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Red with purple stripe and black.

Two Conductor Start Interlock Cable (Starter Switch to Processor to Starter Solenoid)
16 AWG, 300 V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Yellow with red stripe.

3.4 TOOLS REQUIRED FOR INSTALLATION

- Wago Tool (provided)
- Anti-static Wrist Strap (provided)
- Wire cutter, stripper, and crimper (Recommend Thomas & Betts WT-2000)
- Screwdriver – med. Phillips #2
- Screwdriver – med. straight slot
- Screwdriver -- small straight slot
- Hole saw -- 1 inch (25,4mm)
- Drills -- 9/32 inch (7,2mm) and 7/32 inch (5,6mm)
- Saw (appropriate type of saw for cutting material Control Head will be mounted on)
- Multimeter

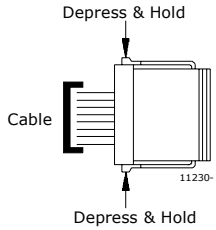
3.5 PUSH-PULL CABLE

Use Type 33C push-pull cable to the transmission clutch selector lever.

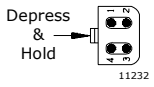
NOTE: If 43C cable is required for this application, a 43C Cable Conversion Kit is required. These Kits are available from ZF Mathers, LLC. Refer to Appendix A.1 - MM13821 43C Cable Conversion Kit Manual for more information.

When measuring cable length, measure cable from end of thread to end of thread. Many transmissions are delivered with factory push-pull cable mounting kits. If mounting kit is not included, contact the transmission dealer for a Factory Cable Connection Kit or refer to the Universal Mounting Figure in the Push-Pull Cable Installation Section of this manual.

3.6 WIRE HARNESS



Detail I
Large Plug Side View



Detail II
Small Plug End View

Figure 12: Wire Harness Connection Plug

Harnesses are available from ZF Mathers, LLC. Select from Appendix A.1 – Parts List the correct Wire Harness for your System.

Throttle Wire Harness (Processor to Engine Interface)

Serial Communication Wire Harness (Twin Screw) (Processor to Processor)

Tachometer Sensor Harness (Twin Screw) (Processor to Engine Pulse Transmitter) (OPTIONAL)

The above cable harnesses use one or both of the plug connector types detailed in Figure 12:.

When connecting the plugs, ensure that the release button or buttons are depressed and held until plug is fully connected or disconnected.

Connecting or disconnecting plugs without depressing and holding the release button or buttons will damage the plug.

3.7 ENGINE STOP SWITCH

It is mandatory for an Engine Stop Switch to be located at each Station.

WARNING: An Engine Stop Switch at each Station is an absolute requirement. Refer to CFR 46, SEC. 62.35-5 and ABYC P-24.5.8.

3.8 CONTROL SYSTEM POWER

The Processor requires:

- A battery source of 12 or 24 volts DC
- A 10 ampere circuit breaker with manual reset
- Automatic Power Selector (refer to Appendix A.1 - S-214 APS Service Sheet)

The power for the Control System should come from the same power distribution panel as the other required engine functions. (Refer to Appendix C.1 Drawing Notes)

4.0 PLAN THE INSTALLATION

4.1 PROCESSOR(S) LOCATION

NOTE: Read the Warranty in Appendix A.1. Improper mounting location may cancel warranty.

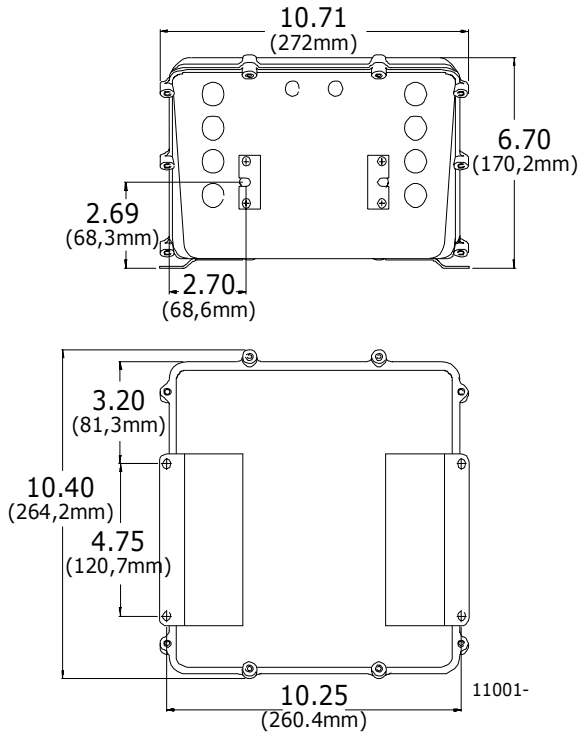


Figure 13: Control Processor Dimensions

Processors are spray proof, but must not be immersed.

An engine room location of the Processor is preferred.

- If the engine room is too small, locate in any area where it is accessible for electrical and push-pull cable connections.

Bulkhead mounting preferred for ease of access for wiring and adjustments, the Processor can be mounted in any attitude.

- If the clutch cable is connected to an I/O drive outside the hull, the Processor must be two feet (0,6m) or more above waterline.

Do not mount the Processor on the engine, to the transmission, or in any location that will subject it to excessive vibration.

Refer to Figure 13: for Processor dimensions.

Locate Processor(s) away from heat sources, such as engine exhaust manifolds. Allow 4 feet (1,2m) of clearance, or more, between the Processor(s) and such heat sources.

CAUTION: Electro-magnetic fields can influence ClearCommand's electronic circuits.

Do not mount close to gas engine ignition systems, alternators, or electric motors. Allow 4 feet (1,2m) of clearance between the Processor and alternators or electric motors.

The Processor's mounting feet must be connected to the vessel's bonding system.

Locate each Processor such that the push-pull cables from it to the engine governor and/or transmission have large radius bends, with the least total degrees of bend and moderate length.

NOTE: The minimum bend radius of 10 inches (254mm), for a total degree of bends of less than 270 degrees. Push-pull cable lengths should not exceed 20 feet (6m).

4.2 CONTROL HEAD LOCATION

Refer to Appendix A.1 Control Head Dimensions and Variations for specific information on a Control Head.

4.2.1 400 Series Control Heads

When properly mounted on a console, the Control Head is watertight from the top. An adhesive gasket must be used to seal the Control Head to the mounting surface. However, below the mounting surface the Control Head needs protection from water or spray.

NOTE: If a Control Head is mounted weather exposed from the underside, consider using a Weather Mount Enclosure. Reference Appendix A.1 Weather Mount Enclosure for specific information.

See Appendix A.1 Control Head sheets for mounting dimensions.

4.2.2 MC2000 Series Control Heads

When properly mounted on a console, the Control Head is watertight from the top. An adhesive gasket is mounted on the bottom of the Control Head to seal it to the mounting surface. However, below the mounting surface the Control Head needs protection from water or spray.

NOTE: If a Control Head is mounted weather exposed from the underside, consider using a Weather Mount Enclosure. Reference Appendix A.1 Weather Mount Enclosure for specific information.

See Appendix A.1 Control Head sheets for mounting dimensions.

4.2.3 700 Series Control Heads

When properly mounted on a console, the Control Head is watertight.

See Appendix A.1 Control Head sheets for mounting dimensions.

4.3 DC POWER SOURCE

It is important to keep the length of power cable short to reduce voltage drop. The power cable should not exceed 20 feet (6m).

If individual wires are used for supply (+) and return (-) then the total wire length should not exceed 40 feet (12m).

CAUTION: It is <u>important</u> that the wire size from the battery to the circuit breaker panel is large enough to keep voltage drop due to current flow, to less than 3 percent. The DC return to the battery must be large enough to supply <u>all</u> current requirements with a voltage drop of less than 3 percent.

It is recommended by ZF Mathers that an Automatic Power Switch (APS) and a second power source be used. Refer to Appendix A.1 - APS Service Sheet and Appendix C.1 system drawing.

5.0 INSTALLATION

NOTE: Before starting the actual installation of ClearCommand, make sure you have the correct parts and tools on hand. See Section 3. Read ALL the instructions pertinent to each part before beginning the installation of that part.

CAUTION: Static electricity can destroy electronic components. Anytime the Processor cover is off, use the anti-static wrist strap provided and connect it to the Processor frame. This will drain any static charge you may have on your person.

5.1 EIGHT-CONDUCTOR CABLE

A) Install the eight-conductor electric cable between each Control Head and the appropriate Processor.

B) Label each eight-conductor cable at both ends with the station it connects, and Port, Center, or Starboard for Twin or more Screw applications.

When installing the eight-conductor cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

5.2 PROCESSOR

A) Secure the Processor using 1/4 inch or M6 fasteners.

B) Remove the Processor cover.

C) Connect the wrist strap to your person, and the ground connector to the Processor frame.

CAUTION: When not working on the Processor, keep the cover in place to prevent damage to circuits.

D) Install the watertight cable grips needed for cable entrance. Refer to Figure 14:.

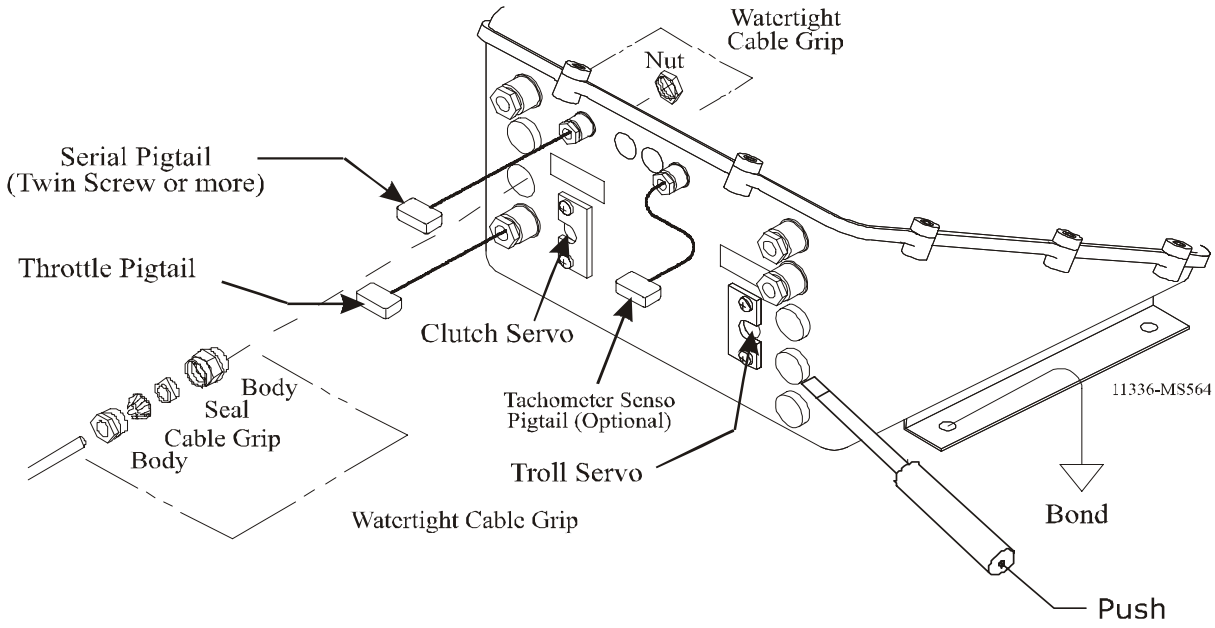


Figure 14: Plug Removal and Cable Grip Installation

5.3 PROCESSOR ELECTRIC CABLE CONNECTIONS AND SET UP

5.3.1 Processor Station Connections

A) Insert cable through the appropriate watertight cable grip.

B) Strip the PVC jacket and shielding back approximately 3 inches (75mm).

C) Stagger wire lead length to match the correct Station terminal strip.

CAUTION: Wire leads must not touch frame.

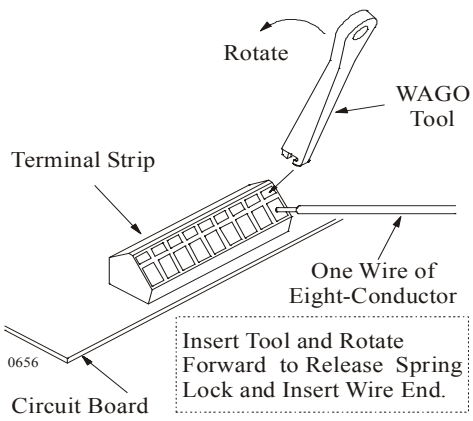


Figure 15: Terminal Connection

D) Strip the wire insulation 3/8-inch (9,5mm) on each wire.

E) Locate the WAGO Tool that is taped to the relay on the circuit board in each Processor.

F) Use the WAGO Tool to depress the spring lock for the individual wire connections to the terminal strip. (Refer to Figure 15:)

G) Connect colors to the station terminal strips as shown on system drawing in Appendix C.1.

H) Connect the shielding drain wire (bare wire) to Terminal 8 on the station terminal strip.

CAUTION: The shielding drain wire MUST NOT touch any other components.

I) Feed through a little slack cable, and tighten the cable grip on the eight-conductor cable.

NOTE: Bring the other Station's eight-conductor cables in the same way, and connect to the appropriate station terminal strips. (Refer to drawing in Appendix C.1)

J) Tie wrap the Station cable to the Processor frame.

5.3.2 Power Cable

WARNING: When connecting the DC power cable to the Processor be sure the power is OFF.

A) Run the length of two-conductor power cable between the DC Power Supply and the Processor.

NOTE: ZF Mathers highly recommends the use of an Automatic Power Selector (APS). Refer to Appendix A - S-214 APS Service Sheet.

B) Install the power cable grip in the Processor enclosure. (refer to Figure 11:)

C) Connect the two-conductor cable to the Processor. Refer to the drawing in Appendix C.1 for power connection points.

D) Feed through a little slack cable and tighten the cable grip.

E) Tie wrap the power cable to the Processor frame.

F) Ensure all connections are as indicated on the drawing in Appendix C.1.

5.3.3 Start Interlock

CAUTION: The Processor is designed for a maximum of 30 amperes start signal current. Greater current will damage the interlock circuit.

Run the length of two-conductor start interlock cable between the Starter Solenoid and the Processor. (Refer to Figure 16:)

Connections at Starter Solenoid:

A) Remove the remote start switch lead from the Starter Solenoid.

B) Strip and connect one start interlock cable wire to this lead.

C) Strip and connect the second start interlock cable wire to the Starter Solenoid.

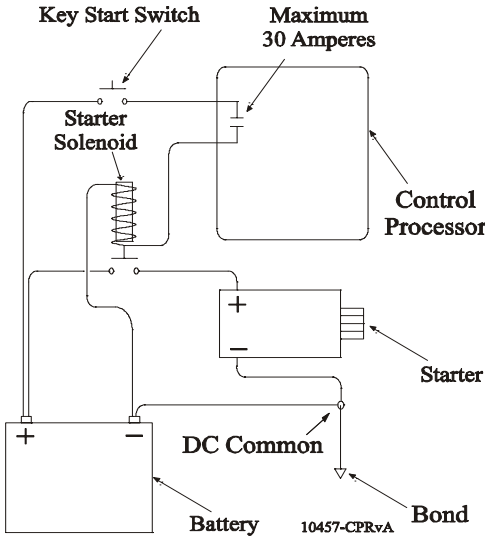


Figure 16: Start Interlock Connections

Connections at Processor:

A) Install the start interlock grip in the Processor enclosure. (refer to Figure 5:

B) Run the two-conductor start interlock cable through the watertight cable grip.

C) Strip insulation off of each wire 3/8-inch (9,5mm), then install crimp terminals.

D) Connect the two-conductor cable as indicated on the drawing in Appendix C.1.

E) Feed through a little slack cable and tighten the cable grip.

F) Tie wrap the start interlock cable to the Processor frame.

G) Ensure all connections are as indicated on the drawing in Appendix C.1.

CAUTION: The most common source of trouble is loose wiring connections. Verify wiring connectors are properly crimped and cannot be pulled out. Crimps and connections must be made to the wire, not to the wire insulation. Verify all screwed wire connections are secure.

5.3.4 Synchronization (Twin or more Screw Only)

CAUTION: When connecting the plugs, ensure that the release buttons are depressed and held until plug is fully connected. To disconnect the plugs, the release buttons MUST be depressed and held until plug is disconnected.

NOTE: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

For Twin or more Screw Applications, the Processors need to be interconnected with a Serial Communication Wire Harness as demonstrated on the drawing in Appendix C.1.

A) Plug the Serial Communication Harness to the Serial Harness pigtail of the Processor.

B) Run the harness cable to the next Processor.

C) Plug the Serial Communication Harness to the Serial Harness pigtail of the Processor. Continue until all Processors are connected.

5.3.5 Tachometer Sensor Cable (Optional) (Twin Screw or more)

CAUTION: When connecting the plugs, ensure that the release buttons are depressed and held until plug is fully connected. To disconnect the plugs, the release buttons MUST be depressed and held until plug is disconnected.

NOTE: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

NOTE: The use of the Tachometer Sensor Harness is a requirement if using Active Synchronization.

A) Plug the Tachometer Sensor Cable Plug into the appropriate Processor pigtail.

B) Run the Port Tachometer Sensor Cable to the Port engine pulse transmitter.

C) Run the Starboard Tachometer Sensor Cable to the Starboard engine pulse transmitter, etc.

D) Make cable connections at the tachometer sensor as indicated on the system drawing in Appendix C.1.

5.4 CONTROL HEADS

See Appendix A.1 Control Head Dimensions and Variations for location of cutout and mounting holes for the Control Heads used with this application. Refer only to the following Sections that relate to the Control Heads used.

5.4.1 Mounting

400 Series Control Head:

A) Use the template supplied in Appendix A.1 and drill the screw holes and the corner cutout holes.

B) Saw between the corner cutout holes.

C) Check that the four mounting screws will start into the Control Head.

D) Remove the Control Head.

E) Strip the adhesive cover from the gasket and apply the adhesive side to the console.

700 Series Control Head:

A) Drill the screw holes and the cable holes.

B) Remove the six screws holding the bottom cover of the Control Head housing and set aside. (Refer to Appendix A.1 Control Head Variations sheet)

C) Run the eight-conductor cable through the correct cable grip in the bottom cover.

CAUTION: For Twin Screw applications, Port cable to Port side of Control Head, Starboard cable to the Starboard side of Control Head.

MC2000 Series Control Head:

A) Use the template supplied in Appendix A.1 and drill the screw holes and the corner cutout holes.

B) Saw between the corner cutout holes.

C) Check that the two mounting screws will start into the Control Head.

5.4.2 Cable Connection

Refer to Appendix A.1 Control Head Variations Sheet for the Control Heads being used with this application.

A) At the Control Head, strip back the PVC jacket on the eight-conductor cable approximately 2-1/2 inches (63,5mm).

B) Strip and cut off the shielding and drain wire flush with the end of the PVC jacket.

CAUTION: Do not connect the drain wire at the Control Head to ground.

C) Strip 3/8-inch (9,5mm) insulation off each wire, then install crimp terminals.

CAUTION: Connections 5 and 7 at the terminal block are direction sensitive.

Port Lever:	Starboard Lever:
Terminal 5 Blue	Terminal 5 Yellow
Terminal 7 Yellow	Terminal 7 Blue

5.4.3 Aft Facing Control Heads

Refer to Figure 17:.

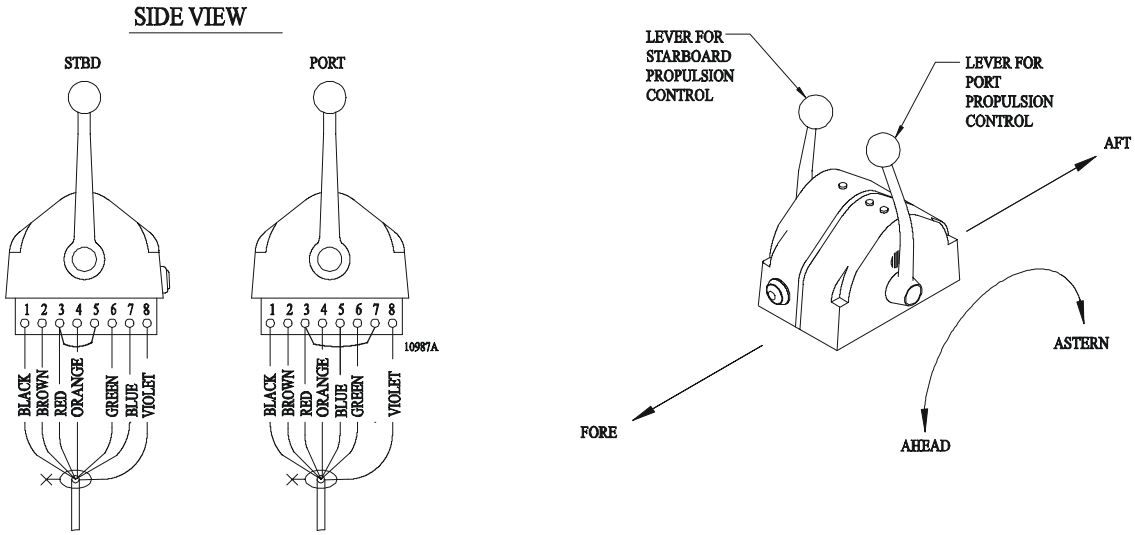


Figure 17: Aft Facing Control Heads

For dual lever Control Head Stations that have the user facing aft:

- Reverse connections 5 and 7.
- If the synchronization option is being used, ensure the violet wire is connected on the Control Head side that is commanding the Starboard Processor.

For single lever Control Head Stations that have the user facing aft and the single Control Head lever on the user's right, reverse connections 5 and 7.

5.4.4 700 Series Control Head Only

When cable connections are complete, replace the bottom cover with the six screws removed earlier. Ensure seal is in place.

5.5 ENGINE STOP SWITCH

The Installer supplies the Stop Switches. Refer to the information supplied with the Stop Switches for installation.

WARNING: An Engine Stop Switch at each station is an absolute requirement. Refer to CFR46, SEC.62.35-5 and ABYC P-24.5.8

5.6 MAIN ENGINE SPEED CONTROL

NOTE: Ensure all Processors are setup using the same jumper 6 Throttle Profile and Wire Harness.

- Ensure the correct Wire Harness is selected for the Engine Selection required for this System.
- Refer to the system drawing notes in Appendix C.1 for the correct jumper 6 Throttle Profile.

5.6.1 Throttle Wire Harness

The Processor(s) connects directly to the engine interface using a throttle wire harness.

Refer to Appendix A - Parts List to select the correct throttle wire harness for the engine signal required.

A) Connect the plug end of the throttle wire harness at the Processor.

CAUTION: When connecting the plugs, ensure that the release buttons are depressed and held until plug is fully connected. To disconnect the plugs, the release buttons MUST be depressed and held until plug is disconnected.

B) Run the cable to the engine interface.

NOTE: When installing the cable, support the cables using clamps or straps not more than 18 inches (0,5m) apart, unless contained in a conduit. Install each cable so it is protected from physical damage.

C) Refer to the engine documentation for termination points at the engine interface.

5.6.2 Auxiliary Circuit Board Jumper Setting

A) Locate jumper 6 on the Processor Auxiliary Circuit Board. Refer to Appendix C.1 drawing.

B) Select the Throttle setting for the Engine being used in this application.

5.7 PUSH-PULL CABLES

The Processor interconnects with the transmission by push-pull cable to operate the clutch and troll selector levers. The maximum load rating is 30 pounds force and 3-inches (7,62 cm) maximum movement of the push-pull cable.

Verify installation of push-pull cable brackets on the transmission. If the brackets are missing, fabricate brackets as shown in Figure 18:

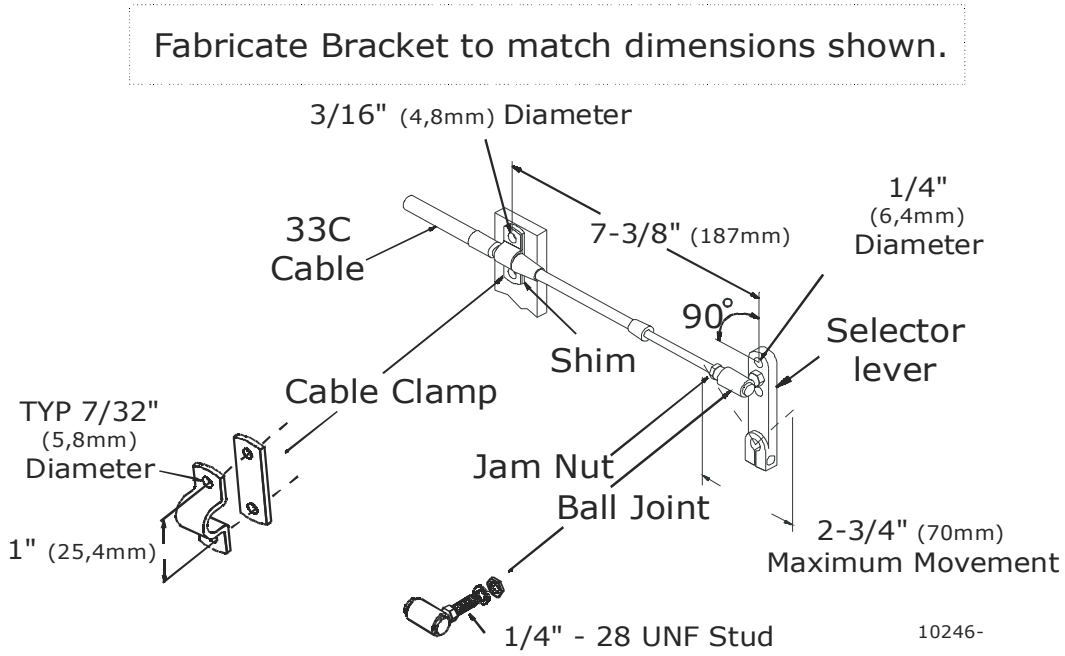


Figure 18: Universal Mounting

CAUTION: If 43C cable is required for this application, a 43C Cable Conversion Kit is required. These Kits are available from ZF Mathers, LLC. Refer to Appendix A.1 - MM13821 43C Cable Conversion Kit Manual. Skip Section 5.7.1 and refer to MM13821 Manual for installation of the 43C Cable.

5.7.1 Push-Pull Connection at Processor

NOTE: Perform the following steps for 33C Clutch push-pull cable installation.

A) Remove the Number 10-32 jam nut and the two rubber seals from the push-pull cable end that is to connect to the Processor. Discard seals.

B) On the Processor housing, remove one screw from the cable retainer clip.

C) Loosen the remaining screw and swing the cable retainer clip away from the entry hole.

D) Insert the push-pull cables through the entry hole.

E) When the push-pull cable end is visible within the Processor interior, reinstall the Number 10-32 jam nut.

F) Connect the push-pull cable to the hex nut (See Figure 19:, Detail I). Use a 7/16-inch socket to turn the hex nut onto the cable rod end until

there is approximately 5/16 inch (7,9mm) of thread showing beyond the jam nut.

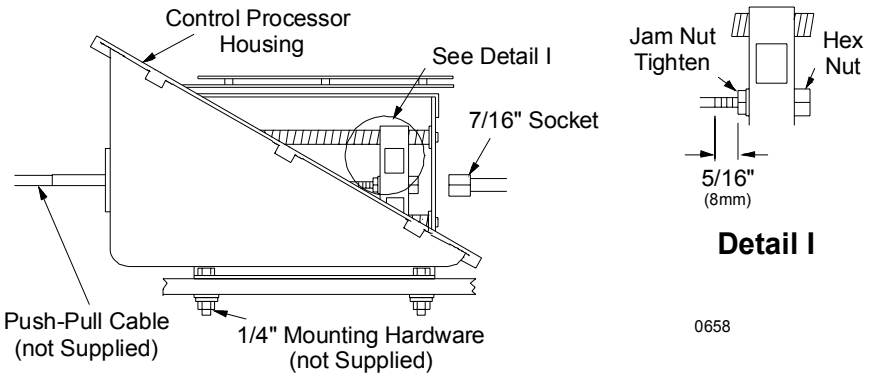


Figure 19: Push-Pull Cable Connection

G) Tighten the jam nut to the hex nut.

H) Reinstall the cable retainer clip to secure the push-pull cable to the Processor housing.

I) Run the push-pull cable to the transmission. Insure the correct push-pull cable is ran to the correct selector lever. Refer to the System Drawing in Appendix C.1 and to Figure 13:, page 21.

J) Do not connect the push-pull cable at this time.

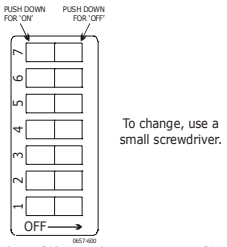
6.0 SET UP PROCEDURES

Before beginning any of the Set Up Procedures, ensure the following is completed:

- All electric cabling is completely installed.
- The jumpers are removed from all Processor Station Terminals that are being used in this application.
- All Wire Harnesses are plugged into the Processor and all connections are made to the appropriate equipment.
- Section 6.1 has been read and understood thoroughly.

6.1 SET UP STEPS

6.1.1 Dip Switch Settings



Settings and adjustments are made by selecting the appropriate dip switches SW1-1 through SW1-7 on the main circuit board and then saving the configuration by pressing PB1 on the auxiliary circuit board. Refer to Figure 20: and Figure 21:.

Figure 20: Main Circuit Board SW1 Dip Switch

NOTE: All the dip switches are preset and placed in the Off position at the Factory.

NOTE: Depending on the auxiliary Board revision level, the button for storing the value selected in the ClearCommand memory may be labeled SW1 (RevC and before) or PB1 (RevD and after). The following Set Up Procedures all reflect PB1. THE USAGE OF THE BUTTON IS THE SAME, ONLY THE DESIGNATION IS DIFFERENT.

- Settings can be changed at any time during the lifetime of this ClearCommand Control System.
- Some settings require the operator to move the Control Head lever and/or to adjust potentiometer R7. Read the Section for the parameter carefully before making the adjustment.
- When all adjustments are completed System must be returned to the Run State Refer to Section 6.1.4 Run State (Normal Operating Mode).
- All of the parameters can be reset to the Factory Default Values at anytime. Refer to Appendix B.1 Troubleshooting Section.

6.1.2 Order of Set Up Adjustments

Adjustment settings can be done one right after another or one at a time. Once a setting has been saved by depressing PB1, adjustment of another parameter may be started by:

1. Set all the dip switches to the Off position.
2. Place the Control Head lever(s) in the vertical position.
3. Ensure Potentiometer R7 is in the fully counter clockwise ↺ position.
4. Adjustment of another parameter may be started.

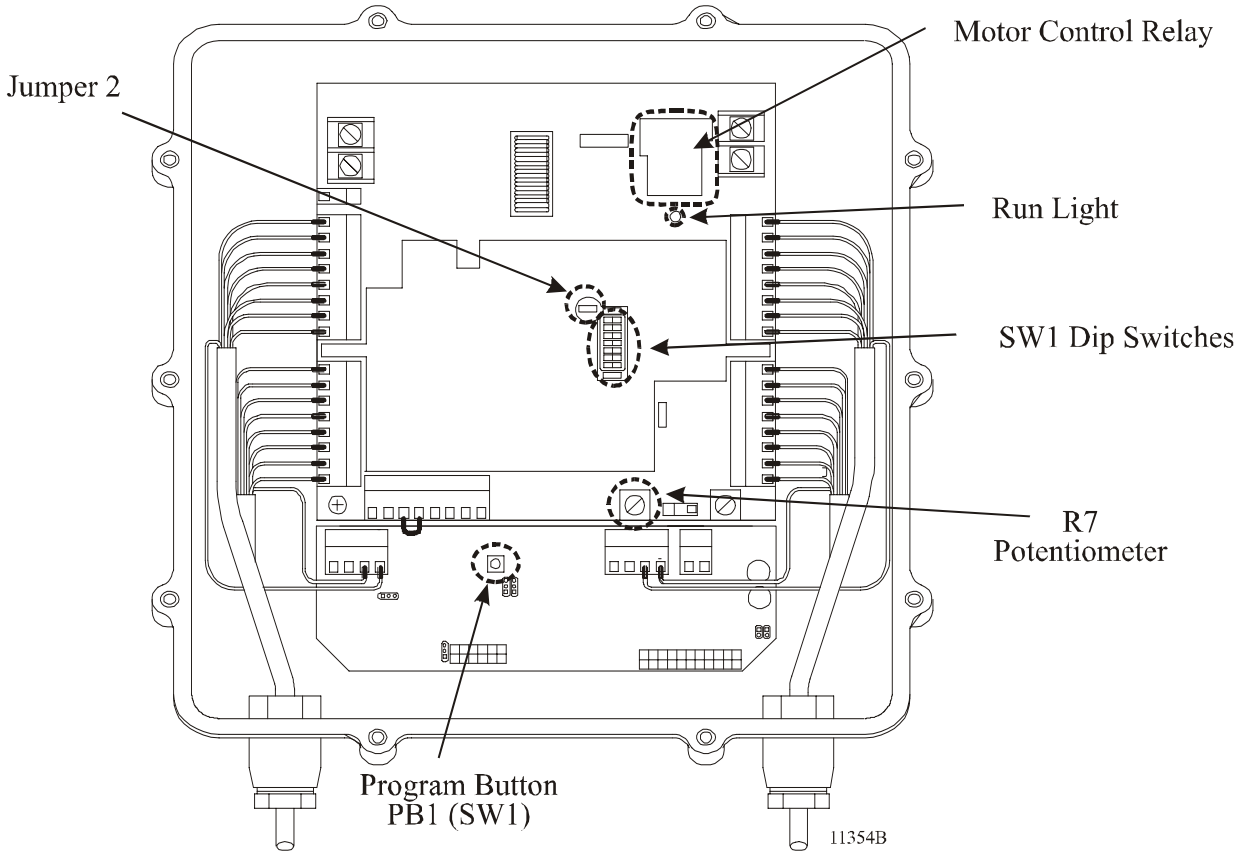
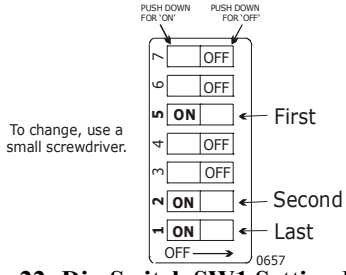


Figure 21: Processor Circuit Board Set Up Locations

6.1.3 Selecting Dip Switches



When switching the dip switches ON, select the switches in the order from Highest to Lowest.

EXAMPLE: Refer to Figure 22:. Throttle Maximum:

SW1-5 select ON 1st,

SW1-2 select ON 2nd,

SW1-1 select ON last

Figure 22: Dip Switch SW1 Setting Example

6.1.4 Run State (Normal Operating Mode)

NOTE: When selecting the dip switch setting, a nearly solid tone may sound and the motor control relay (located next to the Power Supply Terminal Block) will begin clicking. The tone and clicking will continue until a valid switch setting is completed.

CAUTION: IF THE TONE AND CLICKING CONTINUES ONCE THE DIP SWITCH SELECTION IS COMPLETED, the dip switch selection is not a valid selection or the system was not in the Run State (Normal Operating Mode) when entering the Set Up Mode. Place the System into the Run State and then follow each step, ensure the dip switch selection is set exactly.

NOTE: The Normal Operating Mode was called Safe State in earlier versions. ONLY THE NAME OF THE STATE HAS CHANGED, ALL FUNCTIONS ARE THE SAME.

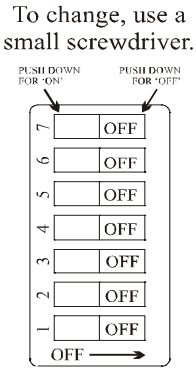


Figure 23: Dip Switch Run State

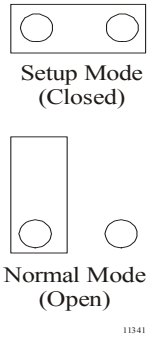


Figure 24: Jumper 2 Closed & Open

Run State is the Normal Operating Mode. The System must be in Run State during the operation of ClearCommand.

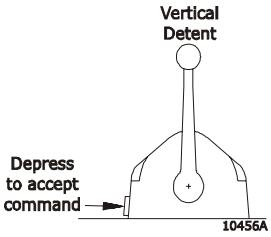
Run State:

- All SW1 dip switches are in the Off position (Refer to Figure 23:)
- Jumper 2 is in the Open State ⌷.

Refer to Figure 21:, page 31, or the drawing in Appendix C.1 for location of SW1 dip switch and Jumper 2.

NOTE: When all Adjustments have been completed the System must be placed in the Run State for Normal Operation.

6.1.5 Enabling Set Up Mode

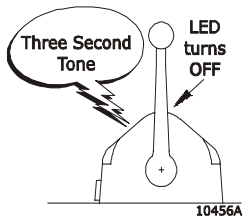


A) Take command at a Station.

B) Ensure the Control Head lever(s) are in the Neutral / Idle (vertical) position.

C) Enable Set Up Mode by closing Jumper 2 ⌷. (Figure 24:) (Refer to Figure 21:, page 31, for location of Jumper 2)

- When Set Up Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- If a nearly solid tone is heard and the motor control relay begins clicking THE SYSTEM WAS NOT in the Run State (Normal Operating Mode). Place all dip switches in the Off position (Refer to Figure 23:) and place Jumper 2 in the Open State ⌷. Continue with Step A) again, placing the system into Set Up Mode.

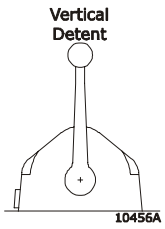


D) Place the appropriate SW1 dip switches ON for adjustment of a parameter.

- The Run LED on the Processor main circuit board will be unlit when Set Up Mode is enabled:
- All Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off. (On Twin Screw or more Systems the LED on just the side that is in Set Up Mode will turn Off. The other side will stay On and in Operating Mode.)
- The Run LED on the Processor main circuit board will be unlit for three-seconds.

E) Set up adjustment steps can now be started.

6.1.6 Storing Set Up Value



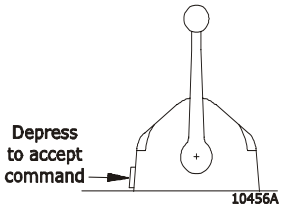
A) Store the value that has been set by depressing PB1 located on the auxiliary circuit board. (Refer to Figure 20:, page 30, for location of PB1)
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.

B) Reset all of the dip switches to the Off position. Refer to Figure 23:, page 32.

C) Ensure Control Head lever is in the vertical detent.
- If another adjustment setting is necessary, continue with the appropriate adjustment instruction Section.
- If another adjustment setting is not necessary, continue with the next step.

D) If dip switch R7 has been used during the set up, ensure R7 is in the fully counterclockwise position.

E) Place Jumper 2 in the Open State ◻◦.
- A low repetitious rate tone is heard indicating that the Control System is out of Set Up Mode and no Station is in command.



F) Take command at a Station.
- The red LED will light; indicating Station is in command.

6.2 NUMBER OF SCREWS SELECTION [SINGLE/TWIN, ETC]

CAUTION: The Number of Screws setting MUST be the FIRST setting completed.

CAUTION: The settings on all Processors main circuit boards MUST be set the same for Multi Screw applications.

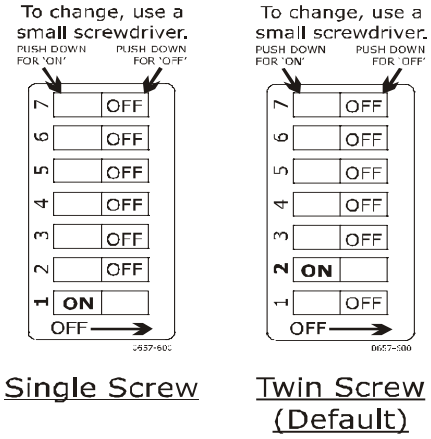


Figure 25: Dip Switch Setting Number of Screws (Single - Twin Screw or more)

A) Place the System in Set Up Mode.

B) Make the required dip switch setting. Refer to the Figure 25:

C) Store the value that has been set.

6.3 CLUTCH PRESSURE TIME

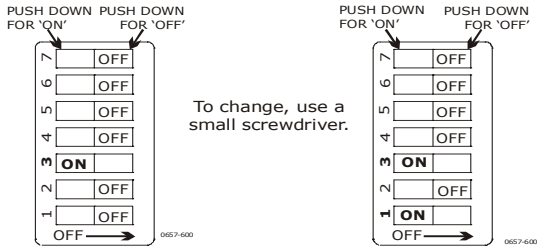
This feature is only available if the optional Clutch Pressure Switch is being used.

CAUTION: The setting on all Processors main circuit boards MUST be set the same for Multi-Screw applications.

Clutch Pressure Time is preset at the Factory for **5.0** seconds.

The Clutch Pressure Time feature allows throttle to be commanded above Idle for 0.5 or 5.0 seconds prior to the clutch pressure switch closing. If the clutch pressure switch has not closed within the Clutch Pressure Time setting, throttle will command Idle.

Change the Clutch Pressure Time by setting the SW1 dip switches on the Processor main circuit board using the following steps.



0.5 Second No Delay

5.0 Second Delay FACTORY DEFAULT

A) Place the System in Set Up Mode.

B) Place the appropriate dip switches On for the Clutch Pressure Time required. Refer Figure 26:

C) Store the value that has been set.

Figure 26: Dip Switch Setting Clutch Pressure Time

6.4 CLUTCH DELAY

CAUTION: The settings on all Processors main circuit boards MUST be set the same for Multi-Screw applications.

The Clutch Delay feature provides engine deceleration, followed by a delay in throttling to the commanded speed in the new desired direction, upon a Full-Speed Reversal.

The Throttle position drops to Idle and the transmission remains engaged Ahead or shifts to Neutral, the delay that follows is in proportion to the prior Control Head lever position and how long the lever had been in that position before the reversal.

NOTE: The pause in gear on a through-shift is proportional to the speed commanded and time at that speed. The times listed in Figure 26: are maximum.
Shifting from Idle Ahead to Idle Astern, the pause is ZERO.
The time required to build to the maximum pause is six times the pause listed in Figure 27:.
The pause from Full Astern to Ahead is half that listed in Figure 27: for Full Ahead to Astern.

Change the Clutch Delay by setting the SW1 dip switches on the Processor main circuit board using the following steps.

A) Place the System in Set Up Mode.

B) Place the appropriate dip switches On for the Clutch Delay required. Refer to the Figure 27:

C) Store the value that has been set .

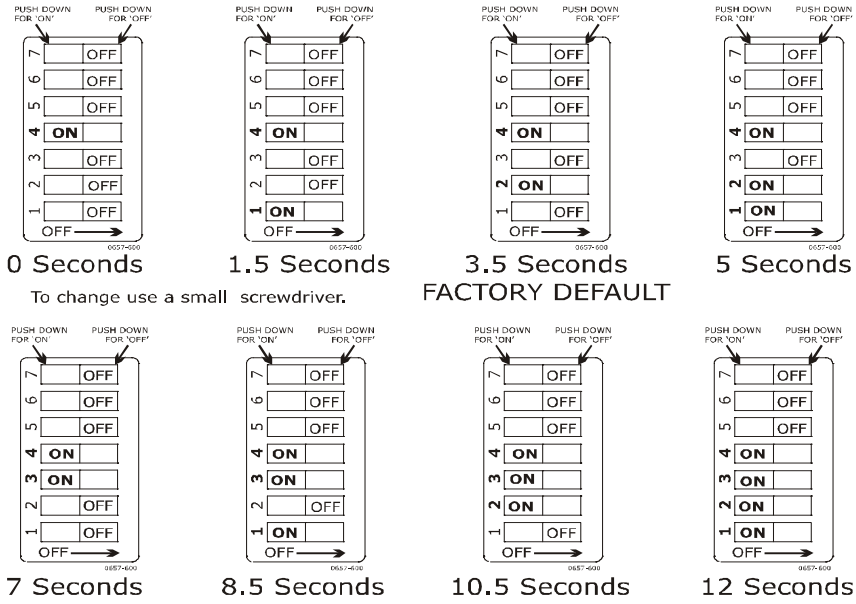


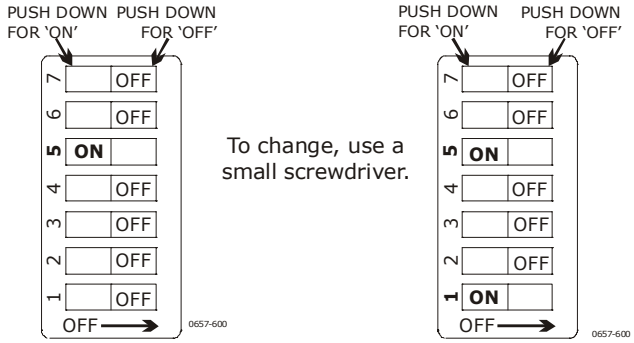
Figure 27: Dip Switch Setting 0 - 12 Seconds Clutch Delay

6.5 THROTTLE PAUSE

CAUTION: The setting on all Processors main circuit boards MUST be set the same for Multi-Screw applications.

Hydraulic actuated clutches require 1/2 second, or longer, following clutch selector lever movement before there is clutch plate contact. Some clutches may build clutch pressure more slowly. This could mean high engine RPM before clutch engagement. The optional Clutch Oil Pressure Switch will ensure sufficient clutch oil pressure, before allowing speed to the governor.

Throttle Pause is preset at the Factory for **0.5** second.



0.5 Second FACTORY DEFAULT

1.0 Second Pause

Figure 28: Dip Switch Setting Throttle Pause

A) Place the System in Set Up Mode.

B) Place the appropriate dip switches ON for Throttle Pause required for this application. Refer to Figure 28:

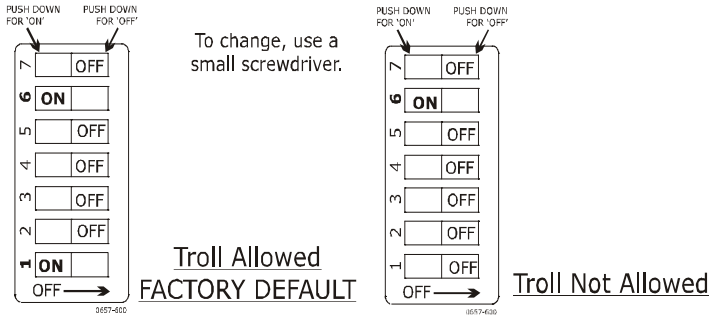
C) Store the value that has been set.

6.6 TROLL ALLOWED/NOT ALLOWED

CAUTION: The setting on all Processors Main Circuit Boards MUST be set the same for Twin Screw (or more) applications.

The Processors are set at the Factory with Troll **Allowed**.

If Trolling Valve command is not required, turn Troll to Not Allowed by setting the Dip Switches on the Processor Main Circuit Boards using the following steps.



A) Place the System in Set Up Mode.

B) Place the appropriate dip switches ON for Troll Allowed / Not Allowed required for this application Refer to Figure 29:

C) Store the value that has been set.

Figure 29: Dip Switch Setting Troll Allowed/Not Allowed

6.7 CONTROL HEAD DEGREES OF TROLLING RANGE:

CAUTION: The setting on both Processors Main Circuit Boards MUST be set the same for Twin Screw applications.

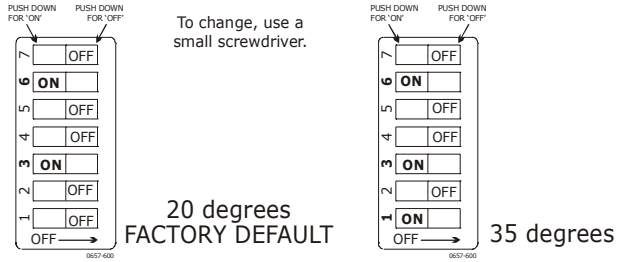
Two Troll Range settings are available:

- 20 degrees
- 35 degrees

The Control Head Troll Range is preset at the factory for Normal Range (**20 degrees** Troll Range).

Refer to Section 2.7 for operation in 20 degrees or 35 degrees.

Troll Range may be set to 35 degrees by setting the Dip Switches on the Processor Main Circuit Boards using the following steps.



A) Place the System in Set Up Mode.

B) Place the appropriate dip switches ON for Troll Range 20 or 35 required for this application Refer to Figure 30:

C) Store the value that has been set.

Figure 30: Dip Switch Setting Troll Range 20/35 Degrees

6.8 ACTIVE SYNCH DISABLE / ENABLE

CAUTION: The setting on all Processors main circuit boards MUST be set the same for Multi-Screw applications.

Active Synch is preset at the factory to be **disabled**.

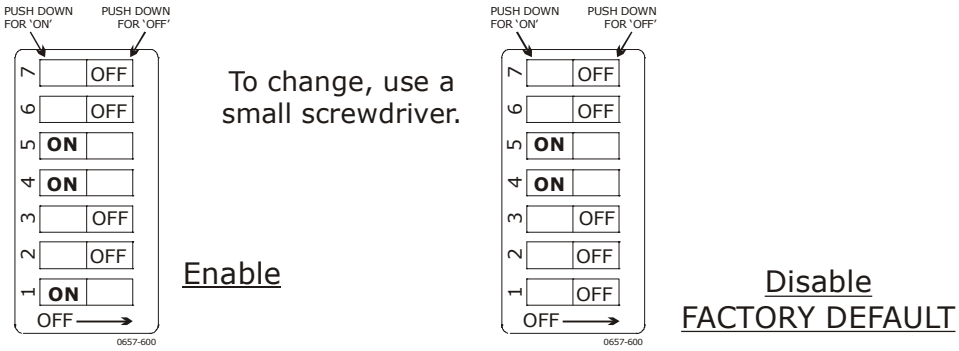


Figure 31: Dip Switch Setting Throttle Pause

A) Place the System in Set Up Mode.

B) Place the appropriate dip switches ON for Enable / Disable as required for this application. Refer to Figure 31:

C) Store the value that has been set.

7.0 ADJUSTMENTS AND TESTS (SECURED TO DOCK)

7.1 CONTROL HEAD (ENGINES STOPPED)

A) Turn the power ON to the control system.

WARNING: Keep hands and tools clear of the Processor when power is ON. Turn OFF the control system power before disconnecting from the batteries. Do not disconnect battery terminals when engine is operating.

B) The Control Head at each station will produce an intermittent tone.

C) Take command at a remote station.

- Verify the the red LED is lighted on the Control Head.

D) Move each Control Head lever full Ahead and full Astern. Ensure Processor reacts to lever movement.

NOTE: This will check that the Control Head is operating.

*** On Multi-Screw applications ensure the Port Control Head lever operates the Port Processor and the Starboard Control Head lever operates the Starboard Processor, etc. ***

7.2 START INTERLOCK (ENGINES STOPPED)

NOTE: If any of the following tests fail, verify Start Interlock installation and Start Interlock connections as shown on the drawing in Appendix C and in Section 5.2.2 , page 16.

7.2.1 All Processors

A) Turn the ClearCommand DC power OFF.
- Verify that the engine(s) will not start.

B) Turn the ClearCommand DC power ON. Do not take command at a Station.
- Verify engine(s) will not start.

C) Take command at a Station. Place the Control Head lever(s) to 50 percent throttle.
- Verify engine(s) will not start.

D) Place the Control Head lever(s) in the Neutral/Idle (vertical) position. Take command at a Station.
- Verify engine(s) will start in this position.

E) Place Jumper 2 on the main circuit board Closed .
- Verify engine(s) will not start.

F) Place Jumper 2 on the main circuit board Open  .

G) Place the Control Head lever(s) in the Neutral/Idle (vertical) position. Take command at a Station.
- Verify engine(s) will start in this position.

7.3 ELECTRIC THROTTLE SIGNAL

ADJUSTMENTS MAY NOT BE REQUIRED. Verify the existing Throttle Minimum and Maximum values prior to adjusting them.

NOTE: Jumper 6 on the Processor auxiliary board must be set to either PWM output or Voltage/ Current output. Refer to the Appendix C.1 drawing.

The following are examples of the idle and full throttle requirements of some of the Electronic Governors. Always refer to the engine manual for specific information:

Voltage	
Cummins (Centry)	0.90- 4.50 VDC
Cummins (QSM-11)	1.20- 4.00 VDC
Scania	0.30- 2.90 VDC
Volvo	0.20- 3.50 VDC
Current	
MAN & MTU	4.00- 20.00 mA
PWM	
Caterpillar	10- 90% Duty Cycle @ 500 Hz

7.3.1 Throttle Minimum Signal (Engines Stopped)

Change the throttle minimum signal by:

A) Take command at a Station.

B) Leave the Control Head lever in the vertical position.

C) Ensure that Potentiometer R7 is in the fully counter clockwise ↺ position.

D) Enable Set Up Mode.

E) Press the transfer button at the remote station being used during set up.
- Verify a tone is heard when depressing the station transfer button.
- The Control Head LED will not be lit, but the Control Head will be active for set up procedures.

F) Place the appropriate dip switches On to ready the Processor for adjustment. Refer Figure 32:

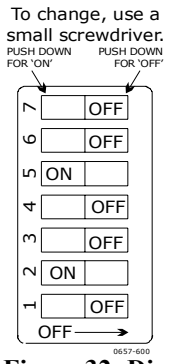


Figure 32: Dip Switch Setting Throttle Minimum

G) Adjust Throttle Minimum Output using the PWM, Voltage, or Current steps outlined in **Table 1:**

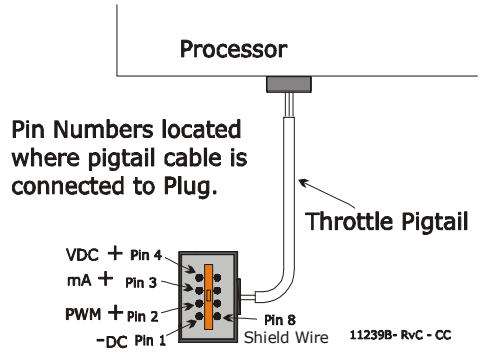


Figure 33: Throttle Connector at Processor Pigtail

To Measure Throttle Signals:

8 Pin Throttle Connector at the Processor Pigtail

PIN 1 – DC Return

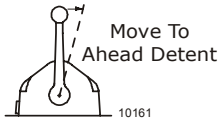
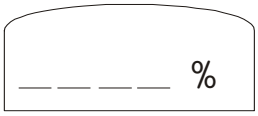
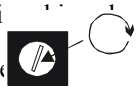
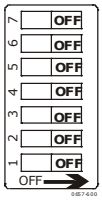
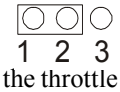
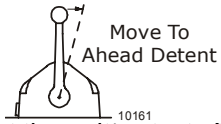
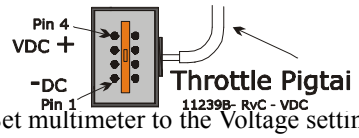
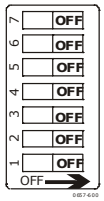
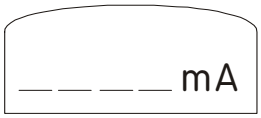
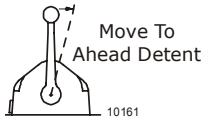
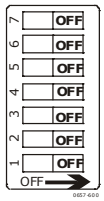
PIN 2 – PWM +

PIN 3 – mA (current) +

PIN 4 – VDC (voltage) +

PIN 8 – Shield Wire

Table 1: Throttle Minimum Output Adjustments

PWM (Duty Cycle)	Voltage (VDC)	Current (mA)
1) Disconnect the Throttle Wire Harness from the throttle pigtail at the Processor. 2) Place the Control Head lever into the Ahead Detent position.  3) Move Jumper 6 on auxiliary board to Pins 2-3 (voltage/ current setting).  4) Connect the multimeter to PWM Pins on the Throttle Connector (Refer to Figure 33:).  5) Set multimeter to Duty Cycle setting.  6) Rotate Potentiometer R7 slowly clockwise until minimum throttle signal i  7) Store the value 8) Reset all of the dip switche to the Off position. 9) Return Potentiometer R7 fully counter clockwise.  10)Replace Jumper 6 on auxiliary board to its original position.  11)Reconnect the throttle wire the throttle pigtail at the P 	1) Disconnect the throttle wire harness from the throttle pigtail at the Processor. 2) Place the Control Head lever into the Ahead Detent position.  3) Connect the multimeter to Pins 1 and 4 of the Throttle Connector (Refer to Figure 33:)  4) Set multimeter to the Voltage setting.  5) Rotate Potentiometer R7 slowly clockwise until minimum throttle signal is achieved.  6) Store the value. 7)Reset all of the dip switches to the Off position (Run State) 8) Return Potentiometer R7 fully clockwise.   9) Reconnect the throttle wire ha the throttle pigtail at the Processor.	1) Disconnect the positive (+) throttle signal wire from the governor (refer to the drawing in Appendix A) 2)Set the multimeter up as an Amp Meter (current).  3) Connect one multimeter probe to the disconnected positive (+) throttle signal wire 4)Connect the other Multimeter probe to the terminal governor. 5) Place the Control Head lever into the Ahead detent position.  6) Rotate Potentiometer R7 slowly clockwise until minimum throttle signal is achieved. .  7) Store the value. 8) Reset all of the dip switches to the Off position (Run State). 9) Return Potentiometer R7 fully counter clockwise.   10)Reconnect the positive (+) throttle signal wire from the governor

CAUTION: The settings on all Processors main circuit board MUST be set the same for Twin Screw (or more) applications.

7.3.2 Throttle Maximum Signal

Change the throttle maximum signal by:

A)Take command at a Station.

B)Leave the Control Head lever(s) in the vertical detent.

C)Ensure that Potentiometer R7 is in the fully counter clockwise position.

D)Enable Set Up Mode

E) Press the transfer button at the remote station being used during set up.
- Verify a tone is heard when depressing the transfer button.
- The Control Head LED will not be lit, but the Control Head will be active for set up procedures.

F) Place the appropriate dip switches On to ready the Processor for adjustment. Refer to Figure 34:

G)Adjust Throttle Maximum Output using the PWM, Voltage, or Current steps outlined in **Table 2:**

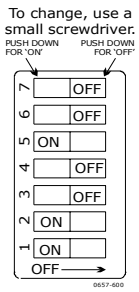


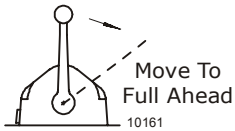
Figure 34: Dip Switch Throttle Maximum

Table 2: Throttle Maximum Output Adjustments

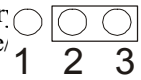
PWM (Duty Cycle)

1)Disconnect the throttle wire harness from the throttle pigtail at the Processor.

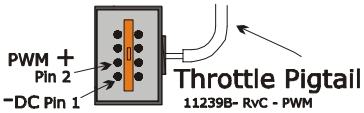
2) Place the Control Head lever into the Full Ahead position.



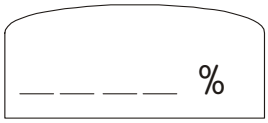
3) Move Jumper 6 on auxiliary board to Pins 2-3 (voltage/ current setting).



4)Connect the Multimeter to PWM Pins on the Throttle Connector (Refer to Figure 33:).



5)Set Multimeter to Duty Cycle setting.

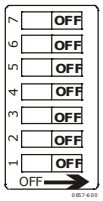


6)Rotate Potentiometer R7 slowly clockwise until maximum throttle signal is achieved. Refer to system drawing for R7 location.

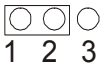
7) Store the value.

8) Reset all of the dip switches to the Off position.

9) Return Potentiometer R7 fully counter clockwise.



10)Replace Jumper 6 on auxiliary board to its original position.

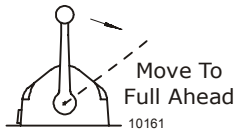


11)Reconnect the throttle wire harness to the throttle pigtail at the Processor.

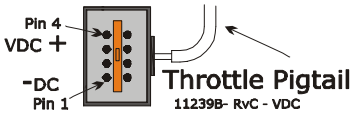
Voltage (VDC)

1)Disconnect the throttle wire harness from the throttle pigtail at the Processor.

2) Place the Control Head lever into the Full Ahead position.



3)Connect the Multimeter to Pins 1 and 4 of the Throttle Connector (Refer to Figure 33:).



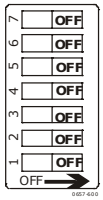
4)Set Multimeter to the Voltage setting.

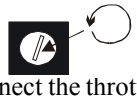
5)Rotate Potentiometer R7 slowly clockwise until maximum throttle signal is achieved. Refer to system drawing for R7 location.

6)Store the value.

7)Reset all of the dip switches to the Off position (Run State)

8) Return Potentiometer R7 fully counter clockwise.



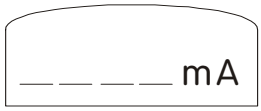


9) Reconnect the throttle wire harness to the throttle pigtail at the Processor.

Current (mA)

1) Disconnect the positive (+) throttle signal wire from the governor (refer to the system drawing in Appendix C)

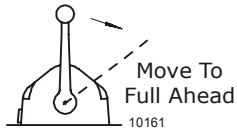
2)Set the Multimeter up as an Amp Meter (current).



3)Connect one Multi-meter probe to the disconnected positive (+) throttle signal wire.

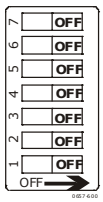
4) Connect the other Multimeter probe to the terminal on the governor.

5)Place the Control Head lever into the Full Ahead position.



6)Rotate Potentiometer R7 slowly clockwise until maximum throttle signal is achieved. Refer to system drawing for R7 location.

7) Store the value.



8) Reset all of the dip switches to the Off position (Run State).

9) Return Potentiometer R7 fully counter clockwise.

10)Reconnect the positive (+) throttle signal wire from the governor

7.4 ENGINE STOP SWITCHES TEST (ENGINES RUNNING)

A) Start engine(s).

B) Verify that all Engine Stop Switches function correctly at all stations.

Refer to information supplied by engine manufacturer or switch supplier for set up and adjustments.

CAUTION: An Engine Stop Switch at each station is an absolute requirement. Refer to CFR46, SEC.62.35-5 and ABYC P-24.5.8.

WARNING: Do not attempt to continue tests until Engine Stop Switches function correctly.

7.5 WARM-UP MODE TEST (ENGINES RUNNING)

NOTE: Use Warm-up Mode on each engine at each Station, one engine at a time to confirm speed command.

A) Place the Control Head lever(s) in the Neutral position.

B) Depress and hold the station transfer button.

C) Move the Control Head lever(s) to the Ahead detent position.

D) Release the station transfer button.

- If the red indicator light blinks, Warm-up Mode has been activated. Continue with Adjustments and Tests.
- If the indicator light does not blink, refer to Control Head installation section, and verify all connections are correct. Make any necessary changes and then repeat this Section.

7.6 TROLL ENGAGE PRIOR TO SHIFTING ENABLE/DISABLE

This Processor offers the option of having the trolling valve engage prior to shifting or after shifting.

- **Enable** will engage the trolling valve prior to the gear shifting into Ahead or Astern.
- **Disable** will shift the gear into Ahead or Astern and then engage the trolling valve.

To **Enable** Troll Engage Prior to Shifting, install a Jumper between the Auxiliary Circuit Board [MS13294] TB1-3 and TB1-4. The Processor is shipped from the factory with NO Jumper installed (**Disable**). Refer to Figure 35: for location of Jumper setting.

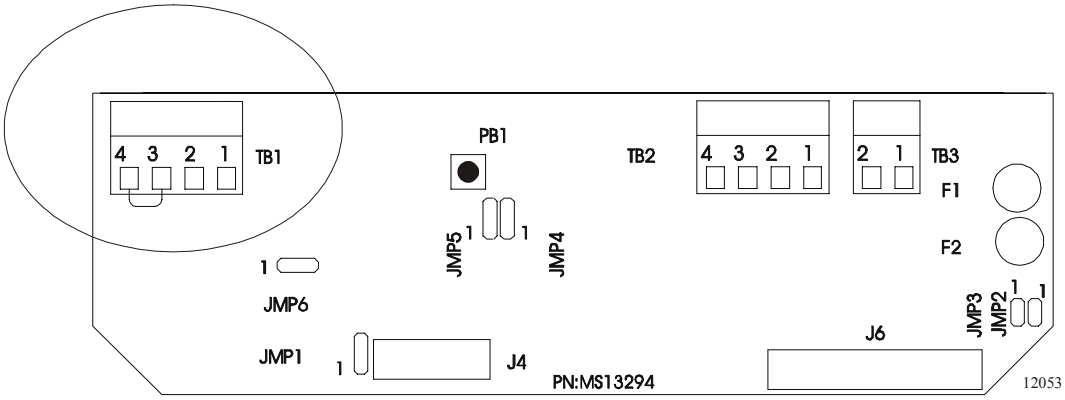


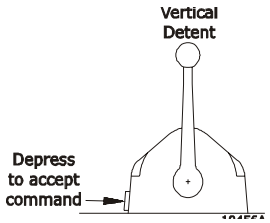
Figure 35: MS13294 Auxiliary Circuit Board Jumper Setting

7.7 CLUTCH TRAVEL (ENGINES STOPPED)

The clutch push-pull cable travel is adjusted by turning Potentiometer R7 while in Set Up Mode. The adjustment is made only to the cable travel from Neutral to Ahead. Travel from Neutral to Astern will reflect the same distance as the chosen Ahead travel.The Processors are set at the Factory with the default setting of **3 inches** (75.4mm).

NOTE: Ensure the Jumper 4 setting on the main circuit board is in the correct position for the Servo direction required for this vessel.

CAUTION: The total cable travel must be within 2 inches (51mm) to 3 inches (76.2mm).



A)Move the clutch selector lever on the transmission from the Ahead position to the Astern position, measuring the length of cable travel required.

B) Transfer command to the Station you will be working from.

C) Leave the Control Head lever in the vertical detent position.

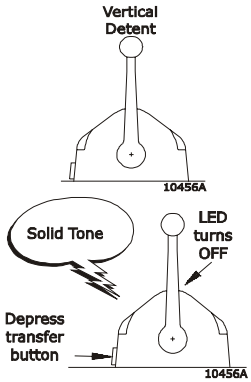
7.7.1 Neutral Position

Adjust the clutch cable ball joint at the transmission to match the clutch selector lever in the Neutral position.

NOTE: The push-pull cable must form a right angle (90 degrees) with the clutch selector lever in the Neutral position.

Leave the clutch cable disconnected.

7.7.2 Ahead Position



A) Move the clutch selector lever on the transmission from the Neutral position to the Ahead position.

B) Leave the Control Head lever in the vertical detent.

C) Ensure Potentiometer R7 is in the fully counter clockwise ↺ position.

D) Enable Set Up Mode.

E) Press the transfer button at the remote station that will be used during clutch set up.
- Verify a tone is heard when depressing the transfer button.
- The Control Head LED will not be lit, but the Control Head will be active for set up procedures.

CAUTION: The Processors are shipped with the Clutch Travel set for maximum cable movement.

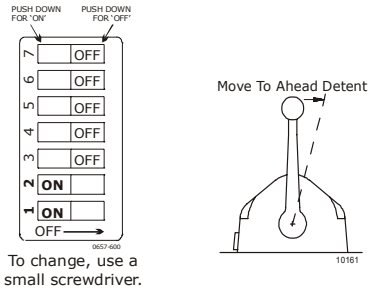


Figure 36: Dip Switch Setting Clutch Cable Travel

F) Place the appropriate dip switches On to allow adjustment to the Clutch Travel. Refer to Figure 36: for the dip switch settings.

G) Place the Control Head lever into the Ahead detent position.
- The push-pull cable will move to the Ahead position. If cable does not move in the correct direction for ahead, ensure Jumper 4 on the main circuit board is on the correct setting.

H) If cable needs adjustment rotate Potentiometer R7 clockwise ↻ to achieve the required clutch cable travel for Ahead. (Refer to the system drawing for location of R7)

NOTE: Only the Ahead cable travel is adjusted. The Astern cable travel will be the same as the Ahead cable travel.

7.7.3 Verify Neutral, Ahead, and Astern

A) Verify all three positions by moving the Control Head lever: Ahead, Neutral, and Astern.
- If cable travel is correct at all three positions, continue with the next step.
- If cable travel is incorrect, review Sections 7.7.1 and 7.7.2, making the necessary adjustments.

B) Connect the clutch cable at the transmission.

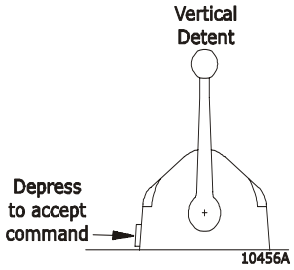
C) Confirm that the Processor does not jam the clutch selector lever against its stops, and that Neutral is correct.
- If the Processor moves the push-pull cable correctly for all positions, continue with the next Section.
- If the Processor jams the clutch selector lever against its stops, disconnect the clutch cable at the transmission and review Sections 7.7.1 and 7.7.2, making the necessary changes.

7.8 TROLL ADJUSTMENTS (ENGINES STOPPED)

7.8.1 Troll Push-Pull Cable Direction

A) Manually move the transmission troll selector lever to the maximum oil pressure position.

CAUTION: Refer to the transmission manufacturer's data for the position of the trolling valve selector lever at maximum oil pressure.



B) Insure troll push-pull cable is disconnected at the trolling valve.

C) Take command at the Primary Station.

D) Insure System is in the Non-Troll Mode.

E) Verify the push-pull cable has extended or retracted to the trolling valve lever's maximum oil pressure position (lock-up).

- If the cable movement direction to reach the trolling valve lever's maximum oil pressure (lock-up) position is correct, continue with the next step.
- If the cable movement direction to reach the trolling valve lever's maximum oil pressure (lock-up) position needs to be reversed, change the push-pull cable direction by correcting Jumper 3 setting on the Processor main circuit board. (Refer to the Appendix C.1 Drawing Notes for jumper location and correct jumper setting.)

F) Adjust the troll cable ball joint to align with the troll selector lever at the maximum oil pressure (lock-up) position.

NOTE: Do not connect the Troll push-pull cable to the trolling valve at this time.

7.8.2 Minimum Troll Pressure Adjustment (Engines Stopped)

NOTE: Ensure the Troll push-pull cable is not connected to the trolling valve at this time.

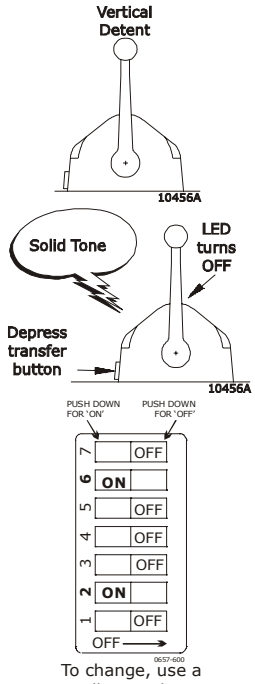


Figure 37: Dip Switch Setting Troll Minimum

A) Move the Control Head lever to the vertical detent.

B) Ensure Potentiometer R7 is in the fully counter clockwise ↺ position.

- Refer to the system drawing for location of R7.

C) Enable Setup Mode.

D) Press the transfer button at the remote station being used during Troll setup.

- Verify a tone is heard when depressing the station transfer button.
- The Control Head LED will not be lit, but the Control Head will be active for set up procedures

E) Place the appropriate dip switches On to adjust Minimum Troll pressure. Refer to Figure 37:

F) Ensure the Troll push-pull cable is not connected to the trolling valve at this time.

G) Place the Control Head lever in the Ahead detent.

H) Manually move the troll selector lever to the minimum oil pressure position.

CAUTION: Refer to the transmission manufacturer's data for the position of the trolling valve selector lever at minimum oil pressure.

I) Rotate Potentiometer R7 clockwise ↻ until the push-pull cable ball joint aligns with the troll selector lever achieving minimum troll pressure.
- Refer to system drawing for R7 location.
- Do not connect the push-pull cable at this time.

J) Store the value that has been set and exit Set Up Mode .

K) Return Potentiometer R7 to the fully counter clockwise ↺ position.

L) Take command at the Station.
- The LED will light; indicating the Station is in command.

M) Test Minimum Troll Pressure as described in Section 7.8.4, page 49.

7.8.3 Maximum Troll Pressure Adjustment (Engines Stopped)

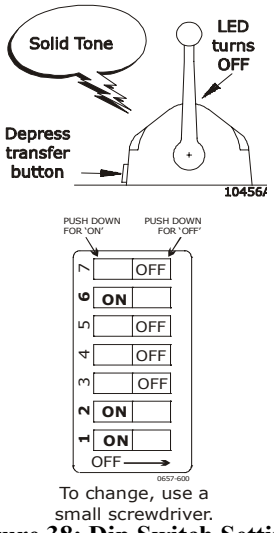


Figure 38: Dip Switch Setting Troll Maximum

A) Move the Control Head lever to the vertical detent.

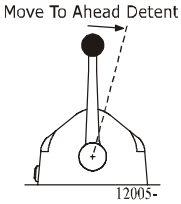
B) Ensure Potentiometer R7 is in the fully counter clockwise ↺ position.
- Refer to the system drawing for location of R7.

C) Enable Setup Mode.

D) Press the transfer button at the remote station being used during Troll setup.
- Verify a tone is heard when depressing the station transfer button.
- The Control Head LED will not be lit, but the Control Head will be active for set up procedures.

E) Place the appropriate dip switches On to adjust Maximum Troll pressure. Refer to Figure 38:

CAUTION: Ensure the Troll push-pull cable is not connected to the trolling valve at this time.



F)Place the Control Head lever in the Ahead detent.

G)Manually move the troll selector lever to the maximum oil pressure position.

CAUTION: Refer to the transmission manufacturer's data for the position of the trolling valve selector lever at maximum oil pressure.

H) Rotate Potentiometer R7 clockwise ↻ until the push-pull cable ball joint aligns with the troll selector lever achieving maximum troll pressure.
- Refer to system drawing for R7 location.
- Do not connect the push-pull cable at this time.

I) Store the value that has been set and exit Set Up Mode.

J) Test Maximum Troll Pressure as described in Section 7.8.4, .

7.8.4 Minimum & Maximum Troll Pressure Test (Engines Stopped)

A) Connect the push-pull cable to the troll selector lever.

B) Take command at a Station.

C) Verify troll push-pull cable movement by toggling between Troll ON and Non-Troll OFF at the Control Head.
   - If troll push-pull cable movement is incorrect, disconnect cable and redo adjustments in Sections 7.8.2 and 7.8.3.
   - If troll push-pull cable movement is correct, ensure System is in Non-Troll Mode and continue with next Section.

8.0 ADJUSTMENT UNDERWAY

WARNING: DO NOT attempt to operate ClearCommand away from the dock with any system abnormality. Verify that all the above tests are completed and are correct.

CAUTION: Start slowly and learn to appreciate that the ClearCommand System provides a light touch that is fast and accurate.

8.1 ENGINE RPM

A) Use Warm-up Mode to warm-up the engine(s).

B) In open water gradually move the Control Head lever to full-speed. Engine(s) should be running at full rated RPM.

C) If adjustment of Maximum Throttle needs to be made, refer to Adjustments and Tests [at Dock] Throttle adjustment Section.

D) Consult the engine operator's manual for additional RPM adjustments.

8.2 TROLL THROTTLE LIMIT

This setting allows for throttle while in the Troll Mode. Using this setting and adjusting R7 will set the percentage of throttle allowed while in the Troll Range during Troll Mode (maximum 20% throttle).

This setting is defaulted OFF. To set throttle perform the following steps:

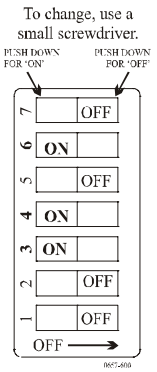


Figure 39: Dip Switch Setting Troll Throttle Limit

A) Place the System in Set Up Mode.

B) Place the appropriate SW1 dip switches ON to adjust Troll Throttle Limit. Refer to Figure 39:

C) Rotate Potentiometer R7 clockwise .

D) Store the value that has been set.

E) Test the Troll Throttle Limit.

- If the percentage of throttle during the Troll Range is incorrect. Perform Steps A) through E) until correct.
- If the percentage of throttle during the Troll Range is correct, continue with the next Section.

9.0 CONTROL OPTIONS

9.1 ALARM CAPABILITY

ClearCommand offers a single alarm connection that OPENS with a system power failure or circuit malfunction.

The Processor's alarm connection point is a single connection block on each Processor Circuit Board. The alarm circuit in the Processor operates an alarm system supplied by others. It is the Shipyard's responsibility to utilize the alarm connection in an appropriate alarm circuit that has the same common mode voltage.

9.2 CLUTCH OIL PRESSURE INTERLOCK

NOTE: A Jumper is installed on the Auxiliary Board, in place of the Pressure Switch connections. If Clutch Oil Pressure Switch is used, remove this Jumper. Refer to Appendix C.1 Drawing Notes for details on Jumper.

The purpose of the Clutch Oil Pressure Interlock is to prevent high engine RPM when the clutch is not fully engaged. The interlock will block a speed signal to the engine until the hydraulic clutch pressure has reached a value recommended by the transmission manufacturer that ensures clutch engagement.

- The pressure switch is Installer supplied.
- The requirement is a N.O. (Normally Open) pressure switch with a trip point adjustable to match the transmission manufacturers recommended setting.
- The hydraulic clutch pressure of either the Ahead or Astern clutch must operate the pressure switch.
- When contacts close, this indicates to the Processor when the clutch is sufficiently engaged to allow a speed command above Idle speed. It is a safety feature that protects the clutch and its use is recommended.

If the clutch pressure should fall below the pressure switch setting, the engine speed will drop to Idle RPM.

The Factory places a jumper between the two clutch oil pressure switch connections on the Processor before shipment. Remove this jumper when connecting the clutch oil pressure switch. Refer to Appendix C Drawing for specific details.

9.3 SYNCHRONIZATION

IMPORTANT: The installation of ClearCommand should be complete and thoroughly tested before testing synchronization. Check Control Head lever and RPM match of the engines through the speed range from IDLE to FULL speed.

CAUTION: When connecting the plugs, ensure that the release buttons are depressed and held until plug is fully connected. To disconnect the plugs, the release buttons MUST be depressed and held until plug is disconnected.

9.3.1 Serial Communication Wire Harness

The Processors need to be interconnected with a Serial Communication Wire Harness as demonstrated on the Drawing in Appendix C.1.

9.3.2 Port and Starboard Tachometer Sensor Wire Harness (Optional)

A tachometer sensor is optional for each engine when using the synchronization option. If Active Synchronization is being used, the Tachometer Sensor feedback is required. The tachometer sensor is Installer supplied. Refer to the information supplied with the switch for installation.

The tachometers sensor are connected to each Processor using the Tachometer Sensor Harness. One harness for Port and one for Starboard. Make cable connections at the tachometer sender as indicated on the system drawing in Appendix C.1.

9.3.3 Control Head Cable Connection

At each Control Head, connect the violet lead to the Starboard terminal 8 connection. DO NOT connect the violet lead to the Port side terminal.

See Appendix A.1 – Control Head Information sheets regarding synchronization connections.

9.3.4 Processor Control Head Cable Connections

Connect the violet lead in the correct Auxiliary Board Terminals of the Starboard Processor only. DO NOT connect the violet lead in the Port Processor.

Refer to the Drawing in Appendix C.1 for Auxiliary Board connection.

9.3.5 Control Head Test (Secured to Dock)

A) Disconnect the clutch and troll push-pull cables at the transmission.

B) Turn On the engines.

C) Move the Control Head levers Ahead to approximately 1500 RPM.
- The green indicator light should start to blink and then go to a steady green when engines synchronize.
- If the green indicator does not perform, verify Control Head and Processor connections.

D) When Test is complete and correct, reconnect the clutch and troll push-pull cables at the transmission.

9.3.6 Synchronization Operation Tests

NOTE: Engines will not synchronize unless shifted to Ahead and above 10% of speed range. The engines should synchronize. If they do not, make the following Operation Checks.

A) Verify all wiring connections at the Processors, Control Heads (reference Drawing in Appendix C.1).

B) Verify that the Port and Starboard Tachometers are correctly connected at the Tachometers, if used.

10.0 MAINTENANCE

10.1 CONTROL PROCESSOR

The Processor requires the following annual checks:

- Check all terminal connections for signs of corrosion or loose connections.
- Check mechanical connections within the Processor.
- Check mechanical connections at the transmission.
- Check mechanical movement of the transmission selector lever. Ensure that the cable does not jam while positioning the selector lever.
- Cycle the Processor and if lead screws are noisy, apply a light coating of silicone grease to the stainless steel lead screw.

10.2 CONTROL HEAD

Verify once a year that Control Head terminals are secure and free of corrosion. Apply a light coating of Teflon grease, or corrosion block, to the contacts.

APPENDIX A.1

PARTS LIST

PART NO.	DESCRIPTION

CONTROL HEADS

SINGLE SCREW

450-3L or 3R	Left or Right Control Head, 'T' Lever
453-3L or 3R	Left or Right Control Head, Chrome Knob Lever
455-3L or 3R	Left or Right Control Head, Black Low Profile Lever
456-3L or 3R	Left or Right Control Head, Chrome Low Profile Lever
456-3LP or 3R P	Left or Right Control Head, Chrome Low Profile Lever, Pluggable
750-L or –R	Left or Right Control Head, Heavy Duty
MC2000-1L or 1R	Left or Right Black Control Head, Black Lever
MC2000-2L or 2R	Left or Right Chrome Control Head, Chrome Lever
MC2000-4L or 4R	Left or Right Black Control Head, Chrome Lever
MC2000-4LP or 4RP	Left or Right Black Control Head, Chrome Lever, Pluggable
MC2000-5L or 5R	Left or Right Black Control Head, Gold Lever

TWIN SCREW (Synchronization Indication)

460-4	Control Head, 'T' Lever
460-4P	Control Head, 'T' Lever, Pluggable
463-4	Control Head, Chrome Knob Lever
463-4P	Control Head, Chrome Knob Lever, Pluggable
464-4	Control Heads, Split, with Single Levers, Chrome Knobs (pair)
465-4	Control Head, Black Low Profile Lever
466-4	Control Head, Chrome Low Profile Lever
760	Control Head, Heavy Duty
760P	Control Head, Heavy Duty, Pluggable
MC2000-1	Black Head, Black Levers
MC2000-1P	Black Head, Black Levers, Pluggable
MC2000-2	Chrome Head, Chrome Levers
MC2000-2P	Chrome Head, Chrome Levers, Pluggable
MC2000-3	Gold Head, Gold Levers
MC2000-4	Black Head, Chrome Levers
MC2000-4P	Black Head, Chrome Levers, Pluggable
MC2000-5	Black Head, Gold Levers

CABLE (Electric)

180	8-Cond. Shielded Cable	Per/ft.
350	8-Cond. Shielded Cable	500’ Spool
11811	8-Cond. Shielded Cable	1000’ Spool
212	2-Cond. Power Cable	Per/ft.
349	2-Cond. Power Cable	250’ Spool
183	2-Cond. Start Interlock Cable	Per/ft.
355	2-Cond. Start Interlock Cable	250’ Spool

WIRE HARNESS (Plug)

Replace the # after the Part Number with the length of harness required. EXAMPLE: 13316-10; 13316-20; 13316-30

13316-#	Serial Communication (Twin Screw)
13408-#	Serial Communication (Multiple Screw)

WIRE HARNESS (Plug) [continued]

13432-#	Throttle, Voltage
13494-#	Throttle, Current
13533-#	Throttle, PWM
14363-#	Throttle, MAN
13322-#	Clutch – Ahead/Astern/Clutch Power
13324-#	Clutch – Ahead/Astern/Neutral/Clutch Power
13240-#	Clutch – Ahead/Astern/Troll/Troll CMD/Clutch Power
14310-#	Clutch – Ahead/Astern/Troll CMD/Clutch Power
13239-#	Magnetic Pickup or Pulse Transmitter
13422-#	ZF Autotroll
14925-#	MAN with Troll
14542-#	MAN without Troll
13631-#	Power/Start Interlock/Clutch Pressure/Alarm Circuit
13552-#	Power/Start Interlock/Clutch Pressure
13756-#	Power/Start Interlock
15073-#	Power
13557-#	Control Head - 1 Connector
14261-#	Control Head - 2 Connectors

TEST UNIT

13927	Service Field Test Unit

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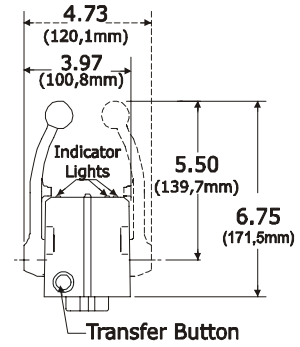
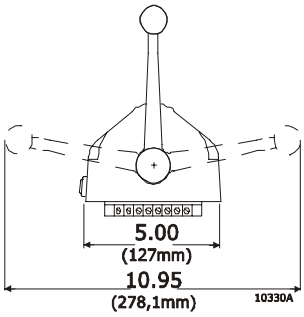
MMC-280 Rev.G 6/01

400 & MC2000 Control Head Variations

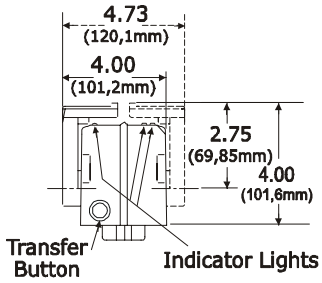
450 - 460 Series

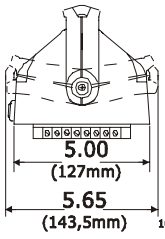
Chrome Lever with Knob



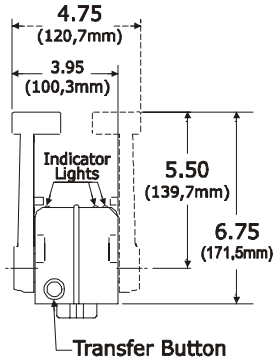


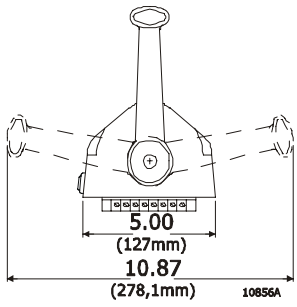
Low Profile Lever



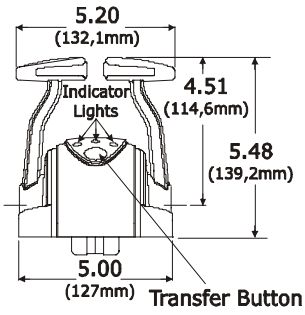


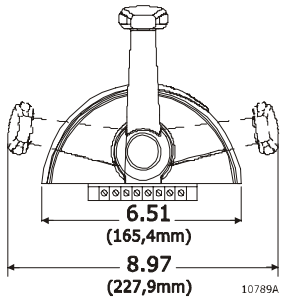
Standard 'T' Handle





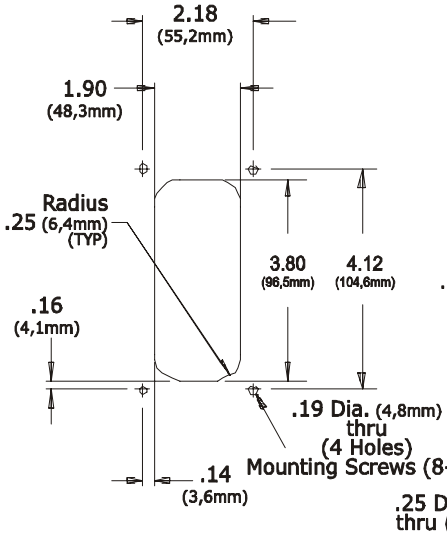
MC2000 Series



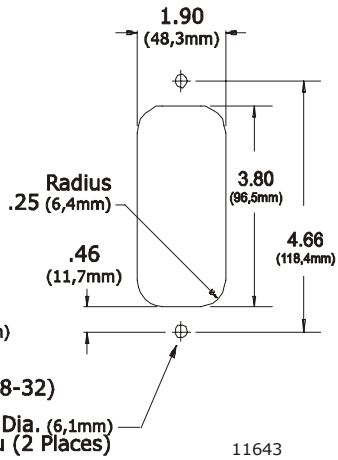


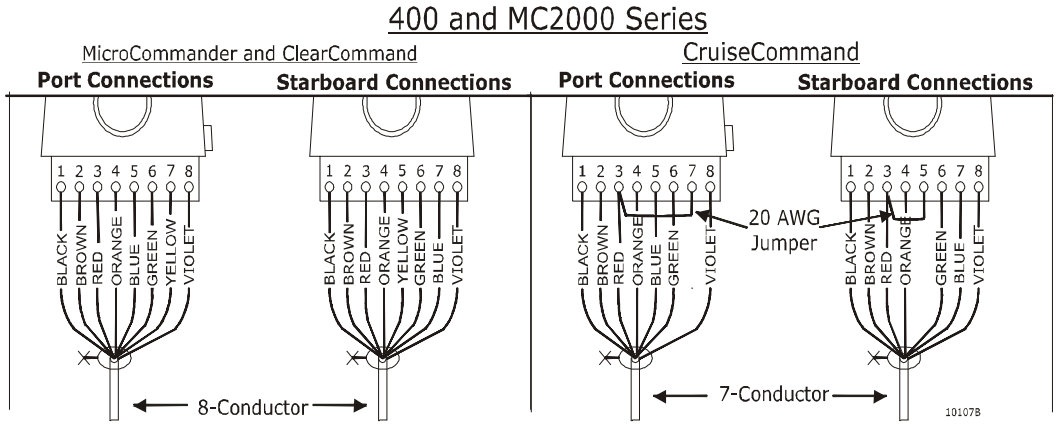
TEMPLATES

450 - 460 Series



MC2000 Series





Standard Cable Connections

Select the desired mounting locations and drill holes per template.

Run cables between Actuator/Processor and Control Head.

At the Control Head, strip back the PVC cover on the shielded cable approximately 2" (50mm).

Strip and cut off the shielding and drain wire flush with the end of the PVC cover (the drain wire at the Control Head is not connected to ground).

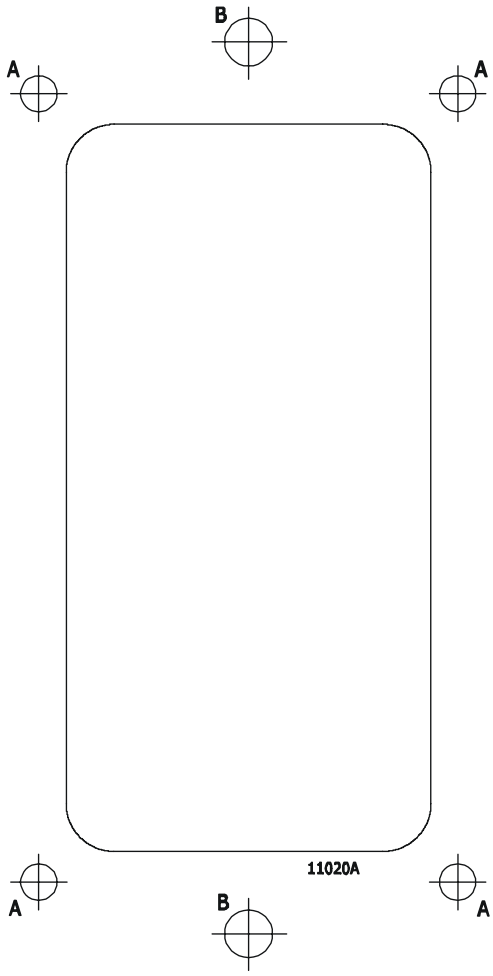
Strip 3/8" (9,5mm) insulation off each wire.

Twist the individual strands of the wires to minimize fraying.

Crimp a locking fork terminal (included with each Control Head) to each of the conductors.

Make connections to the Control Head as shown above for MicroCommander, ClearCommand, and CruiseCommand Systems.

Handheld Control is a Station option. Contact your ZF Mathers Dealer for further information on Handheld requirements and options.



"A" HOLES 450 - 460 SERIES: ø.19

"B" HOLES MC2000 SERIES: ø.25

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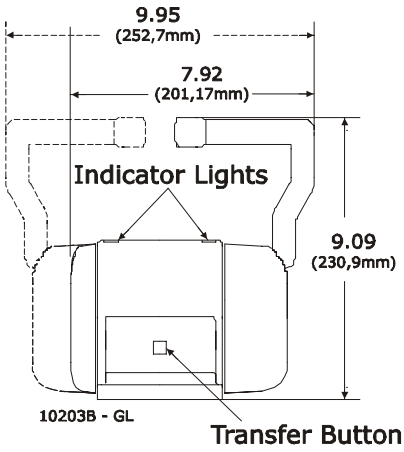
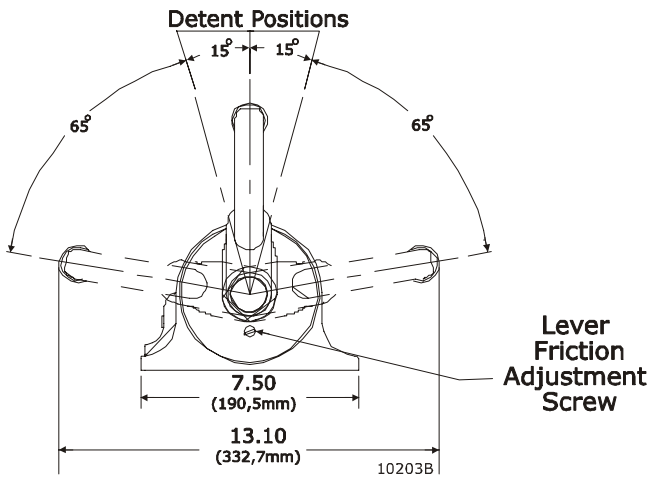
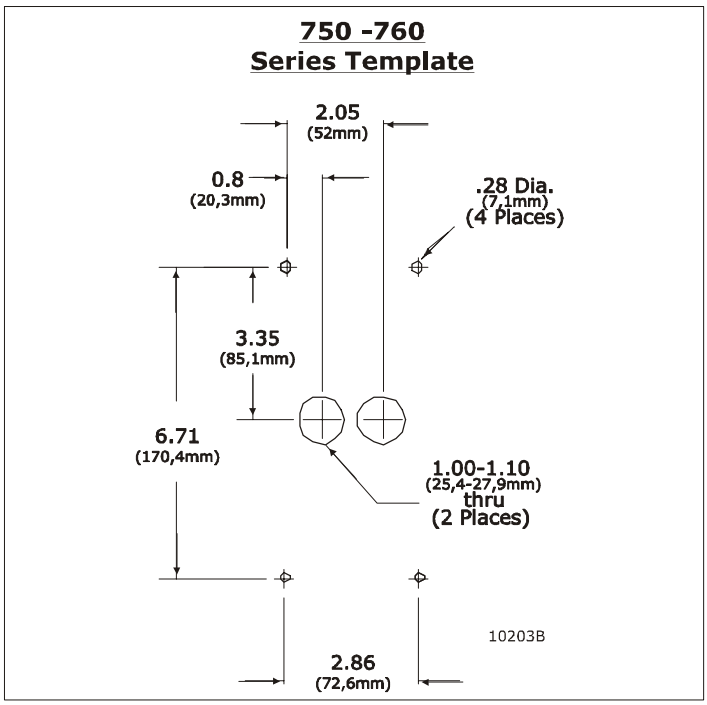
700 Series Control Head Sheet

750 - 760 Series Front View



750 - 760 Series Side View





Standard Cable Connections

A) Remove the bottom cover from the Control Head.

B) Insert electrical cable through watertight cable grip(s) in Control Head bottom cover.

C) Strip back the PVC cover on the shielded cable approximately 2" (50mm).

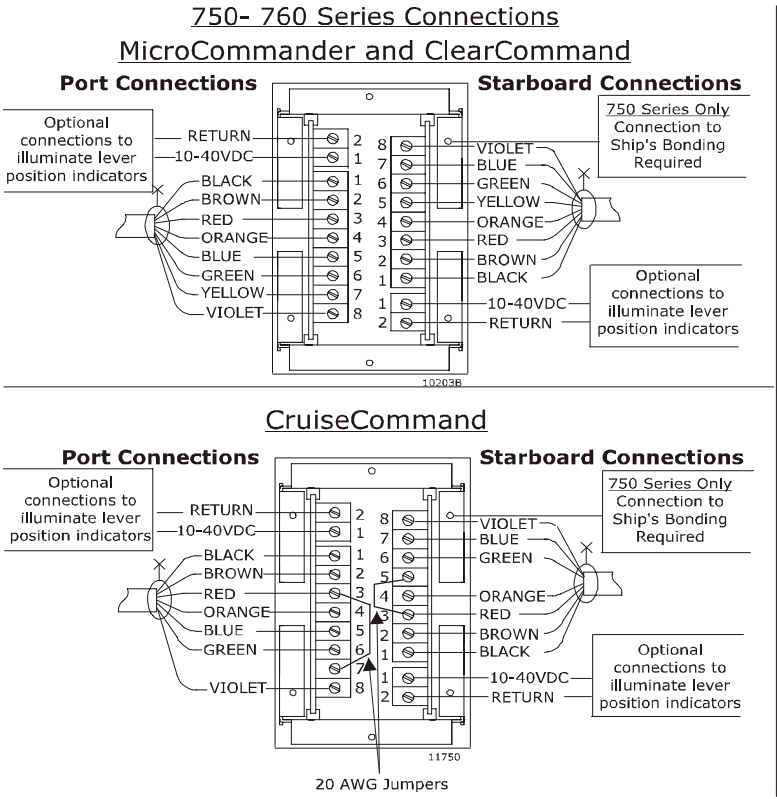
D) Strip and cut off the shielding and drain wire flush with the end of the PVC cover (the drain wire at the Control Head is not connected to ground).

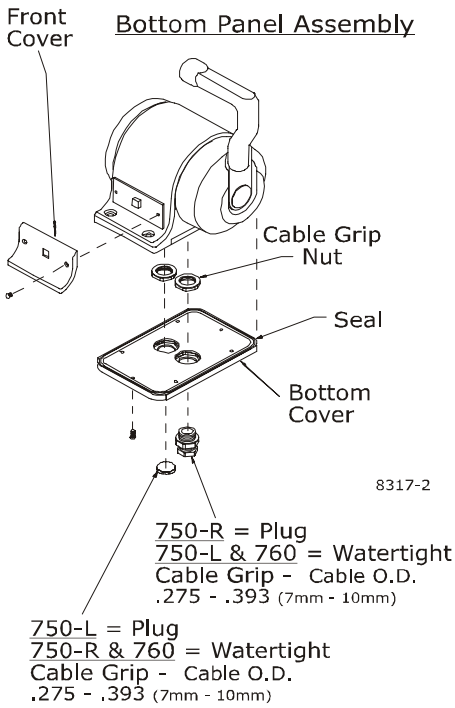
E) Strip 3/8" (9,5mm) insulation off each wire.

F) Twist the individual strands of the wires to minimize fraying.

G) Crimp a locking fork terminal (included with each Control Head) to each of the conductors.

H) Make connections to the Control Head as shown below for MicroCommander, ClearCommand, and CruiseCommand Systems.





I) When connections are complete, replace the bottom cover to the bottom of the Control Head housing.

NOTE: On 750 Series Control Heads use one of the bottom cover screws to connect to the ship's bonding system.

J) Tighten watertight cable grip(s).

Mounting

A) Select mounting location and drill mounting holes as shown in the template on the front page.

B) Remove front cover from the Control Head

C) Mount Control Head with supplied hardware.

D) Replace front cover when mounting is complete.

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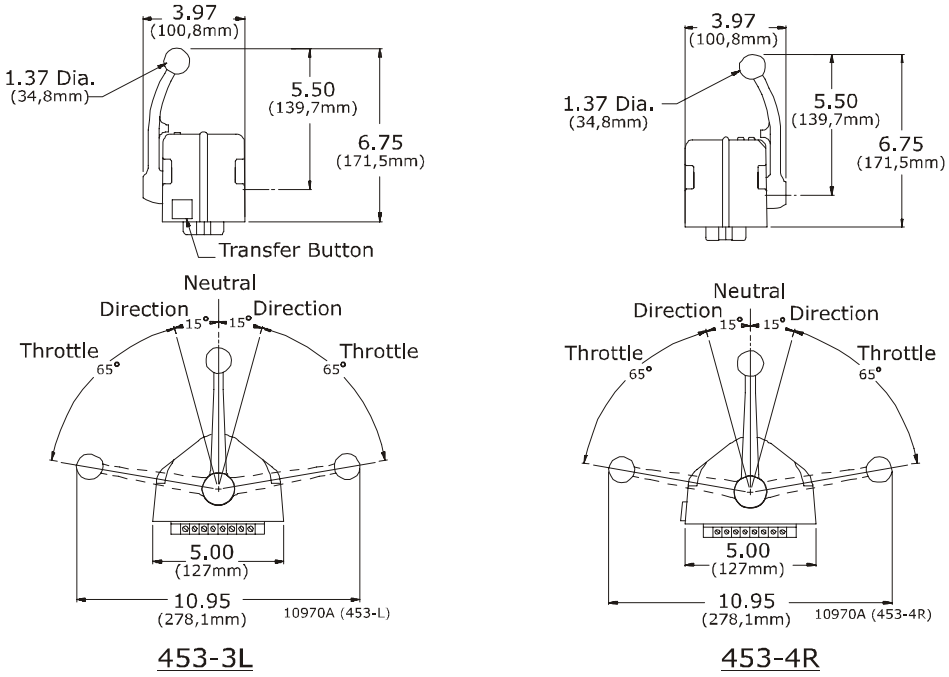
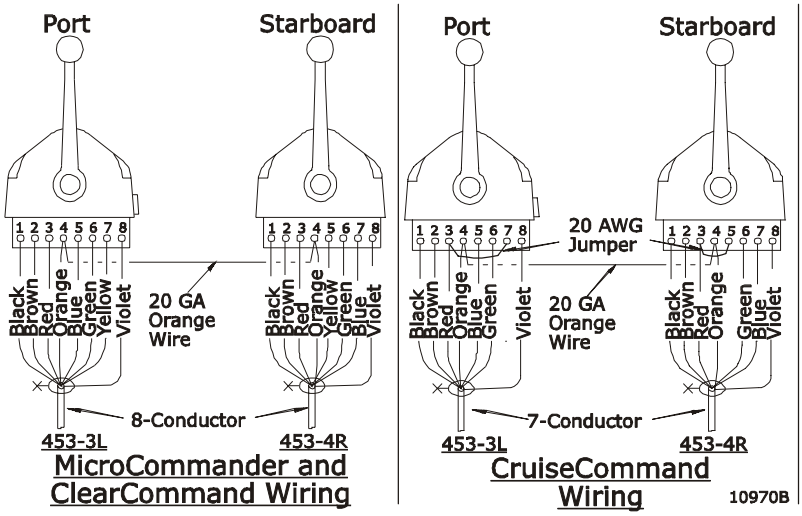
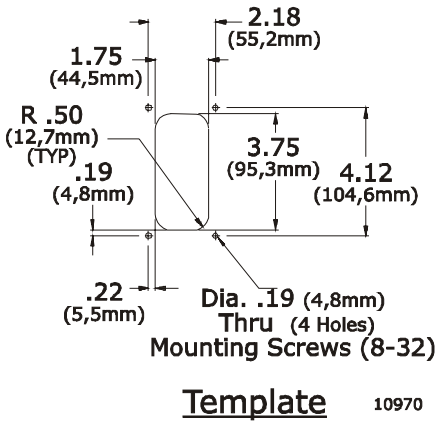
464-4 Control Head Sheet



Standard Cable Connections

Select the desired mounting locations and drill holes per template. Run cables between Actuator/ Processor and Control Head. At the Control Head, strip back the PVC cover on the shielded cable approximately 2" (50mm). Strip and cut off the shielding and drain wire flush with the end of the PVC cover (the drain wire at the Control Head is not connected to ground). Strip 3/8" (9,5mm) insulation off each wire. Twist the individual strands of the wires to minimize fraying. Crimp a locking fork terminal (included with each Control Head) to each of the conductors. Make connections to the Control Heads for MicroCommander, ClearCommand, and CruiseCommand as shown below.





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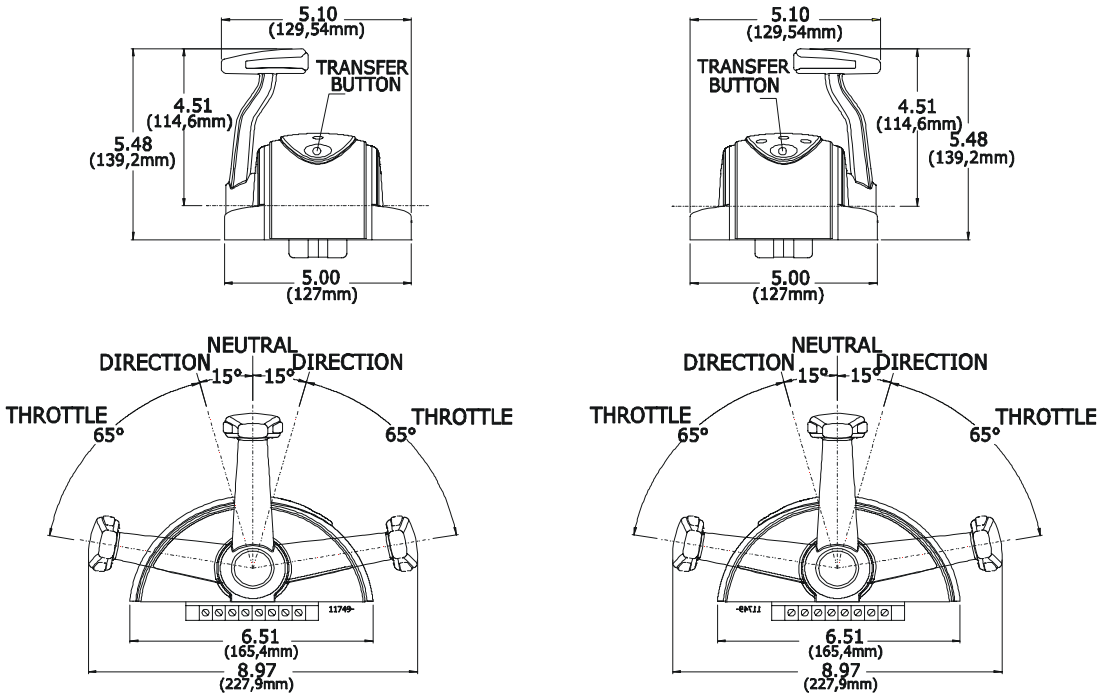
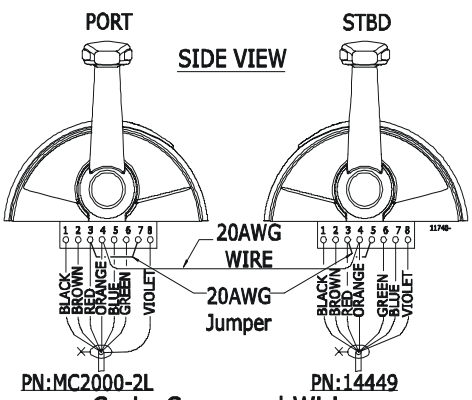
MMC-326 Rev.- 7/01

CH14450 Control Head Sheet

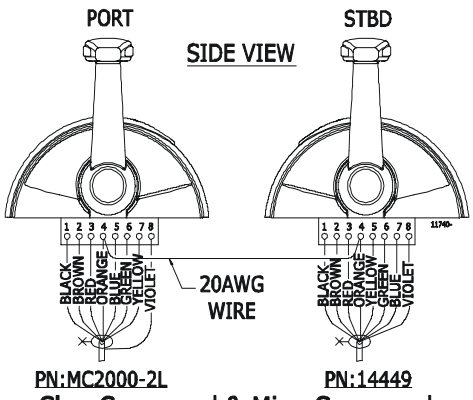


Standard Cable Connections

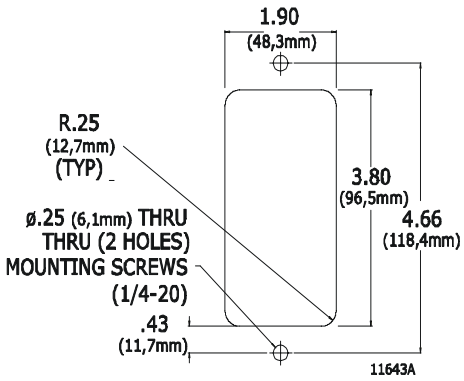
Select the desired mounting locations and drill holes per template. Run cables between Actuator/Processor and Control Head. At the Control Head, strip back the PVC cover on the shielded cable approximately 2" (50mm). Strip and cut off the shielding and drain wire flush with the end of the PVC cover (the drain wire at the Control Head is not connected to ground). Strip 3/8" (9,5mm) insulation off each wire. Twist the individual strands of the wires to minimize fraying. Crimp a locking fork terminal (included with each Control Head) to each of the conductors. Make connections to the Control Heads for MicroCommander, ClearCommand, and CruiseCommand as shown below.



CruiseCommand Wiring Connections



ClearCommand & MicroCommander Wiring Connections



PANEL CUT DIMENSIONS

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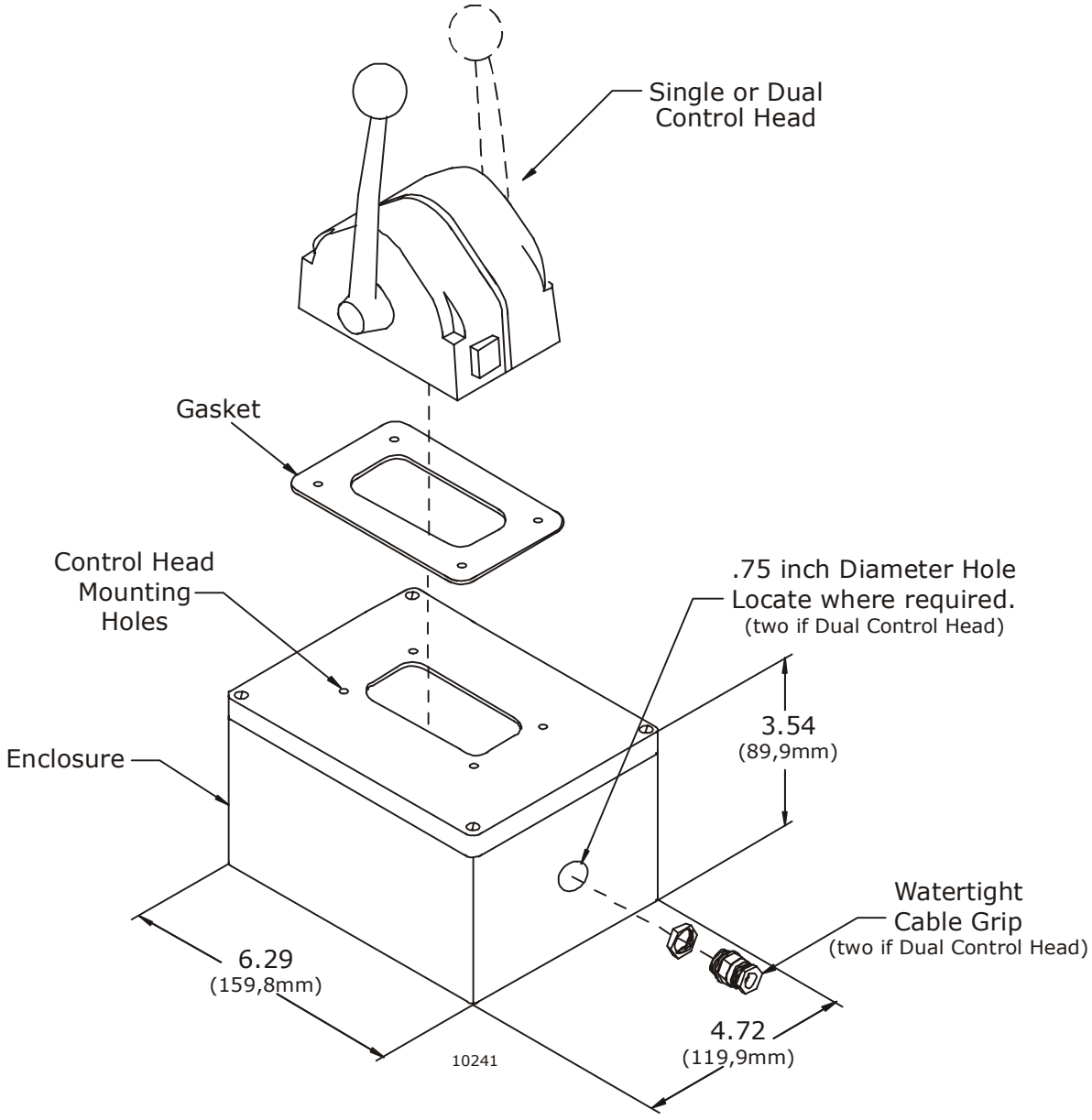
MMC-279 Rev.B 7/02

400 Series Weather Mount Enclosure



Deck Mount or Exposed Mount

Ideal for outside Weather Mount

To prevent internal condensation and moisture build up the mount is drilled to allow air circulation.

Part No. 12110

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ZF Mathers, LLC
1415 Pacific Drive
Burlington WA 98233-3103 U.S.A.
800-546-5455 / 360-757-6265
Fax: 360-757-2500

S-214 Rev.C 7/02

Automatic Power Selector (APS) Model: 13505

A) GENERAL INFORMATION

The APS (Automatic Power Selector), Model 13505, provides a simple, solid state solution to the need for routing redundant DC power sources for vital electronic equipment while maintaining isolation of the DC power sources.

Two independent batteries rated at the same nominal voltage are wired to separate terminals on the APS and internal diodes maintain total isolation between them. A single output terminal is wired to the ZF Mathers Propulsion Control System.

The APS is rated for loads of up to 70 Amps on 12-24V systems. The unit is ruggedly constructed with heavy-duty wiring studs and epoxy-potted components in an anodized aluminum case.

B) APS SPECIFICATIONS

Model: 13505

Maximum Load Current: 70 amps

Operating Temperature: -40 degrees C to +80 degrees C; derate linearly from 100% @ 50 degrees C to 70% @ 80 degrees C

Voltage Drop: 0.7 VDC @ 50% load; 0.9 VDC @ full load

Dimensions: 3.25" x 4.5" x 3.1" (8,3 x 11,4 x 7,9 cm)

C) MATERIALS PROVIDED

The APS is supplied with a hardware packet containing (8) hex nuts, (4) lock washers, (6) self-tapping mounting screws, (1) instructions diagram.

NOTE: Not all of the hardware will be used in the installation; some spares are provided. Nut size is M-6.

D) INSTALLATION

Refer to the installation diagram Figure 1:.

1. Shut off all charging sources and disconnect the negative (ground) side of each battery which will be wired to the APS.
2. Mount the APS in a suitable location which will keep wire runs to a minimum length, and is (preferably) ventilated, for cooler operation. The case of the APS is electrically isolated from the internal diodes, so mounting on either a metal or non-metal surface is acceptable. Complete the wiring as shown on Page 2.
3. Reconnect the negative battery posts.

E) IMPORTANT NOTE ABOUT BATTERY SOURCES

Whenever the load is turned on, it can be drawing power from the batteries. Therefore, if the batteries are not simultaneously being recharged, or if charging will not be available for an extended period, it is recommended that the load be shut off to prevent complete discharge of batteries.

F) INSTALLATION DIAGRAM

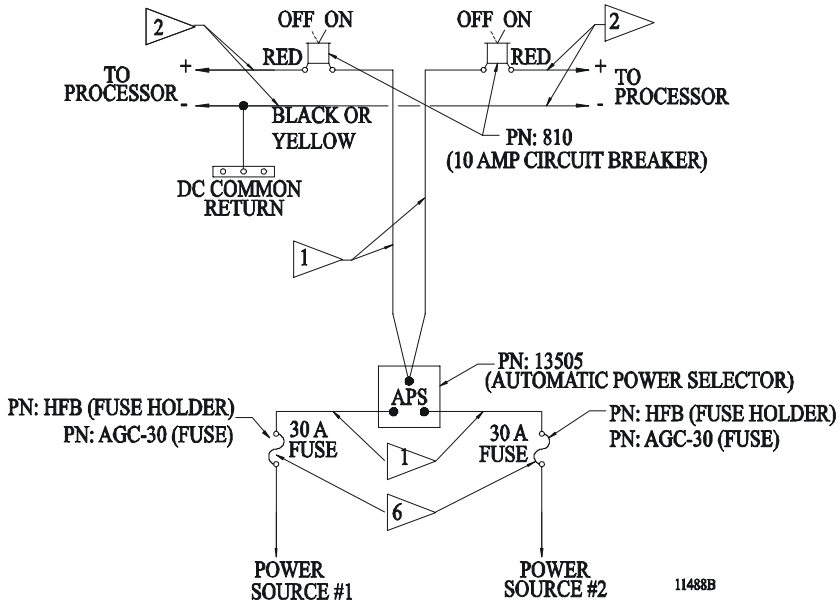

Figure 1:

Flag 1: Wire Size (Ref ABYC E9.15.9 10%)
0-15' 12 AWG (#3 Metric Equivalent)
15'-30' 10 AWG (#5 Metric Equivalent)
30'-60' 8 AWG (#8 Metric Equivalent)

Flag 2: Wire Size (Recommended Twisted Pair)
0-20' 14 AWG (#2 Metric Equivalent)
20'-40' 12 AWG (#3 Metric Equivalent)

Flag 6: Maximum wire size allowed in fuseholder is 12 AWG. If a larger wire size is required for installation, the customer shall provide an appropriate fuse and fuse holder.

Flag 7: If this configuration is used with an electronic engine, the circuit breaker must be turned on prior to applying power to the remote switch.

Note:
1. APS output is strictly for ZF Mathers Controls
2. Power Sources may be 12 or 24 volts DC

A.P.S. (Auto Power Selector) Kits

Twin Screw	Single Screw	Include the following:
13984	13983	

Quantity		Description	Part Number
1	1	A.P.S. Unit	13505
2	1	10 amp Switch Circuit Breaker	810
2	2	Fuse Holder In-Line	HFB
2	2	30 Amp Fuse	AGC-30

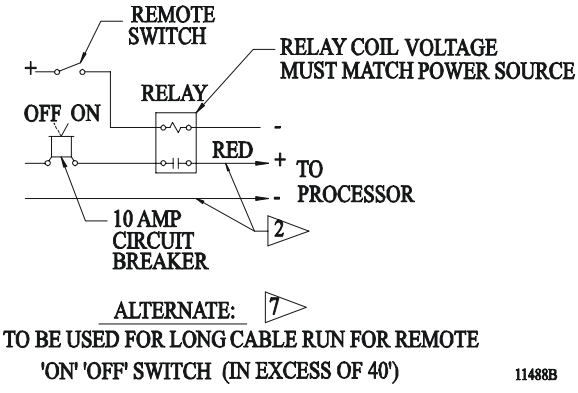

Figure 2:

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Burlington WA 98233-3103 U.S.A.
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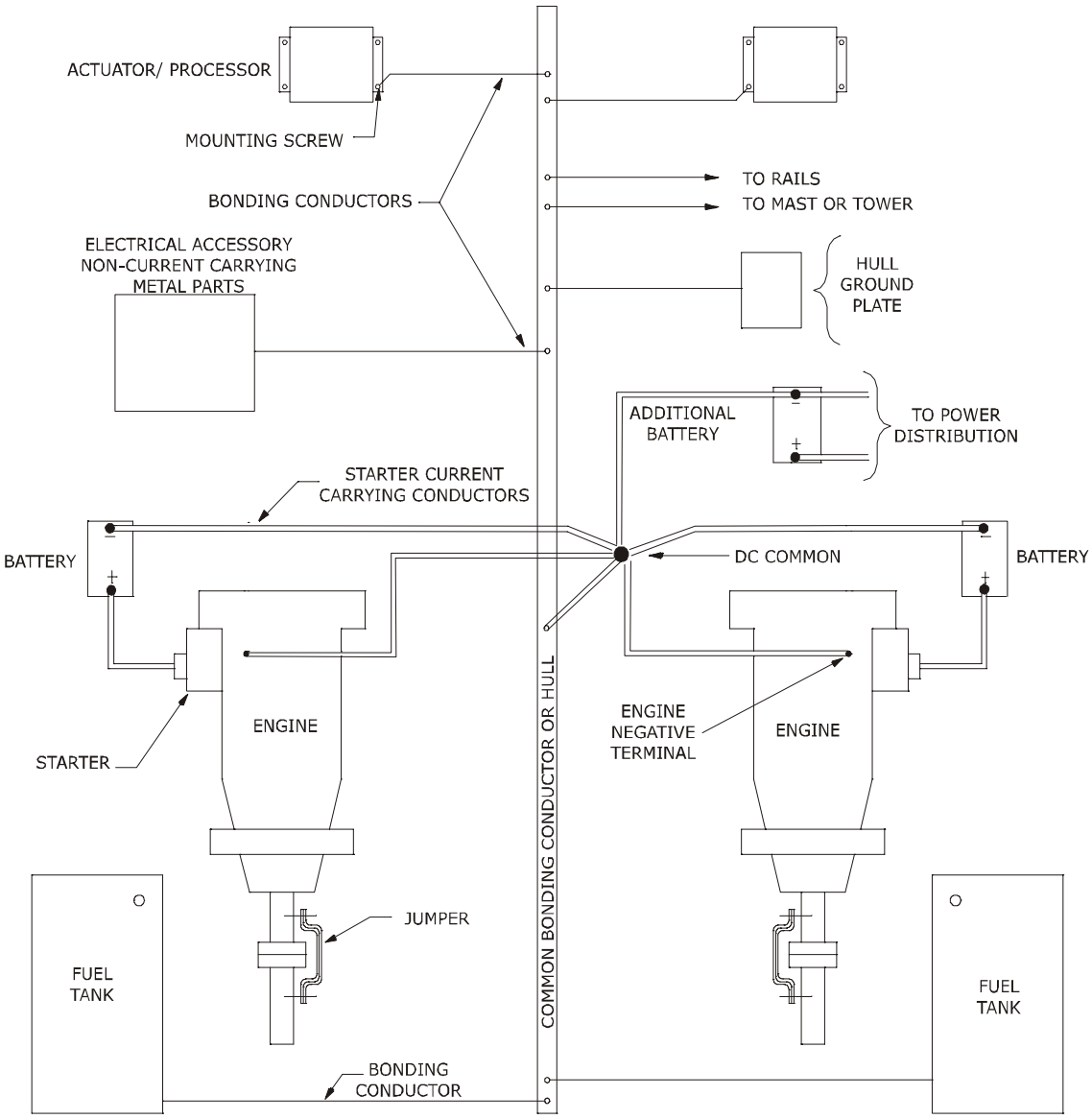
Bonding - A.B.Y.C. E-9 46 CFR 111.05

All boats equipped with a permanently installed electrical system shall also be equipped with a bonding system. The negative terminal of all batteries should be connected at only one point, the DC common, and from DC common to bond system or hull.

Metal - Hull Vessels

The hull of a metal - hull vessel may serve as the common bonding conductor. Any item to be bonded not in contact with the hull requires a bonding conductor to the hull.



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Burlington WA 98233-3103 U.S.A.
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MM13821 Rev.- 7/00

43C Cable Conversion Kit

585CE Actuator (Serial Number B06500 and up)
813CE Actuator (Serial Number C01150 and up)
ClearCommand Processors (Serial Number D02100 and up)

Revisions List

Rev	Date	Revision Description

This procedure is to be used in conjunction with the technical manual supplied with the System's Actuator / Processor.

1.0 Parts Required:

One 43C Conversion Kit (P/N 13821) for each cable. Kit includes the following:

- 43C cable nut (P/N MS12820)
- 43C cable retainer (P/N 13694)
- Cable retainer screws (P/N 00791)

2.0 Tools Required:

- Snap Ring Tool or Small Slotted Screwdriver
- Phillips Screwdriver
- 7/16 Nut Driver or Socket
- 7/16 Open End Wrench

3.0 Actuator/Processor Preparation [Refer to Figure 1]

A) Remove cover to Actuator/Processor.

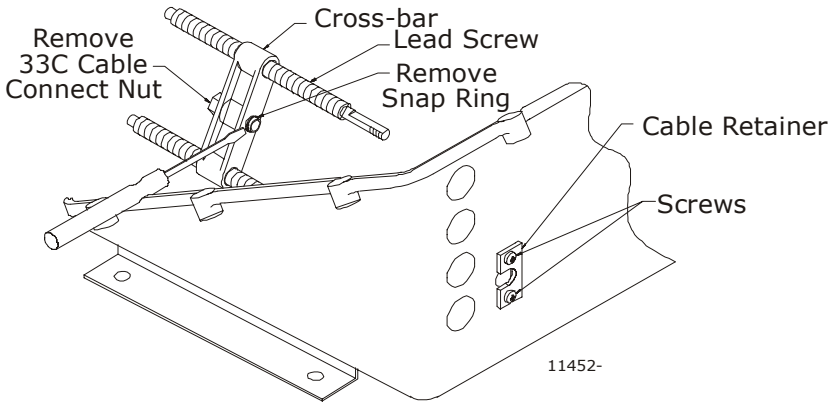

Figure 1: Actuator/Processor Preparation

CAUTION: Static electricity can destroy electronic components. Anytime the Actuator/Processor cover is off, use an anti-static wrist strap and connect it to the Actuator/Processor frame. This will drain any static charge you may have on your person.

B) Remove screws holding Cable Retainer in place.

C) Remove and discard Cable Retainer.

D) Remove the Snap Ring holding the Cable Connect Nut in the cross-bar using a snap ring tool or small screwdriver.

E) Remove and discard Cable Connect Nut and Snap Ring.

4.0 Cable Installation [Refer To Figure 2]

NOTE:	**43C cable and jam nut are supplied by others.**

A) Remove and retain the jam nut from the end of the 43C cable to be installed in the Actuator/Processor.

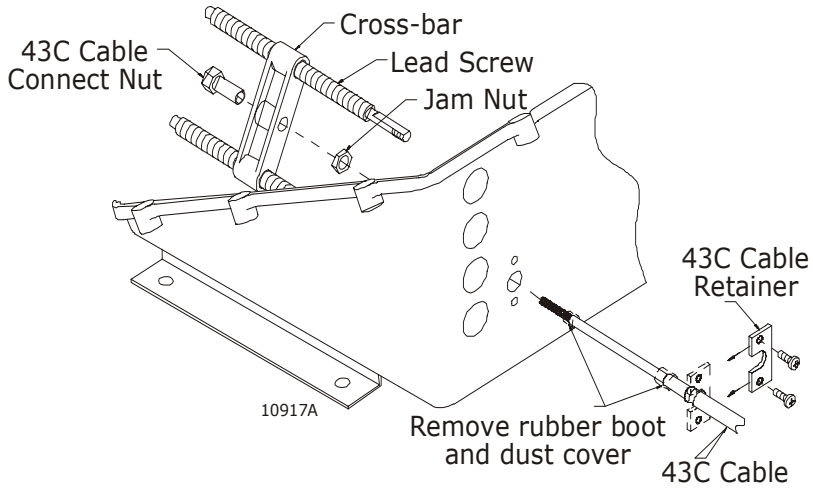

Figure 2: Actuator/Processor Cable Installation

B) Remove and discard the rubber boot and the rubber dust cover from the end of the 43C cable to be installed in the Actuator / Processor.

C) Insert the end of the cable through the hole in the Actuator / Processor.

D) Thread the jam nut onto the end of the cable inside the Actuator / Processor.

E) On the outside of the Actuator/Processor, press the 43C Cable Retainer over the notch in the 43C cable. This is intended to be a snug fit and may require some force.

F) Install two screws through the 43C Cable Retainer and into the Actuator/Processor.

G) Tighten the two screws securely with a Phillips Screwdriver.

H) Insert the 43C Cable Connect Nut through the cross-bar.

I) Thread the 43C Cable Connect Nut onto the end of the 43C cable.

J) After the cable connect nut is threaded onto the cable, tighten the jam nut against the cross-bar using a 7/16 nut driver or socket and 7/16 open end wrench.

K) Replace cover to Actuator/Processor. Refer to technical manual supplied with the Actuator/Processor for any other required set up or adjustment.

ZF Mathers, LLC
1415 Pacific Drive
Burlington WA 98233-3103 U.S.A.
800-546-5455 / 360-757-6265
Fax: 360-757-2500

References and Parts Source

A) **REFERENCES**

1. American Boat & Yacht Council (ABYC)
   3069 Solomons Island Road
   Edgewater, MD 21037-1416
   E-3 Wiring Identification on Boats
   E-9 DC Electrical Systems on Boats
   H-2.4e or 32.4g Ambient Temp. 50 degrees C
   P-24 Electric/Electronic Propulsion Controls
2. Code of Federal Regulations
   33 CFR 183 Subpart I - Electrical Systems
   33 CFR 183.410 Ignition protection
   33 CFR 183.415 Grounding
   33 CFR 183.425 Conductors: General
   33 CFR 183.430 Conductors in circuit of less than 50 Volts
   33 CFR 183.445 Conductors: Protection
   33 CFR 183.455 Over-current and Protection: General
   46 CFR 111.01 - 15(b) Ambient Temp. Machinery Spaces 50 degrees C
   46 CFR 111.05- System Grounds
3. Society of Automotive Engineers
   400 Commonwealth Drive
   Warrendale, PA 15096
   J1171 External Ignition Protection
   J1428 Marine Circuit Breakers
   J378 Marine Engine Wiring
4. National Marine Manufacturers Association
   401 North Michigan Avenue
   Chicago, IL 60611
5. Underwriters Laboratories

B)PARTS SOURCE

Anti-Static Wrist Strap	P/N 517 [Thomas & Betts (P/N AWCC)]
Automatic Power Selector	P/N 13505
Circuit Breaker- UL Approved	P/N 810 [E-T-A (P/N 41-2-514-LN2-10)]
Fuse	P/N 1030 [Bussman (P/N. GDC-1A)]
Relay 12 VDC	P/N 1114 [Potter-Brumfield (P/N KRPA5D6-12)]
Relay 24 VDC	P/N 1122 [Potter-Brumfield (P/N KRPA5D6-24)]
Service Field Test Unit (Break-out Box)	P/N 13927
WAGO Tool	P/N 397 [WAGO (P/N 236-332)]

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1415 Pacific Drive
Burlington WA 98233-3103 U.S.A.
800-546-5455 / 360-757-6265
Fax: 360-757-2500

MMC-165 Rev.D 3/02

Electronic Propulsion Control Systems Three Year Limited Warranty

Your ZF Mathers product has been designed and manufactured by experienced engineers and craftsmen. ZF Mathers LLC., warrants for the period indicated below, each product to be free from defect in material and workmanship. Repair or replacement, at ZF Mathers option, will be provided if the product, upon ZF Mathers inspection, is found to be properly installed and operated in accordance with ZF Mathers Manual. This warranty does not apply to malfunction caused by damage, unreasonable use, misuse, repair or service by unauthorized persons or normal wear and tear.

A)Coverage Under Warranty

Three years from the date of purchase by the original end user.

Year One

No charge for equipment repair, parts and labor. Up to three hours labor toward troubleshooting and replacement of defective equipment.

Year Two and Three

There is no charge for equipment repairs performed at the factory that are covered under warranty. No labor allowance for troubleshooting and replacement of defective equipment.

B)No Coverage Under Warranty

The following will not be covered under warranty.

1. Travel to and from the job site.
2. Adjustment or calibration of any ZF Mathers equipment.
3. Adjustment or calibration of any associated equipment which may include but not limited to push-pull cables, engine governor or carburetor, transmission or trolling valve.
4. Damage due to accidents, improper installation or handling and or improper storage.
5. Damage due to faulty repairs performed by an unauthorized service representative.
6. Damage due to conditions, modifications or installation contrary to published specifications or recommendations.
7. Original installation charges or start-up costs.
8. Battery service including labor charges related to battery service.
9. Rental of equipment during performance of warranty repairs.
10. Unauthorized repair shop labor, without prior approval from ZF Mathers Service Department.
11. Shop supplies such as connectors, wire, cable, etc.

C)Warranty Service

Call 1-800-546-5455 or 1-360-757-6265 for your nearest ZF Mathers Factory Authorized Dealer.

1. Prior to returning any product to the factory, you must contact ZF Mathers Service Department for a Material Return Authorization (MRA) number. Return the product freight prepaid, marked clearly with the MRA number and a description of the malfunction.

2. If there is a defect covered by warranty, ZF Mathers will, at its option, either repair or replace the defective part or product. If after inspection, ZF Mathers determines that the product is not defective, ZF Mathers will charge a testing fee and return the product to the sender, freight collect.
3. Repair or replacement during the warranty period will not extend the warranty period.
4. All claims must be submitted within 30 days from date of service.
5. Claims for over 3 hours must be pre-approved by the ZF Mathers Service Department.

This Warranty is expressly in lieu of all other Warranties, express or implied. Except to the extent prohibited by applicable law, ZF Mathers hereby disclaims all other implied or express warranties of any kind, including warranties of merchantability and fitness for a particular purpose. Under no circumstances shall ZF Mathers be liable for any consequential damages sustained in connection with the product or its use, including any costs or damages which result from loss of use of the product or any engine or boat with which it is used. ZF Mathers does not authorize any representative or agent to assume for it any obligation or liability other than those expressly set forth above. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. All implied warranties, if any, are limited to the duration of this express warranty. This warranty gives you legal rights, and you may have other rights which may vary from State to State.

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Fax: 360-757-2500

F-226 Rev.A 11/00

Sea Trial Report

Vessel Name:_____ Trial Date:_____ SSN:_____

Owners Name:_____

Address:_____

Tel/Fax/e-mail:_____

Contact Name:_____

APPLICATION:

A:**Boat Builder**_____ Model_____ Size_____ Year_____

Original Equipment ___ Retrofit ___ Type of Controls Replaced_____

B:**Single or Twin Screw**_____

Engine Make_____ Model_____

Horsepower _____ RPM_____ Engine Hours_____

Reduction Gear/Drive_____ Model/Ratio_____ Trolling? Yes___ No___

Type of Service (Pleasure, Fishing, Rental, Etc.)_____

C:**Number of Remote Stations**_____

Actuator/Control Processor: Port Model_____ Starboard Model_____

Port SN:_____ Starboard SN:_____

Before Running Engine:	**Port**	**Stbd**
1. Voltage at the Battery Terminals._____VDC	_____VDC	
2. Voltage at the Actuator/Control Processor._____VDC	_____VDC	
3. Warm-up Indicator Light blinks in 'Ahead'. All Stations.Yes ___ No___	Yes___ No___	
4. Electric Cables are supported every 18 inches (45,72cm)Yes ___ No___	Yes___ No___	
5. Cable connections are tight at the Actuator/Control Processor and Control Heads.	Yes ___ No___	Yes___ No___
6. Engine Stop Switches at EACH Remote Station are operational.	Yes ___ No___	Yes___ No___
7. Check push-pull cable match. Disconnect push-pull cables at the clutch and throttle. Check that cables travel in the correct direction. Check the cable movement, insure that it matches clutch and throttle.Yes ___ No___Yes___ No___		

Dock Side Tests (Running):		
1. Voltage at the Battery Terminals._____VDC	_____VDC	
2. Does Engine 'Start' when Controls are OFF?Yes ___ No___	Yes___ No___	
3. Low Idle RPM. _____RPM	_____RPM	
4. High Idle RPM (optional). _____RPM	_____RPM	
5. Check Warm-Up Mode. Yes ___ No___	Yes___ No___	
6. Check shift in both directions.Yes ___ No___	Yes___ No___	

Sea Trials:

		Port	Stbd
1.	Check that Twin Screw Control Head levers match position and RPM through speed range.	Yes ___ No___	Yes___ No___
2.	Set maximum engine RPM as required._____RPM	_____RPM	
3.	Adjust Full Speed Reversal Delay_____SEC	_____SEC	
4.	Is Synchronization operational?Yes ___ No___	Yes___ No___	
5.	Is Trolling Valve operational? Yes ___ No___	Yes___ No___	

SW1 Switch Settings:

PORT								**STBD**							
1	2	3	4	5	6	7			1	2	3	4	5	6	7
ON								ON							
OFF								OFF							

PORT JMPR 3  ___ ___

PUSH ← → PULL

JMPR 4  ___ ___

PUSH ← → PULL

STBD JMPR 3  ___ ___

PUSH ← → PULL

JMPR 4  ___ ___

PUSH ← → PULL

Comments (Please use additional paper as necessary):

General Installation Condition:

Any Irregularities:

ARE THE MANUALS ON BOARD? Yes___ No___

IS THE OPERATOR CARD ON BOARD? Yes___ No___

INSPECTOR_____ DATE_____

MAIL COMPLETED COPY TO:

ZF Mathers, LLC

1415 Pacific Drive

Burlington, WA 98233

OR FAX TO: 360-757-2500

APPENDIX B.1

1.0 TROUBLESHOOTING

The ClearCommand Control System consists of Control Heads located at the vessel's Stations, connected to Control Processor(s) located in the engine room area.

Before beginning troubleshooting, review the Appendix C Drawings. Become familiar with the component configuration on your vessel.

Carefully inspect the following:

- DC Power Source
- Component Location
- Component Condition
- Interconnecting Wiring
- Wire Termination's

A key in troubleshooting the ClearCommand System is identifying the problem as:

- DC Power Source
- Interconnection wiring or termination
- Component Calibration
- Component Failure

The ClearCommand System has Station-in-Command indicator lights on each Control Head, as well as audible tone indicators. These indicators will assist in troubleshooting and control system status.

When contacting an authorized ZF Mathers servicing dealer, or the ZF Mathers Service Department, please be ready with the Control Processor Part Number and Serial Number.

CAUTION: Static electricity can destroy electronic components. Any time the Control Processor cover is off, wear the wrist strap provided and connect it to the Processor frame. This will drain any static charge you may have on your person.

NOTE: Always check the other Stations, to see if the symptom can be repeated.

1.1 SYMPTOM - WHEN DC POWER IS TURNED ON, OPERATOR CANNOT TAKE COMMAND AT ONE STATION (BOTH PORT AND STARBOARD FOR TWIN SCREW).

Cause:

A) A corroded or loose electrical connection.

B) Incorrectly wired eight-conductor cable.

C) Defective Control Head.

Remedy:

A) At the Control Head verify crimps and screws are tight. Verify the station connections at the Processor. Tighten or re-crimp as necessary.

B) Rewire the cable connections as shown on Appendix B Drawing and Paragraph 5.3.3 of the main manual. Correct as necessary.

C) Verify the voltage between the red and orange wires (Terminals 3 and 4). The reading should be 4.80 to 5.00 volts DC. Verify the voltage at Terminals 3 and 4 while depressing the transfer button. The voltage reading should be less than 0.50 volts DC. If the voltage remains near 5.00 volts, the Control Head needs to be replaced.

1.2 SYMPTOM - ONE SIDE WILL NOT TAKE COMMAND WHEN DC POWER IS FIRST TURNED ON.

Cause:

A) Port and Starboard power sources do not have a common ground (only the Starboard would be unable to take command).

B) Miswired eight-conductor cable.

C) Defective Control Head potentiometer.

Remedy:

A) Verify that the negative terminal connections of both batteries are to a common point. If not, connect both to a common point.

B) Rewire cable connections as shown on the Appendix C.1 Drawing, Appendix A.1 Control Head Variations sheets, and the Control Head Installation Section of the main manual.

C) Verify the voltage between the yellow and the blue wires (Terminals 5 and 7) at the suspected Control. Head. The reading should be 4.80 to 5.00 VDC. Measure the voltage between the blue and green wires for left hand Control Heads and the yellow and green wires for right hand Control Heads. The measurement should be between 49 percent and 51 percent of that measured at Terminals 5 and 7 with the Control Head lever at the Neutral Idle position. If not, replace the Control Head.

1.3 SYMPTOM - THE ENGINE RPM VARIES, WITHOUT MOVING THE CONTROL HEAD LEVER.

Cause:

A) Problem with the governor.

B) Erratic command signal.

Remedy:

A) Signal to the governor should be steady. If not, go on to B).

B) At the Processor, measure the DC voltage at the yellow and green wires (Terminals 5 and 6) of the Station-in-Command. The reading should be a stable voltage (no variations). If not, check for a loose connection between the Processor and the Control Head. If the connections are tight and no corrosion is present, replace the Control Head.

1.4 SYMPTOM - THE ENGINE RPM REDUCES TO IDLE, THE CONTROL HEAD INDICATOR LIGHT TURNS OFF, AND A SLOW REPETITIVE TONE EMITTED AT ALL STATIONS AFTER REPOSITIONING THE CONTROL HEAD LEVER.

Cause:

A drop in battery voltage (12 volt systems only) at the Processor.

Remedy:

Measure the voltage at the battery without the engine or charger running. The reading should be a minimum of 12.4 volts. If not, the battery needs charging or possibly replacing. Measure the voltage at the Processor. This reading should be not more than 0.20 volt below the measured battery voltage.

1.5 SYMPTOM - THE INDICATOR LIGHT BLINKS WHEN THE STATION'S TRANSFER BUTTON IS PRESSED, AND CONTINUES TO BLINK AFTER RELEASED (CONTROL HEAD LEVER IS IN THE NEUTRAL IDLE POSITION). CANNOT TRANSFER TO THIS STATION IF ANOTHER STATION WAS PREVIOUSLY IN COMMAND.

Cause:

Off center Control Head potentiometer.

Remedy:

Replace the Control Head.

1.6 SYMPTOM - NO AUDIBLE TONE AT A CONTROL HEAD WHEN SYSTEM IS FIRST TURNED ON, BUT OTHERWISE WORKS PERFECTLY.

Cause:

A) Incorrectly wired eight-conductor cable.

B) Defective sound transducer.

Remedy:

A) Verify connection of the black wire to Terminal 1 in the Processor and Terminal 1 at the Control Head. Verify connection of the red wire to Terminal 3 in the Processor and Terminal 3 at the Control Head. In addition, the red indicator light would not work if the red wire was loose or incorrectly wired. Check for loose or corroded connections.

B) Measure the voltage at Terminals 1 and 2 of the Control Head (do not depress the transfer button). The voltage should fluctuate at a steady rate. If a fluctuating voltage is not measured, replace the Control Head.

1.7 SYMPTOM - AUDIBLE STEADY TONE FROM ALL STATIONS. CANNOT GAIN COMMAND AT ANY STATION.

Cause:

A) Low battery voltage at the Processor.

B) Component failure on the Processor circuit board.

Remedy:

A) Check the battery voltage at the Processor. If the measurement is less than 8 volts, replace battery or correct source of voltage drop.

B) If the voltage tested good, the circuit board needs repair or a Circuit Board Kit needs to be installed.

1.8 SYMPTOM - THE CONTROL HEAD RED INDICATOR LIGHT DOES NOT LIGHT WHEN IN COMMAND, BUT EVERYTHING ELSE WORKS PERFECTLY.

Cause:

A) Incorrectly wired eight-conductor cable.

B) Defective red indicator light.

Remedy:

A) Verify brown wire connection to Terminal 2 of the Processor and the Control Head.

B) Measure the DC voltage between Terminals 2 and 3 at the Control Head. The reading will be 1.00 to 2.00 volts in normal operation. A measurement of 4.00 volts means the indicator light is OPEN. Replace the Control Head.

1.9 SYMPTOM - NO TONES OR LIGHTED INDICATOR LIGHTS AT THE CONTROL HEAD, AND NO LIGHTED INDICATOR LIGHTS ON THE PROCESSOR CIRCUIT BOARD.

Cause:

A) No power to the Processor.

B) Polarity of the battery voltage reversed.

C) Fuse on the Processor circuit board blown.

Remedy:

A) Verify the power source to the Processor.

B) Connect the red wire to the terminal labeled ‘ + ‘ and the black wire to the terminal labeled ‘ - ‘.

C) Measure the battery voltage at the Processor. It is MANDATORY to correct power source if voltage can exceed 40 volts under any condition. Replace the fuse with the spare, which is taped to the relay on the Processor circuit board. If the fuse again blows, the circuit board needs repair or replaced with a Circuit Board Kit.

1.10 SYMPTOM - THE ENGINE STARTS TO TURN OVER WHILE STARTING AND THEN STOPS. A SLOW REPETITIVE AUDIBLE TONE FROM ALL CONTROL HEAD STATIONS.

Cause:

A) The voltage to the Processor has dropped too low, due to the starters current requirements.

B) Battery charge is low.

Remedy:

A) Supply power to the Processor from a battery other then the starting battery.

B) Recharge or replace the battery.

1.11 SYMPTOM - THE ENGINE WILL NOT START.

Cause:

A) ClearCommand does not have power turned ON.

B) ClearCommand does not have a Station in command.

C) The Control Head levers at the Station-in-Command are not at the Idle position.

D) Low battery voltage.

E) Faulty start interlock circuit in the Processor.

F) Faulty wire or component in the starting system.

G) System is in Setup Mode (Jumper 2 Closed ).

Remedy:

A) Turn power ON to the ClearCommand System.

B) Take command at a Station.

C) Place the Station-in-Command Control Head levers into the Idle position.

D) Check the battery voltage. If the voltage is low, charge or replace the battery.

E) Connect the two start interlock wires (yellow with red stripe) at the Processor to the same terminal. If the engine starts, have the Processor repaired.

F) Ensure starting system is installed and works correctly.

G) Take the System out of Setup Mode (Jumper 2 Open ).

1.12 SYMPTOM - ONE LONG - ONE SHORT TONES FROM ALL CONTROL HEAD STATIONS.

Cause:

Clutch feedback error.

Remedy:

Depress the transfer button twice. Have Processor repaired at the first opportunity.

1.13 SYMPTOM - ONE LONG - TWO SHORT TONES FROM ALL CONTROL HEAD STATIONS.

Cause:

Troll feedback error.

Remedy:

Depress the transfer button twice. Have Processor repaired at the first opportunity.

1.14 SYMPTOM - THREE SHORT - ONE LONG TONE FROM ALL STATIONS.

Cause:

Control Head command signal is malfunctioning because of loose / unconnected cable connections or defective potentiometer.

Remedy:

Verify that the cable connections at the Control Head are secure and correct as shown on the system drawing in Appendix C.1, Control Head Sheets in Appendix A.1, or the Control Head Installation Section of the main manual.

If connections are tight and correct, replace the Control Head.

1.15 SYMPTOM - HIGH REPETITION RATE TONE FROM ALL STATIONS.

Cause:

Jam tone caused by excessive push-pull cable load or from failed motor driver board.

Remedy:

Move Control Head lever away from position that caused tone. Investigate push-pull cable run to find source of jam. If this does not solve problem, replace motor driver board.

1.16 SYMPTOM - CANNOT GET ANY SPEED ABOVE IDLE.

Cause:

A) Gear oil pressure switch is not closing, or is incorrectly wired.

B) The gear oil pressure switch not installed.

Remedy:

A) Replace the pressure switch or correct wiring.

B) Install a jumper between the appropriate terminals of the Processor. Refer to the main manual for appropriate terminals.

1.17 SYMPTOM - A SLOW REPETITIVE TONE IS HEARD FROM ALL STATIONS WHEN POWER IS APPLIED TO THE SYSTEM. THE SLOW REPETITIVE TONE CEASES WHEN THE TRANSFER BUTTON IS DEPRESSED. SUBSEQUENTLY, A STEADY TONE IS HEARD WHENEVER THE TRANSFER BUTTON IS DEPRESSED. THE CONTROL HEAD LED DOES NOT LIGHT. THE TRANSMISSION AND ENGINE REMAIN AT THE NEUTRAL/IDLE POSITION REGARDLESS OF CONTROL HEAD LEVER POSITION.

Cause:

The Processor is in the Set Up Mode.

Remedy:

Configure the Processor into the Run State by placing Jumper 2 in the Open State ◦. Refer to the Run State Section of the manual.

1.18 SYMPTOM - A SLOW REPETITIVE TONE IS HEARD FROM ALL STATIONS WHEN POWER IS APPLIED TO THE SYSTEM. WHEN THE TRANSFER BUTTON IS DEPRESSED, THE TONE CEASES BUT THE RED LED DOES NOT LIGHT. FURTHER DEPRESSING OF THE TRANSFER BUTTON HAS NO EFFECT. THE TRANSMISSION AND ENGINE REMAIN AT THE NEUTRAL/IDLE POSITION REGARDLESS OF THE CONTROL HEAD LEVER POSITION.

Cause:

The Processor is in the Set Up Mode and an adjustment setting is selected.

Remedy:

Configure the Processor into the Run State by placing Jumper 2 in the Open State ◦ and SW1-1 through SW1-7 to the Off positions. Refer to the Run State Section of the manual.

1.19 SYMPTOM - SETUP MODE IS ENTERED AND THE NORMAL 3 SECOND STEADY TONE IS HEARD. THE MOTOR CONTROL RELAY "CLICKS" CONTINUOUSLY WHEN THE DIP SWITCHES ARE TURNED ON.

Cause:

An invalid switch combination is selected.

Remedy:

Turn SW1-1 through SW1-7 to the Off positions. Refer to the Notes page of the system drawing in Appendix C.1 for proper switch settings.

1.20 SYMPTOM - THE MOTOR RELAY DOES NOT CLICK ONCE, INDICATING VALUES HAVE BEEN STORED, WHEN PB1 ON THE AUXILIARY CIRCUIT IS DEPRESSED.

Cause:

Each Step in the Set Up & Adjustment Sections of the Technical Manual were not followed exactly.

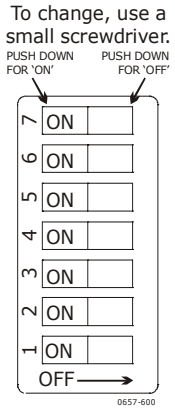
Remedy:

Repeat the set up or adjustment following each step exactly.

2.0 RESET ALL PARAMETERS TO FACTORY DEFAULT VALUES

NOTE: If this procedure is used, all adjustments and tests specified in this manual MUST be repeated.

Set the SW1 dip switches on the Processor main circuit board using the following steps.



A) Place the system in Set Up Mode.

B) Place all of the SW1 dip switches On.

- Refer to Figure 1: for dip switch settings.

C) Start the process by depressing PB1 located on the auxiliary circuit board.

- After approximately 10 seconds, the motor control relay (located next to the Power Supply Terminal Block) will start clicking to confirm the Factory Defaults have been stored.

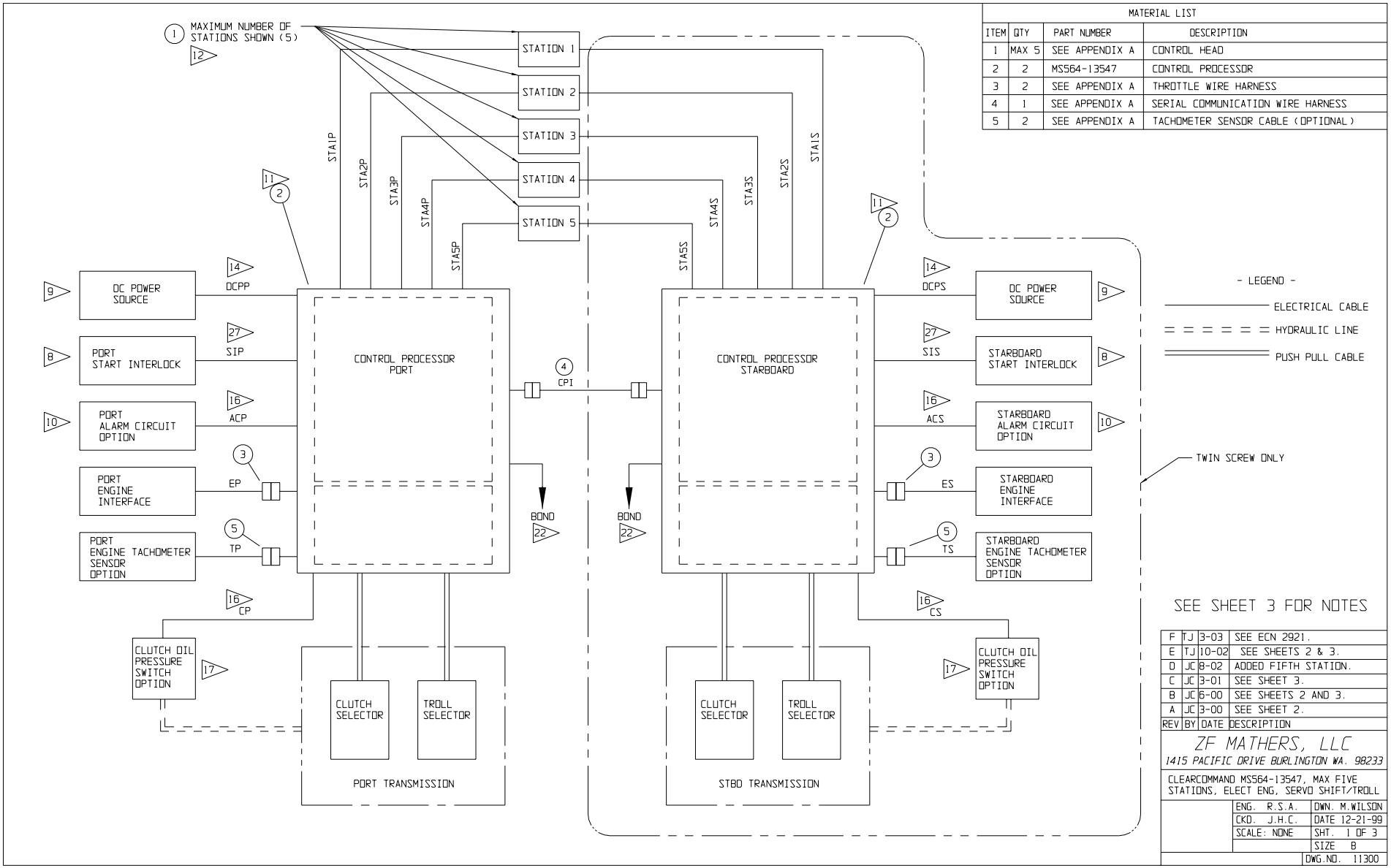
Figure 1: Dip Switch Setting Reset All Parameters to Factory Default Values

D) The clicking will continue until all of the dip switches are reset to the Off position.

NOTE: If this procedure is used, all adjustments and tests specified in this manual MUST be repeated.

APPENDIX C.1

Drawing 11300F-1 System Block Diagram



MATERIAL LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	MAX 5	SEE APPENDIX A	CONTROL HEAD
2	2	MS564-13547	CONTROL PROCESSOR
3	2	SEE APPENDIX A	THROTTLE WIRE HARNESS
4	1	SEE APPENDIX A	SERIAL COMMUNICATION WIRE HARNESS
5	2	SEE APPENDIX A	TACHOMETER SENSOR CABLE (OPTIONAL)

REV	BY	DATE	DESCRIPTION
F	TJ	3-03	SEE ECN 2921.
E	TJ	10-02	SEE SHEETS 2 & 3.
D	JC	8-02	ADDED FIFTH STATION.
C	JC	3-01	SEE SHEET 3.
B	JC	6-00	SEE SHEETS 2 AND 3.
A	JC	3-00	SEE SHEET 2.

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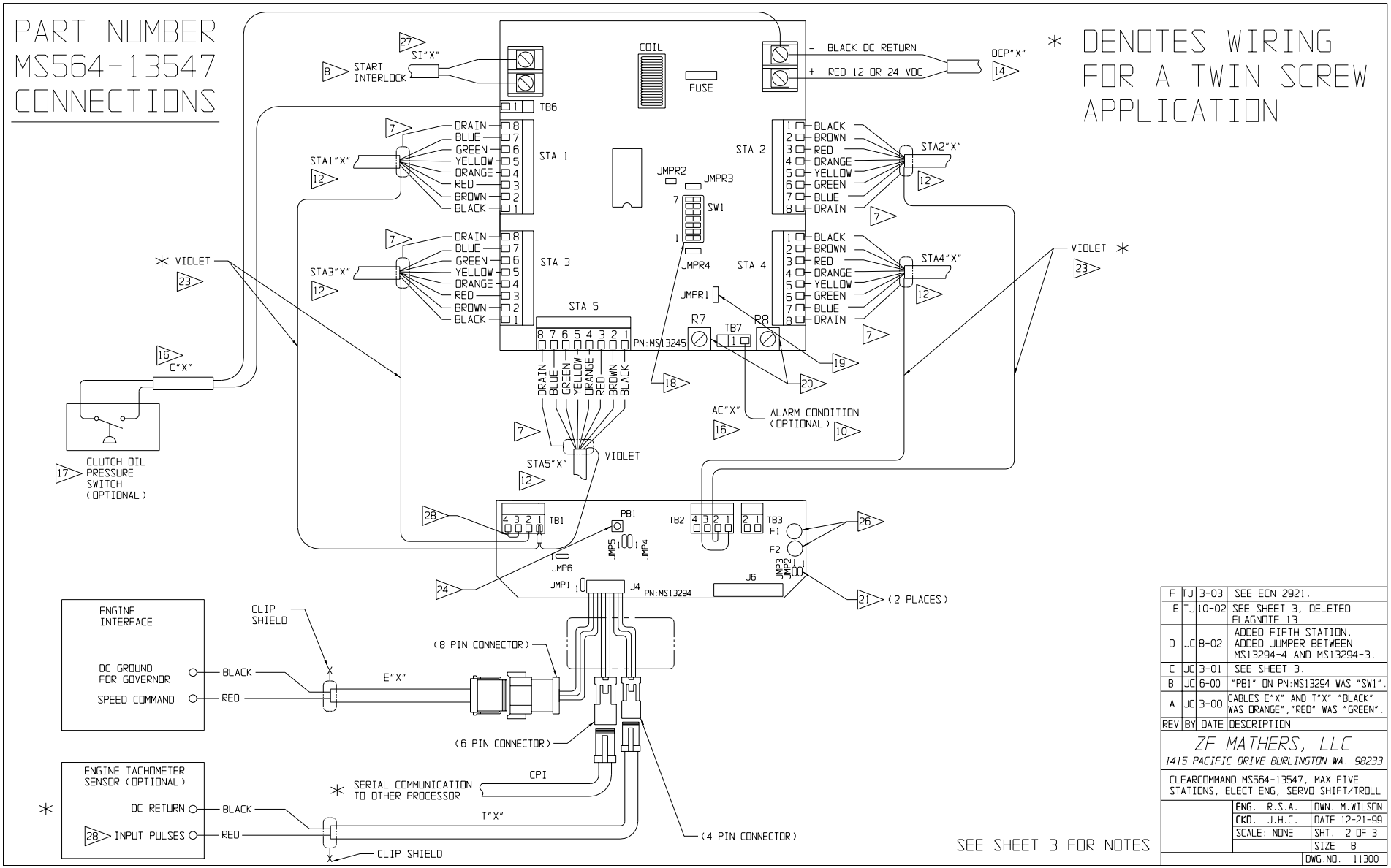
CKD. J.H.C.	DATE 12-21-99
SCALE: NONE	SHT. 1 OF 3
	SIZE B
	DWG.NO. 11300

Drawing 11300F-2 Processor Connections



REV	BY	DATE	DESCRIPTION
F	TJ	3-03	SEE ECN 2921.
E	TJ	10-02	SEE SHEET 3, DELETED FLAGNOTE 13
D	JC	8-02	ADDED FIFTH STATION. ADDED JUMPER BETWEEN MS13294-4 AND MS13294-3.
C	JC	3-01	SEE SHEET 3.
B	JC	6-00	"PB1" ON PN:MS13294 WAS "SW1".
A	JC	3-00	CABLES E"X" AND T"X" "BLACK" WAS ORANGE","RED" WAS "GREEN".

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	SIZE B
	DWG.NO. 11300

Drawing 11300F-3 Notes Page

- NOTES -

1. DO NOT MOUNT CONTROL SYSTEM COMPONENTS ON ENGINE OR REDUCTION GEAR.
2. DO NOT MOUNT CONTROL COMPONENTS NEAR SOURCES OF HIGH HEAT. (EXHAUST DUCTS, ETC.)
3. DO NOT MOUNT CONTROL COMPONENTS NEAR SOURCES OF STRONG ELECTROMAGNETIC FIELDS. (STARTERS GENERATORS,ETC.)
4. MOUNT CONTROL COMPONENTS IN A LOCATION ACCESSIBLE FOR CHECKOUT, MONITORING AND MAINTENANCE.
5. THE "X" SHOWN IN THE CABLE DESIGNATORS CAN BE EITHER P OR S, CORRESPONDING TO PORT OR STARBOARD AS APPROPRIATE.
6. ALL ELECTRICAL CABLES ARE TO BE SUITABLE FOR MARINE APPLICATION AND MEET ALL APPLICABLE REGULATORY REQUIREMENTS.

7. INSURE THAT DRAIN WIRE ON ALL SHIELDED CABLE IS CONNECTED ONLY AT ONE END AS SHOWN ON SCHEMATIC AND THAT THE DRAIN WIRE DOES NOT TOUCH ANY OTHER CONDUCTIVE SURFACE.

8. START INTERLOCK RELAY WITH NORMALLY OPEN CONTACTS. CONTACTS ARE CLOSED WHEN SYSTEM IS OPERATING AND COMMANDING NEUTRAL. MAXIMUM OF 30 AMP, MAXIMUM OF 50V.

9. THE CONTROL PROCESSOR WILL BE PROVIDED SHIPS SUPPLY OF 12 OR 24 VDC, PROTECTED BY A 10 AMP RATED CIRCUIT BREAKER PROVIDED BY THE SHIPYARD.

10. CONTROL FAILURE ALARM RATED FOR A MAXIMUM OF 200mA. DO NOT EXCEED THIS RATING. NORMAL OPERATION IS 21 OHMS TO DC RETURN, HIGH IMPEDENCE INDICATES ALARM CONDITION. IT IS THE SHIPYARDS RESPONSIBILITY TO UTILIZE THE ALARM CONNECTION IN AN APPROPRIATE ALARM CIRCUIT THAT HAS THE SAME COMMON MODE VOLTAGE.

11. CAUTION:
THIS PART CONTAINS ELECTRONIC COMPONENTS WHICH CAN BE DESTROYED BY STATIC ELECTRICITY. PERSONNEL SHOULD GROUND THEMSELVES TO DISSIPATE ANY STATIC ELECTRICITY PRIOR TO WORKING INSIDE THE PART.

12. 8 CONDUCTOR 20 AWG SHIELDED CABLE (P/N 00350) WITH COLOR CODE AS SHOWN.

13. NOT USED.

14. ELECTRICAL CABLING MUST BE 14 AWG OR LARGER.

15. ELECTRICAL CABLING MUST BE 16-20 AWG SHIELDED CABLE.

16. ELECTRICAL CABLING MUST BE 16-20 AWG.

17. PRESSURE SWITCH SETPOINT (N.O. CONTACTS) MUST BE SET AT 150 PSI OR AS AS RECOMMENDED BY TRANSMISSION MANUFACTURER. WHEN CONTACTS CLOSE THIS INDICATES TO THE CONTROL PROCESSOR WHEN THE CLUTCH IS SUFFICIENTLY ENGAGED TO ALLOW A SPEED COMMAND ABOVE IDLE SPEED. IT IS A SAFETY FEATURE THAT PROTECTS THE CLUTCH AND ITS USE IS RECOMMENDED. IF THE SWITCH IS USED, REMOVE THE JUMPER INSTALLED BETWEEN TB6-1 AND - DC RETURN ON THE MAIN BOARD PN: MS13245 AND REPLACE WITH THE PRESSURE SWITCH CONNECTIONS.

18. DIP SWITCH SETTINGS. (PRESET FROM PRODUCTION IN RUN STATE)

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6	SW1-7	
OFF	OFF	OFF	OFF	OFF	OFF	OFF	RUN STATE
ON	OFF	OFF	OFF	OFF	OFF	OFF	SINGLE SCREW
OFF	ON	OFF	OFF	OFF	OFF	OFF	TWIN SCREW (OR MORE)
ON	ON	OFF	OFF	OFF	OFF	OFF	CLUTCH TRAVEL (R7)
OFF	OFF	ON	OFF	OFF	OFF	OFF	CLUTCH PRESSURE TIME = 0.5 SECONDS
ON	OFF	ON	OFF	OFF	OFF	OFF	CLUTCH PRESSURE TIME = 5.0 SECONDS
OFF	OFF	OFF	ON	OFF	OFF	OFF	CLUTCH DELAY - 0 SECONDS
ON	OFF	OFF	ON	OFF	OFF	OFF	CLUTCH DELAY - 1.5 SECONDS
OFF	ON	OFF	ON	OFF	OFF	OFF	CLUTCH DELAY - 3.5 SECONDS
ON	ON	OFF	ON	OFF	OFF	OFF	CLUTCH DELAY - 5 SECONDS
OFF	OFF	ON	ON	OFF	OFF	OFF	CLUTCH DELAY - 7 SECONDS
ON	OFF	ON	ON	OFF	OFF	OFF	CLUTCH DELAY - 8.5 SECONDS
OFF	ON	ON	ON	OFF	OFF	OFF	CLUTCH DELAY - 10.5 SECONDS
ON	ON	ON	ON	OFF	OFF	OFF	CLUTCH DELAY - 12 SECONDS
OFF	OFF	OFF	OFF	ON	OFF	OFF	THROTTLE PAUSE - .5 SECOND
ON	OFF	OFF	OFF	ON	OFF	OFF	THROTTLE PAUSE - 1.0 SECOND
OFF	ON	OFF	OFF	ON	OFF	OFF	THROTTLE MINIMUM (R7)
ON	ON	OFF	OFF	ON	OFF	OFF	THROTTLE MAXIMUM (R7)
OFF	OFF	OFF	OFF	OFF	ON	OFF	TROLL NOT ALLOWED
ON	OFF	OFF	OFF	OFF	ON	OFF	TROLL ALLOWED
OFF	ON	OFF	OFF	OFF	ON	OFF	TROLL MINIMUM PRESSURE (R7)
ON	ON	OFF	OFF	OFF	ON	OFF	TROLL MAXIMUM PRESSURE (R7)
OFF	OFF	ON	OFF	OFF	ON	OFF	TROLL LEVER - 20 DEGREES
ON	OFF	ON	OFF	OFF	ON	OFF	TROLL LEVER - 35 DEGREES
OFF	OFF	ON	ON	OFF	ON	OFF	TROLL THROTTLE LIMIT (R7)
OFF	OFF	OFF	ON	ON	OFF	OFF	ACTIVE SYNC DISABLE
ON	OFF	OFF	ON	ON	OFF	OFF	ACTIVE SYNC ENABLE
ON	ON	ON	ON	ON	ON	ON	RESET ALL PARAMETERS TO FACTORY DEFAULT VALUES

19. MAIN BOARD JUMPER SETTINGS:

JUMPER 1 — 3 / 2 / 1 — MUST BE IN THIS POSITION

JUMPER 2 — 2 1 — NORMAL OPERATION (CLOSED FOR SETUP MODE)

JUMPER 3 — 3 2 1 — TROLL DIRECTION (PUSH FOR MAXIMUM PRESSURE)

JUMPER 4 — 3 2 1 — CLUTCH DIRECTION — PUSH FOR AHEAD (3 2 1) / PULL FOR AHEAD (3 2 1)

20. R8 IS NOT FUNCTIONAL. R7 SETUP (SEE TABLE)
SETTING: FULLY COUNTER CLOCKWISE.

21. AUXILIARY BOARD JUMPER SETTINGS: (PRESET FROM PRODUCTION)

JUMPER 1 — 3 / 2 / 1 — MUST BE IN THIS POSITION

JUMPER 2 — 1 / 2 — NOT FUNCTIONAL

JUMPER 3 — 1 / 2 — NOT FUNCTIONAL

JUMPER 4 — 3 / 2 / 1 — MUST BE IN THIS POSITION

JUMPER 5 — 3 / 2 / 1 — MUST BE IN THIS POSITION

JUMPER 6 — 1 2 3 — THROTTLE SETTING
1 2 3 — MUST BE IN THIS POSITION FOR PWM SIGNAL
1 2 3 — MUST BE IN THIS POSITION FOR VOLTAGE OR CURRENT SIGNAL

22. THE CONTROL PROCESSOR'S MOUNTING FEET MUST BE CONNECTED TO THE VESSELS BONDING SYSTEM

23. CONNECT ONLY ON STARBOARD CONTROL PROCESSOR.

24. PB1 USED FOR SETUP.

25. REFER TO CONTROL SYSTEM MANUAL FOR ENGINE PULSE TRANSMITTER REQUIREMENTS.

26. 6 AMP FUSES, F1 - LOGIC CIRCUIT POWER, F2 - SOLENOID POWER. (THESE ARE NOT USED FOR THIS SYSTEM.)

27. ELECTRICAL CABLING MUST BE 14-16 AWG.

28. INSTALL A JUMPER BETWEEN MS13294-TB1-3 AND MS13294-TB1-4 TO ENGAGE TROLLING GEAR BEFORE SHIFTING INTO AHEAD OR ASTERN, NO JUMPER WILL SHIFT INTO GEAR THEN ENGAGE THE TROLLING GEAR.

REV	BY	DATE	DESCRIPTION
F	TJ	3-03	SEE ECN 2921.
E	TJ	10-02	REVISED FLAGNOTE 18 TO ADD TROLL THROTTLE LIMIT AND RESET, DELETED FLAGNOTE 13
D	JC	8-02	ADDED FLAGNOTE 28.
C	JC	3-01	REVISED FLAGNOTE 21 TO ADD JUMPERS TO 4 & 5 PER ECN 2387.
B	JC	6-00	FLAGNOTE 24 "PB1" WAS "SW1".
A	JC	3-00	SEE SHEET 2.

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	SIZE B
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