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Appendix B.1

1.0 TROUBLESHOOTING - - - - - - - - - - - - - - - - - 1
1.1 SYMPTOM - When DC Power is turned On, operator cannot take command at one Station (both Port and Starboard for twin screw). 2

1.2 SYMPTOM - One side will not take command when DC Power is first turned ON. 2

1.3 SYMPTOM - When system is turned ON, one Station's red indicator light blinks. Cannot transfer command to any other Stations. 3

1.4 SYMPTOM - The engine RPM varies, without moving the Control Head Lever. 3

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. 4

1.6 SYMPTOM - The engine RPM reduces to Idle, transmission to Neutral, the Control Head indicator light turns OFF, and a slow repetitive tone emitted at all Stations after repositioning the Control Head lever. 4

1.7 SYMPTOM - No audible tone at a Control Head when system is first turned ON, but otherwise works perfectly. 4

1.8 SYMPTOM - Audible steady tone from all Stations. Cannot gain command at any Station. 5

1.9 SYMPTOM - The Control Head red indicator light does not light when in command, but everything else works perfectly. 5

1.10 SYMPTOM - No tones or lighted indicator lights at the Control Head, and no lighted indicator lights on the Processor circuit board. 6

1.11 SYMPTOM - The engine starts to turn over while starting and then stops. A slow repetitive audible tone from all Stations. 6

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1.13 SYMPTOM - Three Short - One Long Tone from all Stations. 7

1.14 SYMPTOM - Cannot get any speed above IDLE. 7

1.15 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. 8

1.16 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. 8

1.17 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. 9

1.18 SYMPTOM - The motor relay does not click once, indicating values have been stored, when PB1 on the Auxiliary Circuit is depressed. 9

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Revisions List

Rev	Date	Revision Description

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)

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

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

Appendix C 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 ClearCommand Control Processor (hereafter referred to as Processor) is designed for:

- Engines that require either voltage, mA, or PWM speed command signal
- Transmissions equipped with solenoid clutch selection
- Transmissions equipped with solenoid Trolling Valve 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 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)
- ClearCommand System Fault Indication (Section 2.5)
- High / Low Idle (Section 2.6)
- Trolling Valve Control (Section 2.7)
- Engine Synchronization (optional) (Section 2.8)
- Proportional Pause on through Neutral Shifts using a Clutch Delay (Section 6.7)
- ClearCommand Failure Alarm Contact (optional) (Section 9.1)
- Clutch Oil Pressure Interlock (optional) (Section 9.2)
- One to Four Stations (Appendix C Drawing)

1.2.2 Requirements

Refer to Section 3.

- One Processor per engine
- One Control Head per Remote Station
- One Engine Stop Switch per Remote Station
- One Eight-conductor electric cable for each Control Head connection per Processor
- One Two-conductor electric cable for power connection
- One Two-conductor electric cable for Start Interlock connection
- One Throttle Wire Harness for Processor engine interface connection
- One Clutch/Troll Wire Harness for Processor transmission and clutch power interface connection
- One Serial Communication Wire Harness Processor to Processor interconnection (Twin Screw only)

2.0 OPERATION

2.1 DC POWER ON

When control system DC power is turned ON:

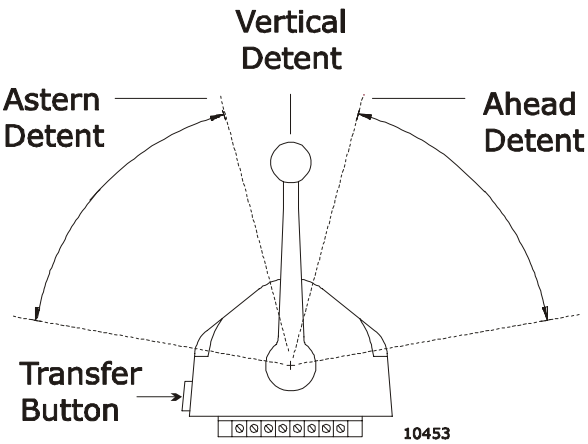


Figure 1: Control Head Detents

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

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

There are four features related to main engine start:

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

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

Start Interlock will 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. Refer to Figure 14:, page 26, for location of the Jumper.

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:):

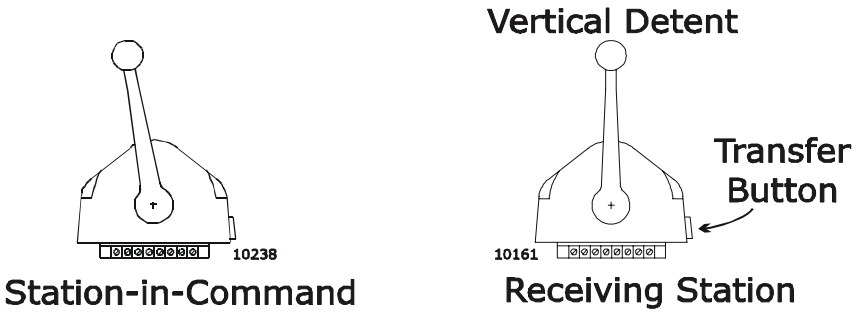


Figure 2: Station Transfer

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.

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:):

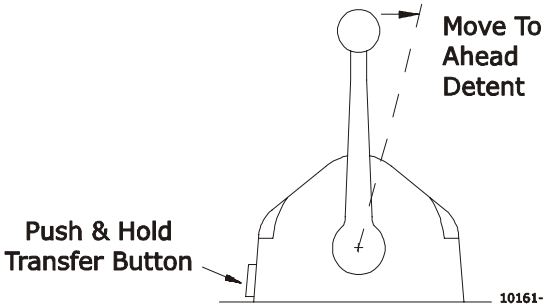


Figure 3: Warm-up Mode

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 CONTROL HEAD TONES

Low Repetition Rate Tone is normal when DC power is first applied to ClearCommand. This tone indicates the Processor is in Neutral and Idle, and the operator can take command at a Station.

If this tone occurs during operation, refer to Appendix B Trouble Shooting Section.

Low Repetition Rate Tone is also heard during Set-up Mode. During the Set-up procedure when the transfer switch is depressed to gain command at a Station to aid in the adjustment setting.

If this tone occurs during operation, refer to Appendix B Trouble Shooting Section.

Steady 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.

If tone continues, refer to the Appendix B Trouble Shooting.

Repetitive Signal - Three Short - One Long is used to indicate a Control Head is malfunctioning due to loose or unconnected cable connections.

Refer to Appendix B Trouble Shooting Section.

2.6 HIGH / LOW IDLE OPTION

The ClearCommand Control System offers an option of two engine IDLE RPM settings.

- The normal Low Idle RPM is the default Idle setting.
- A High Idle RPM may be set electrically.

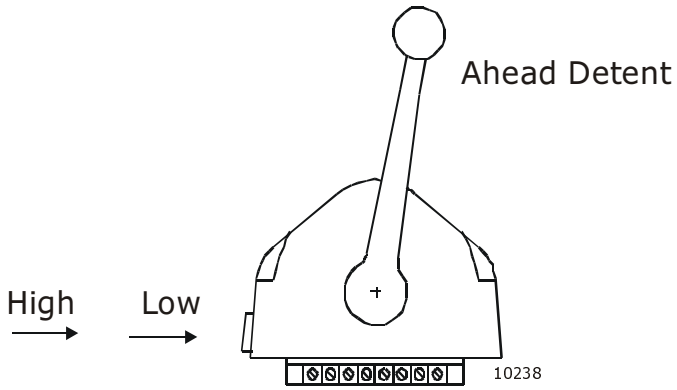


Figure 4: High/Low Idle

The operator selects High or Low Idle by depressing and releasing the transfer button at the Station-in-Command while in the Control Head lever is in the Ahead detent. This feature allows the operator the option of toggling between Low Idle and High Idle.

For Multiple Screw applications ensure that all engines are in Warm-up Mode by placing all engines in Warm-up Mode as described in Paragraph 2.4.

2.7 TROLLING VALVE CONTROL

This ClearCommand System is able to command solenoid Trolling Valves by setting the appropriate Dip Switches on the Processor.

- If Troll Allowed has been selected the control system will operate as described in Section 2.7.1.
- If Troll Not Allowed has been selected the control system will be in the Non-Troll Operation Mode (Refer to Section 2.7.2.)

2.7.1 Operating Modes

This system has two Modes of Operation when Troll Allowed has been set up: **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.

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.

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. When set for 35 degrees the speed is active during the Troll Range. Refer to Section 2.7.3 for Operation in Troll Mode.

Refer to Section 6.11 for Troll Range setting.

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.

A) With the Control Head lever(s) positioned in the Neutral (vertical) detent the System will command Neutral and Idle RPM.

B) Control Head lever movement of 15 degrees to the Ahead or Astern detent will:

- The engine remains at Idle RPM.
- Command of Ahead or Astern clutch engagement.

C) Further movement of the Control Head lever through the next 65 degrees will increase the input to the engine in proportion to the Control Head lever position.

2.7.3 Operation in Troll Mode

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

1. TO TURN TROLL MODE ON:

NOTE: The following outlined steps are the same in the ASTERN direction.

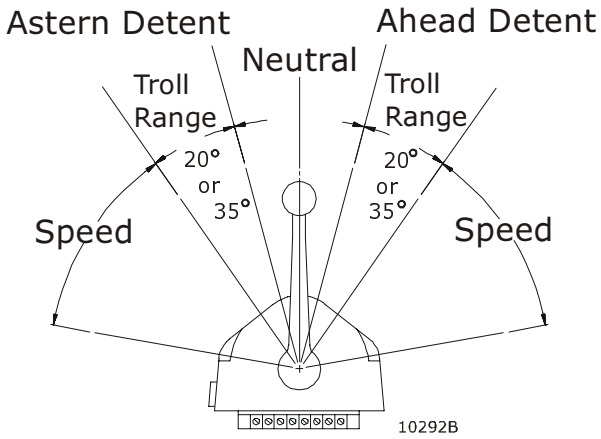


Figure 5: Control Head Troll Range

A) Place the Control Head lever in the Ahead 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 is in the Ahead Detent.

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

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

C) Once the system has been placed in Troll Mode, moving the Control Head lever Ahead into the Troll Range will: (Refer to Figure 5:)

- **20 degrees** Troll Range leaves the engine at Idle RPM; **35 degrees** Troll Range engine will increase in proportion to the Control Head lever movement through Troll Range
- the transmission command Ahead;
- the Trolling Valve command moving through the range of 30 percent shaft RPM to approximately 70 percent shaft RPM;
- Control Head LED flashing.

D) Continued Control Head lever movement Ahead through the Troll Range will:

- Move the trolling valve to maximum oil pressure

- **20 degrees** Troll Range leaves the engine at Idle RPM; **35 degrees** Troll Range engine speed will increase to 20 percent
- The Control Head LED will become a steady light

E) The remaining movement of the Control Head lever Ahead will increase engine speed up to full-speed.

1. TO DISABLE TROLL MODE:

NOTE: The following outlined steps are the same in the ASTERN direction.

A) Place the Control Head lever in the Ahead 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 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.

2.8 SYNCHRONIZATION (MULTI SCREW)

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 percent of the throttle range
- Commanded throttles are within 10 percent of equal RPM

The Processor's throttle signals are compared and then matched. The Processors then send the same signal to both 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:

- Both 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.

3.0 REQUIRED PARTS AND TOOLS

3.1 PROCESSOR

One Processor required per engine (refer to the System Drawing in Appendix C)

Mounting Hardware is installer supplied.

Included with the Processor:

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

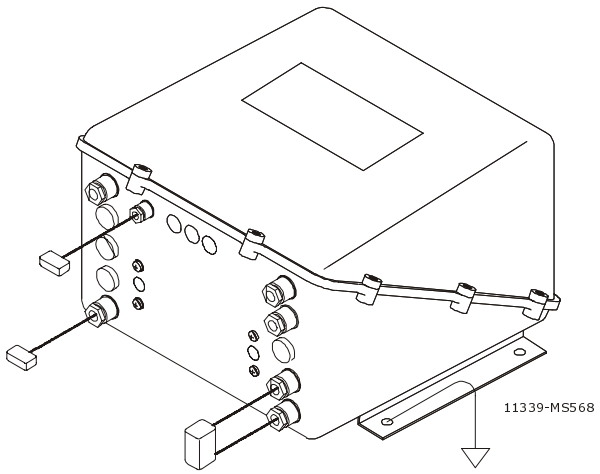


Figure 6: Control Processor

3.2 CONTROL HEAD

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

At least 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.

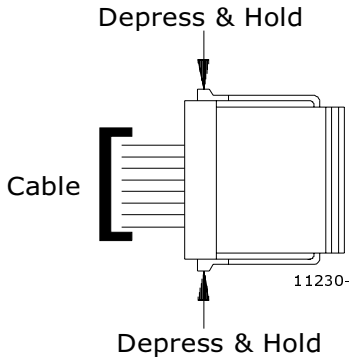
Two Conductor Power Cable (Processor to DC Power Supply)

Supplied by the Installer or available from ZF Mathers, LLC (P/N 212)
14 AWG, 300V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Red with purple stripe and black.

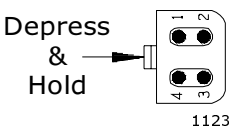
Two Conductor Cable Start Interlock Cable (Starter Switch to Processor to Starter Solenoid)

Supplied by the Installer or available from ZF Mathers, LLC (P/N 183)
14 -16 AWG, 300 V, PVC Insulated: -20 degrees C to +105 degrees C
UL VW-1 PVC Jacket. Yellow with red stripe.

3.4 CABLE HARNESS



Detail I
Large Plug Side View



Detail II
Small Plug End View

Figure 7: Harness Plug

Throttle Wire Harness (Processor to Engine Interface)

Available from ZF Mathers, LLC Select from Appendix A – Parts List the correct Throttle Wire Harness for your System.

Clutch/Troll Wire Harness (Processor to Clutch Power Supply and transmission Clutch & Troll Solenoids)

Available from ZF Mathers, LLC Select from Appendix A – Parts List the correct Clutch/Troll Wire Harness for your System.

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

Available from ZF Mathers, LLC Select from Appendix A – Parts List the correct Serial Communication Wire Harness for your System.

The above Cable Harnesses use one or both of the plug connector types detailed in Figure 7:.

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.

3.5 TOOLS REQUIRED FOR INSTALLATION

- Wago Tool (provided)
- Anti-static Wrist Strap (provided)
- Wire cutter, stripper, 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)
- Multi meter

3.6 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, and will cancel warranty if not installed.

3.7 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 - 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 Drawing Notes)

3.8 CLUTCH POWER SUPPLY

The power for the clutch solenoid may come from the same power distribution panel as the other required engine functions. (Refer to Drawing Notes for power requirements.)

NOTE: The Clutch Power Supply cable and the Processor DC Power Source cable must come from the same breaker.

4.0 PLAN THE INSTALLATION

4.1 PROCESSOR(S) LOCATION

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

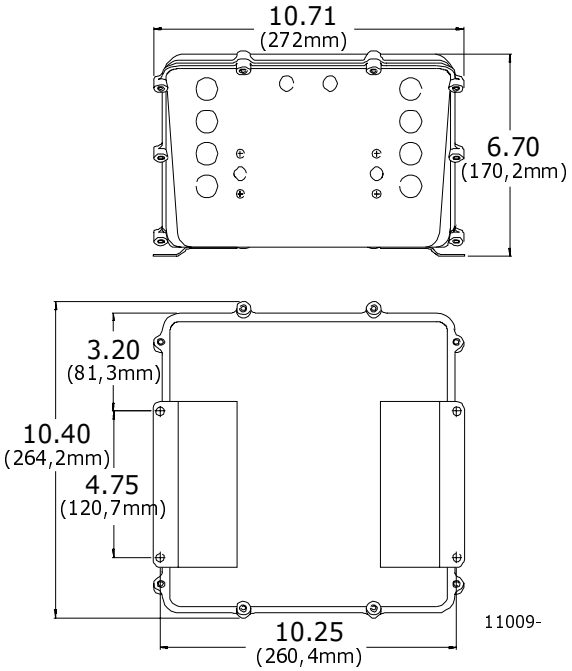


Figure 8: Control Processor Dimensions

Recommendations:

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.

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 8: 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.

CAUTION: It is mandatory that the Processor DC negative is bonded (connected) to the vessel bonding system. See Appendix A Bonding Section.

4.2 CONTROL HEAD LOCATION

Refer to Appendix A 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 Watertight Enclosure. Reference Appendix A Watertight Enclosure for specific information.

See Appendix A 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 Watertight Enclosure. Reference Appendix A Watertight Enclosure for specific information.

See Appendix A 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 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 9:.

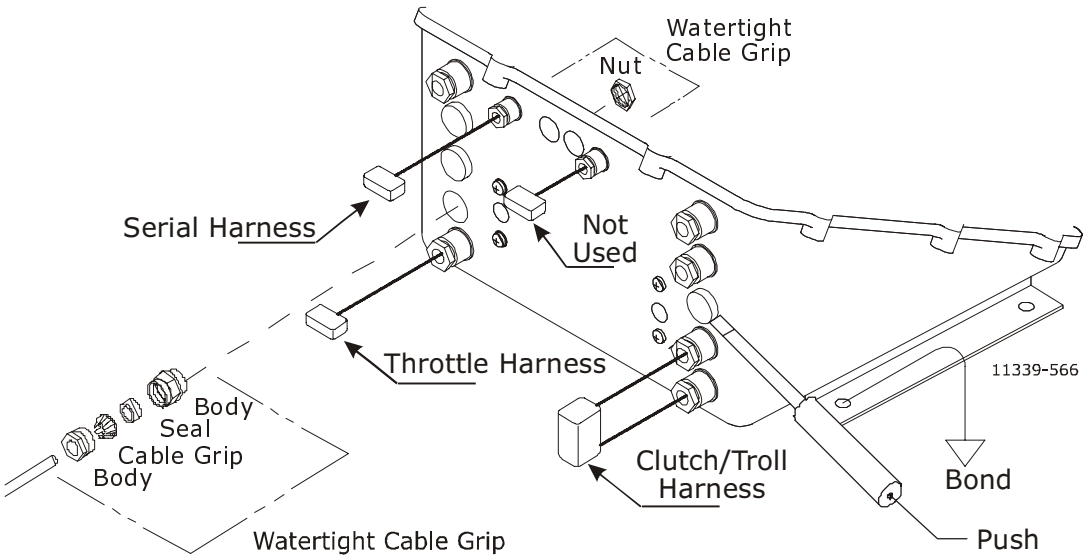


Figure 9: Plug Removal and Cable Grip Installation

5.3 PROCESSOR CONNECTIONS AND SETUP

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.

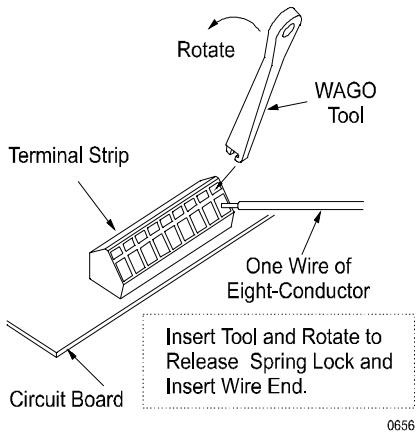


Figure 10: Terminal Connection

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. Use this tool to depress the spring lock to release the Jumper from the Station terminal strip.

F) Use the WAGO Tool to depress the spring lock for the individual wire connections to the terminal strip. (Refer to Figure 10:)

G) Connect colors to the station terminal strips as shown on System Drawing in Appendix C.

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)

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

CAUTION: A jumper is required between terminals 5 and 6 on all unused station terminals on the circuit board. Refer to Drawing Notes in Appendix C.

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 9:)

C) Connect the two-conductor cable to the Processor. Refer to the Drawing in Appendix C 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.

NOTE: Repeat for all Processors. Ensure all connections are as indicated on the Drawing in Appendix C.

5.3.3 Start Interlock

CAUTION: The Processor is designed for a maximum of 30 amperes, maximum 50 volt, 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 11:)

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

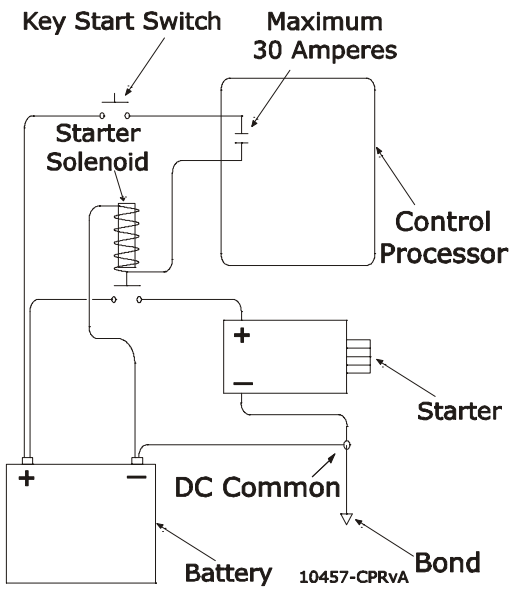


Figure 11: Start Interlock Connections

Connections at Processor:

A) Install the start interlock grip in the Processor enclosure. (refer to Figure 6:)

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.

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

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

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.

NOTE: Repeat for all Processors. Ensure all connections at the Processor are as indicated on the Drawing in Appendix C.

5.4 CLUTCH CONTROL

The Processor(s) connect directly to the transmission's clutch solenoids. Each Clutch Wire Harness has 5 electric cables:

- One for Ahead Clutch solenoid
- One for the Astern Clutch solenoid
- One for Clutch Power
- Two for Trolling Valve operation (refer to Section 5.5)

A) Connect the plug end of the Clutch/Troll 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. Refer to Figure 6:, page 9 .

B) Run the two cables labeled Ahead and Astern Clutch to the transmission.

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 Drawing for termination points at the clutch solenoids.

D) Run the one cable labeled Power to the Clutch Power Supply. Connect to the Power Supply.

5.5 TROLLING VALVE CONTROL

The Processor(s) connect directly to the transmission's Trolling Valve solenoids. Each Clutch/Troll Wire Harness has five electric cables:

- One for the Troll Command solenoid
- One for the Troll ON/OFF solenoid
- Three for Clutch operation (refer to Section 5.4)

A) Connect the plug end of the Clutch/Troll 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. Refer to Figure 6:, page 9 .

B) Run the two cables labeled Troll Command and Troll ON/OFF to the transmission.

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 Drawing in Appendix C for termination points at the Troll solenoids.

5.6 MAIN ENGINE SPEED CONTROL

NOTE: Ensure all Processors are set-up using the same Jumper 6 Throttle Profile, Wire Harness, and Set-up Engine Selection.

- Ensure the correct Wire Harness is selected for the Engine Selection required for this System.
- Refer to the System Drawing Notes in Appendix C for the Engine Selection available.

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. Refer to Figure 7:, page 15.

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 Drawing.

B) Select the Throttle setting for the Engine being used in this application (refer to the Notes page of the System Drawing).

5.6.3 Engine Signal Selection

During the Set-up Procedures Section an Engine Signal is selected. Refer to Section 6.9, page 42.

5.7 CONTROL HEADS

See Appendix A 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.

5.7.1 Mounting

400 Series Control Head:

A) Use the template supplied in Appendix A 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 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 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.

5.7.2 Cable Connection

Refer to Appendix A 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

5.7.3 Aft Facing Control Heads

Refer to Figure 12:.

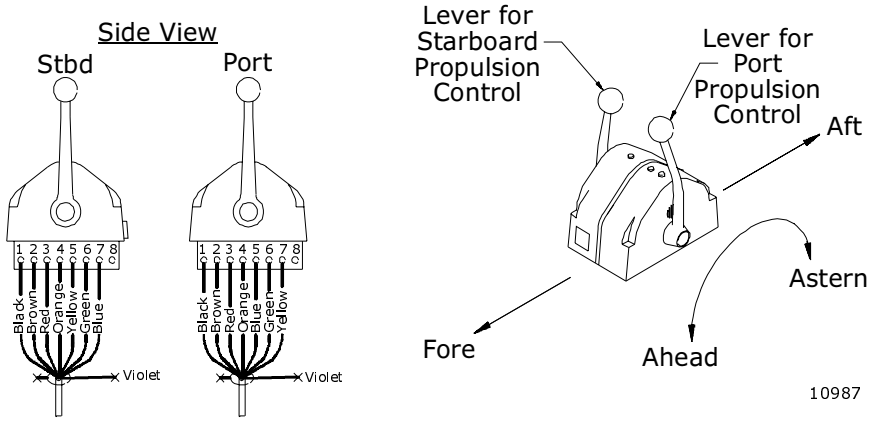


Figure 12: Aft Facing Control Heads

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.

5.7.4 700 Series Control Head Only

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

5.8 ENGINE STOP SWITCH

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

WARNING: Each Station must have some method to stop the engine. Warranty canceled if requirement not followed.

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.

6.1 DIP SWITCH SETTINGS

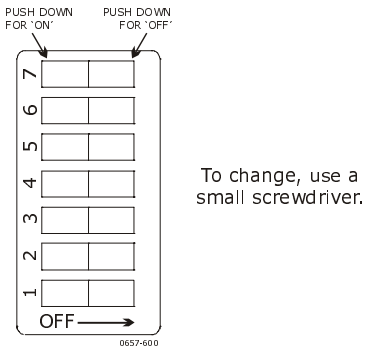


Figure 13: Main Circuit Board SW1 Dip Switch

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 13: and Figure 14:.

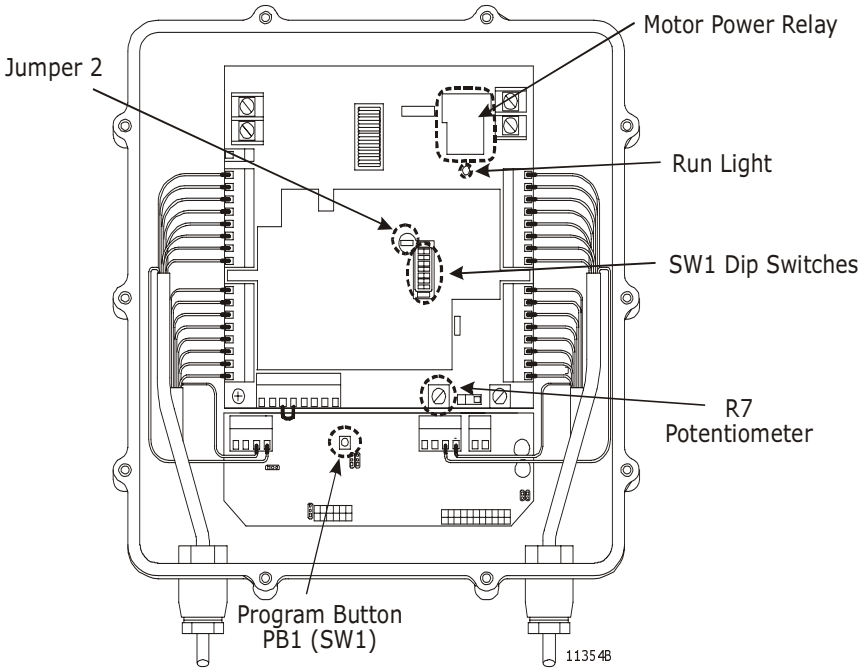


Figure 14: Processor Circuit Board Set-up Locations

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 6.2.
- All of the parameters can be reset to the Factory Default Values at anytime. Refer to Appendix B Trouble Shooting Section on

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.

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

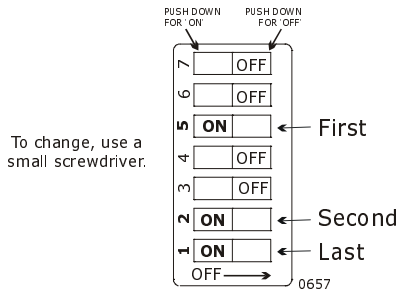


Figure 15: Dip Switch SW1 Setting Example

EXAMPLE: Refer to Figure 15:. Throttle Maximum:

SW1-5 select ON 1st,

SW1-2 select ON 2nd,

SW1-1 select ON last

6.2 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 <u>is not a valid selection</u> or the system was <u>not in the Run State</u> (Normal Operating Mode) when entering the Set-up Mode. Place the System into the Run State (Refer to Section 6.2) 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.

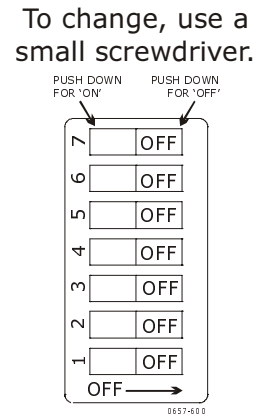


Figure 16: Dip Switch Run State

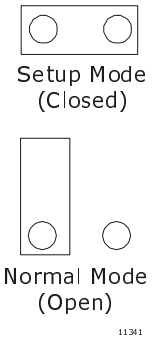


Figure 17: Jumper 2 Closed & Open

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

Run State:

- All SW1 Dip Switches are in the Off position (Refer to Figure 16:)
- Jumper 2 is in the Open State ▯.

Refer to Figure 14:, page 32, or the Drawing in Appendix C for location of SW1 Dip Switch and Jumper 2.

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

6.3 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) Close Jumper 2 on the Main Circuit Board. (Figure 17:) (Refer to Figure 14:, page 32, for location of Jumper 2)

- 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 16:) and place Jumper 2 in the Open State . Begin again with Step A) placing the system into Set-up Mode.

D) 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 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.

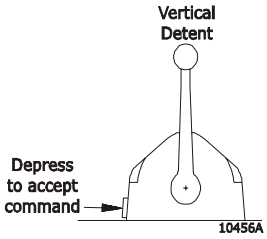
6.4 SINGLE/TWIN SCREW (OR MORE) SELECTION

CAUTION: This setting MUST be made before setting the System ID # of each Processor.

CAUTION: The settings on all Processors Main Circuit Boards <u>MUST</u> be set the same for Multi Screw applications.

The Processors are set at the Factory for **Twin Screw** operation.

Set the SW1 Dip Switches on the Processor Main Circuit Boards using the following steps:

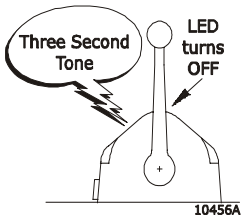


A) Take command at a Station.

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

C) Enable Setup Mode by closing Jumper 2 ▭.

- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.



- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ▯◦. Continue with Step B) again.

D) Place the appropriate SW1 Dip Switches ON for Single Screw or Twin Screw (or more).

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ▯◦. Begin Step B) to enable Setup Mode again.

- Refer to Figure 18: for the Dip Switch settings
- Refer to Figure 13:, page 25, for the location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

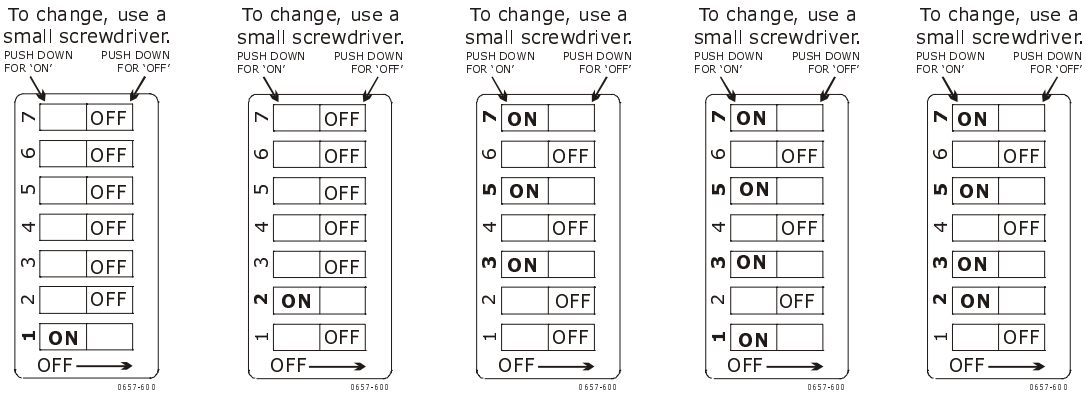
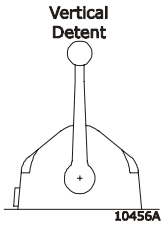


Figure 18: Dip Switch Setting Number of Screws

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 13:, page 25, for location of PB1)

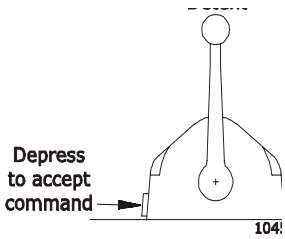
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored..

F) Reset all of the Dip Switches to the Off position.



G) 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.



H) Place Jumper 2 in the Open State ○.

- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

I) Take command at a Station.

- The red LED will light; indicating Station is in command

CAUTION: The settings on all Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) applications.

6.5 SYSTEM ID # SELECTION

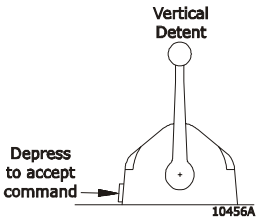
NOTE: IN A MULTI-PROCESSOR APPLICATION THAT USES SERIAL COMMUNICATION, each Processor MUST HAVE ITS OWN UNIQUE SYSTEM ID #. Perform the following set-up on all Processors.

CAUTION: This setup MUST ONLY be made AFTER the Processor has been set-up for Number of Screws.

The Processors must have a System ID set.

Set the SW1 Dip Switches on the Processor Main Circuit Boards using the following steps:

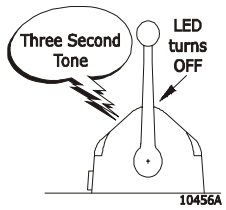
A) Take command at a Station.



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

C) Enable Set-up Mode by closing 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.



- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 14:, page 28) and place Jumper 2 in the Open State ▯◦. Continue with Step B) again.

D) Place the appropriate SW1 Dip Switches ON for the System ID # required for each Processor.

CAUTION: Ensure no Primary Processors are set-up with the same System ID#. Each Primary Processor needs to have its own unique System ID#.

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. IF THE TONE AND CLICKING CONTINUES place all Dip Switches in the Off position (Refer to Figure 14:, page 28) and place Jumper 2 in the Open State ▯◦. Begin Step B) to enable Set-up Mode again.

- Refer to Figure 19: for the Dip Switch settings
- Refer to Figure 15:, page 28, for the location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

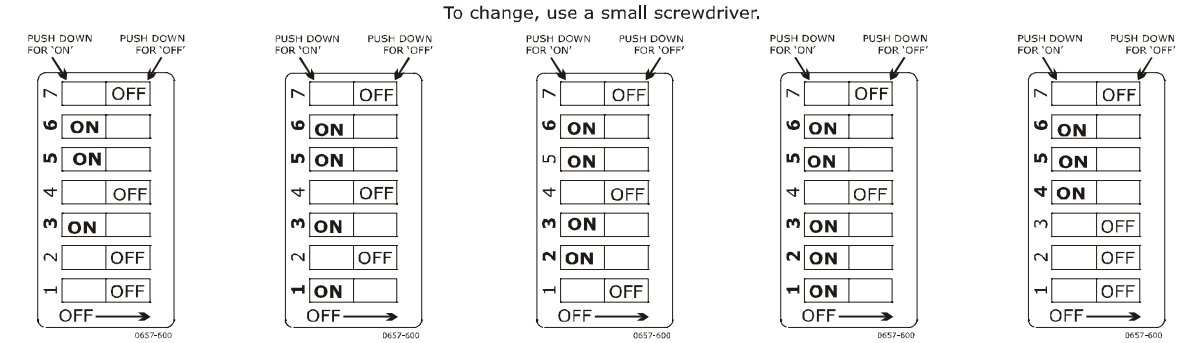
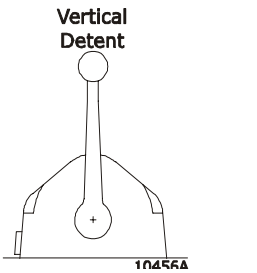


Figure 19: Dip Switch Setting System ID #

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to the Figure 15:, page 28, for location of PB1)

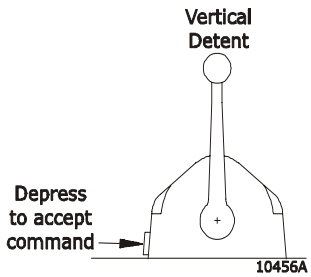
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.



F) Reset all of the Dip Switches to the Off position.

G) 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.



H) 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.

I) Take command at a Station.

- The red LED will light; indicating Station is in command

6.6 CLUTCH PRESSURE TIME

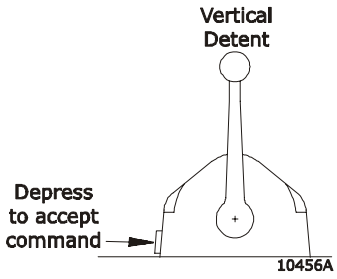
This feature is only available if the optional Clutch Pressure Switch is being used.

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

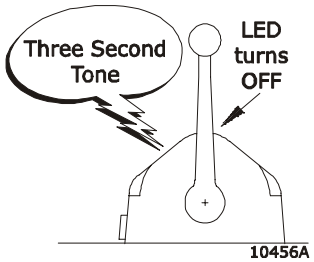


A) Take command at a Station.

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

C) Enable Set-up Mode by closing Jumper 2 on the Main Circuit Board.

- 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.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.



- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ⍀. Continue with Step B) again.

D) Place the appropriate SW1 Dip Switches On for the Clutch Pressure Time required.

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.

IF THE TONE AND CLICKING CONTINUES place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ⍀. Begin Step B) to enable Set-up Mode again.

- Refer Figure 20: for Dip Switch settings
- Refer to Figure 13:, page 25, for location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

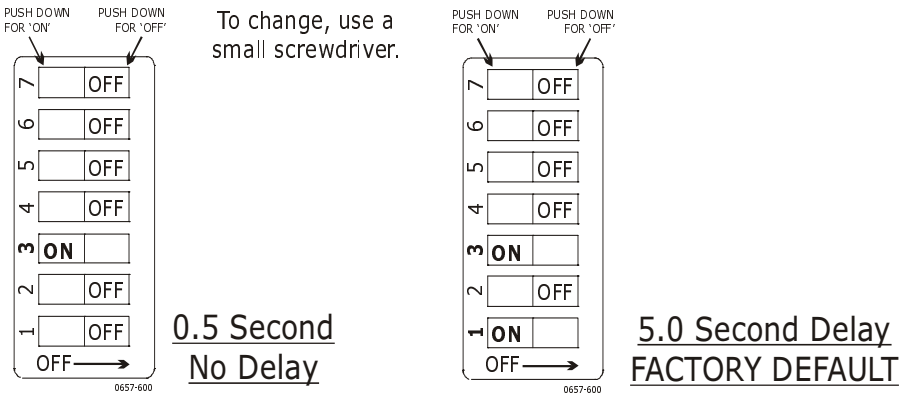


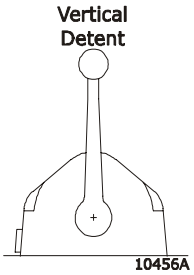
Figure 20: Dip Switch Setting Clutch Pressure Time

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 13:, page 25, for PB1 location)

- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.

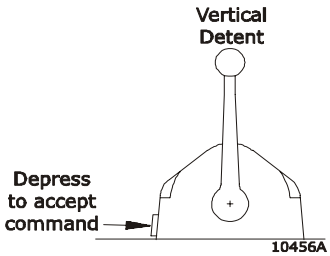
F) Reset all of the Dip Switches to the Off position.

G) Ensure Control Head lever is in the vertical detent.



- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next step

H) 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.

I) Take command at the Station.

- The LED will light; indicating Station is in command.

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

6.7 CLUTCH DELAY

CAUTION: The settings on both Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) 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; 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.

Refer to Figure 21: to configure the Clutch Delay to meet the vessel's requirements.

To change, use a small screwdriver.

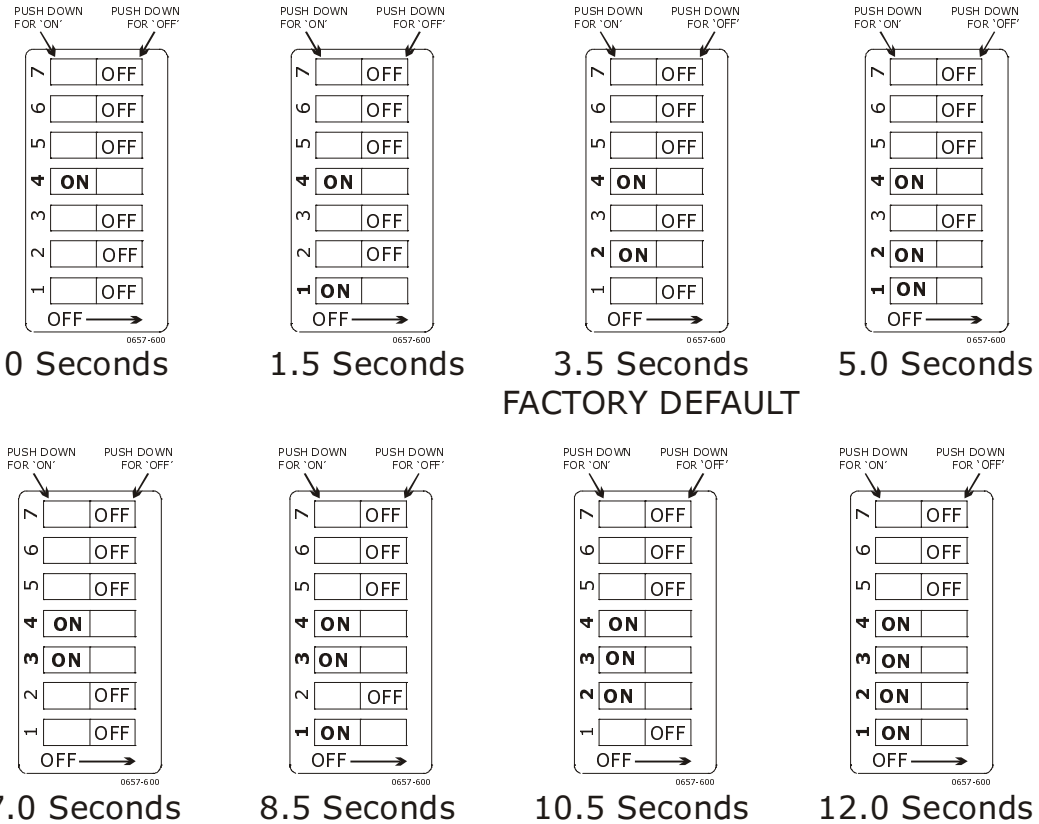
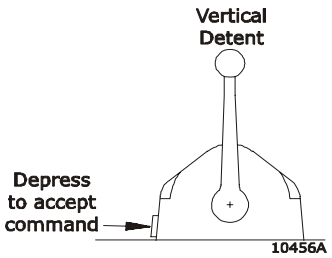


Figure 21: Dip Switch Setting Clutch Delay

Clutch Delay is preset at the Factory for **3.5** seconds. Change the Clutch Delay by setting the SW1 Dip Switches on the Processor Main Circuit Board using the following steps.

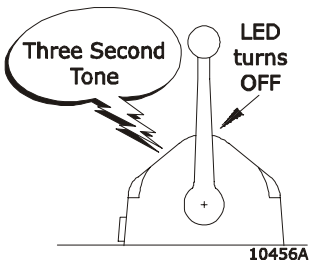


A) Take command at a Station.

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

C) Enable Setup Mode by closing Jumper 2 on the Main Circuit Board.

- The Station-in-Command Control Head LED will turn Off.
- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State. Continue with Step C) again.



D) Place the appropriate SW1 Dip Switches ON for the Clutch Delay Time required for this application.

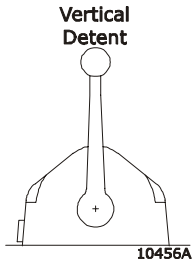
NOTE: When selecting the Dip Switch setting, a nearly solid tone may sound and the motor control relay (located next to the Power Supply Terminal Block) will begin clicking. The tone and clicking will continue until a valid switch setting is completed. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State. Begin Step C) to enable Setup Mode again.

- Refer to Figure 21:, page 43, for the Dip Switch settings.
- Refer to Figure 13:, page 25, for the location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 13:, page 25, for location of PB1)

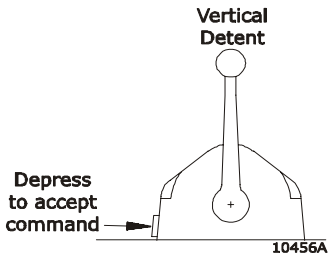
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.



F) Reset all of the Dip Switches to the Off position.

G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.



H) Place Jumper 2 in the Open State ○ ○.

- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

I) Take command at the Station.

- The red LED will light; indicating Station is in command.

CAUTION: The settings on both Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) applications.

6.8 THROTTLE PAUSE

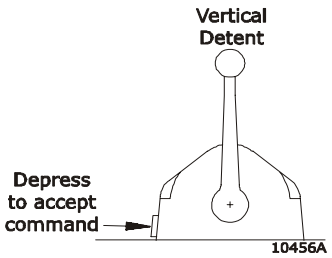
CAUTION: The setting on all Processors Main Circuit Boards MUST be set the same for Twin Screw (or more) applications.

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.

Change Throttle Pause by setting the Dip Switches on the Processor Main Circuit Boards using the following steps.

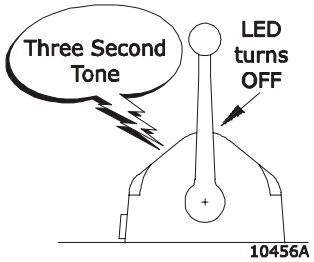


A) Take command at a Station.

B) Ensure the Control Head lever is in the Neutral position.

C) Enable Set-up Mode by closing Jumper 2 on the Main Circuit Board.

- 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.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State. Continue with Step B) again.



D) Place the appropriate Dip Switches ON for Throttle Pause required for this application.

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. IF THE TONE AND CLICKING CONTINUES place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ○. Begin Step B) to enable Set-up Mode again.

- Refer to Figure 22:, page 47, for the Dip Switch settings.
- Refer to Figure 13:, page 25, for the location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

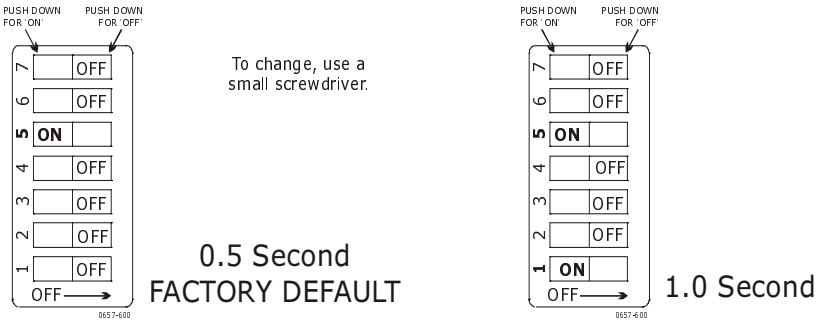
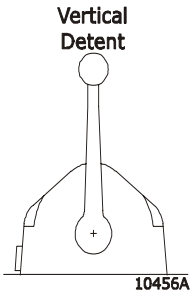


Figure 22: Dip Switch Setting Throttle Pause

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 13:, page 25, 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.

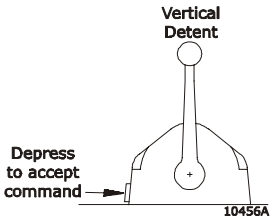
F) Reset all of the Dip Switches to the Off position.



G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.

H) 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.

I) Take command at the Station.

- The LED will light; indicating Station is in command.

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

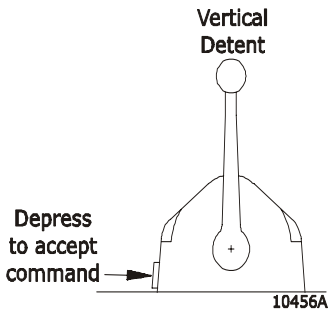
6.9 ENGINE SIGNAL SELECTION

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

The Engine Signal selection is preset at the Factory for **Scania** Engines.

CAUTION: Ensure that the Jumper 6 setting on the Processor Auxiliary Board is the correct setting for the Engine Signal Selection required for this vessel. Refer to Section 5.5.2, page 21, for Jumper 6 setting and Drawing in Appendix C for Jumper 6 location.

Set the SW1 Dip Switches on the Processor Main Circuit Board for the engine signal required for this application by following steps below.

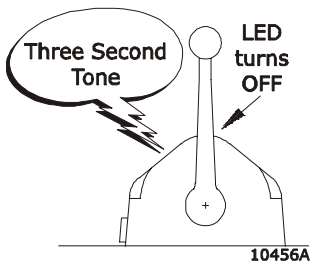


A) Take command at a Station.

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

C) Enable Set-up Mode by closing Jumper 2 on the Main Circuit Board.

- 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.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State . Continue with Step B) again.



D) Place the appropriate SW1 Dip Switches On for the engine signal required for this application.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ○ ○. Begin Step B) to enable Set-up Mode again.

- Refer to Figure 23: for the Dip Switch settings.
- Refer to Figure 13:, page 25, for the location of the Dip Switch

NOTE: All Dip Switches are preset in the Off position at the Factory.

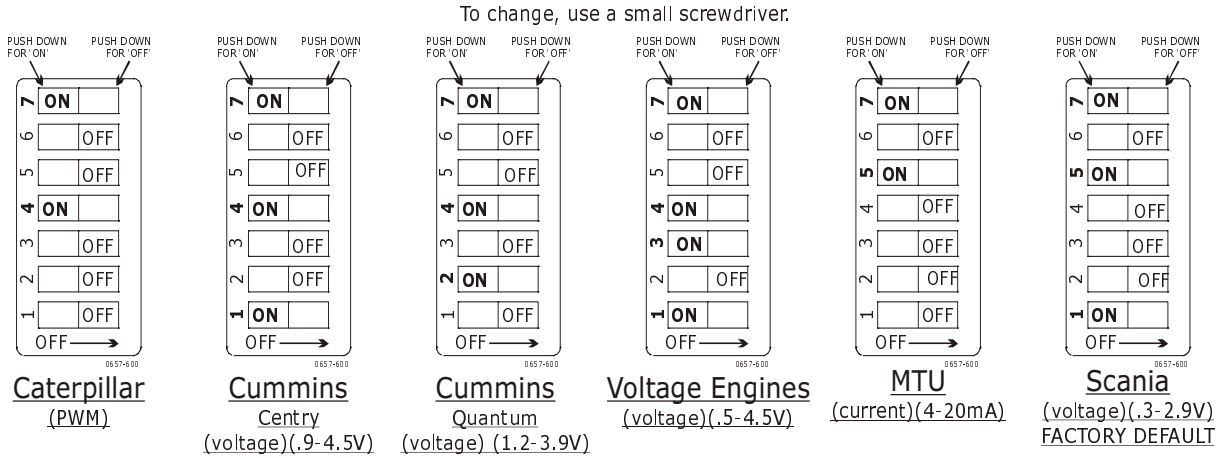
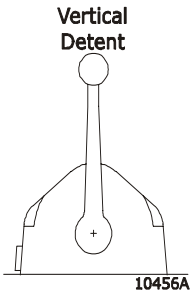


Figure 23: Dip Switch Setting Engine Signal Selection

E) Store the value that has been set by depressing the PB1 located on the Auxiliary Circuit Board. (Refer to the Figure 13:, page 25, for location of PB1)

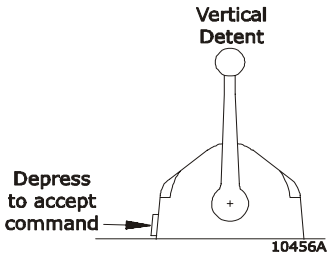
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.

F) Reset all of the Dip Switches to the Off position.



G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.
- 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.

H) Take command at the Station.

- The LED will light; indicating Station is in command.

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

6.10 TROLLING VALVE TYPE SELECTION (NORMAL / INVERSE)

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

NOTE: Processor default is Normal Type. Inverse Selection must be setup. Once Inverse Type Selection is made, to change back to a Normal Type Selection follow all of the setup steps using the Normal Dip Switch setting instead of the Inverse Dip Switches.

Refer to Table 1: to select the correct setup for the trolling valve used with this application.

A **Normal Type** Trolling Valve operates by increasing pressure to the gear as the current signal is increased to the Troll Solenoid.

An **Inverse Type** Trolling Valve requires a signal that is inverse to the Normal Type. As current increases to the Troll Solenoid, the pressure will decrease to the gear.

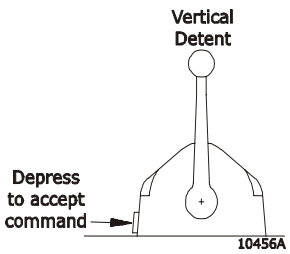
Table 1: Trolling Valve Type Selection

Troll Valve Normal	Troll Valve Inverse
Reintjes ZF 88 and lower (formerly HBW & HSW Series)	Twin Disc 6000 Series ZF 220 and higher (formerly IRM & BW Series)

NOTE: For Twin Disc 6000 Series Gears, the Troll ON/Off signal will not be used, see System Drawing in Appendix C.

The Troll Valve selection is preset at the factory for a **Normal** trolling valve.

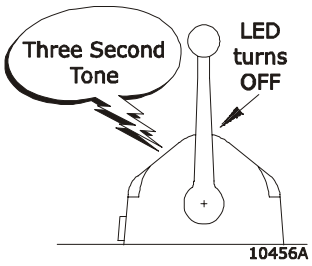
To select Troll Valve Inverse set the Dip Switches on the Processor Main Circuit Boards using the following steps.



A) Take command at a Station.

B) Ensure the Control Head lever is in the vertical detent.

C) Enable Setup Mode by closing Jumper 2 on the Main Circuit Board.



- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State ◦ before continuing with the next Step.

D) Place the appropriate Dip Switches On for Inverse or Normal selection.

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. IF THE TONE AND CLICKING CONTINUES place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State ◦. Begin Step C) to enable Setup Mode again.

- Refer to Figure 24: for the Dip Switch settings.
- Refer to Figure 18:, page 32, for the location of the Dip Switch.

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

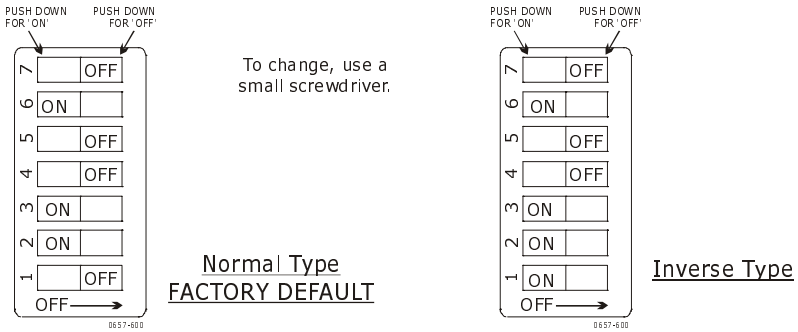
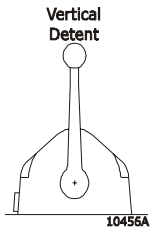


Figure 24: Dip Switch Setting Troll Valve Type Selection [Normal/Inverse]

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to the Figure 18:, page 32, 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.

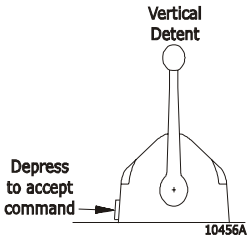
F) Reset all of the Dip Switches to the Off position..



G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.

H) Place Jumper 2 in the Open State ○ ◦.



- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

I) Take command at the Station.

- The LED will light; indicating Station is in command

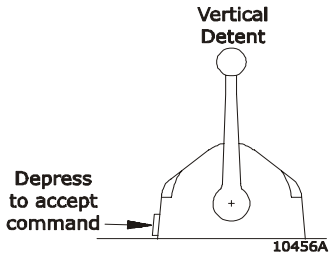
CAUTION: The setting on all Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) applications.

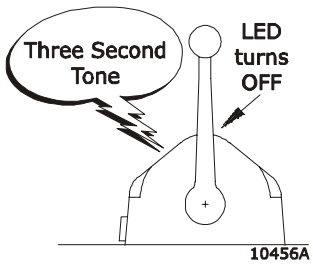
6.11 TROLL ALLOWED/NOT ALLOWED

CAUTION: The setting on all Processors Main Circuit Boards <u>MUST</u> 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) Take command at a Station.

B) Ensure the Control Head lever is in the Neutral position.

C) Enable Setup Mode by closing Jumper 2 on the Main Circuit Board.

- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 20:, page 34)

  and place Jumper 2 in the Open State . Continue with Step B) again.

D) Place the appropriate Dip Switches ON for Troll Allowed / Not Allowed required for this application.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State . Begin Step B) to enable Setup Mode again.

- Refer to Figure 25: for the Dip Switch settings.
- Refer to Figure 18:, page 32, for the location of the Dip Switch

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

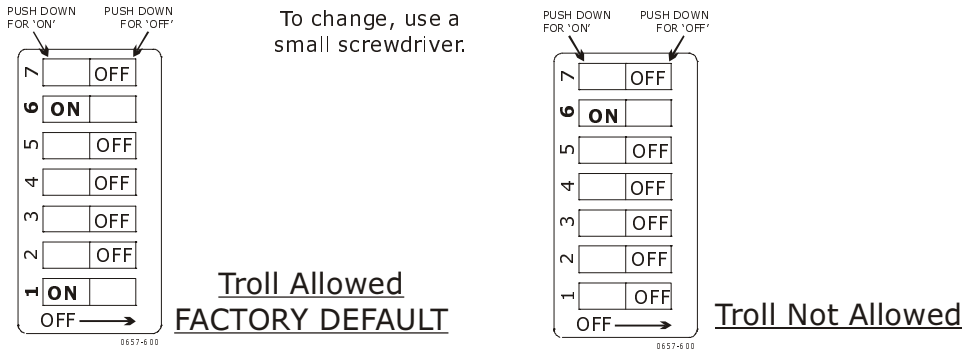
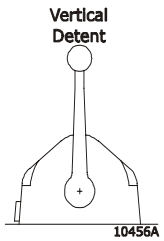


Figure 25: Dip Switch Setting Troll Allowed/Not Allowed

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 18:, page 32, for location of PB1)

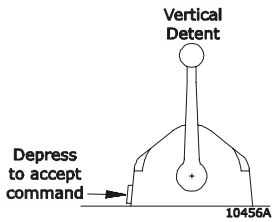
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.

F) Reset all of the Dip Switches to the Off position.



G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.



H) Place Jumper 2 in the Open State ○ ○.

- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

I) Take command at the Station.

The LED will light; indicating Station is in command.

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

6.12 CONTROL HEAD DEGREES OF TROLLING RANGE:

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

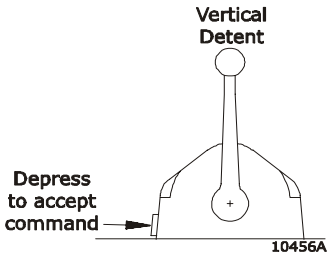
Two Troll Range settings are available:

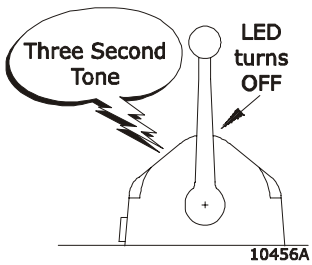
- 20 degrees
- 35 degrees

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

Refer to Section 2.6 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) Take command at a Station.

B) Ensure the Control Head lever is in the Neutral position.

C) Enable Setup Mode by closing Jumper 2 on the Main Circuit Board.

- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.

- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State. Continue with Step B) again.

D) Place the appropriate Dip Switches ON for Troll Range 20 or 35 as required for this application.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State . Begin Step B) to enable Setup Mode again.

- Refer to Figure 26: for the Dip Switch settings.
- Refer to Figure 18:, page 32, for the location of the Dip Switch

NOTE: All the Dip Switches are preset and placed in the Off position at the Factory.

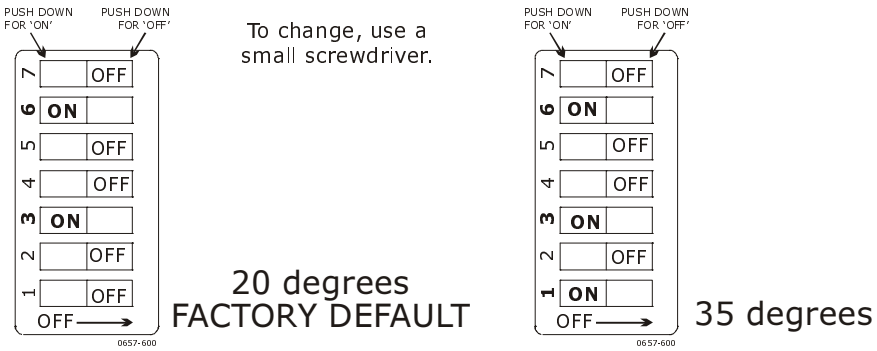
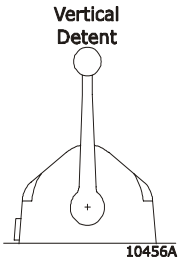


Figure 26: Dip Switch Setting Troll Range 20/35 Degrees

E) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 18:, page 32, 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.

F) Reset all of the Dip Switches to the Off position.

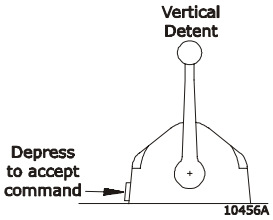


G) Ensure Control Head lever is in the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step.

H) Place Jumper 2 in the Open State ◦ ◦.

- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.



I) Take command at the Station.

- The LED will light; indicating Station is in command.

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

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 Station.

D) Perform each of the following steps on all Control Heads.

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

2. Place the Control Head levers in the Neutral detent position.

3. Depress and hold the transfer button.

4. Move the Control Head levers to the Ahead detent position before releasing the transfer button.

5. The red indicator light on the Control Head should blink, indicating ClearCommand has been placed in Warm-up Mode. Warm-up Mode only operates in the Ahead direction.

   - If the red indicator light blinks, continue with Control Head testing

   - If the red indicator light does not blink, check connections as stated in Section 5.7, page 60.

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 5.3.3, page 20.

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 Jumper 2 on the Main Circuit Board Closed .

- Verify engine(s) will not start.

E) Place Jumper 2 on the Main Circuit Board Open .

F) 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 Installation Section 5.5.2 on Main Engine Speed Control and the Appendix C Drawing.

NOTE: Prior to adjustments, the correct Engine Signal Selection should be made as shown in the Set-up Procedures Section 6.9.

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)	0.90- 4.10 VDC
Scania	0.30- 2.90 VDC
Volvo	0.20- 3.50 VDC

Current

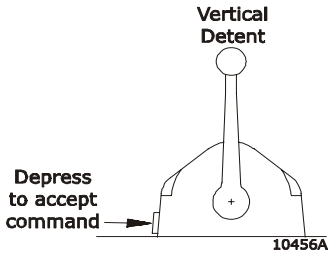
MAN & MTU	4.00- 20.00 mA

PWM

Caterpillar	10- 90% Duty Cycle @ 500 Hz

7.3.1 Throttle Minimum Signal (Engines Stopped)

Change the throttle minimum signal by:

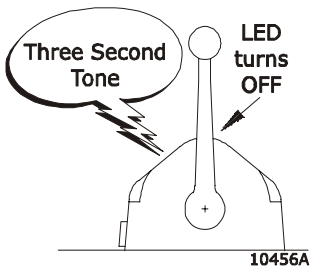


A) Take command at a Station.

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

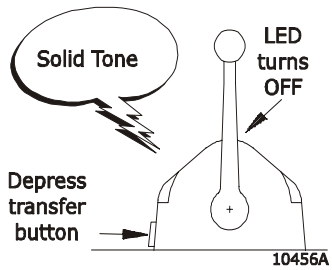
C) Ensure that Potentiometer R7 is in the fully counter clockwise position.

- Refer to Figure 13:, page 25, or the Drawing in Appendix C for R7 location.



D) Enable Set-up Mode by closing Jumper 2 on the Main Circuit Board.

- When Set-up Mode is enabled all Control Heads will emit a three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State. Continue with Step B) again.



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.

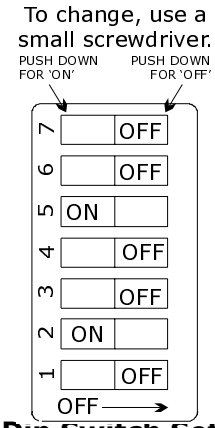


Figure 27: Dip Switch Setting Throttle Minimum

F) Place the appropriate Dip Switches On to ready the Processor for adjustment.

- Refer Figure 27: for the Dip Switch settings of Throttle Minimum.
- Refer to Figure 13:, page 25, for the location of the Dip Switch.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ○ ○. Begin Step B) to enable Set-up Mode again.

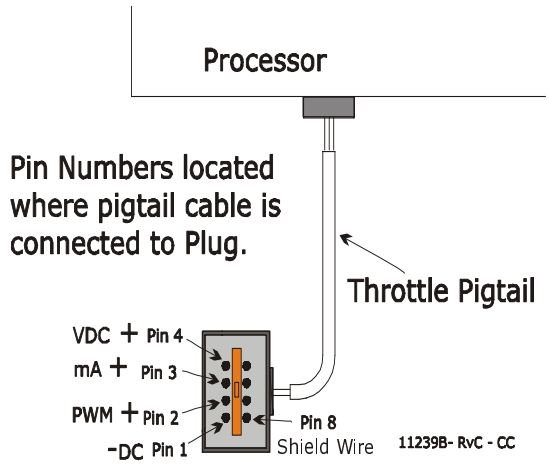


Figure 28: Throttle Connector at Processor Pigtail

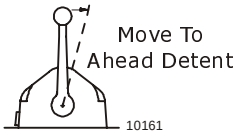
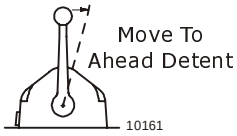
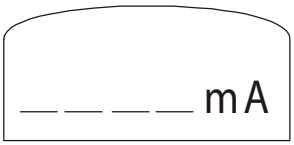
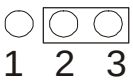
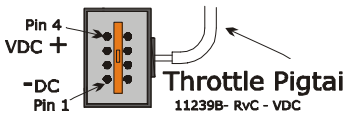
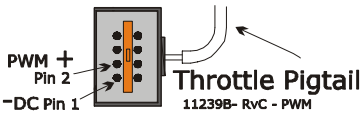
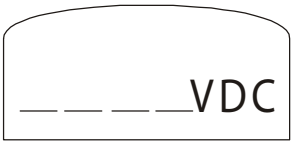
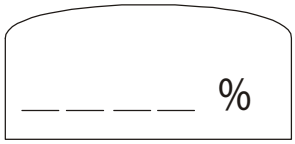
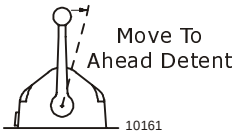
G) Adjust Throttle Minimum Output using the PWM, Voltage, or Current steps outlined in **Table 2:**

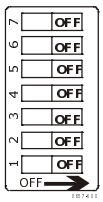
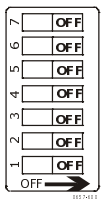
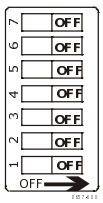
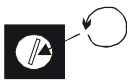
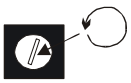
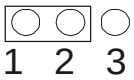
To Measure Throttle Signals:

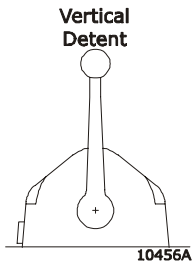
8 Pin Throttle Connector at the Processor Pigtail

PIN 1 – DC Return
PIN 2 – PWM +
PIN 3 – mA (current) +
PIN 4 – VDC (voltage) +
PIN 8 – Shield Wire

Table 2: Throttle Minimum Output Adjustments

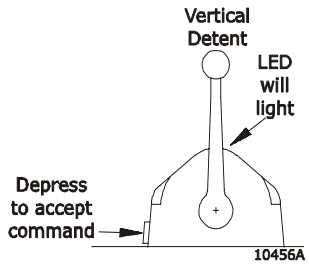
PWM (Duty Cycle)	Voltage (VDC)	Current (mA)
1) Disconnect the Throttle Wire Harness from the Throttle Pigtail at the Processor.	1) Disconnect the Throttle Wire Harness from the Throttle Pigtail at the Processor.	1) Disconnect the positive (+) throttle signal wire from the governor (refer to the System Drawing in Appendix C)
2) Place the Control Head lever into the Ahead Detent position. 	2)Place the Control Head lever into the Ahead Detent position. 	2)Set the Multi meter up as an Amp Meter (current). 
3) Move Jumper 6 on Auxiliary Board to Pins 2-3 (voltage/ current setting). Refer to Figure 13:, page 25 for location. 	3)Connect the Multi meter to Pins 1 and 4 of the Throttle Connector (Refer to Figure 28:) 	3)Connect one Multi-meter probe to the disconnected positive (+) throttle signal wire
4) Connect the Multi meter to PWM Pins on the Throttle Connector (Refer to Figure 28:). 	4) Set Multi meter to the Voltage setting. 	4)Connect the other Multimeter probe to the terminal on the governor.
5)Set Multi meter to Duty Cycle setting. 	5)Rotate Potentiometer R7 slowly clockwise until minimum throttle signal is achieved.	5) Place the Control Head lever into the Ahead detent position. 
6)Rotate Potentiometer R7 slowly clockwise until minimum throttle signal is achieved. Refer to Figure 13:, page 25 for R7 location.	6)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25 for location of PB1) • The motor control relay will click once to confirm the value has been stored.	6)Rotate Potentiometer R7 slowly clockwise until minimum throttle signal is achieved. Refer to Figure 13:, page 25 for R7 location.

7)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25, for location of PB1) • The motor control relay will click once to confirm the value has been stored.	7)Reset all of the Dip Switches to the Off position (Run State). 	7)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25 for location of PB1) • The motor control relay will click once to confirm the value has been stored.
8) Reset all of the Dip Switches to the Off position (Run State). 	8)Return Potentiometer R7 fully counter clockwise.	8)Reset all of the Dip Switches to the Off position (Run State). 
9)Return Potentiometer R7 fully counter clockwise. 	9)Reconnect the Throttle Wire Harness to the Throttle Pigtail at the Processor.	9)Return Potentiometer R7 fully counter clockwise. 
10) Replace Jumper 6 on Auxiliary Board to its original position. 		10)Reconnect the positive (+) throttle signal wire from the governor
11)Reconnect the Throttle Wire Harness to the Throttle Pigtail at the Processor.		



H) Return Control Head lever to the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step



I) Open Jumper 2 ◦ ◦.

- A low repetitious rate tone is heard indicating that the Control System is out of Set-up Mode and no Station is in command.

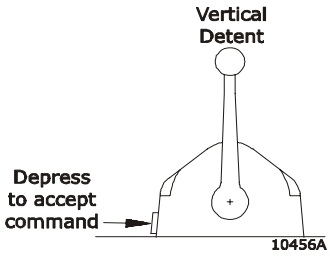
J) Take command at a Station.

- The LED will light indicating Station is in command.

CAUTION: The settings on all Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) applications.

7.3.2 Throttle Maximum Signal

Change the throttle maximum signal by:

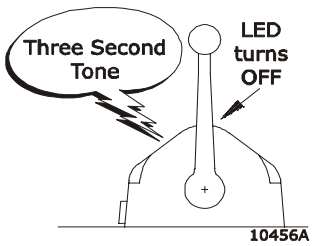


A) Take command at a Station.

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

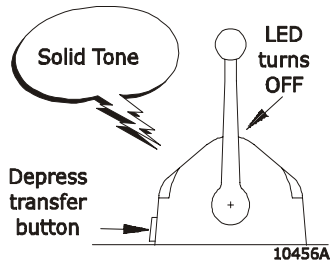
C) Ensure that Potentiometer R7 is in the fully counter clockwise position.

- Refer to Figure 13:, page 25, or the Drawing in Appendix C for R7 location.



D) Enable Set-up Mode by closing Jumper 2 on the Main Circuit Board.

- When Set-up Mode is enabled all Control Heads will emit a three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ◦ ◦. Continue with Step B) again.



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.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State ○ ○. Begin Step B) to enable Set-up Mode again.

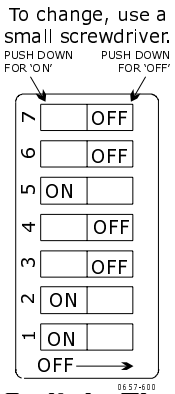


Figure 29: Dip Switch Throttle Maximum

- Refer to Figure 29: for the Dip Switch settings.
- Refer to Figure 13:, page 25, for location of Dip Switch.

G) Adjust Throttle Maximum Output using the PWM, Voltage, or Current steps outlined in Table 3:

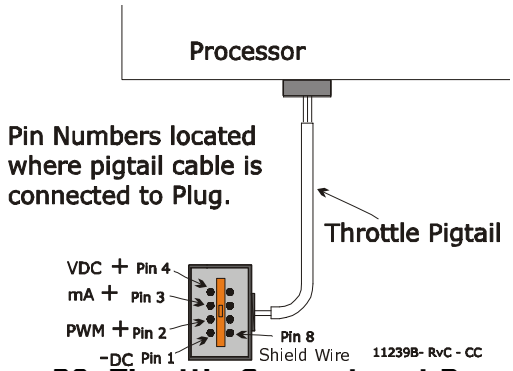


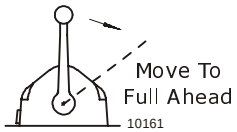
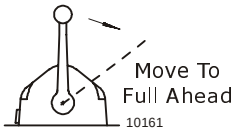
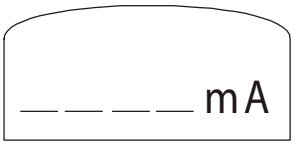
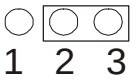
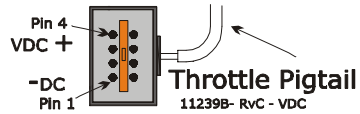
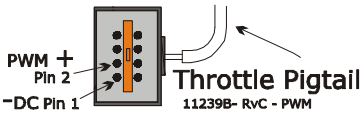
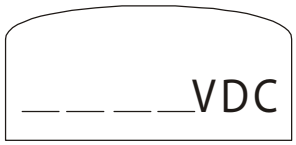
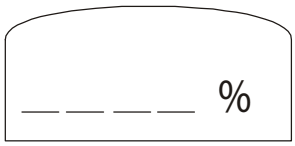
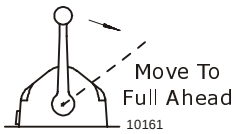
Figure 30: Throttle Connector at Processor Pigtail

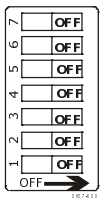
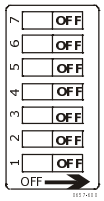
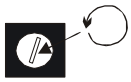
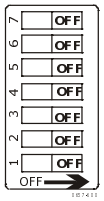
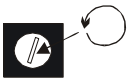
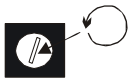
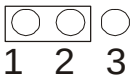
To Measure Throttle Signals:

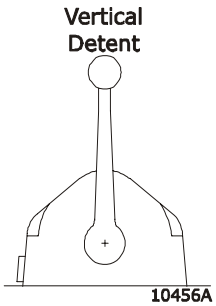
8 Pin Throttle Connector at the Processor Pigtail

PIN 1 – DC Return
PIN 2 – PWM +
PIN 3 – mA (current) +
PIN 4 – VDC (voltage) +
PIN 8 – Shield Wire

Table 3: Throttle Maximum Output Adjustments

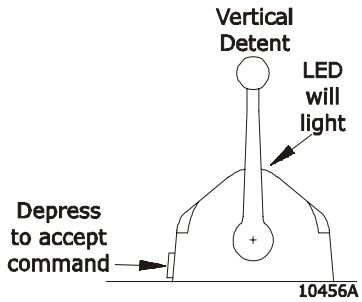
PWM (Duty Cycle)	Voltage (VDC)	Current (mA)
1)Disconnect the Throttle Wire Harness from the Throttle Pigtail at the Processor.	1)Disconnect the Throttle Wire Harness from the Throttle Pigtail at the Processor.	1) Disconnect the positive (+) throttle signal wire from the governor (refer to the System Drawing in Appendix C)
2) Place the Control Head lever into the Full Ahead position. 	2) Place the Control Head lever into the Full Ahead position. 	2)Set the Multimeter up as an Amp Meter (current). 
3) Move Jumper 6 on Auxiliary Board to Pins 2-3 (voltage/ current setting). Refer to Figure 13:, page 25 Appendix C System Drawing. 	3)Connect the Multimeter to Pins 1 and 4 of the Throttle Connector (Refer to Figure 30:). 	3)Connect one Multi-meter probe to the disconnected positive (+) throttle signal wire.
4)Connect the Multimeter to PWM Pins on the Throttle Connector (Refer to Figure 30:). 	4)Set Multimeter to the Voltage setting. 	4) Connect the other Multimeter probe to the terminal on the governor.
5)Set Multimeter to Duty Cycle setting. 	5)Rotate Potentiometer R7 slowly clockwise until maximum throttle signal is achieved. Refer to System Drawing for R7 location.	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.	6)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25 for location of PB1) • The motor control relay will click once to confirm the value has been stored.	6)Rotate Potentiometer R7 slowly clockwise until maximum throttle signal is achieved. Refer to System Drawing for R7 location.

7)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25, for location of PB1) • The motor control relay will click once to confirm the value has been stored.	7)Reset all of the Dip Switches to the Off position (Run State). 	7)Store the value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 13:, page 25, for location of PB1) • The motor control relay will click once to confirm the value has been stored.
8)Reset all of the Dip Switches to the Off position (Run State). 	8)Return Potentiometer R7 fully counter clockwise. 	8)Reset all of the Dip Switches to the Off position (Run State). 
9)Return Potentiometer R7 fully counter clockwise. 	9)Reconnect the Throttle Wire Harness to the Throttle Pigtail at the Processor.	9)Return Potentiometer R7 fully counter clockwise. 
10)Replace Jumper 6 on Auxiliary Board to its original position. 		10)Reconnect the positive (+) throttle signal wire from the governor
11)Reconnect the Throttle Wire Harness to the Throttle Pigtail at the Processor.		



H) Return Control Head lever to the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section.
- If another adjustment setting <u>is not necessary</u>, continue with the next Step



I) Open Jumper 2 .

- A low repetitious rate tone is heard indicating that the Control System is out of Set-up Mode and no Station is in command.

J) Take command at a Station.

- The LED will light indicating Station is in command

.

CAUTION: The settings on all Processors Main Circuit Boards <u>MUST</u> be set the same for Twin Screw (or more) applications.

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, and will cancel warranty if not installed.

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.

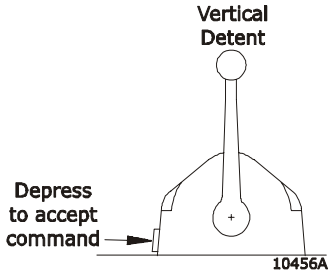
- If the red indicator light blinks, Warm-up Mode has been activated. Continue with Adjustments and Tests.

- If the indicator light does not blink, refer to Section 5.7, page 24 and verify all connections are correct. Make any necessary changes and then repeat this Section.

7.6 HIGH IDLE (ENGINES RUNNING)

7.6.1 Adjustment

Change the High Idle by:

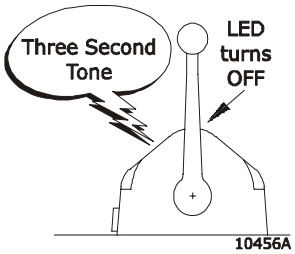


A) Take command at a Station.

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

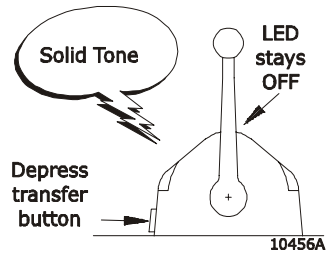
C) Ensure Potentiometer R7 is in the fully counter clockwise position.

- Refer to Figure 13:, page 25, or Appendix C System Drawing for R7 location.



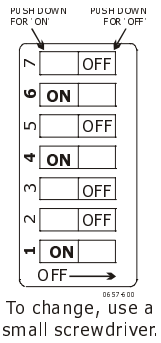
D) Enable Setup Mode by closing Jumper 2 on the Main Circuit Board.

- When Setup Mode is enabled all Control Heads will emit a solid three-second tone.
- The Station-in-Command Control Head LED will turn Off.
- The Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 15:, page 27) and place Jumper 2 in the Open State . Continue with Step B) again.



E) Press the transfer button at the remote station being used during 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 setup procedures.



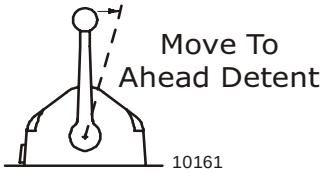
F) Place the appropriate Dip Switches ON to adjust High Idle.

- Refer to Figure 31: for the Dip Switch settings.
- Refer to Figure 13:, page 25, for the location of the Dip Switch.

NOTE: All Dip Switches are preset in the OFF position at the Factory.

Figure 31: Dip Switch Setting High Idle

NOTE: When selecting the Dip Switch setting, a nearly solid tone may sound and the motor control relay will begin clicking. The tone and clicking will continue until a valid switch setting is done. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position and place Jumper 2 in the Open State . Begin with Step B) again.



G) Verify engines are running.

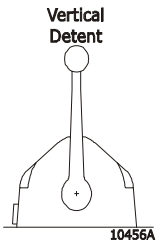
H) Place the Control Head lever(s) to the Ahead detent.

I) Rotate Potentiometer R7 clockwise ↻ while monitoring the engine RPM. Adjust to the desired High Idle RPM

CAUTION: Turning too hard against the stop can damage Potentiometers.

J) Store the value that has been set by depressing PB1 located on the Auxiliary Circuit Board. (Refer to Figure 13:, page 25, for location of PB1)

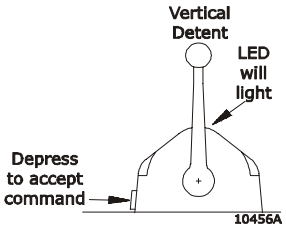
- The motor control relay (located next to the Power Supply Terminal Block) will click once to confirm the value has been stored.
- Throttle cross-bar will return to Idle position.



K) Reset all of the Dip Switches to the Off position.

L) Return Potentiometer R7 to the fully counter clockwise position.

M) Return Control Head lever(s) to the vertical detent.



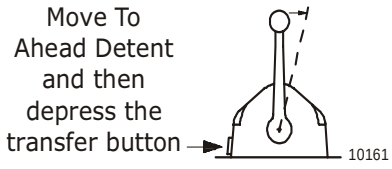
N) Place Jumper 2 in the Open State.

- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

O) Take command at the Station.

- The red LED will light; indicating Station is in command.

7.6.2 Verify High – Low Idle Mode

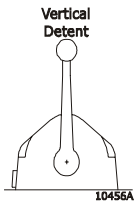


A) Place the Control Head lever(s) in the Ahead position.

B) Depress the transfer button.

- <u>If incorrect</u>, repeat the Section 7.6.1 steps until correct.
- <u>If correct</u>, continue with the next step.

NOTE: Every time the transfer button is depressed while in the Control Head lever is in the Ahead detent the engine Idle should toggle from High to Low Idle Mode or Low to High Idle Mode.



C) Return Control Head lever(s) to the vertical detent.

- If another adjustment setting <u>is necessary</u>, continue with the appropriate adjustment instruction Section

CAUTION: The settings on both Processors Main Circuit Boards <u>MUST</u> be set for Twin Screw applications.

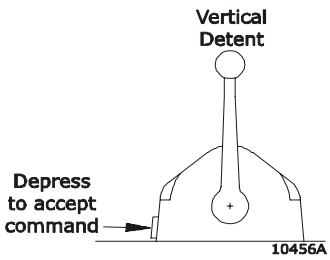
7.7 TROLLING VALVE ADJUSTMENTS (ENGINES RUNNING)

Adjustments of the Trolling Valve Minimum and Maximum Pressure are accomplished at either the dock or underway.

Considerations for dock setup are:

- Vessel Horsepower
- Dock Restrictions

ZF Mathers, LLC. recommends that Minimum Pressure set point at the dock be 30 percent of normal Propeller Shaft RPM, and 30 to 50 percent underway. The range of 30 to 50 percent is based on desired minimum speed for the vessel.



A) Take command at a Station.

B) Ensure the Control Head lever is in the Neutral position.

C)Start the engine(s).

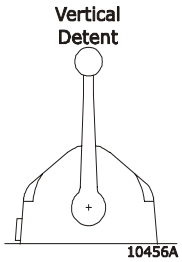
D)When transmission has reached operating temperature, measure and record in Table 4: the Propeller Shaft RPM.

Table 4: Propeller Shaft RPM

Propeller Shaft RPM when engines have reached operating temperature

7.7.1 Troll Minimum & Maximum Pressure

NOTE: When the trolling valve is in the Minimum Trolling Pressure position, Propeller Shaft RPM should be 30 percent of the RPM noted in Table 4: when the clutch is engaged.



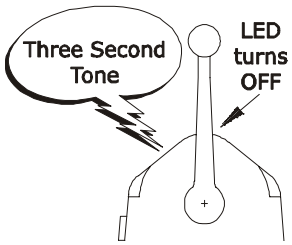
A) Turn Troll Mode On.

B) Place the Control Head lever into the vertical detent.

C) Ensure all SW1 Dip Switches are in the Off position.

D) Ensure Potentiometer R7 is in the fully counterclockwise position.

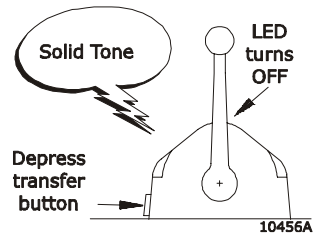
E) (Refer to the System Drawing for location of R7)



- Enable Setup Mode by closing Jumper 2 on the When Setup Mode is enabled all Control Heads will emit a solid three-second tone.

F) Main Circuit Board.

- Also the Run LED on the Processor Main Circuit Board will be unlit for three-seconds.
- The Station-in-Command Control Head LED will turn Off.
- If a nearly solid tone is heard and the motor control relay is clicking place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State . Continue with Step B) again.



G) Press the transfer button at the remote station that will be 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 will be active for setup procedures.

H) Place the appropriate SW1 Dip Switches On for Troll Minimum.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State ○ ○. Begin Step B) to enable Setup Mode again.

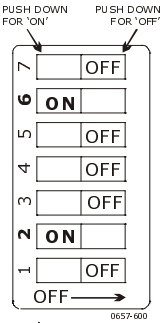
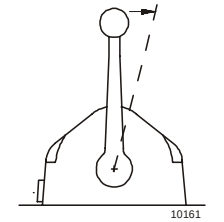


Figure 32: Dip Switch Setting Troll Minimum

- Refer to Figure 32: for the Dip Switch settings of Troll Minimum.
- Refer to Figure 18:, page 32, for the location of the Dip Switch.

NOTE: **All the Dip Switches are preset and placed in the Off position at the Factory.**

I) Place the Control Head lever into the Ahead detent position.



CAUTION: Control Head lever is active during this setup procedure. Ensure the Control Head lever remains in the Ahead Detent during setup.

NOTE: When the trolling valve is in the minimum oil pressure position, Propeller Shaft RPM should be 30 percent of the engaged RPM noted in Table 4:.

J) Rotate Potentiometer R7 clockwise ↻ until Propeller Shaft RPM is 30 percent (30 to 50 percent if underway) of the RPM noted in Table 4:.

- Refer to Drawing in Appendix C for R7 location.

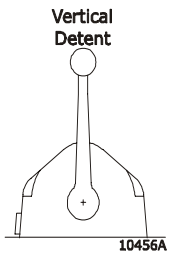
K) Record Propeller Shaft RPM on Table 5:.

Table 5: Minimum Trolling Pressure

Propeller Shaft RPM at minimum trolling pressure at <u>Dock</u>	**Propeller Shaft RPM at minimum trolling pressure <u>Underway</u>**
Approx. 30% of Table 4:	**Approx. 30 - 50% of Table 4:**

L) Store the Minimum Pressure value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 18:, page 32, 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..



M)Reset all of the Dip Switches to the Off position.

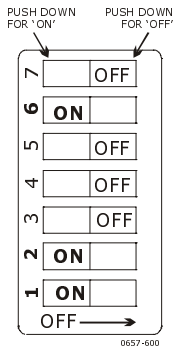
N)Return Control Head lever to the vertical detent.

O)Return Potentiometer R7 to the fully counterclockwise position

NOTE: It is difficult to use a slipping clutch to control shaft RPM between 70 percent and 100 percent of normal shaft RPM. However, it may be desirable to set the Maximum Trolling Pressure position higher than the 70 percent RPM, so that added oil pressure is available when maneuvering.

P) Place the appropriate SW1 Dip Switches On for Troll Maximum.

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. <u>IF THE TONE AND CLICKING CONTINUES</u> place all Dip Switches in the Off position (Refer to Figure 20:, page 34) and place Jumper 2 in the Open State. Begin Step B) to enable Setup Mode again.



To change, use a small screwdriver.

Figure 33: Dip Switch Setting Troll Maximum

- Refer to Figure 33: for Dip Switch settings.
- Refer to Figure 18:, page 32, for the location of the Dip Switch.

Q) Move the Control Head lever to the Ahead detent.

- The trolling valve voltage will move to the Maximum Trolling Pressure position.

R) Rotate Potentiometer R7 clockwise until Propeller Shaft RPM is 70 percent of normal RPM noted in Table 4:. Look for the point at which the clutch is still slipping.

S) Record Propeller Shaft RPM on Table 6:

Table 6: Maximum Trolling Pressure

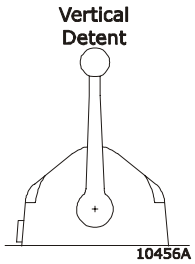
Propeller Shaft RPM at maximum trolling pressure
Approx. 70% of Table 4:

T) Store the Maximum Trolling Pressure value by depressing PB1 located on the Auxiliary Board. (Refer to Figure 18:, page 32, 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.

U) Reset all of the Dip Switches to the Off position.

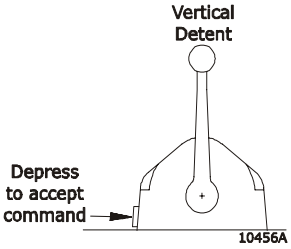
V) Return Potentiometer R7 to the fully counterclockwise position.



W) Return the Control Head lever to 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.

X) Open Jumper 2 .



- A low repetitious rate tone is heard indicating that the Control System is out of Setup Mode and no Station is in command.

Y) Take command at a Station.

- The red LED will light; indicating Station is in command.

NOTE: Final adjustment of the Maximum Trolling Pressure position is done once the vessel is underway. Refer to Section 8.2, page 68.

7.8 TROLLING VALVE

A) Take command at a Station.

B) Toggle On Troll Mode.

C) Verify that the Propeller Shaft RPM is in the Minimum Troll Pressure for desired minimum troll speed for the vessel.

- If correct continue with the next step.
- If incorrect, perform the Troll Minimum Pressure adjustments in Section 7.7.1, page 57, adjusting 30 to 50 percent.

D) Record Propeller Shaft RPM on Table 5:, page 58.

E) Move the Control Head lever to Full Ahead

- The trolling valve will move to the Troll Maximum Pressure position.

F) Verify that the Propeller Shaft RPM is as noted in Table 6:, page 60.

- If correct continue with the next Section.
- If incorrect, perform the Troll Maximum Pressure adjustments in Section 7.7.1, page 57.

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 Section 7.5.2, page 53.

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

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.

The control failure alarm is rated for a maximum of 200 mA. Do not exceed this rating. Normal operation is 21 ohms to DC return, high impedance indicates Alarm Condition.

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 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 installing synchronization. Check Control Head lever and RPM match of the engines through the speed range from IDLE to FULL speed.

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.

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. Refer to Figure 6:, page 9.

9.3.2 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 – Control Head Information sheets regarding synchronization connections.

9.3.3 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 for Auxiliary Board connection.

9.3.4 Control Head Test (Secured to Dock)

A) Unplug the clutch harness at the Processor pigtail.

B) Turn On the engines.

C) Move the Control Head levers Ahead to approximately 1500 RPM.

D) The green indicator light should go to a steady green when engines synchronize.

- If the green indicator does not go steady, verify Control Head and Processor connections.

E) When Test is complete and correct, replug the clutch harness(es) to the Processor(s) pigtail(s).

9.3.5 Synchronization Operation Tests

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

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

10.0 MAINTENANCE

10.1 CONTROL PROCESSOR

Check all terminal connections for signs of corrosion or loose connections.

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
750-L or –R	Left or Right Control Head, Heavy Duty

TWIN SCREW (Synchronization Indication)

460-4	Control Head, 'T' Lever
463-4	Control Head, Chrome Knob Lever
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
MC2000-1	Black Head, Black Levers
MC2000-2	Chrome Head, Chrome Levers
MC2000-3	Gold Head, Gold Levers
MC2000-4	Black Head, Chrome Levers
MC2000-5	Black Head, Gold Levers
MC2000-2L or 2R	Left or Right, Chrome Head, Chrome Levers
MC2000-4L or 4R	Left or Right, Black Head, Chrome Levers
MC2000-5L or 5R	Left or Right, 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)
13432-#	Throttle, Voltage
13565-#	Throttle, Voltage (Cummins Plug)
14148-#	Throttle, Voltage (John Deere Plug)
13494-#	Throttle, Current
13533-#	Throttle, PWM
13239-#	Magnetic Pickup or Pulse Transmitter
13322-#	Clutch – Ahead/Astern/Clutch Power
13324-#	Clutch – Ahead/Astern/Neutral/Clutch Power
13240-#	Clutch – Ahead/Astern/Troll/Clutch Power
14152-#	2 Speed
13422-#	ZF Autotroll
13676-#	ZF Autotroll/MTU
13631-#	Power/Start Interlock/Clutch Pressure/Alarm Circuit
13552-#	Power/Start Interlock/Clutch Pressure
13756-#	Power/Start Interlock
14134-#	ZF CPP Junction Box Cable
14155-#	CPP (Sol pwr, Ahd & Ast Sol, CPP PS, Clutch PS, Comb Mode)
14212-#	CPP (Sol pwr, Ahd & Ast Sol, CPP PS)

ZF Mathers, LLC
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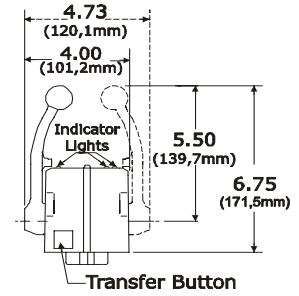
800-546-5455 / 360-757-6265
Fax: 360-757-2500

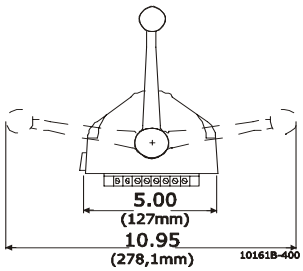
MMC-280 Rev.F 11-00

MicroCommander, ClearCommand 400 & MC2000 Control Head Variations

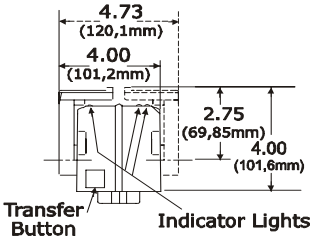
450 - 460 Series

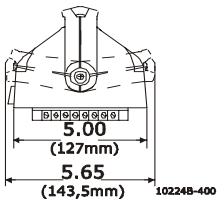
Chrome Lever with Knob



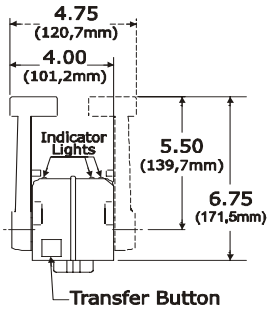


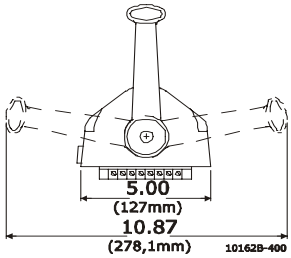
Low Profile Lever



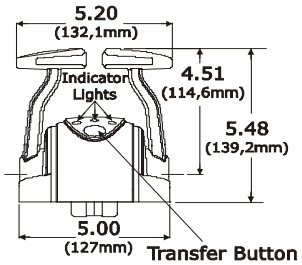


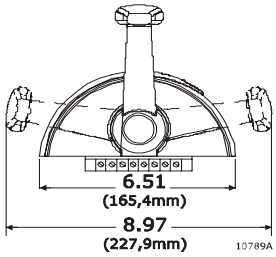
Standard 'T' Handle





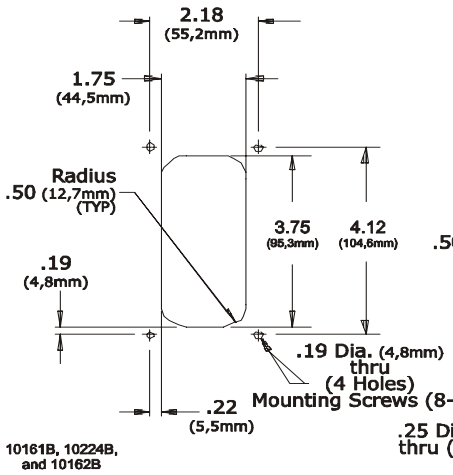
MC2000 Series



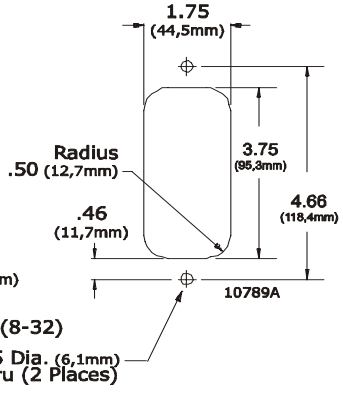


TEMPLATES

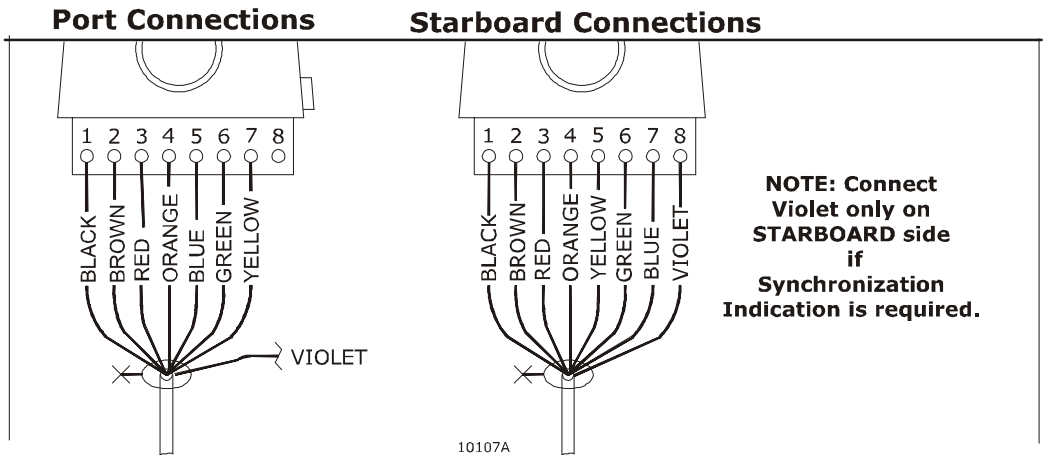
450 - 460 Series



MC2000 Series



450 - 460 Series and MC2000 Series



Standard Cable Connections

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).

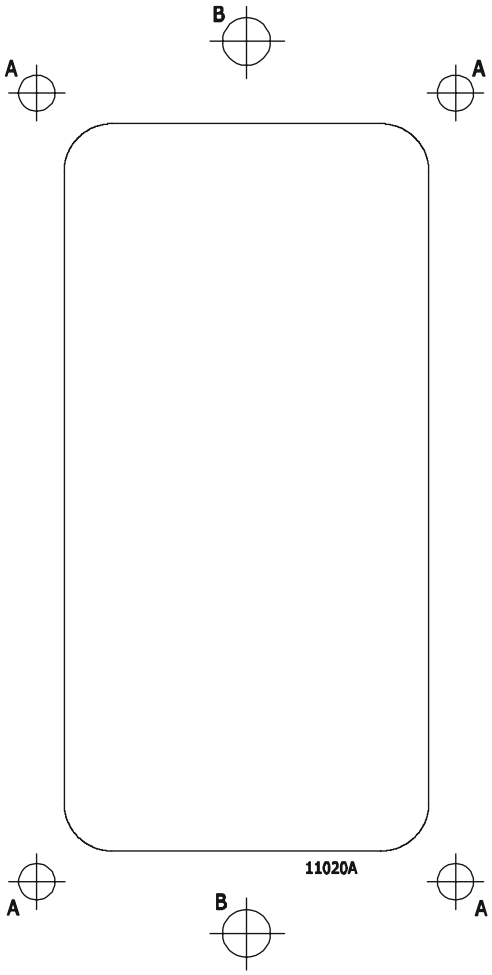
Strip 3/8" (9,5mm) insulation off each wire.

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.

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



"A" HOLES 450 - 460 SERIES: ø.19

"B" HOLES MC2000 SERIES: ø.25

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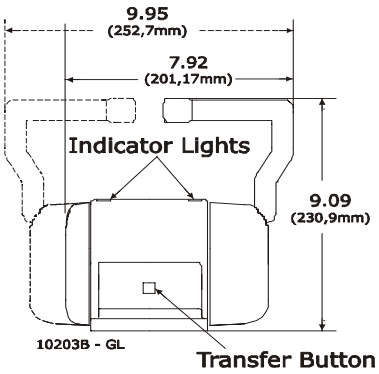
e-mail: zfmathers@zf.com

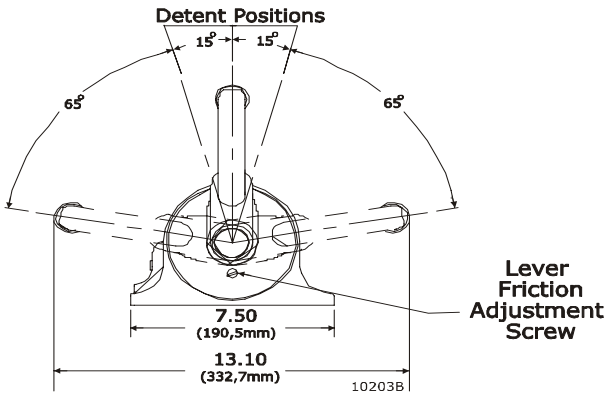
MMC-307 Rev.B 11-00

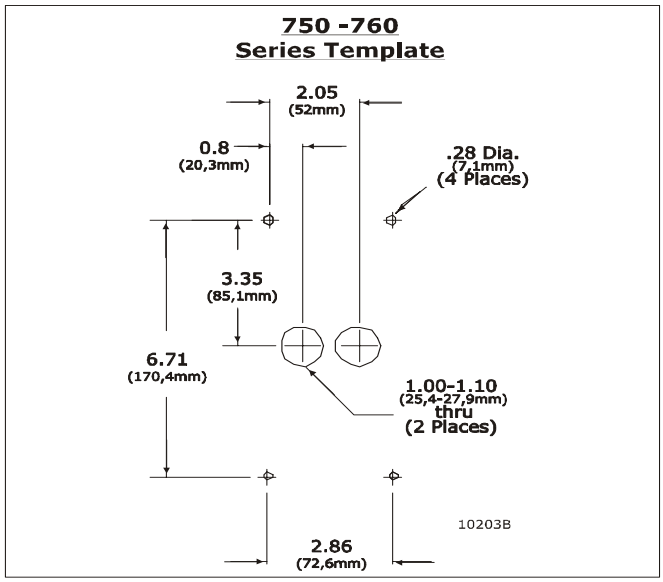
ClearCommand
700 Series Control Head Sheet

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.

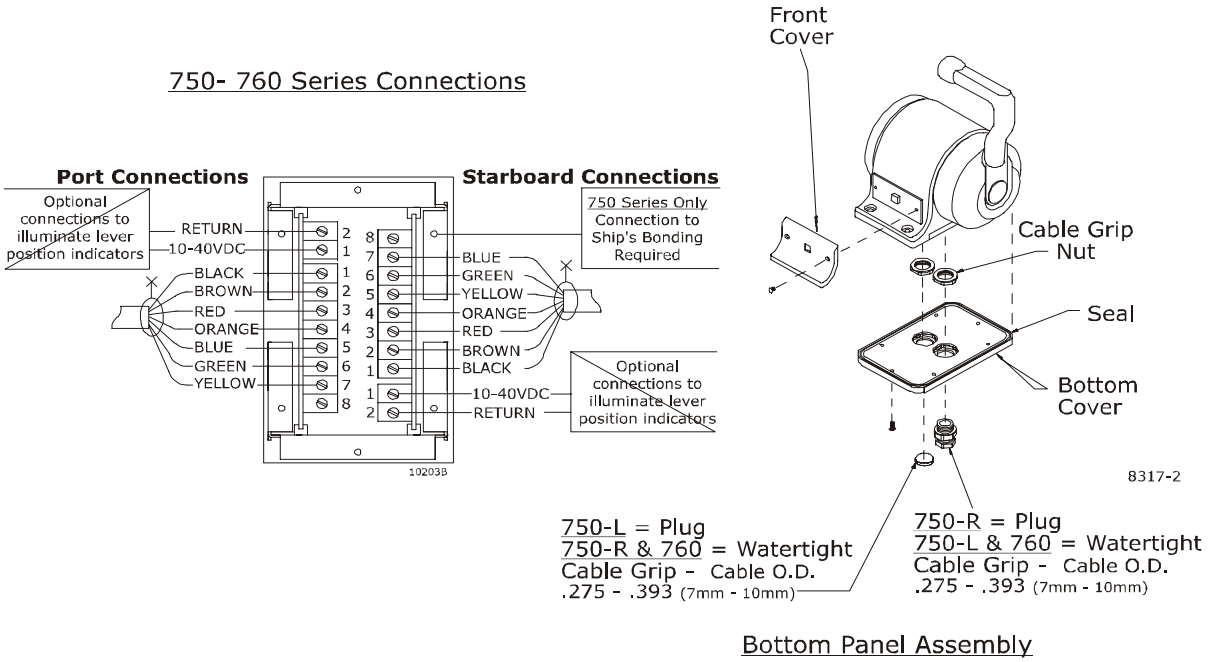
G) Crimp a locking fork terminal (included with each Control Head) to each of the conductors.

H) Make connections to the Control Head as shown below.

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).



Bottom Panel Assembly

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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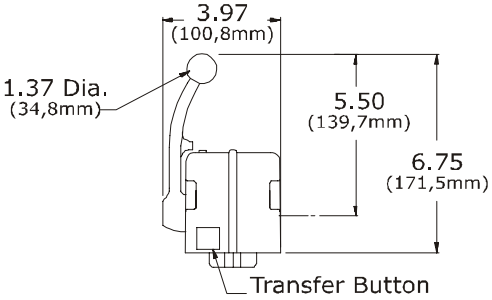
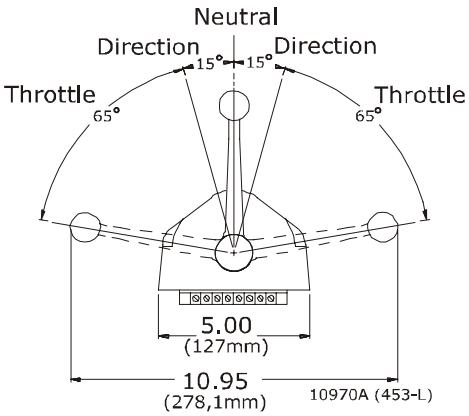
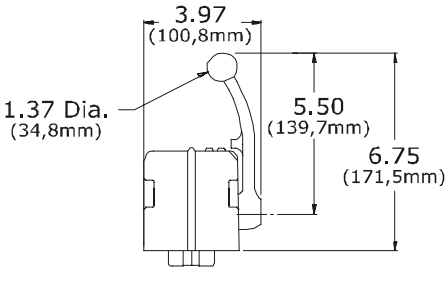
MMC-310 Rev.C 12-00

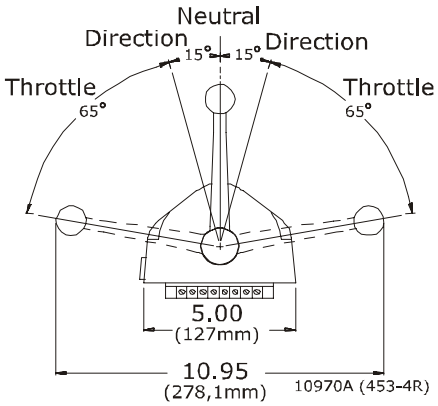
MicroCommander, ClearCommand 464-4 Control Head Sheet





453-3L





453-4R

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).

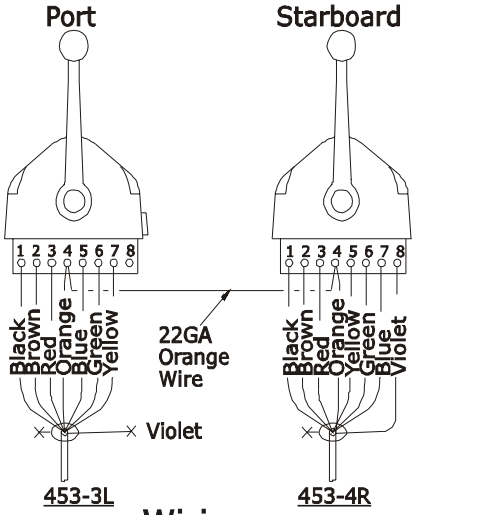
Strip and cut off the shielding and drain wire flush with the end of the PVC cover (the drain wire at the Control Head is not connected to ground).

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

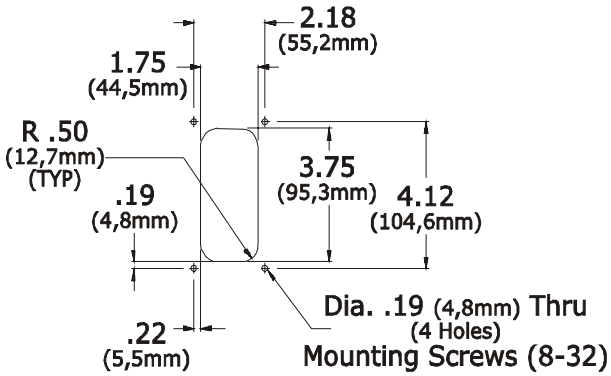
Twist the individual strands of the wires to minimize fraying.

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

Make connections to the Control Heads as shown below.



Wiring 10970A (464-4)



Template 10970

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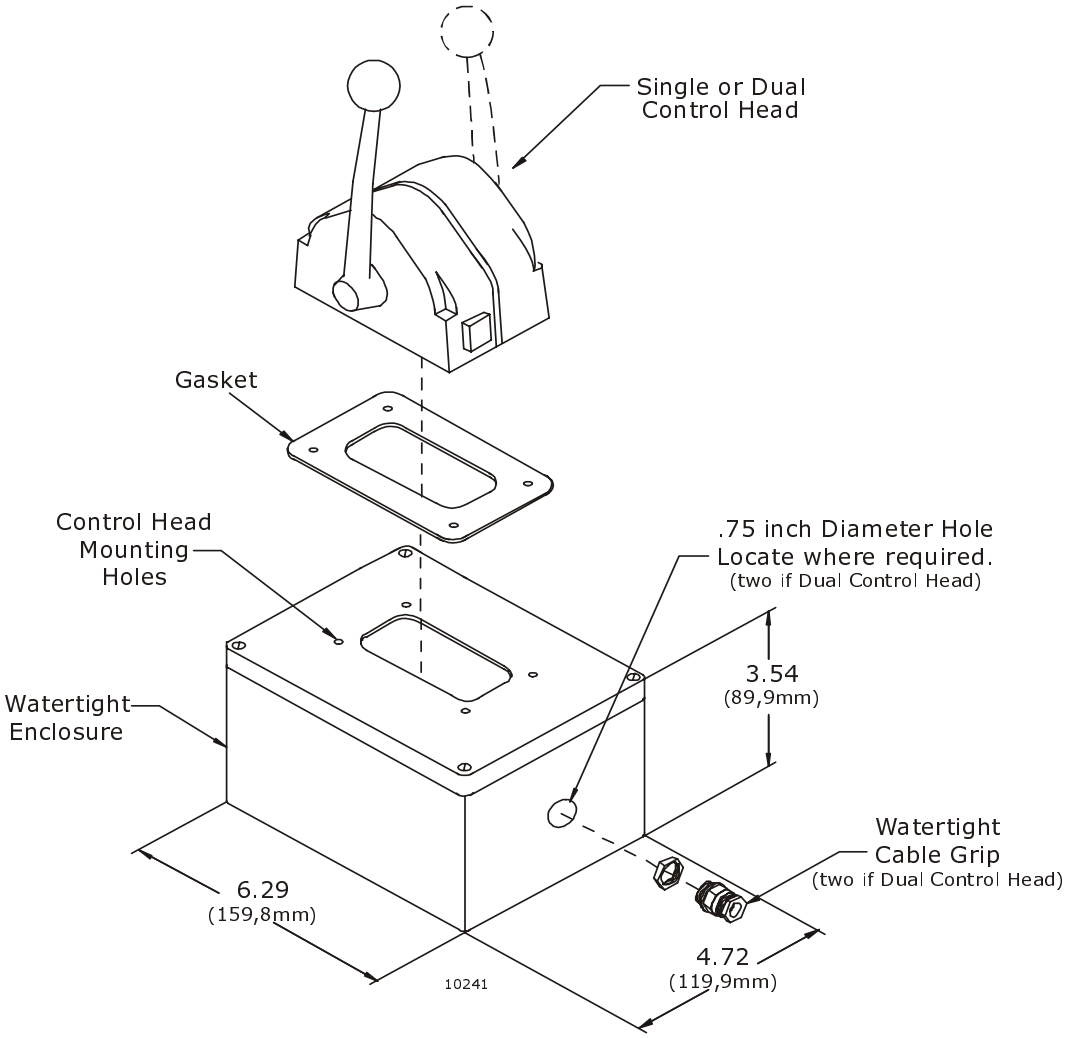
e-mail: zfmathers@zf.com

MMC-279 Rev.A 11-00

MicroCommander/ClearCommand 400 Series Watertight 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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Fax: 360-757-2500

S-214 Rev.- 1/01

MicroCommander, ClearCommand, MasterCommand 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) nut 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

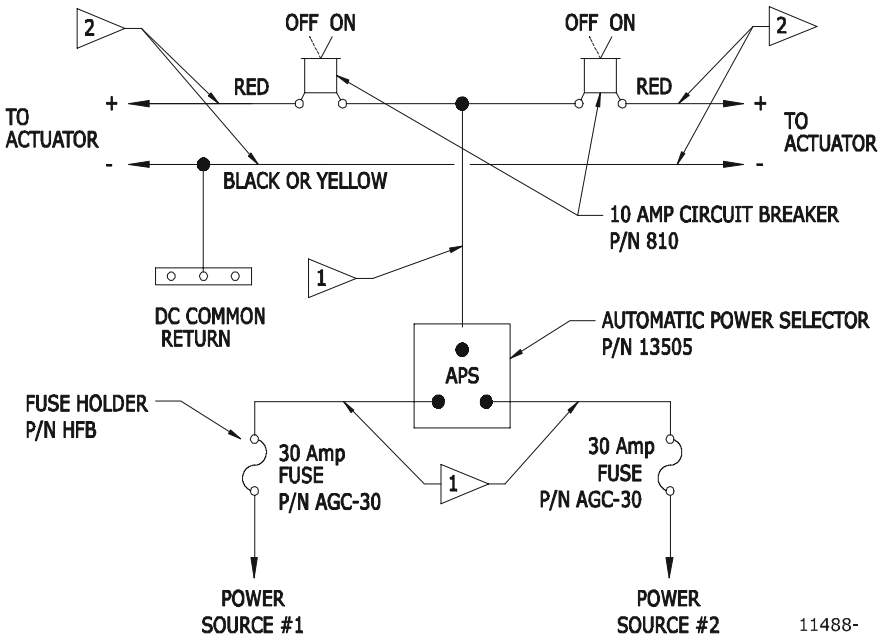
Refer to the installation diagram Figure 1:.

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



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)

Note:

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

Figure 1:

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

Twin Screw 13983 **Single Screw** 13984 Include the following:

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

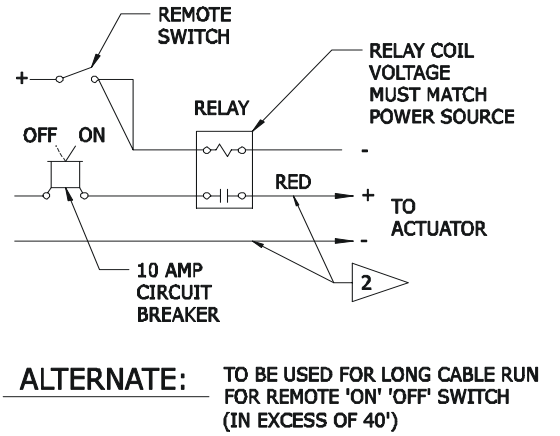


Figure 2:

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e-mail: zfmathers@zf.com

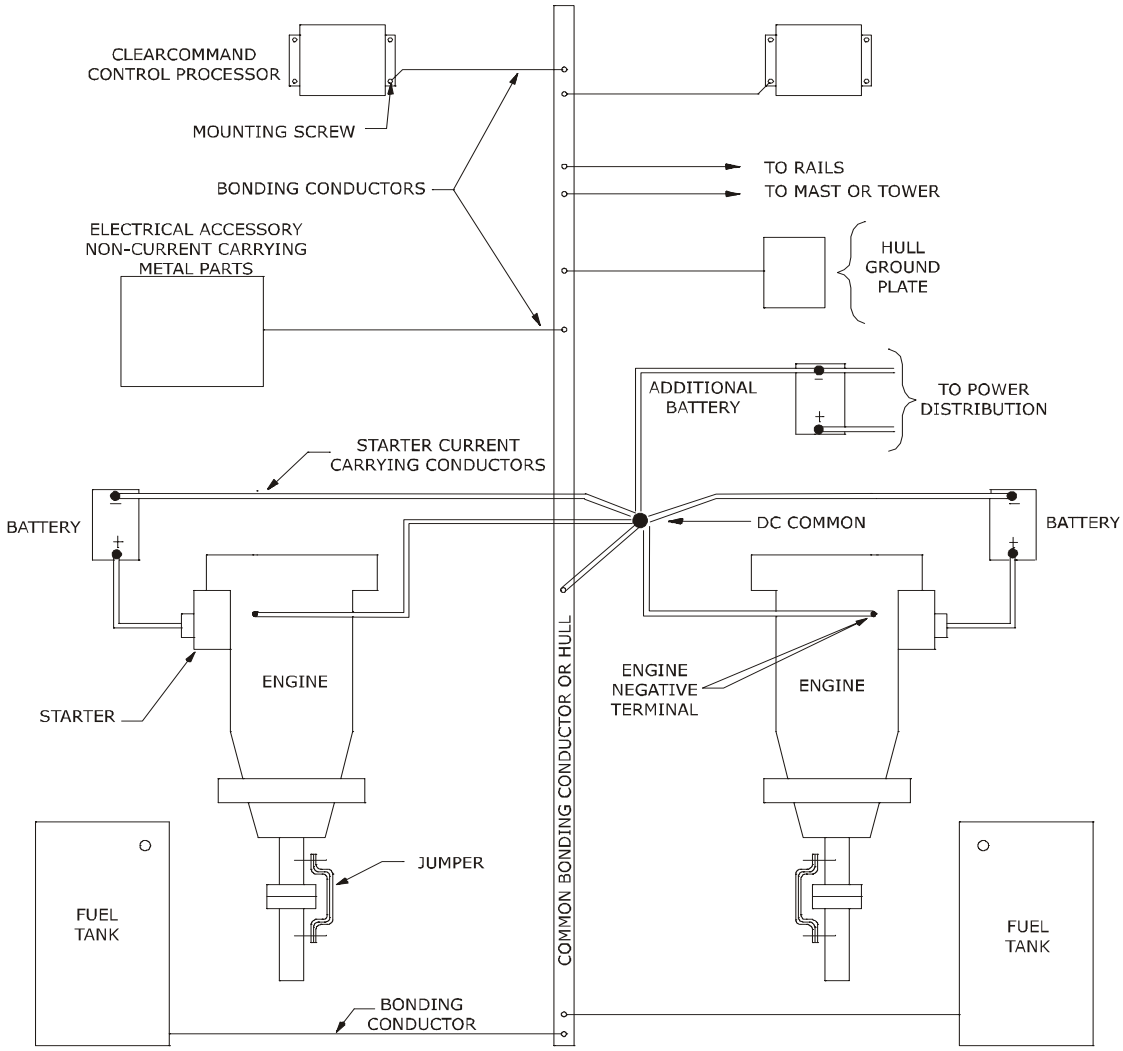
MMC-287 Rev.A 4-00

MicroCommander, ClearCommand, MasterCommand Bonding - A.B.Y.C. 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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Fax: 360-757-2500

MMC-288 Rev.A 2/01

MicroCommander, ClearCommand References and Parts Source

A) REFERENCES

1. American Boat & Yacht Council (ABYC)

   Box 806

   Amityville, NY 11701

   E-1 Bonding of Direct Current Systems

   E-3 Wiring Identification on Boats

   E-9 DC Electrical Systems on Boats

   H-2.4e or 32.4g Ambient Temp. 50 degrees C

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)]
Fuse	P/N 1030 [Bussman (Part No. GDC-1A)]
WAGO Tool	P/N 397 [WAGO (Part No. 236-332)]
Automatic Power Selector	P/N 13505

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e-mail: zfmathers@zf.com

MMC-165 Rev.C 10-00

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.

1.0 Coverage Under Warranty

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

1.1 Year One

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

1.2 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.

2.0 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.

3.0 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, it will return the product to the sender, freight collect.
3. Repair or replacement during the warranty period will not extend the warranty period.

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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e-mail: zfmathers@zf.com

F-226 Rev.A 11-00

MicroCommander, ClearCommand 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:

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, LLC. servicing dealer, or ZF Mathers, LLC. 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 repair.

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 indicated in the Control Head Installation Section of the main manual, Appendix A Control Head Sheets, or the Appendix C Drawing.

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 or install a Control Head Repair Kit

1.3 SYMPTOM - When system is turned ON, one Station's red indicator light blinks. Cannot transfer command to any other Stations.

Cause:

Shorted transfer button.

Remedy:

Measure the DC voltage across Terminals 3 and 4 of the Control Head. The reading should be 4.80 to 5.00 volts. If not, Control Head needs repair.

1.4 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 or install a Control Head Repair Kit.

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 or install a Control Head Repair Kit

1.6 SYMPTOM - THE ENGINE RPM REDUCES TO IDLE, TRANSMISSION TO NEUTRAL, 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.

1.7 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, or install a Control Head Repair Kit.

1.8 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.

1.9 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 or install a Control Head Repair Kit.

1.10 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.

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

1.12 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 Neutral/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 Control Head levers into the Neutral/Idle position and depress the station transfer button.

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

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

Cause:

Control Head is malfunctioning because of loose or unconnected cable connections.

Remedy:

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

If connections are tight and correct, replace the Control Head or install a Control Head Repair Kit.

1.14 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 Auxiliary Circuit. Refer to the main manual for appropriate terminals.

1.15 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 Setup 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.

1.16 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 Setup 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.

1.17 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 for proper switch settings.

1.18 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 Setup & Adjustment Sections of the Technical Manual were not followed exactly.

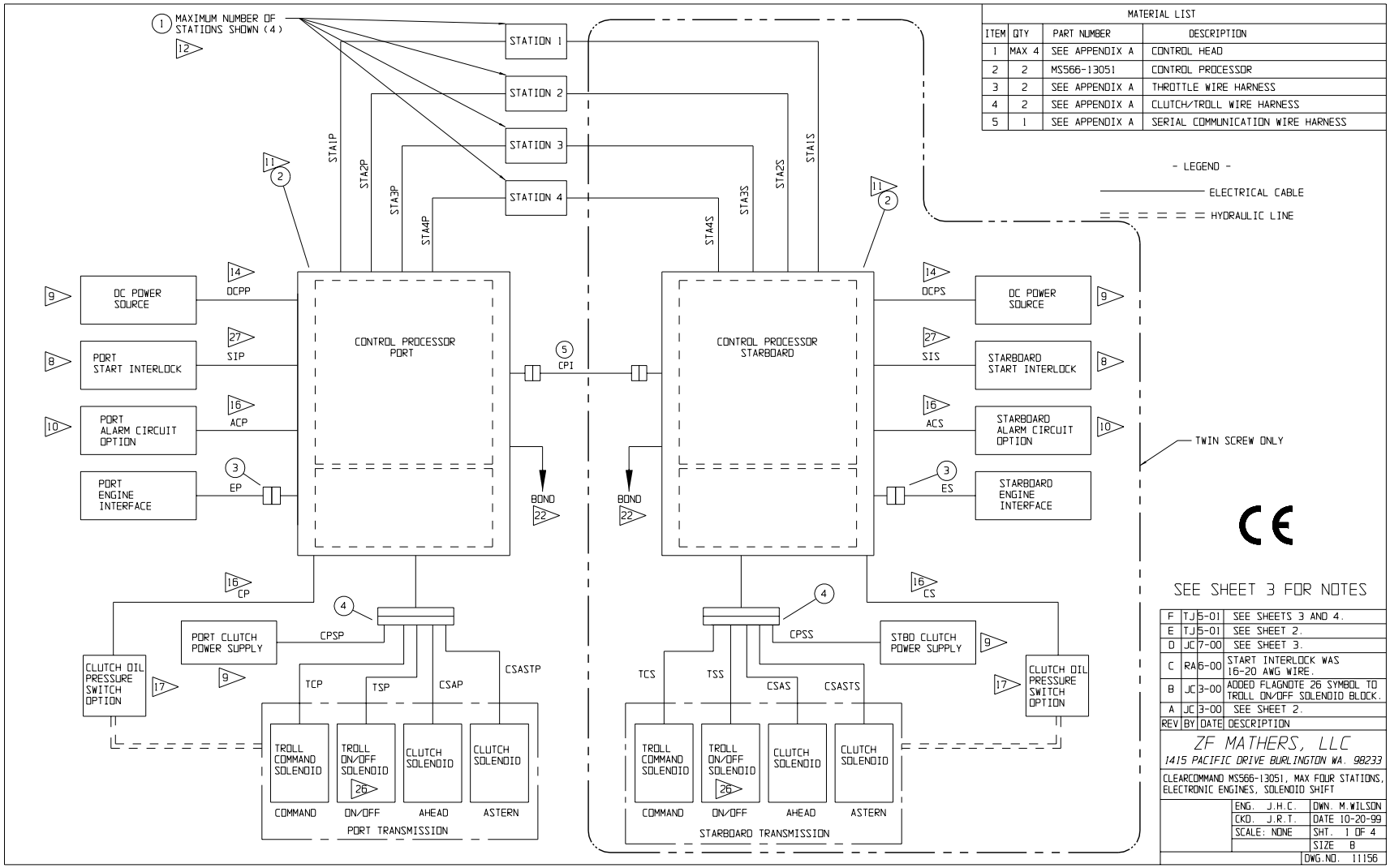
Remedy:

Repeat the setup or adjustment following each step exactly.

APPENDIX B

APPENDIX C.1

Drawing 11156F-1



MATERIAL LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	MAX 4	SEE APPENDIX A	CONTROL HEAD
2	2	MS566-13051	CONTROL PROCESSOR
3	2	SEE APPENDIX A	THROTTLE WIRE HARNESS
4	2	SEE APPENDIX A	CLUTCH/TROLL WIRE HARNESS
5	1	SEE APPENDIX A	SERIAL COMMUNICATION WIRE HARNESS

REV	BY	DATE	DESCRIPTION
F	TJ	5-01	SEE SHEETS 3 AND 4.
E	TJ	5-01	SEE SHEET 2.
D	JC	7-00	SEE SHEET 3.
C	RA	6-00	START INTERLOCK WAS 16-20 AWG WIRE.
B	JC	3-00	ADDED FLAGNOTE 26 SYMBOL TO TROLL ON/OFF SOLENOID BLOCK.
A	JC	3-00	SEE SHEET 2.

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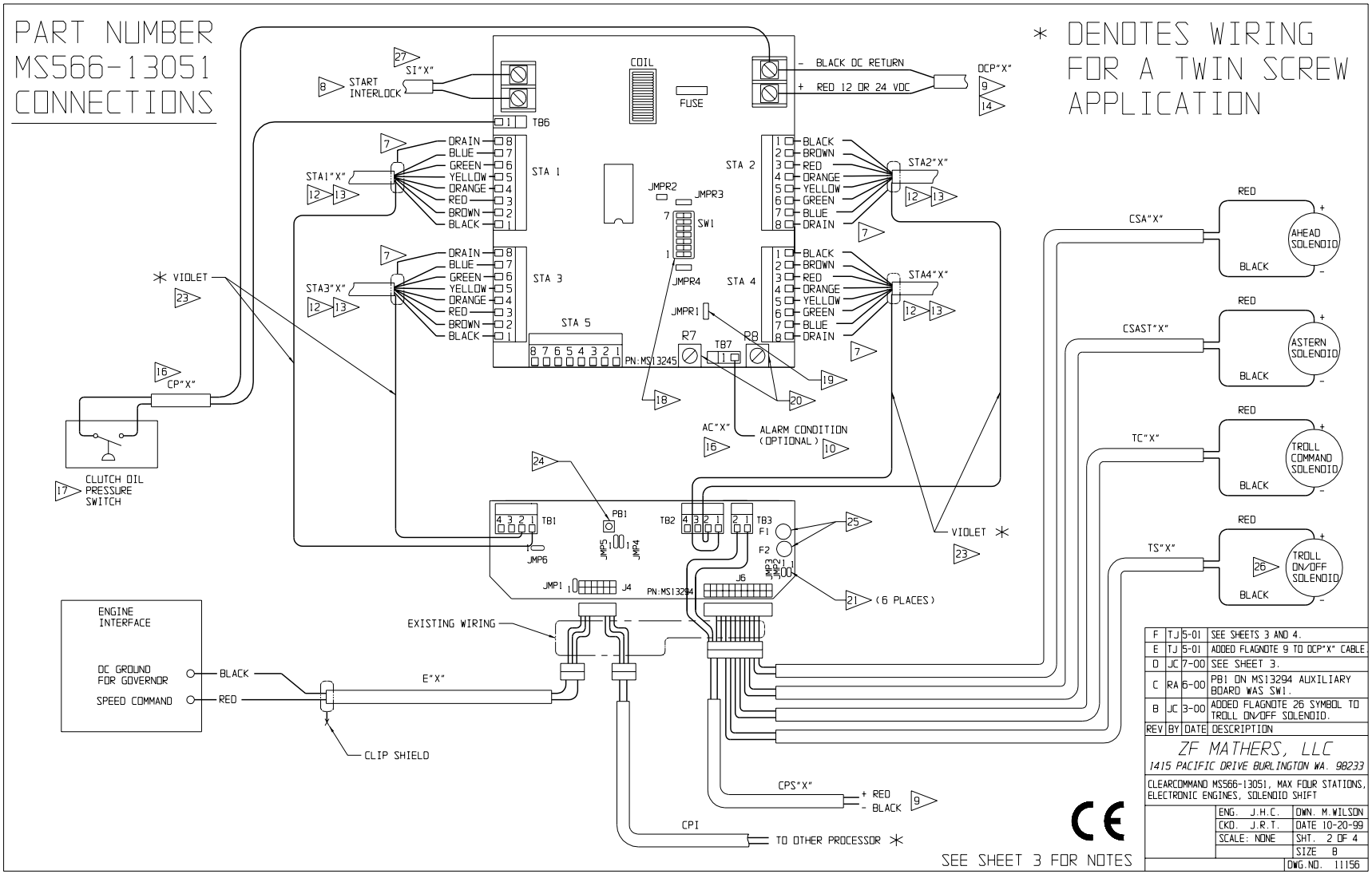
CLEARCOMMAND MS566-13051, MAX FOUR STATIONS, ELECTRONIC ENGINES, SOLENOID SHIFT

ENG. J.H.C.	DWN. M.WILSON
CKD. J.R.T.	DATE 10-20-99
SCALE: NONE	SHT. 1 OF 4
	SIZE B
	DWG.NO. 11156

Drawing 11156F-2



REV	BY	DATE	DESCRIPTION
F	TJ	5-01	SEE SHEETS 3 AND 4.
E	TJ	5-01	ADDED FLAGNOTE 9 TO DCP"X" CABLE
D	JC	7-00	SEE SHEET 3.
C	RA	6-00	PB1 ON MS13294 AUXILIARY BOARD WAS SW1.
B	JC	3-00	ADDED FLAGNOTE 26 SYMBOL TO TROLL ON/OFF SOLENOID.

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SCALE: NONE	SHT. 2 OF 4
	SIZE B
	DWG.NO. 11156

Drawing 11156F-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. CABLES DCP'X' AND CPS'X' MUST COME FROM THE SAME BREAKER.

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> REMOVE THE JUMPER IF CONNECTING A CONTROL HEAD TO THIS TERMINAL BLOCK. PLACE A JUMPER BETWEEN PINS 5 AND 6 ON THE TERMINAL BLOCK IF REMOVING A CONTROL HEAD FROM THIS STATION

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.

- NOTES - (CONTINUED)

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
OFF	OFF	ON	OFF	ON	OFF	ON	3 SCREW
ON	OFF	ON	OFF	ON	OFF	ON	4 SCREW
OFF	ON	ON	OFF	ON	OFF	ON	5 SCREW
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 - 0.5 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)
ON	OFF	OFF	ON	OFF	ON	OFF	HIGH IDLE SETUP (R7)
OFF	OFF	OFF	ON	OFF	OFF	ON	CATERPILLAR (PWM) (8-92%)
ON	OFF	OFF	ON	OFF	OFF	ON	CUMMINS CENTRY (VOLTAGE) (.9-4.5V)
OFF	ON	OFF	ON	OFF	OFF	ON	CUMMINS QUANTUM (VOLTAGE) (1.2-3.9V)
ON	OFF	ON	ON	OFF	OFF	ON	VOLTAGE (.5-4.5V)
OFF	OFF	OFF	OFF	ON	OFF	ON	MTU (CURRENT) (4-20mA)
ON	OFF	OFF	OFF	ON	OFF	ON	SCANIA (VOLTAGE) (.3-2.9V)
OFF	OFF	ON	OFF	ON	ON	OFF	SYSTEM ID #1
ON	OFF	ON	OFF	ON	ON	OFF	SYSTEM ID #2
OFF	ON	ON	OFF	ON	ON	OFF	SYSTEM ID #3
ON	ON	ON	OFF	ON	ON	OFF	SYSTEM ID #4
OFF	OFF	OFF	ON	ON	ON	OFF	SYSTEM ID #5
OFF	ON	ON	OFF	OFF	ON	OFF	TROLL VALVE NORMAL
ON	ON	ON	OFF	OFF	ON	OFF	TROLL VALVE INVERSE
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
ON	ON	ON	ON	ON	ON	ON	RESET ALL PARAMETERS TO FACTORY DEFAULT VALUES

- NOTES - (CONTINUED)

19> MAIN BOARD JUMPER SETTINGS: (PRESET FROM PRODUCTION)

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 — NOT FUNCTIONAL

JUMPER 4 — 3 2 1 — NOT FUNCTIONAL

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

CE

REV	BY	DATE	DESCRIPTION
F	TJ	5-01	ADDED SYSTEM ID'S AND 3, 4 AND 5 SCREW SETUP VALUES TO FLAGNOTE 18.
E	TJ	5-01	SEE SHEET 2.
D	JC	7-00	ADDED HIGH IDLE SETUP AND ELECT ENG PROFILES & RESET VALUES TO FLAGNOTE 18.
C	RA	6-00	REVISED FLAGNOTES 19 & 21 TO REFLECT JUMPER ORIENTATION. ADDED FLAGNOTE 27. REVISED FLAGNOTE 24.
B	JC	3-00	FLAGNOTE 18 TABLE, TROLL VALVE "NORMAL" WAS TYPE 1 AND INVERSE WAS TYPE 2. ADDED FLAGNOTE 26.
A	JC	3-00	SEE SHEET 2.

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SCALE: NONE	SHT. 3 OF 4
	SIZE B
	DWG.NO. 11156

Drawing 11156F-4 Notes Page

- NOTES - (CONTINUED)

21> AUXILIARY BOARD JUMPER SETTINGS:

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 — MUST BE IN THIS POSITION FOR PWM THROTTLE

1 2 3 — MUST BE IN THIS POSITION FOR VOLTAGE OR CURRENT THROTTLE

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.

NOTE THAT THE SWITCH WAS LABELED "SW1" ON OLDER VERSIONS OF PN: MS13294 (REV C AND BEFORE).

25> 6 AMP FUSES, F1 - LOGIC CIRCUIT POWER, F2 - CLUTCH POWER.

26> FOR TWIN DISC 6000 SERIES GEARS, THE TROLL ON/OFF SIGNAL IS NOT USED.

27> ELECTRICAL CABLING MUST BE 14-16 AWG.

REV	BY	DATE	DESCRIPTION
F	TJ	5-01	THIS SHEET ADDED

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	SCALE: NONE	SHT. 4 OF 4
		SIZE B
		DWG.NO. 11156