MicroCommander Troll 9001 Installation Manual

MM9001 Rev.C 9/03

MM9001 Rev.- 8/03

9001 Trolling Actuator Installation & Troubleshooting Manual

Preface

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

NOTE: CONTAINS HELPFUL INFORMATION.

CAUTION: Damage to the equipment may occur if these messages are not followed.

WARNING: PERSONAL INJURY MAY RESULT IF THESE MESSAGES ARE NOT FOLLOWED.

ATTENTION

It is important to keep this Manual and the associated MicroCommander or ClearCommand Manual in a safe place for future reference. These manuals contain answers to questions that may arise during operation or installation of the System.

CAUTION: Do not attempt to operate the 9001 Trolling Actuator until the 9110 MicroCommander or the 9000 Series ClearCommand System has been completely installed and tested.

NOTE: THE 9001 TROLL ACTUATOR WILL NOT FUNCTION WITH ANY PROCESSORS OTHER THAN THE 9110 MICROCOMMANDER OR THE 9000 SERIES CLEARCOMMAND PROCESSORS, WHICH REQUIRE EXTERNAL TROLLING VALVE COMMAND.

CAUTION: Disconnect the positive and negative battery leads from the Actuator when welding on the vessel. Failure to do so may damage the circuit board and will void warranty.

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9001 Revisions List

Rev	Date	Revision Description

1 INTRODUCTION

This manual details the installation, adjustments and troubleshooting of single and twin screw applications where one or both of the Reduction Gears have mechanically actuated Trolling Valves installed.

1-1 MANUAL CONTENTS

The purpose of this manual is to explain in detail the following in the order presented:

- System Requirements (Section 1-2)
- Features (Section 1-3)
- System Basics (Section 1-4)
- Operation (Section 2)
- Non-Troll Mode (Section 2-1)
- Troll Mode (Section 2-2)
- Periodic Checks and Maintenance (Section 9)
- ZF Mathers Service Sheets (Appendix A)
- Troubleshooting (Appendix B)
- General System Power Supply Examples (Appendix C)

1-2 SYSTEM REQUIREMENTS

NOTE: THE TROLLING VALVE'S SELECTOR LEVER LOAD MAY NOT EXCEED 40 POUNDS (18 KG.).

NOTE: A PROPELLER SHAFT TACHOMETER IS REQUIRED, IN ORDER TO PROPERLY AND ACCURATELY ADJUST THE TROLLING VALVE.

- **One** 9001 Actuator for a single or twin screw application.
- **A new or existing** 9110 MicroCommander System or 9000 Series ClearCommand System that requires external trolling valve command.
- **One** Power Harness (p/n 15023-X) or **One** two-conductor electric power cable (p/n 212). The Power Harness is available in lengths from 10 feet (3,0m) to 100 feet (30,5m).
- **One** Serial Communication Harness for single screw applications (p/n 13316-X) or **One** Multi-Screw Serial Communication Harness for twin screw applications (p/n 15544-X).
- **One** 33C type Push-Pull cable for single screw trolling valve applications (**Two** are required for twin screw trolling valve applications)
- **A Battery Power Source** of 12 or 24 VDC.

1-3 FEATURES

- Trolling Valve Control from all Remote Stations.
- Troll Mode selectable from all Remote Stations with the push of a the Transfer Button.
- Single Lever Trolling, Throttle and Shift control.
- Visual Trolling Indication.
- Easily configures to various trolling valve requirements.
- Push Button Set Up.
- Audible system diagnostics and status indications.
- Visual system diagnostics, set up, and status indication.
- Pluggable Connections.
- Accepts 12 or 24 VDC power
- Easily retrofitted to 9110 MicroCommander Processor and 9000 Series ClearCommands requiring external trolling valve control.

1-4 SYSTEM BASICS

The Trolling Actuator (hereafter referred to as Actuator) is designed for pleasure and light commercial marine vessels that require remote control of mechanically actuated trolling valves.

- The Actuator System is electronic and requires a 12 or 24 VDC power supply.
- The Actuator has two servos, which can be configured to control single or twin screw trolling applications.

- The Actuator works in conjunction with the 9110 MicroCommander Processor, or a 9000 Series ClearCommand Processor that does not offer integrated Trolling Valve as a feature, to provide control of the vessel's mechanical trolling valve(s). (The MicroCommander and ClearCommand Processors will hereafter be referred to as Processor or corresponding Processor.)
- The Actuator is typically mounted in the engine room area and is connected mechanically to the trolling valve(s) with standard 33C type push-pull cable.

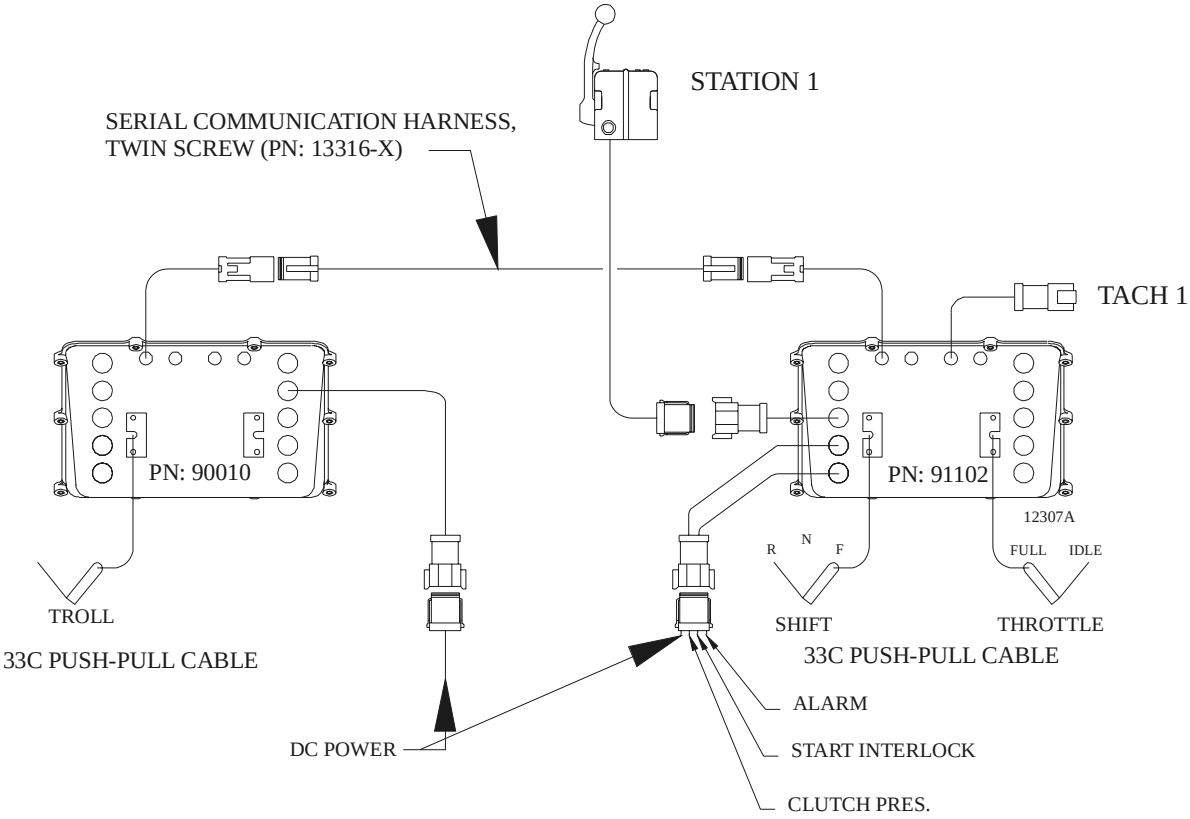


Figure 1-1: Basic Single Screw with Troll

- The Actuator communicates with the Processor(s) through the Serial Communication Harness.
- The majority of the adjustments for the Actuator are performed on the associated Processor(s).

2 OPERATION

The System has two modes of operation, **Troll** and **Non-Troll**. The Actuator's mode on power-up is selectable. (Refer to Section 5-4.1.1, page 5-5).

2-1 NON-TROLL MODE OPERATION

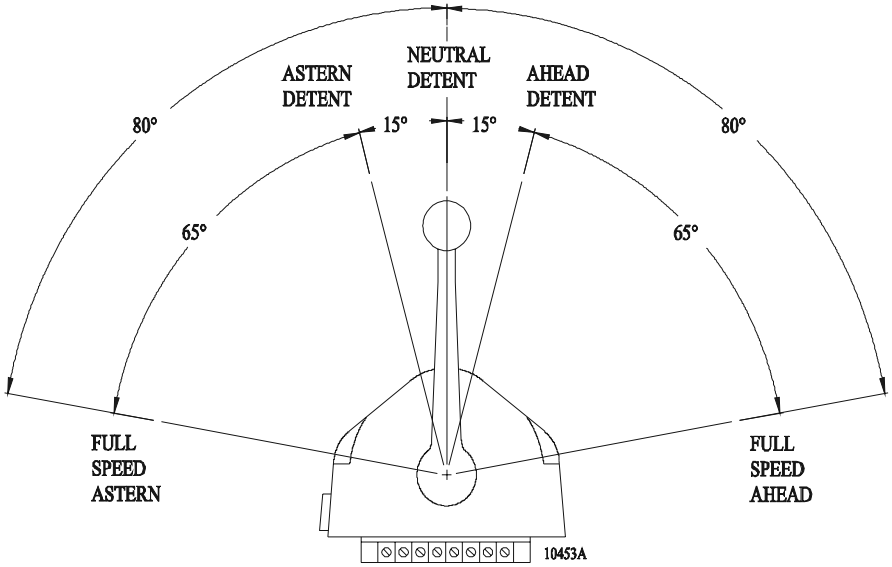


Figure 2-1: Control Head Detents

During **Non-Troll Mode** the Actuator functions as follows:

- When power is applied to the Control System, the Processor's Throttle will command Idle and the Shift will command Neutral. The Actuator's Servos will be positioned to the Full Pressure (Lock-up) position. A Slow Repetitive Tone will be heard from all Remote Stations.
- To take command, the Control Head's lever must be at the Neutral/Idle (vertical) position. When the Transfer Button is pressed, the tone will cease, the red LED indicator light will turn ON and the Start Interlock relay contact will close, allowing the engine to be started.
- Movement of the Control Head's lever Ahead or Astern 15 degrees to the detent, will command Ahead or Astern clutch engagement. The Throttle will remain at Idle and the Troll will remain at the Full Pressure position.
- Further movement of the Control Head's lever Ahead or Astern for the next 65 degrees will command an increase of engine RPM from Idle to Full. The Trolling Valve will remain at the Full Pressure position.

2-2 TROLL MODE

Operation during **Troll Mode** is as follows:

- When power is applied to the Control System, the Processor's Throttle will command Idle and the Shift will command Neutral. The Actuator's Servos will be positioned to the Full Pressure (Lock-up) position. A Slow Repetitive Tone will be heard from all Remote Stations.

- To take command, the Control Head's lever must be at the Neutral/Idle (vertical) position. When the Transfer Button is pressed, the tone will cease, the red LED indicator light will turn ON and the Start Interlock relay contact will close, allowing the engine to be started.
- Troll Mode can be activated or deactivated with the Control Head lever in the Neutral, Ahead or Astern detents.
- Press and hold the Transfer Button until the red LED indicator light begins to blink rapidly.
- Movement of the Control Head lever to the Ahead detent commands Ahead clutch engagement on the main Processor, while the Actuator's servo drives to the Minimum Troll Pressure (Range) position.
- Further movement of the Control Head lever proportionally moves the troll selector lever from Minimum Troll Pressure position to the Maximum Troll Pressure position. The amount of Control Head lever movement dedicated to controlling the slippage of the clutch has four selections (25, 35, 45, or 55 degrees past the Ahead or Astern detents. Refer to Figure 5-8:, Figure 5-9:, Figure 5-10:, and Figure 5-11: on page 5-6).
- Once the Control lever reaches 25, 35, 45, or 55 degrees, the red LED indicator light turns ON solid and the Troll selector lever drives from the Maximum Troll Pressure position to Full Pressure.
- The Throttle can be programmed to remain at Idle throughout the Trolling Range or increase proportionally with the lever movement up to a maximum of 20% of the Throttle range.

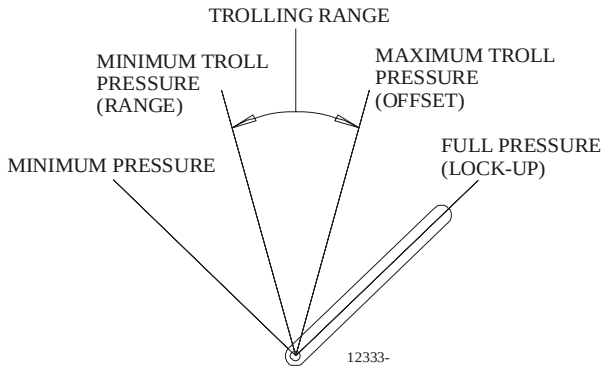


Figure 2-2: Trolling Valve Selector Lever Trolling Range

- Further movement of the Control Head lever:
  - when set to 25 or 35 degrees, increases the Throttle to Full

    or
  - when set to 45 degrees, increases the Throttle to 75% of Full

    or
  - when set to 55 degrees, increases the Throttle to 10% of Full
- When the Control Head lever is brought back to the point where Lock-up occurred, the red LED indicator light again starts blinking rapidly indicating clutch slippage.
- The Troll functions in the same manner in Astern as in Ahead.

3 PLAN THE INSTALLATION

NOTE: ZF MATHERS RECOMMENDS THAT THE SYSTEM BE INSTALLED IN ACCORDANCE WITH ABYC, E-11 AND P24.

3-1 TROLLING ACTUATOR

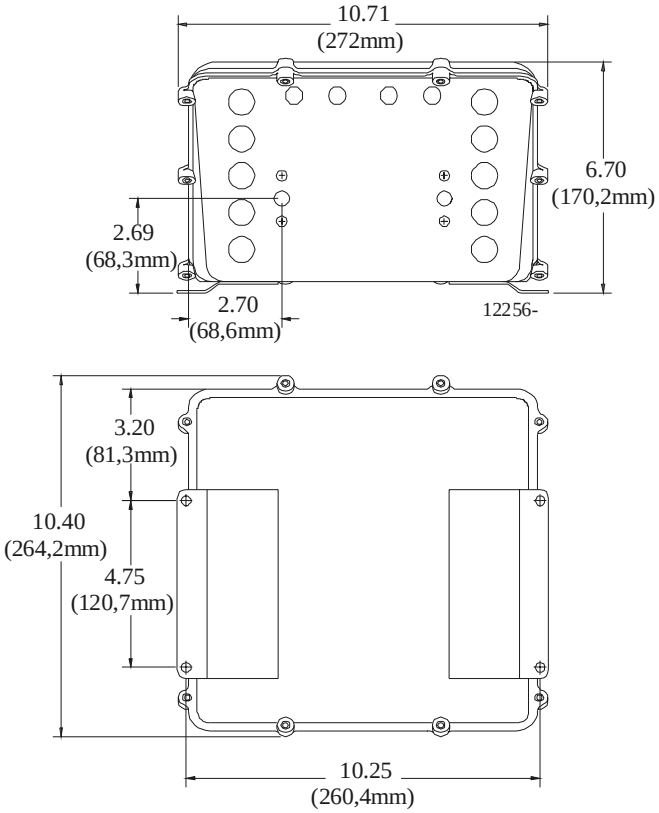


Figure 3-1: Actuator Dimensions

- Bonding is required for maximum electromagnetic compatibility (EMC) performance. Refer to Bonding: A.B.Y.C. E-11, 46 CFR 111.05, page A-33
- Locate the Actuator such that the push-pull cables have the shortest, most direct path to the Trolling Valve selector lever. The push-pull cable length should not exceed 20 feet (6,0m), the bend radius should not be less than 10 inches (254mm) and the total degrees of bends must be less than 270 degrees.

NOTE: **EXAMPLE:** A TYPICAL MINIMUM BEND RADIUS IS 10 INCHES (254MM); TOTAL DEGREES OF BEND SHOULD BE LESS THAN 270 DEGREES AND TOTAL LENGTH SHOULD NOT EXCEED 20 FEET (6M). THERE ARE PREMIUM CABLES AVAILABLE THAT ALLOW TIGHTER BENDS, MORE BENDS AND LONGER LENGTHS. REFER TO THE MANUFACTURERS SPECIFICATIONS FOR SPECIFIC LIMITATIONS.

- The Actuator is spray proof, but not water proof. Therefore, an area must be selected that typically stays dry.
- Bulkhead mounting is the preferred method due to ease of access for wiring and adjustments. However, the Actuator can be mounted in any attitude that allows easy connection of the push-pull cables to the trolling valve.
- Do not mount the Actuator on the engine, transmission, or in any location that will subject it to excessive vibration.
- Do not mount the Actuator to the transom when the vessel is equipped with a surface piercing drive system, due to vibration concerns.

- The Actuator is designed to work in environments with an ambient temperature up to 160 degrees Fahrenheit (70 degrees Celsius). Locate the Actuator away from sources of high heat, such as an engine exhaust manifolds or turbochargers. Allow 4 feet (1,2m) of clearance, or more, between the Actuator and such heat sources.
- Do not mount the Actuator in close proximity to gas engine ignition systems, alternators, generators or any equipment producing strong magnetic fields. Allow 4 feet (1,2m) clearance or more.

CAUTION: The Actuator uses electronic circuits that can be influenced by EMI (Electro-Magnetic Interference) and RFI (Radio Frequency Interference). Strong magnetic fields can influence the Processor's electronic circuits and void your warranty.

3-2 ELECTRICAL HARNESSES

3-2.1 Power Harness

Unlike the Power Harnesses required by the MicroCommander and ClearCommand Processors, the Troll Actuator's Power Harness (p/n 15023-X) has no functions other than to supply 12 or 24 VDC power to the Actuator.

- The power supply must be protected by a 10 Ampere Circuit Breaker for both single and twin screw applications.
- The ZF Mathers supplied Power Harness length must not exceed 20 feet (6,1m) with 12 VDC systems or 40 feet (12,2m) for 24 VDC systems.
- The Power Harness length can be increased to 30 feet (9,1m) in 12 VDC systems and 65 feet (19,8m) in 24 VDC systems, when using 12 AWG (No. 4 metric).

3-2.2 Serial Communication Harness

The Troll Actuator Servos are controlled by the MicroCommander or ClearCommand Processors by way of the Serial Communication Harness.

- A Single Screw Trolling Valve installation requires a Serial Harness that links the Actuator to the Processor. The part number for this Harness is **13316-X**. The **X** represents the length of the Harness in feet and is available in various lengths from 3 feet (1m) to 100 feet (36,6m)

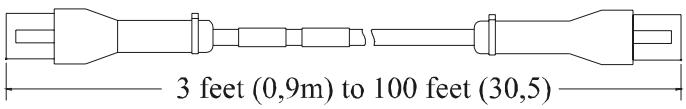


Figure 3-2: Serial Communication Harness P/N 13316-X

- A Twin Screw Trolling Valve installation requires a special Multi-Screw Harness (p/n 15544-X) and in some cases an additional p/n 13316-X Harness (required when the distance between the Processor and Actuator are more than 18 inches [0,46m].). The Multi-Screw Harness comes in various lengths, with the male

plugged end varying in length from 3 feet (1m) to 40 feet (12,2m). The female plugged end has a standard length of approximately 18 inches (0,46m). Figure 3-3: depicts the interfacing of the Harnesses

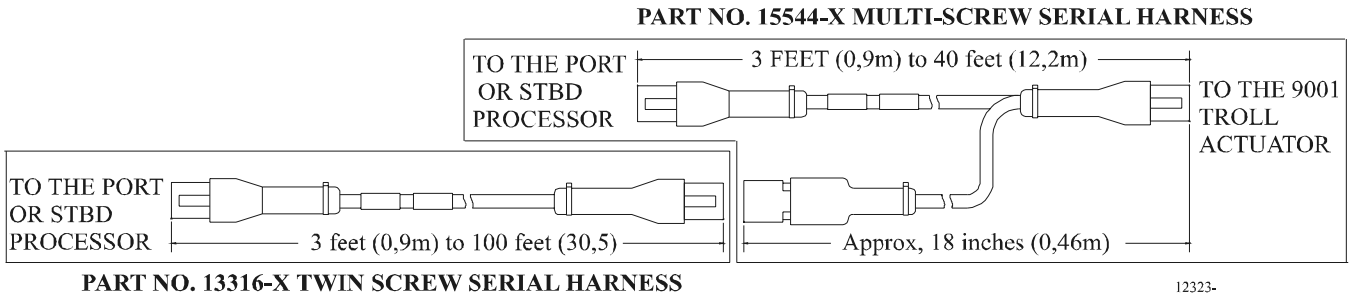


Figure 3-3: Serial Communication 15544-X Harness to 13316-X Harness Interface

3-3 INSTALLER SUPPLIED TOOLS AND PARTS

3-3.1 Required Tools

- Anti-static wrist strap (included with Actuator).
- Screwdriver – medium Phillips, #2.
- Wire cutter, stripper & crimper (Thomas & Betts model WT-2000 or equivalent).
- 7/16 inch Nut Driver or Socket with ratchet and medium extension.
- 5/16 inch Wrench – open end.
- Screwdriver – small straight slot.
- Drill Motor with 9/32 inch and 7/32 inch drill bits.

3-3.2 Optional Tools

Calibrated Digital Multimeter (Fluke 80 Series or equivalent).

Service Field Test Unit (P/N 13927, available through ZF Mathers)

3-3.3 Required Parts

- Two 33C type push-pull cables. The cables are measured from the end of the threads to the end of the threads. Available in 1 foot (0,3m) increments. (If 43C type push-pull cables are required, a 43C Conversion Kit is available from ZF Mathers. Refer to 43C Cable Conversion Kit, page A-13)
- Many transmissions are delivered with mounting kits. If not, contact the gear dealer or manufacturer for a factory Cable Connection Kit. Refer to Universal Mounting Kit, page A-11, to show other connection options.

3-4 DC POWER SOURCE

One of the most important (and often overlooked) items for proper operation of your control system is a clean, dedicated, and reliable source of DC Power.

The wiring used to supply power from the power source (battery) through the various components (fuses, distribution panel, relays,

etc.) to the Actuator must be sized for a voltage drop of 10% or less using 10 amps as the maximum current draw. Refer to **ABYC** Standard E-11, Table X to determine the appropriate wire gauge for the necessary conductor length.

When using ZF Mathers supplied 14 gauge power cable, and in accordance with **ABYC** Standard E-11, the distance from a 12 volt power source (battery or DC Distribution Panel) shall not exceed 15 feet (4,6m). In 24 volt systems, the maximum cable length is 20 feet (6,1m).

It is recommended by ZF Mathers that an **A**utomatic **P**ower **S**elector (**APS**) and a second power source (battery) be used. Refer to Automatic Power Selector (APS) Model: 13505, page A-1 for examples of power supplies.

3-4.1 Actuator Power

The items listed below will help ensure optimum performance from your control system.

- The Actuator requires a battery source of 12 or 24 VDC.
- Two 5 ampere (when isolated power supplies are required) or one 10 ampere trip-free thermal circuit breaker(s) with manual On/ Off actuation
- The use of an APS (Automatic Power Selector) is strongly recommended.
- Power should come from the vessel's DC Distribution Panel.
- Do not use engine starting batteries on a 12 VDC system, unless an APS is installed.
- The cables feeding power from the battery to the Actuator must be sized large enough to keep voltage drop, due to current flow, below 10%. See Reference Automatic Power Selector (APS) Model: 13505, page A-1.

Ultimately, it is the boat builder or installer's responsibility to ensure that the vessel's wiring meets the requirements of **A**merican **B**oating & **Y**achting **C**ouncel standard E-11, for AC and DC Electrical Systems on Boats.

4 INSTALLATION

4-1 TROLLING ACTUATOR

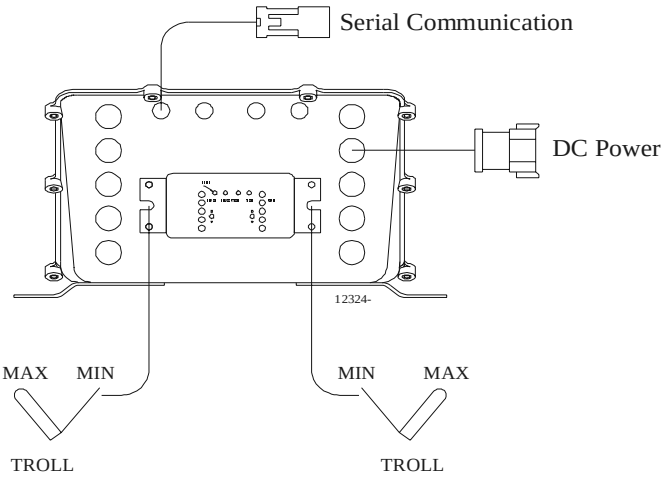


Figure 4-1: 9001 Troll Actuator View

4-1.1 Mounting

A) Mount the Actuator in a suitable location as described in Section 3-1, page 3-1.

B) Secure the Actuator to the mounting surface using the four 1/4 inch (6mm) or M5 fasteners.

4-1.2 Bonding

A) Run a green 12 AWG (2,5 metric) minimum bonding wire from the Actuator to the vessel's bonding system as shown in Bonding: A.B.Y.C. E-11, 46 CFR 111.05, page A-33.

B) Crimp a 1/4 inch ring terminal to the bonding wire at the Actuator.

C) Remove one of the Actuators mounting bolts and insert it into the ring terminal.

D) Reinstall the mounting bolt with the ring terminal.

E) Connect the bonding wire to the bonding system.

4-2 POWER HARNESS

A) The Power Harness (p/n 15023-X) connects the Actuator to the 12 or 24 VDC power source.

B) There are various methods of supplying power to the Trolling Actuator: (Refer to Appendix C Power Example Drawings)

- Directly from the DC Distribution Panel.
- Ignition Switch activated relay for remote switching.
- Directly from the battery through a 10 Ampere On/OFF Circuit Breaker.
- From the output of an APS. This method automatically supplies power when either the Port or Starboard Processor is energized.
- An APS may be used to supply two power sources to the Processors, in addition to the Troll APS in 24 VDC systems only. This is due to the inherent 700 mV forward voltage drop across each APS.

4-3 PUSH-PULL CABLE(S)

4-3.1 Actuator

A) Refer to Figure 4-1:, page 4-1.

B) Remove the #10-32 jam nut and the two rubber seals from the end of each push-pull cable that is to connect to the Actuator only; discard the seals, but save the nuts.

C) Remove one screw from each Cable Anchor Clip and loosen the other screw. Swing the two Clips clear. Refer to Figure 4-2:.

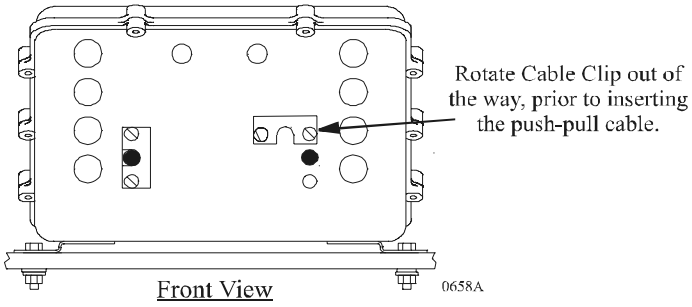


Figure 4-2: Actuator Cable Clip Rotation

D) Insert the appropriate push-pull cable into the Actuator according to the labels located above the cable clips on the Actuator enclosure.

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

F) Connect the push-pull cables to the hex nuts (See Figure 4-3:). Use a 7/16 inch socket to turn the hex nut onto the cable rod end until there is approximately 5/16 inch (7,9mm) of thread showing beyond the jam nut.

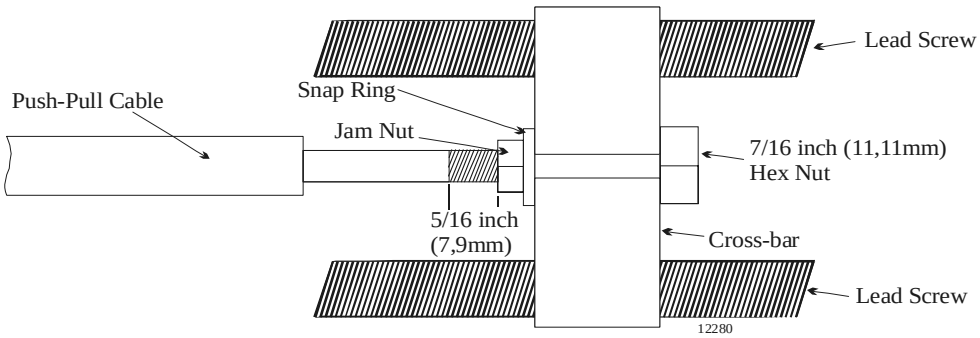


Figure 4-3: Push-Pull Cable Interior Connection

G) Use a 7/16 inch socket wrench and a 5/16-inch open end wrench to tighten the jam nuts.

H) Position the Cable Anchor Clips to secure the cables to the Actuator housing.

I) Install the screws removed in step B).

J) Tighten all Cable Anchor Clip screws.

4-3.2 Trolling Valve Push-Pull Cable Brackets

Verify whether push-pull cable brackets are installed on the trolling valve(s). If brackets are not provided, refer to Universal Mounting Kit, page A-11.

5 SET UP PROCEDURE

The Trolling System uses the push buttons in conjunction with Display LED's on both the corresponding Processor(s) and the 9001 Trolling Actuator to program, adjust, calibrate and set up the various features. The push buttons also allow you to access and display information regarding the health of the System. The following paragraphs explain how to locate and use the push buttons and Display LEDs:

5-1 ACTUATOR COMPONENTS USED IN SET UP

Figure 5-1: Typical Actuator Cover

- Each Actuator has a Display LED and Push Buttons.
- The Display LED can be viewed through a window on the Actuator's cover as shown in Figure 5-1:

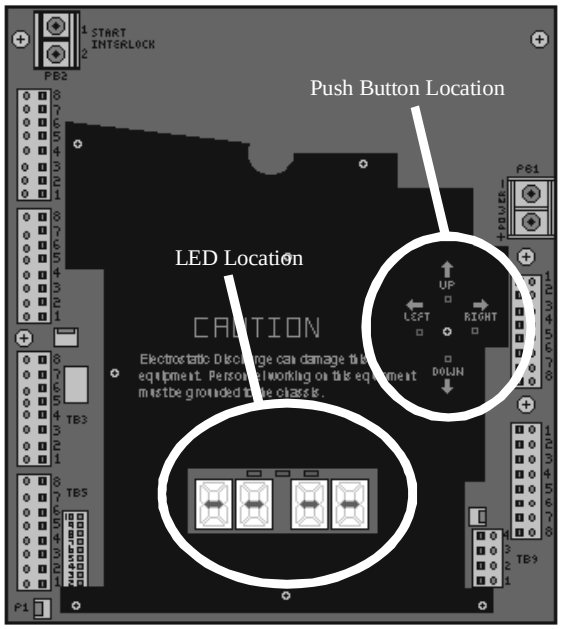
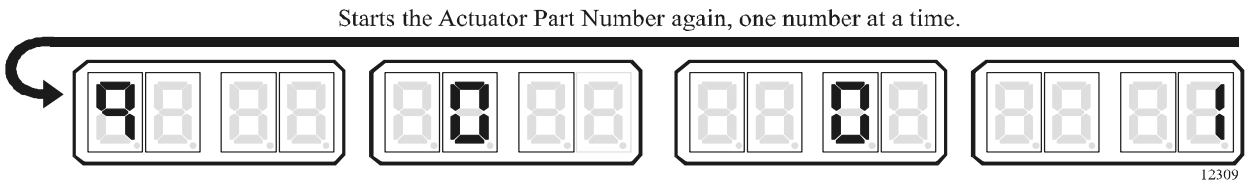


Figure 5-2: Actuator Shield Push Button and Display LED Locations

- The Actuator enclosure cover must be removed to access the Push Buttons as shown in Figure 5-2:
- The **Display LED** is used to view the Function Codes and the Values for those Functions (Section 5-1.1, page 5-1).
- The **Push Buttons** are used to scroll through Function Codes, select Function Codes and set the Values of the Function Codes. (Section 5-1.2, page 5-2)

5-1.1 Actuator Display LED



EXAMPLE: Running Actuator Part Number during Normal Operation (9001)

Figure 5-3: Display LED at Normal Operation

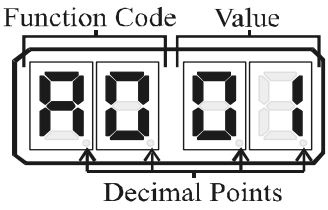


Figure 5-4: Display LED Designations

- The Actuator's Display LED has four 7-segment LED's, which light up to show either letters or numbers.
- The Display LED will have the Actuator Part Number showing in a running pattern during Normal operation (Figure 5-3:)
- The first two digit Display LED's to the left, indicate the **Function Code**, which is alphanumeric.
- The second two digit Display LED's indicate the numeric **Value** that is programmed into the Processor for the Function Code displayed to the left.
- A **decimal point** indicator is located on the bottom right corner of each Display LED.

5-1.2 Push Buttons

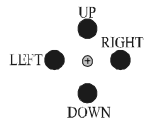


Figure 5-5: Circuit Board Push Buttons

The Actuator has four Push Buttons located on the Circuit Board. They are identified by the words LEFT, RIGHT, UP and DOWN silk-screened on the Shield covering the Circuit Board.

5-1.2.1 Up and Down Push Buttons

Pressing the Up or Down Push Buttons once has the following functions:

- Stops Normal Operation Display (running Processor Part Number) and activates the Function Menu.
- While in the Function Menu, scrolls through the Function Codes one at a time.
- When an Error Code (Refer to Section B-1, page B-1) is displayed, scrolls through the error messages one at a time.
- When in Set Up Mode, increases (Up) or decreases (Down) the Value one digit at a time.

5-1.2.2 Left and Right Push Buttons

Pressing and holding the Left and Right Push Buttons simultaneously has the following functions:

- Activates Set Up Mode as indicated by the blinking Display LED. (must hold the buttons until the blinking begins)
- While in Set Up Mode, deactivates Set Up Mode, saves the displayed Value to memory and returns to the Function Menu. (must hold the button until the blinking stops)

5-1.2.3 Left Push Button Only

Pressing the Left Push Button once has the following functions:

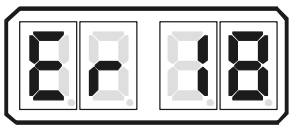


Figure 5-6: Display LED Error Menu Example

- Deactivates Set Up Mode <u>without</u> any changes to the Value being stored to memory. The Left Push Button must be held down until function code stops blinking. The default value will then be displayed.
- While in Function Menu, changes the Display LED to the Error Menu, if any errors are present. (has no effect if there are no errors stored)
- While in the Error Menu, changes the Display LED back to the Function Menu.

5-1.2.4 Right Push Button Only

Pressing the Right Push Button once has the following functions:

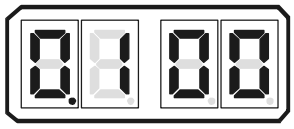


Figure 5-7: Display LED Four Digit Value

- While in the Error Menu, clears inactive errors. (Active errors blink, inactive do not)
- While in Set Up Mode or Function Menu, allows the Value of the current Function Code to be displayed with all four Display LEDs.

5-2 ACTIVATING SET UP MODE

NOTE: TO **ESCAPE** FROM THE SET UP PROCEDURE AT ANY TIME WITHOUT SAVING THE CHANGED VALUE TO MEMORY, DEPRESS THE **LEFT PUSH BUTTON.** THE FUNCTION CODE WILL STOP FLASHING AND THE FUNCTION WILL BE SAVED WITH THE ORIGINAL VALUE.

A) The Display LED is in Normal operating condition with the red running Actuator Part Number.

B) Depressing either the Up or Down Push Button will activate the Function Menu.

C) Depressing the Up or Down Push Button will scroll through the Function Codes one at a time.

D) Once the desired Function Code is visible on the Display LED, press and hold down the Left and Right Push Buttons simultaneously, until the Function Code begins to blink.

E) Depressing the Up Push Button will increase the Value of the Function, while pressing the Down Push Button will decrease the Value of the Function. (Pressing and holding the Up or Down Push Button will increase or decrease the Value rapidly)

5-3 STORING VALUES TO MEMORY

Once the desired Value has been reached in Set Up Mode, the Value is stored to memory as follows:

A) Depress and hold the right push button first. Then still depressing the right button, depress and hold the Left push button until the Function Code stops blinking.
   - The new Value is now programmed into memory.
   - Set Up Mode is exited.

B) Depress the Up or Down Push Button until the next required Function Code is reached.

C) Reactivate Set Up Mode.

NOTE: IF NO PUSH BUTTONS ARE PRESSED FOR FIVE MINUTES, THE SELECTED MODE OF OPERATION IS AUTOMATICALLY EXITED AND THE SYSTEM RETURNS TO NORMAL MODE. IF NO PUSH BUTTONS ARE PRESSED FOR FIVE MINUTES WHILE IN SET UP MODE, IT WILL BE EXITED WITHOUT THE CHANGES STORED TO MEMORY.

NOTE: CHANGES TO FUNCTION CODES ASSOCIATED WITH SERIAL COMMUNICATION (I.E. PROCESSOR ID, NUMBER OF ENGINES, ETC.) DO NOT TAKE EFFECT FOR FIVE MINUTES OR UNTIL POWER IS CYCLED.

NOTE: SOME OF THE ADJUSTMENTS TO THE 9001 TROLLING ACTUATOR ARE PERFORMED AT THE CORRESONDING MICROCOMMANDER OR CLEARCOMMAND PROCESSOR. FUNCTION CODE **L0** IS AUTOMATICALLY DISPLAYED ON THE CORRESPONDING PROCESSOR WHEN IT DETECTS THAT A TROLLING ACTUATOR IS CONNECTED TO THE SERIAL COMMUNICATION BUS.

5-4 SET UP FUNCTION CODES AND VALUES

The following table lists the Function Codes' Name, Default Value and Range or available Options. Each of the Function Codes are explained in further detail in the following sections.

NOTE: THE FUNCTION CODES LISTED IN TABLE 5-1: ARE DISPLAYED ON THE ASSOCIATED PROCESSOR(S) AND NOT ON THE 9001 TROLLING ACTUATOR. THE FUNCTION CODES LISTED ON TABLE 5-2:, PAGE 5-4, ARE DISPLAYED ON THE 9001 TROLLING ACTUATOR.

NONE OF THE **L** FUNCTION CODES ARE DISPLAYED ON THE ASSOCIATED PROCESSOR UNTIL SERIAL COMMUNICATION HAS BEEN ESTABLISHED BETWEEN THE PROCESSOR AND ACTUATOR.

ONCE COMMUNICATION IS ESTABLISHED, THE **L0** FUNCTION IS DISPLAYED AT THE PROCESSOR AT ITS' DEFAULT VALUE OF **00**. IN ORDER TO DISPLAY THE REMAINING **L** FUNCTION CODES, THE VALUE OF **L0** MUST BE CHANGED AT THE PROCESSOR TO **01**, **02**, **03,** OR **04**.

Table 5-1: Processor Function Codes

Function Code	Function Name	Default Value	Value Range or Options
TROLLING FUNCTIONS (Section 5-4.1, page 5-5)			
L0	Troll Enable and Control Head Troll Lever Range	00	00 – No Troll 01 – 20 Degrees- Type 1 02 – 35 Degrees- Type 2 03 – 45 Degrees- Type 3 (Throttle limited to 75%) 04 – 55 Degrees - Type 4 (Throttle limited to 10%)
L1	Troll Servo Direction	20	20 – Cable Fully Retracted [Pull] at Lock-up. 21 – Cable Fully Extended [Push] at Lock-up.
L2	Troll Minimum Pressure	70.0	01.0 to 90.0% Will always be at least 10% below Maximum.
L3	Troll Maximum Pressure	90.0	11.0 to 100.0% Will always be at least 10% above Minimum.
L4	Troll Throttle Limit	00	00 to 20% of Maximum Throttle.
L5	Troll Pulse Duration	00.6	00.0 to 09.9 Seconds.
L6	Troll Pulse Percentage	90.0	00.0 to 100.0% of available Troll Servo range.

Table 5-2: 9001 Actuator Function Codes

Function Code	Function Name	Default Value	Value Range or Options
ACTUATOR FUNCTIONS (Section 5-4.2, page 5-10)			
A0	Servo No.1 ID	00	00 - Servo No.1 Inactive 01 - Servo No.1 controlled by Processor ID No.1 02 - Servo No.1 controlled by Processor ID No.2 03 - Servo No.1 controlled by Processor ID No.3 04 - Servo No.1 controlled by Processor ID No.4 05 - Servo No.1 controlled by Processor ID No.5
A1	Servo No.2 ID	00	00 - Servo No.2 Inactive 01 - Servo No.2 controlled by Processor ID No.1 02 - Servo No.2 controlled by Processor ID No.2 03 - Servo No.2 controlled by Processor ID No.3 04 - Servo No.2 controlled by Processor ID No.4 05 - Servo No.2 controlled by Processor ID No.5
TROUBLESHOOTING FUNCTIONS (Section 5-4.3, page 5-11)			
H0	Diagnostic	00	Input Voltage) 0000 - (Not Used) 0.0.0.0 - (Not Used) 0.0.00. - (Not Used) 0.00.0. - (Not Used) 00.0.0. - (Not Used) 00.00. - Servo No.2 Feedback 0.0.00 -Servo No.1 Feedback 0000 - (Not Used) rr X.X - (Present Software Revision)
H1	Return to Factory Defaults	00	Store to Return to Factory Defaults (Contact Factory prior to Resetting.)

5-4.1 Troll Functions

The following Functions are displayed only on the associated Processor(s) once Serial Communication has been established between the Processor and the Actuator.

5-4.1.1 Function Code L0 – Troll Enable and Control Head Lever Troll Range

This Function Code tells the Processor whether or not:

- A 9001 Trolling Actuator or integrated Troll Control exists.
- How the trolling valve is to be controlled.

There are four types which can be used to control any trolling valve.

The available Values are:

00 No Troll (Default Value) - When the Value is set to **00** the Processor does not attempt to operate or monitor the function of the Trolling Valve.

01 20 Degrees – Type 1 - Type 1 dedicates the first 20 degrees of Control Head lever movement, out of the Ahead and Astern detents, for controlling the amount of clutch slippage. The remaining 45 degrees controls the throttle signal from Idle to Full Throttle. This setting is typically chosen when the primary purpose of the trolling valve is to merely reduce the vessel's speed through the water. Precise slow vessel speeds are not obtainable with this setting. Precise throttle control is still available with this selection without disabling the troll function.

02 35 Degrees – Type 2 - Type 2 dedicates the first 35 degrees of Control Head lever movement, out of the Ahead and Astern detents, for controlling the amount of clutch slippage. The remaining 30 degrees controls the throttle signal from Idle to Full. The Type 2 selection is a compromise between the Types 1 and 2. With this selection, good control of both the clutch slippage and the throttle signal are available. This allows the operator fairly precise control of the vessel's slow and medium speeds.

03 45 Degrees – Type 3 (Throttle limited to 75%) - type 3 dedicates the first 45 degrees of the Control Head lever movement, out of the Ahead and Astern detents, for controlling the amount of clutch slippage. The remaining 20 degrees controls the throttle signal from the Idle to a maximum of 75% of the Full speed setting. This Type is most useful when precise control of slow vessel speed is critical, such as fishing for specific species of fish. With only 20 degrees of Control Head lever movement used for speed, precise control of engine RPM when the clutch is locked-up is sacrificed.

04 55 Degrees - Type 4 (Throttle limited to 10%) - Type 4 dedicates the first 55 degrees of Control Head lever movement, out of the Ahead and Astern detents, for controlling the amount of clutch slippage. The remaining 10 degrees controls the throttle signal from Idle to a maximum of 10% of the Full speed setting. This Type is most useful for docking of the vessel.

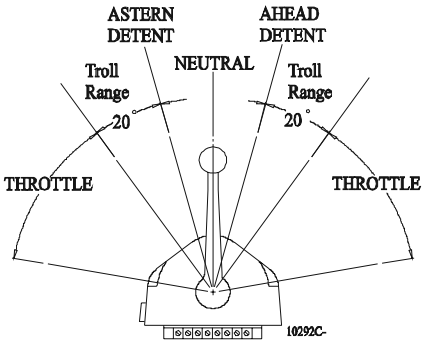


Figure 5-8: Control Head 20 Degree Troll Range - Type 1

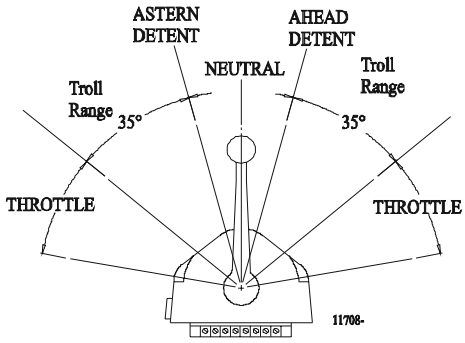


Figure 5-9: Control Head 35 Degree Troll Range - Type 2

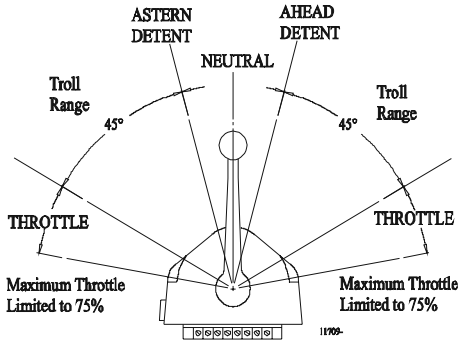


Figure 5-10: Control Head 45 Degree Troll Range - Type 3

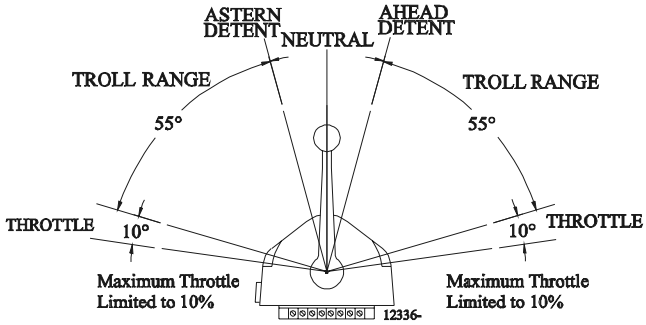


Figure 5-11: Control Head 55 Degree Troll Range - Type 4

To change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) Scroll to Function Code **L0**.

B) Activate Set Up Mode.

C) Scroll Up or Down to the desired Value.

D) Store the Value to memory.

NOTE: FUNCTION CODES **L1** THRU **L6** ARE NOT DISPLAYED ON THE PROCESSOR DISPLAY LED UNLESS FUNCTION CODE **L0** IS SET TO A VALUE OTHER THAN **00**.

5-4.1.2 Function Code L1 – Troll Servo Direction

This Function Code determines whether the Troll Push-Pull cable is fully extended or retracted when at Lock-up.

The available Values are:

20 Lock-up – Push-Pull cable fully retracted [Pull]. (Default Value)

21 Lock-up – Push-Pull cable fully extended [Push].

To determine, and if required, change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) Move the Troll Selector Lever to the Lock-up (Full Pressure) position.

B) Check to see if the Push-Pull cable's ball joint are in close proximity to one another.

- If so, no adjustments of Function Code **L1** Troll Servo Direction are required.
- If they are not, continue with the next step.

C) Scroll to Function Code **L1**.

D) Activate Set Up Mode.

E) Scroll Up or Down to Value **20** or **21**.

F) Store the Value to memory.

5-4.1.3 Function Code L2 – Troll Minimum Pressure

This Function adjusts the Troll Push-Pull cable travel to the point where clutch pressure is at the minimum point where shaft rotations are still possible.

The hydraulic pressure on the Clutch plate can typically be decrease to a point where the shaft is rotating at 30% to 50% of normal shaft RPM at Idle.

The available Values are **01.0** to **90.0** percent of the Maximum (Lock-up) Troll lever position.

EXAMPLE: Let's assume that the maximum amount of available push-pull cable travel is 3.00 inches (76,2mm). When **L2** is set to 01.0%, the push-pull cable will travel 01.0% shy of the maximum 3.00 inches (76,2mm) or 2.97 (75,4mm) from Lock-up position.

The Value selected must always be at least 10% lower than the value programmed for **L3** Troll Maximum Pressure.

To determine, and if required, change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

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

B) Scroll to Function Code **L2**.

C) Activate Set Up Mode.

D) Scroll Up or Down to the desired Value.

E) Store the Value to memory.

5-4.1.4 Function Code L3 – Troll Maximum Pressure

This Function adjusts the Troll Push-Pull cable travel to the point where clutch pressure is at the maximum point, yet not quite at normal shaft RPM at Idle.

The hydraulic pressure on the Clutch plate can typically be decreased to a point where the shaft is rotating at approximately 70% of normal shaft RPM at Idle.

The available Values are **11.0** to **100.0** percent of the Maximum (Lock-up) Troll lever position.

EXAMPLE: Let's assume that the maximum amount of available push-pull cable travel is 3.00 inches (76,2mm). When **L3** is set to 11.0%, the push-pull

cable will travel 11.0% shy of the maximum 3.00 inches (76,2mm) or 2.67 (67,8mm) from Lock-up position.

The Value selected must always be at least 10% higher than the value programmed for **L2** Troll Minimum Pressure.

To determine, and if required, change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

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

B) Scroll to Function Code **L3**.

C) Activate Set Up Mode.

D) Scroll Up or Down to the desired Value.

E) Store the Value to memory.

5-4.1.5 Function Code L4 – Troll Throttle Limit

This Function allows an increase in throttle above Idle while commanding clutch slippage. The engine RPM increases linearly with the Control Head lever movement while in the troll range, up to the Value programmed.

The Value is programmable from **00.0**%, where the engine RPM remains at Idle through the troll range, up to **20.0**% of the throttle range when the clutch pack's fully locked-up.

EXAMPLE: The engine Idles at 600 RPM's and has a top speed of 2400 RPM's. This provides an 1800 RPM throttle range. If the Troll Throttle Limit's Value is set to 10.0%, the throttle would increase from 600 to 780 RPM's while in the troll range.

CAUTION: The Troll Throttle Limit Value must not be adjusted where the engine RPM exceeds 1000 RPM's while slipping the clutch. Failure to abide by this rule may result in severe damage to the clutch pack.

To change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) Scroll to Function Code **L4**.

B) Activate Set Up Mode.

C) Scroll Up or Down to the desired Value.

D) Store the Value to memory.

5-4.1.6 Function Code L5 – Troll Pulse Duration and Function Code L6 - Troll Pulse Percentage

These two Functions work together in order to configure how quickly or how slowly the desired amount of clutch slippage is realized.

A) When the Control Head lever is positioned at the Neutral Idle position, the Troll Selector Lever is at the Maximum Pressure (Lock-up) position as shown in Figure 5-12:.

B) When the Control Head lever is placed into the Ahead or Astern detent, with Troll selected, the push-pull cable

will immediately drive to the location selected with the Function Troll Pulse Percentage.

C) The push-pull cable will pause at this position for the time selected with the Function Troll Pulse Duration.

D) Once this time has expired, the push-pull cable will drive to the position selected with Troll Minimum Pressure.

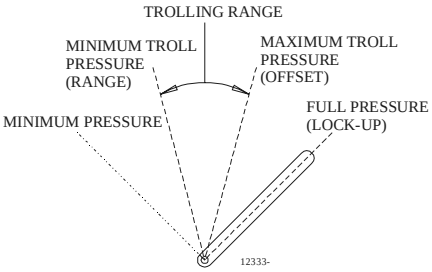


Figure 5-12: Trolling Selector Lever when the Control Head Lever @ Neutral/Idle

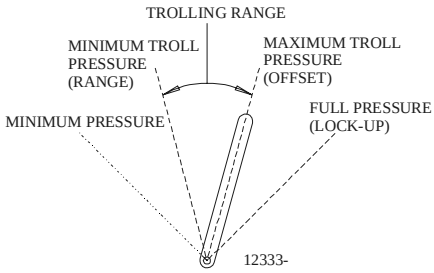


Figure 5-13: Trolling Selector Lever when the Control Head Lever @ Ahead or Astern Detent

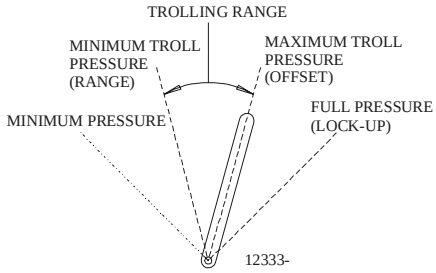


Figure 5-14: Trolling Selector Lever when the Control Head Lever is Close to the end of the Troll Range

By allowing for these variables, the pressure applied to the Clutch Pack is increased long enough to overcome the initial friction and allow rotation of the shaft at lower RPM's in a reasonable amount of time. Without this initial pressure increase, the time required for shaft rotation to begin may be too long when set at the desired Troll Minim Pressure Value, therefore, sacrificing the lower end water speed.

The available Values for this Function **L5** are **00.0** to **09.9** seconds.

The available Values for this Function **L6** are **00.0** to **100.0** percent of available Troll Servo Range.

To determine, and if required, change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) With Troll selected, place the Control Head lever into the Ahead detent.

- If the vessel lunges forward or the shaft takes too long to start rotating, continue with the next step.

B) Scroll to Function Code **L5** or **L6**.

C) Activate Set Up Mode.

D) Scroll Up or Down to the desired Value.

E) Store the Value to memory.

5-4.2 Actuator Functions

5-4.2.7 Function Code A0 – *Servo No.1 Processor ID Selection*

This Function Code selects which Processor controls the Servo 1 of the Actuator.

The default Value for this Function is **00** and allows ID numbers **01**, **02**, **03**, **04**, and **05**. When the Value is set at **00**, Servo 1 is not functional.

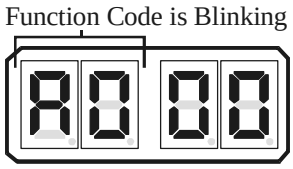


Figure 5-15: Display LED Function A0 Set Up Activated

To change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) Scroll to Function Code **A0**.

B) Activate Set Up Mode.

C) Scroll Up or Down to the desired Value.

D) Store the Value to memory.

5-4.2.8 Function Code A1 – *Servo No.2 Processor ID Selection*

This Function Code selects which Processor controls the Servo 2 of the Actuator.

The default Value for this Function is **00** and allows ID numbers **01**, **02**, **03**, **04**, and **05**. When the Value is set at **00**, Servo 2 is not functional.

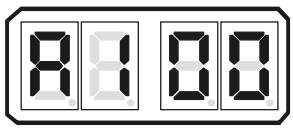


Figure 5-16: Display LED Function A1 Set Up Activated

To change the Value (Refer to Sections 5-2 and 5-3, page 5-3):

A) Scroll to Function Code **A1**.

B) Activate Set Up Mode.

C) Scroll Up or Down to the desired Value.

D) Store the Value to memory.

NOTE: BEFORE CONTINUING SET UP, WAIT 5 MINUTES OR CYCLE POWER.

5-4.3 Troubleshooting Functions

5-4.3.9 Function Code H0 - Diagnostics

There are ten items listed within the Diagnostic window, of which only four are active. They are as follows:

- **Input Voltage** - This item allows the technician a measurement of the battery voltage applied at the Actuator.
- **Servo No.2 Feedback** - The Value displayed represents the position of the Servo No.2 cross-bar in A/D counts.
- **Servo No.1 Feedback** - The Value displayed represents the position of Servo No.1 cross-bar in A/D counts.
- **Software Revision** - The Value represents the software revision currently installed into the Actuator.

5-4.3.10 Function Code H1 – Return to Factory Defaults

This Function may be used during troubleshooting.

(Do not make any adjustments to this Function Code, unless directed to do so by ZF Mathers Service or Engineering Departments).

6 ADJUSTMENTS

NOTE: ENSURE THAT THE CORRESPONDING PROCESSOR(S) ARE FULLY PROGRAMMED AND TESTED PRIOR TO ACTIVATING AND ADJUSTING THE TROLL ACTUATOR.

6-1 ENABLING THE TROLL FUNCTION

A) Turn power ON to the Processor(s) and the Actuator. Take command at any Remote Station.

B) On the Processor, scroll to Function **A0**, and ensure that it is set to the appropriate ID. (Any ID number is fine from **01** thru **05**. Do not leave at **00**)

C) Assign a Processor ID to Servo 1 and/or 2 on the Actuator by scrolling to Functions **A0** and/or **A1** on the Troll Actuator.

D) Enter Set Up Mode as described in Section 5-2, page 5-3.

E) Change the value from **00** to the corresponding Processor's ID number.

F) Enter the new value into memory as described in Section 5-3, page 5-3.

G) Scroll Up or Down on the Processor to Function Code **L0**. (**L0** will not be displayed if the Trolling Actuator is not turned ON, serial communication is not established, the Processor ID has not been set on the Processor, or a Processor ID has not been assigned to a Servo in the Trolling Actuator.)

H) Enter Set Up Mode and change the value of **L0** to **01**, **02**, **03**, or **04** as described in Section **5-4.1.1, page 5-5.** (The remaining **L** Function Codes will appear once **L0** is changed from **00**.)

6-2 SELECTING TROLL PUSH-PULL CABLE DIRECTION

The connections and adjustments between the Troll Actuator, Push-Pull Cable, and Troll Selector lever are made mechanically. However, the Troll Actuator may have to be reprogrammed to fully extend the push-pull cable when at the Maximum Pressure (Lock-up) position.

A) Manually move the Troll selector lever to the maximum oil pressure (Lock-up) position.

B) Check to see if the push-pull cable end and the Troll selector lever are close to one another.

- If not, continue with Step C)
- If so, skip to Section 6-3.

C) On the Processor, scroll to Function **L1** Troll Servo Direction

D) Enter Set Up Mode as described in Section 5-2, page 5-3.

E) Change the value from **20** to **21.** (The servo will drive to the fully extended position).

F) Enter the new value into memory as described in Section 5-3, page 5-3.

6-3 MECHANICAL ADJUSTMENT AT LOCK-UP

The alignment between the push-pull cable and the Troll selector lever may be adjusted at both ends of the cable.

CAUTION: Make certain that sufficient amount of threads are showing at both ends of the push-pull cable(s). No more than 5/8 inch (18,4mm) of threads should be showing at both ends of the cable with the jam nuts tightened.

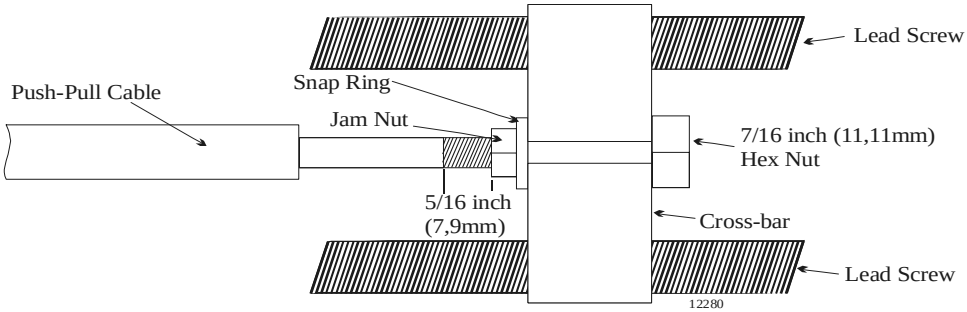


Figure 6-1: Push-Pull Cable Interior Connection within the Actuator

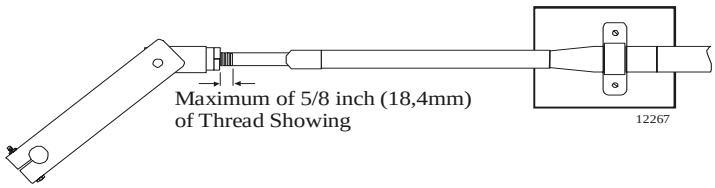


Figure 6-2: Push-Pull Cable at the Troll Selector Lever

A) Verify that the Troll Selector Lever is at the Full Oil Pressure (Lock-Up) position.

B) Apply DC Power to the system.

C) Take command at a Remote STation.

D) The 9001 Trolling Actuator should be at the Full Pressure position.

E) Align the push-pull cable with the Troll selector lever by loosening the jam nut and adjusting the ball joint at the end of the push-pull cable.

F) If exact alignment cannot be made without exceeding 5/8 inch (18,4mm) of threads showing, further adjust the cable within the Actuator.

G) Tighten the jam nuts and connect the push-pull cable to the Troll Selector lever.

NOTE: ALL THE ADJUSTMENTS FOR TROLL FROM THIS POINT FORWARD ARE MADE AT THE CORRESPONDING PROCESSOR.

6-4 TROLL MINIMUM PRESSURE ADJUSTMENT (FUNCTION L2)

NOTE: THE GEAR OIL MUST REACH NORMAL OPERATING TEMPERATURE BEFORE THE TROLLING VALVE CAN BE ACCURATELY ADJUSTED. THE ADJUSTMENT OF THE MINIMUM PRESSURE POINT MUST BE DONE ONE SCREW AT A TIME WHEN TIED TO A DOCK.

A) Verify that the Troll push-pull cable is positioned at the Full Pressure (lock-up) position.

B) With the engine running, place the Station-in-Command's lever into the Ahead Detent.

C) Measure the Shaft RPM at Idle with a Shaft Tach and record on Table 6-1:

Table 6-1: Shaft RPM at Idle

Port	Starboard

D) Enable Troll Mode by pressing the Transfer Button for two seconds or until the red LED indicator light begins blinking rapidly. (If twin screw, return one of the Control Head levers to the Neutral/Idle position.)

E) Scroll to Function Code **L2** (Troll Minimum Pressure) and activate Set Up Mode as described in Section 5-2, page 5-3.

F) While monitoring the Shaft RPM, change the value of Function **L2** until the desired shaft RPM is reached. (Typically 30 to 50% of the RPM measured in Table 6-1: above.)

G) Enter the new Value into memory as described in Section 5-3, page 5-3.

H) Repeat Step F) as many times as needed until the desired RPM is reached. (Some trolling valves react very slowly to changes, so give plenty of time between adjustments for the shaft RPM to stabilize.)

I) Record the RPM on Table 6-2:

Table 6-2: Shaft RPM Values Entered

Port	Starboard

J) If twin screw, repeat Steps D) through I) on the opposite side.

K) Place both levers into the Ahead detents. (Both red LED indicator lights should still be blinking rapidly.)

L) Record the Shaft RPM's on Table 6-2:. Repeat Steps E) through G) as many times as necessary until the desired RPM is realized.

NOTE: DO NOT ADJUST THE SHAFT RPM IN THE PREVIOUS SECTION BASED ON THE TIME IT TAKES FOR THE SHAFT TO BEGIN TO ROTATE. THIS CAN BE ADJUSTED WITH TROLL PULSE DURATION **L5** AND TROLL PULSE PERCENTAGE **L6**.

6-5 TROLL MAXIMUM PRESSURE ADJUSTMENTS (FUNCTION L3)

A) Place the Control Head lever(s) into the Ahead detent with Troll Mode selected (The red LED indictor light should be blinking rapidly.)

B) Scroll down to Function **L3**, and enter Set Up Mode as described in Section 5-2, page 5-3.

C) While monitoring the Shaft RPM, change the value of Function **L3** until the desired shaft RPM is reached. (Typically 70% of the RPM recorded on Table 6-1:,page 6-3)

D) Enter the new Value into memory as described in Section 5-3, page 5-3.

E) Repeat Steps B) through D) as many times as necessary in order to obtain the desired shaft RPM. (Once again, give plenty of time between adjustments for the shaft RPM to stabilize.)

6-6 TROLL THROTTLE LIMIT (FUNCTION L4)

A) While in Troll Mode (The red LED indictor light should be blinking rapidly.), slowly move the Control Head lever(s) through the troll range until the red LED indicator lights become steady.

B) Move the Control Head lever back into the Troll range to the point where the red LED indicator light again begins blinking rapidly, and stop.

C) Scroll down to Function **L4**, and enter Set Up Mode as described in Section 5-2, page 5-3.

D) While monitoring the Shaft RPM, change the value of Function **L4** until the desired shaft RPM is reached. (Up to 20% of the speed range above Idle)

E) Enter the new Value into memory as described in Section 5-3, page 5-3.

F) Repeat on the opposite side if Twin Screw application.

6-7 TROLL PULSE DURATION (FUNCTION L5) AND TROLL PULSE PERCENTAGE (FUNCTION L6)

The Pulse Duration has a default value of **0.6** seconds, which is normally adequate in combination with the Pulse Percentage to get the shaft rotating in a timely fashion. The value of Troll Pulse Percentage automatically changes as the value of Troll Maximum Pressure **L3** is changes. This ensures that approximately the pressure required to rotate the shaft at 70% of its' normal RPM is applied for a short period of time.

If the shaft takes too long to begin rotating or if a surge is felt every time Ahead or Astern is entered in Troll Mode, adjustments to these two parameters may be warranted.

When making the adjustments to the values of these two Functions, make the adjustments small each time and retry the results.

6-7.1 Troll Pulse Duration L5

A) Scroll up or down to Function **L5**, and enter Set Up Mode as described in Section 5-2, page 5-3.

B) Increase or decrease the value by no more than 0.5 seconds at a time. (Increasing the value will increase the response time, while decreasing will decrease response time, such as surging when going into gear with Troll)

C) Enter the new Value into memory as described in Section 5-3, page 5-3.

D) Command Ahead with Troll selected and observe the vessel's response.

E) Readjust the Pulse Duration, if needed, or make further adjustments with Troll Pulse Percentage **L6**.

6-7.2 Troll Pulse Percentage L6

A) Scroll up or down to Function **L6**, and enter Set Up Mode as described in 5-2, page 5-3.

B) Increase or decrease the value by no more than 1% at a time. (Increasing the value will increase the response time, while decreasing will decrease response time, such as surging when going into gear with Troll)

C) Enter the new Value into memory as described in Section 5-3, page 5-3.

D) Command Ahead with Troll selected and observe the vessel's response.

E) Readjust the Pulse Percentage, if needed, or make further adjustments with Troll Pulse Duration **L5**.

6-8 TROUBLESHOOTING FUNCTIONS

NOTE: THE FOLLOWING ITEMS CAN BE VIEWED AT ANY TIME, WITH OR WITHOUT THE PRESENCE OF ANY ERROR CODES OR MALFUNCTIONS. WE RECOMMEND THAT THE VALUES LISTED FOR THE ITEMS UNDER **H0** SHOULD BE COPIED AND USED FOR COMPARISON IN THE EVENT OF A PROBLEM IN THE FUTURE.

6-8.1 Diagnostics H0

When the diagnostics Function is entered, there will be ten (10) different items that can be scrolled through. Of these ten (10) items, only four (4) are used in the Troll Actuator. The Diagnostic Menu is accessed as follows.

A) Scroll up or down to Function **H0**, and enter Set Up Mode as described in Section 5-2, page 5-3.

B) The Display LED will show the voltage presently inputted to the Actuator.

C) Once the required diagnostic information is viewed, the Diagnostic Menu is exited in the same manner as when items are written to memory, pressing the left and right push button arrows simultaneously.

The Active Diagnostic Functions available are as follows:

6-8.1.1 Input Battery Voltage

A) The first item displayed is the battery voltage that is being applied to the Actuator. The voltage is displayed in whole numbers only and has an accuracy of +/- 0.5 VDC.

B) The additional diagnostic items can be displayed by pressing the "Down" or "Up" arrows.

C) In order to display the next usable diagnostic function, the "Down" arrow must be pressed six (6) times, since the second through the sixth display are not functional in the 9001 Actuator.

6-8.1.2 Servo No.2 Feedback

A) Servo No.2 is the mechanical drive mechanism on the right side, when the Actuator is right side up with the push-pull cable entry point facing you.

B) The numeric value displayed represents the present position of the cross-bar in A/D (Analog to Digital) counts.

C) The expected A.D count for a fully extended push-pull cable should be between **90** to **100** A/D counts. When fully retracted, the A.D count should be between **910** and **920** A/D counts.

D) The A/D count will vary between **90** and **920** counts when the cross-bar is positioned anywhere between the fully extended and fully retracted positions.

E) If the A/D count exceeds **920** or is less than **90**, an error indication will be activated.

F) In order to access Servo No.1 Feedback, press the "Down" arrow one time.

6-8.1.3 Servo No.1 Feedback

A) Servo No.1 is the mechanical drive mechanism on the left side, when the Actuator is right side up with the push-pull cable entry point facing you.

B) The numeric value displayed represents the present position of the cross-bar in A/D (Analog to Digital) counts.

C) The expected A.D count for a fully extended push-pull cable should be between **910** and **920** A/D counts. When fully retracted, the A.D count should be between **90** to **100** A/D counts.

D) The A/D count will vary between **90** and **920** counts when the cross-bar is positioned anywhere between the fully extended and fully retracted positions.

E) If the A/D count exceeds **920** or is less than **90**, an error indication will be activated.

F) In order to access the next usable diagnostic function, press the "Down" arrow twice.

6-8.1.4 Software Revision Level

ZF Mathers continually strives to perfect the products we manufacture. Future releases of the 9001 Actuator may come equipped with software that varies from today. Knowing the version of software installed may be very helpful to technicians in the future if more than one version of software for the 9001 exists.

9 PERIODIC CHECKS AND MAINTENANCE

The items listed below should be checked on an annual basis or less, when noted:

9-1 ACTUATOR

- Check all terminal connections for signs of corrosion or loose connections.
- Un-plug and inspect all Deutsch connectors for signs of moisture or corrosion.
- Check mechanical connections within the Actuator and at the Troll selector levers.
- Check the mechanical movement of the Troll selector lever from Lock-up to Minimum pressure and back to Lock-up. Ensure that the cable moves smoothly and does not bind while positioning the Control Head lever.

9-2 POWER SUPPLY

9-2.1 Battery

WARNING: BATTERIES CONTAIN SULFURIC ACID AND EMIT HYDROGEN GAS WHILE CHARGING. THEREFORE, SPECIFIC SAFETY PRECAUTIONS MUST BE ADHERED TO WHILE HANDLING AND SERVICING. SPECIFIC INFORMATION ON HANDLING AND SERVICING BATTERIES CAN BE OBTAINED FROM THE BATTERY COUNCIL INTERNATIONAL, BATTERY SERVICE MANUAL.

CAUTION: In many newer batteries, the vent cap is permanently attached, preventing access to the electrolyte for water level and specific gravity tests. Attempting to pry off these caps could result in premature battery failure.

The following tests should be performed in the intervals specified:

9-2.1.1 Quarterly (Every 3 Months)

- Check the level of the water (electrolyte) within the Lead-Acid batteries. The plates must be covered. If not, add a small amount of distilled water.
- Check the voltage of the battery. The battery must have a chance to "rest" (no charging and no load for a couple of hours) prior to testing. The following table represents a fully charged battery:

Table 9-1: Fully Charged Battery

Lead Acid Batteries	Gel Cell or AGM Batteries
12V – 12.6 TO 12.8V	12V – 12.4 TO 12.6V
24V – 25.2 TO 25.6V	24V – 25.0 TO 25.4V

- Check the battery terminals for signs of corrosion, acid build-up or loose connections.

9-2.1.2 Semi-Annually (Every 6 Months)

- Check the specific gravity of your Lead-Acid battery(s) with a Hydrometer. The reading for a fully charged lead acid battery is 1.260 to 1.280.

9-2.1.3 Annually (Every 12 Months)

WARNING: THE BATTERY LOAD TEST SHOULD BE PERFORMED BY A QUALIFIED MARINE ELECTRICIAN ONLY.

The tests performed on quarterly and semi-annual basis, give a relatively good indication of the batteries' health. However, the only way to accurately determine the actual health of your battery is to perform a Battery Load Test.

- There are two types of Battery Load Tests performed in the field, Performance and Service. In order to determine the actual health of your battery a Performance Load Test is recommended. The Service Load Test determines how well your battery performs in the boat and doesn't take into account the battery's original rating, which could result in misleading results. The Performance Load Test places an accurate load on the battery and compares the results to the battery manufacture's specification. The battery should be replaced if the results are 80% or less than the manufacture specifications.

9-2.2 Power Cables, Distribution Panels, etc.

- Check all of the connections from the battery to the DC Distribution Panel to the APS for loose or corroded connections.
- Measure the voltage at the battery and at the Processor while the Clutch or Throttle Servo is driving. There should be no more than 10% difference between these two points. If so, check all devices and connections for excessive voltage drop.

NOTE: IF AN APS IS USED IN THE CIRCUIT TO SUPPLY POWER TO THE PROCESSOR, ACCOUNT FOR THE 0.7V DROP ACROSS THE APS. EXAMPLE: 12.6V @ BATTERY – 1.26V (10% DROP) – 0.7V (APS DROP) = 10.64V (MINIMUM ALLOWABLE VOLTAGE)

APPENDIX A

ZF Mathers, LLC
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S-214 Rev.E 5/03

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 **single** APS is supplied with a hardware packet containing (6) hex nuts, (3) lock washers, (4) self-tapping mounting screws, (1) instructions diagram.

NOTE: NOT ALL OF THE HARDWARE WILL BE USED IN THE INSTALLATION; SOME SPARES ARE PROVIDED. NUT SIZE IS M-6.

The **twin** APS is supplied with (2) single APS hardware packets.

D) INSTALLATION

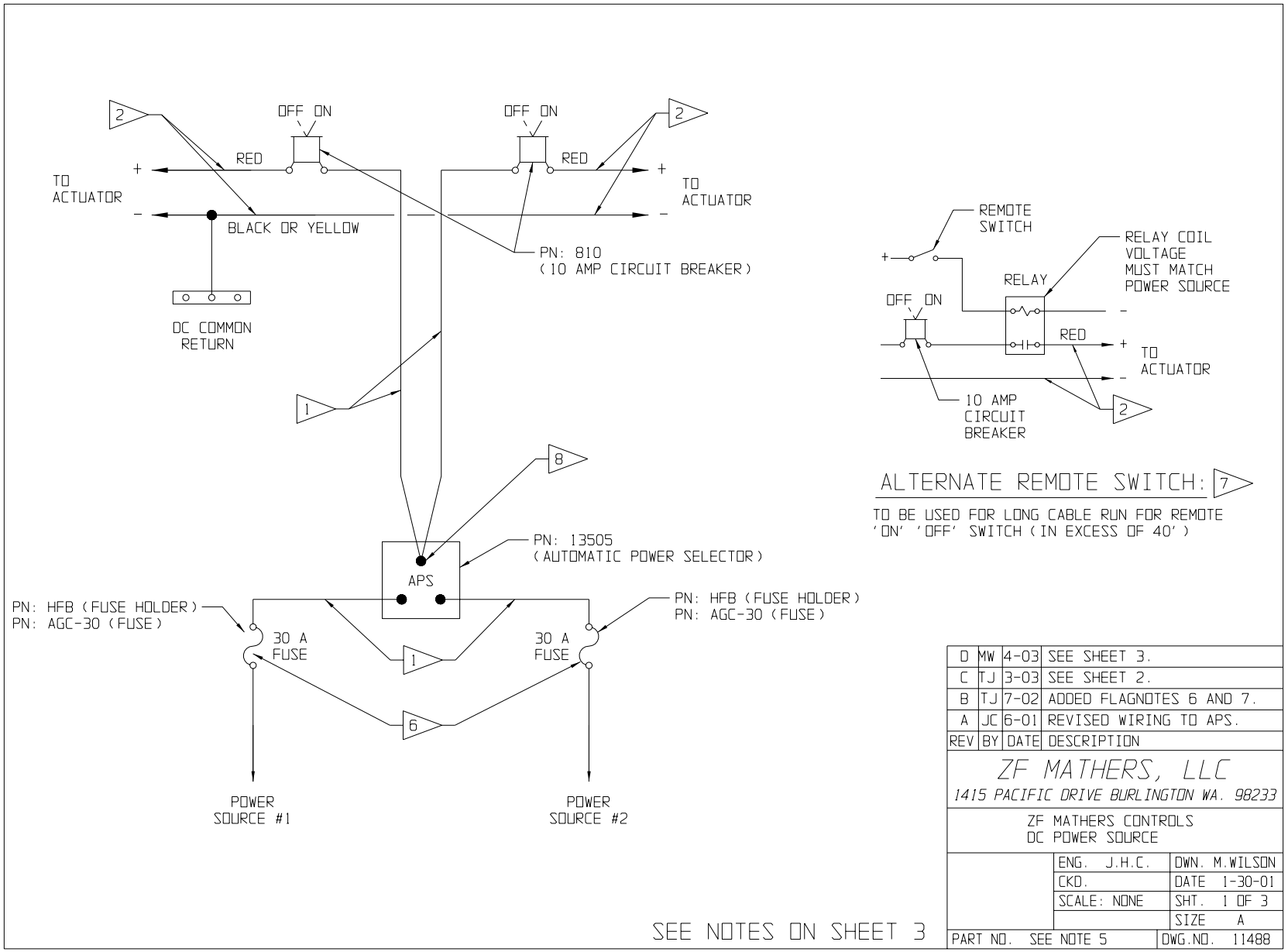
Refer to the installation Drawing 11488C.

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(s) 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.
3. Complete the wiring as indicated on either Drawing 11488C-1 or 11488C-2.
4. 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.

Drawing 11488D-1 Twin Screw Single APS Connection & Alternate Remote Switch



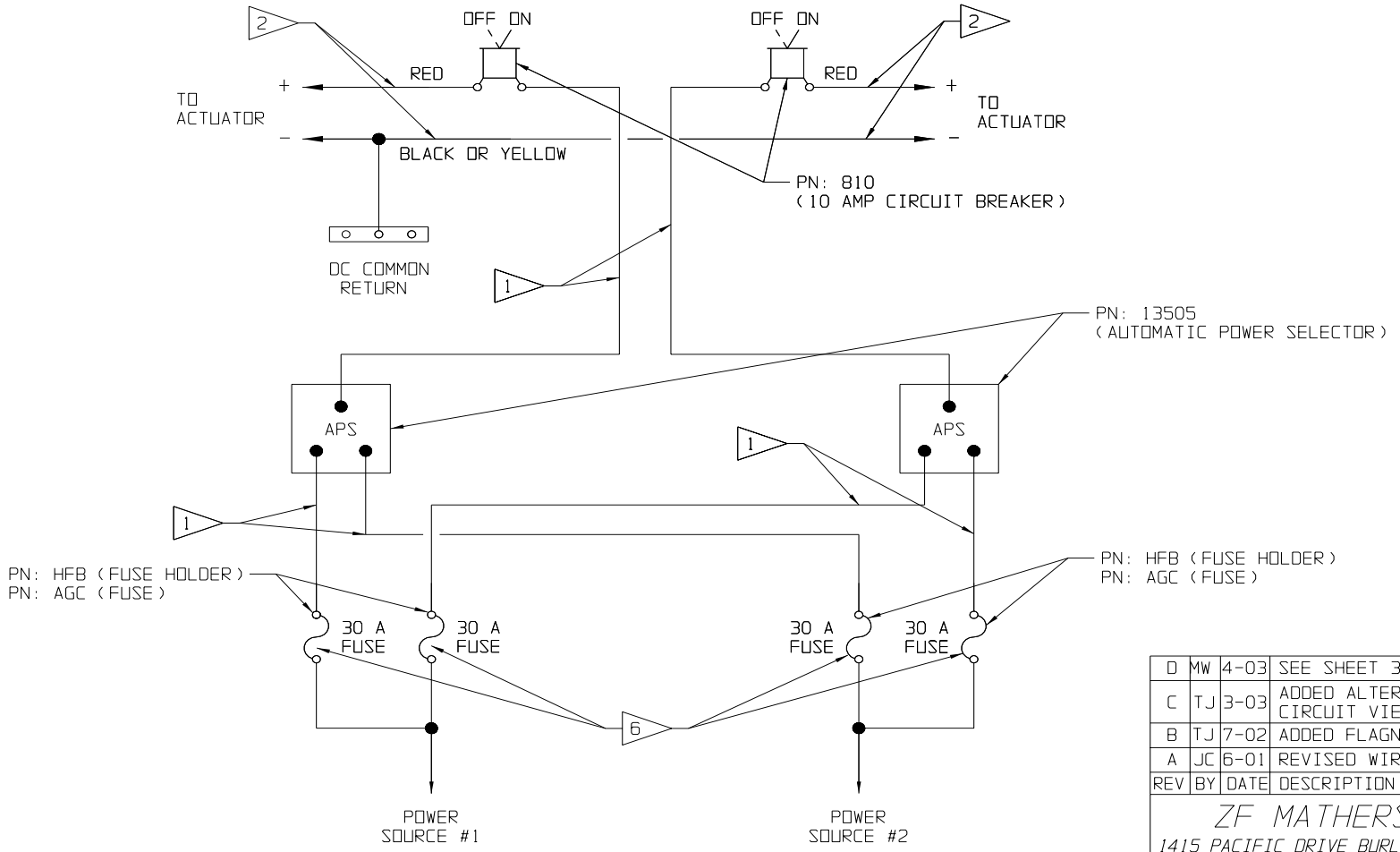
REV	BY	DATE	DESCRIPTION
D	MW	4-03	SEE SHEET 3.
C	TJ	3-03	SEE SHEET 2.
B	TJ	7-02	ADDED FLAGNOTES 6 AND 7.
A	JC	6-01	REVISED WIRING TO APS.

ZF MATHERS, LLC
1415 PACIFIC DRIVE BURLINGTON WA. 98233

ZF MATHERS CONTROLS
DC POWER SOURCE

	ENG. J.H.C.	DWN. M.WILSON
	CKD.	DATE 1-30-01
	SCALE: NONE	SHT. 1 OF 3
		SIZE A
PART NO. SEE NOTE 5		DWG.NO. 11488

Drawing 11488D-2 Twin Screw Dual APS Connections



ALTERNATE APS CIRCUIT:

SEE NOTES ON SHEET 3

REV	BY	DATE	DESCRIPTION
D	MW	4-03	SEE SHEET 3.
C	TJ	3-03	ADDED ALTERNATE APS CIRCUIT VIEW.
B	TJ	7-02	ADDED FLAGNOTES 6 AND 7.
A	JC	6-01	REVISED WIRING TO APS.

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ZF MATHERS CONTROLS
DC POWER SOURCE

	ENG. J.H.C.	DWN. M.WILSON
	CKD.	DATE 1-30-01
	SCALE: NONE	SHT. 2 OF 3
		SIZE A
PART NO. SEE NOTE 5		DWG.NO. 11488

Drawing 11488D-3 APS Notes Page

NOTES:

1. WIRE SIZE (REF ABYC E9.15.9 10%)

12VDC POWER SYSTEMS:

0-15'	(0-4,6M)	12 AWG (#4 METRIC EQUIVALENT)
15'-25'	(4,6-7,6M)	10 AWG (#6 " ")
25'-40'	(7,6-12,2M)	8 AWG (#10 " ")
40'-70'	(12,2-21,3M)	6 AWG (#16 " ")

24VDC POWER SYSTEMS:

0-20'	(0-6,1M)	14 AWG (#2,5 METRIC EQUIVALENT)
20'-30'	(6,1-9,1M)	12 AWG (#4 " ")
30'-50'	(9,1-15,2M)	10 AWG (#6 " ")
50'-80'	(15,2-24,3M)	8 AWG (#10 " ")

2. WIRE SIZE. (RECOMMENDED TWISTED PAIR)

12VDC POWER SYSTEMS:

0-20'	(0-6,1M)	14 AWG (#2,5 METRIC EQUIVALENT)
20'-30'	(6,1-9,1M)	12 AWG (#4 " ")

24VDC POWER SYSTEMS:

0-40'	(0-12,2M)	14 AWG (#2,5 METRIC EQUIVALENT)
40'-65'	(12,2-19,8M)	12 AWG (#4 " ")

3. APS OUTPUT IS STRICTLY FOR ZF MATHERS CONTROLS.

4. POWER SOURCES MAY BE 12 OR 24 VOLTS DC.

5. SINGLE SCREW KIT - PN: 13983.

PN: 13505 (AUTOMATIC POWER SELECTOR)	QTY 1
PN: 810 (10 AMP CIRCUIT BREAKER)	QTY 1
PN: AGC-30 (30 AMP FUSE)	QTY 2
PN: HFB (FUSE HOLDER)	QTY 2

TWIN SCREW KIT - PN: 13984.

PN: 13505 (AUTOMATIC POWER SELECTOR)	QTY 1
PN: 810 (10AMP CIRCUIT BREAKER)	QTY 2
PN: AGC-30 (30 AMP FUSE)	QTY 2
PN: HFB (FUSE HOLDER)	QTY 2

6. MAXIMUM WIRE SIZE ALLOWED IN FUSEHOLDER IS 12 AWG. IF A LARGER WIRE SIZE IS REQUIRED FOR INSTALLATION, THE CUSTOMER SHALL PROVIDE AN APPROPRIATE FUSE AND FUSE HOLDER. (SUGGESTED MANUFACTURER BLUE SEA SYSTEMS, MAXI FUSE BLOCK SERIES).

7. IF THIS CONFIGURATION IS USED WITH AN ELECTRONIC ENGINE THE CIRCUIT BREAKER MUST BE TURNED ON PRIOR TO APPLYING POWER TO THE REMOTE SWITCH.

8. SEE FIGURE 1 BELOW FOR THE SUGGESTED HARDWARE STACK FOR SYSTEMS UTILIZING MULTIPLE OUTPUTS FROM THE PN: 13505 (AUTOMATIC POWER SELECTOR).

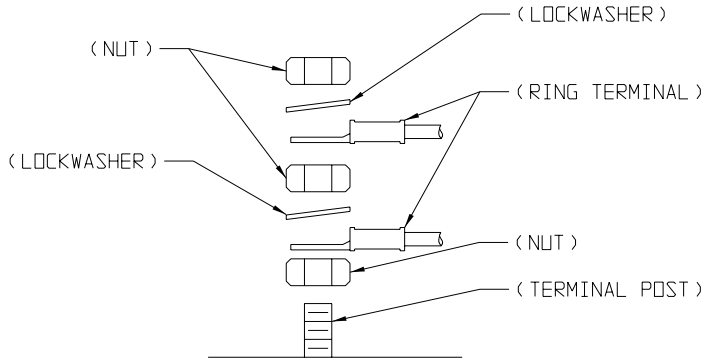

FIGURE 1

REV	BY	DATE	DESCRIPTION
D	MW	4-03	REVISED FLAGNOTES 1 & 2.
C	TJ	3-03	ADDED FLAGNOTE 8. REVISED FLAGNOTE 6.
B	TJ	7-02	ADDED FLAGNOTES 6 AND 7.
A	JC	6-01	SEE SHEET 1.

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ZF MATHERS CONTROLS
DC POWER SOURCE

	ENG. J.H.C.	DWN. M.WILSON
	CKD.	DATE 1-30-01
	SCALE: NONE	SHT. 3 OF 3
		SIZE A
PART NO. SEE NOTE 5		DWG.NO. 11488

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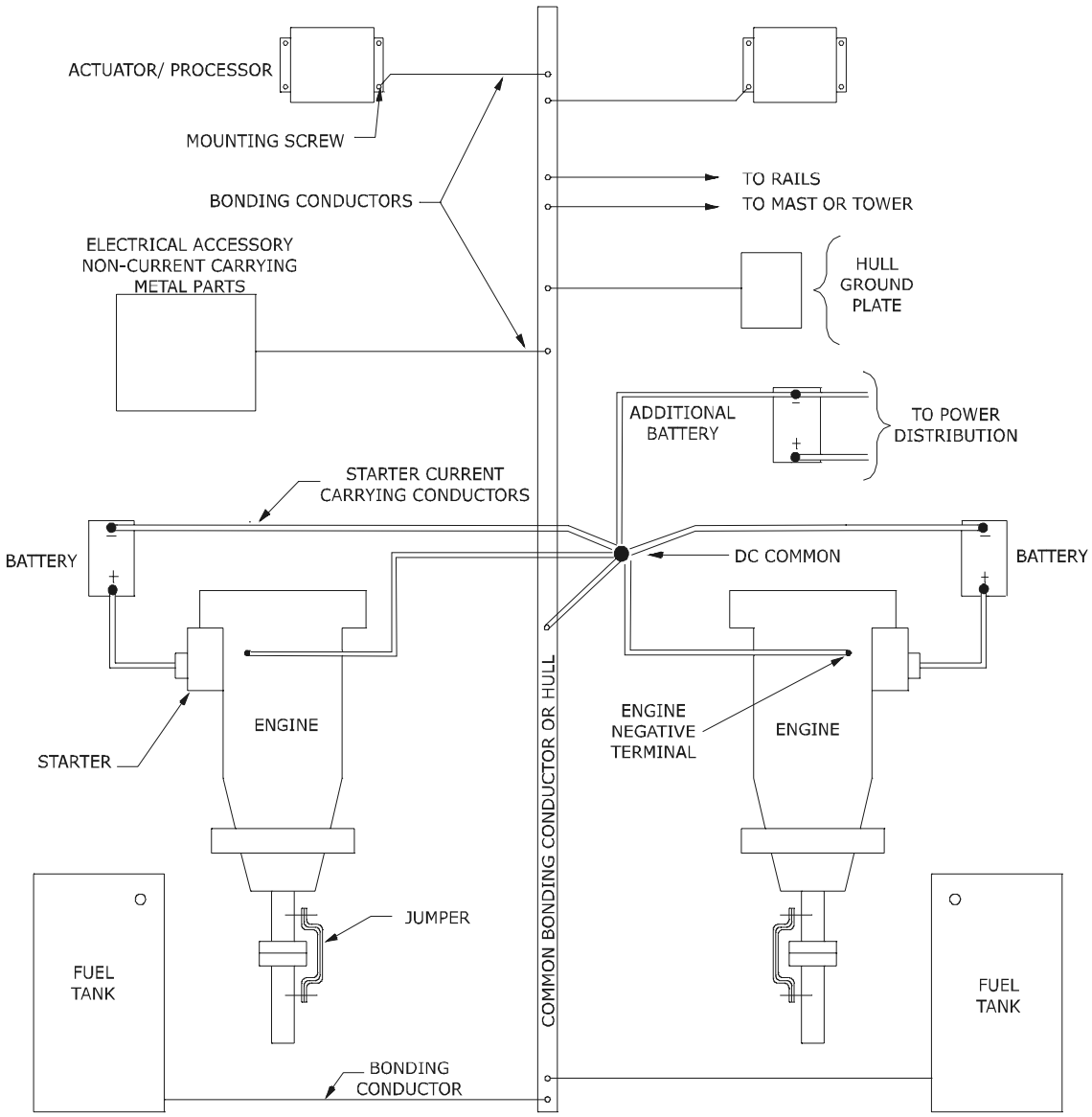
Bonding: A.B.Y.C. E-11, 46 CFR 111.05

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 metallic hull of the vessel may also serve as the common bonding conductor.

If it is desirable for the item being installed to be bonded to the vessel bonding system, and the installation or mounting method does not provide the desired path, a separate bonding conductor may be required.



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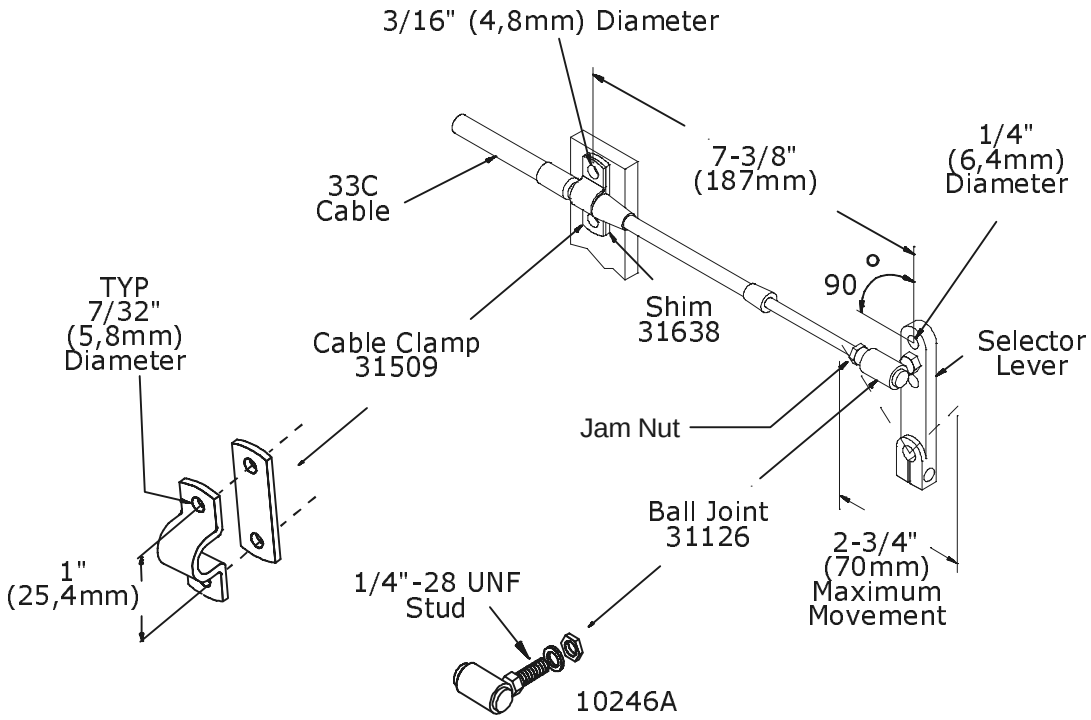
Universal Mounting Kit

Fabricate Bracket to match dimensions shown



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MM13821 Rev.A 8/03

43C Cable Conversion Kit

9000 Series Processors and Actuators
585CE Actuator (Serial Number B06500 and up)
813CE Actuator (Serial Number C01150 and up)
ClearCommand Processors (Serial Number D02100 and up)

Revisions List

Rev	Date	Revision Description
A	8/03	Added 9000 Series.

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

A) Parts Required:
One 43C Conversion Kit (P/N 13821) for each cable. Kit includes the following:
- 43C cable nut (P/N MS12820)
- 43C cable retainer (P/N 13694)
- Cable retainer screws (P/N 00791)

B) Tools Required:
- Snap Ring Tool or Small Slotted Screwdriver
- Phillips Screwdriver
- 7/16 Nut Driver or Socket
- 7/16 Open End Wrench

C) Actuator/Processor Preparation [Refer to Figure 1:]

D) Remove cover to Actuator/Processor.

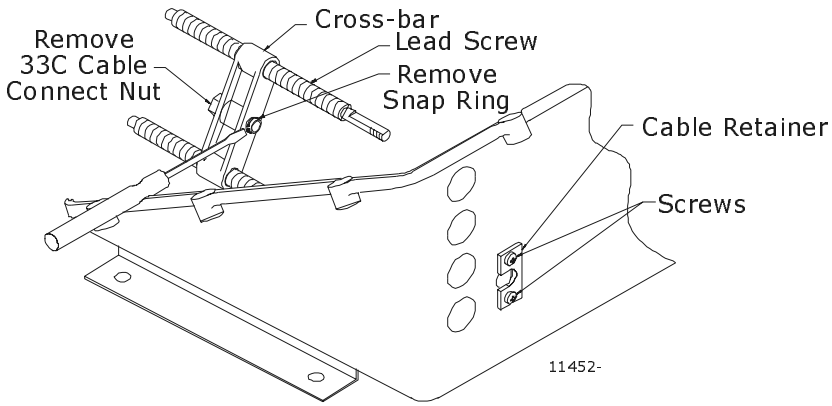

Figure 1: Actuator/Processor Preparation

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

E) Remove screws holding Cable Retainer in place.

F) Remove and discard Cable Retainer.

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

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

I) Cable Installation [Refer To Figure 2:]

NOTE: 43C CABLE AND JAM NUT ARE SUPPLIED BY OTHERS.

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

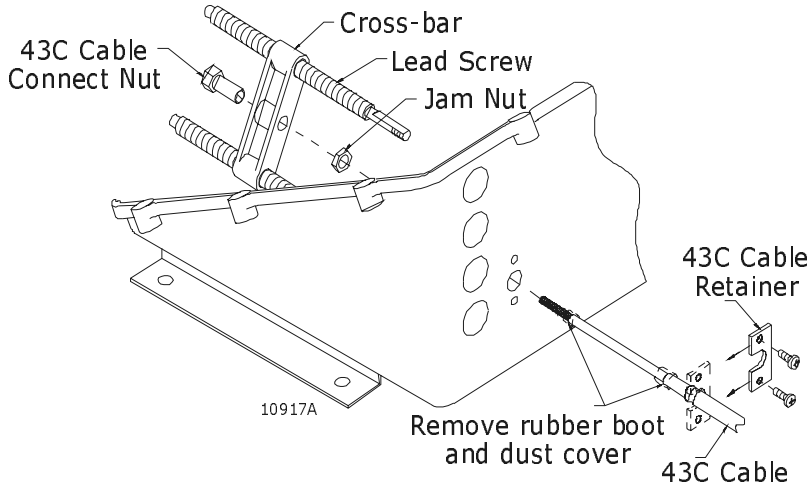

Figure 2: Actuator/Processor Cable Installation

2. Remove and discard the rubber boot and the rubber dust cover from the end of the 43C cable to be installed in the Actuator/Processor.
3. Insert the end of the cable through the hole in the Actuator/Processor.
4. Thread the jam nut onto the end of the cable inside the Actuator/Processor.
5. On the outside of the Actuator/Processor, press the 43C Cable Retainer over the notch in the 43C cable. This is intended to be a snug fit and may require some force.
6. Install two screws through the 43C Cable Retainer and into the Actuator/Processor.
7. Tighten the two screws securely with a Phillips Screwdriver.
8. Insert the 43C Cable Connect Nut through the cross-bar.
9. Thread the 43C Cable Connect Nut onto the end of the 43C cable.
10. After the cable connect nut is threaded onto the cable, tighten the jam nut against the cross-bar using a 7/16 nut driver or socket and 7/16 open end wrench.
11. Replace cover to Actuator/Processor. Refer to technical manual supplied with the Actuator/Processor for any other required set up or adjustment.

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MMC-165 Rev.D 3/02

Electronic Propulsion Control Systems Three Year Limited Warranty

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

A) Coverage Under Warranty

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

Year One

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

Year Two and Three

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

B) No Coverage Under Warranty

The following will not be covered under warranty.

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

C) Warranty Service

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

1. Prior to returning any product to the factory, you must contact ZF Mathers Service Department for a Material Return Authorization (MRA) number. Return the product freight prepaid, marked clearly with the MRA number and a description of the malfunction.
2. If there is a defect covered by warranty, ZF Mathers will, at its option, either repair or replace the defective part or product. If after inspection, ZF Mathers determines that the product is not defective, ZF Mathers will charge a testing fee and return the product to the sender, freight collect.
3. Repair or replacement during the warranty period will not extend the warranty period.
4. All claims must be submitted within 30 days from date of service.
5. Claims for over 3 hours must be pre-approved by the ZF Mathers Service Department.

APPENDIX B

B TROUBLESHOOTING

B-1 ERROR CODES

If any errors were to occur with the 9001 Actuator, the operator would be warned, first of all, with a tone at the Remote Stations. This tone indicates that a problem exists, but doesn't provide in depth details. The details regarding the type of error will be displayed at both the corresponding Processor and the Trolling Actuator. The Error Code will be displayed on the Processor or Actuator which is directly affected by the error. In some cases, a single fault could produce and Error Code on the Actuator and a different Error Code on the corresponding Processor. More on multiple Error Codes will be covered later.

Error Codes will be displayed in two manners, a steady or a blinking display. When the Error Code is steady, a fault had been detected, but is no longer and Active Error. A blinking Error Code indicates that an Error Code has been detected and is still an Active Error.

The corresponding Processor, as far as error reporting is concerned, considers the Troll Actuator's servo as Servo No. 3. Therefore a problem with the Troll Actuators Servo No. 1 will be reported as a Servo No. 3 error on the corresponding Processor.

The following Error Codes, in addition to Error Codes listed in the Processor's Manual, may be reported on the Primary Processor in the event of an error with the Trolling Actuator:

Table B-1: Primary Processor (Troll related Error Codes)

Error No.	Title	Description
55	Station Expander/ Trolling Actuator Communication Error	Communication between the Primary Processor and the Trolling Actuator has been lost.
68	Servo No. 3 (Trolling) Jam	The Troll Servo is unable to reach the commanded position.
69	Servo No. 3 (Trolling) Feedback High	The Feedback signal from the Troll Servo it too high.
70	Servo No .3 (Trolling) Feedback Low	The Feedback signal from the Troll Servo is too low.

The following Error Codes may be reported on the Trolling Actuator in the event of an error with the Trolling Actuator:

Table B-2: 9001 Error Codes

Error No.	Title	Description
44	CAN Communication Form Error	The CAN message is not received in the proper format.
45	CAN Communication Acknowledge Error	The Trolling Actuator has not received an acknowledgement from the Primary Processor.
47	CAN Communication Bit 0 Error	A discrepancy is detected with Bit 0.
50	Communication Error Time-out w/ Processor ID No. 1	Serial Communication cannot be established with Processor ID No. 1.
51	Communication Error Time-out w/ Processor ID No. 2	Serial Communication cannot be established with Processor ID No. 2.
52	Communication Error Time-out w/ Processor ID No. 3	Serial Communication cannot be established with Processor ID No. 3.
53	Communication Error Time-out w/ Processor ID No. 4	Serial Communication cannot be established with processor ID No. 4

Table B-2: 9001 Error Codes

Error No.	Title	Description
54	Communication Error Time-out w/ Processor ID No. 5	Serial Communication cannot be established with Processor ID No. 5.
62	Servo No. 1 (Troll) Jam	Servo No. 1 is unable to reach the commanded position.
63	Servo No. 1 (Troll) Feedback Signal High	The Feedback Signal from Servo No. 1 is too high.
64	Servo No. 1 (Troll) Feedback Signal Low	The Feedback Signal from Servo No. 1 is too low.
65	Servo No. 2 (Troll) Jam	Servo No. 2 is unable to reach the commanded position.
66	Servo No. 2 (Troll) Feedback Signal High	The Feedback Signal from Servo No. 2 is too high.
67	Servo No. 2 (Troll) Feedback Signal Low	The Feedback Signal from Servo No. 2 is too low.

The following tables list the same Error Codes as above, along with possible causes and solutions.

Table B-3: Primary Processor (Troll related Error Codes)

NOTE: IN TWIN SCREW TROLL APPLICATION, BOTH PORT AND STARBOARD PROCESSORS MAY DISPLAY ERROR CODES.

Error #	Cause	Solution
55	a. Power it turned 'Off' to the Troll Actuator.	a. Turn power 'On' to the Troll Actuator, clear all Errors and cycle power.
	b. Serial Communication cannot be established with the 9001 Actuator.	b. Serial Harness is not wired or plugged in properly.
	c. The Troll Actuator's Control Circuit (MS14528) is defective.	c. Replace the Troll Actuator's Control Circuit.
	d. The incorrect Processor ID is assigned to a Servo.	d. Assign an ID number to a Servo which matches the ID number of the corresponding Processor
68	a. The Troll push-pull cable is unable to reach the commanded position due to misadjusted travel.	a. Readjust the Troll push-pull cable. Refer to Section 5.5 of this Manual.
	b. Defective push-pull cable.	b. Replace the push-pull cable.
	c. Trolling Valve lever bound up.	c. Call a Certified Marine Transmission Service Technician.
	d. Defective Servo Motor.	d. Replace the entire Troll Actuator.
	e. The Control Circuit (MS14528) is defective.	e. Replace the entire Troll Actuator.
69	a. The Troll Servo's feedback potentiometer is out of calibration.	a. Replace the entire Troll Actuator or call the factory for calibration details.
	b. The Troll Servo's feedback potentiometer is defective.	b. Replace the entire Troll Actuator.
	c. The Troll Servo's feedback potentiometer plug's blue wire is not making good contact.	c. Check the pin on the blue wire and re-crimp if necessary or replace.
70	a. The Troll Servo's feedback potentiometer is out of calibration.	a. Replace the entire Troll Actuator or call the factory for calibration details.
	b. The Troll Servo's feedback potentiometer is defective.	b. Replace the entire Troll Actuator
	c. The Troll Servo's feedback potentiometer plug's green or orange wire is not making good contact.	c. Check the pin on the green wire and re-crimp if necessary or replace.
	d. The Control Circuit (MS14528) is defective.	d. Replace the entire Troll Actuator.

Table B-4: 9001 Error Codes

Error #	Cause	Solution
44	a. The Termination Resistor jumpers "JMP1" are not properly configured.	a. Make certain that the jumper is on both pins at the Processor or Actuators which have a single cable connected to the Serial Communication Pigtail.
	b. The Serial Harness is in excess of 130 feet (40 m.).	b. Reposition the Processor or Actuator so that the Harness is 120 feet or less.
	c. The Serial Harness' shield is not properly terminated.	c. Ensure that the shield is terminated, and the termination is at one side only.

Table B-4: 9001 Error Codes

Error #	Cause	Solution
45	a. The Serial Communication Cable is not properly installed at the 9001 Actuator. b. The 9001 Serial Pigtail not properly wired. c. Defective Serial Transceiver.	a. Ensure that the Serial Harness is plugged fully into the 9001 Pigtail. b. Check the Pigtail connections for proper terminations. c. Replace the 9001 Control Circuit or the Actuator.
46	a. The Termination Resistor jumpers "JMP1" are not properly configured. b. The Serial Harness is in excess of 130 ft. (40 m). c. The Serial Harness' shield is not properly terminated.	a. Make certain that the jumper is on both pins at the processor or Actuators which have a single cable connected to the Serial Communication pigtail. b. Reposition the Processor or Actuator so that the Harness is 120 feet or less. c. Ensure that the shield is terminated, and the termination is at one side only.
47	a. The Termination Resistor jumpers "JMP1" are not properly configured. b. The Serial Harness is in excess of 130 feet (40 m.). c. The Serial Harness' shield is not properly terminated.	a. Make certain that the jumper is on both pins at the Processor or Actuators which have a single cable connected to the Serial Communication Pigtail. b. Reposition the Processor or Actuator so that the Harness is 120 feet or less. c. Ensure that the shield is terminated, and the termination is at one side only.
50	a. The Serial Communication Cable is not properly installed. b. Loss of Serial Communication with Processor ID No. 1. c. Processor ID No. 1 DC power is turned 'Off'. d. Processor ID No .1 failure.	
51	a. The Serial Communication Cable is not properly installed. b. Loss of Serial Communication with Processor ID No. 2. c. Processor ID No. 2 DC power is turned 'Off'. d. Processor ID No. 2 failure.	
52	a. The Serial Communication Cable is not properly installed. b. Loss of Serial Communication with Processor ID No. 3. c. Processor ID No. 3 DC power is turned 'Off'. d. Processor ID No. 3 failure.	
53	a. The Serial Communication Cable is not properly installed. b. Loss of Serial Communication with Processor ID No. 4. c. Processor ID No. 4 DC power is turned 'Off'. d. Processor ID No .4 failure.	
54	a. The Serial Communication Cable is not properly installed. b. Loss of Serial Communication with Processor ID No. 5. c. Processor ID No. 5 DC power is turned 'Off'. d. Processor ID No. 5 failure	
62	a. Misadjusted Servo No. 1 push-pull cable travel. b. Servo No. 1 excessive troll lever load. c. Servo No. 1 push-pull cable defective. d. Low voltage to the Troll Actuator. e. Defective Troll Actuator.	a. Refer to Sections 5-4.1.2, 5-4.1.3 & 5-4.1.4. b. Disconnect push-pull cable from lever and manually manipulate. Must be less than 40 lb. (454 g.) load. c. Replace the push-pull cable. d. Correct the power supply as required. e. Replace the Troll Actuator.

Table B-4: 9001 Error Codes

Error #	Cause	Solution
63	a. Servo No. 1 feedback potentiometer's orange lead not making good contact with "P2" on the circuit board.	a. Solder or crimp the connection as necessary.
	b. Servo No. 1 feedback potentiometer out of calibration.	b. Replace the Actuator or calibrate the potentiometer.
64	a. Servo No.1 feedback potentiometer's green or blue lead not making good contact with "P2" on the circuit board.	a. Solder or crimp the connection as necessary.
	b. Servo No.1 feedback potentiometer's not plugged into "P2" on the circuit board.	b. Insert the potentiometer plug into "P2".
	c. Servo No.1 feedback potentiometer out of calibration.	c. Replace the Actuator or calibrate the potentiometer.
65	a. Misadjusted Servo No.2 push-pull cable travel.	a. Refer to Sections 5-4.1.2, 5-4.1.3 & 5-4.1.4.
	b. Servo No.2 excessive troll lever load.	b. Disconnect push-pull cable from lever and manually manipulate. Must be less than 40 lb. (454 g.) load.
	c. Servo No.2 push-pull cable defective.	c. Replace the push-pull cable.
	d. Low voltage to the Troll Actuator.	d. Correct the power supply as required.
	e. Defective Troll Actuator.	e. Replace the Troll Actuator.
66	a. Servo No.2 feedback potentiometer's orange lead not making good contact with "P2" on the circuit board.	a. Solder or crimp the connection as necessary.
	b. Servo No.2 feedback potentiometer out of calibration.	b. Replace the Actuator or calibrate the potentiometer.
67	a. Servo No.2 feedback potentiometer's green or blue lead not making good contact with "P2" on the circuit board.	a. Solder or crimp the connection as necessary.
	b. Servo No.2 feedback potentiometer's not plugged into "P2" on the circuit board.	b. Insert the potentiometer plug into "P2".
	c. Servo No.2 feedback potentiometer out of calibration.	c. Replace the Actuator or calibrate the potentiometer.

SER-165, Rev. I 1-03

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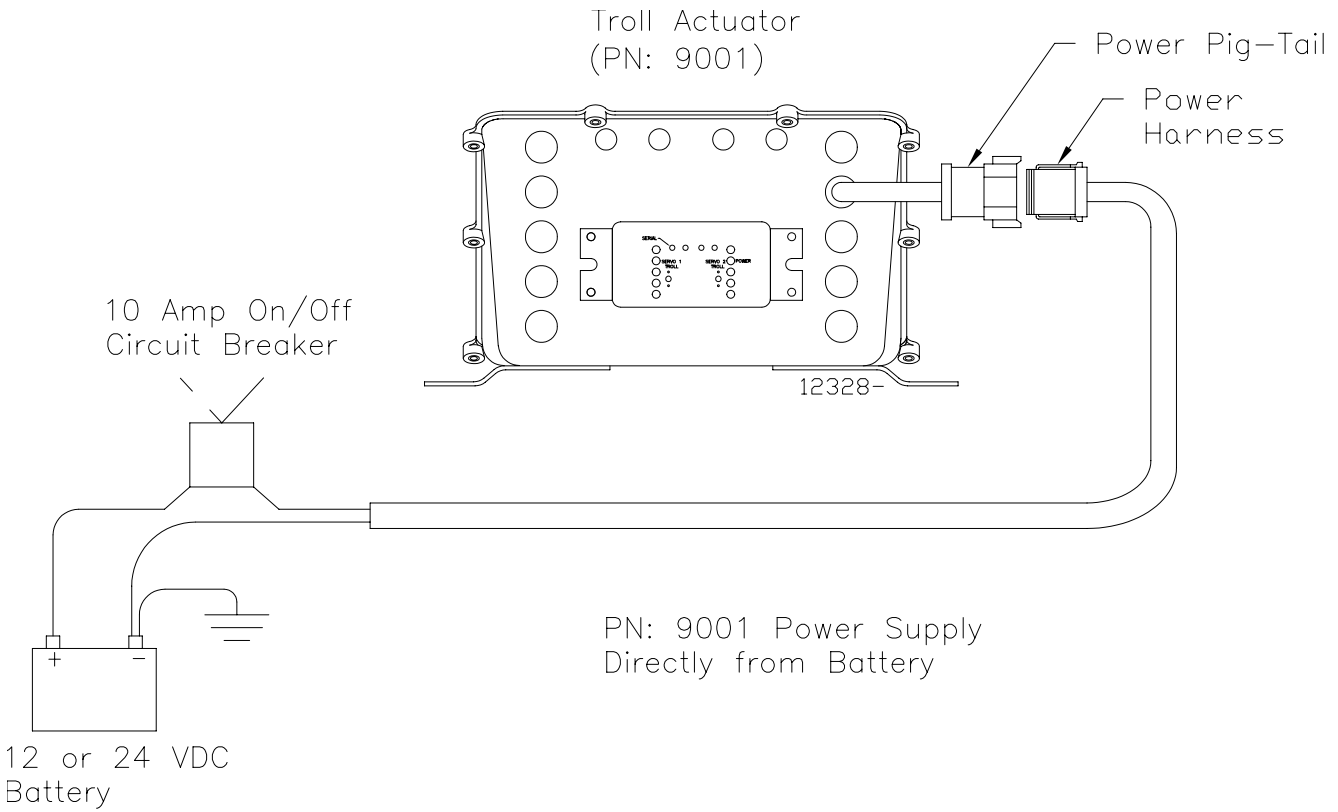
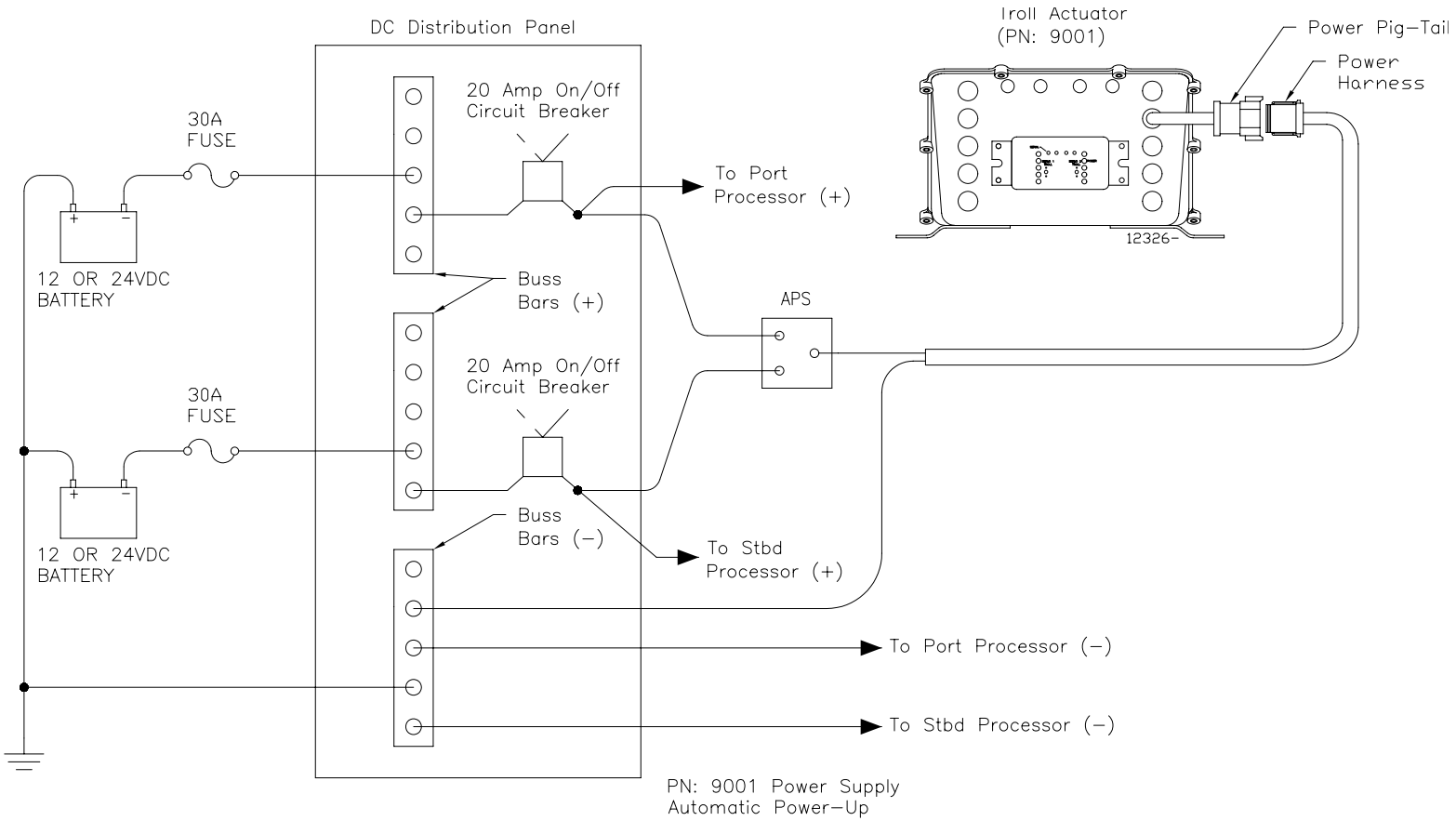
APPENDIX C

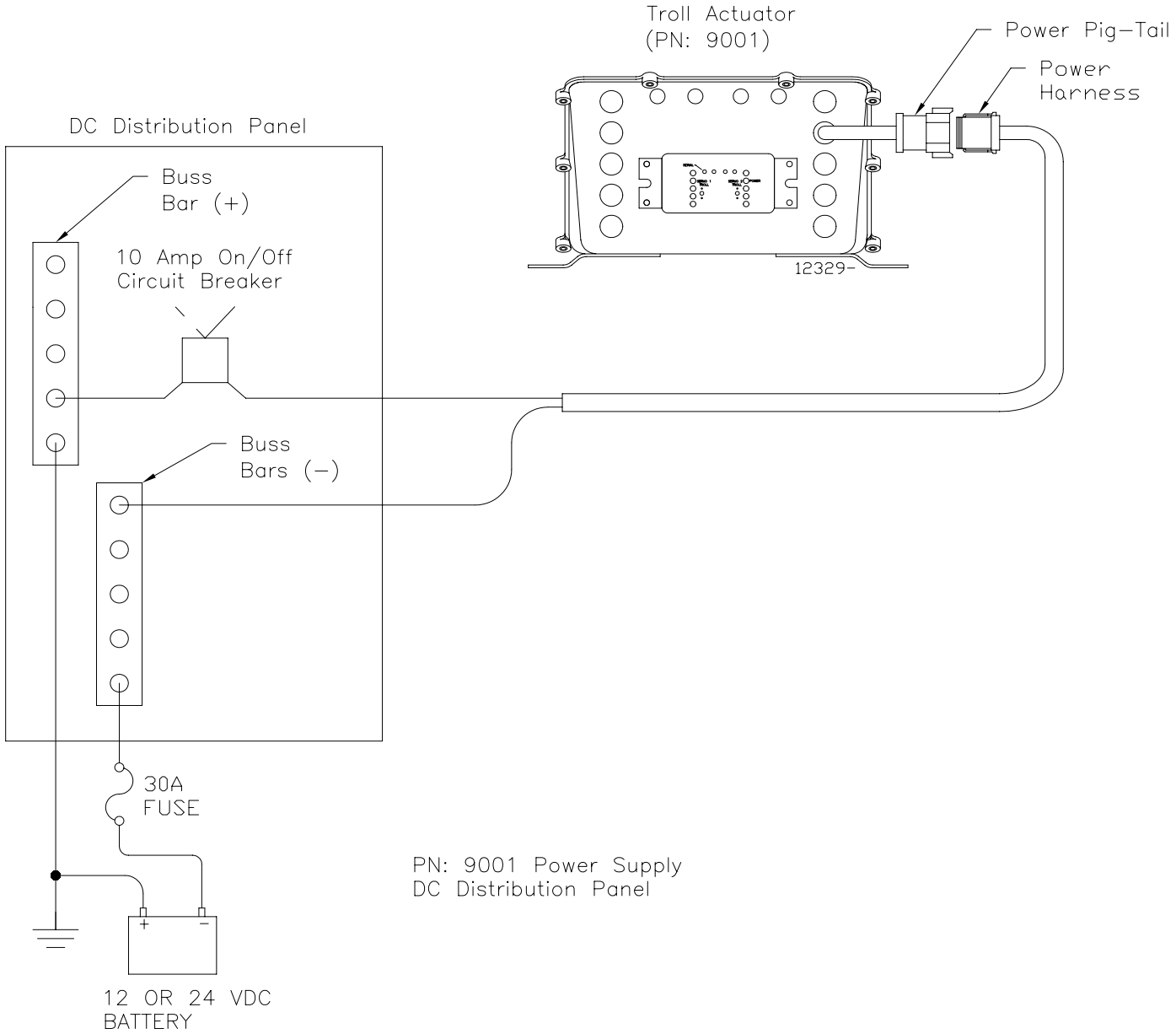
Drawing 12328- 9001 Power Supply Automatic Power-Up



Drawing 12326- 9001 Power Supply Automatic Power-Up



Drawing 12329- 9001 Power Supply DC Distribution Panel



Drawing 12330- 9001 Power Supply Remote Switching