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**MicroCommander
Engine Control
Installation Instructions
585 Actuator**



Manufactured by:

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1. GENERAL INFORMATION

The MicroCommander engine control provides single lever operation of engine speed and shift from one to five remote stations. The control system operates from a 12, 24, or 32 volt DC battery supply and in the static condition draws seven watts. Maximum is 160 watts.

The engine speed and shift are sequenced such that the engine throttle must be at Idle before shift, and shift must then be completed before the engine throttle will advance.

The connection to the engine throttle and clutch is through standard Type 33C push-pull cables. (Reference Section 11.)

The MicroCommander Engine Control offers an option to add automatic engine synchronization and trolling valve control. Sections 18. and 19. of this manual explains operation, installation, and adjustments of these options.

Requirements:

- Throttle or clutch selector lever load should not exceed 40 lbs. (18kg).
- MicroCommander Engine Controls require a reliable battery source of 12 to 32 volts DC.
- The DC power required is to be supplied through a 10 ampere circuit breaker. (One for each Actuator)

CAUTION: Avoid using the starting battery on 12 volt systems, if possible. A dedicated battery for MicroCommander and other electronic equipment is recommended. Do not use a power converter or battery charger without a battery.

2. REQUIRED PARTS AND TOOLS

2.1 SUPPLIED BY YOUR MICROCOMMANDER DEALER

2.1.1 Control Head

	Black	Chrome Lever
Single Control Head (Single Screw)	450-1	453-1
Dual Control Head (Twin Screw)	460-1 or -2	463-1 or -2

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One station transfer button is included with each Control Head, a twin screw remote station requires only one transfer button.

The -2 includes a green LED for synchronization.

Included are gasket, wire, terminals, mounting screws, and watertight cable grip (for cable entrance on Actuator).

Optional Control Head levers are available. (Contact Mathers Controls Inc.)

2.1.2 Actuator

One 585 Actuator for each engine. Included are installation instructions, ferrite bead, wire, terminals, tie wraps, anti-static wrist strap, and WAGO tool (See Figure 11). A WAGO tool and a spare fuse are taped inside the Actuator. Also included are two cable grips for power cable and for start interlock cable. Mounting hardware is not included.

2.1.3 Electric Cable

Pc.No. 180

Eight- Conductor Cable (Control to Actuator) Pc.No. 350
500 foot (152m) spool
Shielded 20 AWG, 300 V, PVC Insulated: -20°C to +80°C, PVC Jacket.
Color Coded UL VW-1.

Pc.No. 212

Two- Conductor Power Cable Pc.No. 349
250 foot (76m) spool
14 AWG, 300 V, PVC Insulated: -20°C to +105°C PVC Jacket.
Red with purple stripe and black UL VW-1.

Pc.No. 183

Two- Conductor Cable Start Interlock Pc.No. 355
250 foot (76m) spool
16 AWG, 300 V, PVC Insulated: -20°C to +105°C PVC Jacket.
Yellow with red stripe UL VW-1.

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2.2 SUPPLIED BY INSTALLER

2.2.1 Tools Required For Installation

Anti-static wrist strap is included with Actuator.

Wire cutter (Recommend Thomas & Betts WT-2000)

Wire stripper (Recommend Thomas & Betts WT-2000)

Wire crimper (Recommend Thomas & Betts WT-2000)

7/16" Socket and medium extension

3/8" Wrench

7/16" Wrench

Screwdriver - medium phillips head #2

Screwdriver - medium straight slot

Screwdriver - small straight slot

Hole saw - 1" (25,4mm)

Drills - 9/32" (7,2mm) and 7/32" (5,6mm)

2.2.2 Push-Pull Cables

Type 33C push-pull cables. (two per engine) The cable length is measured from end of thread to end of thread. Cables are usually stocked in one foot (0,3m) increments.

2.2.3 Push-Pull Cable Connection Kits

The kits provide hardware to connect the Type 33C cable to the engine throttle and transmission. Many engines and out drives are delivered with factory mounted kits. Morse standard connection kits are listed in Section 9. A Universal Mounting kit, listing parts and dimensional data, is shown in Section 10.

2.2.4 Control System Power 'ON' - 'OFF' (See Figure 3)

The power for controls should come from the same power distribution panel as the other required engine function. Each Actuator requires a switched 10 amp circuit breaker with manual reset. If this is not possible, a circuit breaker and relay may be mounted near the battery and

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power connected directly to the Actuator. Examples are shown in Fig. 3. Use a relay with coil voltage to match your DC battery voltage. (Reference Section 11.)

NOTE: Do not use the key switch as the DC power supply. The key switch must only energize a relay as described above.

2.2.5 Engine 'STOP' Button

An engine 'STOP' button, or switch, **MUST** be located at each remote station.

WARNING: An engine 'STOP' button at each station is an absolute requirement and will cancel warranty, if the requirement is not followed.

3. PLAN THE INSTALLATION

3.1 ACTUATOR LOCATION

Considerations:

- A) The Actuator is spray proof but cannot be immersed.
- B) Bulkhead mount is preferred for ease of access for wiring and adjustments, but the Actuator can be mounted in any attitude. If the clutch cable is connected to an I/O drive outside the hull, then the Actuator must be two feet (0,6m) above water line. Do not mount to the engine, or transmission, or any location that will allow excessive vibration. Use 1/4" or M6 fasteners (four each).
- C) Locate the Actuator so that the push-pull cables from the

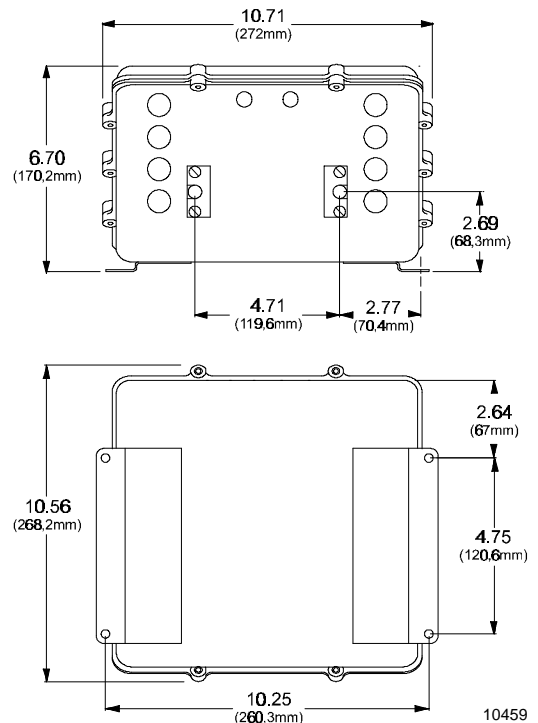


Figure 1 – Actuator Dimensions

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Actuator to the engine have easy bends, with the least total degrees of bend and moderate length. EXAMPLE: Minimum bend radius 10" (254mm) try for total degrees of bends of less than 270 degrees - Cable length normally under 20 feet (6m).

- D) The Actuator is usually located in the engine room. If the engine room is too small, locate in any accessible area.
- E) MicroCommander uses electronic circuits that can be influenced by strong magnetic fields, and static charges. Power source must be bonded (connected) to the hull. Do not mount close to gas engine ignition systems, alternators, or electric motors. Allow four feet (1,2m) of clearance, or more.
- F) Locate Actuator away from heat sources, such as engine exhaust manifolds.
- G) Locate Actuator to be accessible for electric, and push-pull cable connections.

3.2 REMOTE CONTROL HEAD LOCATION

Considerations:

- A) The Control Head is watertight when properly mounted on a console, but must be protected from water or spray inside or below console.
- B) The Control Head mounts flush to the console. The only penetration of the console is for wiring and mounting screws. The control is secured with screws from the bottom side of the panel. Screws provided are #8-32 x 1".
- C) When mounting a control head that may be weather exposed from the

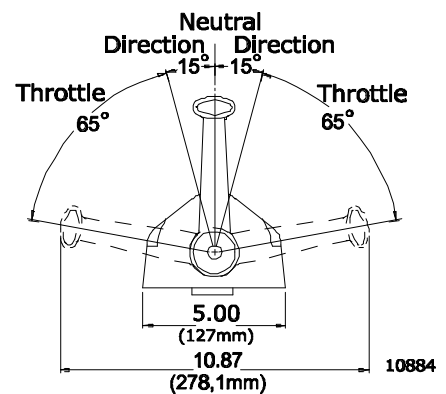
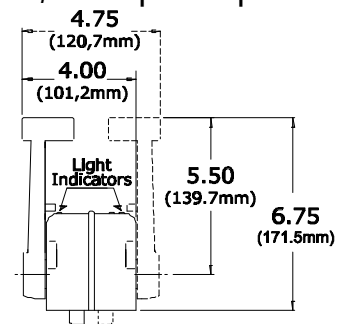


Figure 2 – Control Head Dimensions

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underside, consider using a Weather Mounting Control Box available from Mathers Controls Inc.

D) Retrofit applications will need to plan an adapter pad to cover the old control cutout and to mount the control head. Adapter and cover pads are available from Mathers Controls Inc.

3.3 DC POWER SOURCE

The MicroCommander Actuator requires a battery source (12, 24 or 32 volts DC) protected by a 10 ampere circuit breaker. It is not recommended to use engine starting batteries on 12 volt systems, because the cranking voltage may be too low. It is important to keep the length of power cable short to reduce voltage drop. The 14 gauge twisted pair 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).

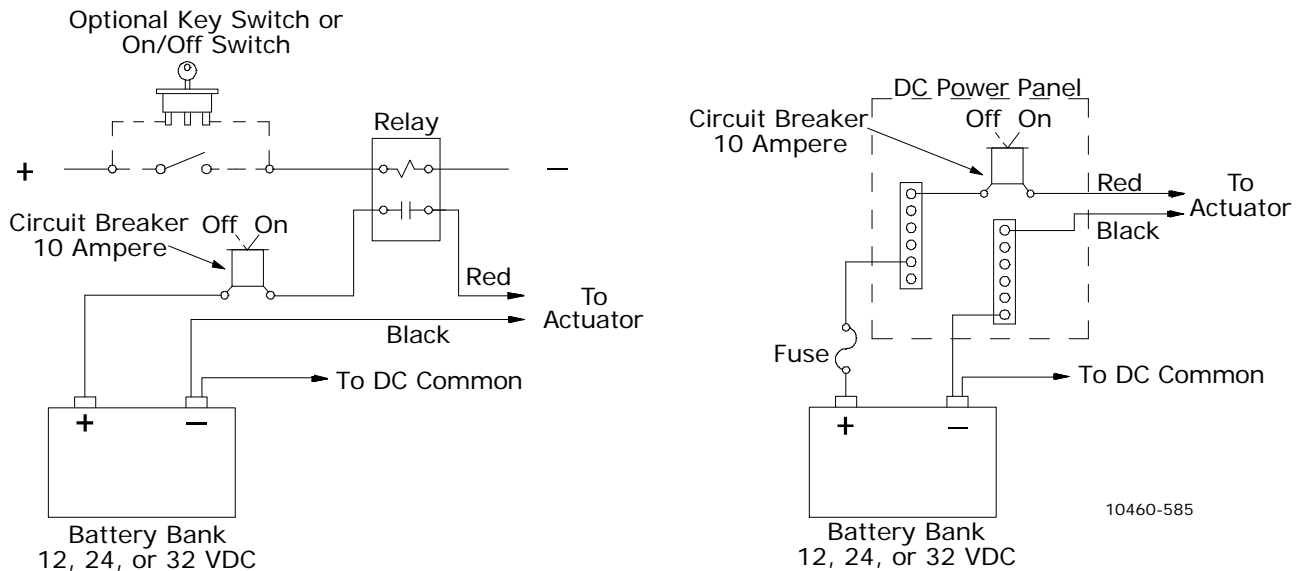


Figure 3 – Power Source

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NOTE: It is important 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%. The DC return to the battery must be large enough to supply all current requirements with a voltage drop of less than 1%. (Reference Section 11.)

4. INSTALLATION

Before starting the actual installation of the MicroCommander Engine Control make sure you have the correct parts and tools on hand. See Section 2 - REQUIRED PARTS AND TOOLS. Read all the instructions pertinent to each part before beginning the installation of that part.

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

4.1 THE ACTUATOR

Secure the Actuator using ¼" or M6 fasteners. When the Actuator cover is removed, connect the wrist strap to your person and the ground connector to the Actuator frame. Install the power cable grip and the start interlock grip in the top frame holes as shown in Figure 7. When not working on the Actuator, keep the cover in place to prevent damage to circuits.

4.2 THE CONTROL HEADS

Use the control head template, Section 15., to locate holes. Drill the screw holes 7/32" (5,6mm) and the 1" (25,4mm) corner cutout holes. The #8-32 x 1" mounting screws are for a ¾" (19,1mm) maximum thick mounting surface. Check that the four (4) mounting screws will start into the control head. Remove the control and strip the adhesive cover from the gasket. Apply the adhesive side to the console.

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4.3 STATION TRANSFER BUTTON

One station transfer button is required at each control station. Locate carefully so that the button is accessible, but will not be inadvertently depressed. Use the hole template, Section 15. The station transfer button is waterproof. There are two methods of mounting: Surface mount or Recessed mount for thin panels (See Figure 4).

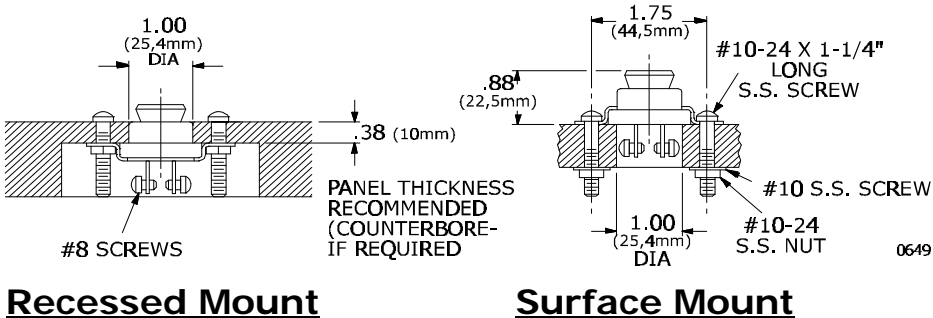


Figure 4 – Transfer Button Mounting Dimensions

4.4 ENGINE 'START' SWITCH

MicroCommander is interlocked to prevent engine 'start' until power is 'ON' and the transmission is in 'NEUTRAL'. The engine 'START' signal must be connected through the Actuator to the starter solenoid or relay. (See Figure 5) The interlock will function with a 'START' signal up to 50 volts DC and 30 amp maximum.

CAUTION: The circuit board is designed for a maximum of 30 amps 'START' signal current. Greater current will damage the interlock circuit.

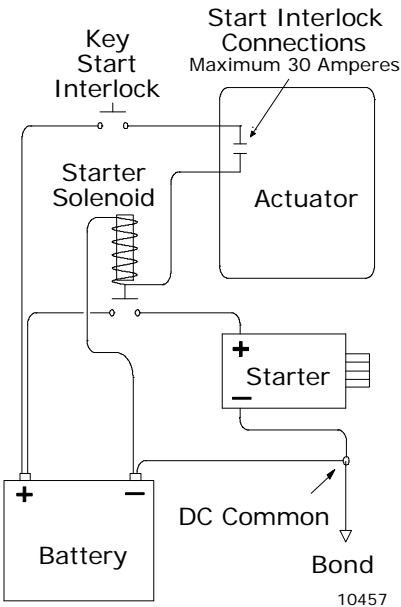


Figure 5 – Start Interlock

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4.5 ENGINE 'STOP' SWITCHES

Engine 'STOP' switches are required at all remote control stations. The 'STOP' switches are installer supplied.

WARNING: Each remote station must have some method to stop the engine or engines. This requirement must be followed or warranty is canceled.

4.6 EIGHT-CONDUCTOR CABLE

Install the eight-conductor electric cable (two cables if twin screw) between each control head and the appropriate Actuator. There can be as many as five remote stations. Label each eight-conductor cable at both ends with the station it connects, and port or starboard engine control.

The eight-conductors in the electric cable are color coded. Each conductor shall be installed so that it is protected from physical damage. Conductors shall be supported by clamps or straps not more than 18" (0,5m) apart, unless contained in a conduit. (Reference Section 11.)

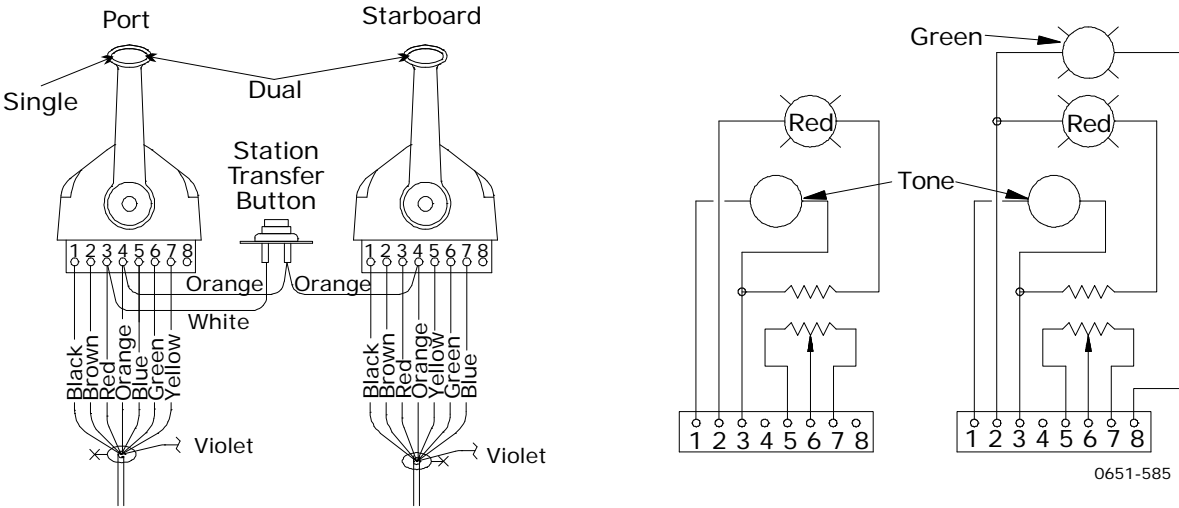


Figure 6 – Control Head Connections

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4.7 CONTROL HEAD

At the control head, strip back the PVC cover on the cable approximately 2½" (63,5mm). 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. The installer must strip ¾" (9,5mm) insulation off each wire and crimp connectors. Connections 5 and 7 of the control connector plug are direction sensitive. The connections must be as follows:

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

CAUTION: When making a twin screw installation, the white wire connects to Terminal 3 on the Port control only. The Starboard Terminal 3 is not connected. This is true at all stations. See Circuit Dwg., Section 14. Cable must be supported to eliminate load on Terminal Connections.

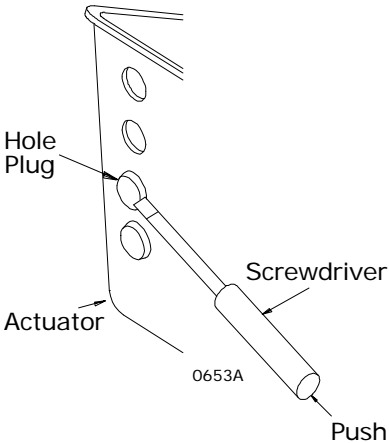


Figure 8 – Actuator Plug Removal

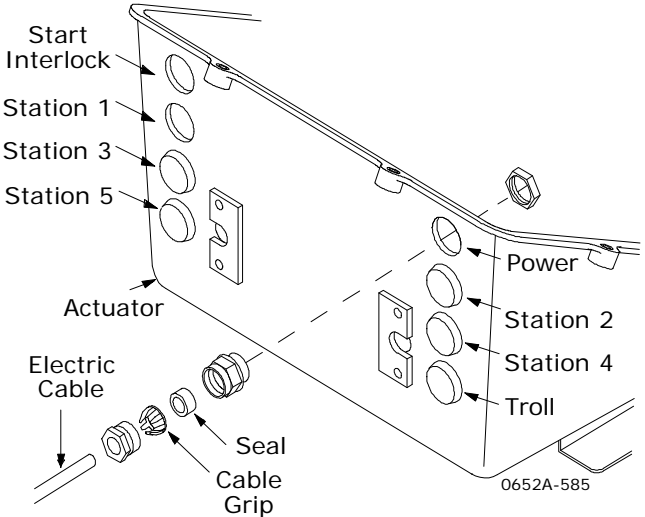


Figure 7 – Cable to Actuator

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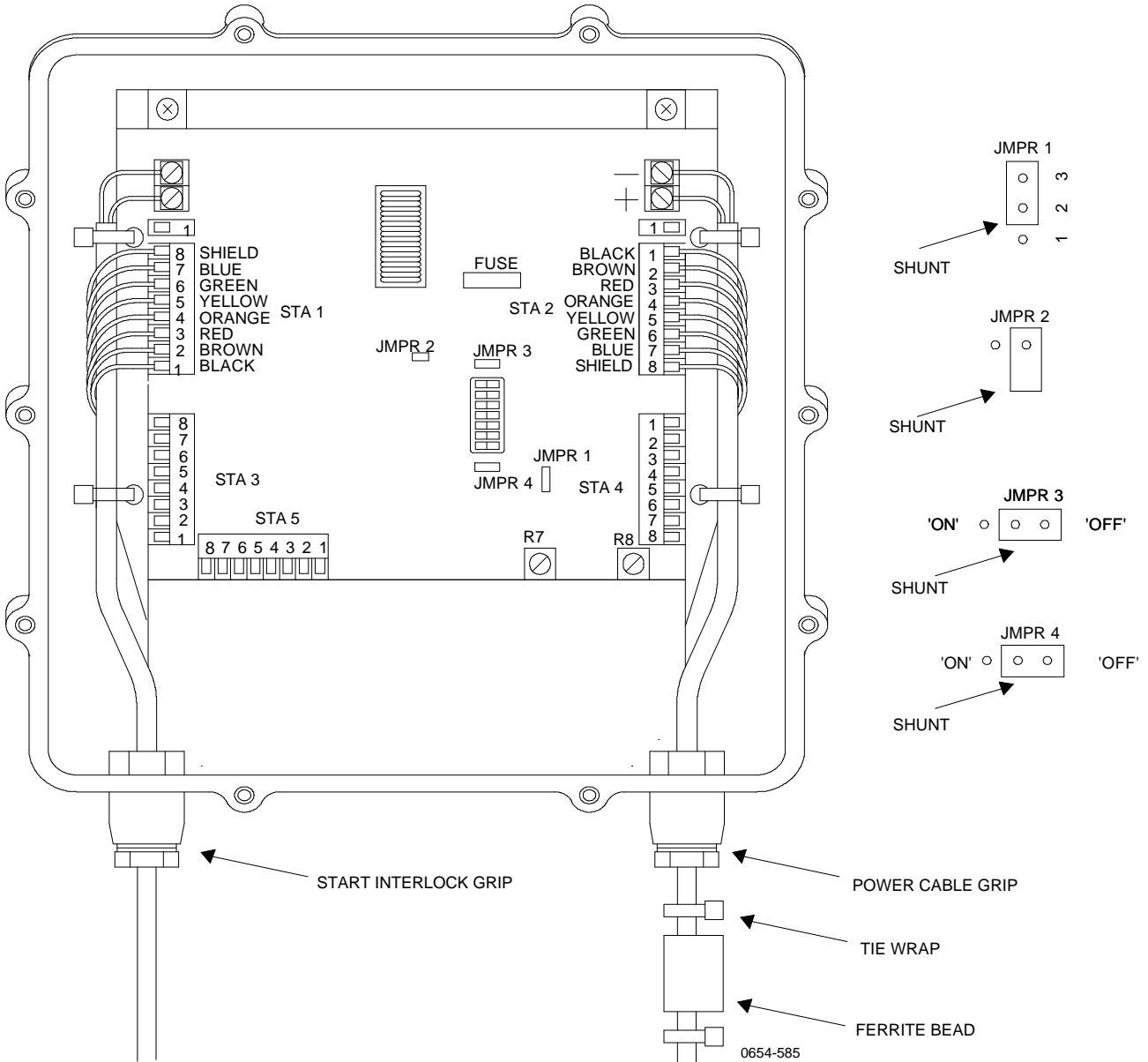


Figure 9 – Actuator Connections

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4.8 BONDING A.B.Y.C. E-1 46 CFR 111.05

All boats equipped with a permanently installed electrical system shall be equipped with a bonding system. The negative terminal of all batteries should be connected at only one (1) 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.

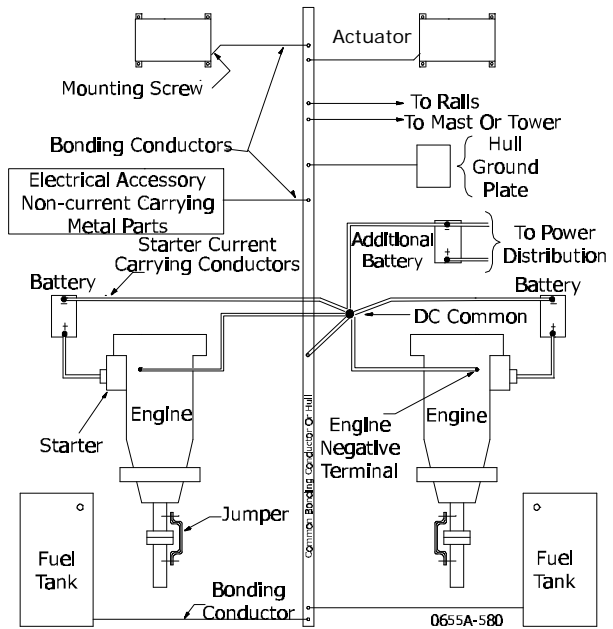


Figure 10 - Bonding

4.9 ACTUATOR

Remove the Actuator cover and connect your anti-static wrist strap to the Actuator frame and your wrist. Remove the cable hole plugs as required. (See Figure 8) Install the watertight cable grip that is packaged with the control head. Station No. 1 will connect through 'Station 1' as shown in Figure 7. Strip the PVC jacket and shielding back approximately 2" (50,8mm). The wire leads can be staggered for length to match the Station 1 terminal strip, and must not come in contact with the frame. Strip the wire 3/8" (9,5mm) on each lead. It is also recommended that the wire be LIGHTLY tinned. Connect colors as shown on Circuit Dwgs, Sections 13. and 14. A WAGO Tool, No. 236-332,

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is included with each Actuator. It is taped to the relay on the circuit board. It is used to depress the spring lock for the individual wire connection to the terminal strip. (See Figure 11) The shielding drain wire (bare wire) must be connected to terminal 8 on the terminal strip, and must not come in contact with the frame. Feed through a little slack cable and tighten the cable grip on the eight (8) conductor cable. The other stations eight (8) conductor cables are brought in the same way and are connected to the appropriate terminal. (See Figure 9) Secure the cable to the frame using tie wraps provided.

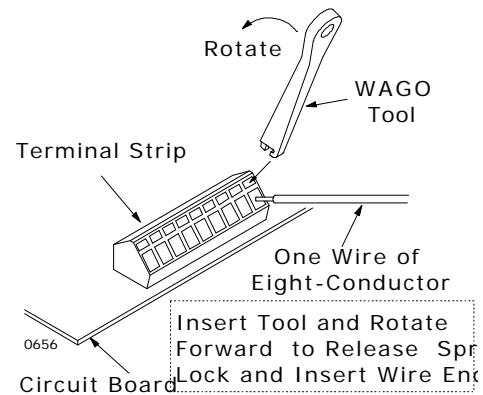


Figure 11 – Terminal Connection

NOTE: A jumper is required between terminals 5 and 6 on all unused stations on the circuit board.

4.10 CONNECT DC POWER TO ACTUATOR

When connecting the DC power cable to the Actuator be sure the power is 'OFF'. The (+) positive lead (red with purple stripe) connects the + DC power source to the Actuator. (See Figure 3) The (-) negative lead is black. The ferrite bead is fed onto the power cable before entering the Actuator. Tie wrap the power cable to the frame and tighten the cable grip.

4.11 INSTALL START INTERLOCK CABLE

NOTE: Maximum current rating of interlock relay is 30 amperes.

The start interlock cable, two (2) wires are yellow with a red stripe. Remove the key start lead at the start solenoid. (See Figure 5) Connect one (1) yellow with red striped wire to this

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lead and the other yellow with red striped wire to the start solenoid. Run the cable to the Actuator through the cable grip to the start interlock connections on the Actuator circuit board. See circuit drawings in Sections 13. and 14. The Actuator provides a start interlock that requires the controls to be 'ON' and clutch in 'NEUTRAL'. The 'START' signal voltage can be 12, 24 or 32 volts as it only passes through a relay in the Actuator.

NOTE: The most common source of trouble is loose wiring connections. Make certain that wiring connectors are properly crimped and cannot be pulled out. Crimps and connections must be made to the wire, not to the wire insulation. All screwed wire connections must be checked for security.

5. ADJUSTMENTS (ENGINES STOPPED)

- A) Turn the power 'ON' to the controls.
- B) The control head at each station will produce an intermittent tone.
- C) Depress one (1) station transfer button (control head lever in 'NEUTRAL'). The red indicator light on the control head should be illuminated, showing this station has control. Note on dual control heads, both red indicator lights must be illuminated.
- D) Move the control head lever full-ahead and full-astern. This will check that the controls are operating.

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

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5.1 ACTUATOR

Actuator Settings (as shipped) (see Sections 13 and 14.)

Throttle	R7 Pot	Fully counterclockwise gives minimum throttle.
'HI' Idle	R8 Pot	Fully counterclockwise. Leave in this position unless the 'HI' idle option is selected. (See Section 7.1.)
	JMPR 1	Shunt between 2 and 3 set for Station 5.
	JMPR 2	Shunt open as set for Station 5.
Throttle	JMPR 3	Throttle cable PUSH to increase speed.
Direction	◦ <input type="checkbox"/> <input type="checkbox"/>	Shunt 'OFF'.
Clutch	JMPR 4	Clutch cable 'PULL' ahead.
Direction	◦ <input type="checkbox"/> <input type="checkbox"/>	Shunt 'OFF'

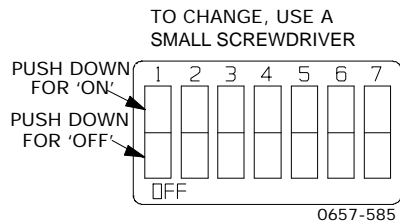


Figure 12 – SW1 Dip Switch

SW1 Settings (as shipped)(see Figure 12)

Throttle	(7) 'OFF'	Throttle pause of 0.5 second following shift.
Pause		Use when controlling hydraulic actuated clutches.
Clutch	(6) 'OFF'	Provides a maximum pause from full-ahead of 3.5 seconds.
Pause	(5) 'ON'	Section 6.1.2., lists optional settings.
	(4) 'OFF'	
Clutch	(3) 'ON'	1/16" (1,6mm) Dimensions are equal each side of neutral.
Movement	(2) 'ON'	1/8" (3,2mm) Switches to 'OFF' gives incremental increase.
	(1) 'ON'	1/4" (6,4mm) All switches 'ON' gives minimum cable travel.

5.2 CHECK REMOTE CONTROLS AND STATION TRANSFER

Move to each remote control station, and with the controls in the 'NEUTRAL' position, PUSH the station transfer button. The indicator light on the control will confirm that control transfer has taken place and that you have control.

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The controls are direction sensitive. To prove that the control wiring connections are correct:

- A) Place the control head levers in the 'NEUTRAL' position.
- B) Depress and hold the station transfer button, move the control head lever to the 'AHEAD' detent position. This will put the control system in "Warm-up" Mode.
- C) The red indicator light on the control head should blink in "Warm-up" Mode. The blinking indicator light shows that the clutch is in 'NEUTRAL', and the control head lever will position the throttle only.
- D) If the red indicator light is 'ON' in 'AHEAD' and blinks in 'ASTERN', then connections 5 and 7 on the control connector must be reversed (See Section 4.7).
- E) The "Warm-up" Mode must operate only in the 'AHEAD' direction.
- F) There are no further adjustments to the remote control.

5.3 PUSH-PULL CABLES

WARNING: Misadjusted clutch and throttle cables cause motors to burn out. Do it right by following these instructions:

- A) Check that push-pull cable anchor brackets are installed on the engine. If the brackets are not on the engine, select from Section 9., or fabricate brackets as shown in Section 10.
- B) As shipped from the factory, Clutch Direction Shunt (JMPR 4) is 'OFF', and therefore, the push-pull cable will 'PULL' on the shift lever for 'AHEAD'. If this is correct, leave it. If it is wrong, move shunt (JMPR 4) to 'ON', and the push-pull cable will PUSH the shift lever for 'AHEAD'.

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- C) As shipped from the factory, Throttle Direction Shunt (JMPR 3) is 'OFF', and therefore, the push-pull cable will PUSH the throttle lever for full-speed. If this is correct, leave it. If it is wrong, move shunt (JMPR 3) to 'ON', and the push-pull cable will 'PULL' on the throttle lever for full-speed.
- D) Connect the push-pull cables to the MicroCommander Actuator (See Figure 13). Remove the #10-32 jam nut and the two (2) rubber seals from the push-pull cable end that is to connect to the Actuator. Reinstall the #10-32 jam nut. Remove one (1) cable anchor clip screw from the Actuator housing and swing the cable clips clear. Connect the shift cable and throttle cable to the proper hex nut. See label on the Actuator. (See Figure 13, Detail I) Use a 7/16" socket to turn the hex nut onto the #10-32 cable rod end until there is approximately 5/16" (7,9mm) of thread showing beyond the jam nut. Tighten the #10-32 jam nut to the hex nut. Install the cable anchor clips to secure the Type 33C cable to the Actuator housing.

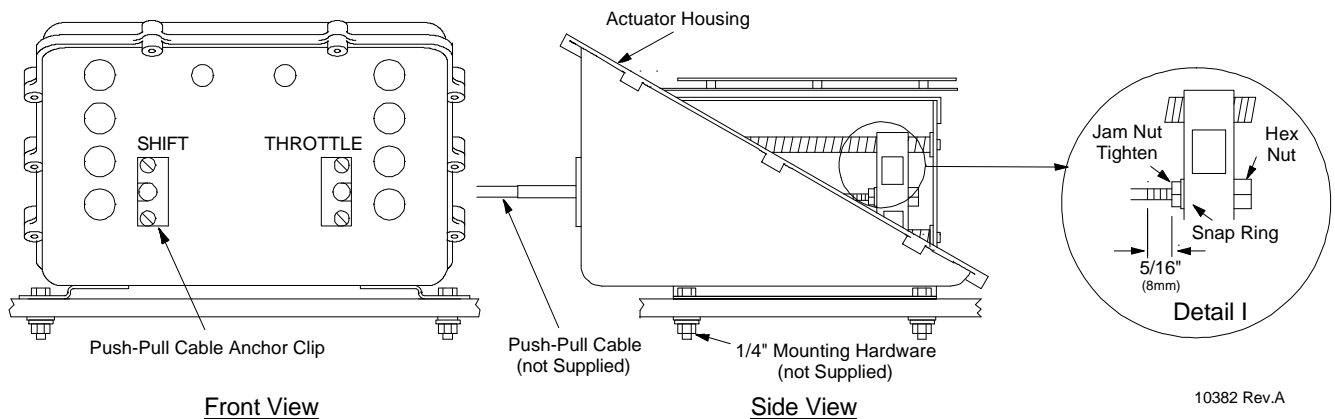


Figure 13 – Push-Pull Cable Connection

5.3.1 Transmission Cable Adjustment

- A) Place the remote control head in 'NEUTRAL', and turn the controls 'ON'.

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- B) Adjust the clutch cable ball joint at the transmission to match the clutch lever in 'NEUTRAL'. The push-pull cable should form a right angle (90°) with the shift lever in the 'NEUTRAL' position. Leave the cable disconnected.
- C) Move the control head lever to the 'AHEAD' detent. The Actuator can be adjusted for a total clutch movement of 2" (51mm) to 3" (76mm). The Actuators are shipped with switches set for minimum movement.
- D) Measure the clutch lever movement from 'AHEAD' to 'ASTERN' detent. The lever movement must be within the adjustment range of 2" (51mm) to 3" (76mm).

SW1 will increase the clutch movement in each direction from 'NEUTRAL' by moving the switches from 'ON' to 'OFF'.

Switch 1 1/4" (6,4mm)
Switch 2 1/8" (3,2mm) APPROXIMATE DIMENSIONS
Switch 3 1/16" (1,6mm)

- E) Match the required movement and then check the 'ASTERN' direction. Recheck 'AHEAD', 'NEUTRAL', and 'ASTERN' with the clutch cable disconnected. Confirm that the Actuator does not jam the clutch lever against its stops and that 'NEUTRAL' is correct. Connect the clutch cable.

5.3.2 Throttle Cable Adjustment

- A) Check that potentiometers R7 and R8 are in the fully counterclockwise position, as shipped from the factory.

CAUTION: Potentiometers can be damaged by turning too hard against the stop.

- B) Measure the throttle movement at the engine from 'IDLE' to 'FULL'. It must be within the Actuator range

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of 1" (25,4mm) to 2 7/8" (73mm). If the throttle movement is less than 1" (25,4mm) or greater than 2 7/8" (73mm) the lever radius must be changed to be within range. If possible, throttle movement should be 2 1/2" (64mm) 'IDLE' to 'FULL'. Leave throttle cable disconnected at this time.

- C) Place controls in 'NEUTRAL', 'start' engine and run at 'IDLE'. Adjust ball joint on throttle cable to match throttle lever 'IDLE' position.
- D) 'Stop' the engine. Move the control head lever to full-speed. Move throttle lever to the full-speed stop. Gradually turn potentiometer R7 on the circuit board clockwise until the ball joint can be connected with a slight amount of pressure against the full-speed throttle stop. Recheck 'IDLE' and 'FULL'. Connect ball joint to throttle lever. The throttle adjustment is complete.

5.4 STATION TRANSFER

The operator can leave the Station-in-Control with the control head lever in any position from full-ahead to full-astern. To gain control at any other station the control head lever must be in the 'NEUTRAL' position. When the control indicator light shows red, the operator has control. There is a one (1) second pause after the indicator light is 'ON' to allow the operator time to match the previous speed setting before control transfer takes place.

5.5 START INTERLOCK

Check proper operation of start interlock:

- A) Turn 'OFF' DC power to MicroCommander, check that engines will not 'start'. Controls 'OFF', interlock check.

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- B) Turn 'ON' DC power to MicroCommander, accept control, place control head lever to 'AHEAD' detent and check that engines will not 'start'. Clutch in 'NEUTRAL', interlock check.
- C) Place control head lever in 'NEUTRAL', engines should 'start' in this position.

5.6 THROTTLE PAUSE

Hydraulic actuated clutches require 0.5 (½) second or longer following selector lever movement before there is clutch plate contact. Switch SW1-7 in the 'OFF' position allows 0.5 (½) second idle throttle pause after clutch selector movement is complete. Dog clutches and cone clutches used on some I/O's and outboards do not require a throttle pause following clutch shift and SW1-7 should be 'ON'.

Some clutches may build clutch pressure more slowly. This could mean high engine RPM before clutch engagement. A clutch oil pressure interlock is available and is described in Sect. 7.4.

5.7 FINAL CHECK

- A) Shut 'OFF' the engine.
- B) Check that all push-pull cable connecting fasteners are tightened securely.
- C) Operate controls 'AHEAD' and 'ASTERN' and check clutch lever movement. Operate controls from 'IDLE' to full-ahead and check throttle movement.
- D) Check that the push-pull cable jam nut in the Actuator is jammed. (See Figure 13, Detail I) If this is not done, the Hex Nut can back off the push-pull cable threaded end, and effectively change the cable length. Shift and throttle cables must have jam nuts tightened.

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6. TESTS

Do the following tests with the vessel secured to the dock:

- A) 'Start' engine and check that engine 'Stop' switches (normally a push button) function correctly at all stations.
- B) 'IDLE' the engines and place one (1) control head lever at a time in the 'AHEAD' detent and then the 'ASTERN' detent. Do this at each station to confirm direction control.
- C) Then use "Warm-up" idle on each engine at each station, one (1) engine at a time to confirm speed control.
- D) Check that all the above tests are made and are correct. Only then is the vessel ready to leave the dock.

WARNING: Do not attempt to operate the controls away from the dock with any system abnormality.

CAUTION: The MicroCommander is single lever control that provides fingertip operation that is fast and accurate. When you move the lever, that is what you get! Start slowly and learn to appreciate a light touch and excellent control.

6.1 ADJUSTMENTS TO CHECK UNDERWAY

6.1.1 Full-Speed Setting

Warm-up the engine and in open water gradually move the control head lever to full-speed.

If the engine RPM is low, check that the throttle lever is against the full-speed stop. Other possibilities are the full-speed stops are set incorrectly, or the propeller load is too great.

If full-speed should be lowered, turn potentiometer R7 counterclockwise to desired maximum RPM. For twin screw applications, check that idle, mid-range, and full-speed are equal RPM on both engines with matching control head lever positions.

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6.1.2 Proportional Pause On Direction Change

This feature allows for engine deceleration and vessel speed to decrease on a 'Full Speed Reversal'. The throttle setting drops to 'IDLE' and the transmission remains engaged 'AHEAD'. The pause is in proportion to control lever position and how long the control lever has been in that position, prior to the reversal. The minimum pause is zero seconds with SW1 switches 4, 5, and 6 in the 'OFF' position. The maximum pause is 11.5 seconds with SW1 switches 4, 5, and 6 in the 'ON' position. Factory settings at the time of shipment are 3.5 seconds.

SW1 Switch: Full-Speed Pause

Switch SW1-4	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Switch SW1-5	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Switch SW1-6	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Seconds:	0	1.5	3.5	5	7	8.5	10.25	11.5

NOTE: The pause in gear on a through shift is proportional to the speed commanded and time at that speed. The times listed above are maximum. Shifting from idle 'AHEAD' to idle 'ASTERN' the pause is ZERO. The time required to build to the maximum pause is six (6) times the pause listed above. The pause from full-astern to 'AHEAD' is half that listed above for full-ahead to 'ASTERN'.

6.2 CONTROL HEAD TONE

There are five (5) functions of the tone.

- Low Repetition Tone is normal when DC power is first applied to the controls. This tone shows the controls are in 'NEUTRAL' and 'IDLE' and the operator can take control by depressing a station transfer button.

If the operator places the control lever to the 'AHEAD' position before depressing the transfer button, he will get "Warm-up" Mode with a blinking red light. The clutch will remain in 'NEUTRAL'.

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- High Repetition Rate Tone is used to signal a jam condition of either the shift or throttle cable. The Actuator has stopped when this tone is heard. Moving the control head lever away from the position that the tone was encountered, will usually 'stop' this tone. The cause of the excessive push-pull cable load must be found. Disconnect the throttle and shift cables at the engine and check the engine and transmission levers for heavy loads. Operate the controls moving the push-pull cables only, to confirm the cables are moving freely. Check to see that the push-pull set up is adjusted correctly. (See Sect. 5.3)
- Steady Tone is used to signal a voltage problem or a component has failed. Confirm the voltage is steady between 12 and 32 volts DC, and that there is not a momentary voltage drop. Depress the station transfer button. If the tone continues, the Actuator or circuit board may need to be replaced.
- Repetitive Signal - One (1) Long, One (1) Short Tone is used to show a clutch feedback error. See Section 17.
- Repetitive Signal - One (1) Long, Two (2) Short Tones is used to show a throttle feedback error. See Section 17.

7. CONTROL OPTIONS

7.1 HIGH ('HI') IDLE

The MicroCommander Control offers an option of two (2) idle RPM settings for the engine. The normal LOW ('LO') idle RPM is set mechanically by adjusting the push-pull cable ball joint at the engine to hold a small amount of pressure against the engine idle stop. (As described in Section 5.3.2) A second 'HI' idle RPM can be set electrically. Pushing the station transfer button will alternately move the engine idle setting back and forth between 'LO' idle and 'HI' idle.

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The 585 Actuator is shipped from the factory with five (5) station remote control available. When the 'HI' idle option is selected, Station 5 cannot be used. To select the 'HI' idle option requires the following adjustments to the circuit board (See Figure 9).

- Move JMPR 1 shunt to pins 1 and 2.
- Move JMPR 2 shunt to both pins.

7.1.1 High 'HI' Idle Setting

High 'HI' Idle is set using potentiometer R8. When turned fully counterclockwise 'HI' idle is minimum, and is the same as 'LO' idle. R8 is shipped this way from the factory.

To adjust 'HI' idle, place the controls in 'NEUTRAL' and 'Start' the engine. Depress and hold the station transfer button at the Station-in-Command and move the control lever to the 'AHEAD' detent position. The blinking light at the control shows "Warm-up" Mode. THE MICROCOMMANDER CONTROL IS ALWAYS IN 'HI' IDLE MODE WHEN THE INDICATOR LIGHT IS BLINKING. Adjust 'HI' idle using potentiometer R8, ONLY when in "Warm-up" Mode with the indicator light blinking, and the control lever in the 'AHEAD' detent position ('IDLE' position).

Rotate potentiometer R8 clockwise to the desired 'HI' idle RPM.

Check your 'HI' idle and 'LO' idle settings by placing the control lever in 'NEUTRAL' and PUSH the station transfer button. Alternately the RPM will move between 'LO' and 'HI' idle when the transfer button is pushed. Twin screw, if 'HI' and 'LO' idle are out of sync, place both engines in

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'ahead' "Warm-up" Mode. Both engines will then be 'HI' idle.

CAUTION: Adjust potentiometer R8 for 'HI' idle, only with the control lever in the 'AHEAD' detent and the indicator light blinking. Otherwise you may be trying to adjust 'HI' idle when you are in 'LO' idle Mode.

7.2 PRIMARY STATION ISOLATION SWITCH

One SPST (single pole single throw) switch can be mounted at the primary station (Station 1). When the switch is CLOSED, control remains at the primary station and other stations cannot take control. When the switch is OPEN, all stations can take control by means of their station transfer button. Use a quality toggle switch with screw connections and crimped wire terminals. See Single Screw Figure 15 and Twin Screw Figure 14.

7.3 ALARM CAPABILITY

The MicroCommander Actuator offers a single alarm connection that OPENS with a control power failure or circuit malfunction.

The 585 Actuator's alarm connection point is a single connection

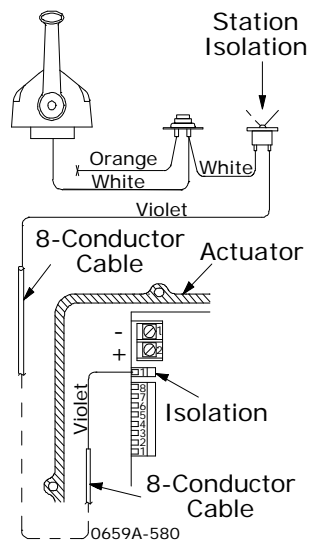


Figure 15 – Single Screw – Primary Station

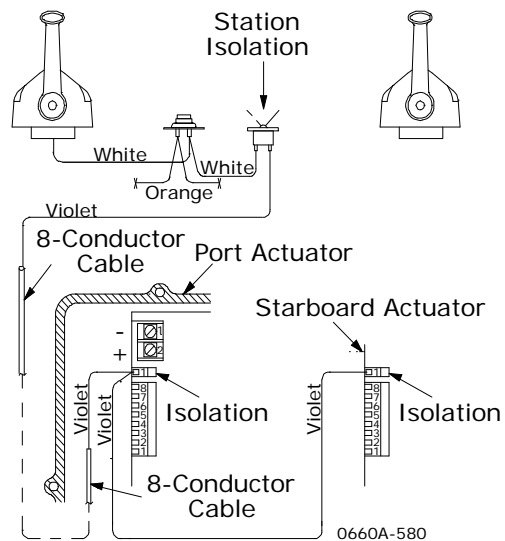


Figure 14 – Twin Screw – Primary Station

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block on the Actuator circuit board labeled ALARM. It is located next to the DC Power terminal.

The alarm circuit in the Actuator is designed to operate a relay in an alarm system supplied by others. The resistance through the Actuator to battery negative is approximately 21 ohms. Maximum current draw must not exceed 200 milliamperes.

7.4 CLUTCH OIL PRESSURE INTERLOCK

The purpose is to prevent clutch engagement at high engine RPM. The Clutch Oil Pressure Interlock will block a speed signal to the engine until the hydraulic clutch pressure has reached a value recommended by the transmission manufacturer that assures clutch lock-up.

To take advantage of the Clutch Oil Pressure Interlock, the 585 Actuator must be set up to use the 'HI' idle 'LO' idle option described in Section 7.1. This means that the fifth station is not available.

- Move JMPR 1 shunt to pins 1 and 2.
- Move JMPR 2 shunt to both pins.

The requirement is a N.C. (Normally Closed) pressure switch with a trip point adjustable to match the transmission manufacturers recommended setting. The pressure switch is supplied by others. The pressure switch is operated by the hydraulic clutch oil pressure of both the 'AHEAD' or 'ASTERN' clutch.

When Terminals 3 and 4 of Station 5 (see Figure 9) are connected, the engine speed signal is held at "idle". Therefore, connect Station 5 terminals 3 and 4 to the N.C. pressure switch. The engine speed signal will be held at "idle" until the clutch oil pressure opens the pressure switch contacts.

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When operating, if for any reason the clutch oil pressure should fall below the pressure switch setting, the engine speed will drop to idle RPM.

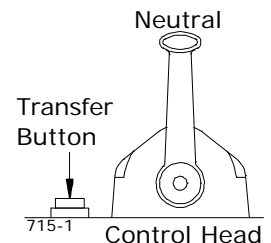
8. OPERATOR INSTRUCTIONS

8.1 CONTROL TYPE

MicroCommander is a single lever, electronic marine engine control providing speed and direction control with one (1) lever. In the 'NEUTRAL' detent position, the control lever is vertical to the mounting surface. Throttle is at 'IDLE' speed and clutch is in 'NEUTRAL'. Movement 15° forward, to the 'AHEAD' detent, engages the clutch and the throttle remains at 'IDLE'. Continued forward movement raises the throttle from 'IDLE' to 'FULL' speed as the lever is moved forward to the stop. Movement 'ASTERN' from 'NEUTRAL', first shifts the clutch 'ASTERN' and then controls speed 'ASTERN'.

8.2 CONTROL START-UP

When the control system is turned 'ON', MicroCommander will automatically move to 'NEUTRAL' and 'IDLE' position. An intermittent 'TONE' will sound at all control stations, no station has control. The operator must depress the station transfer button to take control. The 'TONE' will stop at all stations and the indicator light will be 'ON' at the Station-in-Control. Only one (1) station has control at a time.



**Figure 16 –
Taking
Command**

8.3 ENGINE START

There are three (3) MicroCommander features related to main engine 'start':

- The MicroCommander is interlocked to block the engine 'START' signal if the power has not been turned 'ON'.

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- The MicroCommander is interlocked to block the engine 'START' signal if the clutch is in the engaged position.
- The MicroCommander allows engine speed change without engaging the clutch to help starting and warming up a cold engine. This is called "Warm-up" Mode.

With the control in the 'NEUTRAL' position, depress and hold down the station transfer button, move the control to the 'AHEAD' detent position. Now release the station transfer button. The indicator light will blink, showing the clutch has stayed in 'NEUTRAL'. The operator can now move the control lever through the speed range and 'start' and warm-up the engine. MicroCommander resets to normal when the control lever is returned to 'NEUTRAL'.

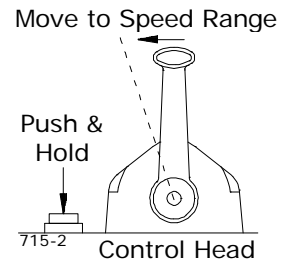


Figure 17 – Neutral Fast Idle

8.4 STATION TRANSFER

Only one (1) station has control at a time. Control is transferred by a transfer push button. There is one (1) push button at each station. When transferring control stations, the control lever of the Station-in-Control may be in any position. The station taking control must be in the 'NEUTRAL' position. The light on the control head is red when the station has control. The indicator light at all other stations will be 'OFF'. Control remains unchanged for one (1) second after the red light to allow the operator time to move the control lever from 'NEUTRAL' to a position approximately matching the last speed setting.

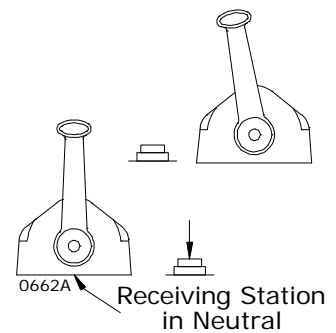


Figure 18 – Station Transfer

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8.5 'HI' IDLE 'LO' IDLE (OPTIONAL)

The MicroCommander Control offers an option of two (2) engine idle RPM settings. The normal LOW ('LO') idle RPM is set mechanically, adjusting the ball joint connector at the engine. A second 'HI' idle RPM can be set electrically. Pushing the station transfer button will alternately move the engine idle setting back and forth between 'LO' idle and 'HI' idle. To synchronize two (2) engines in 'HI' idle, place both engines in 'Warm-up' Mode as described under **ENGINE START**.

8.6 MASTER STATION ISOLATION (OPTIONAL)

The main starting station has the option of a switch that will prevent control transfer to any other station unless the operator positions the switch to allow transfer. With the switch in "normal" position, other stations can take control. In "isolate" position, control is isolated to the master station.

8.7 SYNCHRONIZATION (ADDITIONAL OPTION)

A green LED light is added to the starboard control lever. Synchronization is automatic when both engines are in 'AHEAD' in the cruise range. When engine RPM's are within 15% of one another the green LED will blink, indicating the system is working to synchronize. When the green LED is full 'ON' the engines are in sync. When the light is out sync is 'OFF'.

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9. MORSE CLUTCH AND THROTTLE KIT SELECTION

9.1 PRE-ENGINEERED THROTTLE CONNECTION KITS

• MAKE	• ENGINE MODEL	• KIT NO.
Caterpillar	334, 3304, 3306	36680
	3406 & 343	36680
	3408	36680
Chrysler	N1SSANM633	-----
Cummins	A11 w/MV5GOV	300580
	AFC Fuel pump V504M, V555M, V903M, VT903M, VTA903M, NT855M, VT1710M, VTA1710M, KT & KTA 115M, KT & KTA 2300M, 1975 and later	36680
General Motors	3, 4, & 6-71 w/var.sp.gov.	41736
	6, 8, 12 V-71 & 6, 8 V-92 w/var.sp.gov.	41736
	6-71 inclined	36680
	2, 3, 4-53 w/left hand gov.	36680
	Right hand gov.	36680
	6V-53 Rear entry	36680
	6V-53 Front entry	36680
	6, 8V-71 Front entry	36680
	12, 16V-149	36680
	Perkins	4, 236M
6, 3544M; T6, 3544M; ST6, 3544M; SST6, 3544M		302026
4, 108 W/shut off		303878

9.2 PRE-ENGINEERED CLUTCH CONNECTION KITS

• MAKE	• TRANSMISSION MODEL	• KIT NO.
Borg Worner	70, 71, 72 In line w/red gear rear entry	301474
Capital	12400	36680
	2, 3, & 4 HD & HE	36680
Caterpillar	7200 Series	NA
MerCruiser	Inboard W/o Warner red gear	62355
Paragon	HF-7	36680
Twin Disc	MG508, 509, 510, 510A, 512, 514C, 514CHP, 518, 521, 527, 530, 540	42577
	MG502, 506, 507, W/x9994, xA7022, A7048 Valves	63696

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9.3 OUTBOARD AND I/O CABLE CONNECTION KITS

• ENGINE MAKE	• KIT NO.
Chrysler 1975 & later	300465
Evinrude/Johnson 55-235 H.P. 1978 to date	301729
Mercury 40-300 H.P.	301901
Mercuriser I/O	302123
OMC Sterndrive I/O	300557
Volvo I/O	Engine and out drive brackets are provided by

10. UNIVERSAL MOUNTING FOR 33C TYPE CABLE

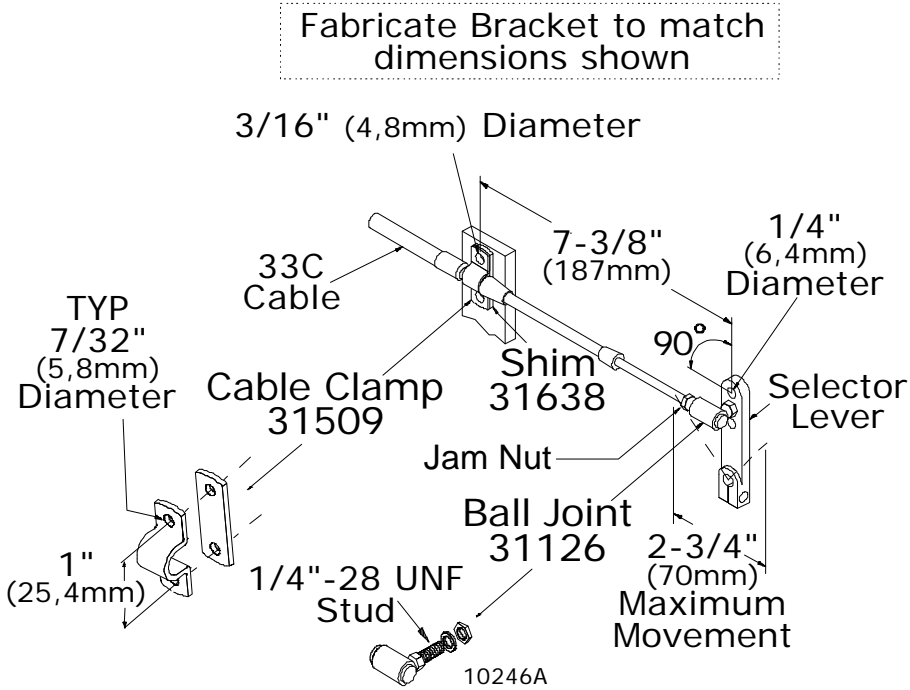


Figure 19 - Universal Mounting

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11. REFERENCES

11.1 AMERICAN BOAT AND 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°C

11.2 CODE OF FEDERAL REGULATIONS

33 CFR 183 Subpart I - Electrical Systems

183, 410 Ignition protection

183, 415 Grounding

183, 425 Conductors: General

183, 430 Conductors in circuit of less than 50 Volts

183, 445 Conductors: Protection

183, 455 Overcurrent and Protection: General

46 CFR 111.01 - 15(b) Ambient Temp.

Machinery Spaces 50°C

111.05 - System Grounds

11.3 SOCIETY OF AUTOMOTIVE ENGINEERS

400 Commonwealth Drive

Warrendale, PA 15096

J917 Marine Push-Pull Cables

J1171 External Ignition Protection

J1428 Marine Circuit Breakers

J378 Marine Engine Wiring

11.4 NATIONAL MARINE MANUFACTURERS ASSOCIATION

401 North Michigan Avenue

Chicago, IL 60611

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Please contact Mathers Controls for support information.

11.5 UNDERWRITERS LABORATORIES

12. PARTS SOURCE

12.1 ANTI-STATIC WRIST STRAP

Pc.No. 517

Thomas & Betts (Pc.No. AWCC)

12.2 CIRCUIT BREAKER

Pc.No. 810

E-T-A Manufacturer (Pc.No. 41-2-514-LN2-10) UL
Approved

12.3 FUSE

Pc.No. 1030

Bussman (Pc.No. GDC-1A)

12.4 WAGO TOOL

Pc.No. 397

WAGO (Pc.No. 236-332)

12.5 RELAY 12 VDC

Pc.No. 1114

Potter-Brumfield (Pc.No. KRPA5D6-12)

12.6 RELAY 24 VDC

Pc.No. 1122

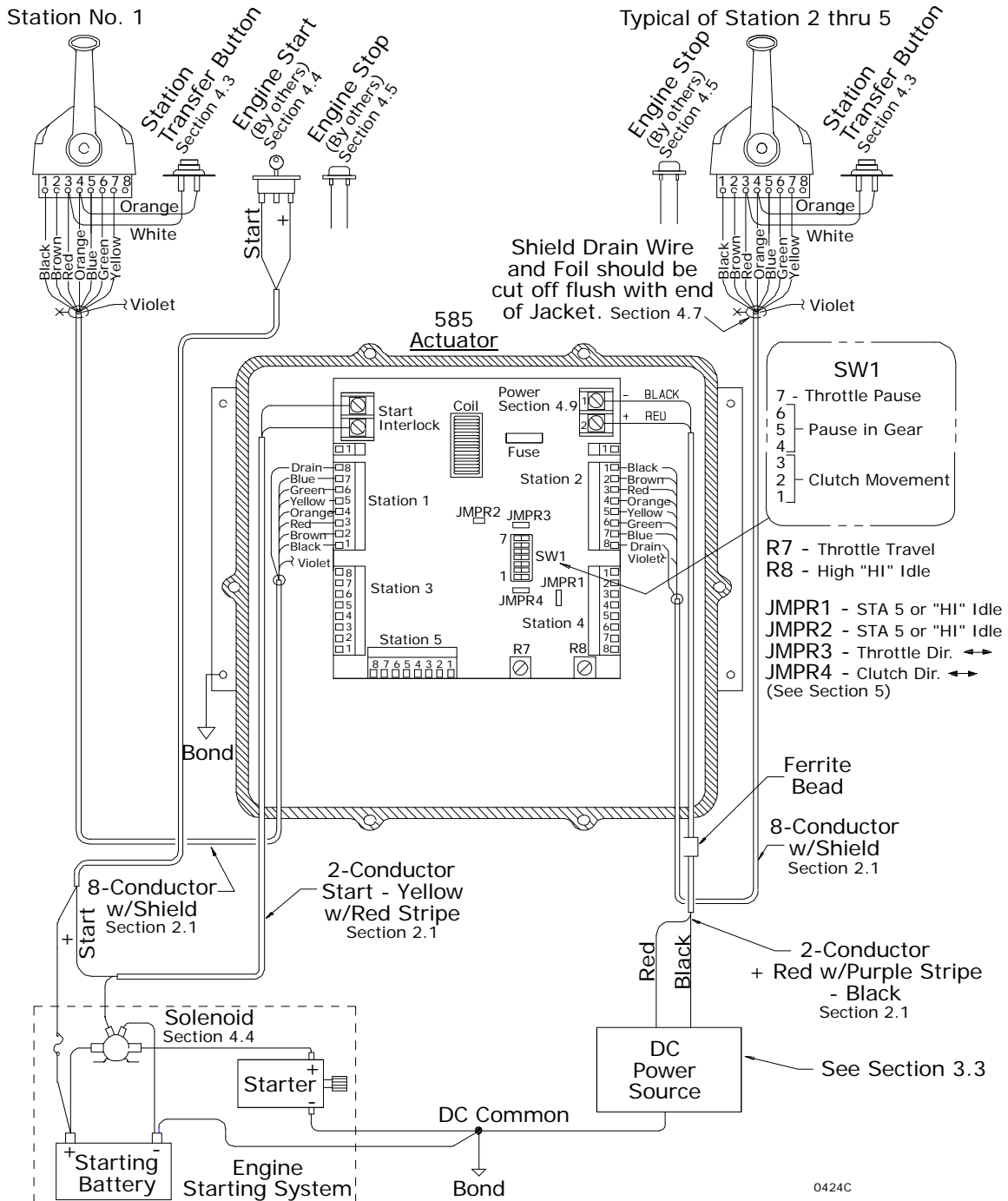
Potter-Brumfield (Pc.No. KRPA5D6-24)

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13. SINGLE SCREW CIRCUIT



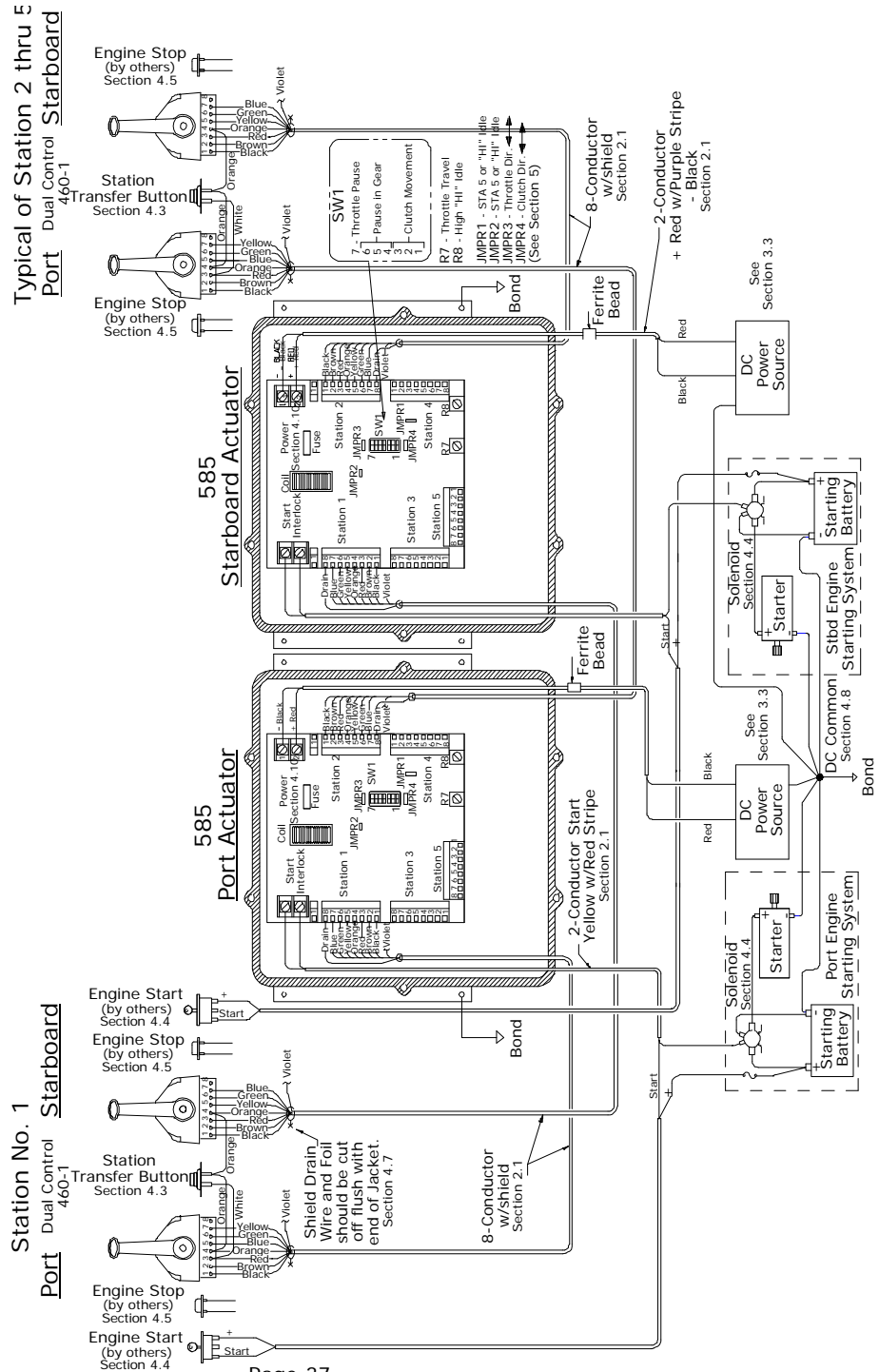
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14. TWIN SCREW CIRCUIT

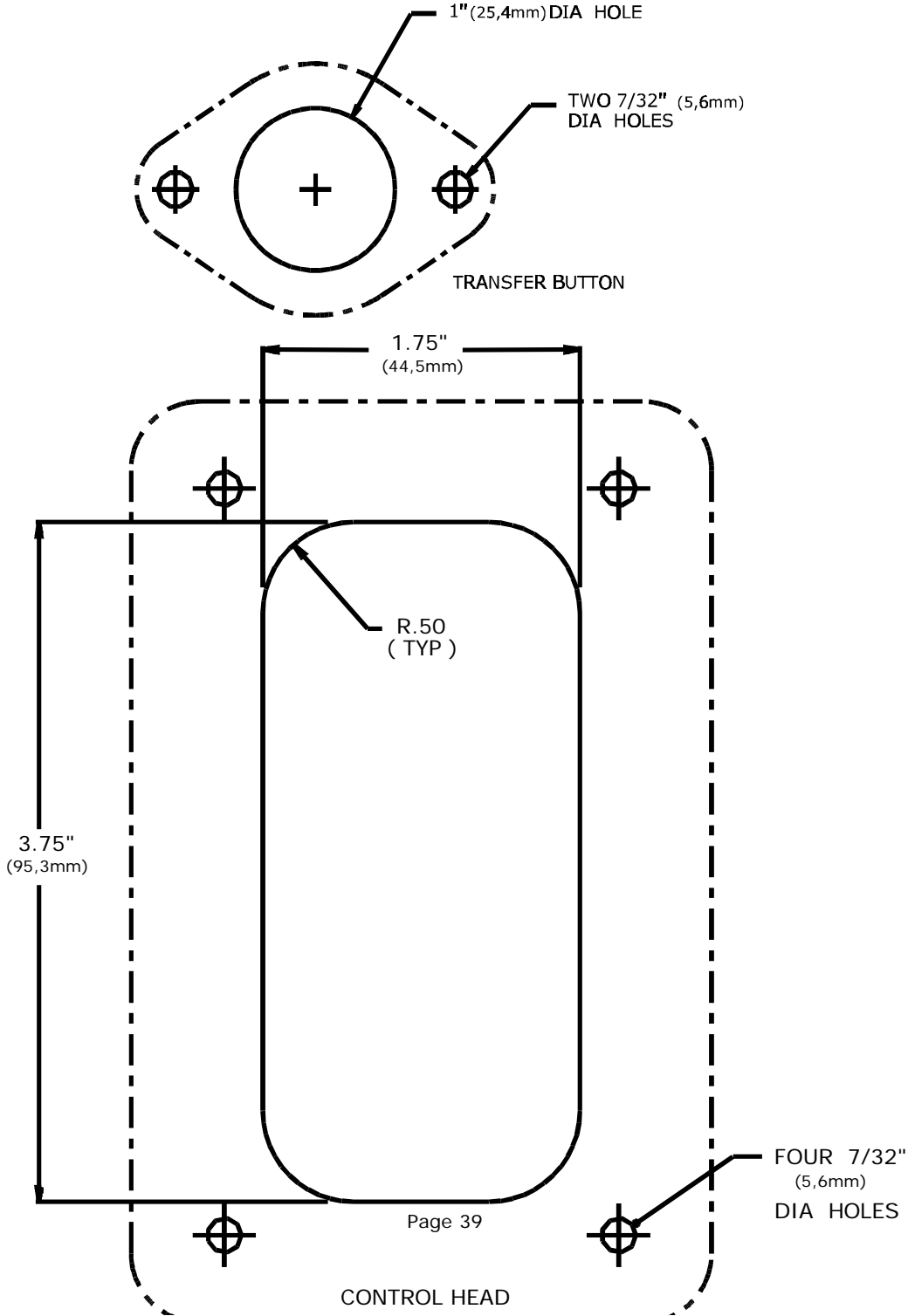


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15. TEMPLATE



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16. MAINTENANCE

16.1 ACTUATOR

The Actuator does not require scheduled maintenance. If the Actuator becomes noisy, a light coating of silicone grease may be applied to the stainless steel lead screws.

16.2 CONTROL HEAD

The control heads should be checked once a year to insure the plug connections or terminals are secure and free of corrosion. The contacts should be checked and a light coating of Teflon grease, or corrosion block applied.

17. TROUBLE SHOOTING

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

17.1 SYMPTOM: CANNOT TAKE CONTROL AT ONE (1) STATION (BOTH PORT AND STARBOARD FOR TWIN SCREW), WHEN THE SYSTEM IS INITIALLY TURNED 'ON'.

CAUSE

- a) A bad electrical connection.
- b) Incorrectly wired eight (8) conductor cable or transfer button.
- c) Defective transfer button

REMEDY

- a) Check the crimps and insure that all the screws are tight at the control head. Check the station connections at the Actuator. Tighten, or re-crimp as necessary.
- b) Wire the cable connections as shown in Section 4.7, Figure 6 and Figure 9. Correct as necessary.

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- c) Check the voltage between the red and orange wires (pins 3 & 4). The reading should be 4.80 to 5.00 volts DC. Check the voltage at pins 3 & 4 while depressing the transfer button. The voltage reading should be less than 0.50 volts DC. Replace the transfer button if the voltage remains at 5.00 volts.

17.2 SYMPTOM: ONE SIDE WILL NOT TAKE CONTROL WHEN INITIALLY TURNING 'ON' THE SYSTEM

CAUSE

- a) Port and Star-board power sources do not have a common ground (only the starboard would be unable to take control)
- b) Mis-wired eight (8) conductor cable.
- c) Defective control head potentiometer.
- d) One control head not in Neutral.

REMEDY

- a) The negative terminals of both batteries must be connected to a common point. If not, connect both to a common point.
- b) The cable connections must be wired as shown in in Section 4.7, Figure 6 and Figure 9.
- c) Check the voltage between the yellow and the blue wires (pins 5 & 7) at the suspected control head. The reading should be 4.80 to 5.00 volts DC. 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% and 51% of that measured at pins 5 and 7 with the lever at the Neutral/Idle position. If not, replace the control head or install a Control Head Repair Kit.

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17.3 SYMPTOM: THE LED BLINKS AT ONE (1) STATION WHEN POWER IS INITIALLY TURNED 'ON' TO THE CONTROLS. CANNOT TRANSFER TO ANY OTHER STATIONS

CAUSE

- a) The transfer button is mis-wired.
- b) The transfer button is shorted.

REMEDY

- a) Insure that the transfer button is wired per in Section 4.7, Figure 6. Correct if necessary.
- b) Measure the DC voltage across the transfer button. The reading should be 4.80 to 5.00 volts. If not, replace the transfer button.

17.4 SYMPTOM: THE LED BLINKS WHEN THE TRANSFER BUTTON IS DEPRESSED, AND CONTINUES TO BLINK AFTER RELEASED (LEVER IS IN THE NEUTRAL/IDLE POSITION). CANNOT TRANSFER TO THIS STATION IF ANOTHER STATION WAS PREVIOUSLY IN CONTROL

CAUSE

The control head potentiometer is not centered.

REMEDY

Replace the control head or install a Control Head Repair Kit.

17.5 SYMPTOM: THE ENGINE RPM VARIES, WITHOUT MOVING THE CONTROL HEAD LEVER (SYNCHRONIZATION DISABLED).

CAUSE

- a) Problem with the governor or carburetor.
- b) Erratic command signal.

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REMEDY

- a) Watch the push-pull cable at the governor or carburetor. If the push-pull cable is moving, go to step b). If not, contact a certified mechanic.
- b) At the Actuator, measure the DC voltage at the yellow and green wires (pins 5 & 6) of the Station-in-Control. The reading should be a stable voltage (no variations). If not, check for a loose connection between the Actuator 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.

17.6 SYMPTOM: THE ENGINE RPM REDUCES TO IDLE, TRANSMISSION TO NEUTRAL, THE CONTROL HEAD LED TURNS 'OFF', AND A SLOW REPETITIVE TONE IS HEARD AT ALL STATIONS AFTER REPOSITIONING THE CONTROL HEAD LEVER.

CAUSE

- a) A drop in battery voltage (12 volt systems only) at the Actuator.
- b) Defective control head.

REMEDY

- a) 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 Actuator. This reading should be no less than 0.20 volt below the measured battery voltage.
- b) Replace the control head or install a Control Head Repair Kit if the voltage at the Actuator tested good.

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17.7 SYMPTOM: NO AUDIBLE TONE AT A CONTROL HEAD WHEN POWER IS INITIALLY TURNED 'ON', BUT OTHERWISE, WORKS PERFECTLY.

CAUSE

- a) Incorrectly wired eight (8) conductor cable.
- b) Defective sound transducer.

REMEDY

- a) Insure that the black wire is connected to pin 1 in the Actuator, and pin 1 at the control head. The brown wire must be connected to pin 2 in the Actuator and pin 2 at the control head. In addition, the LED would not work if the brown wire was loose or incorrectly wired. Check for loose or corroded connections.
- b) Measure the voltage at pins 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 measured, replace the control head or install a Control Head Repair Kit.

17.8 SYMPTOM: THE CONTROL HEAD LED DOESN'T LIGHT WHEN IN CONTROL, BUT EVERYTHING ELSE WORKS PERFECTLY.

CAUSE

- a) Incorrectly wired eight (8) conductor cable.
- b) Defective LED

REMEDY

- a) Verify that the brown wire is connected to pin 2 of the Actuator and the control head.
- b) Measure the DC voltage between pins 2 & 3 at the control head. The reading will be 1.00 to 2.00 volts in normal operation. If 4.00 volts is measured, the LED is OPEN. Replace the control head or install a Control Head Repair Kit.

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17.9 SYMPTOM: CANNOT OBTAIN "WARM-UP" MODE.

CAUSE

- a) The Actuator is sensing lever movement in the astern direction.

REMEDY

- a) Depress the transfer button, while moving the lever to the astern detent. If the LED now blinks, the Actuator is incorrectly set up. This will be corrected by performing the following:

- Check the eight (8) conductor wiring.
- The yellow wire should go to pin 5 at both the Actuator and control head for right hand control heads.
- The blue wire should go to pin 7 at both the Actuator and control head for right hand control heads.
- The yellow wire should go to pin 7 at the control head and pin 5 at the Actuator for left hand control heads.
- The blue wire should go to pin 5 at the control head and pin 7 at the Actuator for left hand control heads.

If any changes to the wiring were necessary, the shunt at JMPR4 would have to be changed to the opposite two (2) pins.

17.10 SYMPTOM: STEADY TONE IS HEARD FROM ALL CONTROL STATIONS. CANNOT GAIN CONTROL AT ANY STATIONS.

CAUSE

- a) Low battery voltage at the Actuator.
- b) Component failure on the circuit board.

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REMEDY

- a) Check the battery voltage at the Actuator. If the measurement is less than eight (8) volts, the battery needs to be replaced or the source of the voltage drop needs to be corrected.
- b) If the voltage tested good, the circuit board needs to be repaired or a Circuit Board Kit needs to be installed.

17.11 SYMPTOM: NO TONES OR LIGHTS AT THE CONTROL HEAD, AND NO LEDS LIT ON THE CIRCUIT BOARD.

CAUSE

- a) No power to the Actuator.
- b) Polarity of the battery voltage reversed.
- c) Fuse (Part No. GDC-1A) on the circuit board blown.

REMEDY

- a) Check the power source to the Actuator.
- b) Connect the red wire to the terminal labeled "+", and the black wire to the terminal labeled "-".
- c) Measure the battery voltage at the Actuator. If the voltage exceeds 40 volts, the power source must be corrected. Replace the fuse with the spare, which is taped to the relay on the circuit board. If the fuse again blows, the circuit board needs to be serviced, or replaced with a Circuit Board Kit.

17.12 SYMPTOM: RAPID TONE AT ALL CONTROL STATIONS.

CAUSE

- a) Incorrectly adjusted push-pull cable.
- b) Defective push-pull cable.
- c) Low battery voltage at the Actuator (12 volt systems).

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- d) Defective servo unit in the Actuator.

REMEDY

- a) Disconnect the push-pull cable from the shift lever at the transmission or reduction gear. Disconnect the push-pull cable from the throttle lever at the carburetor or governor. Operate the controls. If the rapid tone is no longer present, follow the control set up procedure in Section 5.
- b) Remove the push-pull cables from the Actuator. Operate the controls. If the rapid tone is no longer present, replace the defective push-pull cable.
- c) Measure the battery voltage at the Actuator. If the measured voltage is 8 to 12 volts, the power source needs to be checked.
- d) If a), b) and c) tested good, the entire Actuator needs to be repaired or replaced.

17.13 SYMPTOM: THE ENGINE STARTS TO TURN OVER WHILE STARTING, AND THEN STOPS. A SLOW REPETITIVE TONE IS HEARD FROM ALL STATIONS.

CAUSE

- a) The voltage to the Actuator has dropped too low, due to the starters current requirements.
- b) Battery charge is low.

REMEDY

- a) Supply power to the Actuator from a battery other than the starting battery.
- b) Recharge or replace the battery.

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17.14 SYMPTOM: THE ENGINE STARTER WILL NOT ENGAGE.

CAUSE

- a) The controls are not turned 'ON'.
- b) The controls are not at the NEUTRAL position.
- c) Low battery voltage.
- d) Faulty start interlock circuit in the Actuator.
- e) Faulty wire, or component, in the starting system.

REMEDY

- a) Turn power 'ON' to the control system.
- b) Place the control head lever into the NEUTRAL position, and depress the transfer button.
- c) Check the battery voltage. If the voltage is low, charge or replace the battery.
- d) Connect the two (2) start interlock wires (yellow with red stripe) at the Actuator to the same terminal. If the engine starts, the Actuator needs to be serviced.

17.15 SYMPTOM: ONE (1) LONG - TWO (2) SHORT TONES FROM ALL CONTROL STATIONS.

CAUSE

- a) Throttle feedback error.

REMEDY

- a) Depress the transfer button twice. The Actuator will need to be serviced at the first opportunity.

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18. HAND HELD REMOTE CONTROL

18.1 PURPOSE

The Hand Held Remote offers control of the engine speed, direction, engine stop, and is connected by a single multi-conductor cable. This allows the boat operator to move from one (1) location to another.

18.2 SAFETY

The Hand Held Remote places a great deal of power at your fingertips. Failure to observe the following, and any other applicable safety precautions, will greatly increase the risk of serious or fatal injury while using the Hand Held Remote.

- Ensure a qualified person operates the Hand Held only.
- Always be braced against any change in vessel motion, which could result from a change of engine speed, gear, rudder position, or any combination of these.
- A person standing on the dock or another boat should never operate the Hand Held Remote.
- A holding bracket is available for the Hand Held Remote (see Figure 20). It is recommended that the Hand Held Remote be used in a holding bracket. Brackets can be located where needed.
- If the Hand Held Remote is operated outside of the holding bracket, always wear the safety lanyard (see Figure 21). In the

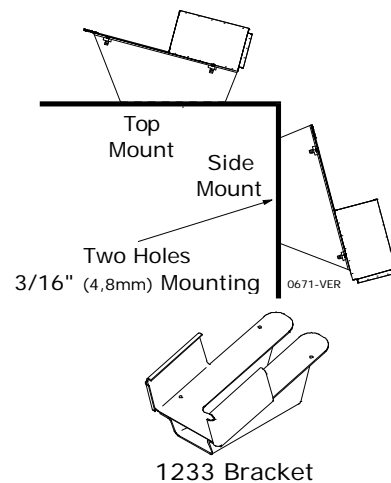


Figure 20 – Hand Held Mount

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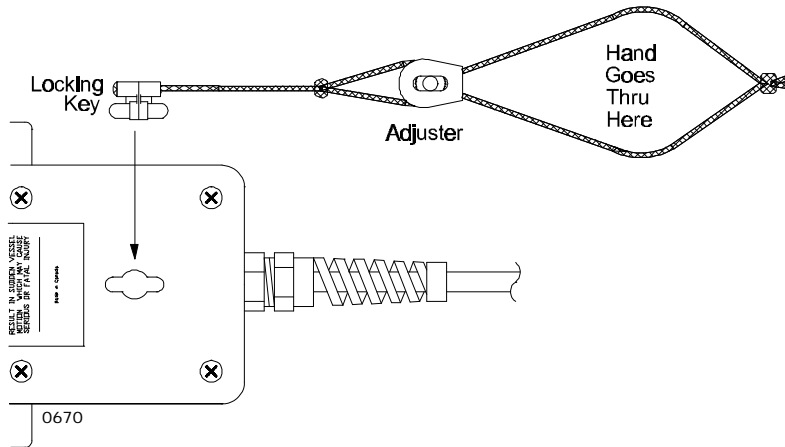


Figure 21 – Safety Lanyard

event of a change of engine speed, gear, rudder position or any combination of these that causes you to stumble or fall, perhaps even overboard, the safety lanyard should cause the locking key to pull out of the back of the Hand Held Remote, putting the engines into idle and gear shift into neutral.

- Do not attempt to operate the Hand Held Remote out of the holding bracket in heavy weather unless you are securely positioned in such a way to prevent any vessel motion from throwing you off balance, or otherwise interfering with the safe operation of the vessel controls.
- If the locking key (on the safety lanyard) is pulled out of the Hand Held Remote, the engine(s) will go to neutral and idle. To regain control, replace the locking key, position the control knob to neutral, and depress the station transfer button. The Hand Held Remote will not operate without the locking key in place.

18.3 HAND HELD INSTALLATION INSTRUCTIONS

The Hand Held Remote is supplied with a 60 foot (18,3m) cable that is pre-wired from the Hand Held Remote to the Distribution Box (see Figure 22). The Distribution Box is water resistant but

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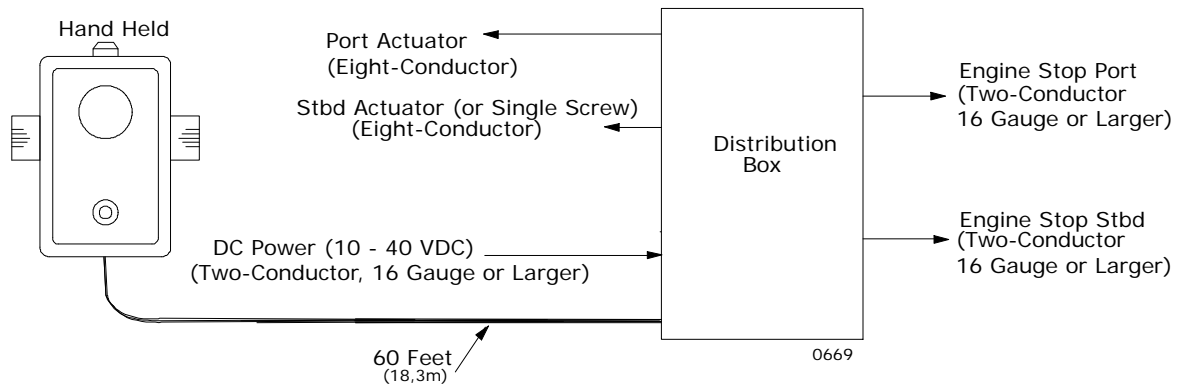


Figure 22 – External Wiring

should be mounted in a dry location. If the cable must pass through holes in the deck or bulkhead, it may be disconnected from the Distribution Box. When reconnecting the cable to the Distribution Box, carefully check that each wire is inserted into the correct terminal and re-secured with a tie wrap.

NOTE: The Hand Held Remote should not be used for initial set up of the MicroCommander Actuator because its engine speed range is limited to approximately 80% of full speed.

For a single screw boat, connect the eight (8) conductor cable from the MicroCommander Actuator to the "Engine 1" terminal block inside the Distribution Box (see Figure 24).

For a twin screw boat, connect the eight (8) conductor cable from the Starboard MicroCommander Actuator to the "Engine 1" terminal

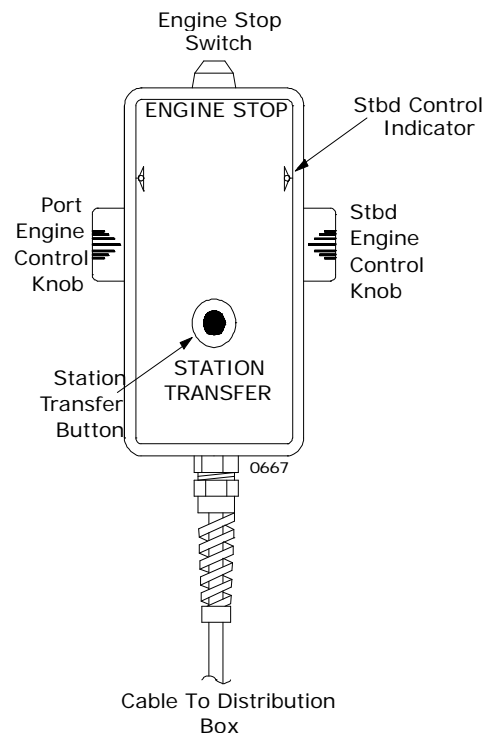
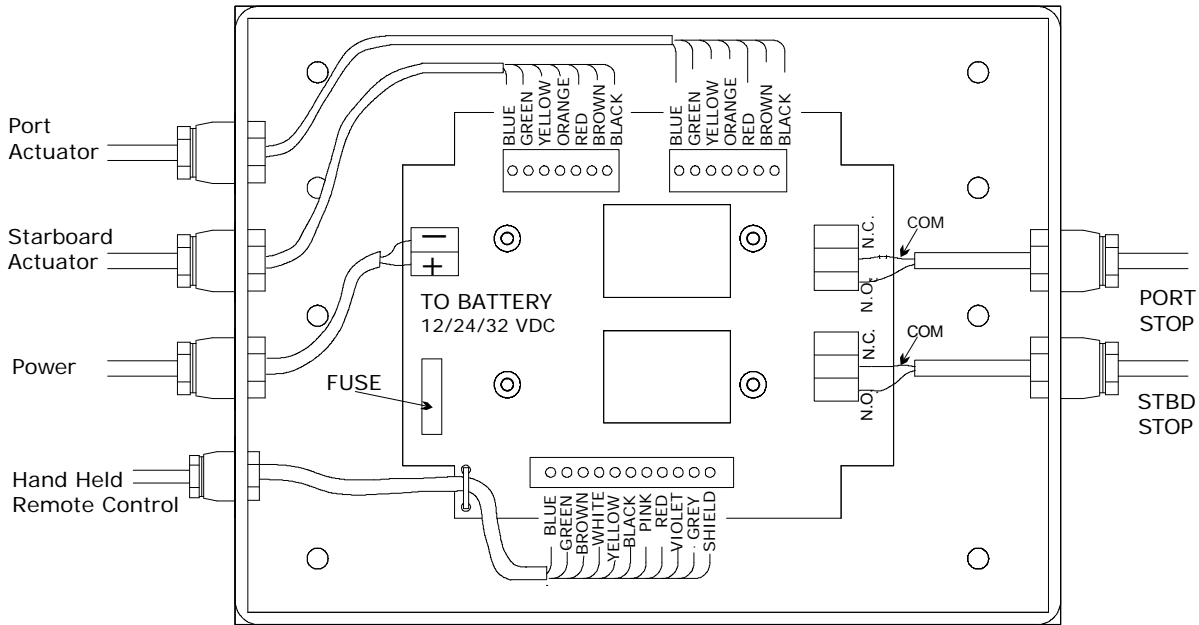


Figure 23 – Hand Held Control

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block. Connect the Port MicroCommander Actuator eight (8) conductor cable to the "Engine 2" terminal block inside the Distribution Box (see Figure 24). Connect per the color code marked on the terminal block.



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Figure 24 – Distribution Box

The following cables are Dealer supplied;

- DC Power Cable (Two [2] Conductor Power Cable)
- Engine Stop Cables (Two [2] Conductor Start Interlock Cable)
- Distribution Box to Actuators (Eight [8] Conductor, Pc.No. 350)

Cable grips are provided with the Distribution Box. These are to be used with the Dealer supplied cables for making penetrations into the Distribution Box.

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DC Input Power - The Distribution Box will operate on 12, 24 or 32 VDC. The DC input on the circuit board is polarity and over voltage protected. Note that reverse polarity will result in the fuse blowing. A spare fuse is provided inside the Distribution Box.

Engine Stop - The engine stop relays have normally open (maximum 20 amp) and normally closed (maximum 10 amp) contacts. The normally open contacts are typically used for fuel shut-off solenoids and should be wired in parallel with any existing fuel shut-off circuits. The normally closed contacts are used with ignition circuits and should be wired in series with any existing ignition circuits.

18.4 OPERATING INSTRUCTIONS

Station Transfer - Pressing the station transfer button will transfer command to the Hand Held Remote when the engine control knob(s) are in neutral. A red indicator light next to control lever will show that the Hand Held Remote is in command.

CAUTION: Engine Stop - To stop engine(s), depress and hold the engine stop button until the engine(s) come to a full stop.

The Hand Held Remote features a safety lanyard, which must be worn over the wrist of the operator. If the operator becomes separated from the Hand Held for any reason, the lanyard will detach from the Hand Held and cause the MicroCommander Control System to immediately move the engine to idle and the gear to neutral. To restore control, turn engine control knob(s) to neutral, re-insert the locking key and then press the station transfer button.

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19. SYNCHRONIZATION

19.1 GENERAL INFORMATION DWG.No. 0486-A

NOTE: The Synchronization Option may not be compatible with diesel engines using "speed limiting governors" exp. 8.2L Detroit Diesel.

The MicroCommander synchronization is fully automatic, in that it is not necessary to turn it 'ON' or 'OFF'. When both engines are in 'AHEAD', above 10% of the speed range, and are within 15% of equal RPM the control system will work to synchronize. This is shown by a blinking green LED at the control. The blinking will go to steady green within a few seconds, showing the engines are synchronized.

Moving either control lever beyond the 15% window of RPM will turn 'OFF' the green LED, and synchronization will be inactive. The control levers are active at all times.

NOTE: It is important to complete the installation of the clutch and throttle control, and to thoroughly test the system before installing synchronization. Check the lever and RPM match of the engines through the speed range from 'IDLE' to 'FULL' speed.

19.2 PARTS REQUIRED

- 2 only 585 Actuators (existing)
- 1 or more 460-2 Dual Controls
- 1 only 1135 Starboard Auxiliary Board (Follow)
- 1135-1 Starboard Auxiliary Board (Follow) Gasoline Engines
- 1 only 1133 Port Auxiliary Board (Lead)

Speed Indication - (One of the following)

- 2 only 1124 Diesel Engine Dual Sender (Mechanical Drive)
- or -
- 2 only Magnetic Senders (Flywheel Ring Gear)
- or -
- 2 only Single wire lead for gas engines

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NOTE: Either engine can be 'Lead' engine. We have elected to make the Port engine 'Lead' and the Starboard engine 'Follow'. The drawings and explanation reflect this selection. The remote control stations will have the green LED synchronization light on the Starboard side.

19.3 INSTALLATION

- A) Remote Control Stations - Connect the violet lead to terminal 8 at each Starboard remote station lever that has a green LED.

NOTE: The control head part number followed by a -2 specifies one (1) green LED on the 'Follow' control head. If you are adding synchronization to an existing system you may not have the green LED. The system will synchronize without the light, however, you won't have a visual indication of synchronization.

- B) Auxiliary Board 1133 'Lead' Port 585 Actuator - The kit includes the Auxiliary Board, mounting screws, and a $\frac{3}{4}$ " cable grip. Install the cable grip for the cross over lead. Install the Auxiliary Board to the plug connector and secure with screws.
- C) The Auxiliary Board for the Starboard 585 Actuator is either Pc.No. 1135 (for a diesel engine) or Pc.No. 1135-1 (for a gas engine). The kit includes the Auxiliary Board, mounting screws, a $\frac{3}{4}$ " cable grip, and two (2) only $\frac{1}{2}$ " cable grips. Install the cable grips, and then the Auxiliary Board to the plug connector using the mounting screws.
- D) Connect the violet conductor in the Starboard Actuator for station 1, 3, or 5 to Terminal 1, 2, or 3 of TB4. Connect the violet lead for station 2 or 4 to Terminal 7 or 8 of TB1. (See Sync Circuit Dwg. 0486-A)
- E) Run a length of eight (8) conductor cable between the Actuators using the $\frac{3}{4}$ " cable grips, and connect the green lead to Terminal 6 of TB1 in each Actuator. Connect the eight (8) conductor drain wire to the Auxiliary Board mounting screw on one (1) Actuator. Do not connect the other end

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F) The 1135 Starboard Auxiliary Board requires an electric pulse input in proportion to RPM from each engine. The electric pulse can come from a tachometer pulse generator driven by the engine mechanical tach drive. The electric pulse can also come from a magnetic pickup mounted in proximity of the flywheel ring gear. The 1135-1, Starboard Auxiliary Board, is required when gasoline engine speed pulses are taken from the point side of the coil. See Figure 25 and Figure 26.

G) To verify senders are working properly: at 'IDLE', between Terminal 2 and 3 on TB2 and TB3 you should see approximately 3.0 AC volts, increasing with RPM.

H) Synchronization will occur automatically when both control levers are 'AHEAD', above 10% of speed range, and within 15% of equal RPM. To check synchronization operation tied to the dock, disconnect the shift push-pull cables at the

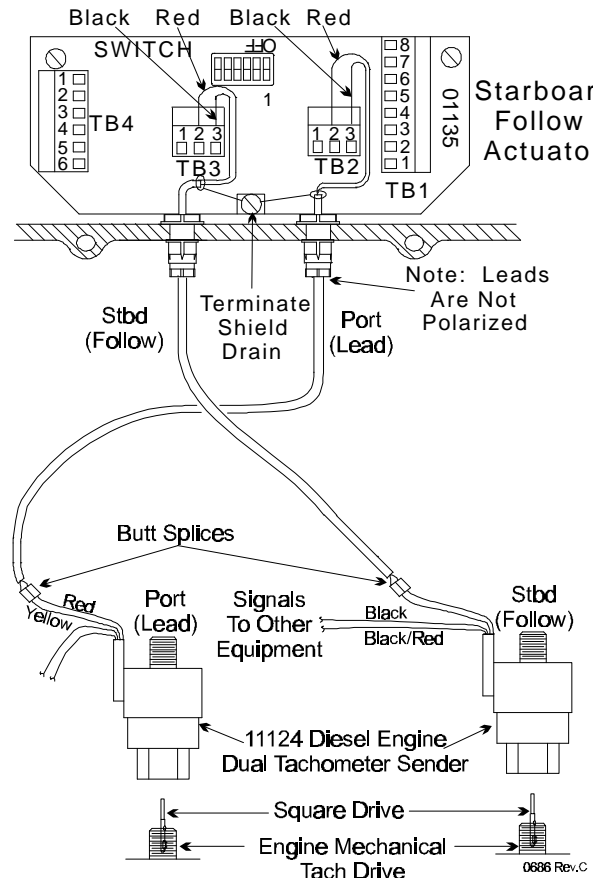


Figure 25 – Diesel Engine

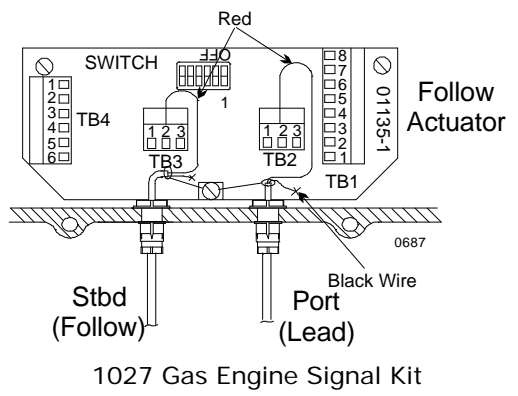


Figure 26 – Gas Engine

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transmission and place shift levers in 'NEUTRAL'. 'Start' the engines and move the controls ahead beyond shift to approximately 1500 RPM. The green LED should blink, and the engines synchronize.

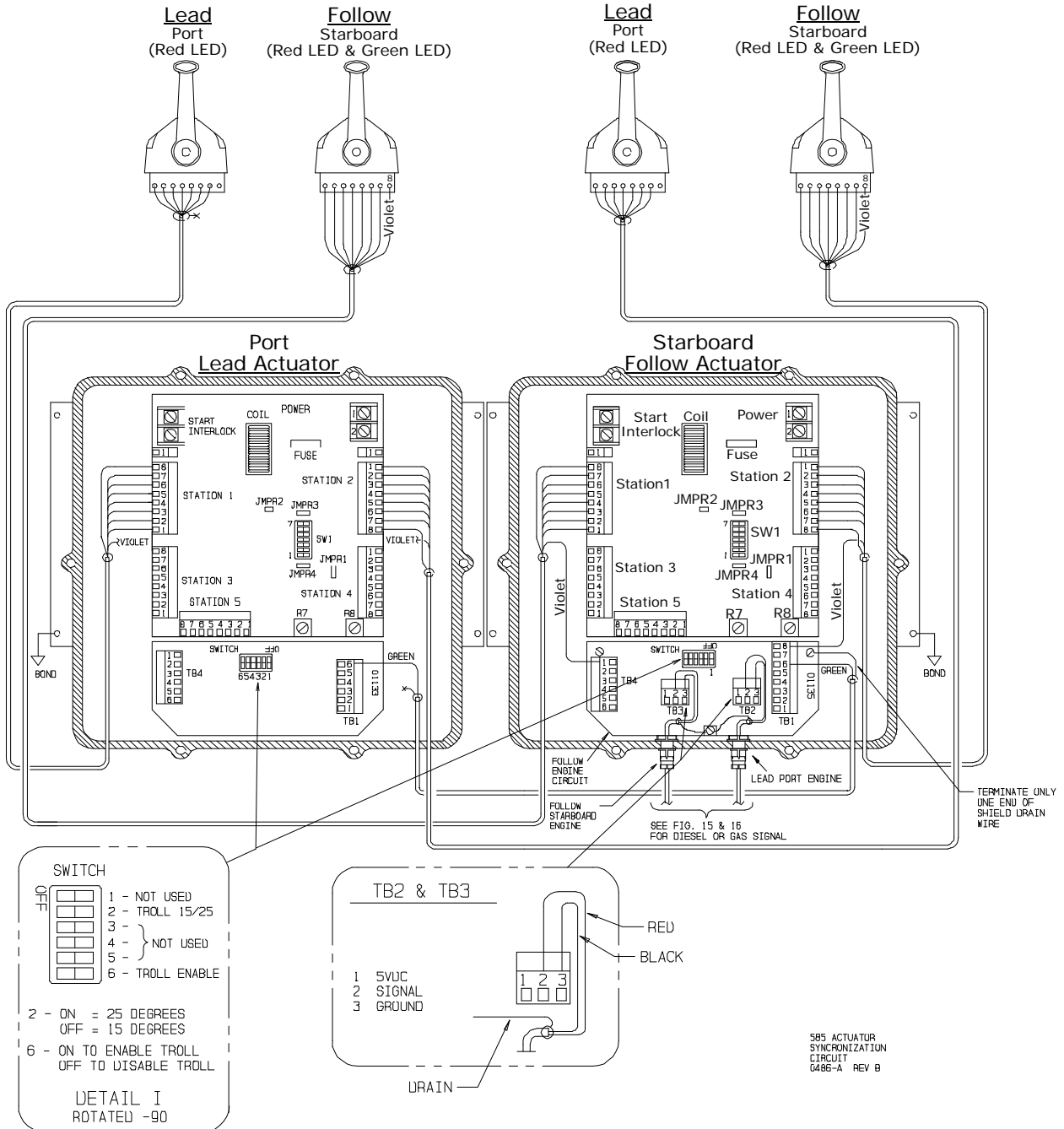
NOTE: Engines will not synchronize unless shifted to 'AHEAD' and above 10% of speed range. The engines should synchronize. If they do not, make the CHECKS listed below.

19.4 OPERATION CHECKS

- A) Check wiring connections (Dwg.No.0486-A)
- B) Check that the 'Lead' and 'Follow' are correct entering the 'Follow' Actuator.
- C) Check for 3.Ø AC volts or greater between Terminals 2 and 3 on TB2 and TB3 Auxiliary Board 1135 or 1135-1. This with the engines idling.

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19.5 SYNCHRONIZATION DRAWING 0486-A



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20. TROLLING VALVE CONTROL

20.1 PURPOSE OF A TROLLING VALVE

A Trolling Valve will allow a boat to move more slowly with the clutch fully engaged, at IDLE speed.

A Trolling Valve is a bolt on addition to some hydraulic marine reverse-reduction gears. The purpose is to reduce the hydraulic clutch pressure to a point that allows the clutch to slip, and therefore the propeller to turn more slowly than IDLE speed lock-up. The engine RPM must not exceed 1000 RPM in Trolling Mode, as the heat build up can cause damage to the transmission.

20.2 MICROCOMMANDER CONTROL OPERATION

The existing MicroCommander control lever operating speed and direction will now, in addition, operate the trolling valve lever.

When in Troll Mode, the MicroCommander control lever can be placed in the 'AHEAD' detent and the trolling valve lever will move to maximum slip position (approximately 70% slip). Continued control lever movement in the AHEAD direction thru the next 15° or 25° , will leave the engine at IDLE RPM, the transmission lever in ahead, and troll lever moving thru the slip range from maximum slip (approximately 70% slip) to minimum slip (approximately 30% slip). Continued movement 'AHEAD' of the MicroCommander control lever will move the Troll lever to lock-up position and begin to increase engine speed. The remaining movement of the MicroCommander control lever 'AHEAD' will increase engine speed up to full speed. Movement of the MicroCommander control lever back to 'NEUTRAL' will reverse the steps outlined above.

Operation in 'ASTERN' is the same as 'AHEAD', but in the 'ASTERN' direction.

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The controls at all remote control stations will operate as outlined when in the Troll Mode.

Troll Mode 'ON'/'OFF'. One (1) switch at the Master Control Station can be used to turn Troll Mode 'ON' or 'OFF'. When in the 'OFF' position there is no clutch slip.

The system is designed such that the operator cannot mishandle the controls to damage the transmission.

A consideration is the installation of a propeller shaft tachometer. It is the best way of knowing your propeller speed when you are in the Troll Mode.

Requirements:

- 1) The trolling valve lever load should not exceed 40 lbs. (18kg)
- 2) The Trolling Valve Actuator requires a reliable battery source of 12 to 32 volts DC.

NOTE: It is important to complete the installation of the clutch and throttle control and to thoroughly test the system before installing the Trolling Valve Control.

20.3 PARTS REQUIRED

20.3.1 Supplied By Your MicroCommander Dealer

1 only	813	Actuator Trolling (Twin Screw)
1 only	1133	Auxiliary Board Kit (Lead) Port
1 only	1135 or 1135-1	Auxiliary Board Kit (Follow) Starboard

- 1) The Auxiliary Boards are to be installed in the 585 Actuators.
- 2) A ferrite bead for the power cable is included with the Trolling Valve Actuator.

Eight (8) Conductor Shielded Cable	Pc.No. 180
500' spool	Pc.No. 350
Two (2) Conductor Power Cable	Pc.No. 212
250' spool	Pc.No. 349

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20.3.2 Supplied By Installer

PUSH-PULL CABLES

Type 33-C Cables - one (1) per engine - length to suit.

PUSH-PULL CABLE CONNECTION KIT

Kit may be available from the transmission manufacturer. A Universal Mounting Kit, listing parts and dimensional data is shown in Section 10.

CONTROL SYSTEM POWER 'ON'/'OFF'

Use the same type of circuit breaker and relay as used on the 585 Engine Actuators. Power can be turned 'ON' by a separate switch.

20.4 INSTALLATION

ACTUATOR

Locate and mount the Trolling Valve Actuator in the area of the engine, but do not mount to the engine or transmission.

AUXILIARY BOARDS

Install the Auxiliary Boards in the 585 Actuators, see Dwg. No. 0490-B. The Auxiliary Board, Part No. 1133, will be the 'Lead' and mount to the Port Actuator. Auxiliary Board, Part No. 1135, will be the 'Follow' and mount to the starboard Actuator. Auxiliary Board mounting screws are included. The Auxiliary Boards will handle both Synchronization and Trolling Valve. The 'Follow' Auxiliary Board is 1135 for diesel engines and is 1135-1 for gas engine applications. Connect as shown in Dwg. No. 0490-B.

CAUTION: Terminate the eight (8) conductor shielded drain wire only at the Trolling Valve Actuator.

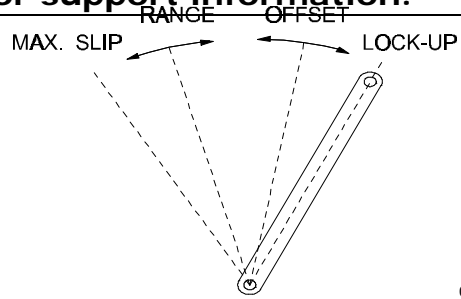
20.5 SET UP

The standard MicroCommander 585 Actuator Control System should be installed, set up, tested, and trialed before attempting to set up the Trolling Valve Actuator. If this is an

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existing installation, the 585 PROM's may need to be changed.

A tachometer to measure propeller RPM is helpful in setting up the Trolling Valve Control.



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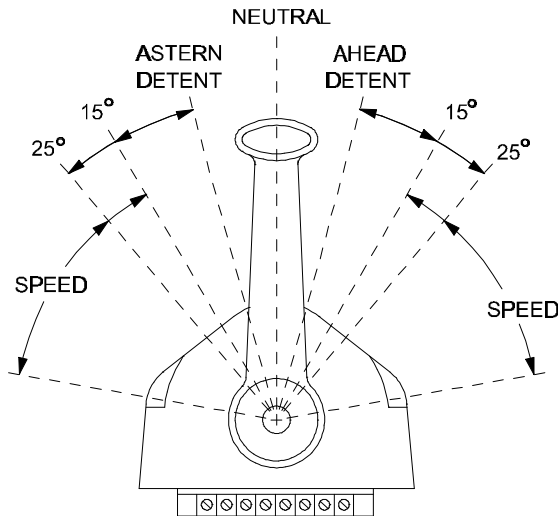
Figure 27 – Trolling Valve Lever

20.5.1 Adjustments

1) GENERAL

Install push-pull cable in the Trolling Valve Actuator. Do not connect at the Trolling Valve Lever. Set DIP Switch 6 on the Auxiliary Boards to 'ON' to enable Troll Command.

Turn 'ON' the controls, 585 Actuator, and the 813 Trolling Valve Actuator. Take control at the remote



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Figure 28 – Control Head Lever Movement

station and place the control lever in NEUTRAL. Make sure the Troll Mode switch is in 'Troll' or a Jumper is between TB5-3 and TB5-4 (see Dwg. No. 0490-B) in

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the Trolling Valve Actuator. The Trolling Valve Actuator will now be in the Troll lock-up position.

2) TROLLING VALVE CONTROL

You can select whether 15 degrees or 25 degrees of control lever movement as dedicated to the control of the Trolling Valve. This is measured from the 'AHEAD' or 'ASTERN' detent and will control propeller slip from minimum to maximum. Through this range there will be no speed increase. At the end of the 15 degrees or 25 degrees of control lever movement, the Trolling Valve will move to lock-up position, and speed will begin to increase, reaching full speed at maximum lever position.

DIP Switch 2 on the Auxiliary Boards sets the Trolling Valve degrees of control.

Switch 2 'OFF' 15 degrees
 'ON' 25 degrees

The switches on both Auxiliary Boards shall be set the same.

3) PUSH-PULL CABLE DIRECTION

Place the MicroCommander control lever in the 'NEUTRAL' position. The Trolling Valve Actuator will extend, or retract the push-pull cable to the Trolling Valve lock-up position. If this is correct, leave it. If it is reversed, you can change it using the shunt on JMPR 3 to change Starboard, and the shunt on JMPR 4 to change Port.

Shunt 'ON' Push to lock-up
 'OFF' Pull to lock-up

Now mechanically adjust the push-pull cable to connect to the Trolling Valve Lever in the lock-up position.

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4) ADJUSTMENT 'RANGE' 'OFFSET'

The next step is to adjust the 'Range' (maximum slip) and 'Offset' (minimum slip), see Figure 27. The goal is to adjust the 'Range' such that in the 'AHEAD' or 'ASTERN' detent position the propeller is turning, but at the slowest possible speed (maximum slip). This may correspond to approximately 70% slip. 'Offset' will be adjusted to give approximately 30% slip (minimum slip).

The slip RPM will vary with the temperature of the gear oil, and therefore, it is important to warm-up the engines and gear oil before these adjustments are attempted.

The vessel should be tied securely to the dock with only one (1) engine at a time running. The control for the running engine can be placed in the 'AHEAD' detent.

Dip switches 1 and 2 on SW1 on the 813 Trolling Valve Actuator allows for set up of the Trolling Valve Actuator. You will adjust 'Range' first, and then 'Offset'.

RANGE

Place SW1-1 in the 'ON' position. SW1-2 must be 'OFF'. Potentiometer R7 will adjust Port 'Range' and R8 will adjust Starboard 'Range'. Adjust lightly so as not to damage the potentiometer stops. Adjust 'Range' for maximum slip, approximately 70% slip. Once set, turn SW1-1 to the 'OFF' position.

OFFSET

Place SW1-2 in the 'ON' position. SW1-1 must be 'OFF'. Adjust for minimum slip approximately 30% slip. You are looking for the point the clutch is still

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slipping just before lock-up. Adjust potentiometer R10 for Port and R9 for Starboard. Once set, turn SW1-2 to the 'OFF' position. You are now set.

5. SLIP DELAY

It may be necessary to delay the response of the troll lever, to insure that the clutch oil pressure is high enough to rotate the propeller shaft. The delay can be increased with switches on Trolling Actuator (SW1-3 and SW1-4). This feature is only available with the Trolling Valve Actuator Part No. 813 starting with serial number 20290.

SW1-3	OFF	ON	OFF	ON
SW1-4	OFF	OFF	ON	ON
Delay (sec)	0.0	0.4	0.8	1.2

Following a Sea Trial you will likely need to fine tune the above adjustments, because the propulsion machinery will be thoroughly warmed up and you may see some change.

20.6 TROUBLE SHOOTING

There is an erratic tone beeper at all control stations to warn of a problem with the Trolling Valve Actuator.

This tone would sound for the following reasons:

- 1) The Trolling Valve Actuator power has not been turned 'ON'.
- 2) For any reason the Actuator cannot get to lock-up position. This could be something jamming the push-pull cable. Once a problem is corrected, push the station transfer button for a reset.
- 3) If the problem cannot be corrected, the alarm tone may be stopped by turning dip switch SW1-6 on the Auxiliary Boards to the 'OFF' position. The trolling valve lever on the

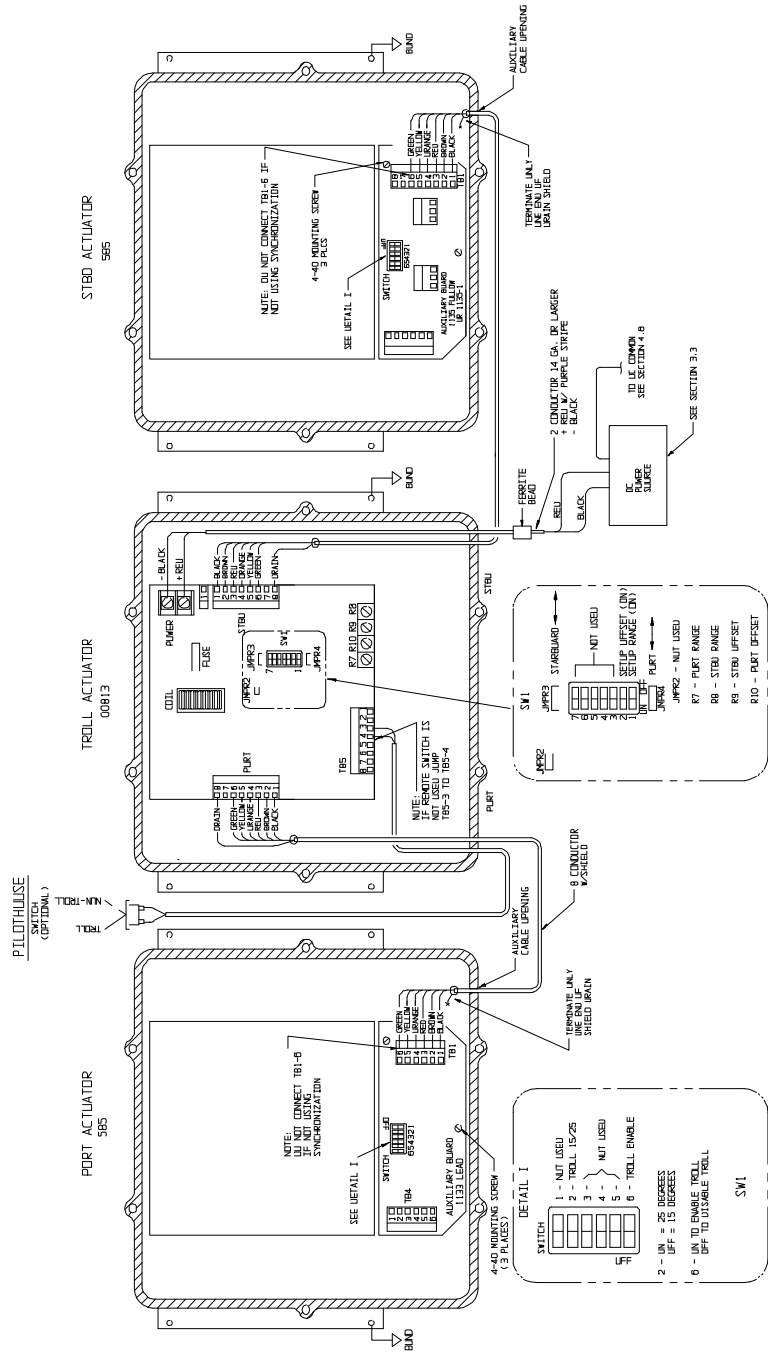
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transmission must be disconnected, and lever placed manually in the lock-up position.

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20.7 TROLLING VALVE DRAWING 0490-B



TROLLING VALVE
0490-B REV B

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