

MATHERS



585CE Manual



• MicroCommander™



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1. GENERAL INFORMATION

The Mathers MicroCommander Marine Propulsion Control System is designed for pleasure marine and light commercial marine applications on vessels to approximately 100 feet in length. The control system is electronic, consisting of one Actuator per engine located in the engine room area. The Actuator requires a 12 to 32 VDC power supply from the vessels DC power distribution panel and is mechanically connected to the vessels main engine throttle for speed control and to the transmission for direction control.

The MicroCommander System features single lever control of the vessels speed and direction from one to five remote control stations. The control heads are connected from the remote stations to the Actuator with an eight-conductor shielded cable. Only one station will have control at any time. Station transfer is by push button acknowledgment with Station-in-Command indicated by a light at the control head.

1.1 MICROCOMMANDER FEATURES INCLUDE:

- Single lever control of speed and direction
- One to five remote stations
- Single or dual lever control heads
- Push button station transfer
- Station-in-Command indication
- Audible system diagnostics and status indication
- Mechanical interface to most engine / gear combinations
- Easily configured to vessel control requirements
- Proportional pause on through-Neutral shifts
- Neutral Fast Idle
- Low / High Idle selection
- Neutral-only start interlock
- System failure alarm contact

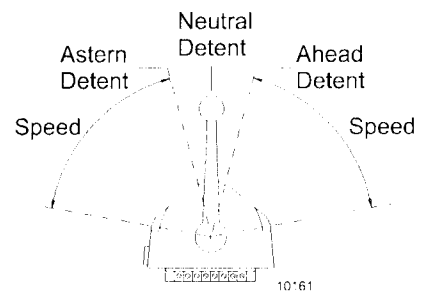
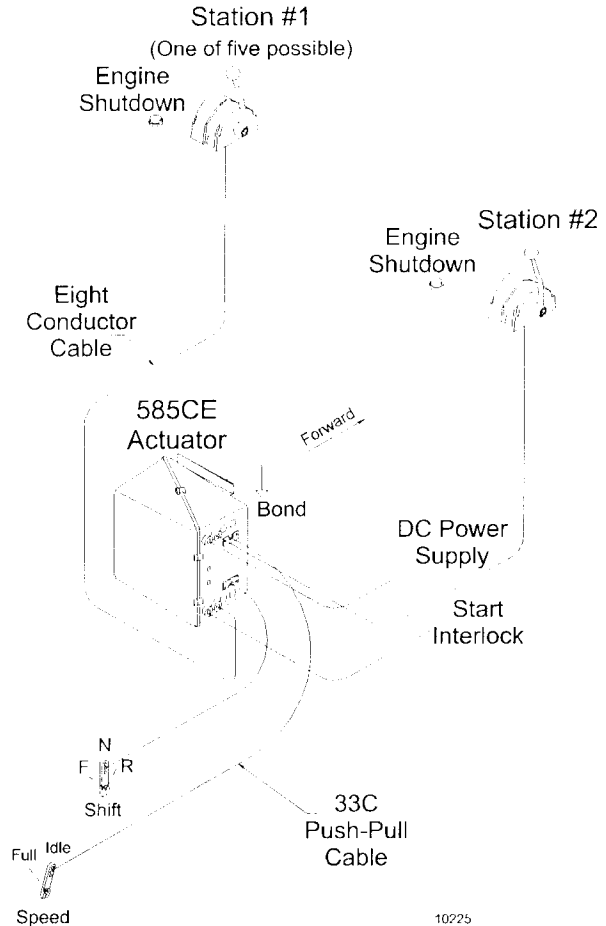
1.2 MICROCOMMANDER OPTIONS INCLUDE:

- Automatic engine synchronization
- Integrated trolling valve control
- Clutch oil pressure interlock
- Hand Held Remote Control with or without bow thruster control

1.3 MICROCOMMANDER SYSTEM OPERATION

1.3.1 MicroCommander Basic Control Functions

The MicroCommander Marine Propulsion Control System consists of an electronically controlled Actuator, mechanically interfaced to the vessel's main propulsion engine and transmission. The MicroCommander offers single lever control of speed and direction. The remote control head has three detents. With the control lever positioned in the vertical Neutral detent the system will command



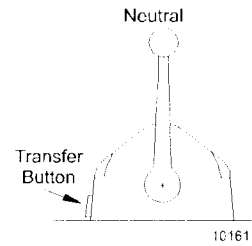


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Neutral and Idle RPM. Movement of the control lever 15 degrees to the Ahead or Astern detent will command Ahead or Astern clutch engagement and the engine will remain at Idle RPM. Further movement of the control lever will increase engine RPM in proportion to the control lever position.

1.3.2 MicroCommander Initialization

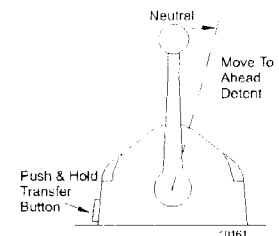
The MicroCommander Control System is activated by first applying DC power from the vessel's power distribution panel. The MicroCommander Actuator will initialize by positioning the engine throttle lever to Idle and the transmission lever to Neutral. An audible beeping tone is present at all control stations. The beeping tone indicates that the system has initialized, the system is at Neutral and Idle, and no station has command. Control may be accepted at any station by depressing the station transfer button at the desired station. The Station-in-Command is indicated by the illuminated red light in the control head. There will be two red indicator lights on twin screw applications.



1.3.3 Neutral Fast Idle

The MicroCommander Propulsion Control System has a Neutral Fast Idle feature, whereby the transmission is held in Neutral and the engine throttle may be adjusted to any desired RPM. This feature may be useful for engine start, warm-up, or PTO operations.

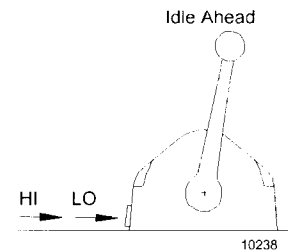
Neutral Fast Idle is achieved by first positioning the control lever in the Neutral detent. Depress and hold the station transfer button. Move the control lever to the Ahead detent. The red indicator light on the control housing will blink while the transmission remains in Neutral. Further movement of the control lever will increase engine RPM to the desired level. By returning the control lever to the Neutral detent, the red indicator light will become steady and standard control is active.



1.3.4 High / Low Idle

MicroCommander features an option for two engine Idle settings. The normal Low Idle RPM is set mechanically by the Low Idle stop at the engine throttle. A secondary High Idle RPM is configured by the Actuator at a RPM that may be desirable for maneuvering or engine warm-up.

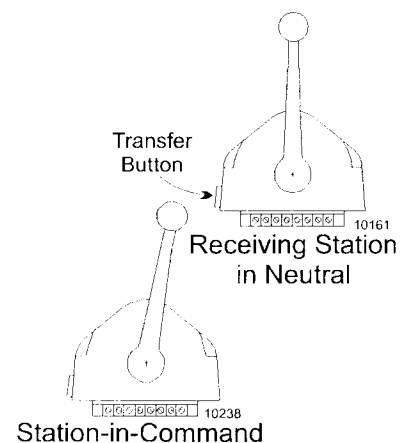
Selection of High or Low Idle is by alternately depressing the station transfer button.



1.3.5 Station Transfer

The MicroCommander Control System may accommodate from one to five remote control stations. Each station is independent and only one station will be in command at any time. The Station-in-Command is indicated by the red light in the control head housing.

Station transfer may be accomplished by positioning the receiving control station levers in the Neutral detent and momentarily pressing the station transfer button. The red lights will illuminate indicating Station-in-Command. To transfer stations while the vessel is in transit, leave the control levers at the last commanded position. At the receiving station, position the control levers in the Neutral detent and press the station transfer button. The red indicator lights will illuminate. The operator has one second to position the control levers to the position of the previous control station levers before transfer is complete, allowing for a smooth transfer without interruption of speed.





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1.3.6 Engine Synchronization

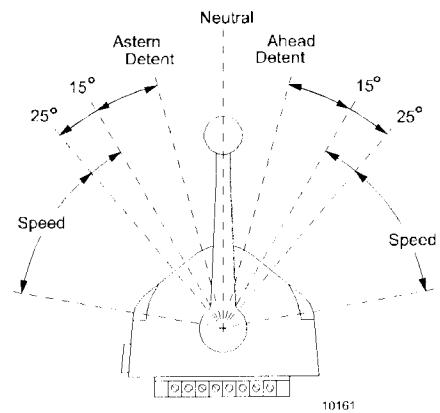
The MicroCommander Control System may be configured to offer automatic engine synchronization for twin screw applications. The Actuator requires an input signal from each engine representing engine RPM. The signals are compared and an adjusted speed signal is given to the Follow engine throttle.

Engine synchronization is automatic, activated when the Port and Starboard controls are commanding Ahead, the control levers are commanding at least 10 percent speed, and the control levers are within 15 degrees of each other. As the engines become synchronized a green indicator light in the control housing is illuminated.

1.3.7 Trolling Valve Control

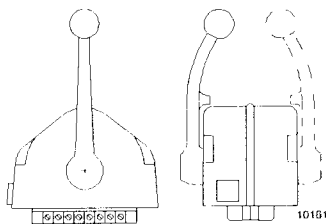
The MicroCommander Control System may be configured to offer integrated trolling valve control for vessels equipped with trolling valves. During trolling valve operation the remote control lever will command clutch direction, trolling valve position, and interlock speed.

When the control lever is in the Neutral detent the MicroCommander System commands Neutral and Idle. As the operator selects Idle Ahead or Astern the clutch will engage and the trolling valve will be commanded to minimum clutch oil pressure while the throttle is interlocked to Idle RPM. The propeller shaft is turning at minimum RPM. As the operator positions the control lever from the detent through the next 25 degrees the trolling valve is adjusted to increase clutch oil pressure to increase shaft speed while the throttle is interlocked to Idle RPM. As the control lever passes 25 degrees the trolling valve is positioned to the maximum clutch oil pressure and the engine speed is increased in proportion to the control lever position.

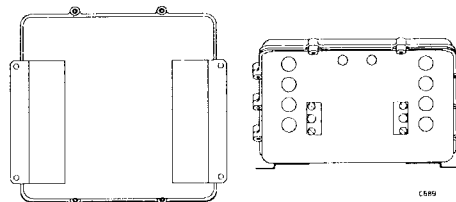


2. REQUIRED PARTS AND TOOLS

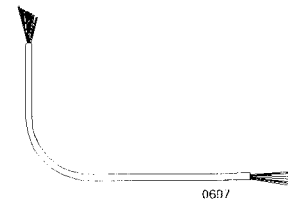
2.1 REQUIRED PARTS FROM YOUR MICROCOMMANDER DEALER



Control Head



Actuator



Electrical Cable

Control Head - The MicroCommander Control Heads are offered in single or dual lever configurations. One control head is required per remote control station.

Actuator - One Actuator is required per engine

Electrical Cable - Eight-conductor cable will connect the control heads with the engine room mounted Actuator. One eight-conductor cable is required per control lever.

See Appendix A for MicroCommander Parts List.



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2.2 REQUIRED TOOLS AND PARTS FROM YOUR MICROCOMMANDER INSTALLER

2.2.1 Tools

Anti-static wrist strap (Included with Actuator)
 Wire cutter (Thomas & Betts WT-2000 or equal)
 Wire stripper (Thomas & Betts WT-2000 or equal)
 Wire crimper (Thomas & Betts WT-2000 or equal)
 7/16-inch Socket and medium extension
 5/16-inch Wrench - open end

Screwdriver - medium Phillips head #2
 Screwdriver - medium straight slot
 Screwdriver - small straight slot
 Hole saw - 1-inch (25,4mm)
 Saw: blade suitable for Console Top Panel
 Drills - 9/32-inch (7,2mm) and 7/32-inch (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

Many engines, transmission, and inboard/outboard (I/O) drives are delivered with factory mounted kits. If factory mounting kit is not included, contact the engine dealer for Factory Cable Connection Kit. Other connection options are shown in Appendix B.

2.2.4 Control System Power On/Off Switch

Power for the MicroCommander Control System should come from the DC power distribution panel. Each Actuator requires a switched 10 ampere circuit breaker with manual reset. This may be used as the Power On/Off Switch.

2.2.5 Engine 'Stop' Button

An engine 'stop' button, or switch, **MUST** be located at each control station.

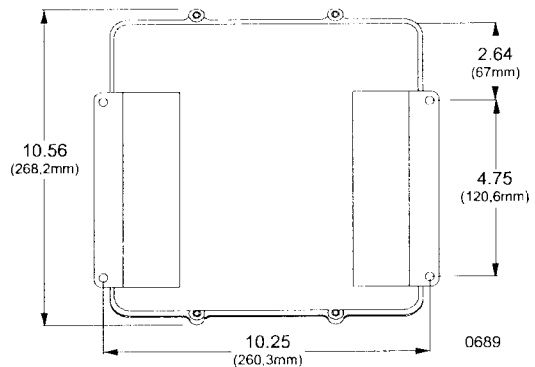
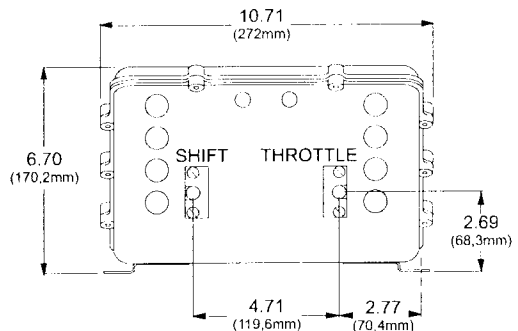
CAUTION: An engine 'stop' button at each station is an absolute requirement and will void the warranty if the requirement is not followed.

3. PLAN THE INSTALLATION

3.1 ACTUATOR LOCATION

Considerations:

- 1) Refer to Figure 1 for Actuator dimensions.
- 2) An Actuator is spray proof but it must not be immersed.
- 3) The Actuator is usually located in the engine room. If the engine room is too small, locate in any area where it is accessible for electrical and push-pull cable connections.
- 4) Bulkhead mounting 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, the Actuator must be two feet (0,6m) above water line. Do not mount the Actuator to the engine, to the transmission, or in any location that will subject it to excessive vibration. Use 1/4-inch or M6 fasteners (four each).



**Actuator Dimensions
Figure 1**



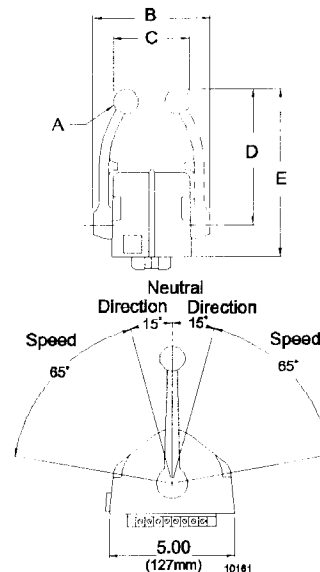
MicroCommander Instructions: 585CE Actuator

- 5) MicroCommander's electronic circuits can be influenced by strong magnetic fields and static charges. Power source must be bonded (connected) to the hull in metal-hulled vessels or to the bonding buss in non-metal vessels. (Reference Bonding in Appendix A) Do not mount close to gas engine ignition systems, alternators, or electric motors. Allow four feet (1,2m) of clearance, or more, between the Actuator(s) and such devices.
- 6) Locate each Actuator such that the push-pull cables from it to the engine have large radius bends, with the least total degrees of bend and moderate length. **EXAMPLE:** Minimum bend radius 10-inches (254mm) for total degrees of bends of less than 270 degrees. Push-pull cable lengths should not exceed 20 feet (6m).
- 7) Locate Actuator(s) away from heat sources, such as engine exhaust manifolds. Allow four feet (1,2m) of clearance, or more, between the Actuator(s) and such heat sources.

3.2 Control Head Location

Considerations:

- 1) Refer to Figure 2 for Control Head dimensions. Note that dimensions A, B, C, D, and E depend on lever style. Refer to Control Head Options in Appendix A.
- 2) The Control Head is watertight and the junction with the mounting surface will be made watertight by an adhesive gasket at installation; however, it must be protected from water or spray coming from below.
- 3) Usually, the Control Head mounts to top surface of the console after an opening has been prepared for a projecting terminal block and after four mounting-screw holes have been drilled. Then, the Control Head is secured with screws from the bottom side of the panel; four 8-32 x 1-inch screws are provided.
- 4) When mounting a Control Head that may be weather-exposed from the underside, consider using a Weather Mounting Control Box, reference Appendix A.
- 5) Retrofit applications may require planning for 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.



**Control Head
Dimensions
Figure 2**

3.3 DC POWER SOURCE (REF. FIGURE 3)

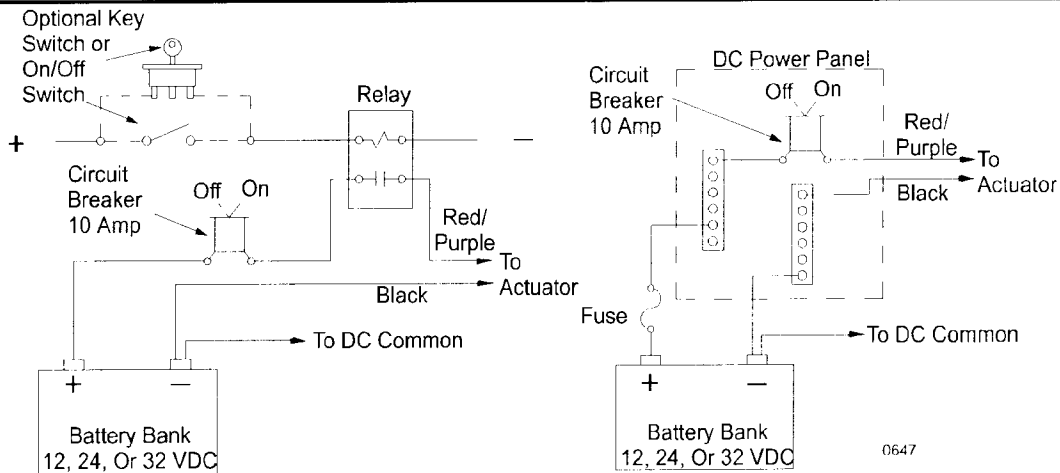
The MicroCommander Actuator requires a battery source (12, 24 or 32 volts DC) protected by a 10 ampere circuit breaker. It is not recommended to use engine starting batteries on 12 volt system, because the cranking voltage may be too low. It is important to keep the length of power cable short to reduce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

CAUTION: When more than one Actuator is used, or if used with a Troll Actuator, all Actuators must be connected to power sources that have a common DC return (-).

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 three percent. The DC return to the battery must be large enough to supply all current requirements with a voltage drop of less than one percent. (See References, Appendix A.)



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DC Power Sources
Figure 3

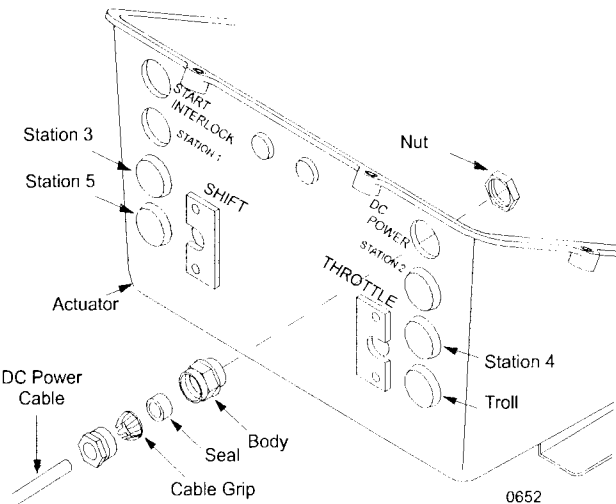
4. INSTALLATION

Before starting the actual installation of the MicroCommander Propulsion Control System, 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.

CAUTION: *Static electricity can destroy electronic components. Any time the Actuator cover is off, wear 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

- 1) Refer to Figures 4 and 5.
- 2) Secure the Actuator(s), using 1/4-inch or M6 fasteners; make sure to bond each unit to the hull or to the bonding buss. (Reference Bonding - Appendix A) When the Actuator cover is removed, connect the wrist strap to your person and connect the ground connector to the Actuator frame.
- 3) Install the Power Cable grip and the Start Interlock Cable grip in the top cable entry holes, as shown in Figure 4.
- 4) Do not remove Hole Plugs from STATION 2 through STATION 5 or TROLL cable entry holes, unless necessary. To remove a plug(s), use a screwdriver as shown in Figure 5
- 5) When not working on the Actuator, keep the cover in place to prevent damage to circuits.



Typical Cable Grip Installation
Figure 4

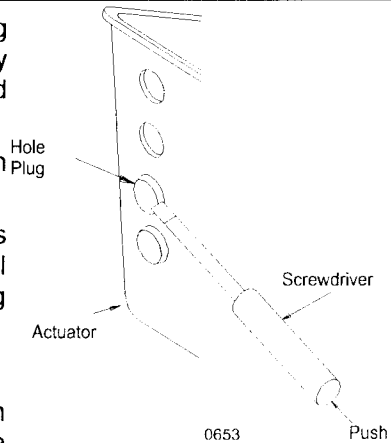
4.2 THE CONTROL HEADS

- 1) Drill four 7/32-inch (5,6mm) diameter mounting-screw holes and four 1-inch (25,4mm) diameter corner-cutout holes.
- 2) Using a Saw, complete the rectangular opening for the Control Head terminal block.



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- 3) Use the four #8-32 x 1-inch mounting screws (supplied) for mounting to a 3/4-inch (19,1mm) maximum thickness mounting surface; verify that all four mounting screws will penetrate the mounting surface and start into the Control Head.
- 4) Strip the cover from the adhesive side of the gasket and apply with the adhesive side to the mounting surface.
- 5) It may be desirable to defer final mounting until wiring connections have been made at the Terminal Block; otherwise locate the Control Head on the console and install the four #8-32 x 1-inch mounting screws to secure it in place.



**Plug Removal
Figure 5**

4.3 ENGINE START SWITCH/INTERLOCK

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, as shown in Figure 6. The interlock will function with a Start signal up to 50 volts DC and 30 amperes maximum.

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

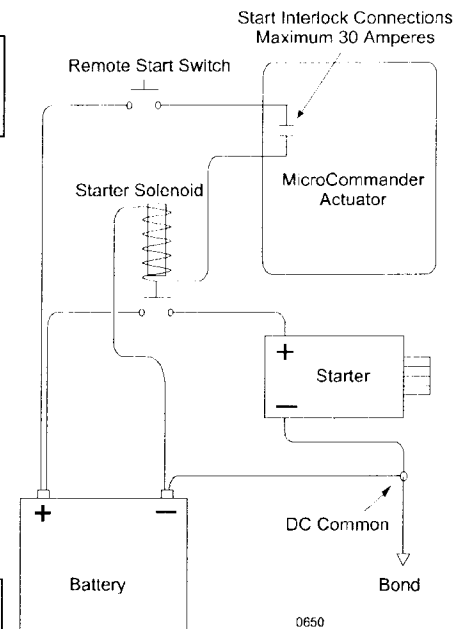
4.4 ENGINE STOP SWITCHES

Engine STOP switches are required at all Control Head stations. The STOP switches are installer-supplied.

4.5 EIGHT-CONDUCTOR CABLE

Route an eight-conductor cable (two cables, if twin-screw) between each Control Head and the appropriate Actuator. There can be as many as five control stations, except when High Idle option is installed; in such a case, there can be four control stations. Label each eight-conductor cable at both ends to identify it with the station it connects, and whether it is for port or starboard engine control if applicable. The wires in the eight-conductor cable are color-coded.

NOTE: Each eight-conductor cable shall be installed so that it is protected from physical damage. All conductor cables shall be supported by clamps or straps not more than 18-inches (0,5m) apart, unless contained in a conduit. (See Appendix B - References)



**Start Interlock
Figure 6**

4.6 CONTROL HEAD CONNECTIONS

Refer to Figure 7 and proceed as follows:

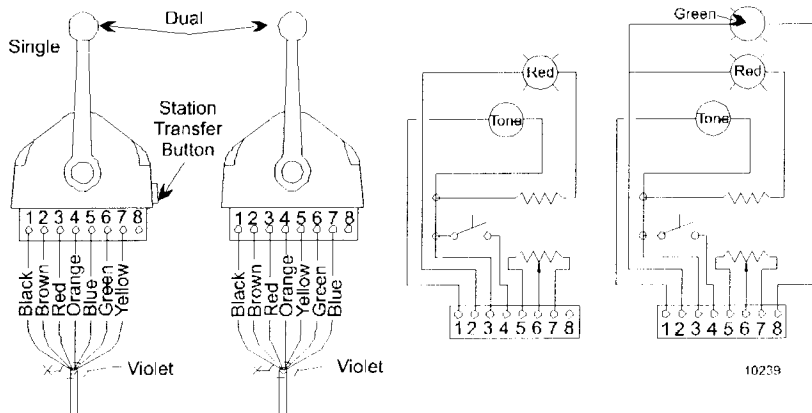
- 1) At the Control Head, strip back the PVC cover on the cable approximately 2-1/2-inches (63,5mm). Strip and cut off the shielding and bare drain wire flush with the end of the PVC cover. (Do not connect the drain wire to ground at the Control Head.)
- 2) Bend the Violet wire out of the wire bundle and wrap or otherwise compact it at the cover; secure with tape for possible use as a spare or in optional wiring.
- 3) Strip 3/8-inch (9,5mm) insulation off each of the seven remaining wires and install crimp terminals provided for the #6 terminal-block screws.



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- 4) Make connections to Control Head terminal block(s). Note that connections 5 and 7 on each terminal block are direction-sensitive.

Figure 7 depicts a twin-screw control station with the control lever for the Port engine on the user's left and the control lever for the Starboard engine on the user's right. For an aft facing control station, connections 5 and 7 must be transposed at the two Control Heads only.

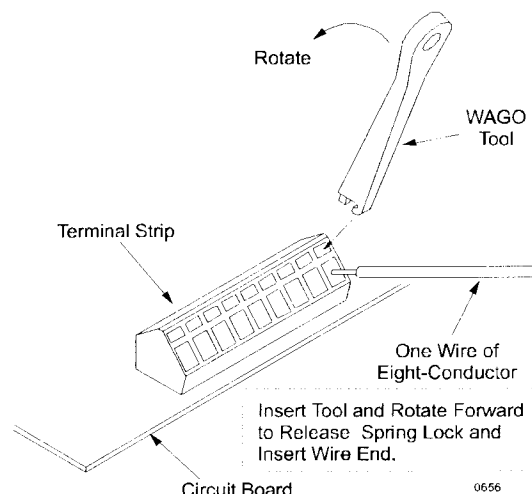


Twin Screw Control Head Connections
Figure 7

Figure 7 also depicts a single-screw control station with the control lever on the user's left; if it is desired to install the Control Head with control lever on the user's right, or for an aft facing control station, connections 5 and 7 must be transposed at the Control Head only.

4.7 ACTUATOR CONNECTIONS

- 1) Place the anti-static wrist strap on your wrist, then remove the Actuator cover and connect your anti-static wrist strap to the Actuator frame.
- 2) The eight-conductor cable from Station Number 1 will enter through STATION 1 hole, and so on. Remove only the cable hole plugs as required for additional cables. (See Figure 5)
- 3) Install the watertight cable grip that is packaged with the Control Head(s).
- 4) On each cable, strip the PVC jacket and shielding back approximately 2-inches (50,8mm).
- 5) Bend the Violet wire out of the wire bundle and wrap or otherwise compact it at the cover; secure with tape for possible use in optional wiring.
- 6) Stagger the remaining wire leads for length and dress to match the STA 1 or appropriate terminal strip, and to keep them from contact with the frame. Strip each wire 3/8-inch (9,5mm).
- 7) Connect wires as shown on 585CE Standard System Drawing (see Appendix C) as applicable. Refer to Figure 8; use the WAGO Tool, which is included with each Actuator and is taped to the relay on the circuit board. Use this tool to depress the spring lock for the individual wire connection to the terminal strip, as the Figure shows.
- 8) Connect the bare shielding drain wire to terminal 8 on the terminal strip; it must not come in contact with any components.
- 9) Feed through a little slack cable and tighten the cable grip on the eight-conductor cable.
- 10) Secure the cable to the frame, using tie wraps provided.



Terminal Connections
Figure 8



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- 11) Install eight-conductor cables for remaining stations in the same way, making connections to the appropriate terminal strips. (Refer to Figure 9).

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

4.8 DC POWER CABLE CONNECTIONS TO ACTUATOR

Before connecting the two-conductor DC power cable to the Actuator, be sure the power is Off. Refer to Figure 9 and proceed as follows;

- 1) Strip each wire 3/8-inch (9,5mm), then install crimp terminals for #6 screws.
- 2) Connect the (—) negative lead (black) to the — BATT power terminal, terminal 1.
- 3) Connect the (+) positive lead (red with purple stripe) to + BATT power terminal, terminal 2.
- 4) Tie wrap the power cable to the Actuator frame and tighten the cable grip.

4.9 START INTERLOCK CABLE CONNECTIONS

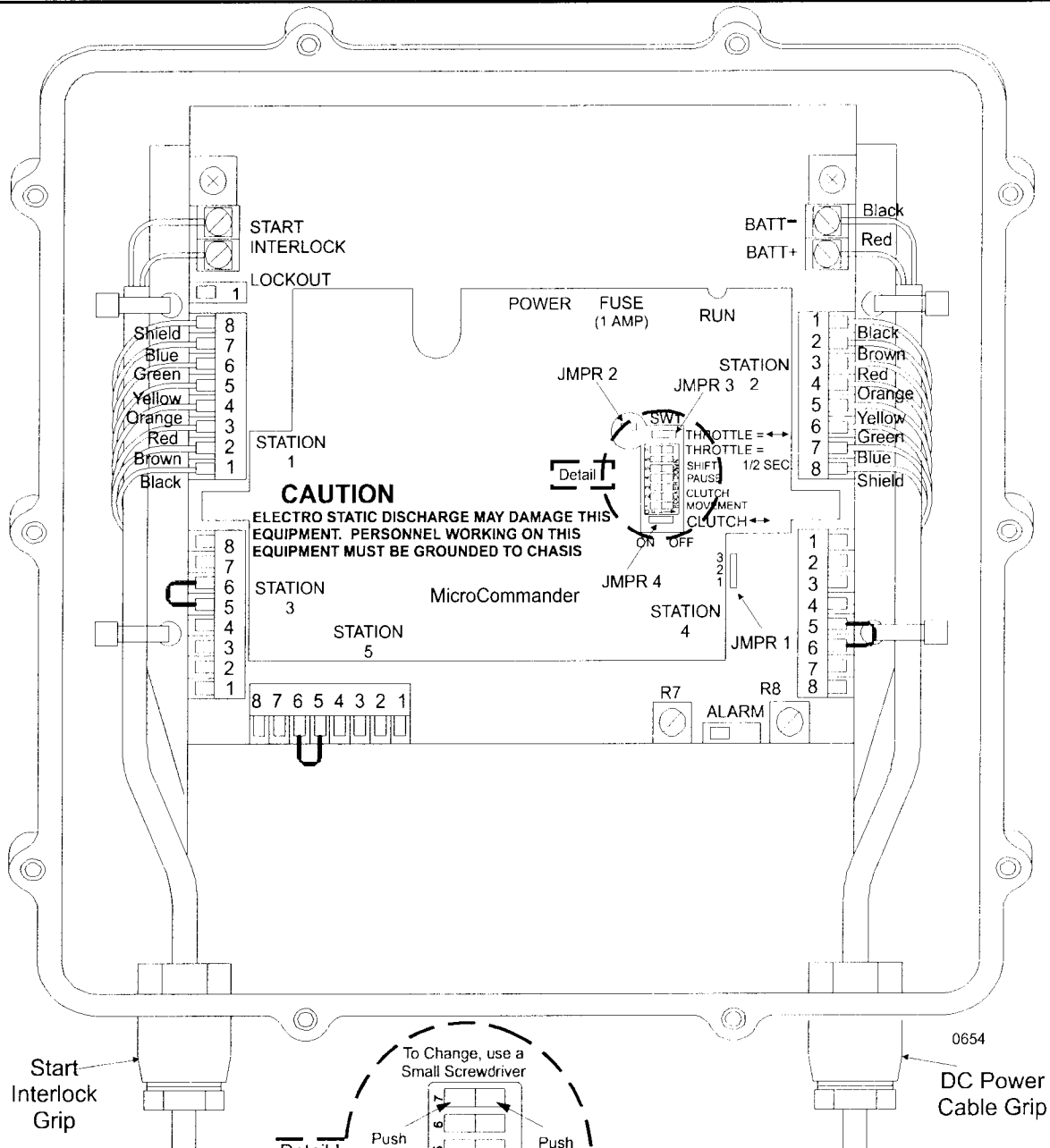
NOTE: Maximum current rating of interlock relay is 30 amperes.

In the two-conductor Start Interlock cable, both wires are yellow with a red stripe. Refer to Figures 5, 6, and 10, and proceed as follows:

- 1) Remove the key start lead at the Starter Solenoid.
- 2) Connect one yellow with red striped wire to this lead.
- 3) Connect the second yellow with red striped wire to the Starter Solenoid.
- 4) Run the cable through the START INTERLOCK cable grip on the Actuator to the START INTERLOCK terminals on the Actuator circuit board.
- 5) Strip each wire 3/8-inch, install crimp terminal for #6 screw.
- 6) Tie wrap the Start Interlock cable to the Actuator frame and tighten the cable grip.

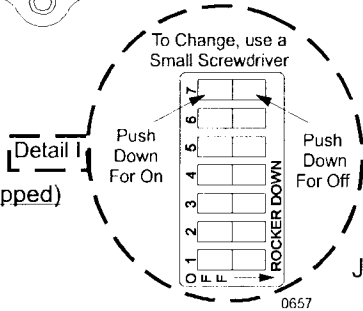


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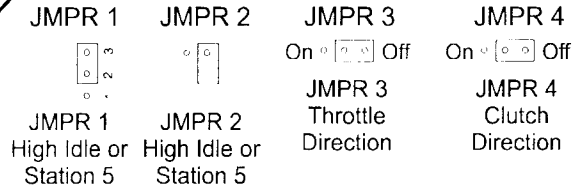
Dip Switch SW1 Settings (as shipped)

- Off (7) Throttle Pause
- Off (6) Clutch Pause - see Timing Chart, Figure 11
- Off (4) Clutch Pause - see Timing Chart, Figure 11
- On (3) 1/16 inch (1,6mm) Shift Cable Movement
- On (2) 1/8 inch (3,2mm) Shift Cable Movement
- On (1) 1/4 inch (6,4mm) Shift Cable Movement



Actuator Settings (as shipped)

- R7 Potentiometer - Throttle
- R8 Potentiometer - High Idle



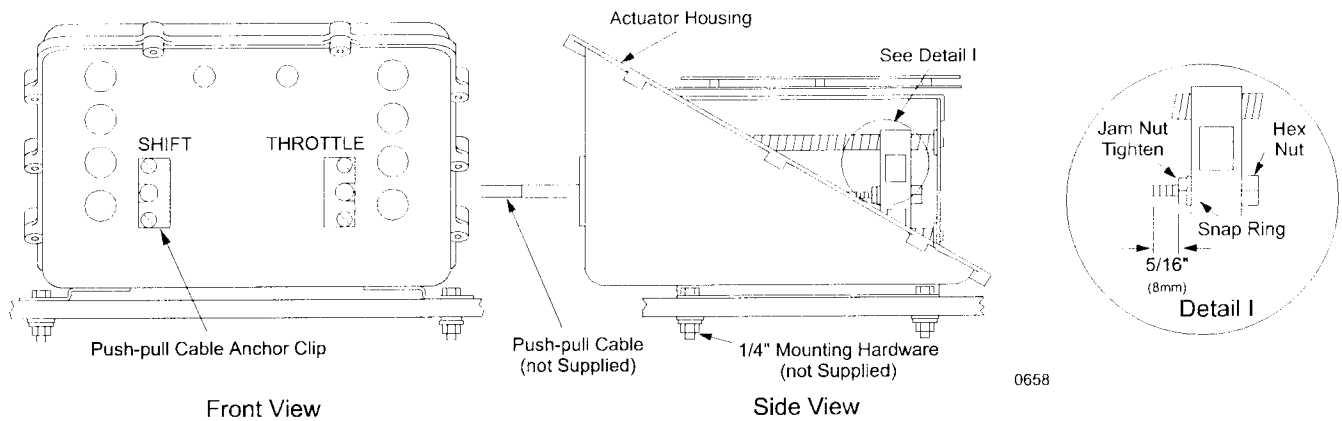
Typical Actuator Connections
Figure 9



MicroCommander Instructions: 585CE Actuator

4.10 ACTUATOR PUSH-PULL CABLE CONNECTIONS

- 1) Refer to Figure 10. 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(s) only; discard the seals
- 2) Remove one screw from each Cable Anchor Clip and swing the two Clips clear.
- 3) Insert the SHIFT cable and THROTTLE cable according to the labels on the Actuator. Reinstall the #10-32 jam nuts, placing them on the cable rod ends such that there is approximately 5/16-inch (8mm) of thread showing behind each jam nut, as shown in Figure 10, Detail I.
- 4) Insert the cable ends in the respective hex nuts and use a 7/16-inch socket wrench and a 5/16-inch open end wrench to tighten the jam nuts.
- 5) Align the push-pull cable sleeve ferrules such that the Cable Anchor Clips will engage the peripheral grooves, then position the Clips to secure the cables to the Actuator housing and install the screws removed in step 2.



Actuator Push-Pull Cable Connections
Figure 10

4.11 ENGINE AND TRANSMISSION PUSH-PULL CABLE CONNECTIONS

- 1) Check whether push-pull cable anchor brackets are installed on the engine and transmission. If the brackets are not on the engine or the transmission, select from Morse Standard Kits (Appendix B) or fabricate brackets as shown in Universal Mounting Kit (Appendix B).
- 2) Use the jam nuts supplied with the cables to secure the cable rod ends in the ball joints.
- 3) Do not remove the two rubber seals from this end of the cable.

5. ADJUSTMENTS (ENGINES STOPPED)

5.1 POWER-UP CHECK

- 1) Apply DC power to the MicroCommander Propulsion Control System.
- 2) The Control Head at each station will produce an intermittent tone.
- 3) Verify that Control Head lever(s) is at Neutral. Depress one Station Transfer Button. The red indicator light on the Control Head should light, showing this station has control. Note that on dual Control Heads, both red indicator lights must be lighted.
- 4) 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.



5.2 CONTROL HEAD AND STATION TRANSFER CHECKS

At each remote control station, move the Control Head lever(s) to the Neutral detent position, then press the Station Transfer Button. The indicator light on the Control Head will confirm that station transfer has taken place. Control Head levers are direction-sensitive; to prove that the control wiring connections are correct:

- 1) Move the Control Head lever(s) to the Neutral detent position.
- 2) Depress and hold the Station Transfer Button, then move the Control Head lever(s) to Ahead detent position: this will put the control system in Neutral Fast Idle Mode and the red indicator light on the Control Head should blink. The blinking red light indicates that the clutch is in Neutral and that the control lever(s) will position the throttle only.
- 3) Depress and hold the Station Transfer Button, then move the Control Head lever(s) to Astern detent position: the red indicator light on the Control Head should now remain On steadily.
- 4) If the red indicator light is On in Ahead and blinks in Astern, connections 5 and 7 on the Control Head terminal block are reversed (See Section 4.6). Neutral Fast Idle Mode must operate only in the Ahead direction.
- 5) There are no further checks for the Control Head.

5.3 CONTROL DIRECTION SHUNT CONFIGURATION

- 1) Refer to Figure 9.
- 2) As shipped from the factory, Clutch Direction - JMPR 4 is at OFF position and, therefore, the push-pull cable will pull on the transmission shift lever for Ahead. If this is wrong, move the Clutch Direction JMPR 4 to ON, and the push-pull cable will push the transmission shift lever for Ahead.
- 3) As shipped from the factory, Throttle Direction - JMPR 3 is at OFF position and, therefore, the push-pull cable will push the throttle lever for full-speed. If this is wrong, move the Throttle Direction JMPR 3 to ON, and the push-pull cable will pull on the throttle lever for full-speed.

5.4 ENGINE PUSH-PULL CABLE ADJUSTMENTS

Verify that push-pull cable anchor brackets are installed on the engine and transmission, but that cable ball joints are disconnected.

CAUTION: *Misadjusted clutch and throttle cables cause Actuator servo motor failure. Do it right by following these instructions:*

5.4.1 Transmission Cable Adjustment

- 1) Position the Control Head lever(s) to the Neutral detent and turn the controls On.
- 2) With the SHIFT Cable disconnected, adjust the SHIFT Cable ball joint at the transmission to align with the transmission clutch lever in Neutral. The push-pull cable should form a right angle (90 degrees) to the transmission clutch lever with the Control Head lever in the Neutral position. Leave the SHIFT Cable disconnected.
- 3) Move the Control Head lever to the Ahead detent. The Actuator can be adjusted for a total clutch movement of 2-inches (51mm) to 3-inches (76mm). Actuators are shipped with switches set for minimum movement
- 4) Measure the transmission clutch lever movement from Ahead detent to Astern detent. The lever movement must be within the adjustment range of 2-inches (51mm) to 3-inches (76mm).

DIP Switch SW1 (Figure 9) will increase the SHIFT cable movement in each direction from Neutral by moving the switches from ON to OFF.

| | | | |
|-----------|-----------|---------|------------------------|
| Switch 1: | 1/4-inch | (6,4mm) | |
| Switch 2: | 1/8-inch | (3,2mm) | Approximate Dimensions |
| Switch 3: | 1/16-inch | (1,6mm) | |



MicroCommander Instructions: 585CE Actuator

- 5) Select combination of switches to obtain the required additional movement, then check the Astern direction. Recheck Ahead, Neutral, and Astern with the SHIFT cable disconnected. Verify that the Actuator will not jam the transmission clutch lever against its stops and that Neutral is correct.
- 6) Connect SHIFT cable.

5.4.2 Throttle Cable Adjustment

- 1) Refer to Figure 9. 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.*

- 2) Leave the THROTTLE cable disconnected at this time.
- 3) Measure the throttle movement at the engine from Idle to Full. It must be within the Actuator range of 1-inch (25,4mm) to 2-7/8-inches (73mm). If the throttle movement is less than 1-inch (25,4mm) or greater than 2-7/8-inches (73mm), the lever radius must be changed to be within range. If possible, throttle movement should be 2-1/2-inches (64mm) Idle to Full.
- 4) Place Control Head lever(s) in Neutral, start the engine, and run at Idle. Adjust the ball joint on the THROTTLE cable to match the throttle lever at Idle position.
- 5) Stop the engine. Move the Control Head lever to the Full Ahead position. Manually move the engine throttle lever to the full-speed stop.
- 6) Gradually turn potentiometer R7 on the circuit board clockwise until the push-pull cable ball joint, when connected, will exert a slight amount of pressure against the full-speed throttle stop. Recheck Idle and Full.
- 7) Connect ball joint to throttle lever.
- 8) Throttle adjustment is complete.

5.5 STATION TRANSFER

Verify correct Station Transfer operation as follows:

- 1) Only one station has control at any one time. The red indicator light on the Control Heads will be On at the station which is presently in control; it will be Off at all other stations.
- 2) When transferring control stations, the Control Head lever at the Station-in-Control can be in any position from full-ahead to full-astern.
- 3) To gain control at any other station, the Control Head lever at that station must be in Neutral position.
- 4) Pressing the Station Transfer Button at the station taking control will cause the Control Head indicator light at that station to illuminate. There is a one-second pause after the indicator light is On to allow the operator time to match the speed setting of the previous Station-in-Control before Station Transfer actually takes place.

5.6 START INTERLOCK

Verify proper operation of Start Interlock:

- 1) Turn DC power to MicroCommander Off; verify that engine(s) can not be started.
- 2) Turn DC power to MicroCommander On and acknowledge control; position the Control Head lever to the Ahead detent and verify that engine(s) can not be started.
- 3) Position the Control Head lever in the Neutral detent and verify that engine(s) can now be started.

5.7 THROTTLE PAUSE

Refer to Figure 9.



MicroCommander Instructions: 585CE Actuator

Hydraulic-actuated clutches typically require 1/2 second or longer following clutch lever movement before there is clutch plate contact; accordingly, DIP switch SW1-7 in the OFF position allows 1/2 second Idle throttle pause after the Actuator has completed clutch selector movement.

Dog clutches and cone clutches used on some inboard/outboard and outboard drives typically do not require a throttle pause following clutch shift and SW1-7 should be in ON position.

Some clutches may build clutch pressure more slowly; this could mean high engine RPM before clutch engagement. A clutch oil pressure interlock is available to minimize this possibility and is described in Section 7.4.

5.8 FINAL CHECK

- 1) Stop the engine(s).
- 2) Check that all push-pull cable connecting fasteners are tightened securely.
- 3) Operate Control Head lever to Ahead and Astern detents and check clutch lever movement. Operate Control Head lever from Idle to Full-Ahead and check throttle movement.
- 4) Refer to Figure 10, Detail I. In the Actuator(s) check that the push-pull cable Hex Nuts are securely tightened to the Jam Nuts. A loose Hex Nut can back off the push-pull cable threaded end and effectively change the cable length.

6. TESTS

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

Perform the following tests with the vessel moored to the dock:

- 1) Start engine(s) and verify that engine Stop switches (normally, push buttons) function correctly at all stations.
- 2) Idle the engine(s) and place one Control Head lever at a time in the Ahead detent and then the Astern detent. Do this at each station to confirm direction control.
- 3) Use Neutral Fast Idle on each engine at each station, one engine at a time, to confirm speed control.
- 4) Check that all the above tests are made and are correct. Only then is the vessel ready to leave the dock.

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.

- 1) If the engine RPM is low, check whether the engine throttle lever is against the full-speed stop. Other possibilities are that the full-speed stops are set incorrectly or that the propeller load is too great.
- 2) If the engine RPM is high, refer to Figure 9 and turn potentiometer R7 counterclockwise to obtain desired full speed. For twin screw applications, check that matching Idle, Mid-range, and Full-speed Control Head lever positions cause equal RPM in both engines.

6.1.2 Proportional Pause Upon Direction Change

The Proportional Pause feature provides engine deceleration, followed by a delay in throttling to the commanded speed in the new desired direction, upon a Full-Speed Reversal. The throttle position drops to Idle and the transmission remains engaged Ahead; the pause that follows is in proportion to the prior Control Head lever position and how long the lever had been in that position before the reversal. Refer to Timing Chart, Figure 11; to configure the Proportional Pause to meet the vessel's requirements. Factory settings at the time of shipment are 3.5 seconds.



MicroCommander Instructions: 585CE Actuator

| 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 |

Timing Chart
Figure 11

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 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 patterns of Control Head tone:

- 1) Low Repetition Tone is normal when DC power is first applied to the controls. This tone indicates that the controls are in Neutral and Idle and the operator can accept control by depressing a Station Transfer Button. If the operator depresses the Station Transfer Button with the Control Head lever at a position other than Neutral, the MicroCommander Control will command Neutral Fast Idle Mode with a blinking red light. The clutch will remain in Neutral.
- 2) High Repetition Rate Tone signals a jam condition of either the SHIFT or THROTTLE cable. The Actuator has stopped when this tone sounds. Moving the Control Head lever away from the position at which the tone began will usually stop this tone; however, 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 that the cables are moving freely. Check to see that the push-pull set up is adjusted correctly. (See Section 5.4.)
- 3) Steady Tone signals a voltage problem or that a component has failed. Confirm that 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 require service.
- 4) Repetitive Signal - One (1) Long, One (1) Short Tone signals a SHIFT feedback error. See Appendix A - TROUBLESHOOTING.
- 5) Repetitive Signal - One (1) Long, Two (2) Short Tones signals a THROTTLE feedback error. Appendix A - TROUBLESHOOTING.

7. CONTROL OPTIONS

7.1 LOW / HIGH IDLE

The MicroCommander Control offers an option of two Idle RPM settings for the engine. The normal Low 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 5.4) A second, or High, Idle RPM can be set and selected electrically. Pressing the Station Transfer Button will then alternately move the engine Idle setting back and forth between Low Idle and High Idle.

The 585CE Actuator is shipped from the factory with five-station remote control available. When the High Idle option is selected, Station 5 cannot be used.

7.1.1 High Idle Selection

Refer to Figure 9. To select the High Idle option the following adjustments to the circuit board are required:

- 1) Move JMPR 1 from pins 2 and 3 to pins 1 and 2.



MicroCommander Instructions: 585CE Actuator

- 2) Move JMPR 2 from one pin to both pins.

7.1.2 High Idle Setting

Refer to Figure 9. High Idle is set by potentiometer R8; when turned fully counterclockwise, High Idle is minimum, and is the same as Low Idle. R8 is set this way at the factory.

To adjust High Idle, proceed as follows:

- 1) Place the controls in Neutral and Start the engine.
- 2) Depress and hold the Station Transfer Button at the Station-in-Command and move the Control Head lever to the Ahead detent position: the blinking light at the Control Head indicates Neutral Fast Idle Mode.

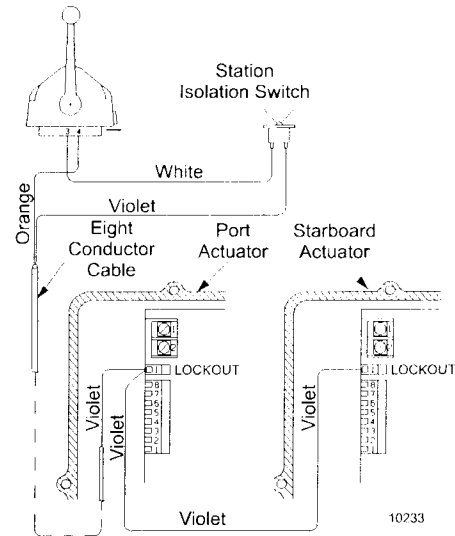
NOTE: Adjust potentiometer R8 for High Idle only with the Control Head lever in the Ahead detent and the indicator light blinking; otherwise you may be trying to adjust High Idle when you are in Low Idle Mode.

- 3) Rotate potentiometer R8 clockwise to obtain the desired High Idle RPM.
- 4) Check your High Idle and Low Idle settings by placing the Control Head lever in Neutral and pressing the Station Transfer Button to alternate between Low and High Idle.
- 5) On a twin-screw vessel, if High and Low Idle are out of sync, place both engines in Ahead Neutral Fast Idle Mode. Both engines will then be in High Idle.

7.2 PRIMARY STATION ISOLATION SWITCH

Primary Station Isolation can be provided by mounting a single-pole single-throw (SPST) switch at Station 1, which is always the Primary Station. When the switch is Closed, control is isolated to this Primary Station and other stations cannot take control. When the switch is Open, all stations can take control by means of their Station Transfer Buttons.

- 1) Use a waterproof, high-quality toggle switch with screw connections.
- 2) Use the spare Violet wire in the eight-conductor cable and a 20 AWG, 300 V, PVC insulated White wire and apply crimped wire terminals.
- 3) Refer to Figure 12 Port side for Single-Screw installations.



**Twin Screw Isolation
Figure 12**

7.3 ALARM CAPABILITY

The MicroCommander 585CE Actuator offers an alarm connection that opens with a control power failure or circuit malfunction.

Refer to Figure 9. The alarm connection point is a single connection block on the Actuator circuit board that is labeled ALARM and is located between R7 and R8.

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 in the alarm condition. Maximum current draw must not exceed 200 milli-amperes.

7.4 CLUTCH OIL PRESSURE INTERLOCK

The purpose of the Clutch Oil Pressure Interlock is to prevent engine acceleration prior to clutch engagement. This is accomplished by blocking a speed signal to the engine until the hydraulic clutch pressure has reached a value recommended by the transmission manufacturer.



MicroCommander Instructions: 585CE Actuator

If, for any reason, the clutch oil pressure should fall below the pressure switch setting while operating, the engine speed will drop to Idle RPM.

The Actuator must be set up to use the High Idle/Low Idle option described in Section 7; this means that the fifth station is not available.

You will need to provide a Normally Closed (NC) pressure switch that is rated for your hydraulic clutch oil pressures and whose trip point is adjustable to match the transmission manufacturer's recommended setting. This pressure switch must be installed so as to be operated by the pressure of both the Ahead and Astern clutches, when either one is activated. Refer to Figure 9 and proceed as follows;

- 1) Move JMPR 1 from pins 2 and 3 to pins 1 and 2.
- 2) Move JMPR 2 from one pin to both pins.
- 3) Connect Station 5 terminals 3 and 4 to the NC pressure switch.

When Terminals 3 and 4 of Station 5 are connected, the engine speed signal is held at Idle. Therefore, the engine speed signal will be held at Idle until the clutch oil pressure opens the pressure switch contacts.

8. MAINTENANCE

8.1 ACTUATOR

The MicroCommander Actuator requires the following annual checks:

- 1) Check all terminal connections for signs of corrosion or loose connections.
- 2) Check mechanical connections within the Actuator, and at the throttle and transmission selector lever.
- 3) Check mechanical movement of the throttle lever from Idle to Full. Ensure that the cable does not jam while positioning the throttle at Idle or Full speed.
- 4) Check mechanical movement of the transmission selector lever from Neutral to Ahead, and Neutral to Astern. Ensure that the cable does not jam while positioning the transmission selector lever at the Ahead or Astern stops.
- 5) Cycle the Actuator and if lead screws are noisy, apply a light coating of silicone grease to the stainless steel lead screw.

8.2 CONTROL HEADS

The Control Heads should be checked annually to insure that 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.





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SYNCHRONIZATION **CANNOT** BE
DISABLED BY DEPRESSING THE
TRANSFER BUTTON ON THIS
MODEL ACTUATOR!



MicroCommander: Synchronization

1. GENERAL INFORMATION

NOTE: *The MicroCommander 585CE Marine Propulsion Control System must be completely installed and thoroughly tested as a system before installing the Synchronization Option. This option may not be compatible with diesel engines using Speed-limiting Governors.*

1.1 OPERATING PRINCIPLES

MicroCommander Synchronization is fully automatic, in that it is not necessary to select synchronization On or Off. When both engines are in Ahead, more than 10 percent above Idle in the speed range, and within 15 percent of equal RPM, the control system will work to synchronize, as is indicated by a blinking green light at the Control Head. The blinking will become steady green within a few seconds, showing that the engines are synchronized.

Moving either Control Head lever beyond the 15 percent window of RPM will deactivate synchronization and turn the green light Off. The control levers are active at all times.

Synchronization Mode may be disabled by depressing the station transfer button for one second while the engines are in Synchronization Mode, the control levers are matched and above 10 percent throttle. Synchronization Mode may be re-enabled by depressing the station transfer button for one second while the control levers are matched in Ahead and above 10 percent throttle.

Synchronization is enabled when the control system has initial power-up.

Either engine could be the Lead engine; however, we have elected to make the Port Engine the Lead engine and the Starboard engine the Follow engine; the drawings, diagrams, and instructions reflect this concept. The remote Control Head(s) controlling the Starboard engine will have the green synchronization light. If you are adding synchronization to an existing system, you may have Control Heads lacking the green light. The system will synchronize without the green light but you will not have the visual indication. (Reference Appendix A - Control Head Options)

1.2 PARTS REQUIRED

| | |
|------------------------------------|--------------------------------|
| Existing 585CE Actuators | Port Auxiliary Board (Lead) |
| Dual Control Heads | Engine RPM Pulse Signal |
| Starboard Auxiliary Board (Follow) | See Appendix A for Parts List. |

2. INSTALLATION

2.1 INSTALLATION

The MicroCommander engine synchronization option may be installed into any twin screw MicroCommander Control System using the Model 585 or 585CE Actuators. The synchronization installation will consist of the following:

- 1) Install an Auxiliary Circuit Board in the Port Actuator.
- 2) Install an Auxiliary Circuit Board in the Starboard Actuator.
- 3) Install Control Heads with the green indicator light option, at the remote stations.

NOTE: *The green indicator light is not required for retrofit applications.*

- 4) Provide a pulse signal representing engine RPM.

2.2 REMOTE CONTROL HEADS

The dual remote control head is equipped with a red indicator light on both the Port and Starboard control halves. An additional green light will be on the Starboard control half only. The Starboard control will be the Follow control, meaning that the Starboard engine RPM will adjust, up or down, to match the



MicroCommander: Synchronization

Port engine RPM. The green light will illuminate as the engines become synchronized. Connect the Violet wire from the Starboard eight-conductor cable to terminal 8 on the Starboard control head terminal block.

2.3 PORT AUXILIARY BOARD (LEAD)

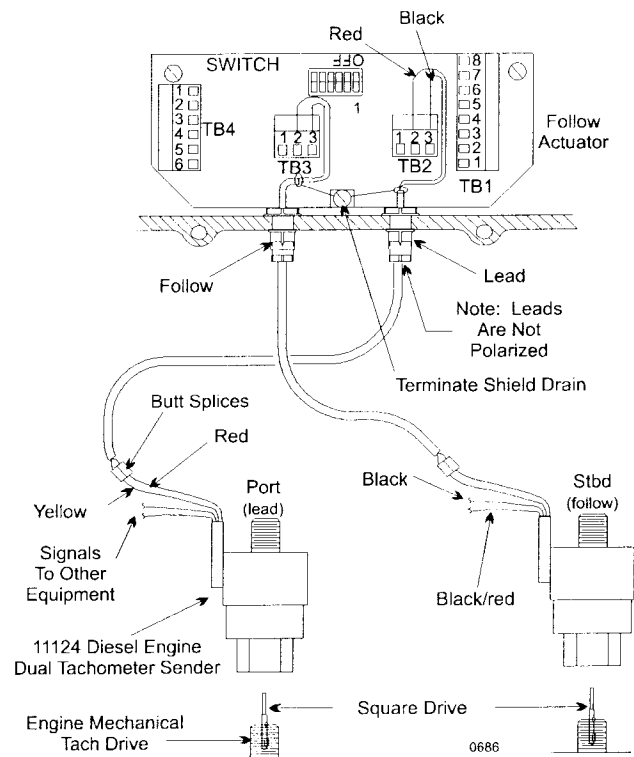
The Lead Auxiliary Board (P/N 1133) will install in the Port Actuator. Plug the board into the socket and secure with the mounting screws supplied.

2.4 STARBOARD AUXILIARY BOARD (FOLLOW)

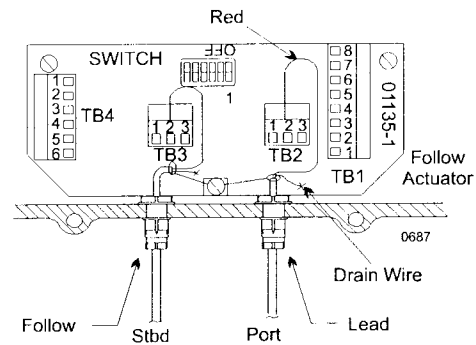
The Follow Auxiliary Board (P/N 1135 for diesel engines, or P/N 1135-1 for gasoline engines) will install in the Starboard Actuator. Plug the board into the socket and secure with the mounting screws supplied.

2.5 CABLE CONNECTIONS

- 1) In the Port and Starboard Actuators, install the 3/4-inch cable grip in an unused entry hole on the right hand side of the Actuator. In the Starboard Actuator, install the two 1/2-inch cable grips in the central entry holes
- 2) Refer to the 585CE Synchronization Drawing in Appendix C. In the Starboard (Follow) Actuator, connect the Violet wire from Station 1, 3, or 5 to Terminal 1, 2, or 3, respectively, of TB4 . Connect the Violet wire from Station 2 or 4 to Terminal 7 or 8, respectively, of TB1.
- 3) Run a length of eight-conductor cable between the Actuators, through the 3/4-inch cable grips . Strip back the PVC cover on each end of the cable approximately 2-1/2-inches (63,5mm). Strip and cut off the shielding flush with the end of the PVC cover. Strip 2/3-inch (9,5mm) insulation off each end of the green wire, lightly tin-tip to prevent stray strands, and connect the green lead to Terminal 6 of TB1 in each Actuator. Connect the solid Drain wire to the Auxiliary Board mounting screw in the Starboard Actuator; do not connect the other end. Do not cut the remaining wires back to the PVC jacket as they may be required for other installations.
- 4) Refer to Figure 1. The 1135 Starboard Auxiliary Board requires an electric pulse input in proportion to RPM from each Diesel engine. This electric pulse can come from a



Diesel Engine Signal Input
Figure 1



Gasoline Engine Signal Input
Figure 2



MicroCommander: Synchronization

tachometer pulse generator driven by the engine mechanical tachometer drive, a magnetic pickup mounted in proximity to the flywheel ring gear, or from an alternator's stator AC terminal.

- 5) Refer to Figure 2. The 1135-1 Starboard Auxiliary Board requires gasoline engine speed signal taken from the point side of the coil.
- 6) Verify the Tachometer Signal with a volt meter. Check across terminals 2 and 3 of TB2, and terminals 2 and 3 of TB3. The output voltage should be approximately 3 VAC, increasing with RPM.
- 7) Verify that Synchronization occurs automatically when both Control Head levers are Ahead, above 10 percent of speed range, and within 15 percent of equal RPM. To check synchronization operation moored to the dock on diesel engines only (gasoline engines can only be checked when under load); disconnect the SHIFT push-pull cables at the transmission and place shift levers in Neutral. Start the engines and move the controls ahead beyond shift to approximately 1500 RPM. The green light should blink and the engines should synchronize; if they do not, perform the Operation Checks listed below.

2.6 Operation Checks

- 1) Check wiring connections; refer to Figures 1, 2, and System Drawing in Appendix C.
- 2) Check that the connection for electric pulse at Starboard Actuator are Port engine (Lead) and Starboard engine (Follow).
- 3) Check for 3.0 AC volts or greater between Terminals 2 and 3 on TB2 and TB3, Auxiliary Board 1135 or 1135-1 when the engines are idling.





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MicroCommander: Trolling Valve Control

1. GENERAL INFORMATION

NOTE: *The MicroCommander 585CE Engine Control System must be completely installed and thoroughly tested as a system before installing the Trolling Valve Control.*

1.1 PURPOSE OF A TROLLING VALVE

A Trolling valve is an optional addition to most modern reverse reduction gears. The Trolling Valve may be ordered with the reduction gear or added at a later date. The Trolling Valve Control System is designed such that the operator cannot mishandle the controls to damage the transmission.

The Trolling Valve is designed to modulate clutch oil pressure to the Ahead or Astern clutch plates, allowing the clutch to slip creating a reduced propeller shaft RPM at Idle engine RPM. In most applications the engine RPM must be limited to 1000 RPM or less. Consult the reduction gear dealer for specific engine RPM limitations.

The MicroCommander Control System integrates the functions of Ahead and Astern clutch selection, Main Engine Speed, and Trolling Valve modulation with the movement of a single control lever.

The MicroCommander Trolling Valve System consists of a single Model 813CE Actuator for single or twin screw applications. The 813CE Actuator interfaces directly with the Port and Starboard Model 585CE Actuators. The 813CE Actuator has dual mechanical outputs and is linked via push-pull cable with the Trolling Valve lever on the reverse reduction gear.

1.2 GENERAL REQUIREMENTS

- 1) A new or existing MicroCommander 585CE Engine Control System.
- 2) Trolling Valve lever load should not exceed 40 pounds (18kg).
- 3) Trolling Valve Actuator requires a reliable battery source of 12 to 32 volts DC.

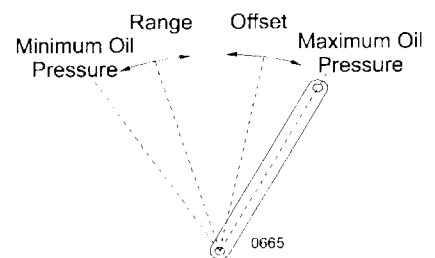
A propeller shaft tachometer is recommended for Trolling Valve applications.

1.3 TROLLING VALVE OPERATION

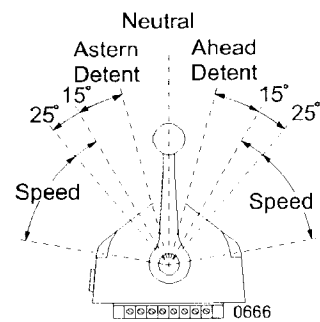
A mode selector switch at the primary remote control station will select Troll or Non-Troll.

During Non-Troll operations the MicroCommander Control System operates as a standard single lever control of vessel speed and direction. The Trolling Valve servo will be at the maximum oil pressure position.

During Troll operations the Trolling Valve is integrated with the clutch and speed control. Movement of the control head lever to the Ahead or Astern detent will command Ahead or Astern from the 585CE Actuator. The 813CE Trolling Valve Actuator will command low oil pressure and the propeller will begin turning at minimum shaft RPM. Further movement of the control lever to 15 degrees or 25 degrees beyond the detent will increase propeller shaft RPM while maintaining Idle engine RPM. As the control lever is moved beyond 15 degrees or 25 degrees, the Trolling Valve will be positioned to maximum oil pressure and the engine RPM will increase from Idle to a speed based on control lever position. Moving the control head lever back to Neutral will reverse the sequence. Operation in Astern is the same as Ahead.



**Trolling Valve Lever
Figure 1**



**Trolling Valve
Operation
Figure 2**



MicroCommander: Trolling Valve Control

2. PARTS REQUIRED

2.1 AVAILABLE FROM YOUR MICROCOMMANDER DEALER

| | |
|------------------------------|--------------------------------|
| Trolling Valve Actuator | Eight-Conductor Shielded Cable |
| Auxiliary Board Kit (Lead) | Two-Conductor Power Cable |
| Auxiliary Board Kit (Follow) | See Appendix A for Parts List. |

2.2 AVAILABLE FROM INSTALLER

PUSH-PULL CABLES

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

PUSH-PULL CABLE CONNECTION KIT

Kit may be available from the transmission manufacturer. A Universal Mounting Kit, is shown in Appendix B - Universal Mounting.

CONTROL SYSTEM POWER ON/OFF

Use the same type of circuit breaker and relay as used on the 585CE Actuators (See Appendix B - References). Power can be turned On by a separate switch.

3. PLAN THE INSTALLATION

3.1 TROLLING VALVE ACTUATOR LOCATION

- 1) The Trolling Valve Actuator is spray-proof, but it must not be immersed.
- 2) Locate and mount the Trolling Valve Actuator in the area of the engine: bulkhead mounting is preferred, for ease of access for wiring and adjustments, but it can be mounted in any attitude.
- 3) Do not mount to the engine, to the transmission, or in any location that will subject it to excessive vibration.
- 4) Locate the Actuator away from heat sources, such as engine exhaust, manifolds. Allow four feet (1,2m) of clearance, or more, between the Actuator and such heat sources.
- 5) Locate the Actuator such that the push-pull cable(s) from it to the Trolling Valve(s) have large radius bends, with the least total degrees of bend and moderate length. EXAMPLE: Minimum bend radius 10-inches (254mm); total degrees of bends less than 270 degrees; total length not to exceed 20 feet (6m).
- 6) Power source and Actuator must be bonded (connected) to the hull in metal-hulled vessels or to the bonding bus in non-metal vessels. (See Appendix A - Bonding)

3.2 DC POWER SOURCE

The 14-gauge twisted-pair Power Cable should not exceed 20 feet (6m) length, to minimize voltage drop. If individual wires are used for supply (+) and return (—); the total wire length should not exceed 40 feet (12m).

Wire from the battery to the circuit breaker panel must be large enough to keep voltage drop due to current flow to less than three percent. The DC return to the battery must be large enough to supply all current requirements with a voltage drop of less than one percent.



MicroCommander: Trolling Valve Control

4. INSTALLATION

4.1 AUXILIARY BOARDS

Install the Auxiliary Boards in the 585CE Actuators, see MicroCommander with Trolling Valve System Drawing in Appendix C for detail. The Auxiliary Boards provide for both Synchronization and Trolling Valve Control.

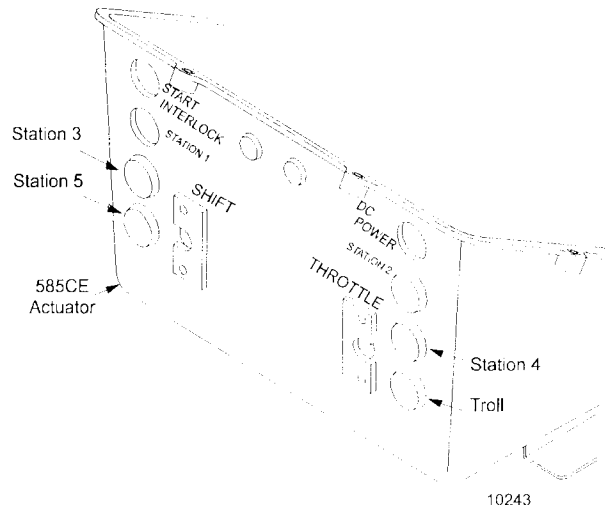
- 1) Auxiliary Board P/N 1133 - At the Port (Lead) or Single Screw 585CE Actuator, plug the Auxiliary Board into the socket and secure with the mounting screws supplied. Install the 3/4-inch cable grip for the eight-conductor cable in the TROLL entry hole. See Figure 3.
- 2) Auxiliary Board P/N 1135 (for diesel engines) or P/N 1135-1 (for gas engines) - at the Starboard (Follow) 585CE Actuator, plug the Auxiliary Board into the plug connector and secure with the mounting screws supplied. Install the 3/4-inch cable grip for the eight-conductor cable in the TROLL entry hole. See Figure 3.
- 3) In the 813CE Troll Actuator, install cable grips for two eight-conductor cables, the two-conductor POWER cable, and the two-conductor switch cable, if used. See Figure 4.
- 4) Run lengths of eight-conductor cable between the 585CE Actuators and the Troll Actuator, via the 3/4-inch cable grips. Strip back the PVC cover on each end of the cables approximately 2-1/2-inches (63,5mm). Strip and cut off the shielding flush with the end of the PVC cover. Strip 2/3-inch (9,5mm) insulation off each end of the wires, and connect as shown in Trolling Valve System Drawing - Appendix C.

Connect the green wire to Terminal 6 of TB1 in the Port and Starboard 585CE Actuators if the Synchronization option is present, or is being installed. If the green wires are unused, do not cut back to the PVC jacket, as they may be required for other applications.

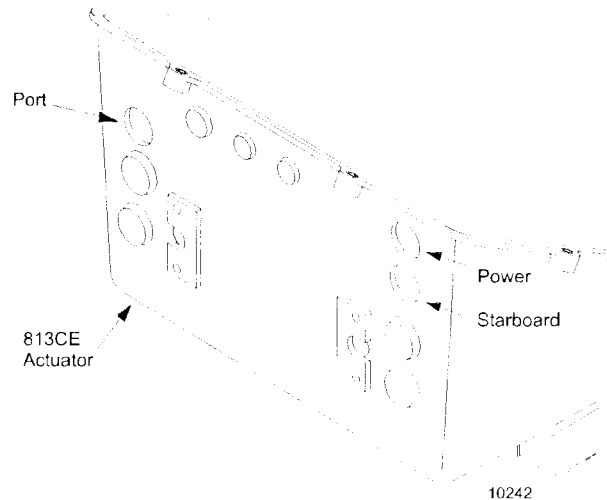
- 5) In the Trolling Valve Actuator only, connect the bare Drain wires to Terminal 8 of the PORT and STARBOARD terminal blocks, respectively. Do not connect the other ends of the Drain wires.
- 6) If the Remote Switch is not used, install a jumper between TB5 terminals 3 and 4 in the Trolling Valve Actuator.

4.2 ACTUATOR PUSH-PULL CABLE CONNECTIONS

- 1) Refer to Figure 5. Remove the #10-32 Jam Nut and the two Rubber Seals only from the end of each push-pull cable that is to connect to the Trolling Valve Actuator; discard the seals.



585CE Actuator Entry
Figure 3

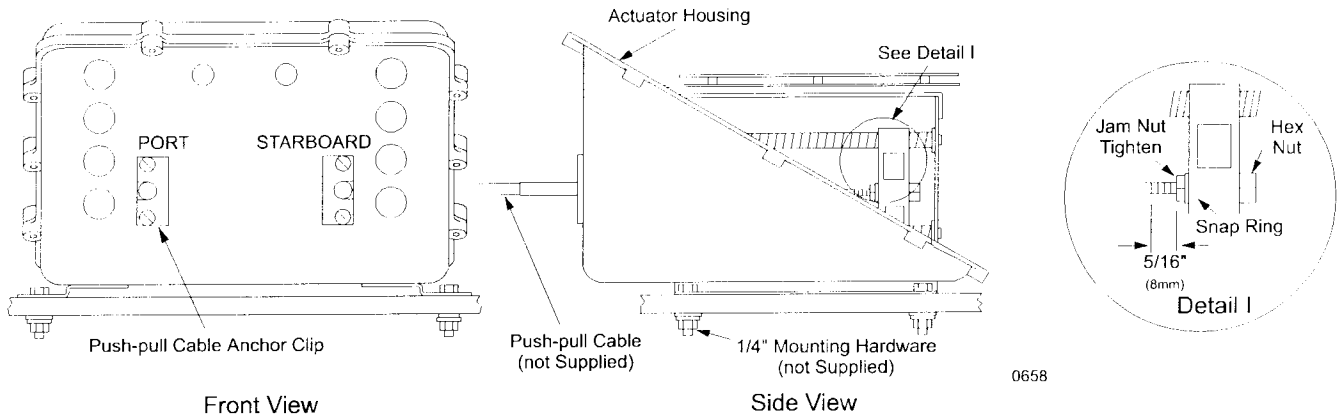


813CE Actuator Entry
Figure 4



MicroCommander: Trolling Valve Control

- 2) Remove one Cable Anchor Clip screw from each Cable Anchor Clip and swing the two Cable Anchor Clips clear.
- 3) Insert the Port cable and Starboard cable according to the labels on the Actuator. See Figure 4.
- 4) Reinstall the #10-32 Jam Nuts, placing them on the cable rod ends such that there is approximately 5/16-inch (8mm) of thread showing behind each Jam Nut, as shown in Figure 5, Detail I.
- 5) Insert the cable rod ends in the respective Hexagonal Nuts and use a 7/16-inch socket wrench and a 5/16-inch open end wrench to tighten the Jam Nuts.
- 6) Align the push-pull cable sleeve ferrules such that the Cable Anchor Clips will engage the peripheral grooves, then position the Cable Anchor Clips to secure the cables to the Actuator housing. Install the screws removed in Step 2).



Trolling Valve Actuator Push-Pull Cable Connections
Figure 5

4.3 ENGINE PUSH-PULL CABLE CONNECTIONS

- 1) Check whether push-pull cable anchor brackets are installed on the trolling valve. If the brackets are not provided, select from Appendix B - Morse Standard Kits, or fabricate brackets as shown in Appendix B - Universal Mounting.
- 2) Use the Jam Nuts supplied with the cables to secure the cable rod ends in the Ball Joints.
- 3) Do not remove the two Rubber Seals from the cable.

5. ADJUSTMENTS

5.1 GENERAL

Do not connect push-pull cable(s) at the trolling valve lever(s). Set DIP Switch 6 on the 585CE Auxiliary Boards to On to enable Troll Mode.

Apply DC power to the controls, 585CE Actuator(s), and the 813CE Trolling Valve Actuator. Place the Control Head lever(s) in the Neutral detent, then press the transfer button to acknowledge control at the remote station. Make sure the Troll Mode switch is in Troll, or that a Jumper is between TB5-3 and TB5-4 in the Trolling Valve Actuator (see Trolling Valve System Drawing - Appendix C). The Trolling Valve Actuator will now be at maximum oil pressure position, as shown in Figure 1

5.2 TROLLING VALVE CONTROL

You can select whether 15 degrees or 25 degrees of Control Head lever movement is dedicated to the control of the Trolling Valve. This is measured from the Ahead or Astern detent and will control clutch oil



MicroCommander: Trolling Valve Control

pressure. (see Figure 2) Through this range, there will be no speed increase. At the end of the 15 degrees or 25 degrees of Control Head lever movement, the Trolling Valve will move to maximum clutch pressure and speed will begin to increase, reaching full speed at maximum lever position.

The DIP Switch on the 585CE Auxiliary Boards sets the Trolling Valve degrees of control.

| | | |
|----------|-----|------------|
| Switch 2 | OFF | 15 degrees |
| | ON | 25 degrees |

The switches on both 585CE Auxiliary Boards must be set the same for twin screw applications.

5.3 PUSH-PULL CABLE DIRECTION

Move the MicroCommander Control Head lever to the Neutral detent position. The Trolling Valve Actuator will extend, or retract, the push-pull cable to the default Trolling Valve maximum pressure position. If this position is correct, leave it; if it is reversed, change it by using the Jumper on JMPR 3 to change Starboard Push-Pull Cable orientation, and the Jumper on JMPR 4 to change Port Push-Pull Cable orientation. See Trolling Valve System Drawing - Appendix C.

| | | |
|--------|-----|--------------------------------|
| Jumper | ON | Cable Push to maximum pressure |
| | OFF | Cable Pull to maximum pressure |

Next, mechanically adjust the push-pull cable to connect to the trolling valve lever in the maximum pressure position.

5.4 ADJUSTMENT: RANGE AND OFFSET

The next step is to adjust the Range (low oil pressure) and Offset (high oil pressure). Reference Figure 1. The goal is to adjust the Range such that in the Ahead or Astern detent position, the propeller is turning at the slowest controllable speed. This should correspond to 30 - 50 percent of the normal shaft RPM. Offset should then be adjusted to give 70 percent of normal shaft RPM.

The shaft RPM with the clutches slipping will vary with the temperature of the clutch oil, and therefore, it is important to warm-up the engines and transmission oil before these adjustments are attempted. This may require an hour or more.

The vessel should be moored securely to the dock with only one engine at a time running. The Control Head lever for the running engine can be placed in the Ahead detent.

Dip switches 1 and 2 on SW1 on the 813CE Trolling Valve Actuator provide for setting-up the Trolling Valve Actuator. Adjust Range first, then adjust Offset. Refer to Trolling Valve System Drawing - Appendix C.

NOTE: To adjust the Range and Offset position accurately, a hand held tachometer is required.

5.4.1 Range

Place SW1-1 in the On position: SW1-2 must be Off. Use Potentiometer R7 to adjust Port Range and Potentiometer R8 to adjust Starboard Range. Adjust lightly so as not to damage the Potentiometer stops. Adjust Range for a shaft RPM that is 30 - 50 percent of normal. Once set, place SW1-1 in the Off position.

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

5.4.2 Offset

Place SW1-2 in the On position: SW1-1 must be OFF. Use Potentiometer R10 to adjust Port Offset and Potentiometer R9 to adjust Starboard Offset. Adjust for a shaft RPM that is 70 percent of normal, you



MicroCommander: Trolling Valve Control

are looking for the point at which the clutch is still slipping. Once set, place SW1-2 in the Off position. You are now set.

NOTE: *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.*

6. TROUBLE SHOOTING

There is an error tone-over-tone at all control stations to warn of a problem with the Trolling Valve Actuator. This tone would sound for any of the following reasons:

- 1) Trolling Valve Actuator power has not been turned On
- 2) For any reason the Actuator cannot get to maximum oil pressure. 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 error tone may be stopped by turning DIP switch SW1-6 on the 585CE Auxiliary Boards to the Off position. The push-pull cable must be disconnected from the trolling valve lever on the transmission, and the trolling valve lever must be placed manually in the maximum oil pressure position.

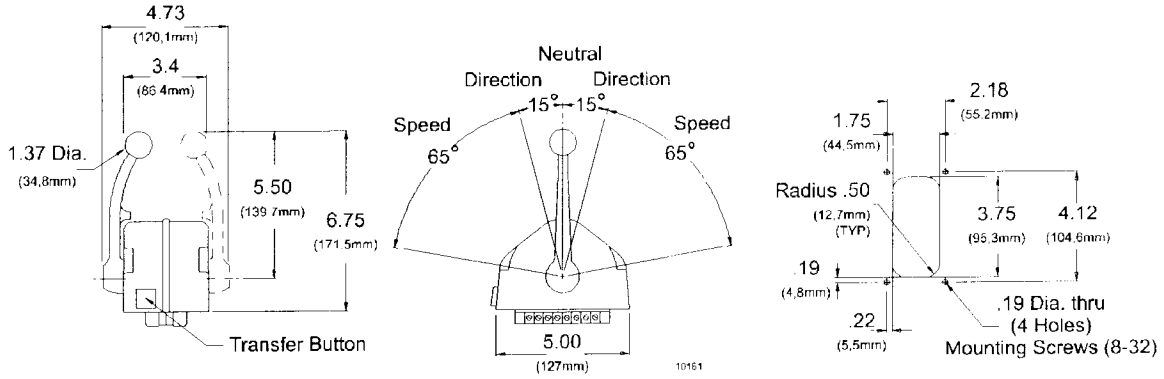
MicroCommander - Appendix A

PARTS LIST

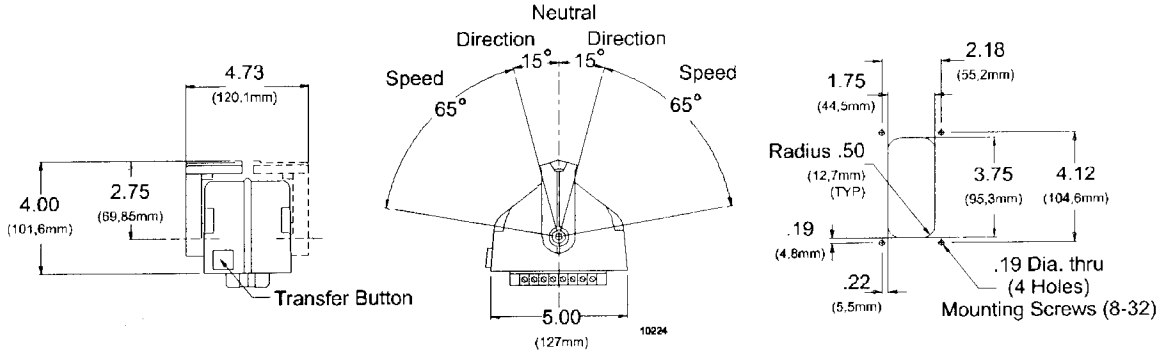
| <u>PART NO.</u> | <u>DESCRIPTION</u> | |
|---------------------------------|---|------------------------|
| <u>ACTUATORS</u> | | |
| 585CE | Actuator (Shift & Speed) | Multivoltage |
| 813CE | Trolling Valve Actuator | Multivoltage |
| <u>CONTROL HEADS</u> | | |
| SINGLE SCREW | | |
| 450-3L | Single Left Hand Standard (Black) 'T' Handle | |
| 450-3R | Single Right Hand Standard (Black) 'T' Handle | |
| 453-3L | Single Left Hand (Black) Chrome Knob Handle | |
| 453-3R | Single Right Hand (Black) Chrome Knob Handle | |
| 455-3L | Single Left Hand (Black) Chrome Low Profile Handle | |
| 455-3R | Single Right Hand (Black) Chrome Low Profile Handle | |
| TWIN SCREW | | |
| 460-3 | Dual Standard (Black) 'T' Handle | |
| 460-4 | Dual Standard (Black) 'T' Handle with Synchronization | |
| 463-3 | Dual (Black) Chrome Knob Handle | |
| 463-4 | Dual (Black) Chrome Knob Handle with Synchronization | |
| 465-3 | Dual (Black) Chrome Low Profile Handle | |
| 465-4 | Dual (Black) Chrome Low Profile Handle with Synchronization | |
| <u>CABLE (Electric)</u> | | |
| 180 | 8-Cond. Shielded Cable | Per/ft |
| 350 | 8-Cond. Shielded Cable | 500' Spool |
| 212 | 2-Cond. Power Cable | Per/ft |
| 349 | 2-Cond. Power Cable | 250' Spool |
| 183 | 2-Cond. Start Interlock Cable | Per/ft |
| 355 | 2-Cond. Start Interlock Cable | 250' Spool |
| <u>AUXILIARY CIRCUIT BOARDS</u> | | |
| 1133 | Auxiliary Board (Lead) | Sync. |
| 1135 | Auxiliary Board (Follow) | Sync. - Diesel Engines |
| 1135-1 | Auxiliary Board (Follow) | Sync. - Gas Engines |
| <u>SYNCHRONIZATION</u> | | |
| 11124 | Tachometer Sender Signal (Dual) | |
| 2241 | Tach Wire Shielded | |

MicroCommander - Appendix A

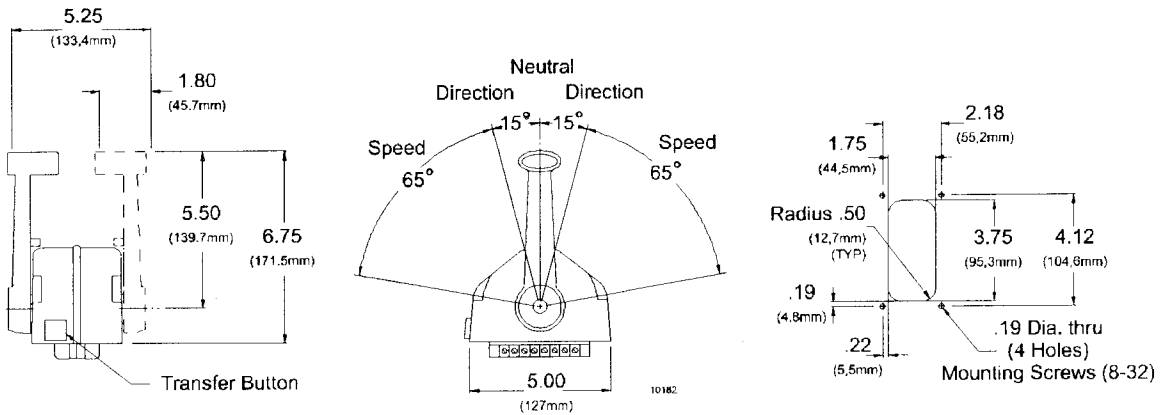
CONTROL HEAD DIMENSIONS AND VARIATIONS



Control Head with Chrome Knob Lever

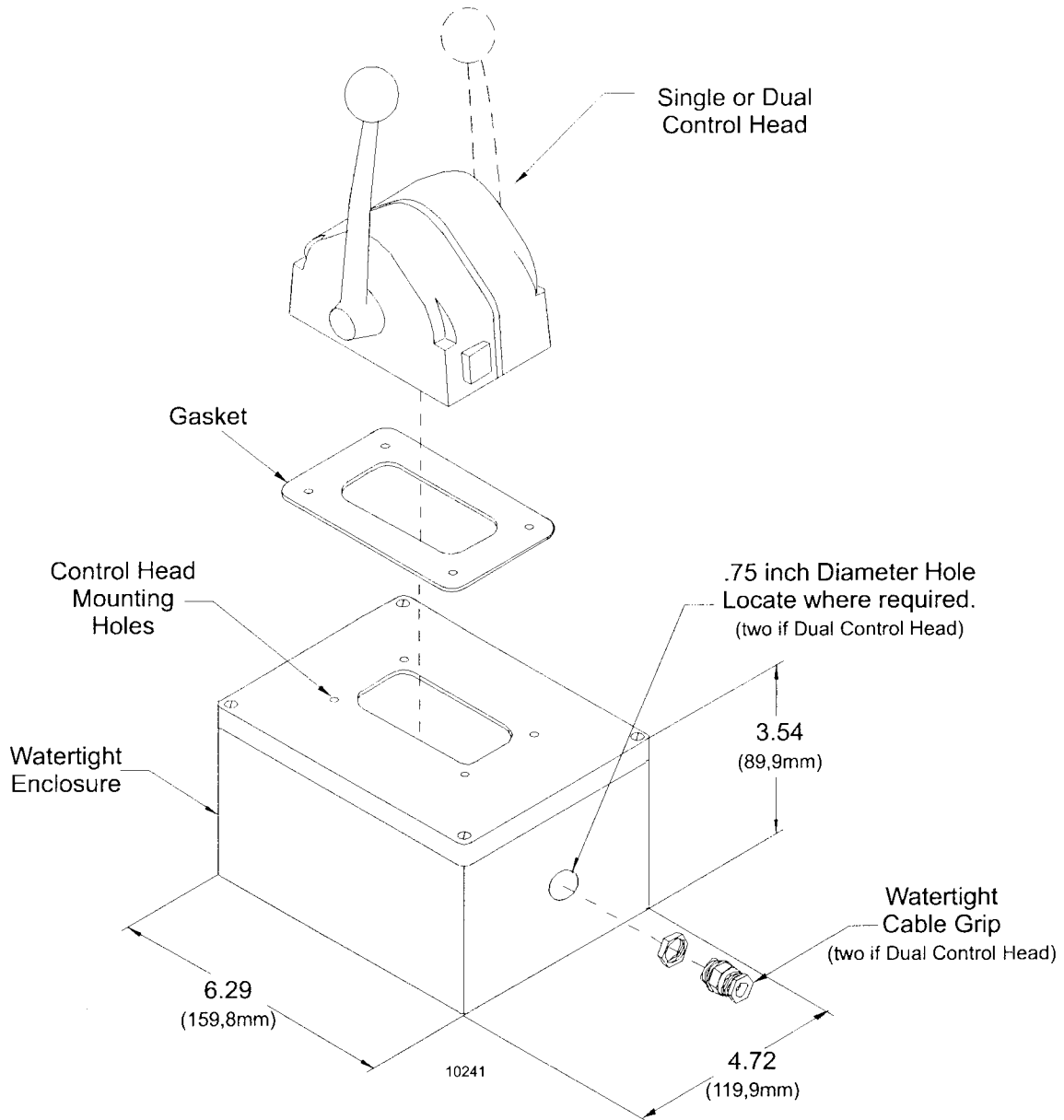


Control Head with Chrome Low Profile Lever



Control Head with Standard 'T' Handle

WATERTIGHT ENCLOSURE



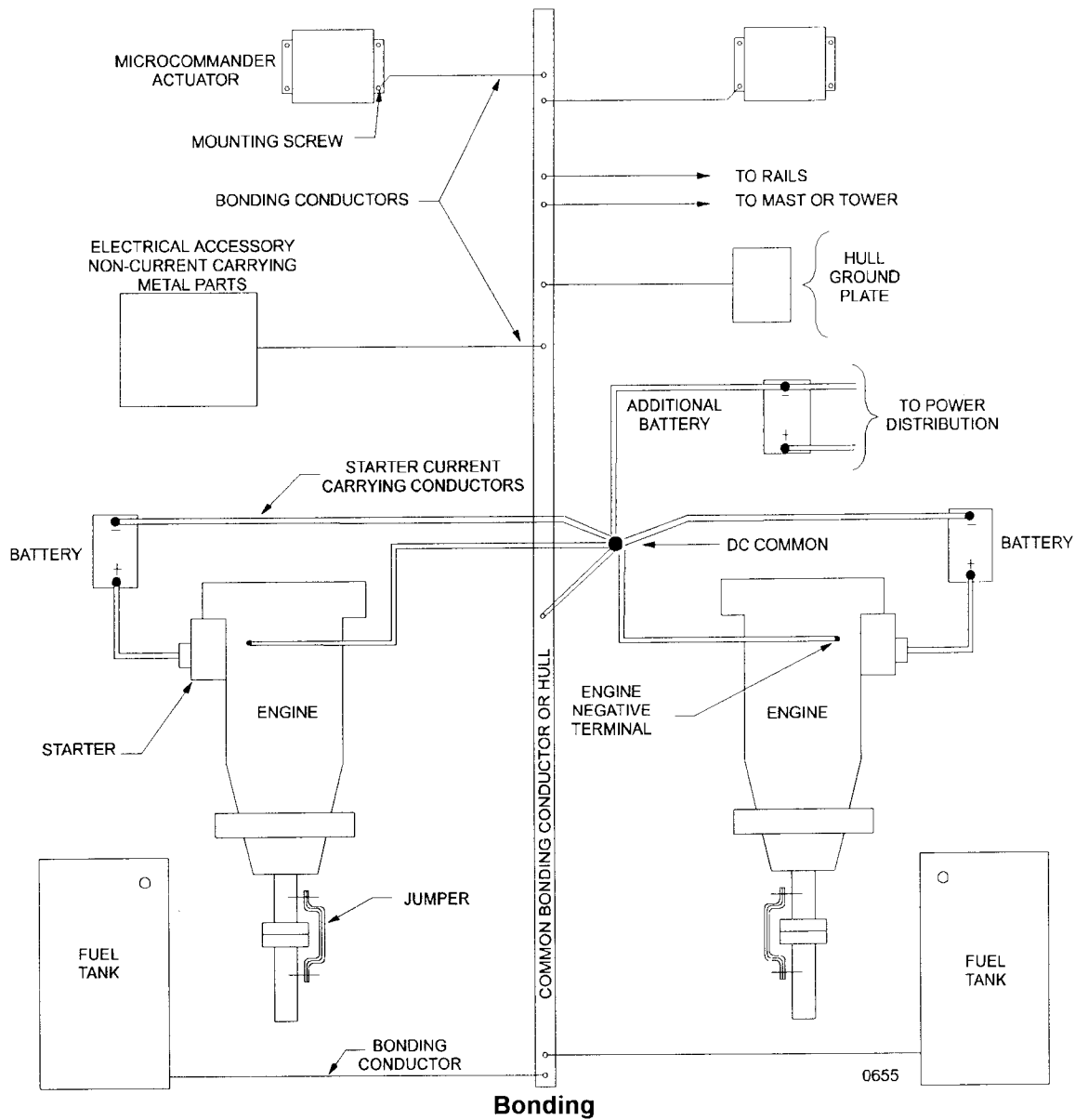
- Deck Mount or Exposed Mount
- Ideal for outside Weather Mount
- To prevent internal condensation and moisture build up the mount is drilled to allow air circulation.
- Part No. 12110

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

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

Metal - Hull Vessels

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



TROUBLESHOOTING

GENERAL

The MicroCommander Control System consists of one to five Control Heads located at the vessel's remote control stations, connected to Actuators located in the engine room area. The Actuators may be configured for main engine speed, and transmission direction only, or configured for automatic engine synchronization and trolling valve control.

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

Carefully inspect the following:

- DC Power Supply
- Component Location
- Component Condition
- Interconnecting Wiring
- Wire Termination's
- Mechanical Connections at the Throttle and Transmission
- Pulse Signal (Synchronization Applications)
- Mechanical Connections at the Trolling Valve

A key in troubleshooting the MicroCommander Control System is identifying the problem as:

- DC Power Supply
- Interconnection wiring or termination
- Mechanical Interface
- Component Calibration
- Component Failure

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

When contacting an authorized MicroCommander servicing dealer, or Mathers Controls Service Department, please be ready with the Actuator Part Number and Serial Number.

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

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

MicroCommander - Appendix A

1. **SYMPTOM** Cannot acknowledge control at one station (both Port and Starboard for twin screw) when the system is first turned On.
- | <u>CAUSE</u> | <u>REMEDY</u> |
|---|--|
| a) A bad electrical connection. | 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) Incorrectly wired eight-conductor cable. | b) Check wire termination's at both the Control Head and the Actuator for correct terminal connections. Refer to Drawings in Appendix C. |
| c) Station Isolation Switch selecting Primary Station only. | c) Change Station Isolation Switch to Normal. |
2. **SYMPTOM** On a Twin Screw Application, one Control Head lever of a Dual Control Head will accept control while the other will not initialize.
- | <u>CAUSE</u> | <u>REMEDY</u> |
|---|--|
| a) During initial power up, the MicroCommander Control System has initialized, although you are unable to acknowledge control, the low repetition tone is present and the red light is out. | |
| A1. Incorrect or poor wire connections at the Control Head or Actuator. | A1. Check wire termination's at the Control Head and the Actuator. Refer to Drawings in Appendix C. |
| A2. Faulty Control Head | A2. Replace Control Head or rebuild with Overhaul Kit (P/N 01154). |
| b) Port and Starboard power sources do not have a common ground (only the starboard would be unable to acknowledge control) | b) The negative terminals of both batteries must be connected to a common point. If not, connect both to a common point. |
| c) Incorrectly wired eight-conductor cable. | c) Wire the cable connections as shown in Appendix C. |
| d) Defective Control Head potentiometer. | d) 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 |

MicroCommander - Appendix A

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 percent 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 (P/N 01564).

3. **SYMPTOM** The red light blinks when the Station Transfer Button is depressed, and continues to blink after it is released (Control Head lever is in Neutral/Idle position). Cannot transfer to this station if another station was previously in control.

CAUSE

REMEDY

- | | |
|--|---|
| a) The Control Head potentiometer is not centered. | a) Replace the Control Head or install a Control Head Repair Kit (P/N 01564). |
|--|---|

4. **SYMPTOM** The engine RPM varies, without moving the Control Head lever (synchronization disabled).

CAUSE

REMEDY

- | | |
|---|---|
| a) Problem with the governor or carburetor. | 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) Erratic command signal. | 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 (P/N 01564) |

5. **SYMPTOM** The engine RPM drops to Idle, transmission to Neutral, the Control Head red light turns Off, and a slow repetitive tone is heard at all stations after repositioning the Control Head lever.

CAUSE

REMEDY

- | | |
|--|--|
| a) A drop in battery voltage (12 volt systems only) at the Actuator. | 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 Actuator BATT+ and BATT- terminals; this reading should be no less than 0.20 volt below the measured battery voltage. |
|--|--|

MicroCommander - Appendix A

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 left-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.
- If any changes to the wiring are necessary, the shunt at JMPR 4 may need to be changed to the opposite two pins.
- Check all Stations for Ahead and Astern operation.

9. SYMPTOM Steady tone is heard from all control stations. Cannot gain control at any stations.

CAUSE

REMEDY

- | | |
|--|--|
| a) Low battery voltage at the Actuator. | a) Check the battery voltage at the Actuator. If the measurement is less than eight volts, the battery needs to be replaced or the source of the voltage drop needs to be corrected. |
| b) Component failure on the circuit board. | b) If the voltage tested good, the circuit board needs to be repaired or replaced with Circuit Board (P/N 11983). The Actuator may require service by an authorized MicroCommander servicing dealer or Mathers Controls. |

10. SYMPTOM No tones or lights at the Control Head, and no LEDs lit on the circuit board.

CAUSE

REMEDY

- | | |
|---|--|
| a) No power to the Actuator. | a) Check the power source to the Actuator. |
| b) Polarity of the battery voltage reversed. | b) Connect the red/purple wire to the Actuator terminal labeled BATT+ and the black wire to the terminal labeled BATT-. |
| c) Fuse (Part No. GDC-1A) on the circuit board blown. | 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 |

MicroCommander - Appendix A

circuit board needs to be serviced or replaced with a Circuit Board Kit (P/N 01154).

11. SYMPTOM *Rapid tone at all control stations.*

| CAUSE | REMEDY |
|---|--|
| a) Incorrectly adjusted push-pull cable. | 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 cable set up procedure in Section 4.12. |
| b) Defective push-pull cable. | b) One-by-one, remove the push-pull cables from the Actuator and operate the controls. If the rapid tone is no longer present, replace the defective push-pull cable. |
| c) Low battery voltage at the Actuator (12 volt systems). | 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) Defective servo unit in the Actuator. | d) If a), b), and c) tested good, the entire Actuator needs to be repaired or replaced. |

12. SYMPTOM *The engine starts to turn over while starting, and then stops. A slow repetitive tone is heard from all stations.*

| CAUSE | REMEDY |
|--|---|
| a) The voltage to the Actuator has dropped too low, due to the starter's current requirements. | a) Supply power to the Actuator from a battery other than the starting battery. |
| b) Battery charge is low. | b) Recharge or replace the battery. |

13. SYMPTOM *The engine starter will not engage.*

| CAUSE | REMEDY |
|--|--|
| a) The controls are not turned On. | a) Turn power On to the control system. |
| b) The controls are not at the Neutral position. | b) Place the Control Head lever in the Neutral position and depress the Station Transfer Button. |
| c) Low battery voltage. | c) Check the battery voltage. If the voltage is low, charge or replace the battery. |

MicroCommander - Appendix A

- d) Faulty start interlock circuit in the Actuator.
- d) Temporarily connect the two start interlock wires (yellow with red stripe) at the Actuator to the same START INTERLOCK terminal. If the engine can now be started, the Actuator needs to be serviced.

14. **SYMPTOM** **One long, two short tones from all control stations.**

CAUSE

- a) Throttle feedback error.

REMEDY

- a) Depress the Station Transfer Button twice. The Actuator will need to be serviced at the first opportunity.

MicroCommander - Appendix A

Mathers Controls Inc. Three Year Limited Warranty

Applies to Actuators with Serial Numbers 25000 and higher.

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

1. COVERAGE UNDER WARRANTY

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

1.1 YEAR ONE

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

1.2 YEAR TWO AND THREE

No charge for equipment repair, parts and labor. No allowance for troubleshooting and replacement of defective equipment.

2. NO COVERAGE UNDER WARRANTY

The following will not be covered under warranty.

- 2.1 Travel to and from the job site.
- 2.2 Adjustment or calibration of any Mathers equipment.
- 2.3 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.
- 2.4 Damage due to accidents, improper installation or handling and or improper storage.
- 2.5 Damage due to faulty repairs performed by an unauthorized service representative.
- 2.6 Damage due to conditions, modifications or installation contrary to published specifications or recommendations.
- 2.7 Original installation charges or start-up costs.
- 2.8 Battery service including labor charges related to battery service.
- 2.9 Rental of equipment during performance of warranty repairs.
- 2.10 Unauthorized repair shop labor, without prior approval from Mathers Service Department.
- 2.11 Shop supplies such as connectors, wire, cable, etc.

3. WARRANTY SERVICE

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

- 3.1 Prior to returning any product to the factory, you must contact 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.
- 3.2 If there is a defect covered by warranty, Mathers will, at its option, either repair or replace the defective part or product. If after inspection, Mathers determines that the product is not defective, it will return the product to the sender, freight collect.
- 3.3 Repair or replacement during the warranty period will not extend the warranty period.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, MATHERS HEREBY DISCLAIMS ALL OTHER IMPLIED OR EXPRESS WARRANTIES OF ANY KIND, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. UNDER NO CIRCUMSTANCES SHALL MATHERS BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES SUSTAINED IN CONNECTION WITH THE PRODUCT OR ITS USE, INCLUDING ANY COSTS OR DAMAGES WHICH RESULT FROM LOSS OF USE OF THE PRODUCT OR ANY ENGINE OR BOAT WITH WHICH IT IS USED. MATHERS DOES NOT AUTHORIZE ANY REPRESENTATIVE OR AGENT TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY OTHER THAN THOSE EXPRESSLY SET FORTH ABOVE. Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. All implied warranties, if any, are limited to the duration of this express warranty. This warranty gives you legal rights, and you may have other rights which may vary from State to State.

MicroCommander - Appendix A

**MICROCOMMANDER
WARRANTY REGISTRATION**

Actuator, Serial # _____ Serial # _____

Number of Control Stations _____

Purchase Date _____

Dealer's Name _____

Installer's Name _____

Phone Number () _____

Purchaser's Name _____

Street Address _____

City, State, Zip _____

Phone Number () _____

YOUR VESSEL:

Engine, Make & Model _____

Length _____

Manufacturer _____

Mathers Controls Inc. Product First Seen At:

- Boat Show Dealer Magazine Friend

MicroCommander - Appendix A



Mathers Controls Inc.

675 Pease Road

Burlington, WA 98233-3101

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MicroCommander - Appendix B

REFERENCES

- 1) American Boat & Yacht Council (ABYC)
Box 806
Amityville, NY 11701

E-1 Bonding of Direct Current Systems
E-3 Wiring Identification on Boats
E-9 DC Electrical Systems on Boats
H-2.4e or 32.4g
Ambient Temp. 50 degrees C
- 2) Code of Federal Regulations
33 CFR 183 Subpart I - Electrical Systems
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 & Protection:
General

46 CFR 111.01 - 15(b) Ambient Temp.
Machinery Spaces 50 degrees C
111.05 - System Grounds
- 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
- 4) National Marine Manufacturers Association
401 North Michigan Avenue
Chicago, IL 60611
- 5) Underwriters Laboratories

PARTS SOURCE

| | |
|--|------------------|
| Anti-Static Wrist Strap - Thomas & Betts (P/N AWCC) | Part Number 517 |
| Circuit Breaker - E-T-A Manufacturer (P/N41-2-514-LN2-10) UL Approved | Part Number 810 |
| Fuse - Bussman (P/N GDC-1A) | Part Number 1030 |
| Wago Tool - Wago (P/N 236-332) | Part Number 397 |
| Relay 12 VDC - Potter-Brumfield (P/N KRPA5D6-12) | Part Number 1114 |
| Relay 24 VDC - Potter-Brumfield (P/N KRPA5D6-24) | Part Number 1122 |

MicroCommander - Appendix B

MORSE CLUTCH AND THROTTLE KIT SELECTION

PRE-ENGINEERED THROTTLE CONNECTION KITS

| MAKE | ENGINE MODEL | KIT NO. |
|-------------------|---|---------|
| Caterpillar | 3208NA | 300172 |
| | 3208TA | 305403 |
| | 334, 3304, 3306 | 36680 |
| | 3406 & 343 | 36680 |
| | 3408 | 36680 |
| Cummins | A11 w/MVSGOV AFC Fuel Pump | 36680 |
| | V504M, V555M, V903M, VT903M, VTA903M, NT855M, VT1710M, VTA1710M, KT & KTA 1150M, KT & KTA 2300M, 1975 and later | 300580 |
| 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 12, 16V-149 | 36680 |
| Perkins | 4, 236M | 48931 |
| | 6, 3544M; T6, 3544M; ST6, 3544M; SST6, 3544M | 302026 |
| | 4, 108 W/shut off | 303878 |

PRE-ENGINEERED CLUTCH CONNECTION KITS

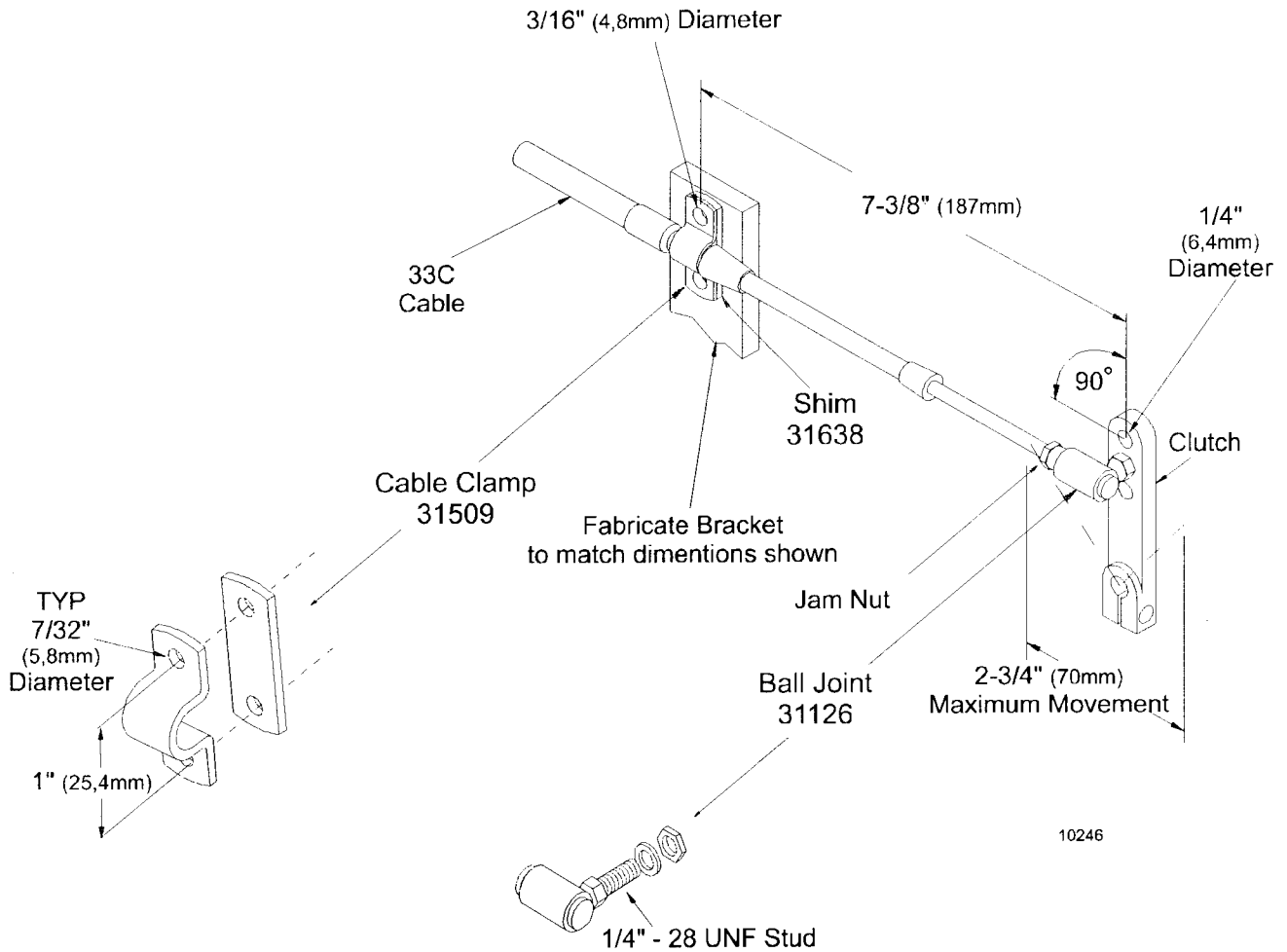
| MAKE | TRANSMISSION MODEL | KIT NO. |
|-----------------------------|--|---------|
| Allison | M & MH | 41482 |
| Borg Worner | 70, 71, 72 In line w/red gear rear entry | 301474 |
| Capital | 12400 | 36680 |
| | 2, 3, & 4 HD & HE | 36680 |
| MerCruiser | Inboard w/o Warner red gear | 62355 |
| Paragon | 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 |
| Twin Disc Trolling Valve | MG509, 510A, 511A, 514C | 307171 |

MicroCommander - Appendix B

OUTBOARD AND I/O CABLE CONNECTION KITS

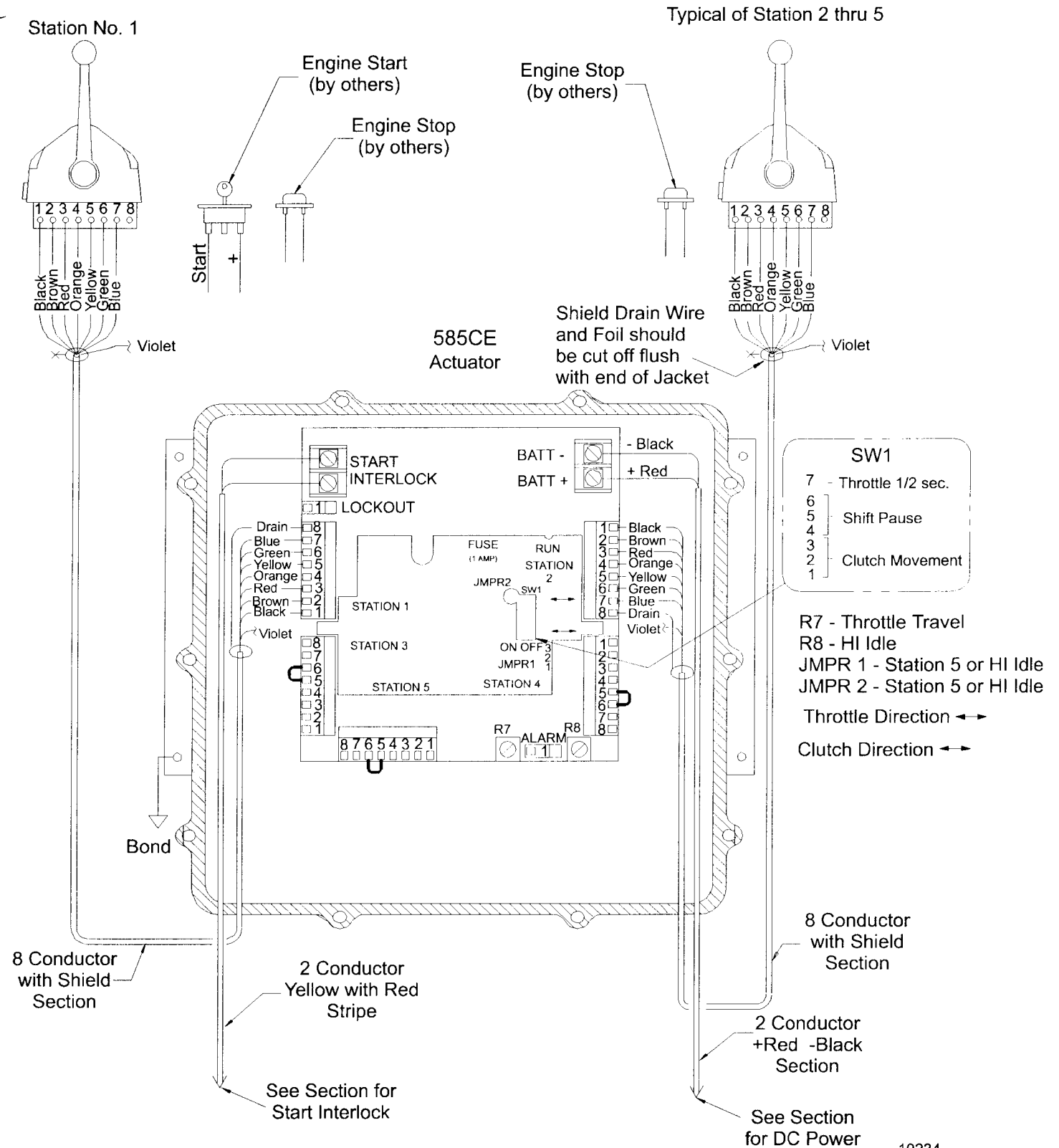
| | ENGINE MAKE | KIT NO. |
|---|---|---------|
| Chrysler 1975 & later | | 300465 |
| Evinrude/Johnson 55-235 H.P. 1978 to date | | 301729 |
| Mercury 40-300 H.P. | | 301901 |
| Mercruiser I/O | | 302123 |
| OMC Sterndrive I/O | | 300557 |
| Volvo I/O | Engine and out drive brackets are provided by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

Universal Mounting Kit



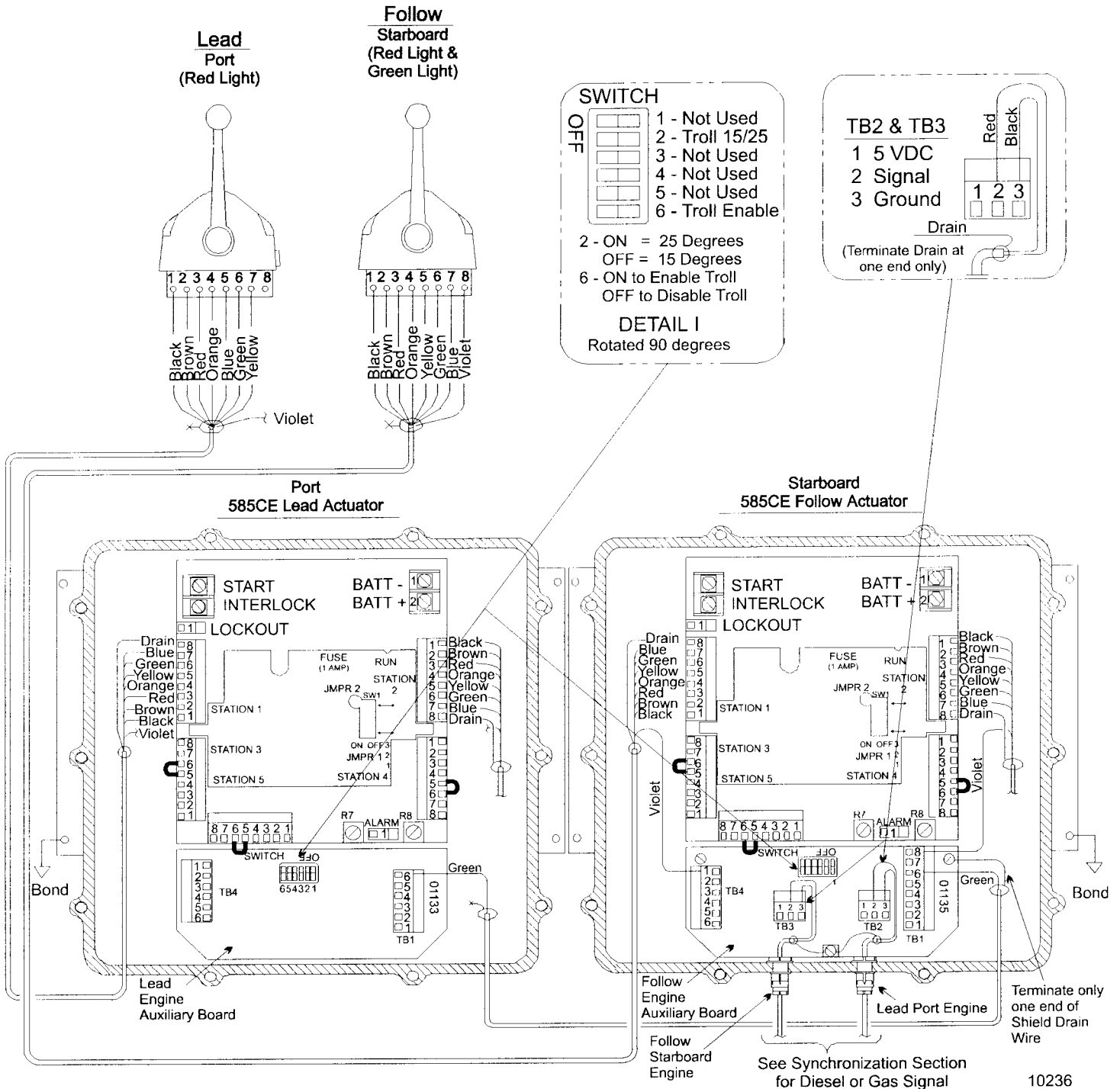
Engine Push-Pull Cable Connections

MicroCommander - Appendix C



Single Engine

MicroCommander - Appendix C



Two Engines with Synchronization



American Bureau of Shipping (ABS),
Certificate number 93-S20958-X.



Det Norske Veritas (DNV),
Certificate number A-6342.



Registro Italiano Navale (RINA),
Certificate number ELE / 53796 / 1.



Bureau Veritas (BV),
Certificate number 4451-6723-A0 0 1.



CE Mark



Germanischer Lloyd (GL)

Approval is pending on ISO-9001

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www.matherscontrols.com

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