

MATHERS CONTROLS INC.

**MicroCommander
Engine Control
Installation Instructions
for 580 Actuator only**



Manufactured by:
Mathers Controls Inc.
675 Pease Road
Burlington, WA 98233
1-800-546-5455
Fax: 1-360-757-2500
e-mail: mathers@matherscontrols.com

MMC-153 Rev. 5
RPN: 00661

THIS PRODUCT IS INACTIVE!
Please contact Mathers Controls for support information.

Table of Contents

1. GENERAL INFORMATION.....	1
2. REQUIRED PARTS AND TOOLS	1
2.1 SUPPLIED BY YOUR MICROCOMMANDER DEALER.....	1
2.1.1 Control Head	1
2.1.2 Actuator	1
2.1.3 Electric Cable.....	2
2.2 SUPPLIED BY INSTALLER.....	2
2.2.1 Tools Required For Installation.....	2
2.2.2 Push-Pull Cables.....	2
2.2.3 Push-Pull Cable Connection Kits.....	2
2.2.4 Control System Power 'On' - 'Off' (See Figure 1).....	2
2.2.5 Engine 'STOP' Button.....	3
3. PLAN THE INSTALLATION	3
3.1 ACTUATOR LOCATION	3
3.2 REMOTE CONTROL HEAD LOCATION	3
3.3 12 VOLT DC POWER.....	4
4. INSTALLATION.....	4
4.1 THE ACTUATOR	5
4.2 THE CONTROL HEADS.....	5
4.3 STATION TRANSFER BUTTON	5
4.4 ENGINE 'START' SWITCH.....	6
4.5 ENGINE 'STOP' SWITCHES.....	6
4.6 EIGHT-CONDUCTOR CABLE	6
4.7 CONTROL HEAD.....	6
4.8 BONDING A.B.Y.C. E-1 46 CFR 111.05	9
4.9 ACTUATOR.....	9
4.10 CONNECT 12 VOLT DC POWER TO ACTUATOR.....	10
4.11 INSTALL START INTERLOCK CABLE.....	10
5. ADJUSTMENTS	10
5.1 ACTUATOR.....	11
5.2 CHECK CONTROL HEADS AND STATION TRANSFER.....	11
5.3 PUSH-PULL CABLES	12
5.3.1 Reverse Gear Cable Adjustment	13
5.3.2 Throttle Cable Adjustment.....	13
5.4 STATION TRANSFER	14
5.5 START INTERLOCK.....	14
5.6 THROTTLE PAUSE	14
5.7 FINAL CHECK	14

6. TESTS	14
6.1 ADJUSTMENTS TO CHECK UNDERWAY	15
6.1.1 <i>Full-Speed Setting</i>	15
6.1.2 <i>Proportional Pause On Direction Change</i>	15
6.2 CONTROL HEAD TONE.....	16
7. CONTROL OPTIONS	16
7.1 HIGH ('HI') IDLE	16
7.1.1 <i>'HI' Idle Setting</i>	17
7.2 PRIMARY STATION ISOLATION SWITCH.....	17
7.3 ALARM CAPABILITY	18
7.4 GEAR OIL PRESSURE INTERLOCK	18
8. OPERATOR INSTRUCTIONS	18
8.1 CONTROL SYSTEM START-UP	18
8.2 ENGINE START	19
8.3 STATION TRANSFER	19
9. MORSE CLUTCH AND THROTTLE KIT SELECTION	19
9.1 PRE-ENGINEERED THROTTLE CONNECTION KITS	19
9.2 PRE-ENGINEERED CLUTCH CONNECTION KITS.....	20
9.3 OUTBOARD AND I/O CABLE CONNECTION KITS.....	20
10. UNIVERSAL MOUNTING FOR 33C TYPE CABLE	21
11. REFERENCES	21
11.1.1 <i>American Boat and Yacht Council (ABYC)</i>	21
11.1.2 <i>Code of Federal Regulations</i>	21
11.1.3 <i>Society of Automotive Engineers</i>	21
11.1.4 <i>National Marine Manufacturers Association</i>	22
11.1.5 <i>Underwriters Laboratories</i>	22
11.2 PARTS SOURCE.....	22
12. SINGLE SCREW CIRCUIT	23
13. TWIN SCREW CIRCUIT	24
14. TEMPLATE	26
15. MAINTENANCE	28
15.1 ACTUATOR	28
15.2 CONTROL HEAD	28
16. TROUBLE SHOOTING	28
16.1 SYMPTOM: CANNOT TAKE COMMAND AT ONE STATION.	28
16.2 NO POWER (POWER INDICATOR LIGHT IS 'OFF')	28
16.3 SYMPTOM: STARTING ENGINE BRINGS ON INTERMITTENT TONE AND ENGINE WON'T CRANK.	28

16.4 SYMPTOM: HIGH RATE TONE AT CONTROL HEAD WHEN SHIFTING OR MOVING UP IN THE
SPEED RANGE. 29

16.5 SYMPTOM: STEADY TONE AT CONTROL HEAD. 29

16.6 SYMPTOM: ONE LONG - ONE SHORT TONE AT THE CONTROL HEAD. 29

16.7 SYMPTOM: ONE LONG - TWO SHORT TONES AT THE CONTROL HEAD. 29

17. WARRANTY AND REGISTRATION..... 30

1. GENERAL INFORMATION

The MicroCommander engine control system provides single lever operation of throttle and shift from one to five remote stations. The control system operates from a 12 volt DC power source and in the static condition draws only 0.4 amperes. The MicroCommander will operate outboards, I/O's and inboards, either gas or diesel powered.

The control system is sequenced such that the throttle must be at 'IDLE' in order to shift and shift must then be completed before the throttle will advance.

The connection to the engine throttle and clutch is through standard Morse Type 33C push-pull cable. (Ref. 3, J917, Sect. 11)

Requirements:

- Throttle or clutch selector lever load should not exceed 40 lbs.
- MicroCommander requires a battery supply of 12 to 16 volts DC and could draw a maximum of 10 amperes.
- The 12 volt DC power required is to be supplied through a 10 ampere, push button type, circuit breaker. (One for each Actuator)

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

2. REQUIRED PARTS AND TOOLS

2.1 SUPPLIED BY MICROCOMMANDER DEALER

2.1.1 Control Head

Single Control Head (Single Screw)	Pc.No.	BLACK 450-1	Chrome Lever 453-1
Dual Control Head (Twin Screw)	Pc.No.	460-1 or -2	463-1 or -2

- One station transfer button is included with each Control Head, a twin screw station requires only one transfer button.
- The -2 includes a green LED for synchronization.
- Included are gasket, wire, terminals, mounting screws, and watertight cable grip (for cable entrance on Actuator).
- Optional Control Head levers are available. (See MMC-129)

2.1.2 Actuator

Pc.No. 580

One Actuator for each engine. Included are installation instructions, ferrite bead, wire, terminals, tie wraps, anti-static wrist strap, and WAGO tool (See Figure 12). A WAGO tool and a spare fuse are taped inside the Actuator. Also included are two cable grips for power cable and for start interlock cable. Mounting hardware is not included.

2.1.3 Electric Cable

Pc.No. 180

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

Pc.No. 212

Two-Conductor Cable 12 V Supply, 250 foot (76m) spool Pc.No. 349
14 AWG, 300 V, PVC Insulated: -20/C to +105/C PVC Jacket.
Red with purple stripe and black UL VW-1.

Pc.No. 183

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

2.2 SUPPLIED BY INSTALLER

2.2.1 Tools Required For Installation

Anti-static wrist strap is included with Actuator.
Wire cutter (Recommend Thomas & Betts WT-2000)
Wire stripper (Recommend Thomas & Betts WT-2000)
Wire crimper (Recommend Thomas & Betts WT-2000)
7/16" Socket and medium extension
3/8" Wrench
7/16" Wrench
Screwdriver - medium phillips head #2
Screwdriver - medium straight slot
Screwdriver - small straight slot
Hole saw - 1" (25,4mm)
Drills - 9/32" (7,2mm) and 7/32" (5,6mm)

2.2.2 Push-Pull Cables

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

2.2.3 Push-Pull Cable Connection Kits

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

2.2.4 Control System Power 'On' - 'Off' (See Figure 1)

There are a few good methods to turn the control system 'ON' - 'OFF'. The key switch or a separate switch may be used to operate a relay. The circuit breaker may be used as a switch. Examples are show in Figure 1. Use a relay with coil voltage to match your DC battery voltage and that is external ignition protected if mounted in a gasoline engine room. Power is drawn from the battery through a circuit breaker, 10-ampere, trip free, external ignition protected, and manual reset. Use an E-T-A circuit breaker, Pc.No. 41-2-S14-

LN2-10, or equal. The circuit breaker can be ordered from Mathers Controls Inc. as Pc.No. 810. (Ref. 1, E-9; Ref. 2, 183, 455; Ref. 3, J1428, Sect. 11)

NOTE: Do not use the key switch as the 12 volt DC power supply for the control system. The key switch must only energize a relay as described above.

2.2.5 Engine 'STOP' Button

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

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

3. PLAN THE INSTALLATION

3.1 ACTUATOR LOCATION

Considerations:

- The Actuator is spray proof but cannot be immersed.
- Bulkhead mount is preferred for ease of access for wiring and adjustments, but the Actuator can be mounted in any attitude. If the clutch cable is connected to an I/O drive outside the hull, then the Actuator must be two feet (0,6m) above water line. Do not mount to the engine or transmission, or any location that will allow excessive vibration.
- Locate the Actuator so that the push-pull cables from the Actuator to the engine have easy bends with the least total degrees of bend and moderate overall length. EXAMPLE: Minimum bend radius 10" (254mm) - Try for total degrees of bends of less than 270 degrees - Cable length normally under 20' (6m).
- The Actuator is usually located in the engine room. If the engine room is too small, locate in any accessible area.
- MicroCommander uses electronic circuits that can be influenced by strong magnetic fields and static charges. Power source must be bonded (connected) to the hull. Do not mount close to gas engine ignition systems, alternators, or electric motors. Allow four feet (1,2m) of clearance or more.
- Locate Actuator away from heat sources such as engine exhaust manifolds.
- Locate Actuator to be accessible for electric and push-pull cable connections.

3.2 REMOTE CONTROL HEAD LOCATION

Considerations:

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

- When mounting a Control Head that may be weather exposed from the underside, consider using a Weather Mounting Control Box, Pc.No. 722 (See Dwg. 0310-A).
- Retrofit applications will need to plan an adapter pad to cover the old Control Head cutout and to mount the Control Head. Adapter and cover pad available from Mathers Controls Inc.

3.3 12 VOLT DC POWER

The MicroCommander Actuator requires a 12 volt DC battery source protected by a 10-ampere circuit breaker. It is not recommended to use engine starting batteries on 12 volt systems, because the cranking voltage may be too low. It is important to keep the length of power cable short to reduce voltage drop. The 14 gauge twisted pair power cable, should not exceed 20 feet (6m). If individual wires are used for supply (+) and return (-) then the total wire length should not exceed 40 feet (12m).

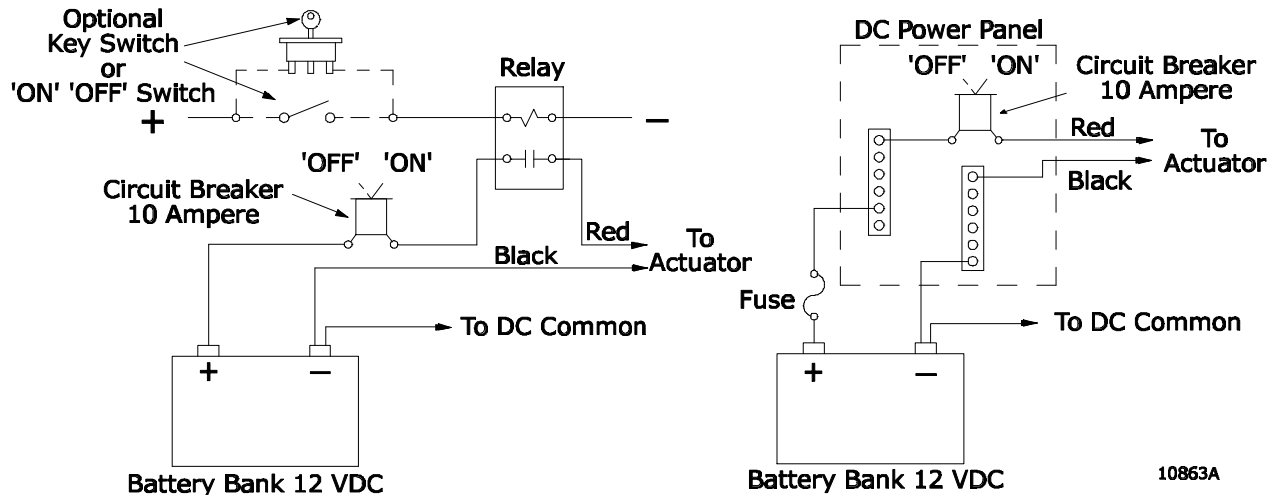


Figure 1
Power Source

NOTE: It is important that the wire size from the battery to the circuit breaker panel is large enough to keep voltage drop due to current flow, to less than 3%. The DC return to the battery must be large enough to supply all current requirements with a voltage drop of less than 1 volt. (See References, Sect. 11)

4. INSTALLATION

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

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

4.1 THE ACTUATOR

Secure the Actuator using 3" (6,4mm) fasteners. When the Actuator cover is removed, connect the wrist strap to your person and the ground connector to the Actuator frame. Install the 12 volt power cable grip and the start interlock grip in the top frame holes as shown in Figure 9. When not working on the Actuator keep the cover in place to eliminate metal chips, dust, or dirt from shorting circuits.

4.2 THE CONTROL HEADS

Use the Control Head template, Sect. 14, to locate holes. Drill the screw holes 7/32" (5,6mm) and the 1" (25,4mm) corner cutout holes. The #8-32 x 1" mounting screws are for a 3/4" (19,1mm) maximum thick mounting surface. Check that the four mounting screws will start into the Control Head. Remove the Control Head and strip the adhesive cover from the gasket and apply the sticky side to the console.

4.3 STATION TRANSFER BUTTON

One station transfer button is required at each remote station. Locate carefully so that the button is accessible but will not be inadvertently depressed. Use the hole template, Sect. 14. The station transfer button is waterproof. There are two methods of mounting: Surface mount or Recessed mount for thin panels (See Figure 3).

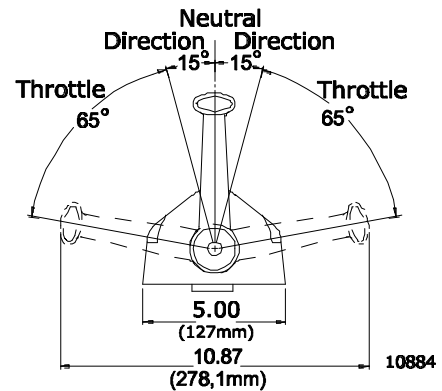
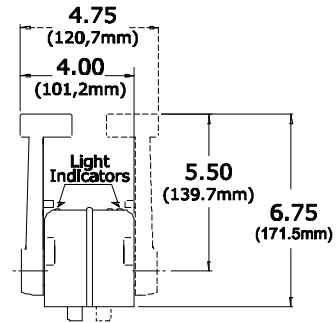
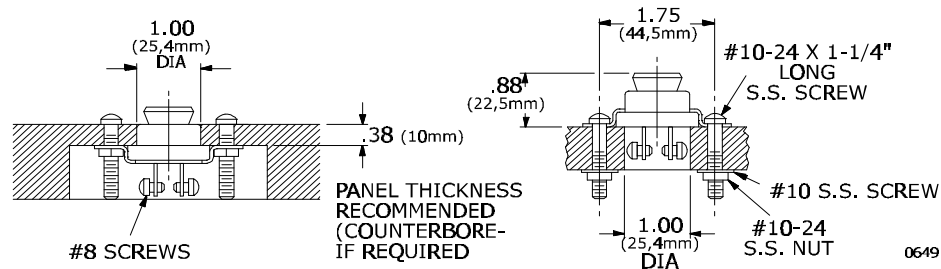


Figure 2
Control Head



Recessed Mount

Surface Mount

4.4 ENGINE 'START' SWITCH

MicroCommander is interlocked to prevent 'START' until control system power is 'ON' and the reverse gear is in Neutral. The engine 'START' signal must be connected through the Actuator to the starter solenoid or relay. (See Figure 4) The interlock will function with a 'START' signal up to 50 volts DC and 30 ampere maximum.

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

4.5 ENGINE 'STOP' SWITCHES

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

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

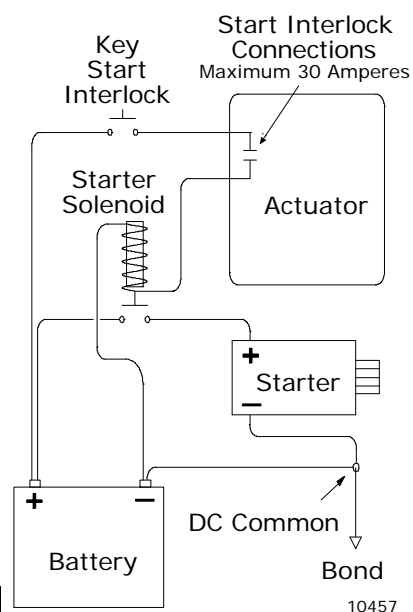


Figure 4
Start Interlock

4.6 EIGHT-CONDUCTOR CABLE

Install the Eight-Conductor electric cable (two cables if twin screw) between each Control Head and the appropriate Actuator. There can be as many as five remote stations. Label each Eight-Conductor cable at both ends with the station it connects and Port or Starboard engine command.

The Eight-Conductors in the electric cable are color coded. Each conductor shall be installed so that it is protected from physical damage. Conductors shall be supported by clamps or straps not more than 18" (95m) apart unless contained in a conduit. (Ref. 1, E-9; Ref. 3, J378, Sect. 11)

4.7 CONTROL HEAD

At the Control Head, strip back the PVC cover on the cable approximately 2 1/2" (63.5mm) (See Figure 5). Strip and cut off the shielding and drain wire flush with the end of the PVC cover. The drain wire at the Control Head is not connected to ground. The installer must strip 3/8" (9.5mm) insulation off each wire and crimp connectors. Connections 5 and 7 of the Control Head connector plug are direction sensitive. The connections must be as follows:

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

CAUTION: When making a twin screw installation, the white ground wire connects to Terminal 3 on the Port Control Head only. The Starboard Terminal 3 is not connected. This is true at all stations. See Circuit Dwg.

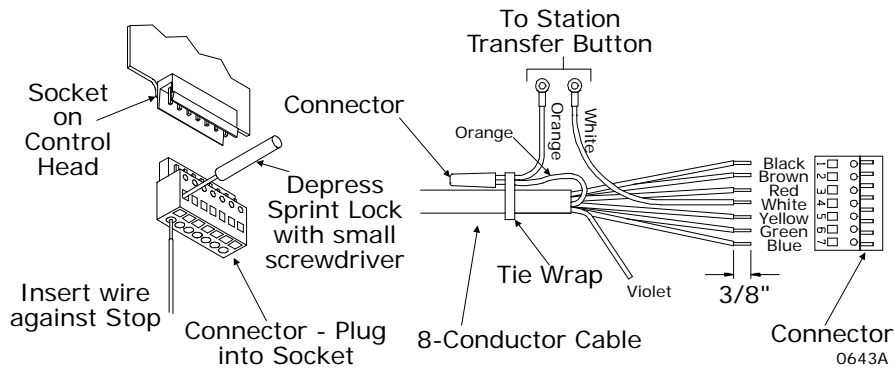


Figure 5
Control Head Socket Connection

NOTE: Starboard Control Head lever connection shown. (Reverse blue and yellow for Port Control Head lever).

Twin Screw
Dual Control Head
without Synch
Indicator Light

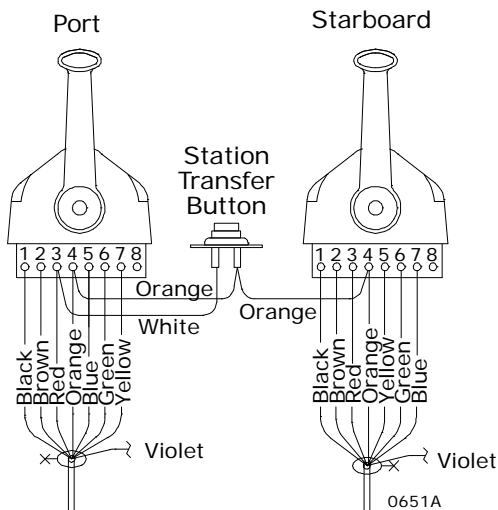


Figure 6
Terminal Connection

Synchronization
Dual Control Head
with Synch
Indicator Light

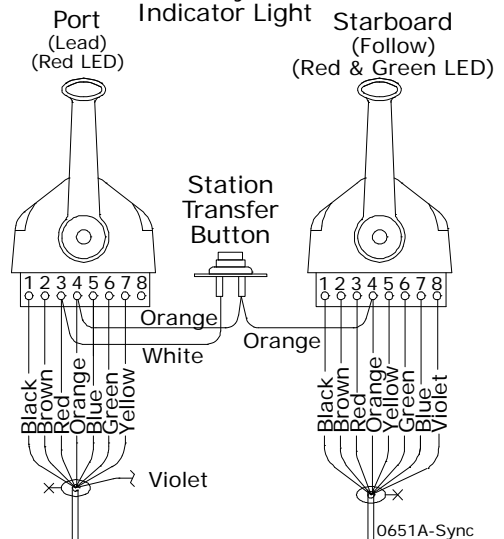


Figure 7
Sync. Terminal Connection

CAUTION: When making a twin screw installation, the white wire connects to Terminal 3 on the Port Control Head only. The Starboard Terminal 3 is not connected. This is true at all stations. See Circuit Dwg., Section 13. Cable must be supported to eliminate load on Terminal Connections.

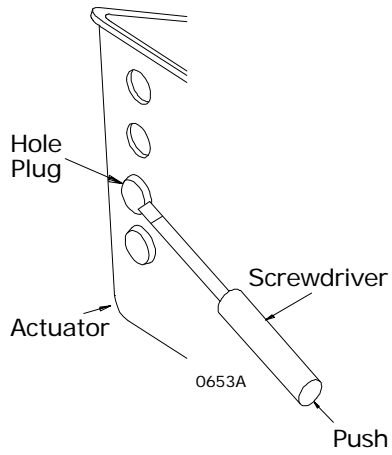


Figure 8
Plug Removal

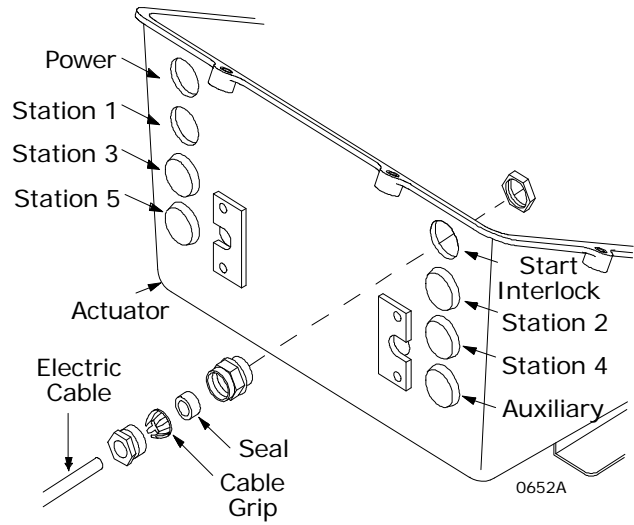


Figure 9
Cable to Actuator

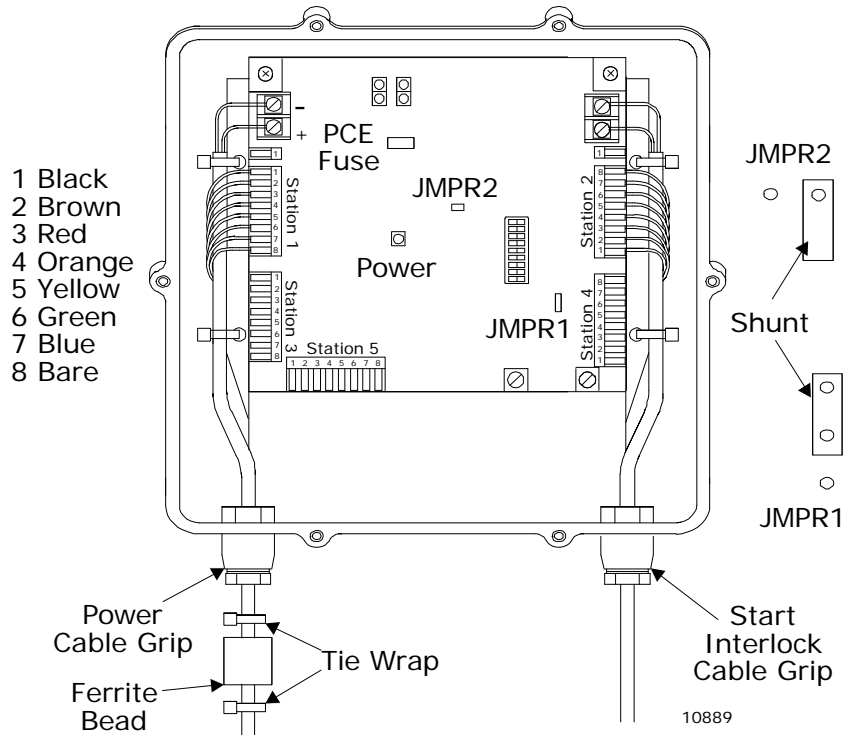


Figure 10
Actuator Connections

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

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

4.9 ACTUATOR

Remove the Actuator cover and connect your anti-static wrist strap to the Actuator frame and your wrist. Remove the cable hole plugs as required. (See Figure 8) Install the watertight cable grip that is included with the Control Head. Station No. 1 will connect to 'STATION 1' as indicated in Figure 9. Strip the PVC cover and shielding back approximately 2" (50,8mm). The wire leads can be staggered for length to match the Station 1 terminal strip. Strip the wire 3/8" (9.5mm) on each lead. It is also recommended that the wire be LIGHTLY tinned. Connect colors as indicated in Figure 10. A WAGO Tool, No. 236-332, is included with each Actuator. It is taped to the relay on the circuit board. It is used to depress the spring lock for the individual wire connection to the terminal strip. (See Figure 12) The shielding drain wire (bare wire) must be connected to terminal 8 on the terminal strip. Feed through a little slack cable and tighten the cable grip on the Eight-Conductor cable. The other stations Eight-Conductor cables are brought in the same way and are

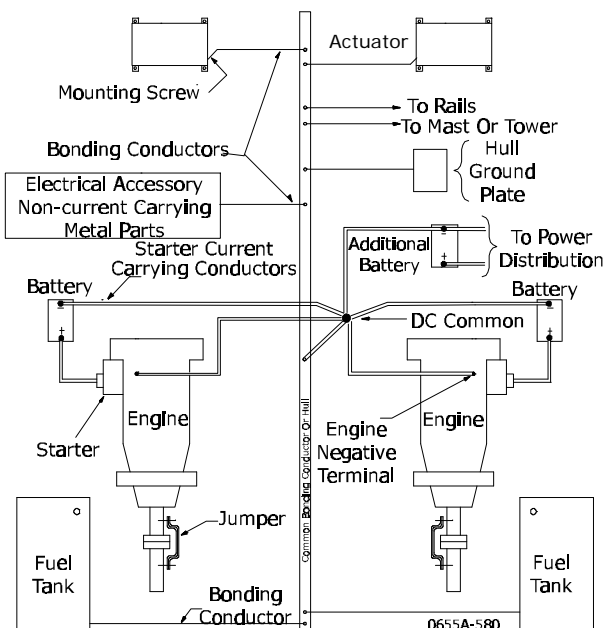


Figure 11
Bonding

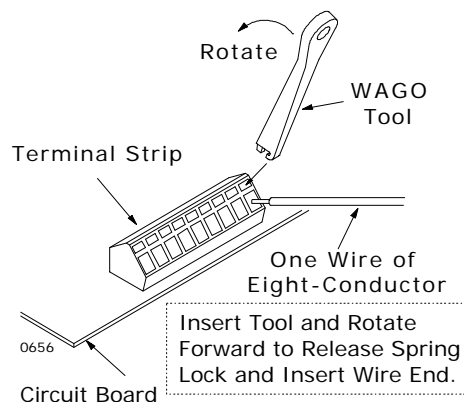


Figure 12
Terminal Connection

connected to the appropriate terminal. (See Figure 9) Secure the cable to the frame using tie wraps provided.

4.10 CONNECT 12 VOLT DC POWER TO ACTUATOR

When connecting the DC power cable to the Actuator be sure the power is 'OFF'. The (+) positive lead (red with purple stripe) connects the + DC power source to the Actuator. (See Figure 1) The (-) negative lead is black. The ferrite bead is fed onto the power cable before entering the Actuator. Tie wrap the power cable to the frame and tighten the cable grip.

4.11 INSTALL START INTERLOCK CABLE

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

The start interlock cable, two wires are yellow with a red stripe. Remove the key start lead at the start solenoid. (See Figure 4) Connect one yellow with red striped wire to this lead and the other yellow with red striped wire to the start solenoid. Run the cable to the Actuator through the cable grip to the start interlock connections on the Actuator circuit board. See circuit drawings in Sect 12 and 13. The Actuator provides a start interlock that requires the control system to be 'ON' and clutch in Neutral. The 'START' signal voltage can be 12, 24 or 32 volts as it only passes through a relay in the Actuator.

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

5. ADJUSTMENTS

- A) Turn the power 'ON' to the control system.
- B) The Control Head at each remote station will produce an intermittent tone.
- C) Depress one station transfer button (Control Head lever in Neutral). The red indicator light on the Control Head should be lit, showing this remote station has command. Note on dual Control Head, both red indicator lights must be lit.
- D) Move the Control Head lever Full-Ahead and Full-Astern. This will check that the Control Heads are operating.

WARNING: Keep hands and tools clear of the Actuator when power is 'ON'. Turn 'OFF' the control system power before disconnecting the 12 volt batteries. Do not disconnect battery terminals when engine is operating.

5.1 ACTUATOR

Actuator Settings (as shipped)

Throttle	R7 Pot	Fully counterclockwise ↺ gives minimum throttle.
'HI' Idle	R8 Pot	Fully counterclockwise ↺. Leave in this position unless the 'HI' Idle option is selected. (See Section 7.1)
	JMPR 1	Shunt between 2 and 3 set for Station 5.
	JMPR 2	Shunt open as set for Station 5.

SW1 Settings (as shipped)

Clutch Direction	(1) 'OFF'	Clutch cable 'PULL' Ahead.
Clutch Movement	(2) 'ON'	1/4" (6.4mm) All switches 'ON' gives minimum cable travel.
	(3) 'ON'	1/8" (3.2mm) Switches to 'OFF' gives incremental increase.
	(4) 'ON'	1/16" (1.6mm) Dimensions are each side of center.
Pause Clutch engaged Ahead	(5) 'OFF'	Provides a maximum pause from Full-Ahead of 3.25 seconds.
	(6) 'ON'	Section 6.1.2, lists optional settings.
	(7) 'OFF'	
Throttle Pause	(8) 'OFF'	Throttle pause of 0.5 second following shift. Use when controlling hydraulic actuated clutches.
Throttle Direction	(9) 'OFF'	Throttle cable PUSH to increase speed.

5.2 CHECK CONTROL HEADS AND STATION TRANSFER

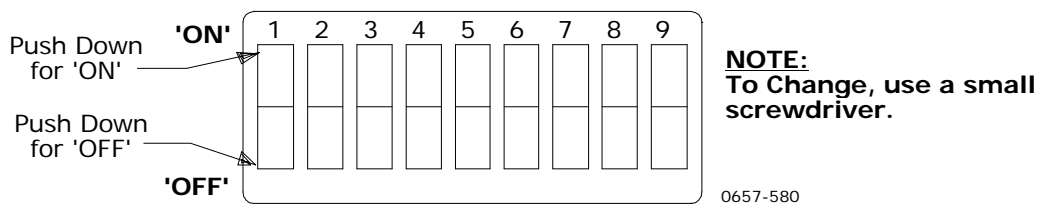


Figure 13
SW1 Dip Switch

Move to each remote station, and with the Control Head levers in the Neutral position, PUSH in the station transfer button. The indicator light on the Control Head will confirm that command transfer has taken place and that you have command.

The Control Heads are direction sensitive. To prove that the Control Head wiring connections are correct:

A) Place the Control Head levers in the Neutral position.

- B) Depress and hold the station transfer button and then move the Control Head lever to the Ahead detent position.
- C) The red indicator light on the Control Head should blink. The blinking indicator light shows that the clutch is in Neutral and the Control Head lever will position the throttle only.
- D) If the red indicator light is 'ON' in Ahead and blinks in Astern, then connections 5 and 7 on the Control Head connector must be reversed (See Sect. 4.7).
- E) The 'WARM-UP' Mode must operate only in the Ahead direction.
- F) There are no further adjustments to the Control Head.

5.3 PUSH-PULL CABLES

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

- A) Check that push-pull cable anchor brackets are installed on the engine. If the brackets are not on the engine, select from Sect. 9, or fabricate brackets as shown in Sect. 10.
- B) As shipped from the factory, Actuator switch (SW1) 1 is 'OFF', and therefore, the push-pull cable will 'PULL' on the clutch selector lever for Ahead. If this is correct, leave it. If it is wrong, change switch 1 to 'ON' and the push-pull cable will PUSH the clutch selector lever for Ahead.
- C) As shipped from the factory, Actuator switch (SW1) 9 is 'OFF', and therefore, the push-pull cable will PUSH the throttle lever for Full-speed. If this is correct leave it. If it is wrong, change switch 9 to 'ON' and the push-pull cable will 'PULL' on the throttle lever for Full-speed.
- D) Connect the push-pull cables to the MicroCommander Actuator (See Figure 14). Remove the #10-32 jam nut and the two rubber seals from the push-pull cable end that is to connect to the Actuator. Reinstall the #10-32 jam nut. Remove one cable anchor clip screw from the Actuator housing and swing the cable clips clear. Connect the shift cable and throttle cable to the proper hex nut. See label on the Actuator. (See Figure 14, Detail I) Use a

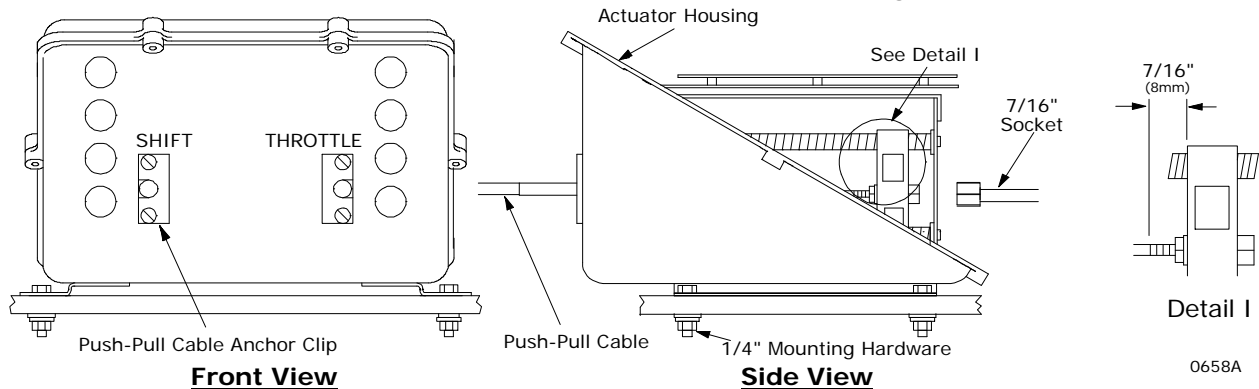


Figure 14
Push-Pull Cable Connection

7/16" socket to turn the hex nut onto the #10-32 cable rod end until there is 5/16" (7,9mm) of thread showing beyond the jam nut. Tighten the #10-32 jam nut to the hex nut. Install the cable anchor clips to secure the Type 33C cable to the Actuator housing.

5.3.1 Reverse Gear Cable Adjustment

- A) Place the Control Head levers in Neutral and turn the control system 'ON'.
- B) Adjust the clutch cable ball joint at the engine to match the clutch selector lever in Neutral. The push-pull cable should form a right angle (90 degrees) to the shift selector lever in the Neutral position. Leave the cable disconnected.
- C) Move the Control Head lever to the Ahead detent. The Actuator can be adjusted for a total clutch movement of 2" (51mm) to 3" (76mm). The Actuators are shipped with switches set for minimum movement.
- D) Measure the clutch selector lever movement from Ahead to Astern detent. The selector lever movement must be within the adjustment range of 2" (51mm) to 3" (76mm).

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

Switch 2 1/4" (6,4mm)


Switch 3 1/8" (3,2mm)

APPROXIMATE DIMENSIONS


Switch 4 1/16" (1,6mm)

- E) Match the required movement and then check the Astern direction. Recheck Ahead, Neutral, and Astern with the clutch cable disconnected. Confirm that the Actuator does not jam the clutch selector lever against its stops and that Neutral is correct. Connect the clutch cable.

5.3.2 Throttle Cable Adjustment

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

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

- B) Measure the throttle movement at the engine from 'IDLE' to 'FULL'. It must be within the Actuator range of 1" (25,4mm) to 2-7/8" (73mm). If the throttle movement is less than 1" (25,4mm) or greater than 2-7/8" (73mm) the lever radius must be changed to be within range. If possible, throttle movement should be 2-1/2" (64mm) 'IDLE' to 'FULL'. Leave throttle cable disconnected at this time.
- C) Place Control Head levers in Neutral, 'Start' engine and run at 'IDLE'. Adjust ball joint on throttle cable to match throttle lever 'IDLE' position.
- D) Stop the engine. Move the Control Head lever to Full-speed. Move throttle lever to the Full-speed stop. Gradually turn potentiometer R7 on the circuit board clockwise  until the ball joint can be connected with a slight amount of pressure against the Full-speed throttle stop. Recheck 'IDLE' and 'FULL'. Connect ball joint to throttle lever. The throttle adjustment is complete.

5.4 STATION TRANSFER

The operator can leave the Station-in-Command with the Control Head lever in any position from Full-Ahead to Full-Astern. To gain command at any other remote station the Control Head lever must be in the Neutral position. When the Control Head indicator light shows red, the operator has command. There is a one second pause after the indicator light is 'ON' to allow the operator time to match the previous speed setting before command transfer takes place.

5.5 START INTERLOCK

- A) Check proper operation of start interlock:
- B) Turn 'OFF' 12 Volt DC power to MicroCommander, check that engines will not 'START'. Control system off interlock check.
- C) Turn 'ON' 12 Volt DC power to MicroCommander, accept command, place Control Head lever to Ahead detent and check that engines will not 'START'. Clutch in Neutral, interlock check.
- D) Place Control Head lever in Neutral, engines should 'START' in this position.

5.6 THROTTLE PAUSE

Hydraulic actuated clutches require 0.5 second or longer following selector lever movement before there is clutch plate contact. SW1 switch 8 in the 'OFF' position allows 0.5 second Idle throttle pause after clutch selector movement is complete. Dog clutches and cone clutches used on some I/O's and outboards do not require a throttle pause following clutch shift and switch 8 should be 'ON'.

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

5.7 FINAL CHECK

- A) Shut 'OFF' the engine.
- B) Check that all push-pull cable connecting fasteners are tightened securely.
- C) Operate Control Head levers Ahead and Astern and check clutch selector lever movement. Operate Control Head levers from Idle to Full-Ahead and check throttle movement.
- D) Check that the push-pull cable jam nut in the Actuator is tight. (See Figure 12, Detail I) If this is not done the Hex Nut can back off the push-pull cable threaded end and effectively change the cable length. Shift and throttle cables must have jam nuts tightened.

6. TESTS

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

- A) 'START' engine and check that engine 'STOP' switches (normally a push button) function correctly at all remote stations.
- B) Idle the engines and place one Control Head lever at a time in the Ahead detent and then the Astern detent. Do this at each remote station to confirm direction command.

- C) Then use 'WARM-UP' Idle on each engine at each remote station, one engine at a time to confirm speed command.
- D) Check that all the above tests are made and are correct. Only then is the vessel ready to leave the dock.

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

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

6.1 ADJUSTMENTS TO CHECK UNDERWAY

6.1.1 Full-Speed Setting

Warm-up the engine and in open water gradually move the Control Head lever to Full-speed.

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

If Full-speed should be lowered, turn potentiometer R7 counterclockwise ↶ to desired maximum RPM. For twin screw applications, check that Idle, mid-range and Full-speed are equal RPM on both engines with matching Control Head lever positions.

6.1.2 Proportional Pause On Direction Change

This feature allows for engine deceleration and vessel speed to decrease on a Full Speed Reversal. The throttle setting drops to Idle and the gear remains engaged Ahead.

The pause is in proportion to Control Head lever position and how long the lever has been in that position, prior to the reversal. The minimum pause is 2 seconds with SW1 switches 5, 6, and 7 in the 'OFF' position. The maximum pause is 11 seconds with SW1 switches 5, 6, and 7 in the 'ON' position. Factory settings at the time of shipment are 3.25 seconds.

SW1 Gang Switch: Full-Speed Pause

Switch 5	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Switch 6	OFF	OFF	ON	ON	OFF	OFF	ON	ON
Switch 7	OFF	ON	OFF	ON	OFF	ON	OFF	ON
Seconds:	0.0	1.8	3.0	5.0	6.8	8.00	9.8	11.25

NOTE: *The pause in gear on a through shift is proportional to the amount of 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 functions of the tone.

- **Low Repetition Tone** is normal when DC power is first applied to the control system. This tone shows the control system is in Neutral and Idle and the operator can take command by depressing a station transfer button.
If the operator places the Control Head lever to the slow Ahead position before depressing the transfer button, they will get warm-up speed command with a blinking red light. The clutch will remain in Neutral.
- **High Repetition Rate Tone** is used to signal a jam condition of either the shift or throttle cable. The Actuator has stopped when this tone is heard. Moving the Control Head lever away from the position the tone was encountered will usually stop the signal. The cause of the high push-pull cable load must be found. Disconnect the throttle and shift cables at the engine and check the engine and gear levers for heavy loads. Operate the control system by moving the push-pull cables only, to confirm the cables are moving freely. Check to see that the push-pull set up is adjusted correctly. (See Sect. 5.3)
- **Steady Tone** is used to signal a voltage problem or a component has failed. Confirm the voltage is steady between 12 and 16 volts DC and that there is not a momentary voltage drop. Depress the station transfer button. If the tone continues the Actuator or circuit board may need to be replaced.
- **Repetitive Signal - One Long, One Short Tone** is used to show a clutch feedback error. See Sect. 16.6.
- **Repetitive Signal - One Long, Two Short Tone** is used to show a throttle feedback error. See Sect. 16.7.

7. CONTROL OPTIONS

7.1 HIGH ('HI') IDLE

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

The 580 Actuator is shipped from the factory with five remote stations available. When the 'HI' Idle option is selected, you eliminate Station 5. To obtain the 'HI' Idle option requires the following adjustments to the circuit board (See Figure 10).

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

The result is that stations 1 through 4 are capable of 'HI' Idle and station 5 is inoperative.

7.1.1 'HI' Idle Setting

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

To adjust 'HI' Idle, place the Control Head levers in Neutral and 'START' the engine. Depress and hold the station transfer button at the remote station in command and move the Control Head lever to the Ahead detent position. The blinking light at the Control Head shows 'WARM-UP' Mode. THE MICROCOMMANDER IS ALWAYS IN 'HI' IDLE MODE WHEN THE INDICATOR LIGHT IS BLINKING. Adjust 'HI' Idle using potentiometer R8, ONLY when in 'WARM-UP' Mode with the indicator light blinking and the Control Head lever in the Ahead detent position (Idle position).

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

Check your 'HI' Idle and 'LO' Idle settings by placing the Control Head lever in Neutral and PUSH the station transfer button. Alternately the RPM will move back and forth between 'LO' Idle and 'HI' Idle when the transfer button is pushed. Twin screw, if 'HI' and 'LO' Idle are out of sync, place both engines in Ahead Warm-up Mode. Both engines will then be 'HI' Idle.

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

7.2 PRIMARY STATION ISOLATION SWITCH

One SPST (single pole single throw) switch can be mounted at the primary station (Station 1). When the switch is closed, command remains at the primary station and other stations cannot take command. When the switch is open, all stations can take command by means of their station transfer button. Use a quality toggle switch with screw connections and crimped wire terminals. See Single Screw Figure 15 and Twin Screw Figure 16.

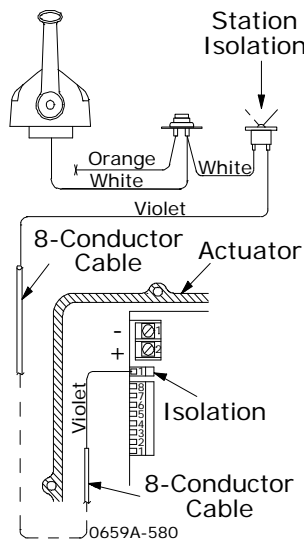


Figure 15
Single Screw
Primary Station

Page 17

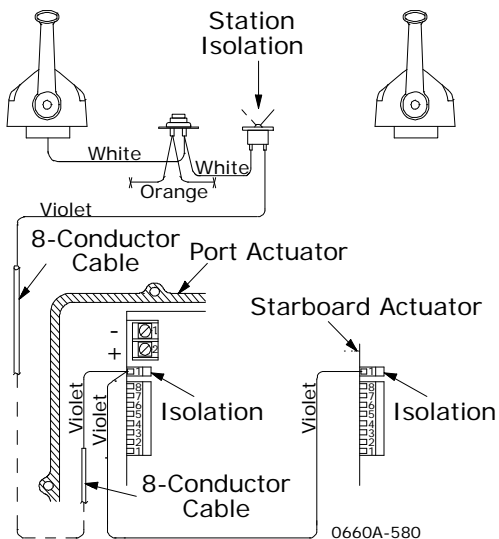


Figure 16
Twin Screw
Primary Station

7.3 ALARM CAPABILITY

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

The 580 Actuator's alarm connection point is a single connection block on the Actuator circuit board labeled ALARM. It is located next to the Start Interlock Terminal.

The alarm circuit in the Actuator is designed to operate a relay in an alarm system supplied by others. The resistance through the Actuator to ground is approximately 21 ohms. Maximum current draw should not exceed 250 milliamperes.

7.4 GEAR OIL PRESSURE INTERLOCK

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

To take advantage of the Gear Pressure Interlock, the 580 Actuator must be set up to use the 'HI' / 'LO' Idle option described in Section 7.1. This means that the fifth station is not available.

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

The requirement is a N.C. (Normally Closed) pressure switch with a trip point adjustable to match the gear manufacturers recommended setting. The pressure switch is supplied by others. The pressure switch is operated by the hydraulic clutch pressure of either the Ahead or Astern clutch.

When Terminals 3 and 4 of Station 5 (see Figure 10) are jumpered, the engine speed signal is blocked. Therefore, connect Station 5 terminals 3 and 4 to the N.C. pressure switch. The engine speed signal will be blocked until the clutch pressure opens the pressure switch contacts and then the engine speed signal will pass.

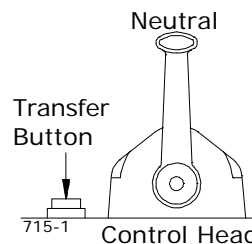
When up and running, if for any reason the clutch pressure should fall below the pressure switch setting, the engine speed will drop to Idle RPM.

8. OPERATOR INSTRUCTIONS

8.1 CONTROL SYSTEM START-UP

When the control system is turned 'ON', the MicroCommander System will automatically move to Neutral and Idle position.

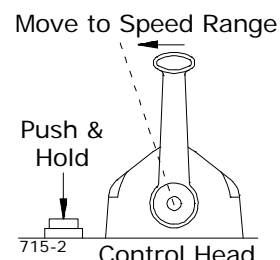
An intermittent 'TONE' will sound at all remote stations as no station has command. The operator must depress the station transfer button to get command. The tone will stop at all stations and the indicator light will be 'ON' at the Station-in-Command. Only one station has command at a time.



8.2 ENGINE START

There are three features related to main engine 'START'.

- The MicroCommander is interlocked to block the engine 'START' signal if the control system has not been turned 'ON'.
- The MicroCommander is interlocked to block the engine 'START' signal if the clutch selector lever is in the engaged position.
- The MicroCommander allows engine speed adjustment without engaging the clutch to help starting and warming up a cold engine. This is called 'WARM-UP' Mode.

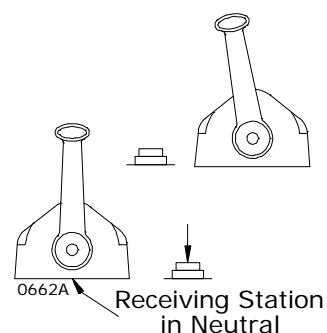


With the Control Head levers are in the Neutral position, depress and hold down the station transfer button, move the Control Head levers to the Ahead detent position. Now release the station transfer button. The indicator light will blink, showing the clutch has stayed in Neutral. The operator can now move the Control Head lever through the speed range and 'START' and warm-up the engine. To reset the normal control system function, the operator returns the Control Head levers to Neutral.

8.3 STATION TRANSFER

Only one remote station has command at a time. Command is transferred by a transfer push button. There is one push button at each remote station. When transferring remote stations, the Control Head lever of the Station-in-Command may be in any position. The station taking command must be in the Neutral position.

The light on the Control Head is red when the remote station has command. The indicator light at all other stations will be 'OFF'. Command remains unchanged for one second after the red light to allow the operator time to move the Control Head lever from Neutral to a position approximately matching the last speed setting.



9. MORSE CLUTCH AND THROTTLE KIT SELECTION

9.1 PRE-ENGINEERED THROTTLE CONNECTION KITS

ENGINE MAKE	ENGINE MODEL	KIT NO.
Caterpillar	334, 3304, 3306	36680
	3406 & 343	36680
	3408	36680
Chrysler	N1SSANM633	-----
Cummins	A11 w/MV5GOV	300580
	AFC Fuel pump	36680
	V504M, V555M, V903M, VT903M, VTA903M, NT855M, VT1710M, VTA1710M, KT & KTA	
	115M, KT & KTA 2300M, 1975 and later	

ENGINE MAKE	ENGINE MODEL	KIT NO.
General Motors	3, 4, & 6-71 w/var.sp.gov.	41736
	6, 8, 12 V-71 & 6, 8 V-92 w/var.sp.gov.	41736
	6-71 inclined	36680
	2, 3, 4-53 w/left hand gov.	36680
	Right hand gov.	36680
	6V-53 Rear entry	36680
	6V-53 Front entry	36680
	6, 8V-71 Front entry	36680
	12, 16V-149	36680
Perkins	4, 236M	48931
	6, 3544M; T6, 3544M; ST6, 3544M; SST6, 3544M	302026
	4, 108 W/shut off	303878

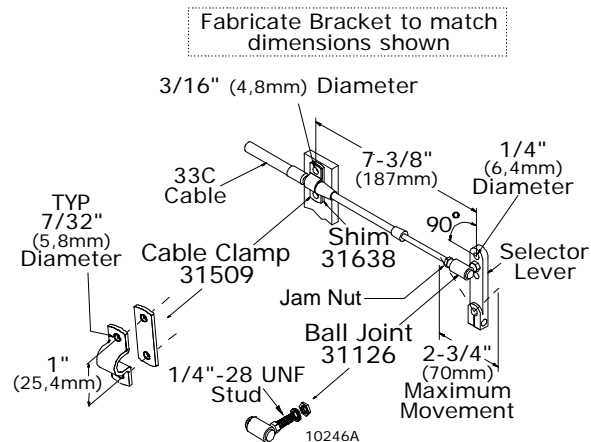
9.2 PRE-ENGINEERED CLUTCH CONNECTION KITS

GEAR MAKE	GEAR MODEL	KIT NO.
Borg Worner	70, 71, 72 In line w/red gear rear entry	301474
Capital	12400	36680
	2, 3, & 4 HD & HE	36680
Caterpillar	7200 Series	NA
Mer cruiser	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

9.3 OUTBOARD AND I/O CABLE CONNECTION KITS

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

10. UNIVERSAL MOUNTING FOR 33C TYPE CABLE



11. REFERENCES

11.1.1 American Boat and Yacht Council (ABYC)

P.O. 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. 50EC

11.1.2 Code of Federal Regulations

33 CFR 183 Subpart I - Electrical Systems
183, 410 Ignition protection
183, 415 Grounding
183, 425 Conductors: General
183, 430 Conductors in circuit of less than 50 Volts
183, 445 Conductors: Protection
183, 455 Overcurrent and Protection:
General
46 CFR 111.01 - 15(b) Ambient Temp.
Machinery Spaces 50EC
111.05 - System Grounds

11.1.3 Society of Automotive Engineers

400 Commonwealth Drive
Warrendale, PA 15096
J917 Marine Push-Pull Cables
J1171 External Ignition Protection
J1428 Marine Circuit Breakers
J378 Marine Engine Wiring

11.1.4 National Marine Manufacturers Association

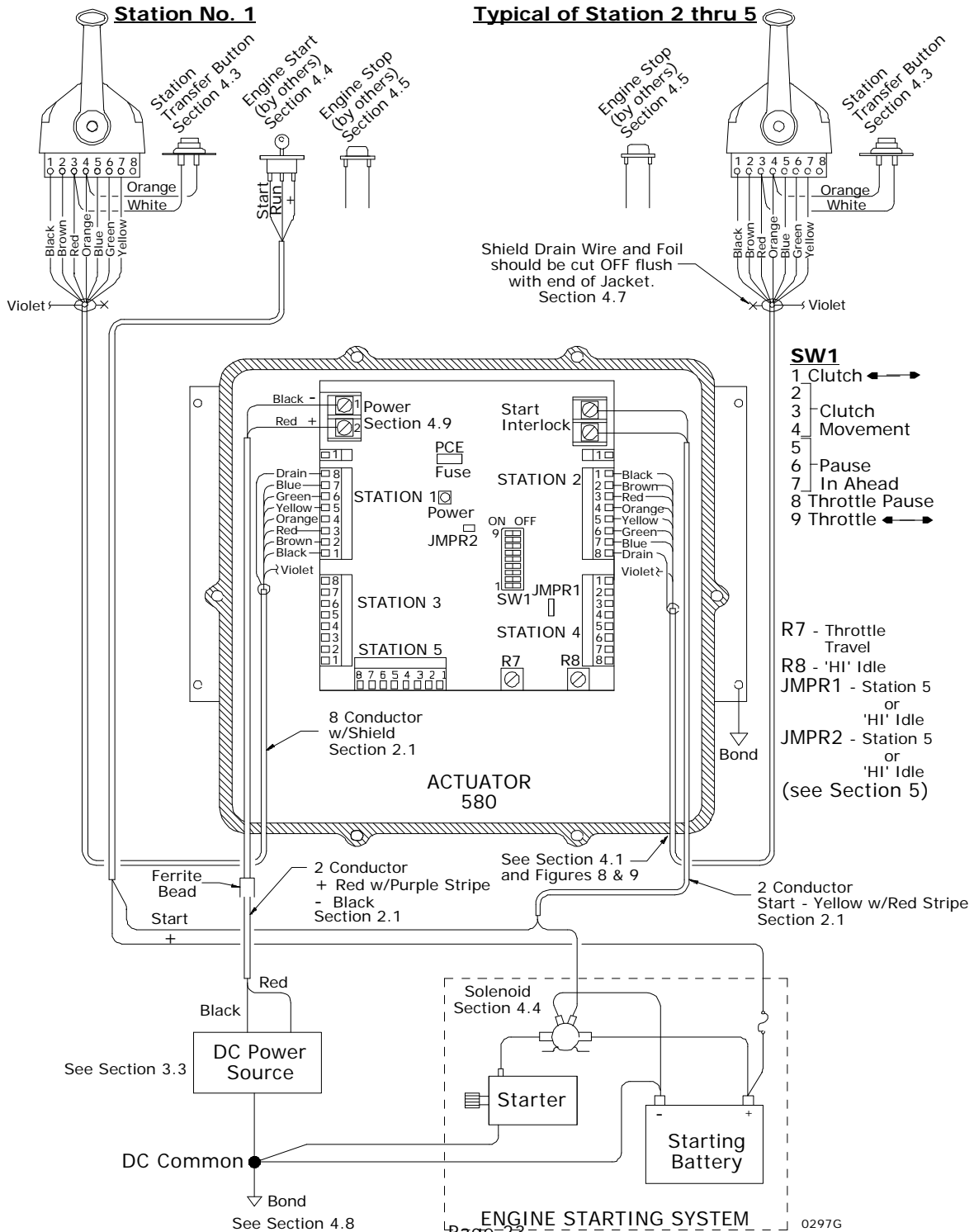
401 North Michigan Avenue
Chicago, IL 60611

11.1.5 Underwriters Laboratories

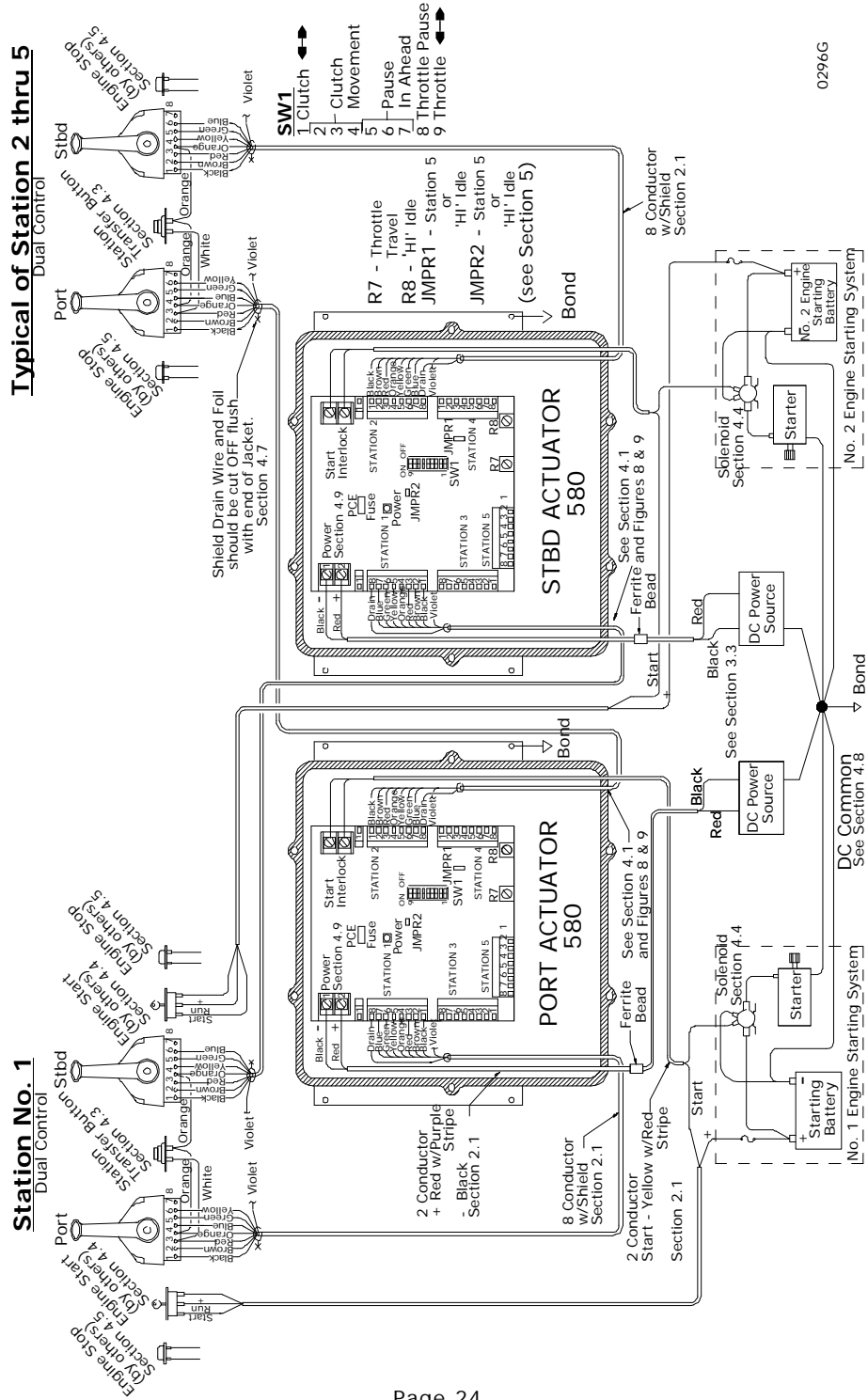
11.2 PARTS SOURCE

ANTI-STATIC WRIST STRAP, Thomas & Betts (Pc.No. AWCC)	Pc.No. 517
CIRCUIT BREAKER, E-T-A Manufacturer (Pc.No. 41-2-514-LN2-10) UL Approved	Pc.No. 810
FUSE, Bussman (Pc.No. PCE - :)	Pc.No. 840
WAGO TOOL, WAGO (Pc.No. 236-332)	Pc.No. 397
RELAY 12 VDC, Potter-Brumfield (Pc.No. KRPA5D6-12)	Pc.No. 1114

12. SINGLE SCREW CIRCUIT



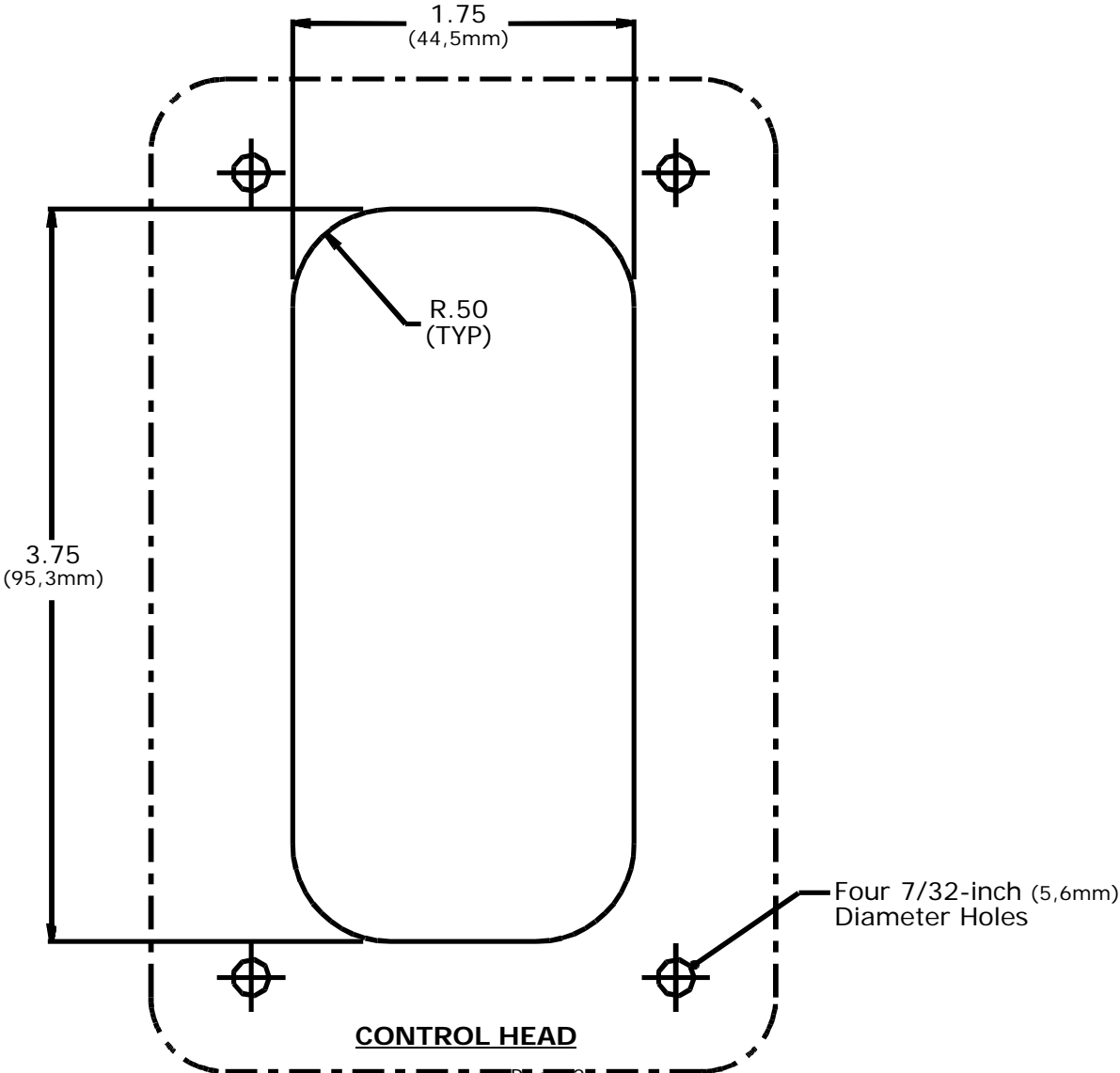
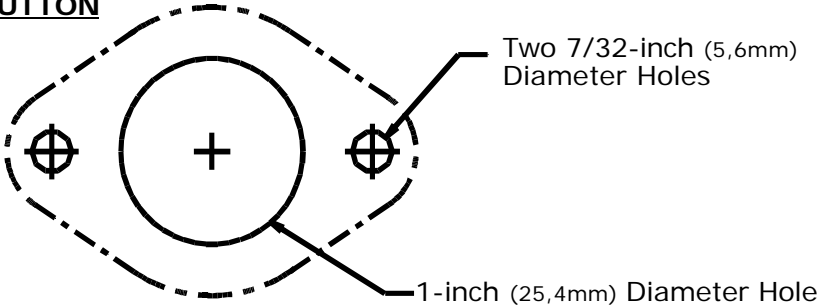
13. TWIN SCREW CIRCUIT



0296G

14. TEMPLATE

TRANSFER BUTTON



15. MAINTENANCE

15.1 ACTUATOR

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

15.2 CONTROL HEAD

The Control Heads should be checked at least once a year to insure the plug connections are secure and free of corrosion. The plug contacts should be checked and a light coating of Teflon grease or corrosion block applied.

16. TROUBLE SHOOTING

16.1 SYMPTOM: CANNOT TAKE COMMAND AT ONE STATION

CAUSE

- A) Control Head lever(s) is not in Neutral.
- B) Bad electrical connection or miswired at Control Head or at Actuator.

REMEDY

- A) Place Control Head lever(s) in Neutral.
- B) Check all connections of Control Head and Actuator. Pull wires to be sure they are tightly connected.

NOTE: *To prove the Control Head, install it at a known operating remote station. To prove the wiring, install an operating Control Head from another remote station.*

16.2 NO POWER (POWER INDICATOR LIGHT IS 'OFF')

CAUSE

No power to Actuator

REMEDY

- Fuse GDC-1A is blown. This can be caused by debris on the circuit board.
- Check power supply.
- Locate cause, blow clear. Then replace fuse. Spare fuse taped to circuit board

16.3 SYMPTOM: STARTING ENGINE BRINGS ON INTERMITTENT TONE AND ENGINE WON'T CRANK.

CAUSE

Voltage has dropped so low, Actuator turned 'OFF' and opened start interlock relay. Weak battery.

REMEDY

Charge battery or consider changing control system power source.

NOTE: As "come home" to bypass a bad start interlock relay in the Actuator, the start interlock leads can be connected. Now the engine can be started without the control system being turned 'ON' The problem must be corrected as soon as possible.

16.4 SYMPTOM: HIGH RATE TONE AT CONTROL HEAD WHEN SHIFTING OR MOVING UP IN THE SPEED RANGE

CAUSE

- A) Shift cable or speed cable throw not matched to engine requirement.
- B) Cable is jamming.

REMEDY

- A) Follow Control Head set up procedures in Sect. 5.3.
- B) Look for damaged cable.

16.5 SYMPTOM: STEADY TONE AT CONTROL HEAD.

CAUSE

- A) Possible low voltage
- B) Possible component failure.

REMEDY

- A) Check for low voltage to Actuator. May be a voltage dip.
- B) Contact your MicroCommander Dealer.

16.6 SYMPTOM: ONE LONG - ONE SHORT TONE AT THE CONTROL HEAD.

CAUSE

Shift Feedback Error.

REMEDY

Depress the transfer button twice. Contact your MicroCommander Dealer at first opportunity.

16.7 SYMPTOM: ONE LONG - TWO SHORT TONES AT THE CONTROL HEAD.

CAUSE

Throttle Feedback Error.

REMEDY

Depress the transfer button twice. Contact your MicroCommander Dealer at first opportunity.

NOTE: 580 Circuit Boards may be changed in the field.

17. WARRANTY AND REGISTRATION

MICROCOMMANDER LIMITED WARRANTY

Mathers Controls Inc. warrants this product to be free from defects in material, assembly, and tests, for one year from the date of purchase.

Any unit that fails during the warranty period will, at **Mathers Controls'** option, be repaired or replaced at no charge to the customer provided it is returned to **Mathers Controls** freight prepaid with proof of date of purchase and a description of the malfunction. **Mathers Controls** is not responsible for any charges related to removal or installation of the product. Repair or replacement during the warranty period will not extend the basic warranty period.

This warranty does not apply to a **MicroCommander** product that has failed due to improper installation, misuse, or accident, nor does it apply to products repaired or altered outside the **Mathers Controls** factory unless authorized in writing by **Mathers Controls Inc.**

This warranty does not include incidental or consequential damages and **Mathers Controls** disclaims any liability for any such damages. All implied warranties, if any, are limited in duration to the above stated one year warranty period. Some states and provinces do not allow the exclusion or limitation of incidental or consequential damages, therefore, the above limitations may not apply to you. **The completion and return of the enclosed registration card is a condition precedent to the warranty coverage.** This warranty gives you specific legal rights that may vary from country to country, state to state, and province to province.

This warranty is limited only to the original purchaser of the unit.

Mathers Controls asks that the **MicroCommander** Installation Approval label on the 580 Actuator be completed by a Factory Authorized Dealer. If the control systems are owner or shipyard installed, a Factory Authorized Dealer should check and approve the installation.

**MICROCOMMANDER
WARRANTY REGISTRATION**

Actuator, Serial # _____ Serial # _____

Number of Remote 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 _____

MicroCommander Product First Seen At:

- Boat Show Dealer Magazine Friend

MMC-163



Mathers Controls Inc.
675 Pease Road
Burlington, WA 98233-3101

Please fold here

Fold here
