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Synchronization

Manual

MM14410 Rev.A 10/01

MicroCommander Synchronization Manual

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Revisions List

Rev	Date	Revision Description
-	**10/01**	**Placed MM12793 Synchronization Section into this manual.**
A	**10/01**	**Revised for current Standards. Please review entire manual.**

Effective only for 585CE Actuators with Serial Numbers B01001 and up.

1.0 GENERAL INFORMATION

NOTE: (1) The MicroCommander Control System must be completely installed and thoroughly tested as a system before installing the Synchronization Option.
(2) The Synchronization option is not compatible with diesel engines using Speed-limiting Governors.

1.1 OPERATING PRINCIPLES

Mathers' engine synchronization requires a minimum of a twin-screw installation. One of these engines is designated as the **Lead** and one to three engines is designated as the **Follow**. Synchronization may be installed on twin, triple, and quad screw vessels. For the purpose of this manual, we have elected to use a twin-screw installation and make the **Port** engine the **Lead** and the **Starboard** engine the **Follow**. The drawings, diagrams and instructions reflect this concept.

The remote stations controlling the Follow engine may have a green LED (Light Emitting Diode), located by the Starboard lever, which indicate the status of synchronization. If you are adding synchronization to an existing system, you may have a Control Head lacking this green LED. The system will synchronize without the green LED, but you will not have the visual indication. (Reference "PARTS LIST" on page 9)

Initial power-up of the MicroCommander system enables Synchronization Mode. Synchronization of the engines will automatically start when both the Port and Starboard Control Head levers are:

- Commanding Ahead,
- Commanding at least 5% of the speed range,
- Within a 10% "Window" of each other.

The Follow Actuator receives an AC signal, which is representative of engine RPM, from both the Port and Starboard engines. These signals are shaped and compared within the Processor. The Follow Actuator then makes the needed adjustments to its' Throttle Push-pull cable until the RPM's of the Port and Starboard engines are synchronized.

A green LED, mounted on the Control Head, will blink slowly while the system is working toward synchronizing the engines. Once the green LED becomes lit steady, the engines' are synchronized.

Synchronization automatically deactivates when one Control Head lever moves beyond the 10% window or drops below 5% of the speed range. When this occurs, the green LED turns 'Off', indicating that the engines are not synchronized.

The operator has the option of disabling synchronization from any remote station by depressing the Transfer Button at the Station currently in command for one second. The green LED will extinguish, indicating that synchronization mode is no longer active.

To disable Synchronization Mode, depress and hold the Station Transfer Button for one second when the Control Head levers are above 10% Throttle in Ahead. The green LED will turn 'Off', indicating that Synchronization has been disabled.

To re-enable Synchronization Mode, match the Control Head levers above 10 percent throttle in Ahead. Depress and hold the Station Transfer Button for one second. The green LED will light indicating that Synchronization Mode is again active

WARNING: A sudden change of RPM may occur on the starboard engine when synchronization is first disabled. This change may be an increase or decrease in RPM, and can be up to 10%. The resulting change in RPM may result in a sudden pull to either the Port or Starboard side.

1.2 PARTS REQUIRED

The following parts, above and beyond the basic installation, are required for synchronization. Refer to "PARTS LIST" on page 9

Follow Auxiliary Circuit:	(Part No.1135 or 1135-1. See Section 2.3)
Lead Auxiliary Circuit:	(Part No.1133)
Eight-conductor Shielded Cable:	(Part No.180)
Engine RPM Pulse Signal:	(Part No. 8902 or 8912. See Section 2.3.3)
3-Conductor Shielded Cable:	(Part No. 2241)
Dual Control Head w/ Green LED:	(Various Options. Refer to "PARTS LIST" on page 9)

2.0 INSTALLATION

The Synchronization option requires the installation of the following:

- Install either a Dual Control Head with a green LED or utilize the existing Dual Control Heads. The green LED is purely an indication of synchronization and has no impact on the actual operation.

NOTE: 1) If installing synchronization on a new or existing system having Control Heads with a green synchronization LED, connect the violet wire at each Control Head starboard terminal block to pin 8. Proceed to. Section 2.2.
2) If installing synchronization on an existing system having Control Heads with no green synchronization LED, proceed to Section 2.1

- Install a Lead Auxiliary Circuit Board (Part No. 1133) in the Lead (Port) Actuator.
- Install a Follow Auxiliary Circuit Board (Part No. 1135 or 1135-1) in the Follow (Starboard) Actuator.
- Provide pulse signals, representing the engines' RPMs, to the Follow (Starboard) Actuator.

2.1 REMOTE CONTROL HEADS WITH SYNCHRONIZATION LED

NOTE: Refer to the drawing "Twin Screw with Synchronization" on page 11 for specific connection information.

A) Remove the existing Control Head(s) from the Console.

B) Disconnect all eight-conductors from both the Port and Starboard sides.

C) Connect the Starboard eight-conductor cable Violet wire to Terminal 8 on the Starboard terminal block of the new Control Head. Connect the remaining wires per the drawing "Twin Screw with Synchronization" on page 11.

D) Mount the Control Head to the Console.

E) Repeat steps A) through D) at all the desired Remote Stations.

2.2 PORT AUXILIARY BOARD (LEAD)

WARNING: Static electricity can destroy electronic components. Always connect the wrist strap provided to the Actuator's frame when working inside the Actuator. This will drain any static electricity you may have on your person.

The Lead Auxiliary Board (P/N 1133) will install in the Port Actuator.

A) Remove the Port Actuator's cover. When not working on the Actuator, keep the cover in place to prevent damage to the circuits.

B) Connect the anti-static wrist strap to your person, and the alligator clip to the Actuator's aluminum frame.

C) Plug the Lead Auxiliary Board into the Actuator's 25-pin connector. Refer to the drawing "Twin Screw with Synchronization" on page 11 for the location.

D) Secure the Lead Auxiliary Board to the Actuator's frame with the three 4-40 x 1/4 inch screws provided.

2.3 CHOOSING THE PROPER FOLLOW AUXILIARY BOARD

1135 Auxiliary Board (Refer to Figure 1:)

The 1135 Follow Auxiliary Board requires an electric pulse input in proportion to RPM from each engine. This Auxiliary Board's circuit contains a filter that allows higher frequencies to pass than the 1135-1 Auxiliary Board permits. Therefore, it is typically used with Magnetic Flywheel Pickups (8912) that count the number of teeth on the flywheel and generally reach higher frequencies.

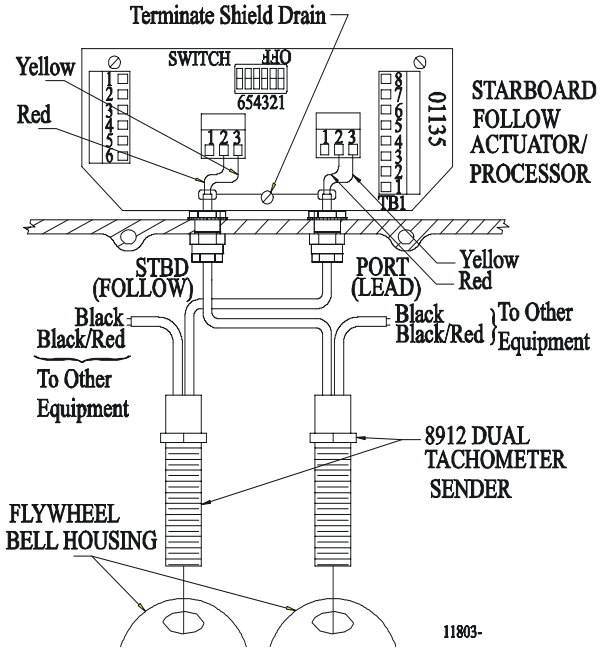


Figure 1: 01135 Magnetic Flywheel Pickup Engine Signal Input

1135-1 Auxiliary Board (Refer to Figure 2: and Figure 3:)

The 1135-1 Follow Auxiliary Board requires electric pulse input in proportion to the RPM of each engine. This Auxiliary Board contains a "Low Pass" filter that rejects any frequencies over a certain level. This filter prevents unwanted electrical noise from being introduced to the Actuator. The Auxiliary Board is generally used when the source of the signal is a Mechanical Tachometer Sender (8902), an Alternator's Stator AC terminal, the point side or negative side of the coil or from an electronic ignition control module.

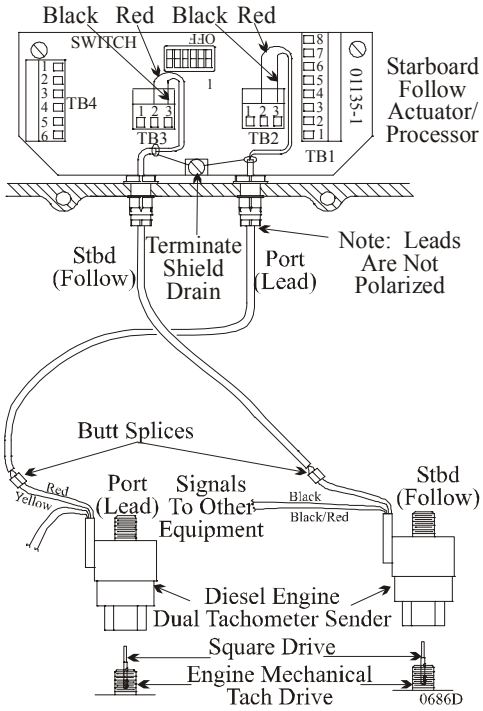


Figure 2: 01135-1 Tach Sender Engine Signal Input

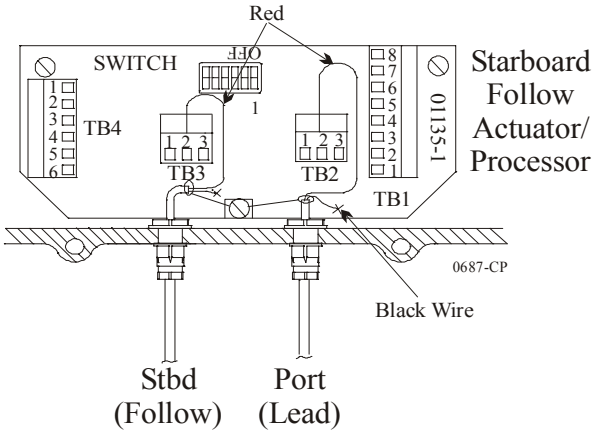


Figure 3: 01135-1 Alternator, Ignition Coil, or Electronic Ignition Control Module Engine Signal Input

2.3.1 Starboard Auxiliary Board (Follow)

The Follow Auxiliary Board (P/N 1135 or 1135-1) will install in the Starboard Actuator.

A) Remove the Starboard Actuator's cover. When not working on the Actuator, keep the cover in place to prevent damage to the circuit.

B) Connect the anti-static wrist strap to your person and the alligator clip to the Actuator aluminum frame.

C) Plug the Follow Auxiliary Board into the plug connector of the Actuator. Refer to the drawing "Twin Screw with Synchronization" on page 11 for the location.

D) Secure the Follow Auxiliary Board to the Actuator's frame with the three 4-40 x 1/4 inch screws provided.

E) Locate the two 1/2 inch central entry holes and remove the plastic plugs. Refer tFigure 4:4 for the location of the holes.

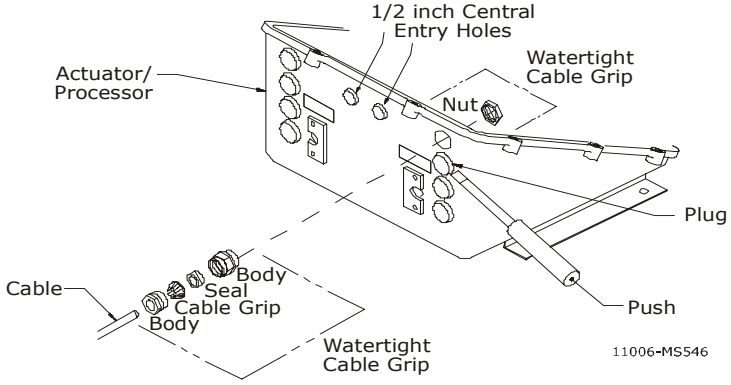


Figure 4: Plug Removal

F) Install two 1/2 inch Liquid Tight Connectors provided, into the two 1/2 inch central entry holes

G) Run the Tachometer Signal Cables through the Liquid Tight Connectors and tighten the nuts.

H) Strip the Insulating jacket off the cable just past the point where it enters the inside of the Enclosure.

I) Strip 3/8 inch (9,5 mm) of insulation off of the Black and Red conductors.

J) Connect the Black conductors to TB2-3 & TB3-3 and the Red conductors to TB2-2 & TB3-2 as shown in Figure 2: and Figure 3: or the Red conductors only, as shown in Figure 1:.

K) Terminate the Drain (Shield) wire under the Auxiliary Board's mounting screw as shown in Figure 1:, Figure 2:, or Figure 3:.

2.3.2 Follow Actuator's Violet Wire Connections

NOTE: If the violet wire does not have sufficient length to reach Terminal Block TB4 or TB1 on the Follow Auxiliary Board, you may butt-splice an additional length of wire.

A) Unwrap the Violet wire from the Starboard Actuator's eight-conductor cable at Station 1.

B) Strip 3/8 inch (9,5 mm) off of the Violet conductor.

C) Use the WAGO tool provided and connect the Violet conductor to the appropriate Terminal on the Follow Auxiliary Circuit Board.

D) Connect all of the Starboard Actuator's eight-conductor cable's Violet wires as follows:

- Station 1- Terminal 1 of TB4
- Station 2- Terminal 8 of TB1
- Station 3- Terminal 2 of TB4
- Station 4- Terminal 7 of TB1
- Station 5- Terminal 3 of TB4

2.3.3 Signal Connections at the Engines

1135 with Flywheel Magnetic Pickups (Refer to Figure 1: .)

A) Screw down the Dual Magnetic Pickup (Part No. 8912) into the Flywheel Bell Housing until light contact is made with one of the teeth.

B) Back off on the Pickup 1/2 of a turn and then tighten down the locking nut.

C) Butt splice the Red and Yellow wires on the Dual Mechanical Tach Senders to the tachometer cable; Red to Red and Yellow to Black.

D) Verify the Tachometer signal at the Follow Actuator with a Voltmeter. Check across terminals 2 and 3 of TB2 for the Port engine, and terminal 2 and 3 of TB3 for the Starboard engine. The output voltage, with the engines running at idle, should be 3 VAC or higher, increasing with RPM.

1135-1 with Mechanical Senders (Refer to Figure 2:.)

A) Screw down the Dual Mechanical Sender (Part No. 8902) into the Engines' Mechanical Tachometer Drive. Ensure the Drive key is in place.

B) Butt-splice the cable to the Red and Yellow wires on the Dual Magnetic Pickup.

C) Verify the Tachometer signal at the Follow Actuator with a Voltmeter. Check across terminals 2 and 3 of TB2 for the Port engine, and terminals 2 and 3 of TB3 for the Starboard engine. The output voltage, with the engines running at idle, should be 3 VAC or higher, increasing with RPM.

1135-1 with Electronic Ignition, Ignition Coils, or Alternator AC Terminal (Refer to Figure 3:.)

A) The cable connects to the electronic ignition module, negative or point side of the engine coil or the alternator's stator AC terminal. Refer to the engine manufacturer's data for specific connection information.

B) When the cable connection is complete, verify that a pulsating 12 or 24 VDC is present at terminal 2 and 3 of TB2, and terminals 2 and 3 of TB3 of the 1135-1 Auxiliary Board.

2.3.4 Port and Starboard Actuators Interconnecting Eight-Conductor Cable

A) Locate an unused hole on the right side in both the Port and Starboard Actuators and remove the plastic plugs.

B) Install a 3/4 inch Liquid Tight Connector into both of the holes.

C) Run a length of eight-conductor cable between the Actuators through the Liquid Tight Connectors.

D) Strip back the PVC cover to the point just inside the Actuator's Enclosure.

E) Strip 2/3 inch (9,5 mm) off each end of the green wire only.

F) Connect the green wire using the WAGO Tool to Terminal 6 of TB1 on both the Lead and Follow Auxiliary Boards.

G) Connect the Drain (Shield) wire to the Starboard Actuator's mounting screw only. Do Not connect the shield on the Port side.

H) Wrap the remaining conductors out of the way and secure with tape for possible use later.

3.0 OPERATION CHECKS

Verify that Synchronization occurs automatically when both Control Head levers are Ahead, above 5% of throttle range, and within 10% of equal RPM.

NOTE: Synchronization checks must be done underway with gasoline engines

A) Disconnect the Shift Push-pull Cables at the transmission. Ensure that the Control Head Shift levers are in the Neutral position.

CAUTION: Make sure the Shift lever at the gear, outdrive, or outboard, will not be moved from the Neutral position while checking synchronization operation!

B) Start the engines.

C) Move the Station-in-Commend Control Head levers Ahead to approximately 1500 RPM. The Control Head's green LED should blink and then light steadily. The engines should now be synchronized; if they are not, perform the steps below:

3.1 CHECKS

A) Check the wiring connections; refer to Figure 1:, Figure 2:, Figure 3:, and the drawing "Twin Screw with Synchronization" on page 11.

B) Check that the connections for the electric pulse at the Follow Actuator are: Port engine (Lead) at Terminal Block TB2 and Starboard engine (Follow) at Terminal Block TB3.

C) In Diesel applications with Magnetic Flywheel Pickups, check the 1135 Auxiliary Board for 3.0 VAC or greater at idle between Terminals 2 and 3 on Terminal Blocks TB2 and TB3.

Or

In Diesel applications with Mechanical Senders, check the 1135-1 Auxiliary Board for 3.0 VAC or greater at idle between Terminals 2 and 3 on Terminal Blocks TB2 and TB3.

Or

In applications where the Alternator's AC Stator or the Negative or Point side of the Coil is the Signal Source, check Terminals 2 and 3 of Terminal Blocks TB2 and TB3 for pulsating 12 or 24 VDC.

Or

In Gasoline Engine applications with Electronic Ignition, check Terminals 2 and 3 at Terminal Blocks TB2 and TB3 for 3.0 VAC at Idle, increasing with RPM.

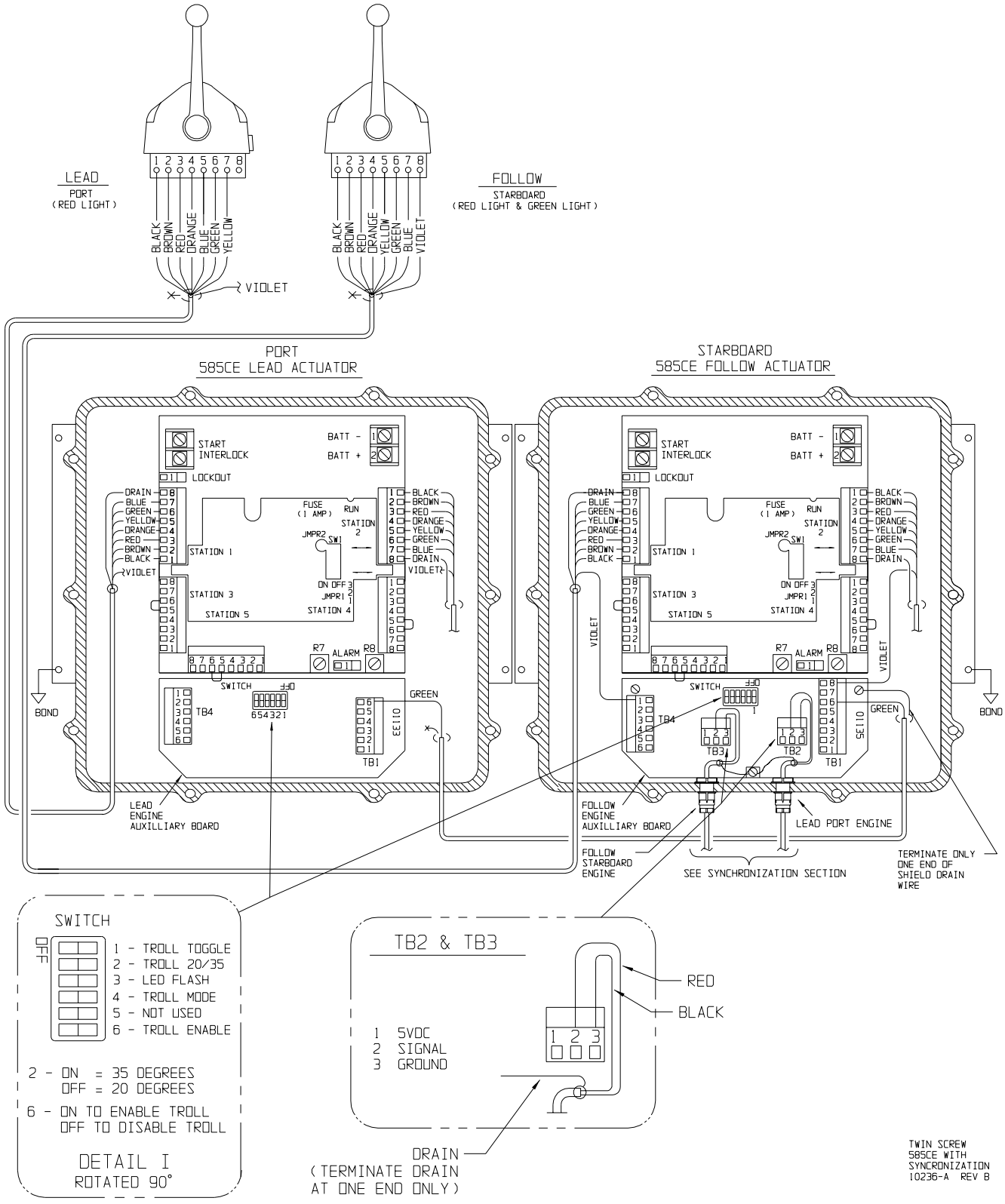
D) With a DC Voltmeter, check the voltage at Terminal 6 of TB1 on the Follow Auxiliary Board. The measurement should be 10- 14VDC when both Control Head levers are commanding Ahead at 1500 RPM's.

NOTE: Refer to the Installation Manual supplied with your original control system for further Control Head requirements, operation principles, and checks.

PARTS LIST

PART NO.	DESCRIPTION		
ACTUATORS			
585CE	Actuator	(Shift & Speed)	Multi-voltage
813CE	Actuator	(Trolling)	Multi-voltage
CONTROL HEADS			
SINGLE SCREW			
450-3L or 3R	Left or Right Control Head, 'T' Lever		
453-3L or 3R	Left or Right Control Head, Chrome Knob Lever		
455-3L or 3R	Left or Right Control Head, Black Low Profile Lever		
456-3L or 3R	Left or Right Control Head, Chrome Low Profile Lever		
750-L or –R	Left or Right Control Head, Heavy Duty		
TWIN SCREW (Synchronization Indication)			
460-4	Control Head, 'T' Lever		
463-4	Control Head, Chrome Knob Lever		
464-4	Control Heads, Split, with Single Levers, Chrome Knobs (pair)		
465-4	Control Head, Black Low Profile Lever		
466-4	Control Head, Chrome Low Profile Lever		
760	Control Head, Heavy Duty		
MC2000-1	Black Head, Black Levers		
MC2000-2	Chrome Head, Chrome Levers		
MC2000-3	Gold Head, Gold Levers		
MC2000-4	Black Head, Chrome Levers		
MC2000-5	Black Head, Gold Levers		
CABLE (Electric)			
180	8-Cond. Shielded Cable	Per/ft.	
350	8-Cond. Shielded Cable	500' Spool	
11811	8-Cond. Shielded Cable	1000’ Spool	
212	2-Cond. Power Cable	Per/ft.	
349	2-Cond. Power Cable	250' Spool	
183	2-Cond. Start Interlock Cable	Per/ft.	
355	2-Cond. Start Interlock Cable	250' Spool	
585CE AUXILIARY CIRCUIT BOARDS FOR OPTIONAL SYNC OR TROLL			
1133	Auxiliary Circuit Board		Lead Actuator
1135	Auxiliary Circuit Board	(Mag. Pickup ONLY)	Follow Actuator
1135-1	Auxiliary Circuit Board		Follow Actuator
585CE ADDITIONAL PARTS FOR OPTIONAL SYNC			
8902	Mechanical Tachometer Sender (Dual)		
2241	Tachometer Wire - Shielded		
8912	Magnetic Pickup (Dual) 3/4 x 16		

Twin Screw with Synchronization



1 - ON - ENABLES TROLL TOGGLE
OFF - DISABLES TROLL TOGGLE

2 - ON - 35 DEGREES
OFF - 20 DEGREES

3 - ON - TROLL BLINKING LED
OFF - TROLL SOLID LED

4 - ON - NON-TROLL ON POWER-UP
OFF - TROLL ON POWER-UP

5 - NOT USED

6 - ON - TROLL ENABLED
OFF - TROLL DISABLED