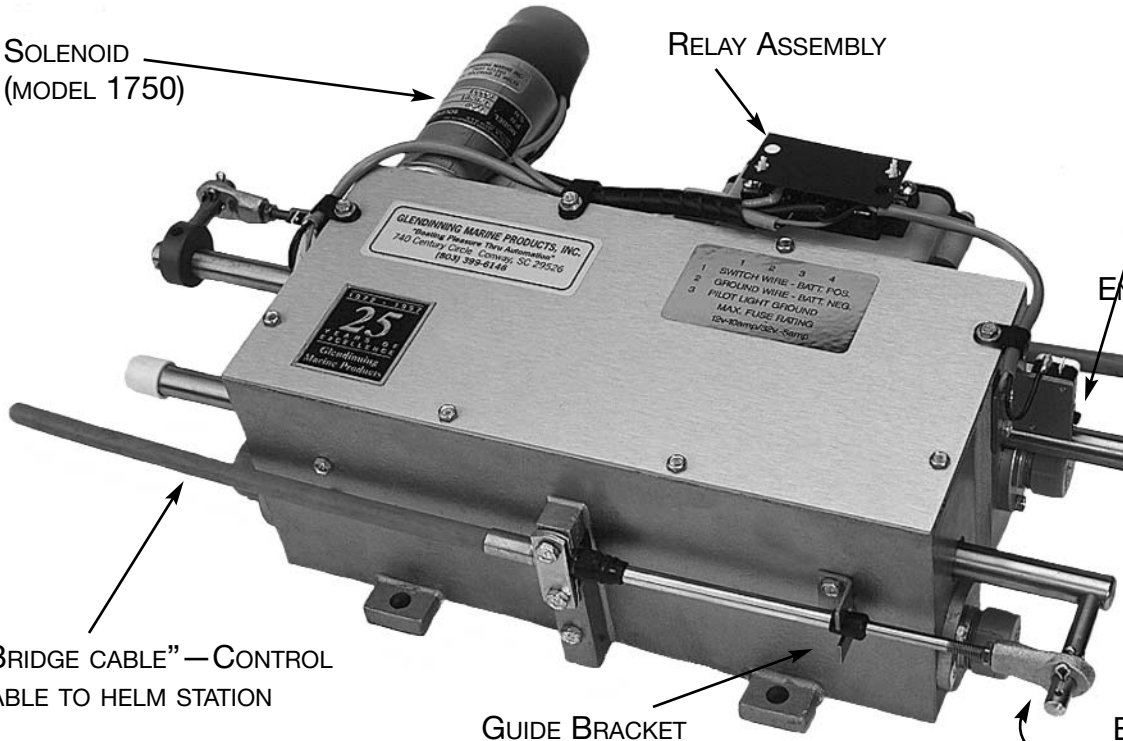
AUTOMATIC SYNCHRONIZER

TROUBLESHOOTING GUIDE



SOLENOID (MODEL 1750)

RELAY ASSEMBLY

LIMIT SWITCH

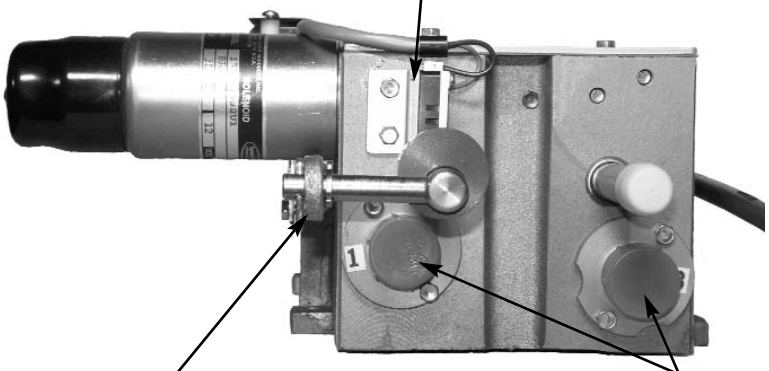
ENGINE CABLE — CABLE TO ENGINE THROTTLE

"RED COLLAR" — ADJUST LIMIT SWITCH OPERATION

"BRIDGE CABLE" — CONTROL CABLE TO HELM STATION

GUIDE BRACKET

BRIDGE CABLE TERMINAL — ADJUST HERE FOR BRIDGE CABLE OVERTRAVEL

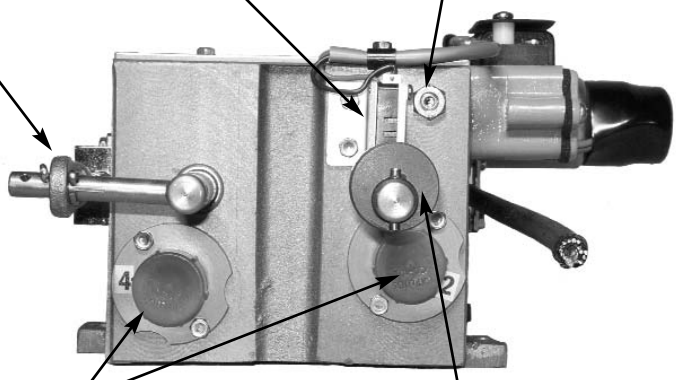


LIMIT SWITCH

BRIDGE CABLE TERMINAL — ADJUST HERE FOR BRIDGE CABLE OVERTRAVEL

ENGINE CABLE TERMINAL — ADJUST HERE FOR THROTTLE CABLE OVERTRAVEL

TACH SENDER EXTENSIONS SCREW IN HERE



LIMIT SWITCH

CLUTCH ADJUSTMENT SCREW

"RED COLLAR" — ADJUST LIMIT SWITCH OPERATION

General Guidelines for Troubleshooting

1) As a first step, verify that synchronizer is working electrically. If necessary apply voltage directly to solenoid.

2) When testing Synchronizer operation, move control handles to mid-travel position before turning Synchronizer ON. Some problems, such as idle speed limit switch or lead engine drive cable failure can be hidden if Synchronizer is turned ON at idle engine speed.

3) If Synchronizer does not appear to be matching engine speeds exactly, manually synchronize engines (by ear). Observe tachometer readings. Turn ON Synchronizer and observe changes in slave engine speed.

4) If mechanical drive adapter fails very radpidly (less than 4-6 months), mechanical drive adapter is misaligned.

5) If Synchronizer has suddenly stopped operating, determine if other work was performed on boat recently. Sometimes other work—such as engine governor repairs or control cable replacements, can change Synchronizer cable adjustments causing problems with Synchronizer operation.

6) If slave engine speed varies, determine if lead engine speed is also varying. When Synchronizer is operating, it will attempt to continuously match slave engine to lead engine speed. If lead engine RPM varies or fluctuates, Synchronizer will strive to repeat variation / fluctuation in speed of slave engine. Of course, Synchronizer has no control of lead engine RPM; the Synchronizer only controls slave engine speed.

7) **IF** Synchronizer has been electrically activated, and **IF** Synchronizer is receiving RPM signal from both engines with correct input rotation, and **IF** Synchronizer clutch is not slipping->Synchronizer must operate; unit will attempt to exactly match slave engine speed with lead engine.

Problem / Symptom:	**Synchronizer does not activate when control switch is turned on.**
Additional symptoms:	1) Pilot light may not illuminate 2) Synchronizer solenoid doesn't make any noise 3) When moving slave engine handle after turning on switch, engine accelerates. Slave engine is not "disengaged" from slave engine control.
Description of Operation:	*When Synchronizer control switch is turned on, power should be applied to synchronizer solenoid input terminals. When power is applied to solenoid input terminals, it will make a sharp, metallic, sound and slave engine handle will be "disconnected" from slave engine control.*
Possible Problem	Recommended actions
Fuse is blown	A fuse is typically installed at the control switch. Check and / or replace fuse. (10 amps at 12 VDC; 5 amps at 24 or 32 VDC)
Broken power supply or ground connection wire	Power supply to synchronizer (relay box terminal #1) or ground wire (relay box terminal #2) connections may have broken or become disconnected. Check for voltage across relay box terminals #1 and #2 when switch is turned on; if none; verify wiring connections.
Relay assembly / limit switch failure	Change ground wire connection at relay box from terminal #2 to terminal #3. If unit becomes operational, replace relay box assembly 12 VDC relay – PN 03312 24 or 32 VDC relay – PN 03324 NOTE: Synchronizer may be used temporarily with ground wire connected to terminal #3. Limit switches will be disabled; avoid using synchronizer at idle or full throttle speed when limit switches are disabled.

Limit switch collars ("red collars") are not set correctly	Move slave engine control handle away from idle speed position. Turn switch off and on. If synchronizer now activates, idle speed limit switch is incorrectly set.
Solenoid failure	Disconnect wires from solenoid and apply correct voltage directly to solenoid terminals. If solenoid does not make any noise, solenoid has failed.

Problem / Symptom:	**Synchronizer solenoid "chatters" or repeatedly clicks when control switch is turned on.**
Additional symptoms:	1) Pilot light is dim 2) Solenoid may hum instead of clicking or chattering 3) Fuse may blow after short time
Description of Operation:	*When Synchronizer control switch is turned on, the solenoid requires a large amount of power (approximately 20 amps) to pull in its internal plunger.*
Possible Problem	Recommended actions
Low voltage	Check voltage applied to solenoid terminals when synchronizer is turned on. At least 90% of full rated voltage must be applied to solenoid terminals during startup. Voltage may be reduced due to corroded or too small power supply or ground wire connections, low battery, etc. To test solenoid, use wire jumpers to apply battery voltage directly to solenoid terminals.
Hold-in coil of solenoid defective.	Replace solenoid
Synchronizer clutch is over-tightened	If the synchronizer clutch is overtightened, the solenoid will not be able to completely pull in the internal plunger. Readjust clutch (see manual Section K).

Problem / Symptom:	**After turning on Synchronizer, pilot light goes out after several seconds.**
Additional symptoms:	None
Description of Operation:	*When Synchronizer control switch is turned on, the pilot light should remain on. Synchronizer should be able to operate at any speed between idle and full throttle. If slave engine idle is set at a speed higher than lead engine idle, synchronization will not be possible at idle speed.*
Possible Problem	Recommended actions
Synchronizer turning off automatically on idle speed limit switch.	Advance lead engine to 50 – 100 RPM above idle before turning on Synchronizer. If desired to operate Synchronizer with lead engine at idle speed, have engine technician reset lead engine idle speed to 25 RPM above slave engine idle speed.
Idle speed limit switch is improperly set	Readjust idle speed limit switch, obtaining 1/16" to 1/8" gap between limit switch button and red collar when engine governor / throttle is at full throttle mechanical stop.
Slave engine tach input to synchronizer has failed	Check for failure in tachometer drive input from slave engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter.

Problem / Symptom:	**While operating with Synchronizer on, or immediately after turning on Synchronizer, slave engine RPM moves quickly to idle.**
Additional symptoms:	1) Pilot light may go out when slave engine speed reaches idle. 2) If lead engine tach input to Synchronizer has failed, helm station tachometer for lead engine may indicate 0 RPM.
Description of Operation:	*When Synchronizer is operating, speed of slave engine will be matched with speed of lead engine. If tachometer information from lead engine to Synchronizer indicates that lead engine has slowed or stopped, Synchronizer will try to match slave engine RPM, reducing slave engine speed to minimum (idle) speed.*
Possible Problem	Recommended actions
Lead engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from lead engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter. Be sure to check the following: DRIVE CABLE – cable core failure, cable end tip failure DRIVE JOINT – on many engines, a drive joint provides tachometer information to the Synchronizer. Disconnect the tachometer cable from the drive joint, start the engine, and verify that the outlet of the drive joint is rotating. MECHANICAL DRIVE ADAPTER – if a mechanical drive adapter has been installed on the engine, check the flex shaft for failure (broken cable, missing tip tang). Flex shafts will fail due to misalignment or lack of lubrication. Reinstall the flex shaft following the
Improper tachometer cable rotation	The Synchronizer is sensitive to the direction of the input tach cable rotation. For new system installations, or after work is done to the engine, it is possible that the tachometer cable rotation input is incorrect. Verify that the cable input rotation is installed per the matrix chart in the Technical Manual (Section E).
Problem / Symptom:	**While operating with Synchronizer on, or immediately after turning on Synchronizer, slave engine RPM moves quickly to full throttle.**
Additional symptoms:	1) Pilot light may go out when slave engine speed reaches full throttle. 2) If slave engine tach input to synchronizer has failed, helm station tachometer for slave engine may indicate 0 RPM.
Description of Operation:	*When Synchronizer is operating, speed of slave engine will be matched with speed of lead engine. If tachometer information from slave engine to Synchronizer indicates that slave engine has slowed or stopped, Synchronizer will try to match slave engine RPM, increasing slave engine speed to full throttle speed.*
Possible Problem	Recommended actions
Slave engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from slave engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter. Be sure to check the following: DRIVE CABLE – cable core failure, cable end tip failure DRIVE JOINT – on many engines, a drive joint provides tachometer information to the Synchronizer. Disconnect the tachometer cable from the drive joint, start the engine, and verify that the outlet of the drive joint is rotating. MECHANICAL DRIVE ADAPTER – if a mechanical drive adapter has been installed on the engine, check the flex shaft for failure (broken cable, missing tip tang). Flex shafts will fail due to misalignment or lack of lubrication. Reinstall the flex shaft following the instructions contained in the technical manual.
Improper tachometer cable rotation	The Synchronizer is sensitive to the direction of the input tach cable rotation. For new system installations, or after work is done to the engine, it is possible that the tachometer cable rotation input is incorrect. Verify that the cable input rotation is installed per the matrix chart in the Technical Manual (Section E).

Problem / Symptom:	**While operating with Synchronizer on at or near wide open throttle (WOT), Synchronizer turns off by itself / pilot light goes out.**
Additional symptoms:	None
Description of Operation:	*The Synchronizer should be able to operate at any speed between idle and full throttle. If the lead engine is able to operate at a higher top end speed than the slave engine can run at, the Synchronizer may turn itself off since it will not be possible to synchronize at this speed.*
Possible Problem	Recommended actions
Synchronizer turning OFF automatically on full speed limit switch. (This is a normal function of the Synchronizer).	Turn Synchronizer control switch OFF and ON to reset Synchronizer. If pilot light turns OFF again, it is likely that the full speed limit switch is being activated—it is not possible for the Synchronizer to operate at this RPM. If it is necessary to run at wide open throttle, operate engines manually (Synchronizer OFF). If it is desireable to operate the boat with the Synchronizer ON, reduce the speed of the lead engine by 50-100 RPM and turn Synchronizer back ON.
Full speed limit switch is improperly set	Readjust full speed limit switch, obtaining 1/16" to 1/8" gap between limit switch button and red collar when engine governor / throttle is at full throttle mechanical stop.
Slave engine tach input to Synchronizer has failed	Check for failure in tachometer drive input from slave engine to Synchronizer. Problem can occur in drive cable, engine outlet drive joint, or in mechanical drive adapter.
Problem / Symptom:	**Synchronizer operation is sluggish; slave engine speed does not always match lead engine speed.**
Additional symptoms:	None
Description of Operation:	*If the Synchronizer is turned ON with a 100 RPM differential between the two engine speeds, approximately 5-6 seconds will be required to synchronize the engine speeds. If there is a larger speed difference when the Synchronizer is turned ON, a longer time will be required to match engine speeds. For a 900-1000 RPM speed differential between engines, perhaps seen when making large changes in the lead engine RPM, approximately 10-12 seconds will be required to adjust and match engine speeds.*
Possible Problem	Recommended actions
Synchronizer clutch is slipping.	Adjust Synchronizer clutch as described in the manual — Section K.
Problem / Symptom:	**After turning Synchronizer OFF, slave engine control handle is not able to control slave engine speed.**
Additional symptoms:	None
Description of Operation:	*When Synchronizer control switch is turned OFF, manual control of the slave engine must be reestablished. This is normally accomplished by moving the slave engine control handle back to the idle speed position, allowing the bridge control cable to be reconnected mechanically to the engine control cable.*
Possible Problem	Recommended actions
Lack of bridge cable overtravel—terminal eye on the control cable from helm station control is incorrectly adjusted.	Readjust the terminal eye on the bridge control cable at the Synchronizer to achieve proper overtravel — see Section J of the manual. NOTE: 1) If the overtravel adjustment is slightly OFF, slave engine control may be regained by very rapidly pulling the slave engine handle back to the idle position. On a 2-station boat, try regaining manual control at the other helm station. 2) The overtravel adjustment can be thrown off by improper adjustment of the stop screws at the control head.

Synchronizer Parts List

Part Number	Item Description	Part Number	Item Description
21202	Solenoid 12 volt - 1750 (new style)	99203	43C Cable clamp
21204	Solenoid 24 volt - 1750 (new style)	99202	Cable shim
21203	Solenoid 32 volt - 1750 (new style)	50202	Term eye (33C - 43C)
21205	Solenoid 12 volt - SL (old style)	50206	Red - Stop collar
21207	Solenoid 24 volt - SL (old style)	50204	Bearing retainer (1-2-3)
21206	Solenoid 32 volt - SL (old style)	51201	Long control rod
03312	Relay assembly - Sync 12 volt	51202	Short control rod
03324	Relay assembly - Sync 24 volt	52201	Sync worm shaft
03332	Relay assembly - Sync 32 volt	60208	Guide bracket
03900	Clutch cable assembly	60205	Switch bracket
99201	33C Cable clamp	03201	Tach sender extension