CETEC BENMAR AUTOPILOTS

Maintenance and trouble-shooting guide

Course Setter 21 and
Course Keeper 210

Maintenance

Although autopilots require relatively low maintenance there are several items that should be checked at least once a year to assure proper operation.

1. Autopilot Compass Assembly: Check for correct fluid level. (Air bubbles in the expansion chamber are normal, however, no air bubbles should be in in main chamber.) See Fig. #1.
2. Compass Contacts: Clean with alcohol and a clean cloth.
3. Plugs & connectors: Check to assure they are clean and free of corrosion. (Clean if necessary with WD-40 or similar subtance)
4. Chain and sprockets: Check for proper lubrication, alignment and chain tension.

Repairing and Shipboard Spares

Autopilots are normally easy to repair and in most cases can be done by the boat owner if he carries a few spare parts on board.

Cetec Benmar's CS21 and CK210 series of autopilots use integrated circuits (IC's) which are plugged into sockets and are easily replaced if one uses care when inserting. The correct orientation and insertion of all 16 pins in the socket is critical. All circuit boards are marked to show the correct orientation.

IC's are the most common failure in the autopilot since lighting or a sudden voltage spike may cause them to fail.

Since IC's are relatively inexpensive, you may wish to take the easy route & change all IC's at once rather than attempt to isolate the one defective IC. Changing of IC's will cure a large percentage of autopilot failures.

Recommended Ship Board Spare Parts Kit

4 each CD4016 2 each CD4011
4 each LM324 2 each CA3130
2 each RC4558

On long range cruises you may wish to carry a spare compass.

Trouble Shooting

First we will assume that the autopilot has been working properly, but now has failed. The following are a few of the most common problems, possible causes, and corrective action.

1. Symptom: Erratic operation or pilot occasionally goes off course.
   Cause: Dirty compass contacts, or low fluid level in compass.
   Cure: Clean compass plug with alcohol. If compass is low on fluid, replace compass.
2. Symptom: Autopilot erratic on some headings and very sluggish on others.
   Cause: Magnetic material has been placed near the autopilot compass such as a speaker, radio, flashlight, etc.
   Cure: Locate and remove magnetic material. This is very evident on CS21 type, since the dial no longer agrees with the ship's compass.
3. Symptom: Helm turns hard right or left when pilot is turned on.
   Cause: Defective IC in either the pilot house control or the power unit.
   Cure: Isolate problem unit:
   a. Unplug interconnect cable from the PHC to the power unit.
   b. Turn on power unit the normal way (when using the CK210 you must turn it on at the power unit by jumpering the terminal marked "on" to the terminal marked.)
   c. If helm still drives hard over, change IC's in power unit. If not, change IC's in PHC.
4. Symptom: Autopilot corrects in one direction only.

Cause: Usual cause is a defective CA3130 IC in the PHC or LM324 in the power unit.

Cure: First change the CA3130 in PHC, if autopilot still does not work, change LM324 in the power unit.

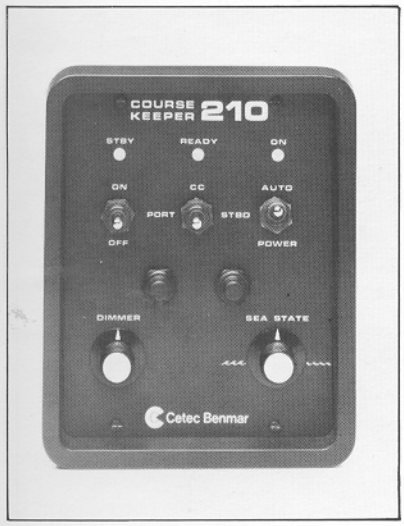
5. Symptom: No action from the power unit and light is on in PHC.
   Cause: Auto/power switch is in the "PWR" position on either the PHC, 2nd station or hand remote.
   Cure: All auto/power switches must be in the "Auto" position.

6. Symptom: Autopilot does not turn on.
   Cause: 12 volt power is low or missing, blown fuse or switch is not engaging properly.
   Cure: Check power connections, fuse, and relay contacts in power unit.

Installation Errors

A large percentage of autopilot problems are a result of incorrect or careless installation, some of the most common mistakes found on boats throughout the world are as follows.

1. Phase switch backwards, causing poor autopilot performance. (CS21 & CS21R only).
   Quick check: Turn compass dial on PHC to the ship's compass heading and open PHC (CS21) or binnacle (CS21R); the "N" on top of the compass should be pointing towards north.
   If pointing to the south, reverse the phase switch on circuit board and rotate compass so the "N" points north, pull out dial knob and set to the ship's compass. (Final adjustment should be made under way).
   Turn on unit and verify that turning the dial to the right turns the wheel right.
2. Power cables to the autopilot under sized or badly grounded
   Usual symptom of a poor ground or low voltage due to under sized power cables is a very erratic and jerky wheel action.
   It is best to connect the autopilot directly t the battery using large wires. Be sure output from battery is at least 13.5 volts. (Refer to manual for proper cable size)
3. Wrong sprocket ratio between wheel and power unit.
   With a hand remote check the time it takes the power unit to drive the rudder from stop to stop. It should be approximately 10 to 15 seconds. If not, adjust the sprocket ratio accordingly.
4. Limit switches not adjusted properly.
   If the limit switches are not adjusted properly, it will not allow the autopilot to drive the rudder its full travel, or will allow it to drive past the rudder stops and cause damage to the steering system.
   With a remote, drive the autopilot until it stops. After it stops, shut off autopilot and check to see that you have about ⅛ of a turn of wheel left before hitting the mechanical rudder stops. (Do this in both directions) if not, reset limit switches. (Refer to the manual for correct procedure).



5. Internal gain not adjusted properly.
   If autopilot wanders and does not hold a tight course or fishtails, it usually means the gain has never been properly adjusted. If the autopilot wanders around the heading, the gain is too low and should be increased (clockwise). If the autopilot fishtails, the gain is too high and should be decreased (counter-clockwise). Only small incremental changes should be made and while under way. (Refer to manual for proper gain adjustment).

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