

S-TEC SYSTEM 50 TWO-AXIS AUTOMATIC FLIGHT GUIDANCE SYSTEM (14 VOLT SYSTEM)

SECTION I

GENERAL

This manual is to acquaint the pilot with the features and functions of the System 50 Two-Axis Autopilot and to provide operating instructions for the system when installed in the PA-28 aircraft. The aircraft must be operated within the limitations herein provided when the autopilot is in use.

WARNING: Some sections of this manual ONLY apply to a System 50 installed in an airplane equipped with GPSS.

This version of this manual refers specifically to the systems installed in PA28-181 N8074T.

SECTION II

OPERATING LIMITATIONS

For Model PA-28, autopilot operation is prohibited above 156 knots IAS.

Use of flaps limited to 10° (one notch) extension when operating in altitude mode.

Autopilot must be off for take-off and landing

SECTION III

EMERGENCY OPERATING PROCEDURES

In the event of an autopilot malfunction, or any time the autopilot is not performing as expected or commanded, do not attempt to identify the system problem. Immediately regain control of the aircraft by overpowering the autopilot as necessary and then disconnect the autopilot. Do not re-engage the autopilot until the problem has been identified and corrected.

1. Autopilot may be disconnected by:
 - a. Depressing the "AP Disconnect" Switch on the left horn of the pilot's control wheel
 - b. Depressing the "ON-OFF" Switch on the autopilot programmer unit.
 - c. Moving the autopilot master switch to "OFF" position.
 - d. Pulling the autopilot circuit breaker.
 - e.
2. Altitude loss during a malfunction and recovery.

Configuration	Bank Angle	Altitude Loss
Climb	45°	20 ft
Cruise	50°	150 ft
Descent	50°	180 ft

The following altitude losses and bank angles were recorded after a malfunction with a 1-second recovery delay:

Configuration	Bank Angle	Altitude Loss
Approach (coupled or uncoupled)	18°	50 ft

The above values are the worst case for all the models covered by this document.

SECTION IV

NORMAL OPERATING PROCEDURES

4-1 SYSTEM DESCRIPTION

The System 50 is a pure rate autopilot, which uses an inclined rate gyro in the Turn Coordinator instrument as the primary roll and turn rate sensor and an accelerometer and an absolute pressure transducer as pitch rate sensors. The turn coordinator includes an autopilot pick-off, a gyro RPM detector and an instrument power monitor. Low electrical power will cause the instrument "flag" to appear while low RPM will cause the autopilot to disconnect. The autopilot includes an automatic pre-flight test feature that allows a visual check of all the annunciator lamps and checks critical elements of the accelerometer system. The test feature will not enable autopilot function unless the automatic test-sequence is satisfactorily completed.

When the pre-flight test is satisfactorily completed and when the rate gyro RPM is correct, the green "**RDY**" light will illuminate indicating the autopilot is ready for the functional check and operation. The autopilot cannot be engaged unless the "**RDY**" light is illuminated. When the system is equipped with the optional 3" Air Driven Directional Gyro (DG) or an HSI, directional information is provided to the autopilot by a heading bug in the instrument.

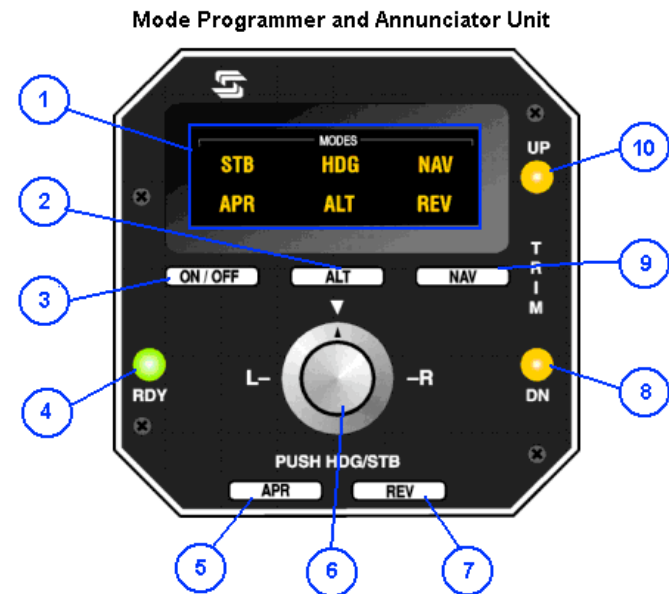
Pitch axis control is provided for the altitude hold function by use of the accelerometer and the pressure transducer. When the altitude hold mode is engaged an elevator trim sensor in the pitch servo will detect the elevator trim condition. When elevator trim is necessary to re-establish a trimmed condition, trim indicator lights on the programmer unit will illuminate to indicate the direction to trim to restore a trimmed condition.

The indicator and annunciator lamp brilliance is controlled through the aircraft instrument light rheostat, except for the "trim" indicators, which always illuminate at full intensity.

1. Mode Annunciation Window - Displays mode in use.
2. Altitude Mode Switch (**ALT**) - Momentary actuation will engage altitude-hold mode or disengage altitude mode if previously engaged. This function is also available by use of the control wheel mounted altitude engage/disengage switch, for added convenience.
3. **ON/OFF** Stabilizer Mode Switch - Momentary actuation engages roll system in stabilizer (**STB**) Mode and allows use of the turn knob (Item 11) to command turn rate desired. When the system is operating a momentary actuation will disengage the system and cancel all annunciations.
4. Ready Light (**RDY**) - Green **RDY** lamp illuminates when autopilot is ready for engagement.
5. Approach Mode Switch (**APR**) - Momentary actuation will engage the VOR or Localizer Tracking Mode. This mode provides a higher level of system gain for more

active tracking of VOR or Localizer front course signals.

6. Turn Knob and Heading Switch - The turn knob allows the selection of turn rates up to standard rate (3 degrees/second) either right or left. Turning the knob to the right or left will cause a turn that is proportional to the displacement of the knob from center. For level flight the electronics provide a small dead zone of approximately 10 degrees at the center index. To actuate heading mode, momentarily depress the turn knob. To return to **STB** Mode from **HDG**, depress the turn knob. When the system is operating in any radio mode and the system is equipped with a D.G., depressing the turn knob will return the system to **HDG** Mode directly.
7. Reverse Approach Mode Switch (**REV**) - Momentary activation will engage the reverse tracking mode for use when tracking a localizer back-course. This mode provides the same system gain as the **APR** Mode with reverse needle sensing.
8. Down Trim Light (**DN**) - This light illuminates to indicate the need for nose down trim. When both the UP and DN lights are not lighted, the aircraft is in trim longitudinally.
9. Navigation Mode Switch (**NAV**) - Momentary activation will engage the VOR Tracking Mode. This mode provides low system gain for comfortable cross-country tracking.
10. UP Trim Light (UP) - This light illuminates to indicate the need for nose up trim.



4-2 PRE-FLIGHT PROCEDURES

NOTE: During system functional checks the system must be provided adequate DC voltage (12 or 24 VDC minimum as appropriate)

MANDATORY PRE-FLIGHT TEST

1. AP Master Switch - Move to **TEST** position.
 - A. Observe that all lights and annunciators illuminate.
 - B. Observe the following light sequence of the trim indicators: (Sequence requires 9 seconds.)
 - a. Initially both trim **UP & DN** lights are illuminated.
 - b. **UP** light extinguishes momentarily and re-lights.
 - c. **DN** light then extinguishes and will remain off.
2. AP Master Switch - Move to **ON** position, observe ready (**RDY**) light illuminates. Autopilot can be engaged and disengaged repeatedly without repeating the test sequence until electrical power is removed. Once power is interrupted the test must be re-conducted to get a ready indication. If the ready light does not illuminate after the test a failure to pass the test is indicated and the system will require service.

NOTE **ALTITUDE MODE CANNOT BE ENGAGED UNLESS POWER IS ON FOR MORE THAN 15 SECONDS.**

SYSTEM FUNCTIONAL TEST

3. Depress **ON/OFF** Switch - **STB** Annunciator illuminates. Rotate turn knob left and right, observe control wheel moves in corresponding direction. Center turn knob.
4. Set DG and place bug under lubber line (if installed) push turn knob to engage **HDG** mode. Observe **HDG** annunciator. Move **HDG** bug left and right observe proper control wheel motion.
5. Overpower Test - Grasp control wheel and overpower roll servo left and right, overpower action should be smooth with no noise or jerky feel. If unusual sounds or excessive play is detected, have the servo installation inspected prior to flight.
6. Radio Check: Either the NAV 1 or GPS 1 can be selected with the CDI button on the GPS.
 - A. Turn on NAV Radio, with a valid NAV signal, engage **NAV** Mode and move VOR OBS so that VOR needle moves left and right - control wheel should follow the direction of the needle movement.
 - B. Select **REV** Mode - the control wheel should rotate in opposite direction of the NAV needle.
 - C. Select **APR** Mode - the control wheel should again follow radio needle movement and with more authority than produced by NAV Mode.
7. Move control wheel to level flight position - Engage **ALT** Mode. Move control wheel fore and aft to

overpower pitch servo clutch. Overpower action should be smooth with no noise or jerky feel. If unusual sounds or excessive play is detected, have the servo installation inspected prior to flight.

8. Trim Check - Manually apply backpressure to control wheel for 2-3 seconds - observe the **DN** trim light illuminates. Apply forward pressure to the control wheel for 2-3 seconds, observe the **UP** trim light illuminates. Move the control wheel to center - observe both **UP/DN** lights extinguish.

9. Hold control wheel and depress **ON/OFF** Switch - note that roll and pitch servo release. Move control wheel to confirm roll and pitch motions are free, with no control restriction or binding. If the option disconnect switch is installed it may be used to effect the disconnect for this check.

4.3 - **IN-FLIGHT PROCEDURES**

NOTE: The required pre-flight test can be conducted in the air if necessary. It should be noted, however, that when the **UP/DN** lights are flashing the pitch servo will momentarily engage and disengage. This alternate engage-disengage sequence is part of the test function. Because of the engage-disengage sequence the test should not be conducted while maneuvering.

1. Check - **RDY** light on.
2. Trim aircraft for existing flight condition. Maintain Yaw Trim during all Autopilot operations.
3. Center turn-knob - depress **ON/OFF** Switch.
4. Set turn knob to level or turning flight, as desired.
5. Set HDG bug to desired heading (if installed) and depress knob to engage heading mode, select headings as desired.

At desired altitude, depress **ALT** Mode Switch. Trim aircraft as necessary to establish cruise condition - disengage **ALT** Mode to climb or descend.

VOR TRACKING AND VOR-LOC APPROACH

1. Tune NAV receiver and select radial.
2. Maneuver aircraft to selected radial (or localizer) within +/- 1 needle width and within 10 degrees of the course heading.
3. Engage **NAV** Mode for VOR tracking.
4. Engage **APR** Mode for VOR or LOC approach.

To track the localizer front course outbound to the procedure turn area, maneuver to the localizer center and, when on the outbound heading, select **REV** Mode. To track the localizer back course inbound, maneuver to the localizer back- course centre and, when on the inbound heading, select **REV** Mode.

Approach Mode may be used to track VOR radials cross country if desired. Use of **APR** Mode for cross- country tracking may result in some course scalloping if the VOR signal is weak or otherwise "noisy". In areas of poor signal quality **NAV** Mode may provide more accurate tracking even with reduced gain.

GPS TRACKING AND GPS APPROACH

1. Set GPS Flight plan or Direct To.
2. Select **GPS** with GPS CDI button..
3. Select **GPSS** on the Aspen PFD.
4. Engage **HDG** Mode for GPS tracking.

The autopilot will not intercept and follow a glideslope. Vertical guidance will be provided on the Aspen, but must be flown manually.

There is GPSS, so turn anticipation is provided. In **HDG** mode maximum bank angle will be less than a standard rate turn. This means that intercepts and holding patterns will be flown wider than expected, but will be within lateral limits.

GPS GUIDANCE SUMMARY

- The autopilot is connected to Nav/GPS 1 through the Aspen. GPSS on the Aspen should be selected.

- The autopilot should normally be in **HDG** mode to take advantage of the GPSS signal.
- GPSS is no longer provided after the FAF when inbound on an ILS. Once inbound on an ILS, **APR** should be selected.
- On an APV approach the autopilot will not capture the glideslope. Cancel **ALT** and hand fly the glideslope.

SECTION V

OPERATIONAL DATA

Text of this Section not affected by installation of this equipment.

SECTION VI

REQUIRED OPERATING EQUIPMENT

Text of this Section not affected by installation of this equipment.

SECTION VII

WEIGHT AND BALANCE

Text of this Section not affected by installation of this equipment.