

S-TEC 40 Single Axis Autopilot
Testing & Operating Procedures

A/P Ground Pre-Flight Test:

1. Battery Or External Power - ON
2. MASTER AVIONICS Sw. - ON
3. A/P Master SW. - TEST - Observe all annunciator lights illuminate.
4. A/P Master Sw. - ON - Observe ready (RDY) light illuminates.
5. Depress ON-OFF Switch
 - A. STB annunciator Illuminates
 - B. Rotate "turn knob" right & left - Yokes should move in same direction as knob turns.
 - C. Center the turn knob.
6. Check Slaved HSI is showing proper heading with magnetic compass.
 - A. Place Heading "Bug" under Upper lubber line.
 - B. PUSH the Turn Knob to engage "HDG" Mode (Observe the "HDG" annunciator Light is on).
 - C. Move the "HDG" Bug right & left - Yokes should "turn" same direction.
 - D. PUSH "turn knob" again to revert to "STB" or basic A/P roll control.
7. "Over-power" TEST - While turning the A/P turn knob either direction, use the yoke to over-power the A/P by trying to turn the yoke in the opposite direction(s). IF unable, or erratic behavior results, do NOT use the A/P until problem(s) resolved.
8. Radio/NAV Checks -
 - A. Tune NAV 1 (Garmin 430) to a receivable station (PWA - 113.4?)
 - B. For proper A/P test & HSI display, be sure Garmin 430 is in VORLOC Mode and NOT GPS for HSI display.
 - C. Engage A/P "NAV" Mode Sw. - Move HSI OBS/Crs knob right/left for CDI Centering/deflections. Yoke should Follow the CDI needle movement
 - D. Select the "REV" (Reverse) Mode - Again, move the HSI OBS/Crs knob right/left for CDI Centering/deflections. The Yoke should move in the OPPOSITE direction as the CDI needle movement
 - E. Select the APR (Approach) Mode - Turn the HSI OBS/Crs knob right/left for CDI Centering/deflections. Yoke should follow the CDI needle movement, only with greater authority/sensitivity.
9. Hold the yoke and depress the red "EMER. Disconnect SW." on the yoke. Note that the A/P (roll servos) do release and that you have positive control of yoke movements without A/P interference/restrictions.
10. Checks are completed. Turn off A/P Switch.

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A/P INFLIGHT PROCEDURES:

1. A/P Master Power Sw. - ON
2. Check "RDY" (Ready) Light - ON
3. Trim airplane for existing flight Conditions (level, climb, etc.)
4. Check "Turn Knob" is CENTERED
5. Check "HDG Bug" is under upper Lubber line on HSI.
6. Depress "ON-OFF" Switch "STB" Light illuminates.
7. Set/turn "Turn Knob" to desired Position for turning or straight/level, As desired, OR -
8. Depress "Turn Knob" to engage A/P "HDG" mode - "HDG" annunciator Light illuminates. Airplane will now Follow the "HDG Bug" commands.

A/P MAY BE TURNED OFF BY:

1. Depressing the red switch/button on the pilot's yoke.
2. Depressing the "ON-OFF" switch on A/P control unit.
3. Moving A/P Master Sw. To "OFF" position
4. Pulling the A/P circuit breaker.

GPS/VOR/LOC/APPROACH TRACKING:

1. On the GARMIN 430, select the desired navigation system - GPS or VORLOC to Feed the HSI and A/P.
2. If in GPS - Set HSI to correct course for Proper display & guidance control.
3. If in VORLOC - tune NAV#1 & select Correct course/radial/etc.
4. Use the "Turn Knob" and/or "Hdg Bug" (I Recommend the "HDG Bug") to maneuver the airplane to the selected radial, course or localizer, to within +/- 1 needle width & Within 10 deg. Of the course (VOR) hdg.
5. Engage "NAV" Mode (switch) for VOR or GPS course tracking.
6. Engage "APR" (Approach) Mode for Non-Precision Localizer Approach.
 - A. For a normal LOC app., use "APR" Mode
 - B. For A B/C LOC, also engage "REV" Mode.

OPERATING LIMITATIONS:

1. A/P operation PROHIBITED above 150 MPH
2. A/P must be OFF during takeoff and landing.



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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 reengage 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 (if installed).
 - b. Depressing the "ON-OFF" Switch on the autopilot programmer unit.
 - c. Moving autopilot master switch to "OFF" position.
 - d. Pulling the autopilot circuit breaker.
2. Altitude loss during a malfunction and recovery.
 - a. The following altitude losses and bank angles were recorded after a malfunction with a 3 second recovery delay:

<u>Configuration</u>	<u>Bank Angle/Altitude Loss</u>
Climb	50° / -20'
Cruise	50° / -40'
Descent	30° / -225'

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

<u>Configuration</u>	<u>Bank Angle/Altitude Loss</u>
Maneuvering	20° / -20'
Approach (coupled or uncoupled)	25° / -20'

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

SECTION IV

NORMAL OPERATING PROCEDURES

4-1 SYSTEM DESCRIPTION

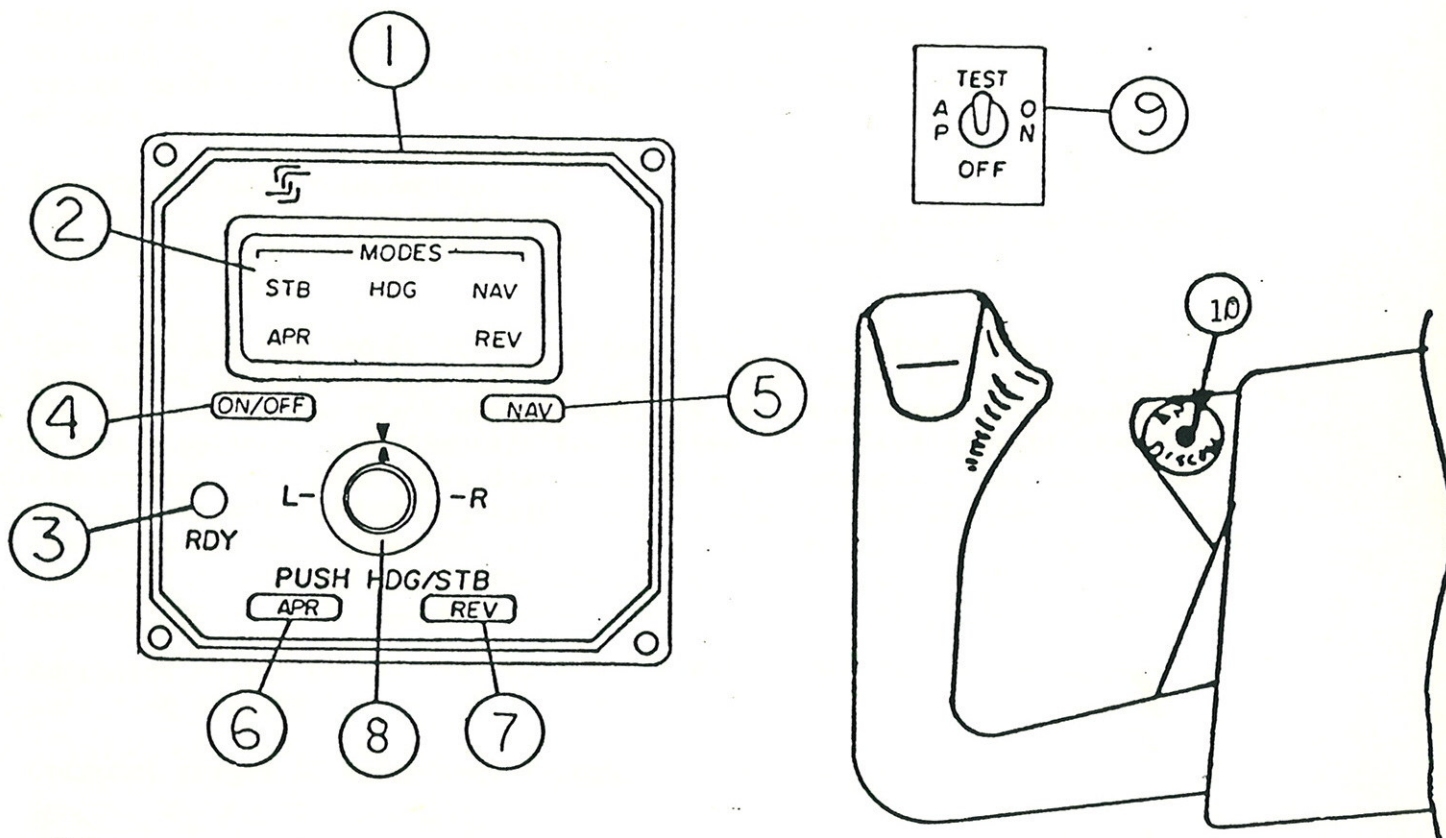
The System 40 is a pure rate autopilot which uses an inclined rate gyro in the Turn Coordinator instrument as the primary roll and turn rate sensor. The turn coordinator includes an autopilot pick-off, a gyro RPM detector and an instrument power monitor. Low electrical power will cause the instrument "flag" to appear while low RPM will cause the autopilot to disconnect. The autopilot includes a pre-flight test feature that allows a visual check of all the annunciator lamps.



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The pre-flight test feature is operated by use of the remote master power ON-OFF test switch located on the instrument panel. When the System master power switch is on and 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 (D.G.) or a compass system, directional information is provided to the autopilot by a heading bug in the instrument.

The indicator and annunciator lamp brilliance is controlled through the aircraft instrument light rheostat.



1. Mode Programmer and Annunciator Unit - Provides mode switches and annunciation for the system.
2. Mode Annunciation Window - Displays mode in use.

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3. Ready Light (RDY) - Green RDY lamp illuminates when autopilot is ready for engagement.
4. ON-OFF Stabilizer Mode Switch - Momentary actuation engages roll system in stabilizer (STB) Mode and allows use of the turn knob (Item 8) to command turn rate desired. When the system is operating a momentary actuation will disengage the system and cancel all annunciations.
5. Navigation Mode Switch (NAV) - Momentary activation will engage the VOR Tracking Mode. This mode provides low system gain for comfortable cross country tracking.
6. 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.
7. Reverse Approach Mode Switch (REV) - Momentary activation will engage the reverse tracking mode for use when tracking a localizer backcourse. This mode provides the same system gain as the APR Mode with reverse needle sensing.
8. Turn Knob and Heading Switch - The turn knob allows the selection of turn rates up to standard rate ($3^{\circ}/\text{sec.}$) 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° at the center indice. 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.
9. Autopilot Master ON-OFF Test Switch - Refer to Pre-Flight Procedures for operating details.
10. Optional remote AP disconnect switch.

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).

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FUNCTIONAL PRE-FLIGHT TEST

1. AP Master Switch - Move to TEST position - Observe all lights and annunciators illuminate.
2. AP Master Switch - Move to ON position, observe ready (RDY) light illuminates.
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 D.G. 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 -
 - A. Turn on NAV Radio, with 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 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. Hold control wheel and depress ON-OFF Switch - note that roll servo releases. Move control wheel to confirm roll motions are free, with no control restriction or binding. If the optional disconnect switch is installed it may be used to effect the disconnect for this check.

4-3 IN-FLIGHT PROCEDURES

1. Check - RDY light on.
2. Trim aircraft for existing flight condition.



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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 turn knob to engage heading mode, select headings as desired.

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° 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 center 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.

SECTION V

OPERATIONAL DATA

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

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SECTION VI

REQUIRED OPERATING EQUIPMENT

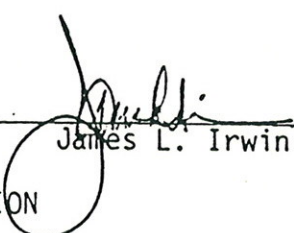
Text of this Section not affected by installation of this equipment.

SECTION VII

WEIGHT AND BALANCE

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

APPROVED BY: _____


James L. Irwin

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