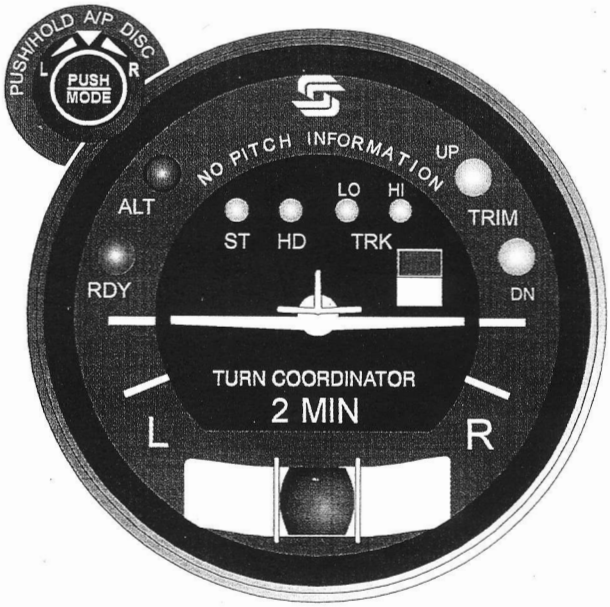
System Twenty/System Thirty
System Thirty ALT Autopilots
Pilot's Operating Handbook



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1.0 Introduction

The primary purpose of the System Twenty/Thirty/Thirty ALT Pilot Operating Handbook **(POH)** is to provide pilots with step-by-step functional Preflight and In-Flight Operating Procedures for the installed system.

NOTICE

This handbook must be used in conjunction with the Federal Aviation Administration **(FAA)** approved Aircraft Flight Manual **(AFM)** or Aircraft Flight Manual Supplement **(AFMS)**. Refer to the applicable **AFM** or **AFMS** for aircraft specific information, aircraft emergency procedures, and return of aircraft to service.

If the autopilot is to be used during Instrument Flight Rules **(IFR)** operations, we recommend that you develop a thorough understanding of the autopilot system, its functions, and characteristics in Visual Meteorological Conditions **(VMC)**. Accomplish this before undertaking an **IFR** flight.

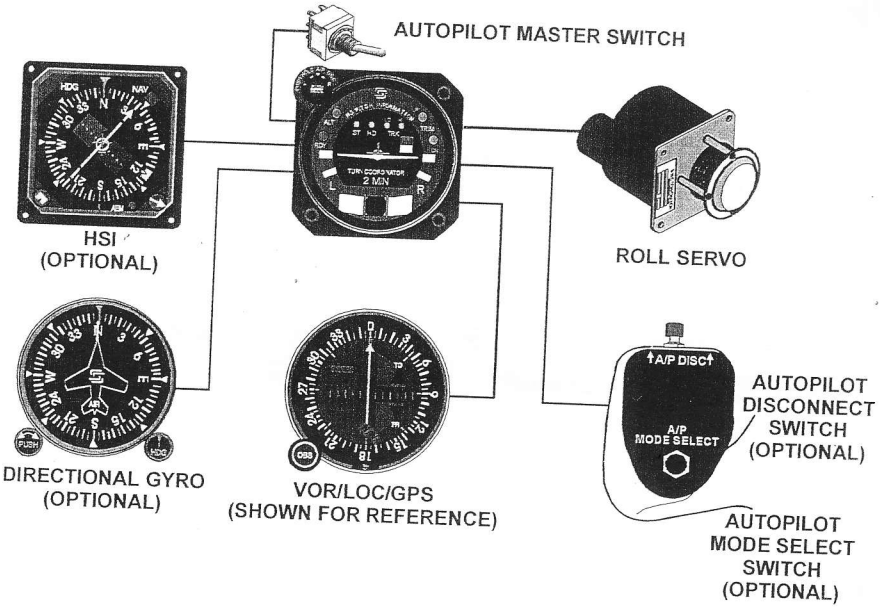

Fig. 2-1. System Twenty Block Diagram

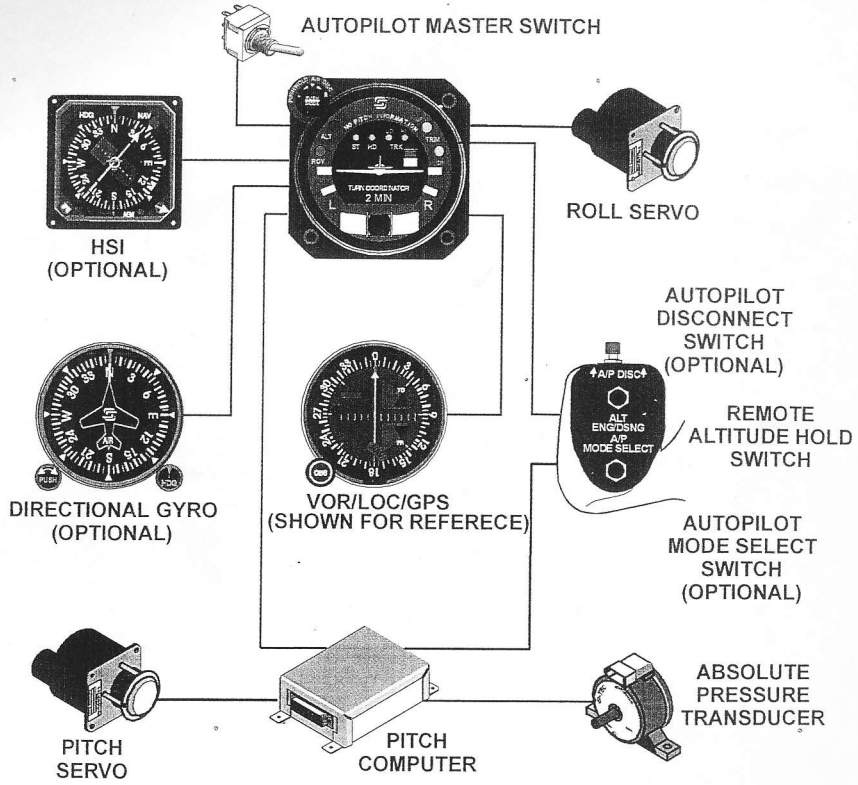

Fig. 2-2. System Thirty Block Diagram

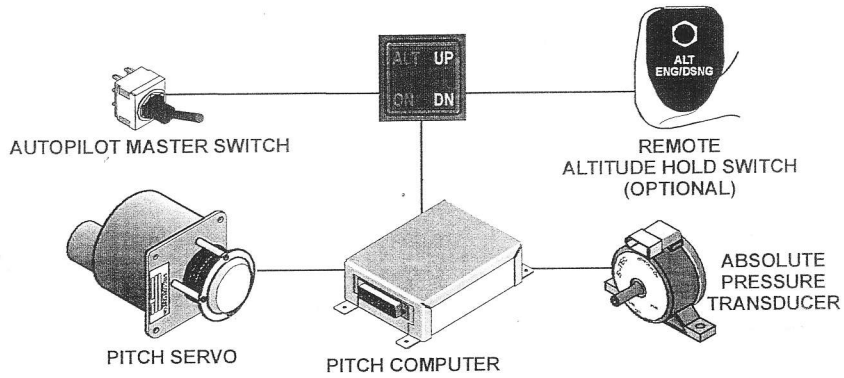

Fig. 2-3. System Thirty ALT Block Diagram

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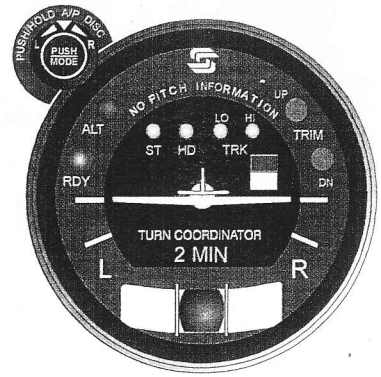
3.0 Theory of Operation

3.1 System Twenty Modes of Operation



1. The System Twenty provides the aircraft with Roll Axis control only.

2. The Turn Coordinator contains the Roll Computer, Rate Gyro, **AP** pick-off, Rate Gyro **RPM** detector, and an instrument power monitor that will flag if low system voltage occurs.

3. The System Twenty Turn Coordinator receives power through the battery buss and connects through an existing circuit breaker **(CB)** such that the basic Turn Coordinator function is powered on application of aircraft power. With adequate power applied, the Red Flag in the face of the unit fully retracts, indicating the Turn Coordinator function is operational.

4. A separately mounted ON/OFF panel switch and an **AP CB** provides Integrated Roll Computer power. Power to the **AP CB** can be supplied through the Avionics Master Switch. When activated a self-test is completed. The Functional Preflight section contains this procedure.

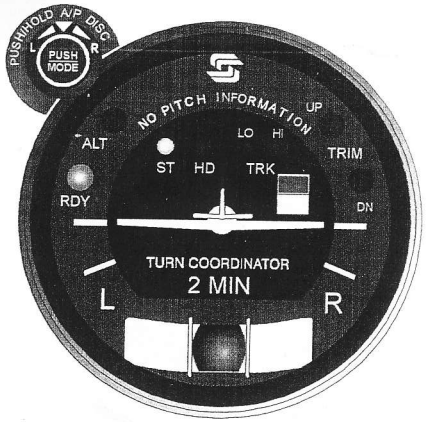
5. The Rate Gyro is the basic sensor for roll stabilization.

6. The Rate Gyro signal combines with the Turn Command Knob, Heading Error Signal, or **NAV** inputs to generate a Roll Error signal, which then drives the roll servo as needed.

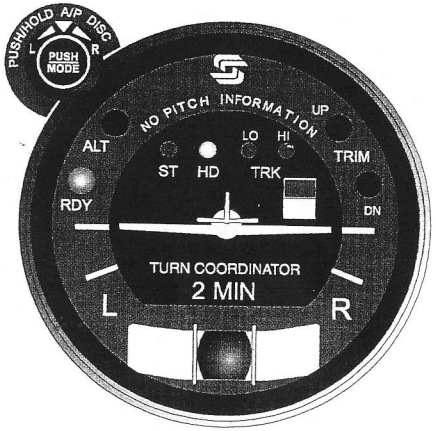
7. The System Twenty operates in one of four roll modes. The modes are Stabilizer, Heading, Low Track, and High Track, the latter two being navigation modes.

8. The green Ready **(RDY)** Light indicates the gyro has reached its operating **RPM** and the autopilot can be engaged.

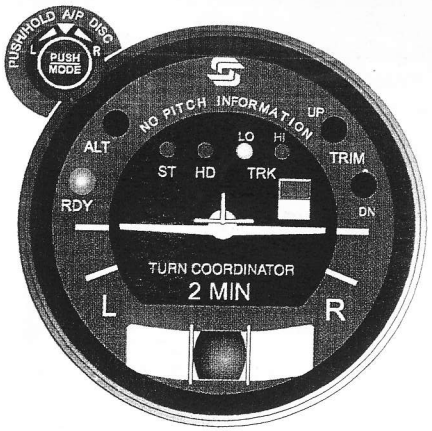
9. The multi-functional Push Mode Select Knob, with each push, engages any one of the four autopilot modes sequentially. Depress and hold it until the **AP** disconnects.



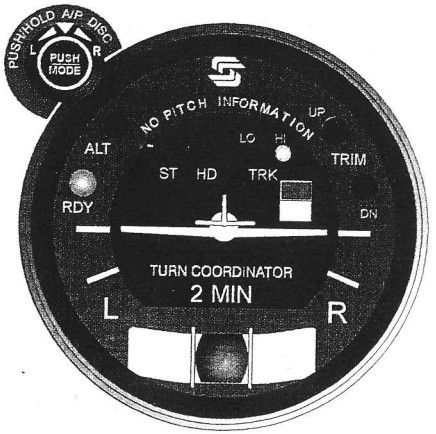
10. In the Stabilizer Mode **(ST)**, the Mode Select Knob, when centered, holds the wings level. When turned left or right it sends a proportional turn command to the roll servo. It activates the turn command for roll axis maneuvers up to 90% of a standard rate turn. The turn command function is inactive in **HD**, **LO-TRK**, and **HI-TRK** modes.



11. Heading Mode requires an optional Directional Gyro **(DG)** or Horizontal Situation Indicator **(HSI)** with compatible outputs. The heading bug permits pre-selected heading turns and heading hold. If the System Twenty is not interfaced to an autopilot compatible **DG** or **HSI** the autopilot will by-pass this mode and advance to the **"LO-TRK"** mode.



12. **LO-TRK** Mode is primarily for **VOR** cross-country navigation. The low gain minimizes autopilot response to needle deviations. This will prevent over-correction in areas where low elevation or extreme distances from a **VOR** cause the needle to become noisy or have a scalloping effect.

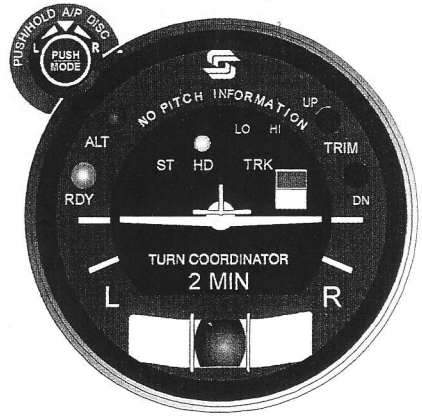


13. The **HI-TRK** Mode is designed for Localizer approaches, **GPS/LORAN** tracking, and a more aggressive **NAV** tracking such as **VOR** approaches.

14. The aircraft lighting rheostat controls the **AP** systems light intensity.

System Thirty Modes of Operation

NOTE: The Roll Axis is identical for the System Twenty and System Thirty. Refer to the System Twenty section for Roll Axis procedures.



1. The System Thirty incorporates an accelerometer and absolute pressure transducer as pitch rate sensors.

2. The Dynamic Acceleration, Vertical Speed, and Altitude Error Signals combine to obtain the Pitch Error Signal that drives the pitch servo as needed.

3. Altitude Hold Mode, the blue Altitude Hold light , located above the green **"RDY"** light illuminates when Altitude Hold engages.

4. The trim Up light indicates the aircraft is out of trim nose down and requires elevator **"UP"** trim.

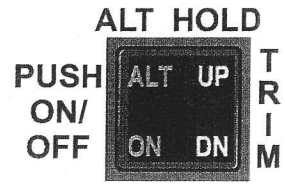
5. The trim Dn light indicates the aircraft is out of trim nose up and requires elevator **"DOWN"** trim.

6. When both lights are out, the aircraft is in trim.

7. The aircraft lighting rheostat controls the **AP** systems light intensity.

NOTE: A roll mode must be engaged before **ALT** can be engaged.

3.3 System Thirty ALT Modes of Operation



1. The System Thirty ALT provides aircraft pitch axis control only. The System Thirty and Thirty ALT pitch computers are identical.

2. The Dynamic Acceleration, Vertical Speed, and Altitude Error Signals combine to obtain the Pitch Error Signal, which then drives the pitch servo as needed.

3. Green **"ON"** and **"ALT"** lights will illuminate when the **ALT** Hold switch is engaged on the **ALT** Hold Push **ON/OFF** panel. A yellow trim **UP** or **DOWN** light will illuminate and a steady audio alert will accompany the trim light after approximately five seconds. If the pilot fails to trim the aircraft, the **UP** or **DN** trim light will begin to flash accompanied by a beeping tone to emphasis a need for trim. When lights are out , the aircraft is in trim.

4. Altitude Hold Power comes through the Master Power Switch for the Thirty ALT System. This switch must be **ON** before the **"ALT Hold"** switch will function.

5. The control wheel **ALT ENG/DSNG** switch is an optional switch that permits the pilot to engage or disengage the Altitude Hold from the control wheel once the Master Switch has been powered up.

6. The aircraft lighting rheostat controls the **AP** systems light intensity.

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4.0 Procedures

4.1 System Twenty Functional Pre-Flight Procedures

NOTE: There must be adequate aircraft **DC** voltage (14 or 28 VDC) to perform these checks. Low voltage may adversely effect the Functional Preflight Procedures.

1. Autopilot Master Switch **"ON"**. The **RDY**, **ST**, **HD**, **LO-TRK**, and **HI-TRK** lamps will temporarily illuminate on the annunciator panel. After 7 seconds, all lamps will be out. After 1-2 minutes the green **"RDY"** light illuminates indicating the autopilot can be engaged.
2. Press and release the Mode Select Knob; **"ST"** lamp illuminates. Rotate turn knob left then right, observe that the control wheel moves respectively. Center the Mode Select Knob. The control wheel should remain motionless.
3. Set the **DG** (if installed) and place the heading bug under the Lubber line. Press and release the Mode Select Knob, **"HD"** lamp illuminates. Rotate heading bug left then right, observe the control wheel moves respectively.
4. Override Test: Grasp the control wheel and slowly overpower the roll servo left and right to ensure proper clutch action.

CAUTION

Control wheel movements should be smooth. If any unusual noise or feel occurs immediately inspect the installation and the clutch setting and repair as needed. Do not operate the Autopilot under these conditions.

5. Radio Check: Tune the **NAV** radio to a valid **VOR** signal. Press and release Mode Select Knob, **LO-TRK** lamp illuminates. Move **VOR OBS** so the **CDI** needle moves left and right. Observe that the control wheel moves respectively. Press and release Mode Select Knob, **HI-TRK** lamp illuminates. Perform the same test. The control wheel response should be slightly faster in this mode.
6. Press and hold the Mode Select Knob until the **AP** disconnects. Repeat this test using the optional control wheel mounted **AP** disconnect switch, if installed. As the autopilot disconnects, the **"RDY"** light flashes with a five-second audible beeping tone.

4.2 System Twenty In-Flight Procedures

1. Check that the **"RDY"** light is **ON**.
2. Trim aircraft to desired flight conditions.
3. Center Mode Select Knob, press and release to engage the **"ST"** mode.
4. Set the Mode Select Knob as desired for level flight or turns.
5. Set the heading bug (if installed) to a desired heading, press and release the Mode Select Knob to engage **"HD"**.

4.3 VOR Tracking and VOR Approach

NOTE: The System Twenty/Thirty does not provide intercept capability but will accurately track a reliable navigation signal when following any of the following procedures:

1. Tune the **NAV** receiver, verify a valid **NAV** Signal, and then select a Radial.
2. Set the **AP NAV** select switch to the proper source, if so equipped.
3. Maneuver the aircraft to within +/-1 needle width and within 10° **HDG** of the selected radial.
4. Press and release Mode Select Knob until **LO-TRK** lamp illuminates for VOR cross country or **HI-TRK** for VOR approaches and more sensitive tracking.

4.4 Localizer Approach

1. Tune the **NAV** receiver to the desired Localizer frequency.
2. Set **AP NAV** select switch to proper source, if so equipped.
3. Maneuver the aircraft to within +/-1 needle width and within 10° **HDG** of the published inbound localizer course.
4. Press and release Mode Select Knob until **HI-TRK** lamp illuminates.

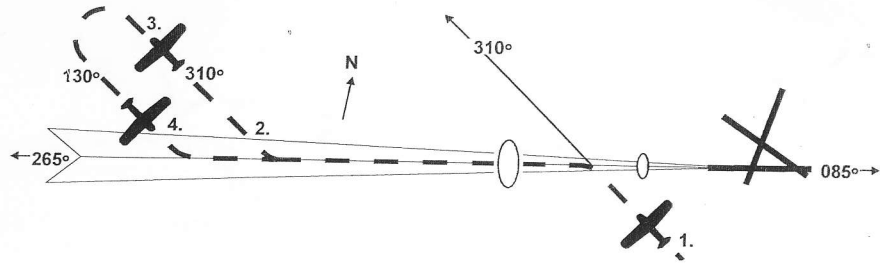
5 GPS Tracking and GPS Approach

1. Enter desired waypoint in **GPS** receiver.
2. Set **AP NAV** select switch to proper source, if so equipped.
3. Maneuver the aircraft to within +/-1 needle width and within 10° of the course displayed on the **GPS** receiver.
4. Press and release Mode Select Knob until **HI-TRK** lamp illuminates.

NOTE: This procedure is also applicable with Loran.

NOTE: When flying multiple waypoints repeat steps 3 & 4 for each leg if it involves more than a 10° course change.

4.6 Procedure Turn Localizer Approach and Tracking with Standard DG

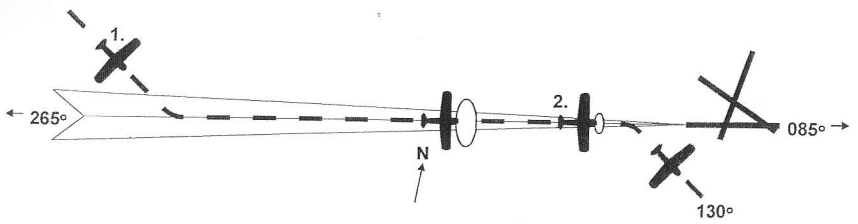


1. A. Tune navigation radio to **LOC** frequency.
   B. Set heading bug to published **OUTBOUND LOC** heading. Select **HDG** Mode.
2. A. Set heading bug to **OUTBOUND** procedure turn heading.
3. A. In 90° increments, set heading bug to **INBOUND** procedure turn heading.
4. A. Set heading bug to **INBOUND LOC** heading.
   B. Select the **HI-TRK** mode. Autopilot will track **INBOUND** to the airport.
   C. Once established in **HI-TRK** mode, set heading bug to the published missed approach heading.

NOTE: Before engaging **HI-TRK** be sure the aircraft is on course within ± 1 needle width and within ± 10° of **HDG** of the inbound course.

5. If a missed approach is declared at the middle marker:
   A. Disconnect the autopilot and stabilize the aircraft for the missed approach.
   B. Select the **HDG** mode.

4.7 Straight-In Localizer Approach and Tracking with Standard DG

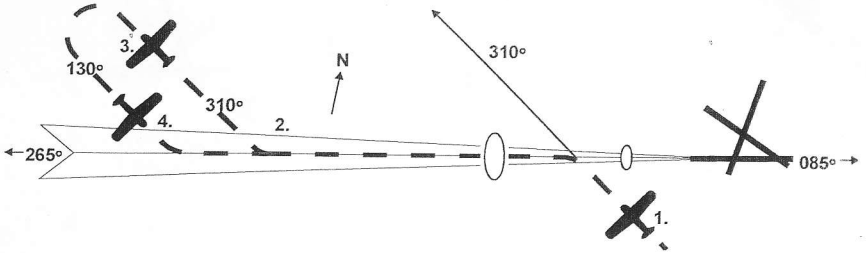


1. A. With **HDG** Mode selected, tune navigation radio to localizer frequency.
   B. With **HDG** bug, position aircraft on the Localizer **INBOUND** course.
   C. Select the **HI-TRK** mode. Autopilot will track **INBOUND** to the airport.
   D. Once established in **HI-TRK** mode, set heading bug to the published missed approach heading.

NOTE: Before engaging **HI-TRK** be sure the aircraft is on course within ±1 needle width and within ±10° of **HDG** of the inbound course.

2. If a missed approach is declared at the middle marker:
   A. Disconnect the autopilot and stabilize the aircraft for the missed approach.
   B. Select the **HDG** mode.

4.8 Procedure Turn Localizer Approach and Tracking, Optional HSI

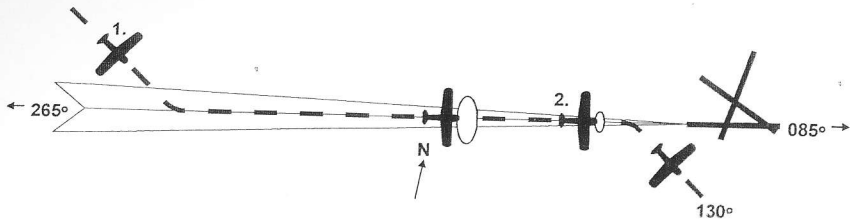


1. A. Tune navigation radio to **LOC** frequency.
   B. Set published **INBOUND LOC** course with course pointer.
   C. Set **HDG** bug to desired **HDG** for Localizer **OUTBOUND**. Press **HDG** mode switch.
2. A. Set **HDG** bug to published **OUTBOUND** procedure turn **HDG**.
3. A. In 90° increments, set heading bug to **INBOUND** procedure turn heading.
   B. When established on **INBOUND** course to the airport select **HI-TRK** mode.
   C. Once established in **HI-TRK** mode, set heading bug to the published missed approach heading.

NOTE: Before engaging **HI-TRK** be sure the aircraft is on course within ±1 needle width and within ±10° of **HDG** of the inbound course.

4. If a missed approach is declared at the middle marker:
   A. Disconnect the autopilot and stabilize the aircraft for the missed approach.
   B. Select the **HDG** mode.

4.9 Straight-In Localizer Approach and Tracking, Optional HSI



1. A. With the **HDG** Mode selected, tune navigation radio to **LOC** frequency.

   B. Set published **INBOUND LOC** course with course pointer.

   C. With the **HDG** bug, position the aircraft on the Localizer course.

   D. Select **HI-TRK** mode. The **AP** will track **INBOUND** to the airport.

   E. Once established in **HI-TRK** mode, set heading bug to the published missed approach heading.

NOTE: Before engaging **HI-TRK** be sure the aircraft is on course within ±1 needle width and within ±10° of **HDG** of the inbound course.

2. If a missed approach is declared at the Middle Marker:

   A. Disconnect the autopilot and stabilize the aircraft for the missed approach.

   B. Select the **HDG** mode.

4.10 System Thirty Functional Pre-Flight Procedures

NOTE: Refer to the System Twenty Pre-Flight for Roll command checks.

1. Autopilot Master Switch **"ON"**.

2. **RDY**, **ST**, **HD**, **LO-TRK**, **HI-TRK**, **Trim-Up**, **Trim-Dn**, **Alt**, all annunciate.

3. **Trim-Up** light extinguishes after 2 seconds. All others extinguish after 7 seconds except **ALT**, which extinguishes after 10 seconds.

4. Engage desired roll mode, move control wheel to the neutral position.

5. Select **ALT** mode by pressing and releasing the Remote Altitude Hold **ENG/DSNG** switch. The blue indicator light will illuminate.

6. Slowly apply forward pressure to the control wheel, **"Trim-Up"** light illuminates and alert tone is audible, release pressure. Light should go out and tone off.

NOTE: Some aircraft have weights in the control system that may apply a **FWD** pressure when the controls are released. This keeps the **"Trim Up"** light illuminated. Applying **AFT** pressure to the controls during this check will **"Unload"** this pressure on the system.

7. Slowly pull control wheel **aft** until the **"Trim Down"** light illuminates and alert tone is audible, return wheel to neutral. Light should go out and tone is off.

8. Press and release the **Alt Hold ENG/DSNG** switch, the blue indicator should go out. Verify disengagement of the pitch servo by moving the control wheel **fwd** and **aft**.

9. Press and hold the Mode Select Switch, until the **AP** disconnects or the optional control wheel mounted **AP** Disconnect Switch (if installed). The **RDY** light flashes, you should get an audible beeping tone for approximately 5 seconds.

4.11 System 30 In-Flight Procedures

CAUTION

If necessary, the required Pre-flight Test can be conducted in flight. However, during the power up test, the pitch servo will engage and disengage to ensure that it will disengage during excessive "G" conditions. Therefore, do not attempt flight maneuvers during the power up test.

CAUTION

If the pilot fails to trim the aircraft, the UP or DN trim light will annunciate with an audible alert tone. Within 4 seconds, the trim light will flash and the alert tone will beep.

1. Trim aircraft for level flight conditions, set power and permit air speed to stabilize, then trim elevator as required.
2. Toggle **"AP"** switch **"ON"**; verify green **"RDY"** light is illuminated after power on test terminates.
3. Select desired Roll Mode, verify light illuminates.
4. Engage Altitude Hold, verify blue **"ALT"** indicator light illuminates.
5. Trim elevator according to light indication on the System Thirty controller.
6. In order to climb or descend, disengage the Altitude Hold.

NOTE: If aircraft encounters turbulence, it is normal for the Trim Annunciator Lights to flicker. Elevator trim is only required if the trim Annunciator Light remains on and you hear an alert tone.

EXAMPLE: **"Trim Up"** indicates the need for nose up trim. The aircraft is in trim when both lights are out.

4.12 System Thirty ALT Functional Preflight Procedures

NOTE: There must be adequate aircraft **DC** voltage (14 or 28 **VDC**) to perform these checks.

1. Each time the Altitude Hold power is switched on, the system will go through a self-test. All annunciator lights and the integral pitch accelerometer circuitry are tested during this time. The following should occur:

   A. All lights on the switch should illuminate.

   B. Trim **UP** light goes out.

   C. Trim **DN** light goes out.

   D. **ALT** and **ON** lights go out.

   E. The system is ready for engagement after approximately 15 seconds.

NOTE: If the system test fails, the Altitude Hold cannot be engaged, and service is required.

CAUTION

If necessary, the required pre-flight test can be conducted in flight. However, when the trim lights are flashing the pitch servo will momentarily engage and disengage as part of the test. Therefore, avoid flight maneuvers during the test.

2. Center the elevator control and engage the Altitude Hold. Notice that the pitch servo engages.
3. Slowly apply forward pressure on the control wheel, after 3 seconds the trim **UP** light illuminates with an audible tone. In approximately 5 seconds, the trim light flashes and audio beeps until the aircraft is trimmed.
4. Slowly apply aft pressure on the control wheel, after 3 seconds the trim **DN** light illuminates with an audible tone.
5. Disconnect the Altitude Hold by pressing the face of the Altitude Hold Switch or by using the remote **ALT ENG/DSNG** switch (if installed) on the control wheel.
6. Verify that the pitch servo has disengaged by moving the control wheel **fwd** and **aft**.

4.13 System Thirty ALT In-Flight Procedures

1. Maintain roll axis trim during Altitude Hold operation.

2. Trim aircraft for level flight conditions, set power, and permit air speed to stabilize, then trim elevator as required.

3. Engage **ALT** Hold by pushing the Altitude Hold Switch or the remote **ALT ENG/DSNG** Switch (if installed) on the control wheel.

4. Trim the elevator according to the trim indications on the Altitude Hold annunciator panel.

5. Disengage the Altitude Hold for climb or descent modes of flight.

NOTE: If the aircraft encounters turbulence, it is normal for the Trim Annunciator Lights to flicker. Elevator trim is only required if the trim Annunciator Light remains on and you hear an alert tone.

EXAMPLE: **"Trim DN"** indicates the need for nose down trim. The Aircraft is in trim with both lights out.

NOTE: If using the Thirty ALT system as a stand alone **AP**, without a Roll Axis system, do not use bank angles exceeding 30°, excessive altitude losses may occur with the need to re-trim the elevator.

4.14 Emergency Procedures

If the aircraft, that has a System Twenty/Thirty/Thirty ALT installed, encounters any malfunctions with the **AP**, follow the procedures below.

The information is supplemental to and does not supercede or amend the information provided in the **AFMS**, **POHS**, **SFM**, for specific aircraft and autopilot installation manuals.

NOTE: If the aircraft does not have a copy of the required **AFMS**, please call customer service and S-TEC will provide a copy at no cost. Have the aircraft model and type of auto pilot when calling for this supplement.

WARNING

In case of an autopilot malfunction, do not attempt to diagnose the problem in flight.

1. Immediately regain manual control of the aircraft by overpowering the servo(s) and then disconnect the autopilot system.

NOTE: The system includes a friction override clutch and a disconnect device at each Servo for that purpose. Over powering the Servo will not damage the system.

2. To disconnect the **AP**, use of the following means. Press and release the remote **AP** disconnect switch on the control wheel (if installed). Press and hold the Mode Select Knob (System Twenty/Thirty only) on the Turn Coordinator/Roll Computer. Move the autopilot master switch to **"OFF"**. Pull the autopilot circuit breaker.

3. If improper operation occurs during instrument approach conditions, disconnect the system and fly a manual approach. If a failure occurs inside the Final Approach Fix, it may be desirable to conduct a Missed Approach. Notify Air Traffic Control **(ATC)** of the problem and fly the approach manually, seeking **ATC's** assistance as necessary.

4. If a particular mode of operation, including **ALT** Hold, develops a fault

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P/N: 8777
Date: June 24, 2002

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