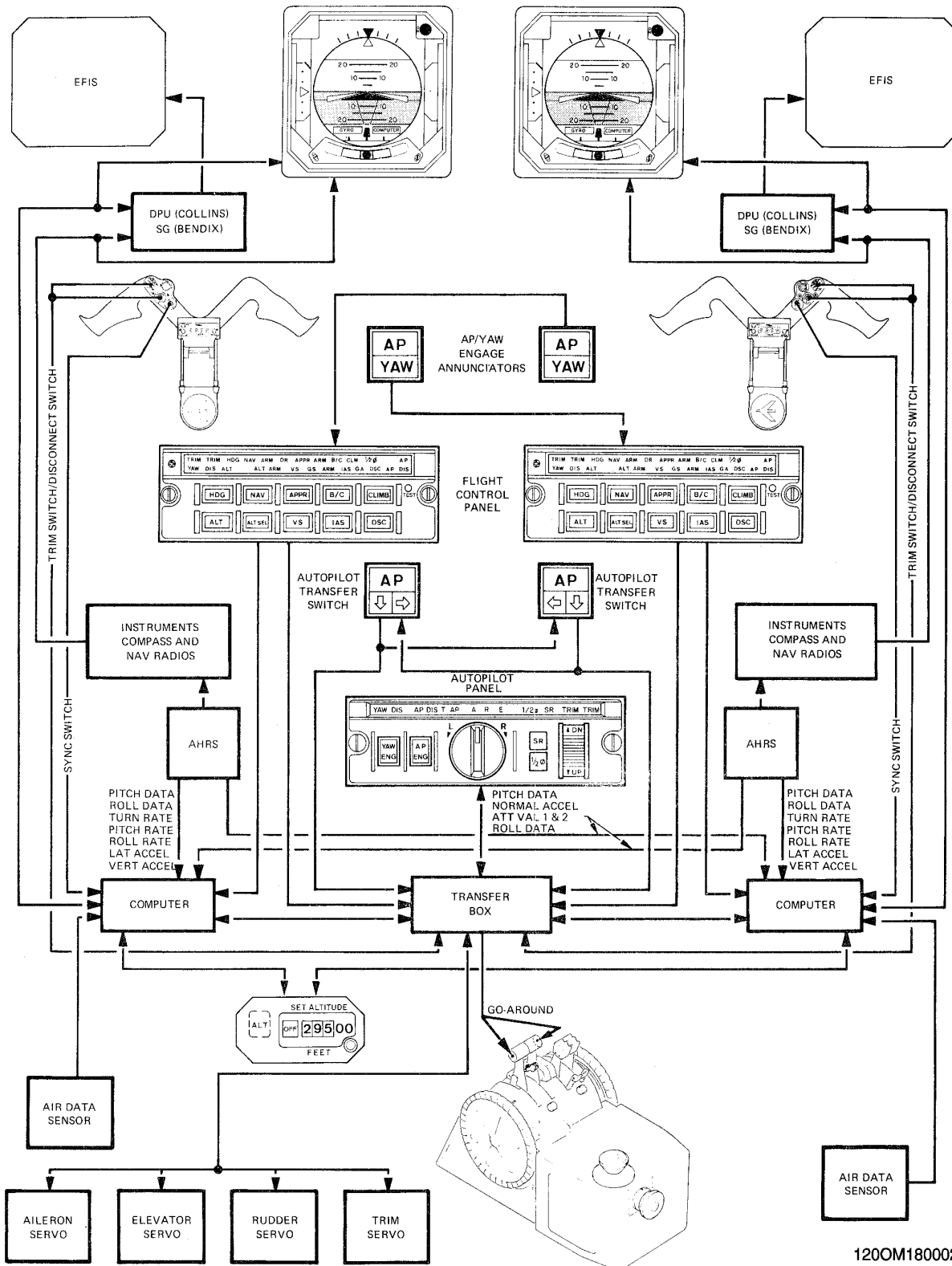




**OPERATIONS MANUAL**  
**SECTION 6-18**  
**AUTOFLIGHT**

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**AUTOFLIGHT SYSTEM SCHEMATIC**

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## **OPERATIONS MANUAL**

### **GENERAL DESCRIPTION**

The Autoflight System is a fully integrated three-axis dual flight control system including manual electric trim. It is divided into two general systems: Flight Director System and Autopilot System.

#### **FLIGHT DIRECTOR SYSTEM (FDS)**

Each FDS consists of an Attitude Director Indicator (ADI or EADI), an Electronic Horizontal Situation Indicator (EHSI) and associated components. The ADI presents attitude data, raw radio information and steering commands provided by the flight guidance computer. The EHSI presents the navigation situation.

#### **AUTOPILOT SYSTEM (APS)**

The APS consists of two autopilot computers, two flight control panels, one autopilot panel, two air data sensors, three primary servos, dual AHRS, and a trim servo. The system also requires compass and navigation system inputs from the avionics system.

The selected autopilot provides the servo commands to provide the autoflight. The non-selected autopilot provides an independent flight director. The transfer switch reverses this configuration.

#### **AUTOPILOT COMPUTER**

The autopilot computer is a flight guidance computer (used in the flight director system) with four servo control circuit cards for roll, pitch, yaw and elevator trim.

The autopilot computer receives inputs from the flight control panel, autopilot panel, attitude and heading reference system (AHRS), air data sensor, compass system and radio navigation system. These inputs are processed to provide lateral and vertical steering commands for the EADI command bars and the required outputs to drive the autopilot servos through the transfer box.

#### **FLIGHT CONTROL PANEL**

The Flight Control Panel is used to select modes of operation for the flight director or autopilot system. The flight control panel also displays all system annunciation.

#### **AUTOPILOT PANEL**

The autopilot panel is the cockpit control center for autopilot function of the system.

#### **AIR DATA SENSOR**

The air data sensor provides dual pressure altitude and IAS outputs that are used by the computer for programming servo torque and channel gains. Signals for ALT hold, IAS hold, and VS hold modes are also provided.

#### **ALTITUDE PRESELECT ALERTER (OPTIONAL)**

The alerter panel provides the computer with altitude preselect error for the altitude preselect modes computation.

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### **PRIMARY SERVOS**

The four servos (roll, pitch, yaw, and trim) position the control surfaces of the airplane in response to commands from the Autopilot Computers through the Transfer Box.

### **TRANSFER BOX**

The Transfer Box provides the interconnection between the Autopilot Panel, the four servos and both Autopilot Computers. The Transfer Box is controlled by the Autopilot Transfer switch in the pilot's and copilot's glareshield panels.

### **DISPLAY**

The autopilot system is integrated with the Flight Instrument System (FIS) or Electronic Flight Instrument System (EFIS), described in Section 6-17.

### **ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS)**

The AHRS senses pitch and roll attitude for the computer. In addition it provides the computer with turn rate, roll rate, lateral acceleration and vertical acceleration for proper flight director/autopilot computation.



## **OPERATIONS MANUAL**

### **AUTOPILOT PANEL DESCRIPTION**

#### **1. AUTOPILOT ANNUNCIATORS**

- YAW (Green) - Indicates that yaw damper is engaged.
- DIS (YAW) (Amber) - Yaw damper is disengaged. DIS portion of annunciator flashes for 7 seconds, then extinguishes. DIS also illuminates when yaw damper is engaged and the SYNC button is pressed.
- AP (Green) - Autopilot is engaged.
- DIS (AP) (Amber) - Autopilot is disengaged. DIS portion of annunciator flashes for 7 seconds, then extinguishes. DIS also illuminates when autopilot is engaged and the SYNC button is pressed.
- T (Amber) - Trim servo failure.
- AP (Red) - Autopilot failure.
- A (Amber) - Aileron servo failure.
- R (Amber) - Rudder servo failure.
- E (Amber) - Elevator servo failure.
- 1/2 Ø (Green) - Selection of half-bank mode.
- SR (Green) - Selection of soft ride mode.
- TRIM (Red) - Trim system failure.
- TRIM (White) - Trim system operating (trim in motion).

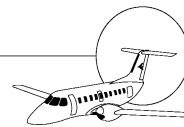
2. YAW ENGAGE BUTTON - Momentary action, push-on/push-off button. Pushed once actuates the yaw channel of the autopilot and engages the rudder servo. Pushed a second time disengages the rudder servo.

3. AUTOPILOT ENGAGE BUTTON - Momentary action, push-on/push-off button. Pushed once engages all autopilot servos, including the rudder and trim servos. However, pushing the AP ENG, a second time disengages all servos except the rudder servo, which must be disengaged by pushing the YAW ENG button or the system disengage button located on the control wheel.

4. TURN CONTROL - A right-left (R/L) bank-angle control that is used to manually control the aileron channel when the autopilot is engaged. The control has a center detent position at the 0-degree (wings-level) position. The control remains at any position between the end stops when released. Operation of the control cancels any previously selected lateral modes, except APPR mode. The bank angle commanded by the control is proportional to the displacement of the control from the center detent position. The turn knob becomes inactive if it is out of the detent position when the SYNC button is pushed.

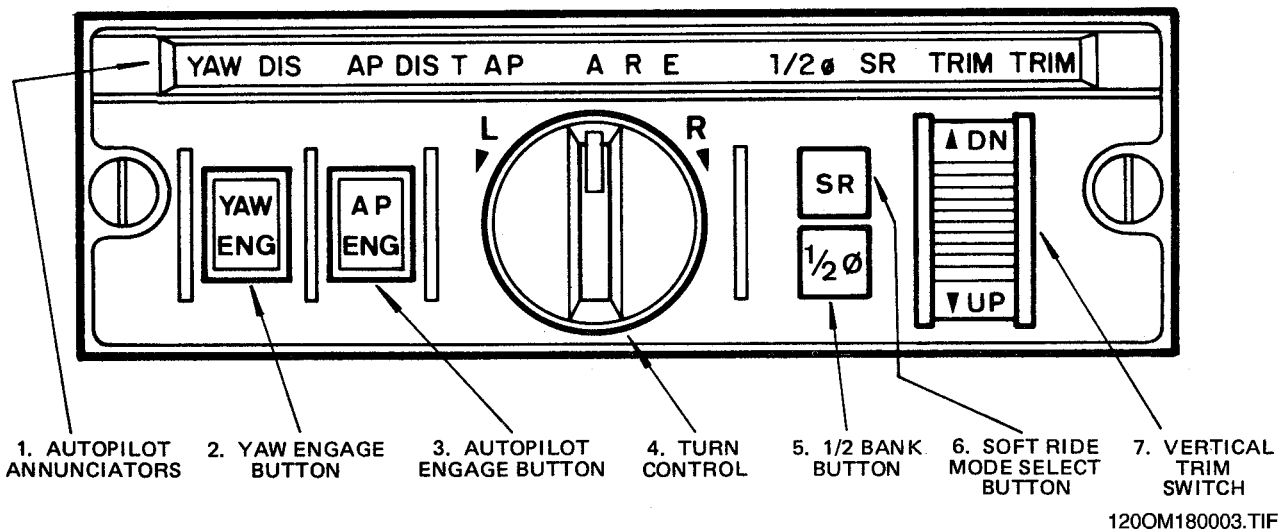
5. 1/2 BANK BUTTON-The half-bank (1/2 Ø) mode select button is a momentary-action push-on/push-off button. Pushing it selects the half-bank mode, which limits the maximum commanded roll angle to one-half of the normal value in the heading mode.

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- 6. SOFT-RIDE MODE SELECT BUTTON - The SR is a momentary-action push-on/push-off button. Pushing it selects the soft-ride mode which adds preventing passenger discomfort during turbulent conditions.
- 7. VERTICAL TRIM SWITCH - The UP/DN vertical trim switch is a center-off, spring-loaded rocker switch that provides manual control of the elevator channel. Operation of the vertical trim switch gives an initial 0.5-degree pitch change and then a constant pitch rate (up to the pitch attitude limit if the switch is held). Holding this switch down longer than one second will cause any selected vertical mode (ALT, IAS, CLM, DSC or VS) to revert to off, except during GS capture and go-around. When the vertical trim switch is released, the autopilot maintains the pitch attitude present at the time the switch returns to the center detent. The vertical trim switch is not operational after glide slope capture occurs.



**AUTOPILOT PANEL  
(AFT PANEL)**

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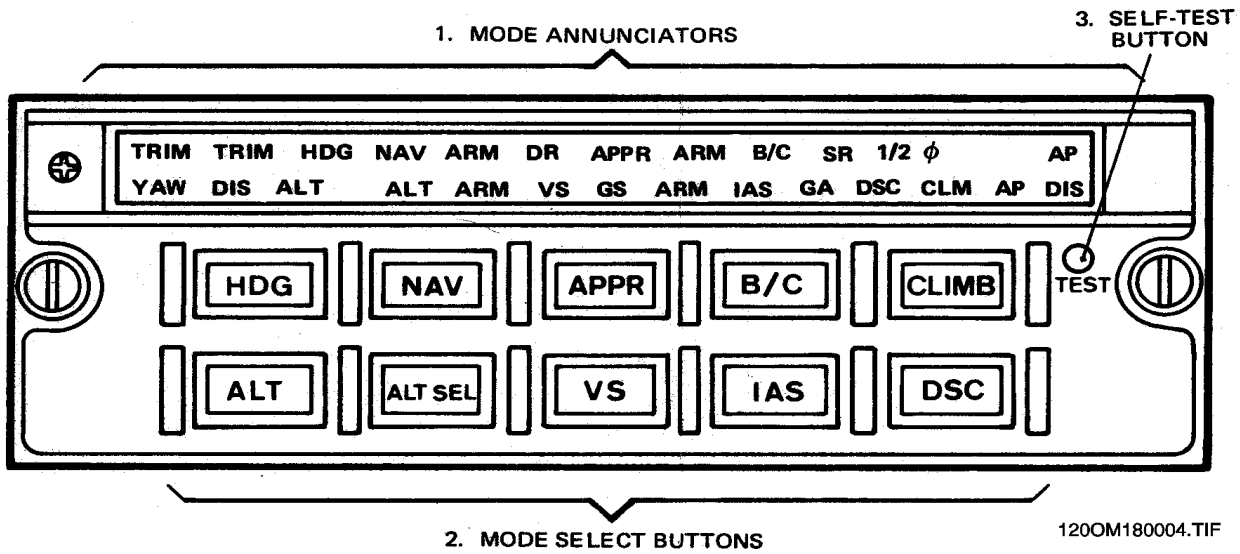
## **OPERATIONS MANUAL**

### **FLIGHT CONTROL PANEL DESCRIPTION**

#### **1. MODE ANNUNCIATORS**

- TRIM (White) - Trim system operating (trim in motion).
- TRIM (Red) - Trim system failure. TRIM FAIL red light in the multiple alarm panel and a TRIM FAIL voice message in the loudspeakers are generated in conjunction.
- HDG (Green) - Selection of heading mode. Also illuminates if NAV, APPR or B/C is selected but capture has not occurred.
- NAV (Green) - After NAV mode is selected and after capture occurs.
- ARM (NAV) (White) - After NAV mode is selected and before capture occurs.
- DR (Green) - Computation is in heading memory over a VOR facility.
- APPR (Green) - After APPR mode is selected and after capture occurs.
- ARM (APPR) (White) - After APPR mode is selected, after an ILS, VOR, or LOC frequency is tuned, and before capture occurs.
- B/C (Green) - After APPR and B/C (back-course) modes are selected. ARM (APPR) also illuminates when a LOC frequency is tuned.
- SR (Green) - Selection of soft-ride mode.
- 1/2 Ø (Green) - Selection of half-bank mode.
- AP (Red) - Autopilot failure - AUTO PILOT FAIL red light in the multiple alarm panel and a AUTO PILOT voice message in the loudspeakers are generated in conjunction. Autopilot will automatically disengage.
- YAW (Green) - Yaw damper is engaged.
- DIS (YAW) (Amber) - Yaw damper is disengaged. DIS portion of annunciator flashes for 7 seconds, then extinguishes. DIS also illuminates when yaw damper is engaged and the SYNC button is pressed.
- ALT (Green) - Selection of altitude hold mode or after ALT SEL is selected and after altitude capture occurs.
- ALT (Green) ARM (White) - Altitude preselect mode is armed for automatic capture.
- VS (Green) - Selection of vertical speed hold mode.
- GS (Green) - After glide slope capture in APPR mode on a front-course approach.
- ARM (GS) (White) - After APPR mode is selected, a LOC frequency is tuned, and a glide slope valid is received on a front-course approach.
- IAS (Green) - Selection of indicated airspeed hold mode.
- GA (Green) - Selection of go-around mode.
- DSC (Green) - Selection of descent mode.
- CLM (Green) - Selection of climb mode.

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FLIGHT CONTROL PANEL  
(PILOT'S AND COPILOT'S GLARESHIELD PANELS)

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## **OPERATIONS MANUAL**

- AP (Green) - Autopilot is engaged.
- DIS (AP) (Amber) - Autopilot is disengaged. Flashes for 7 seconds, then extinguishes.

### **FLASHING MODE ANNUNCIATORS.**

- HDG (Green) - Loss of attitude or compass monitor.
- NAV (Green) - Loss of attitude, compass, or NAV monitor.
- APPR (Green) - Loss of attitude, compass, or NAV monitor.
- DIS (YAW) (Amber) - Flashes for 7 seconds, then extinguishes after yaw disengagement.
- ALT (Green) - Loss of attitude or air data sensor monitor.
- ALT (Green) ARM (White) - Loss of attitude or preselector monitor.  
For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, the ALT ARM annunciator flashes, during ALT SEL mode operation, to indicate a disagreement between the preselected altitude and the airplane vertical displacement.
- VS (Green) - Loss of attitude or air data sensor monitor.
- GS (Green) - Loss of attitude or glide slope monitor.
- IAS (Green) - Loss of attitude or air data sensor monitor.
- GA (Green) - Loss of attitude monitor.
- DIS (AP) (Amber) - Flashes for 7 seconds, then extinguishes after AP disengagement.
- TRIM (AP) (Red) - Flashes in a 2-second cycle to indicate that trim is not reducing the elevator forces.

2. **MODE SELECT BUTTONS** - The mode select buttons are momentary, push-on/push-off buttons, used to select operating modes of the autoflight system. Mode selection is annunciated on the flight control panel and is interlocked to ensure that only compatible modes can be selected at the same time. When no lateral modes are selected, the command bars on the ADI (or EADI) are biased out-of-view.

3. **SELF-TEST BUTTON** - The TEST button is a momentary-action pushbutton that selects the system diagnostic mode. Ground test is performed by pressing TEST button once. Simultaneously, all annunciators must be illuminated. Following, all annunciators turn off, and only GA annunciator will illuminate again, indicating not a fault, but a ground test display. If any other annunciator appears, it is a fault indication. Pressing the TEST button again causes all annunciators to disappear.

In-flight test is performed by holding continuously the TEST button. All annunciators illuminate to next disappear, except the fault annunciators (if any), which will remain illuminated. Releasing the TEST button, mode annunciators resume normal flight condition.

**NOTE:** The self-test button should only be operated by the pilot when a system fault is suspected.



## OPERATIONS MANUAL

### EXTERNAL SWITCHES AND ANNUNCIATORS

1. AUTOPILOT TRIM SWITCH - Provides convenient means to trim the airplane when the autopilot is not engaged (elevator trim is automatic when the autopilot is engaged). The TRIM switch is a split 3-position (UP/OFF/DN) rocker switch. Operation of the switch while the autopilot is engaged will cause the autopilot to disengage. Pilot's TRIM switch actuation overcomes the copilot's.
2. AP/TRIM/PUSHER DISCONNECT SWITCH - Operation of this switch causes:
  - Autopilot (all servos) and yaw damper disengagement.
  - Pusher actuator disengagement, but only as long as the switch is depressed.
  - If the autopilot is engaged in the basic lateral mode, all vertical modes will be cancelled in the flight director. The vertical modes can be reselected after the autopilot disengagement, if a lateral mode has been previously selected.
  - If the autopilot is engaged with lateral and vertical modes, these modes will be retained and in use in the flight director.

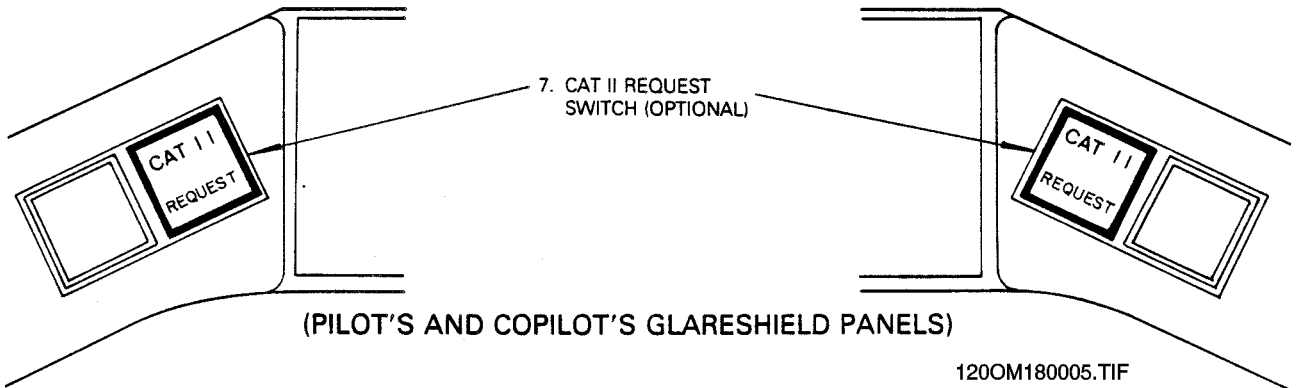
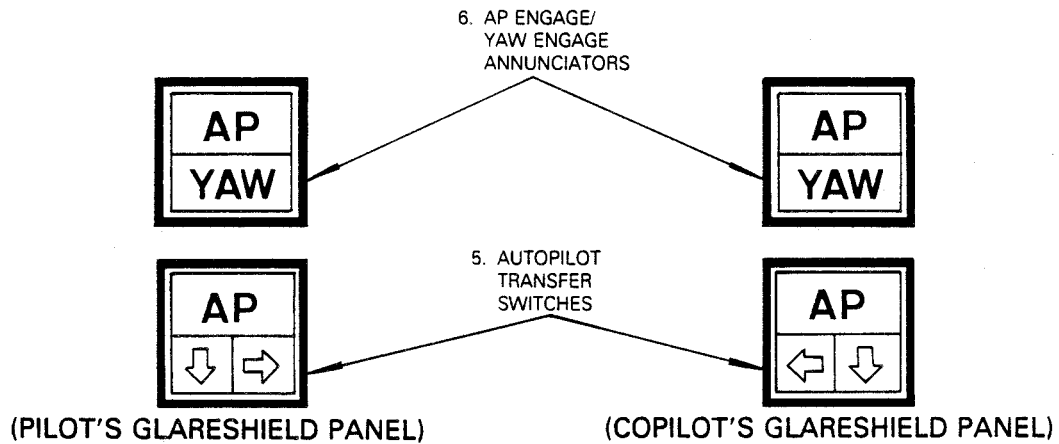
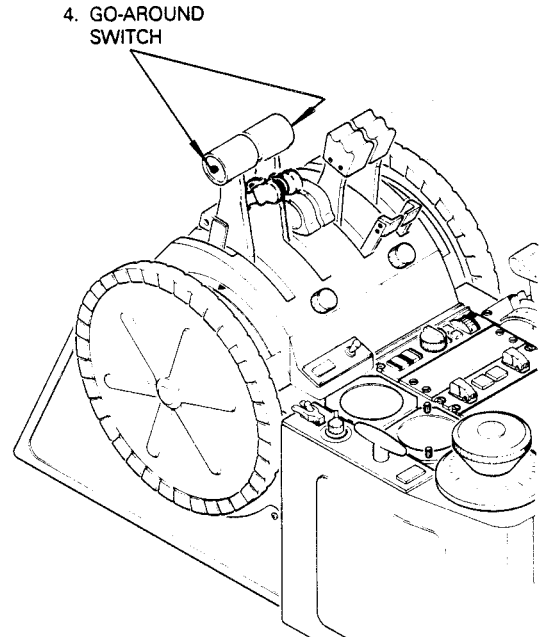
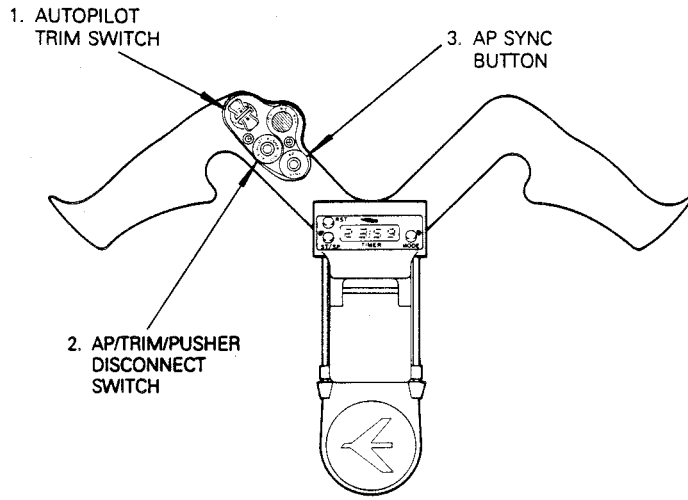
**NOTE:** On airplanes Post-Mod. SB 120-22-0016 or S/N 120.028, 120.035, 120.038, 120.041, 120.043, 120.044, 120.052, 120.056, 120.059, 120.068, 120.071, 120.074 and on, in case of an electric trim runaway, press and hold the AP/TRIM/PUSHER DISC switch to disconnect the elevator trim servo. On airplanes Pre-Mod. SB 120-22-0016, the switch is ineffective in this condition.

3. AP SYNC BUTTON - Is used to manually maneuver the airplane without disengaging the autopilot. Pressing it disengages the primary servos. The airplane can be maneuvered to any desired pitch attitude while the SYNC button is pressed. When the SYNC button is released, the primary servos reengage, the computer synchronizes to the new pitch attitude and maintains it, lateral control is returned to the previously selected lateral mode, and the vertical mode is resynchronized. Return to the lateral mode is filtered to prevent rapid maneuvers.  
After glide slope capture in APPR mode with the autopilot engaged, if the SYNC button is depressed for maneuvering and further released, the autopilot will resume the controls and turn the airplane to the ILS center beam.
4. GO-AROUND SWITCH - Selects the go-around mode.
5. AUTOPILOT TRANSFER SWITCHES - Select the pilot's Autopilot Computer or the copilot's Autopilot Computer in the Transfer Box. In the transference the autopilot is disengaged. When the airplane is powered up, the AP lights turn on, and the arrows will indicate which unit is selected.
6. AP ENGAGE/YAW ENGAGE ANNUNCIATORS - Come on, in accordance with the Flight Control Panel lights, when the autopilot or the yaw channel is engaged.
7. CAT II REQUEST SWITCH (OPTIONAL) – To be used during category II approach. Activates LOC and GS signals monitor circuit, provided all CAT II operating conditions are met. CAT II excessive deviation annunciations are described in Section 6-17.

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# OPERATIONS MANUAL



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## EXTERNAL SWITCHES AND ANNUNCIATORS



## OPERATIONS MANUAL

### AUTOPILOT OPERATION

A turn-on self-test is accomplished when the airplane is powered up. AP (green), Yaw (green), and DIS (amber) annunciators flash for 5 seconds, then extinguish. The autopilot may be engaged in any reasonable attitude. When engaged beyond 30-degree bank, or 15-degree pitch up or 10-degree pitch down, the autopilot will return the airplane to these limits.

Steering information will be presented on the EADI when a lateral mode is selected. Changes in attitude may be made by using the vertical trim switch on the Autopilot Panel or the SYNC button on the control wheel.

The autopilot can be disengaged by any of the following means:

- Pushing the AP/TRIM/PUSHER DISC switch on either pilot's or copilot's control wheel.
- Pushing the AP ENG switch on the Autopilot Panel.
- Operating the TRIM switch on either pilot's or copilot's control wheel.
- Pulling either autopilot DC or AC circuit breaker.

The following conditions will cause the autopilot to disengage automatically:

- Any major degradation, interruption or failure of AC or DC input electrical power.
- Detection of a failure in the Autopilot Computer.
- Loss of valid information from either AHRS systems.
- Roll attitudes in excess of 45 degrees, or pitch attitudes in excess of 30 degrees.
- Activation of the stick shaker system.

### YAW DAMPER OPERATION

The rudder channel of the autopilot may be selected independently for yaw damping by the YAW ENG switch on the Autopilot Panel.

The airplane manual rudder trim may be used with the yaw damper, provided that the rudder trim wheel is moved slowly.

The yaw damper can be disconnected by any of the following means:

- Pushing the AP/TRIM/PUSHER DISC switch on either pilot's or copilot's control wheel.
- Pushing the YAW ENG switch.
- Pulling either autopilot DC or AC circuit breaker.

The following condition will cause the yaw damper to disengage automatically:

- Detection of a failure in the Autopilot Computer.
- Any major degradation, interruption or failure of input electrical power.
- Loss of valid information from either AHRS systems.



## **OPERATIONS MANUAL**

### **OPERATING MODES**

All autopilot functions are controlled by the autopilot panel. All operating modes for the system are selected on the flight control panel by push-on/push-off momentary action switches. All operating modes can be selected while the autopilot is engaged or disengaged. However, engaging or disengaging, the autopilot cancels any vertical modes that were previously selected. Guidance command outputs drive the steering bars on the attitude director indicator. A lateral mode must be selected prior to select a vertical mode for flight director operation. When the autopilot is engaged, the same guidance commands provide automatic control.

#### **LATERAL MODES**

##### **– ROLL HOLD**

When the system is in the roll hold mode (no lateral modes selected), the command bars on the ADI or EADI are biased out-of-view. Roll hold is the basic mode of the lateral channel. It may be selected by cancelling all lateral modes or, if the autopilot is engaged, by rotating the turn control knob on the autopilot panel out of detent. The bank angle can be changed with the turn control knob or the SYNC button. The turn control knob commands the airplane to roll smoothly to a roll attitude proportional to knob displacement, with a bank limit of 30 degrees. Actuating the SYNC button allows the airplane to be flown manually. The system will return to the previously selected lateral mode at the time of SYNC button release. Operation of the SYNC button while the turn control knob is out of detent makes the knob inactive until the SYNC button is released. Upon its release, the airplane returns to the turn control knob command.

When the turn control knob is in detent, or the SYNC button is released with a bank angle less than 5 degrees, the system will switch to a wings level attitude hold submode during which the aircraft is rolled out to a wings level position. If the turn control knob is in detent and the bank angle is changed, either by using the SYNC button or by engaging the autopilot while in a bank angle, the bank angle will be maintained until the turn control knob is rotated out of detent or until a lateral mode is selected. Interlocks are provided to prevent taking command with the turn control knob or using the roll hold mode in the ILS approach mode. Operation of the SYNC button when a lateral mode is selected will disconnect the servos while the button is pressed, allowing the pilot to maneuver the airplane. Upon release of the SYNC button, the system will return to the lateral guidance commands.

##### **– HEADING (HDG)**

When the HDG mode is selected, the autopilot will cause the airplane to turn to and maintain the heading set with the heading bug on the EHSI. For proper operation, the heading bug should not be displaced from the airplane heading by more than 135 degrees, when the HDG mode is selected.



– NAVIGATION (NAV)

The course arrow on the Horizontal Situation Indicator should be set to the desired radio course and the heading bug to the desired intercept angle prior to selecting NAV mode. When the NAV mode is selected, the HDG Select Mode, green HDG, NAV and white ARM annunciators will illuminate. The airplane will maintain the selected heading on the Horizontal Situation Indicator, until the approximate centerline of the selected radio course is approached. HDG mode will then revert to the off condition and the green HDG and white ARM annunciators will extinguish and the airplane will turn to track the beam centerline. Crosswind correction, up to 45 degrees, is automatically computed after course capture.

– APPROACH (APPR)

When the APPR mode is selected, localizer capture is the same as described in the NAV mode. The APPR mode also provides glide slope arm and capture. After localizer beam centerline tracking is achieved, the system will automatically arm to capture the glide slope. The green GS and white ARM annunciators will illuminate at this time. When the glide slope is intercepted, either from above or below, the white ARM annunciator will go out, indicating the system is in full ILS operation. A vertical mode, if engaged, will automatically disengage on glide slope capture. Crosswind correction, up to 45 degrees, is automatically computed after course capture.

– BACK COURSE MODE (B/C)

When the B/C mode is selected, localizer capture follows the same sequence as a front course approach. Correct lateral steering commands are derived on the Flight Director Indicator, but vertical information is displayed as a function of the vertical mode selected.

**NOTE:** The Front Inbound Course must be selected with the Course Arrow.

– GO-AROUND

**NOTE:** Go-around mode can be selected at any time and is to be selected on deciding to discontinue the approach. A coupled go-around, in which the elevator is commanded by the autopilot, will be activated only when in APPR mode. An uncoupled go-around, using only the flight director, will be activated in any selected mode.

The go-around mode (GA) is a wings-level, fixed 7° pitch-up mode which is selected by pressing the GA button (on the outboard side of each power lever). A lateral mode selection will disconnect the go-around mode and synchronize the vertical commands to airplane pitch angle existing at the time of mode selection.

Operation of the SYNC button will cancel the GA mode and synchronizes the vertical command to the aircraft attitude. Reengagement of the autopilot while in GA mode cancels GA and synchronizes the autopilot commands to the aircraft pitch angle at the time of engagement and continues to maintain wings level.



## OPERATIONS MANUAL

### VERTICAL MODES

#### – PITCH HOLD

With a lateral mode (HDG, NAV, APPR, B/C) selected and no vertical mode selected, the ADI command bars are in view and display roll commands appropriate to the selected lateral mode, and pitch commands to maintain the pitch attitude present at the time of mode selection. The pitch command reference can be changed in two ways:

1. Operation of the SYNC button on the control wheel causes the computer to synchronize with the current airplane pitch attitude. This allows the pilot to position the airplane to any desired pitch angle (within the pitch limits), then momentarily press the SYNC button to resynchronize the computer to the new attitude. The ADI command bars then provide commands to maintain the new pitch attitude reference. With a vertical mode selected (ALT, IAS or VS, CLM, DSC), operation of the SYNC button does not cancel the vertical mode and synchronizes the system with the present pitch attitude. The SYNC button is interlocked so it will not cancel the vertical mode during glide slope tracking.
2. When the vertical trim switch is momentarily actuated, it provides a + 0.5-degree pitch change. When it is held down longer than 1/2 second, it provides a fixed slew rate command for the ADI command bars. With the autopilot engaged, the airplane responds to the pitch commands. If an air data mode is selected, the vertical trim switch provides a fixed incremental change for each actuation. Vertical trim switch operation is interlocked so it does not operate during glide slope tracking.

#### – ALTITUDE HOLD (ALT)

ALT can be selected during all modes of operation, except after glide slope capture in APPR mode. Deviations from the altitude at the time the mode was selected are displayed on the Flight Director Indicator as pitch commands.

**NOTE:** The autopilot maintains the airplane at the selected altitude by changing the pitch attitude of the airplane. The pilot must maintain sufficient power settings to assure a safe airspeed.

#### – INDICATED AIRSPEED (IAS)

The IAS mode may be selected during all modes of operation except after glide slope capture in APPR mode. Deviations from the airspeed at the time the mode was selected are displayed on the Flight Director Indicator as pitch commands.

#### – VERTICAL SPEED (VS)

The VS mode may be selected during all modes of operation except after glide slope capture in APPR mode. Deviation in vertical speed provides commands to maintain the vertical speed present at the time of mode selection. VS must be established for 10 seconds prior to selecting VS mode.



## OPERATIONS MANUAL

### – ALTITUDE PRESELECT (ALT SEL)

The altitude preselect mode (ALT SEL) operates in conjunction with the altitude alerter. The ALT SEL mode is used to capture a preselected altitude which is shown on the Altitude Alerter Preselect Panel.

The ALT SEL mode can be used with any other vertical mode of the Autopilot/Flight Director System, as well as in basic pitch mode. From the moment the ALT SEL mode is selected until the preselected altitude is reached, the Autopilot/Flight Director goes through a sequence of phases:

- A. Altitude Preselect Arm
- B. Altitude Preselect Capture
- C. Altitude Preselect Track

A. ALTITUDE PRESELECT ARM – This phase starts after the selection of the ALT SEL mode and the desired vertical mode, on the Flight Control Panel.

It is also possible for the pilots to change the selected altitude without changing the Autopilot/Flight Director operation. The new selected altitude should be consistent with the vertical mode selected or the vertical speed of the airplane.

In the event the new selected altitude is not in accordance with the airplane vertical displacement, the AP/FD systems will not capture the new selected altitude.

For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, the vertical speed is monitored to verify if the airplane is moving towards the preselected altitude. If the computer detects a vertical speed in the opposite direction from the desired preselected altitude, the ALT ARM annunciator flashes indicating that the preselected altitude will not be captured.

**NOTE:** – It is necessary to select, on the altitude alerter preselect panel, an altitude which is exactly a multiple of one hundred. If the altitude value is not properly set (a detent must be felt) a "knob-in-motion" signal will preclude the Autopilot/Flight Director from capturing the preselected altitude.

- For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, if a "knob-in-motion" signal is sensed by the computer, the ALT ARM annunciator flashes indicating that the Flight Director will not capture the selected altitude.

B. ALTITUDE PRESELECT CAPTURE – The moment this phase starts depends on the vertical speed of the airplane. The AP/FD systems will switch from Arm to Capture phase when the numerical difference between the airplane altitude and the preselected altitude is approximately one third of the numerical vertical speed value. When the AP/FD enters the Altitude Preselect Capture phase, the vertical mode (if selected) will drop off and the display will show ALT instead of ALT ARM annunciation.

For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, when the AP/FD enters the Altitude Preselect Capture phase the system will maintain the ALT ARM annunciation.

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## **OPERATIONS MANUAL**

- NOTE:** – If during this phase the pilot changes the preselected altitude value, the AP/FD systems will revert to basic pitch mode and the ALT annunciator will drop off. To capture a new preselected altitude the pilot should reset the AP/FD modes.
- For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, during altitude preselect capture phase, a "knob-in-motion" signal or a vertical mode change causes the system to return to Altitude Preselect Arm phase. The ALT SEL mode will still be operative, but the vertical mode will remain off. The AP/FD may or may not capture the new altitude depending on the attitude of the airplane.

**C. ALTITUDE PRESELECT TRACK** – There is no indication to the pilots when the Autopilot/ Flight Director systems go from the Altitude Preselect Capture phase to Altitude Preselect Track phase. However, this transition normally takes approximately 30 seconds. In this phase, the pilots can change the preselected altitude value without affecting the Autopilot/ Flight Director operation.

When the altitude is captured, the system automatically engages the altitude hold mode. For airplanes Post-Mod. SB 120-022-0020 or S/N 120.154, 120.162, 120.182 and on, when the AP/FD goes into Altitude Preselect Track, the annunciation will go from ALT ARM to ALT.

– **DESCENT MODE (DSC)**

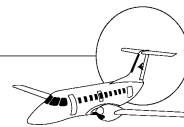
Prior to selecting DSC mode, the desired altitude should be selected on the Altitude Preselector. When descent mode is selected, the autopilot will begin a gradual descent, stabilizing at an average rate of 2000 feet per minute. The pilot may vary the rate of descent by operating the vertical trim switch. The DSC and ALT ARM annunciators go on when the mode is selected.

– **CLIMB MODE (CLIMB)**

Prior to selecting CLIMB mode, the desired altitude should be selected on the Altitude Preselector. When the CLIMB mode is selected, the autopilot begins a gradual climb, stabilizing at an indicated airspeed defined by the climb profile. This profile is:

- 155 KIAS up to 20000 ft, then decreasing by approximately 2 kt/1000 ft to 135 KIAS at 32000 ft, for airplanes equipped with autopilot computer P/N 622-8315-302 MOD. 67,G.
- 170 KIAS at SL decreasing to 155 KIAS at 20000 ft, maintaining 155 KIAS above 20000 ft, for airplanes equipped with autopilot computer P/N 622-8135-402 MOD. 71,G.

**NOTE:** Airplanes S/N 120.287, 120.288, 120.290 and on have the autopilot computer P/N 622-8135-402 MOD 71,G factory incorporated.



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When the altitude is captured, the system automatically engages the Altitude Hold Mode (ALT) and CLIMB mode is cancelled. The CLM and ALT ARM annunciators go on when the mode is selected.

**NOTE:** If CLIMB mode is selected at a speed below the climb profile speed, the APS will decrease the rate of climb to 50 feet per minute, in order to increase the airspeed to the climb profile speed. The pilot is responsible for maintaining proper power to insure the climb profile speed.

**NOTE:** When airplane is not equipped with Altitude Preselect Alerter, ALT SEL, DSC and CLIMB buttons are inoperative and have no inscription.



# OPERATIONS MANUAL

## APS OPERATIONAL TOLERANCES

MODE	PARAMETER	VALUE ± 10%
Attitude hold (engaged with no modes selected)	Pitch command limit	+ 20, – 10 °
	Pitch hold accuracy	± 0.25°, smooth air
	Roll command limit	± 30 ± 3°
	Roll hold accuracy	± 1°, smooth air
Heading hold (HDG)	Roll angle limit	25 ± 2.5°
	Accuracy	± 1°, smooth air
Navigation (NAV)	Beam intercept angle	± 90 ° maximum
	Roll angle limit	± 25 ± 2.5°
VOR track submode	Roll angle limit	10 ± 1°
	Crosswind correction	Up to ± 30° of heading
Approach (APPR) LOC capture submode, (greater than 10 nmi) LOC on course submode  GS submode	Beam intercept angle	± 60° maximum
	Roll angle limit	25 ± 2.5°
	Roll angle limit	15 ± 1.5°
	Crosswind correction	Up to ± 30° of heading
	Localizer beam tracking	CAT I or CAT II limits
	Pitch command limit	6 ± 1°
Go-around (GA)	GS beam tracking	CAT I or CAT II limits
	Pitch-up command limit	7°
	Pitch hold accuracy	± 1°, smooth air
Altitude preselect (ALT SEL)	Roll hold accuracy	± 1°, smooth air
	Engage range	– 1000 to 43000 ft
	Engage vertical speed limit	± 4000 fpm
Altitude hold (ALT)	Engage range	– 1000 to 50000 ft
	Engage vertical speed limit	± 500 ft/min
	Accuracy	± 50 ft max dev at sea level in smooth air
	Pitch command limit	6 ± 1°
	Altitude increment step	± 25 ft
Indicated airspeed hold (IAS)	Engage range	100 kts to 300 kts
	Accuracy	± 5 knots, smooth air
	Pitch command limit	6 ± 1°
	Airspeed increment step	± 1 knot
	Airspeed increment range	± 10 knots
Vertical speed hold (VS)	Engage range	± 4000 fpm
	Pitch command limit	6 ± 1°
	Vertical speed increment step	± 200 ft/min

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**OPERATIONS MANUAL**

ACTIVE MODE ↑	NO MODE	GO-AROUND	HDG	NAV		APPR (RECEIVER TUNED TO LOC FREQ)		APPR (RECEIVER TUNED TO VOR FREQ)									
				VOR, LOC, R-NAV	VOR	FRONT COURSE		BACK COURSE									
				Before capture	After capture	Over the cone	Before capture	After capture	Before capture	After capture							
Submode condition	Attitude hold (AP) Off mode for flight director	Maintains wings level	Captures and holds a selected heading	Heading select intercept	Tracks selected radial or course	Over the cone	Heading select intercept to inbound course	Tracks inbound course	Heading select intercept to back LOC course	Tracks back LOC course	Heading select intercept	Tracks selected radial	After capture	Before capture	Over the cone		
System condition	Attitude hold (AP)	Maintains wings level	Captures and holds a selected heading	Heading select intercept	Tracks selected radial or course	Uncouples radio Accepts course changes	Heading select intercept to inbound course	Tracks inbound course	Heading select intercept to back LOC course	Tracks back LOC course	Heading select intercept	Tracks selected radial	After capture	Before capture	Uncouples radio Accepts course changes		
Roll steer display (ADI)	Out of view	Roll error	Computed heading command	Computed heading command	Computed course command	Memorized course command	Computed heading command	Computed LOC command	Computed heading command	Computed LOC command	Computed heading command	Computed course command	Computed course command	Computed course command	Memorized course command		
Annunciator display		GA	HDG	HDG NAV ARM	NAV	NAV DR	HDG APPR ARM	APPR GS ARM	HDG APPR ARM B/C	APPR B/C	HDG APPR ARM	APPR	APPR	HDG APPR ARM	APPR DR		
Turn knob	Roll command	Not active														Not active (interlocked with APPR mode)	
<b>SYNC button</b>	Syncs to roll attitude																Interrupts servo engage, upon release returns to active command

**LATERAL MODE CHART**





## OPERATIONS MANUAL

### POINTS TO REMEMBER

1. Operation of the vertical trim switch on the Autopilot Panel without a vertical mode selected. This control switch is used for vertical control of the autopilot. In the basic pitch mode, activating this switch gives a 0.5 degree command. If the control switch is held for longer than one second, the autopilot assumes the slew mode and changes the pitch attitude at a rate of one degree per second.
2. In VS Hold mode, the synchronized vertical speed is changed in 200 ft/min increments with each activation of the vertical trim switch.
3. In IAS Hold mode, the synchronized airspeed is changed in one-knot increments with each activation of the switch.
4. In the ALT Hold mode, the synchronized altitude is changed by 25 feet with each activation of the switch.
5. With a vertical mode selected (ALT, IAS, VS, DSC, CLM), operation of the SYNC button does not cancel the vertical mode. It synchronizes the system to the present position of attitude, airspeed, altitude or vertical speed. SYNC button operation is interlocked so it has no effect during glide slope tracking. Operation of the SYNC button cancels Go-Around.
6. Do not select any vertical modes until 3 minutes have elapsed since application of electrical power to the autopilot system.
7. Basic Attitude mode – with no lateral mode selected: The steering display is biased out of view and the ADI is used as a standard Artificial Horizon instrument.
8. Bank command limit is  $\pm 30$  degrees with turn knob,  $\pm 25$  degrees in lateral modes,  $\pm 15$  degrees in approach, and  $\pm 10$  degrees in VOR track. The pitch command limit is  $\pm 15$  degrees up and  $- 10$  degrees down. Vertical mode operation is limited to  $\pm 6$  degrees.
9. Vertical Hold mode information is displayed in Flight Director mode by selecting the desired vertical mode button on the Flight Control Panel. If a vertical mode is selected during manual Flight Director operation, it will automatically be dropped when the autopilot is engaged for coupled operation.
10. To synchronize the vertical Flight Director commands to the airplane attitude, actuate the SYNC button on the control wheel after selection of any lateral mode.
11. When making any autopilot coupled approach, primary flight instruments must be monitored by the pilot. Presence of a VOR, LOC, or GS flag must be considered as a warning of the system or a signal failure. Any Flight Director presentation with a flagged system is unreliable.
12. When flying inbound toward a VOR in NAV mode, do not set up a VOR capture problem within approximately 5 miles of the VOR. The system does not have time to solve the problem and stabilize on course before passage over the station.
13. Radio course may be changed over a VOR station when operating in NAV mode, as long as the course change is not more than 30 degrees. If the course change is more than 30 degrees, the HDG mode should be selected to establish a new intercept and then the NAV mode should be preselected to set up a new capture.



## **OPERATIONS MANUAL**

14. For optimum NAV mode operation, select intercept angle so the system maintains straight and level flight in the NAV mode a minimum of 30 seconds prior to capture.
15. When making a station passage in NAV mode, the computer may automatically switch into heading memory sub-mode to allow a smooth station passage.
16. It is recommended that all capture angles be limited to 90 degrees or less in NAV mode and 60 degrees or less in APPR mode.
17. Always check the Flight Control Panel display to verify that proper switching has taken place.

