



# Introduction

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The KFC 275 Flight Control System combines complete autopilot and flight director computation functions in a single computer. Its digital flight computer and integrated architecture enable the KFC 275 to determine aircraft control requirements sooner and execute them with greater smoothness and accuracy than previous autopilot systems. The implementation of digital solid state circuitry throughout the Flight Control System provides the pilot with maximum reliability while economizing the system weight and required installation space.

The KFC 275 is designed to optimize passenger and flight crew comfort, while still providing accurate control response in any flight situation. Wherever possible, autopilot-induced aircraft motions border on the lower limits of human perceptibility, ensuring exceptionally smooth flight. Many of the Flight Control System's maximum commandable values, however,

are determined for each individual aircraft during the Flight Control System certification process. Consult the KFC 275 Flight Manual Supplement for your aircraft to determine particular operation.

Internal safety monitors keep constant track of the KFC 275's status and provide signals for automatic shutdown of the autopilot or flight director in the event of a malfunction. In addition to reliability and light weight, the KFC 275 is designed to be easily maintained in the field. Qualified Bendix/King Service Centers are located around the world to provide assistance whenever necessary.

The KFC 275 is specially designed to interface with three-inch electromechanical instruments. The KFC 275 is also capable of interfacing to many navigation systems, radar altimeters and other peripheral components.

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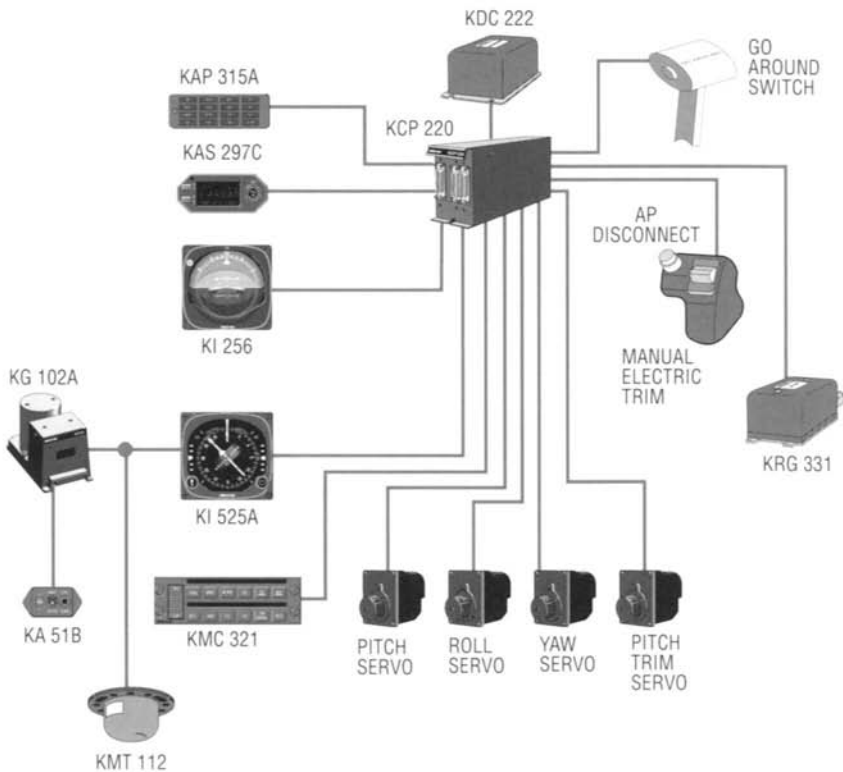
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# System Configuration

The KFC 275 Flight Control System is designed to locate all mode and function controls within convenient reach of the pilot and to provide clear, easily interpreted information displays. The KFC 275 offers a variety of interface options. The following equipment list provides a sample KFC 275 Flight Control System.



## KFC 275

### Cockpit Units

- KMC 321 Autopilot Mode Controller
- KAP 315A Annunciator Panel
- Control Wheel Switch Assembly
- Power Lever Go-Around Pushbutton
- Electromechanical Display Units
- KAS 297C Altitude/Vertical Speed Preselector (optional)

### Remote-Mounted Units

- KCP 220 Flight Computer
- KDC 222 Air Data Sensor
- Servo Actuators
- KCS 55A Compass System
- KRG 331 Rate Gyro

## System Components

# KFC 275



# System Components

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## Mode Controllers



### KMC 321 Mode Controller

The KFC 275 system features either the KMC 321 or KMC 221 Mode Controller. The specific mode controller installed in your aircraft was determined during certification to best suit the operation of your aircraft.

#### Mode Annunciations

**HDG (heading select)** — Illuminates when heading select mode is engaged by the heading pushbutton.

**NAV (capture and track selected navigation sensor)** — Illuminates when Nav mode is engaged and is normally sequenced through Nav Arm. Nav can be used with VOR, RNAV, or Long Range Navigation sensors.

**NAV ARM (pre-engage condition of NAV)** — Illuminates when Nav mode is called for by the NAV pushbutton and course needle deflection exceeds the capture requirements of the Nav mode. When the capture requirements are met (needle displacement and course closure rate), the autopilot will capture and track the needle and NAV Arm will convert to NAV mode. NAV Arm allows a compatible lateral mode to be used to intercept the desired course or track.



### KMC 221 Mode Controller

APR (capture and track selected navigation sensor with approach accuracy) — Illuminates when the Approach mode is engaged and is normally sequenced through Approach Arm. Approach mode may be used with Localizer, RNAV, or VOR approach sensors.

APR ARM (pre-engage condition of APR) — Illuminates when the Approach mode is called for by the APR pushbutton and course needle deflection exceeds the capture requirements of the Approach mode. When the capture requirements are met (needle displacement and course closure rate) the flight director will capture and track the needle. APR Arm will convert to APR (Coupled) .

BC (back course) — Illuminates when the Back Course mode is engaged. Back Course automatically activates the Approach Arm/Capture mode and illuminates the respective annunciator.

YD (yaw damper) — Illuminates when yaw damp is engaged. The yaw damper may be engaged by depressing the YD or AP pushbutton.

AP (autopilot) — Illuminates when the autopilot is engaged. The autopilot may be engaged by depressing the AP pushbutton.



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**ALT** (hold current reference altitude) — Illuminates when the Altitude Hold mode is engaged by depressing the ALT pushbutton or by automatic sequencing through Altitude Capture when using the optional KAS 297C Altitude Preselect system.

**IAS** (hold current reference airspeed) — Illuminates when the Airspeed Hold mode is engaged by depressing the IAS pushbutton.

**FD** (flight director) — Illuminates when the FD button is pushed or by default when any flight director mode is engaged. In the absence of any other vertical or lateral modes, the flight director will command wings level and pitch attitude to hold.

**SR** (soft ride) — Illuminates when Soft Ride mode is engaged. SOFT RIDE can be activated only when the autopilot is engaged.

**HB** (half bank angle) — Illuminates when Half Bank mode is engaged.

**TRIM** (trim warning light) — Illuminates continuously in the absence of trim power or if the system has not been preflight tested. An audible warning accompanies the light during a trim fault.

## Mode Select Pushbuttons



**HDG** (heading select) — Alternately engages and disengages Heading Select mode. Heading information is received from the position of the heading bug on the horizontal situation indicator (HSI). Depressing the HDG pushbutton will activate the flight director in Heading mode.



**NAV** (capture and track selected navigation sensor) — Alternately engages and disengages the Navigation mode. The flight director commands tracking of the coupled navigation receiver upon activation. Consult the Aircraft Flight Manual Supplement for more information on the aircraft NAV sensor selection scheme. Glideslope coupling is inhibited in the NAV mode.



APR (capture and track selected navigation sensor with approach accuracy) — Alternately engages and disengages the Approach mode. Glideslope coupling is enabled in the Approach mode.

YD (yaw damper) — Alternately engages and disengages the Yaw Damp independent of the autopilot pitch and roll axes.



BC (back course) — Alternately engages and disengages the Back Course Approach mode. Back Course functions identically to the Approach mode except that the autopilot response to the localizer signal is reversed. Glideslope coupling is inhibited in the Back Course Approach mode.

AP (autopilot) — Alternately engages and disengages the autopilot. Yaw Damp is automatically activated when the autopilot is engaged, however, Yaw Damp remains engaged if the autopilot is disengaged by depressing the AP pushbutton again.

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DN/UP (vertical trim) — Controls the vertical axis of the autopilot. The rocker switch function is dependent upon the flight director's active mode. Depressing and holding the switch up or down results in the following:



In Pitch Attitude Hold mode the vertical trim switch adjusts the pitch attitude at a rate dependent upon the current airspeed. The maximum pitch rate is one degree per second.

In Altitude Hold mode the vertical trim adjusts the altitude reference at a constant rate of approximately 500 feet per minute.

In Indicated Airspeed Hold mode the vertical trim switch adjusts the indicated airspeed reference at a constant rate of three quarters of a knot per second (0.75 kt/sec).

In Vertical Speed Hold mode the vertical trim switch adjusts the vertical speed at a rate of one hundred feet per minute per second (100 fpm/sec).



ALT (hold current reference altitude) — Alternately engages and disengages Altitude Hold mode. Altitude Hold commands the aircraft to maintain the pressure altitude existing at the moment of selection. (Because the autopilot uses pressure altitude, the pilot must correct for altimeter changes during flight to insure the pressure altitude being maintained matches the baro-altitude.



IAS (hold current reference airspeed) — Alternately engages and disengages Indicated Airspeed Hold mode. The aircraft pitch command is varied by the flight director to maintain the selected airspeed during changing air conditions, power changes and/or aircraft configuration changes.



FD (flight director) — Engages the flight director in Pitch Attitude Hold and Wings Level mode. The pitch attitude is synchronized to the current aircraft pitch attitude. Pressing FD when flight director is engaged will disengage all flight director modes if the autopilot is not engaged.



HALF BANK — Engages the Half Bank autopilot mode. The flight director's maximum commanded bank angle is reduced to one half the normal value. The half bank angle turns provide for extended passenger comfort. This mode is automatically disengaged when the Approach or Back Course Approach mode is activated.



SOFT RIDE — Engages the Soft Ride autopilot mode. Soft Ride mode decreases the autopilot gains thus decreasing the aggressiveness of the autopilot. The result of Soft Ride is a more comfortable ride in turbulent air conditions. Routine use of this mode during all flight conditions may result in less than optimum autopilot performance. Soft Ride mode is automatically disengaged when the Approach or Back Course Approach mode is activated.



TEST (preflight test) — When momentarily pushed, the preflight test button initiates the preflight test sequence. The test includes illumination of all annunciator lights, testing of rate and trim monitors, and testing of valid and disconnect logic within the computer. The AP annunciator will flash for approximately six seconds upon successful completion of the preflight test. An aural tone accompanies the flashing AP annunciation. The Autopilot mode cannot be enabled until preflight test has been successfully passed.

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## Altitude/Vertical Speed Preselect (Optional)



### KAS 297C Preselector

#### Mode Annunciations

The display brightness is adjusted automatically for ambient light conditions by a photocell located on the face of the unit.

**VS (vertical speed)** — Illuminates when Vertical Speed Hold mode is engaged. The ENG pushbutton activates Vertical Speed Hold mode.

**ALERT (altitude alert)** — Illuminates anytime the aircraft is more than 300 feet and less than 1000 feet from the selected altitude. An aural tone accompanies the ALERT. The ALERT will also momentarily illuminate when an armed selected altitude is captured.

**Altitude/Vertical Speed Selection** — The gas discharge display shows the selected altitude from 100 to 50,000 feet or the selected vertical speed ranging from zero to 5,000 feet per minute up or down. Altitude is displayed while the small (inner) selector knob is in the "IN" position. Selected vertical speed is displayed when the small (inner) knob is in the "OUT" position. Rotating the concentric knobs changes the selected vertical speed or altitude.

**Vertical Speed UP/DOWN Caret (∇)** — Indicates whether the selected vertical speed is up or down.

**ARM** — Indicates the Altitude Select mode is armed to capture the selected altitude. The ARM pushbutton activates the Altitude Select mode.

**NOTE:** *The display of the selected altitude is required to activate the Altitude Select mode. This assures pilot verification of altitude before activation.*

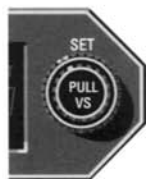
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**CAPT (capture)** — Illuminates when the KAS 297C has switched the flight director from the active Pitch mode to Altitude Capture (CAPT). The Altitude Capture mode occurs prior to the point the flight director engages Altitude Hold. The point at which the flight director initiates Capture varies with vertical speed. The higher the rate of climb, the sooner Altitude Capture becomes active. At a low rate of climb, the activation of the Altitude Capture mode and the transfer to Altitude Hold occur almost simultaneously.

**FT/MIN (scale annunciator)** — Indicates FT/MIN when in Vertical Speed Hold mode. Displays FT when in the Altitude Select mode.

## Controls

**Vertical Speed/Altitude Select Knob** — Concentric knobs which allow easy selection of altitude or vertical speed. The inner (small) knob has an "IN" and "OUT" position.



Altitude is displayed and selected when the small knob is in the "IN" position. When rotated, the small knob selects altitude in 100 foot increments with roll over into the 1000 digits. The outer (larger) knob selects 1000 foot increments with roll over into the 10,000 digits.

Vertical speed is displayed and selected when the small knob is in the "OUT" position. When rotated while positioned "OUT", the small knob selects vertical speed in 100 feet per minute increments. The larger knob selects vertical speed in 1000 feet per minute increments up to a maximum of 5000 feet per minute.

**Altitude Select Mode (ARM) Button** — Engages Altitude Arm mode when depressed while the selected altitude is displayed. Altitude Select (ARM) mode will cancel Altitude Hold (ALT) mode if Altitude Hold is already engaged. Glideslope coupling will cancel Altitude Select (ARM) mode. The engagement of Altitude Hold by the pilot with the mode controller will cancel the Altitude Select (ARM) mode. Altitude Select (ARM) mode allows selection of a new altitude without deactivating the ARM.



**Vertical Speed Mode (ENG) Button**— Engages Vertical Speed Hold mode when pressed while the selected vertical speed is displayed on the indicator. When depressed with altitude being displayed, the Vertical Speed Hold mode is engaged and the vertical speed flight director command is synchronized to the current vertical speed of the aircraft. The synchronized vertical speed is displayed momentarily.

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## Annunciator Panels



### KA 185A Annunciator Panel



### KAP 315A Annunciator Panel

#### Display Features

All display brightness is adjusted automatically for ambient light conditions by a photocell located on the face of the unit.

FD, SR, HDG, HB, APR, APR ARM, IAS, BC, TRIM, ALT, NAV, and NAV ARM operate identically to the annunciators provided by the Mode Controllers.

AP (autopilot) — Illuminates when the autopilot is engaged and flashes for five seconds upon autopilot disengagement.

YD (yaw damper) — Illuminates when the yaw damper is engaged and flashes for five seconds upon yaw damper disengagement.

GA (go around) — Illuminates when the Go-Around button is pushed engaging Go-Around mode.

GS (glideslope) — Illuminates when Approach mode is engaged and the glideslope beam has been captured.

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## Control Wheel Switch Assembly



Mounted on the aircraft control wheel(s), the switch assembly provides pushbutton controls for the Control Wheel Steering function (flight director synchronization) and Autopilot Disconnect/Trim Interrupt. The manual electric trim split rocker switch is also located on the control wheel switch assembly.

### Control Wheel Steering

Pressing the CWS pushbutton disengages autopilot servo clutches, if engaged, and synchronizes the current vertical mode on the flight director. Upon release of the pushbutton, the autopilot servo clutches reengage. The autopilot follows the new vertical reference (when CWS is released) and tracks the engaged lateral mode.

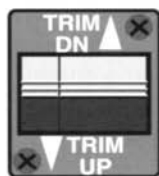
If the flight director is not engaged, pressing the CWS pushbutton activates the flight director in Pitch Attitude and Wings Level. The flight director command bar will synchronize the aircraft to the pitch attitude present upon pushbutton release.

### Autopilot Disconnect/Trim Interrupt Pushbutton

When pressed momentarily, disengages the autopilot and yaw damper and cancels all operating flight director modes. A tone will sound upon autopilot disconnect when the pushbutton is released.

When pressed and held, the Autopilot Disconnect/Trim Interrupt Pushbutton suppresses the autopilot disconnect tone and interrupts the electric trim power in addition to disengaging the autopilot, yaw damper, and flight director.

### Manual Electric Trim Control



A split rocker switch controls manual electric pitch trim and disengages the autopilot. Moving both switches to the forward position activates nose down trim, while moving both rearward activates nose up trim. Activation of manual electric trim will cause the autopilot to disconnect.

*Note: Certain installations may utilize the original manufacturers electric pitch trim control.*



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## Flight Command Indicator

KI 254/KI 256

Flight Command Indicator

### Display Features

The KFC 275 is installed in conjunction with conventional electromechanical flight instruments. The KI 256/254 Flight Command Indicator and the KI 525A Horizontal Situation Indicator provide displays of aircraft pitch and roll attitude, radio navigation information and steering commands computed by the flight control system. The KI 256 differs from the KI 254 in that the KI 256 is an air driven gyro while the KI 254 is 28 vdc electric.

**Roll Attitude Index** — Displays airplane roll attitude with respect to the roll attitude scale.

**Roll Attitude Scale** — Provides roll attitude measurement with scale markers at 10°, 20°, 30°, 45°, and 60° of left and right bank.

**Symbolic Airplane** — A stationary display that provides a reference for pitch and roll attitudes displayed by the flight command indicator's movable background.

**Decision Height Annunciator** — The DH light illuminates when installed with a compatible radio altimeter system and the preselected decision height has been reached.

**Pitch Attitude Scale** — Provides pitch attitude measurement with reference to the symbolic airplane. Scale markers appear at 0°, 5°, 10°, 15°, 20°, and 25° of up and down pitch attitude.

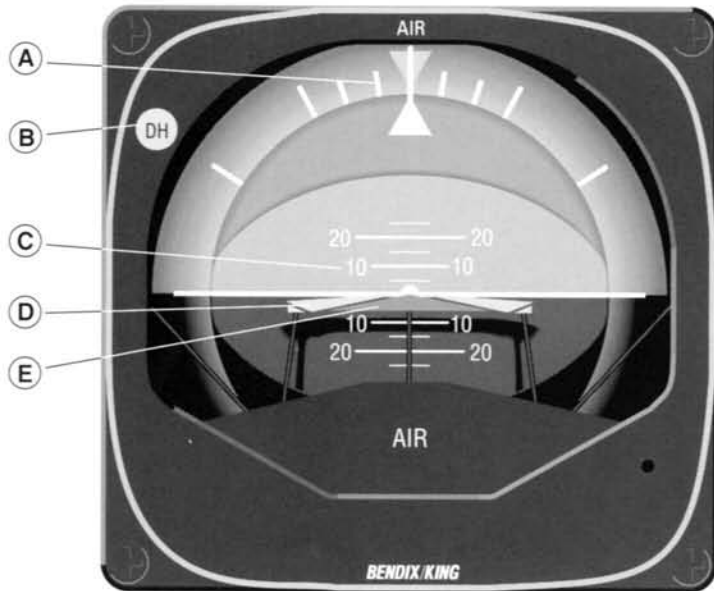
**Flight Director Command Bar** — displays commands computed by the Flight Computer with reference to the symbolic airplane. Deactivation of the flight director by the flight crew will cause the command bars to swing out of view.

The KFC 275 automatically disengages flight director and autopilot functions in event of a Flight Computer malfunction. Component failures within the Flight Command Indicator do not automatically disengage flight director or autopilot systems.

**Attitude Flag** — The KI 254 incorporates an Attitude Flag not present in the KI 256. The KI 254 Attitude Flag indicates an attitude gyro failure. The KI 254 also includes a Flight Director Flag.

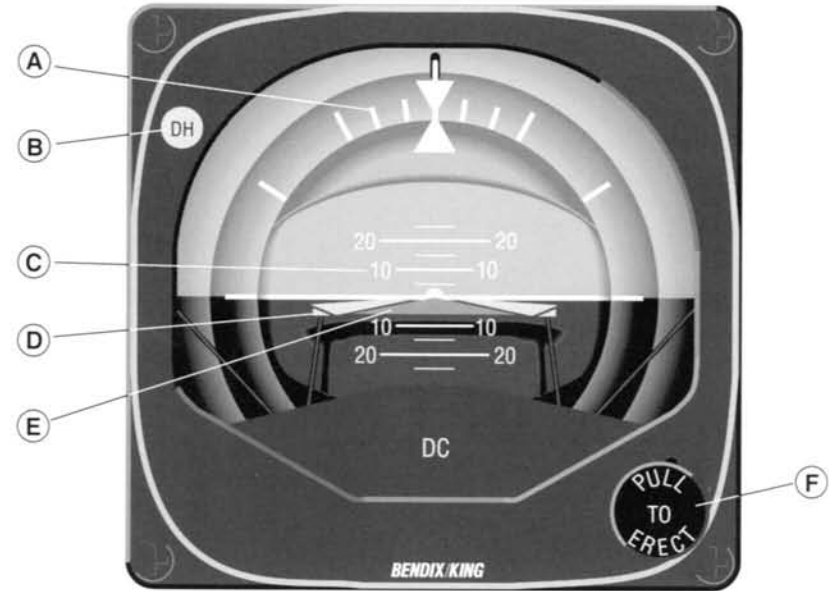
**Caging Knob** — The KI 254 provides a caging knob to erect the gyro. Pulling the caging knob erects the gyro.

KI 256 Flight Command Indicator



- (A) Roll Attitude Scale
- (B) Decision Height Annunciator
- (C) Pitch Attitude Scale
- (D) Command Bars
- (E) Symbolic Airplane

KI 254 Flight Command Indicator



- (A) Roll Attitude Scale
- (B) Decision Height Annunciator
- (C) Pitch Attitude Scale
- (D) Command Bars
- (E) Symbolic Airplane
- (F) Caging Knob

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## Horizontal Situation Indicator

### KI 525A HSI

#### Display Features

**Compass Card** — Displays magnetic heading information received from the aircraft's compass system.

**Lubber Line** — Index mark for current aircraft magnetic heading.

**Nav Flag** — Warns that the received navigation signal is inadequate for course tracking. Some versions of the KFC 275 will not allow NAV on Approach Coupling if the Nav flag is displayed.

**Course Pointer** — Displays the magnetic course selected with the course selector knob. Course pointer remains stationary with respect to the compass card, except during course selection.

**Course Deviation Indicator/Scale** — Measures displacement of the course deviation indicator in relation to a five-dot scale right and left of course centerline. Scale calibration is different for each Nav sensor. In VOR, a five-dot CDI deviation indicates angular displacement of  $10^\circ$  from the selected course. RNAV enroute full-scale deflection indicates a five-mile, linear displacement. In localizer, full-scale deflection indicates  $2.5^\circ$  deviation from the localizer centerline. RNAV Approach full-scale deflection indicates a 1.25-mile linear displacement from the selected course. If the NAV Flag is in view the CDI information is invalid.

**To/From Indicator Flag** — Indicates direction of Nav reference relative to the selected course. The To/From flag is invalid if the Nav flag is displayed.

**Symbolic Aircraft** — Stationary symbol for display reference.

**Glideslope Pointer** — Indicates deviation from beam centerline during glideslope tracking, in relation to the Glideslope Scale.

**Course Selector Knob** — Moves the course pointer in the direction of knob rotation.

**HDG Flag** — Warns that the compass display is invalid. The compass flag is also in view during manual slaving adjustments.

**Heading Bug** — Indicates selected heading for flight director tracking in the Heading mode, as selected with the heading selector knob. Except during selection, the bug remains stationary with respect to the compass card.

**Heading Selector Knob** — Moves the heading bug on the compass card in the direction of selector rotation.

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KI 525A Horizontal Situation Indicator



- |                           |                                |
|---------------------------|--------------------------------|
| (A) Lubber Line           | (F) Course Select Knob         |
| (B) NAV Flag              | (G) Heading Flag               |
| (C) Course Pointer        | (H) Course Deviation Indicator |
| (D) Compass Card          | (I) Heading Bug                |
| (E) Glide Slope Indicator | (J) Heading Bug Select Knob    |

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## Remote Mounted Units

### KCP 220 Flight Computer



The KCP 220 Flight Computer provides all flight director and autopilot command computations as well as safety monitoring functions. Fully digital for reliability and repeatability, the KCP 220 employs individual axis processors for command computation. In addition, the KCP 220 generates audio alerts in case of autopilot disconnects.

The KCP 220 provides both analog and digital (ARINC 429) interfaces.

### Servo Actuators

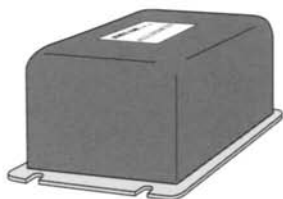


To manipulate trim surfaces, as well as elevator, aileron, and rudder controls, the KFC 275 employs KS 270 or KSA 370 series Servo Actuators installed in the aircraft's fuselage or wing and tail surfaces. Each servo assembly includes a drive motor and its associated circuitry, clutch mechanism, and mounting bracket.

The servo actuator uses a separate capstan assembly (KSM 275 or KSM375) that includes a calibrated slip clutch. The calibrated slip clutch allows the pilot to manually override the autopilot with the controls. The separate capstan allows removal of the servo without the need to dismantle the capstan/bridle cable assembly.

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## KDC 222 Air Data Computer



The KDC 222 Air Data Computer incorporates four sensors to provide air data and acceleration information to the KCP 220 Flight Computer. The altitude and airspeed sensors are used to tailor the Flight Control System to the aircraft's response based on airspeed (scheduling). A vertical acceleration sensor is used with Attitude hold modes while the lateral acceleration sensor provides information for yaw damper computations.

The KDC 222 also contains a monitor that can be used to disconnect the autopilot if vertical acceleration of the aircraft exceeds a set limit determined during autopilot certification.

# Normal Operations

# KFC 275



# Normal Operations

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## Preflight Tests

### Autopilot Self Test

1. Allow 3-4 minutes after applying avionics power for gyros to erect and Heading and Attitude flags to clear.



2. Push the TEST button on the mode controller. The Trim Fail annunciator illuminates upon initial application of power to the autopilot and then extinguishes after successful completion of the self test. Note that the attitude/vertical speed preselect displays all digit segments, flags, and annunciators momentarily. The preflight test concludes with the AP annunciator flashing twelve times accompanied by the autopilot disconnect tone.

3. Upon successful completion of the test all displays return to normal. Some aircraft have preflight test sequences required in addition to the general procedures described here. See the FAA approved Aircraft Flight Manual Supplement for details on your particular aircraft. The KFC 275 must successfully complete the self test before the autopilot is enabled.

*Note: Operation of the Autopilot on the ground may cause the autotrim to run because of back force generated by elevator downsprings or pilot induced forces.*



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## Manual Electric Trim Test

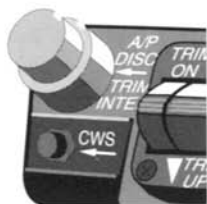
Manual electric trim operation requires both sides of the trim split switch to be depressed in the same direction simultaneously. The following procedure describes a test for the manual electric trim system. Perform this test on the ground.



1. Push the left side of the split switch unit to the fore and aft positions while leaving the right side untouched. The trim wheel should not move. The left side of the split switch provides power to engage the trim servo clutch. Rotate the trim wheel manually against the engaged clutch to check the pilot's trim overpower capability.

2. Depress the right side of the split switch unit to the fore and aft positions while leaving the left side untouched. Again, the trim wheel should not move. Normal trim wheel force should be required to move the trim wheel manually. The right side of the switch controls the servo direction.

3. Depress both sides of the split rocker switch forward. Check to insure that the trim wheel is running in the direction of the nose-down trim. Depress both sides of the split rocker rearward for nose up trim. Verify that the trim is correctly running in the nose up direction.



4. Move both sides of the trim switch fore and aft. Depress the autopilot disconnect/trim interrupt switch while the trim wheel is moving. The trim wheel should stop turning while the autopilot disconnect/trim interrupt switch is held.

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## Flight Director Operations

The KMC 321/KMC 221 mode controllers provide complete selection of flight director modes, ranging from basic pitch attitude and wings level through advanced lateral navigation and vertical speed functions. Continuous, automatic performance monitoring ensures the accuracy and reliability of flight director commands to provide efficient, safe, and effective guidance in almost any situation.



KMC 321

The KFC 275 can engage in only one horizontal and one vertical tracking mode at a time. A number of methods are available to activate the flight director. It is not necessary to press the FD pushbutton prior to selecting a flight director mode. Depressing any one of the HDG, NAV, APR, BC, ALT, or IAS pushbuttons on the mode controller will activate the flight director in the respective mode. Depressing the FD mode controller pushbutton or the control wheel steering (CWS) pushbutton on the yoke will activate the flight director in a pitch attitude (synchronized to the current pitch) and wings level hold mode.

To cancel any active flight director mode, either select an alternate lateral/vertical tracking mode or press the active mode's pushbutton. Go-Around is an exception, as the remote pushbutton provides the engage function only.

When the flight director is operating with no lateral or vertical mode selected, the KFC 275 automatically engages in Wings Level and Pitch Attitude Hold.

The mode controller is the central control unit for flight director mode selection. Annunciator lamps illuminate above the mode controller pushbuttons and on the annunciator panel.

### Flight Director (FD)



Flight Director modes may be activated independently of the autopilot or yaw damper.

The flight director (FD pushbutton) will engage Wings Level and Pitch Attitude Hold and will move the command bars into view synchronized to the current aircraft pitch attitude. Depressing the CWS pushbutton is an alternative way to activate the flight director.

It is not necessary to press the flight director pushbutton prior to selecting another flight director mode. Selecting any flight director mode initiates flight director commands in that mode.

Press the FD pushbutton again to disengage the flight director. The flight director will not disengage if the autopilot is in use.

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## Wings Level and Pitch Attitude Hold (Not Annunciated)

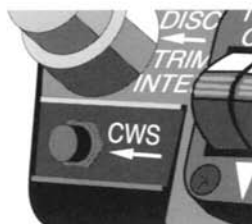
Wings Level and Pitch Attitude Hold, the flight director's default modes, engage automatically in the absence of any active tracking modes. Upon initial activation, the flight director generates commands for wings-level flight at the existing pitch attitude. Wings Level and Pitch Attitude Hold may be activated by depressing the CWS pushbutton on the yoke or the FD pushbutton on the mode controller.

Target pitch attitudes may be modified by adjusting the aircraft's attitude manually while pressing the CWS pushbutton. Alternatively, Pitch Attitude Hold commands may be modified through use of the Vertical Trim control on the mode controller (see System Components, page 1.6).

After release of the CWS pushbutton or the Vertical Trim control, the flight director displays commands to maintain the pitch attitude selected.

Selecting any lateral or vertical tracking mode cancels Wings Level or Pitch Attitude Hold, respectively. Either mode may be used in conjunction with any Arm mode to provide flight guidance for course or altitude intercepts.

## Control Wheel Steering (CWS)



CWS allows the crew to synchronize flight director commands in pitch. The CWS pushbutton activates the flight director in Wings Level and Pitch Attitude Hold mode if pressed and no other modes are active. When the flight director mode selected is Pitch Attitude Hold, Altitude Hold, Airspeed Hold, or Vertical Speed Hold, CWS will cause a new reference attitude, altitude, airspeed, or vertical speed to be established upon release.

The CWS pushbutton disengages the servo clutches giving the pilot full authority of the aircraft while the aircraft is coupled to the autopilot. Release of the CWS pushbutton reestablishes the lateral mode and incorporates the new reference in the vertical mode.

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## Nav (NAV/NAV ARM)



With the Nav mode engaged, the flight director commands roll attitudes necessary to track the course selected on the Nav indicator.

Upon selection, the Nav mode engages either Nav Arm or Nav Capture, depending upon the aircraft's proximity to the selected course and its closure rate. While any lateral tracking mode may be engaged in conjunction with Nav Arm to provide intercept guidance, initiation of the Nav Capture sequence cancels the coexisting mode. If the aircraft's deviation from the selected course centerline is sufficiently small, or if the rate of closure with the new course is sufficiently high, the flight director initiates the Nav Capture sequence immediately.

The Approach mode responds to course needle deviations more aggressively and operates independent of the Nav mode. The Approach mode should be activated when flying a coupled approach to insure maximum autopilot performance. Glideslope is inhibited in Nav mode.

## Heading (HDG)



In Heading mode the flight director commands roll attitudes necessary to track the heading indicated by the bug position on the HSI.

Activating the Heading mode cancels any other lateral tracking mode. The Heading mode may be used during Nav Arm or Approach Arm sequences, but disengages automatically in favor of the Nav or Approach capture functions.

## Approach (APR ARM/APR)



The Approach mode is similar to the Nav mode with regard to Arm. However, the Approach mode is more sensitive to course deviations and responds to the deviations faster than operation in Nav mode. Approach/Approach Arm is activated by depressing the APR pushbutton on the mode controller.

---

Upon initial selection, the Approach mode engages in either Approach Arm or Capture, depending on the aircraft's closure rate and proximity to the selected course. Due to the increased sensitivity of the deviation display in the Approach mode, the flight director may initiate turn commands before any needle movement is shown on the course deviation indicator. Selecting the Approach mode after the aircraft has already passed the point at which Approach Capture would normally begin may result in initial course overshoot due to the flight director's roll command limits.

Approach Capture automatically activates Glideslope Arm, Capture, and Track sequences during ILS front course approaches. Upon capturing glideslope, GS is annunciated on the annunciator panel. Glideslope capture deactivates any other vertical mode. Glideslope coupling is inhibited during back course operation. Exercise caution when Approach Arming the autopilot at significant distances from the localizer or prior to making your final turn for the localizer intercept. Side lobes or false echoes of the localizer are often present on transmitters. The flight director may incorrectly couple and track these false signals. Any lateral tracking mode may be employed during Approach Arm phases, but will cancel automatically upon initiation of Approach Capture.

## Back Course (BC)



The Back Course mode allows the KFC 275 to correctly track the localizer inbound on the back course. This mode also allows the flight director to track outbound on the localizer front course.

Back Course mode is a submode of the Approach mode and may be activated by directly depressing the BC pushbutton. It is essential that the course pointer on the navigation indicator always be aligned with the localizer front course. The Flight Computer reverses the course information selected by the course pointer when in the Back Course Approach mode. Even when using a number two Nav to fly a localizer approach, always select the localizer front course with the omni bearing selector (OBS). An example back course approach is explained in the Example Operations section.

---

## Altitude Hold (ALT)



In the Altitude Hold mode the flight director commands pitch attitudes for tracking of the aircraft pressure altitude current at the moment of mode selection. Altitude Hold can be entered directly by depressing the ALT pushbutton on the mode controller or in conjunction with the Altitude Select mode. Engaging Altitude Hold directly during a climb or descent will cause the aircraft to fly through the desired altitude and then recover from the other side. For this reason, Altitude Hold activation is most effective when vertical speed is less than 500 fpm.

Selecting Altitude Hold after the Altitude Select mode has been engaged cancels Altitude Select and causes the ARM annunciator to extinguish. The flight director will command the aircraft to hold the altitude present at the moment of mode selection.

When operating in environments requiring barometrically corrected altitude, the pilot may have to adjust Altitude Hold to compensate for barometric pressure changes during flight. Altitude Hold commands may be modified by holding the vertical trim rocker switch in the up or down position either momentarily or for several seconds at a time. Continuous vertical trim operation causes the flight director to command a climb or descent, as appropriate, at 500 feet per minute until the switch is released.

## Indicated Airspeed Hold (IAS)



Engaging the Indicated Airspeed Hold Mode causes the flight director to command pitch attitudes to maintain the current indicated airspeed.

Airspeed commands may be altered through use of the vertical trim rocker switch at the rate of 0.75 knots per second or by using CWS. The airspeed value is derived from the outputs of the Air Data Computer.

## Go-Around Mode (GA)



Pressing the Go-Around pushbutton disengages the autopilot and causes the flight director to command a nose-up, wings-level attitude. The exact pitch attitude commanded is selected for each aircraft type during KFC 275 certification. The autopilot and any lateral tracking mode may be subsequently reengaged without cancelling Go-Around. The Go-Around pushbutton is generally located on the throttle, yoke, or panel.

---

## Altitude Select (ALT ARM)



### KAS 297 C Altitude/Vertical Speed Preselector

The Altitude and Vertical Speed Preselect system is a KFC 275 option. The Altitude Select mode arms the flight director for capture and tracking of altitudes selected with the altitude/vertical speed preselector.

A separate vertical mode, must be engaged to provide flight guidance to the point of altitude capture. Upon reaching the altitude capture point, the selected vertical mode will cancel and the flight director will transition to Altitude Capture and then Altitude Hold. Altitude Select is activated by setting the preselector to the desired altitude and then depressing the ARM pushbutton. During ALT ARM, the Selected Attitude may be changed without deactivating the ALT ARM mode.

During transitions to armed altitudes the altitude/vertical speed preselector briefly sounds an alert tone when the aircraft passes within 1000 feet of the selected altitude. In addition, an ALERT annunciator illuminates on the altitude/vertical speed preselector when the aircraft is between 1000 and 300 feet above or below the armed altitude. The annunciator illuminates again, briefly, when the aircraft reaches the selected altitude. Subsequently, alerts are provided if the aircraft deviates more than 300 feet from the selected altitude.

To disengage Altitude Select, press the ALT selector key on the altitude/vertical speed preselector.

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## Vertical Speed (VS)



In the Vertical Speed mode the flight director commands pitch attitudes to maintain the vertical speed selected in altitude/vertical speed preselector. The vertical speed is entered by rotating the extended preselect knob (PULL VS). Vertical Speed is activated by depressing the ENG pushbutton while the desired vertical speed is displayed on the altitude/vertical speed preselector. Verify that the preselected vertical speed displays the caret  $\diamond$  in the appropriate direction.

If no vertical speed value is displayed, depressing ENG will cause the flight director to command a climb or descent at the rate current upon selection. In addition, vertical speed commands may be modified through use of the vertical trim switch at the rate of 100 fpm per second during continuous trim operation. The CWS button may also be used to adjust the vertical speed. The VS select knob changes selected vertical speed by 100 fpm on the small knob and 1000 fpm on the large knob. When Vertical Speed Hold mode is activated, the VS annunciation is illuminated on the altitude/vertical speed preselector.

## Vertical Trim Calibrations



Vertical trim controls the vertical axis commands to the flight director. The function of the rocker switch is dependent upon the active flight director mode. Depressing and holding the rocker in either direction results in the following:

**Pitch Attitude Hold:** Adjusts pitch attitude. The specific value of adjustment is dependent on the aircraft airspeed. The maximum rate of pitch adjustment is one degree per second.

**Altitude Hold:** Maintains 500 fpm climb or descent until released. Altitude present when released is held.

**Indicated Airspeed Hold:** Adjusts the indicated airspeed at a rate of 0.75 knots per second until released.

**Vertical Speed Hold:** Adjusts vertical speed at a rate of 100 fpm per second until released.



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## Autopilot Operations

All of the flight director modes of operation are directed to the autopilot when the autopilot is engaged. The autopilot is engaged by depressing the AP pushbutton on the mode controller. The autopilot cannot be activated if the flight director is not operating properly. To engage modes using the mode controller, press the corresponding pushbuttons. To disengage, press the pushbutton a second time. Annunciator lamps illuminate above the mode controller pushbutton and on the Annunciator Panel indicate engaged modes. The KFC 275 employs an aural alert tone upon autopilot disengagement.

### Autopilot (AP)



Depressing the Autopilot pushbutton initiates autopilot control of the pitch, roll and yaw axes, provided the flight director is active.

The yaw damper, if not previously engaged, engages automatically upon autopilot activation. The autopilot follows the active flight director commands upon engagement.

Pressing the Autopilot pushbutton a second time cancels its operation. The flight director and yaw damper, however, remain engaged until they are cancelled individually.

In case of engine loss consult the aircraft flight manual supplement for procedures regarding autopilot operation.

### Soft Ride (SOFT RIDE)



With the Soft Ride mode engaged, the autopilot reacts softer than normal to deviations from the planned flight track or aircraft attitude. Soft Ride is most useful to reduce the command activity in turbulent air.

Soft Ride may be engaged any time a generally smoother flight is more desirable than immediate corrections of slight altitude, heading, or airspeed deviations.

The specific degree of command softening employed in the Soft Ride mode is determined for each aircraft type during KFC 275 certification. Soft Ride may be engaged with any mode as long as the autopilot is engaged, with the exception of Approach. Soft Ride may be employed at the same time as Approach Arm, but will cancel automatically upon initiation of the Approach Capture sequence.

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## Yaw Damper (YD)



The Yaw Damper pushbutton alternately engages and disengages yaw damper functions independently of the autopilot. If the yaw damper was previously engaged through autopilot activation, pressing the pushbutton cancels the function.

The yaw damper augments aircraft stability by opposing uncommanded motion about the yaw axis and provides turn coordination. In case of engine power loss consult the aircraft flight manual supplement for the procedures specified for yaw damper operation.

## Half Bank (HB)



With the Half Bank mode engaged, the flight director limits the maximum roll attitude command to one-half of the normal limit. Half Bank is activated by depressing the Half Bank pushbutton on the mode controller.

Half Bank may be engaged in conjunction with any flight director tracking mode with the exception of Approach. Half Bank may be employed at the same time as Approach Arm, but will cancel automatically upon initiation of the Approach Capture sequence.

# Emergency Operation

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## Emergency Procedures

The KFC 275 monitors autopilot operations continuously through sensors that monitor the aircraft's pitch attitude and acceleration, as well as servo motor operation. If monitors in the KFC 275 detect a problem, the autopilot will disconnect, illuminate a flashing AP annunciation, and provide an aural disconnect tone. If an autotrim failure is detected, the TRIM annunciator on the annunciator panel illuminates and the trim fail tone sounds. If a manual electric trim failure is detected, the TRIM annunciator illuminates and the trim fail tone sounds. The malfunction continues until the pilot takes action to stop it.

In event of autopilot or flight director malfunction pay primary attention to basic aircraft control prior to attempting to diagnose the exact nature or cause of system failure. Once aircraft control is assured, the crew may attempt to reengage the affected autopilot or flight director mode by pressing the related mode pushbutton.

### Autopilot Emergencies

In the event of an autopilot malfunction, the flight crew should immediately execute the following procedures:

1. Airplane Controls — GRASP FIRMLY AND REGAIN AIRCRAFT CONTROL.
2. Simultaneously PRESS AND HOLD the Autopilot Disconnect/Trim Interrupt Pushbutton located on the yoke. Autopilot and yaw damper will disconnect and trim power is interrupted.
3. While HOLDING the Autopilot Disconnect/Trim Interrupt Pushbutton, pull the autopilot circuit breaker.
4. After the autopilot has been disengaged, DO NOT REENGAGE. Resume normal manual flight operations.
5. Refer to aircraft flight manual supplement for procedures.

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## Manual Autopilot Shutdown

It is important to realize the different ways an autopilot can be manually disconnected. The following list describes the alternate methods to manually shut down the autopilot.

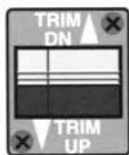
1. Autopilot Mode pushbutton — PRESS AP, THEN RELEASE.



2. Autopilot Disconnect/Trim Interrupt Switch — PRESS AND RELEASE. Both autopilot and yaw damper will disengage.



3. Manual Electric Trim Switch — MOVE TO FORE OR AFT POSITION, THEN RELEASE. Autopilot disengages; flight director remains operational.



4. Go-Around Pushbutton — PRESS, THEN RELEASE. Autopilot disengages; flight director commands a nose-up attitude. The Go-Around pushbutton is generally located on the power lever, yoke, or panel.

5. Autopilot Circuit Breaker — PULL.

6. Autopilot Power Switch (if installed) —TURN OFF.

7. Avionics Master Switch — TURN OFF. Consult aircraft flight manual supplement for your aircraft. Turning off the avionics master will cause loss of power to all connected avionics in the aircraft.

## Engine Failure Emergency (Autopilot Coupled )

1. Disengage the autopilot.
2. Follow the engine inoperative procedures in the airplane operating handbook.

# Operational Examples

# KFC 275

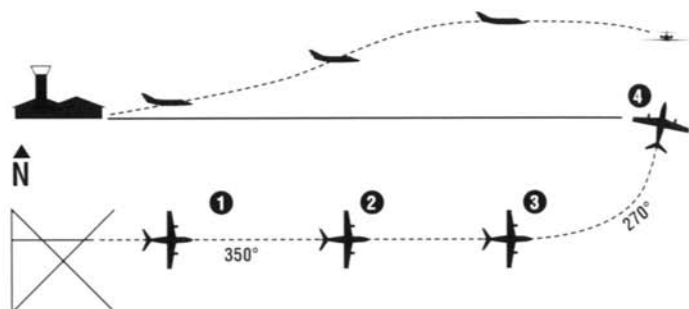


# Operational Examples

## Take Off and Climb

The following examples describe possible applications of the KFC 275 Flight Control System, other applications may be available. Consult the Aircraft Flight Manual Supplement for aircraft specific operating instructions and limitations.

\*Indicates application of the optional KAS 297C Altitude/Vertical Speed Preselector.



Objective: Depart the assigned runway, turn to a 270° heading and climb to 3000 feet. Prior to take off perform the autopilot preflight test as described on page 3.1.

1. After normal take off procedures are complete and the aircraft is rotated to its appropriate climb attitude, the CWS button may be pushed to activate the flight director and sync Pitch Attitude Hold to the current pitch attitude. The flight director will display the set pitch and wings level command until another mode is selected. The heading bug is positioned at the desired or assigned heading (in this case 270°).

\*The KAS 297C is preset to the assigned altitude (3,000 feet) and the appropriate vertical speed for the climb entered by turning the extended knob of the altitude vertical speed preselector.



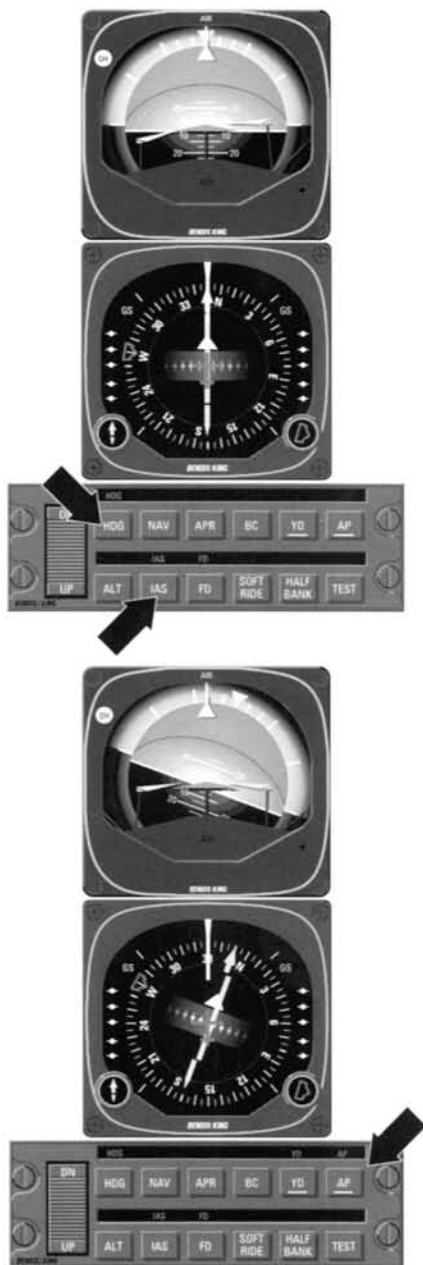
2. When desired, the Heading mode and preferred vertical mode (IAS Hold, Pitch Altitude Hold, or Vertical Speed Hold) are activated. This will result in flight director commands to turn to the selected heading and pitch to the appropriate vertical attitude.

The aircraft will respond to the flight director commands as soon as the autopilot is engaged.

\*To activate Altitude Select for the flight director depress the ARM pushbutton on the altitude/vertical speed preselector while the selected altitude is displayed. For flight director commands corresponding to the selected vertical speed, depress the ENG pushbutton after the selected vertical speed has been entered in the preselector.

3. At a safe altitude, depress the AP pushbutton on the mode controller to engage the autopilot. The autopilot will follow the flight director commands.

\*At 1,000 feet from the selected altitude, an aural tone will momentarily sound and the ALERT annunciator will illuminate on the altitude/vertical speed preselector until the aircraft is within 300 feet of the selected altitude.

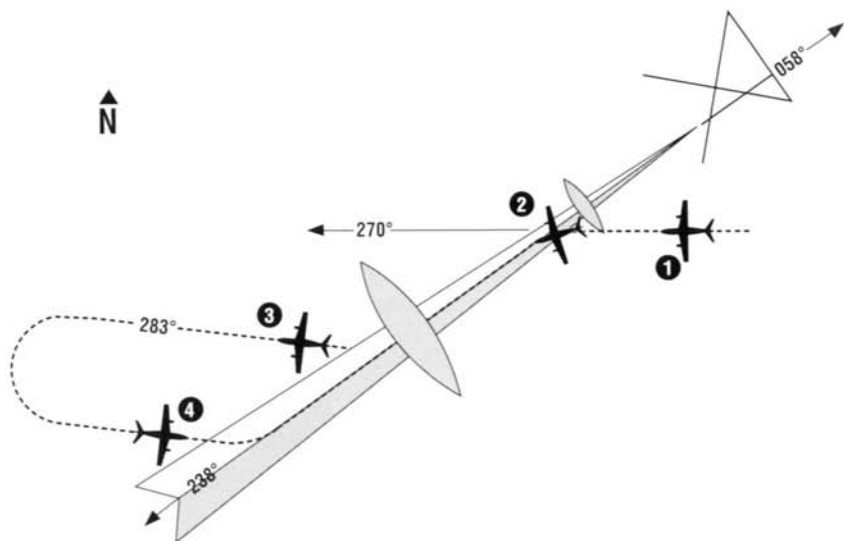


4. The aircraft reaches the selected altitude (3,000 feet) and the ALT pushbutton is depressed engaging Altitude Hold. The 270° heading has been acquired.

\*Prior to reaching the selected altitude, the flight director transitions from Altitude ARM to Altitude Capture (CAPT) and then engages Altitude Hold automatically. There is no need to depress the ALT pushbutton on the mode controller if the altitude/vertical speed preselector is used. An ALERT annunciation will be momentarily present when the selected altitude is reached.



## Procedure Turn to an ILS Approach



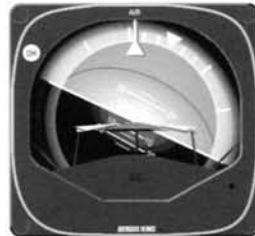
Objective: Fly outbound, execute a procedure turn, and fly a coupled ILS approach.

1. With Heading and Altitude Hold engaged, the aircraft is flying 270° to intercept the localizer outbound. The localizer front course (inbound) of 58° is selected with the HSI course pointer. Since the outbound heading is opposite of the localizer front course, BC is depressed. The course pointer is always selected to the localizer front course to obtain correct course information for the autopilot and proper "fly to" indications on the HSI. Back Course mode is used to go outbound opposite the front course.





2. When the computed capture point is reached, the BC Approach Coupled mode is automatically activated and a left turn outbound on the localizer is commanded by the flight director and satisfied by the autopilot. Note the left/right deviations are directional.



3. Prior to the procedure turn, position the heading bug to 283° which gives the 45° angle for the initial procedure turn heading. At the point where the procedure turn is to be initiated, depress the HDG pushbutton to engage the Heading Select mode. The autopilot will turn the aircraft to the heading bug heading (283°).

During the procedure turn outbound, the deviation bar shows pictorially that the aircraft is flying away from the localizer centerline at a 45° angle.



*Note: When activating Approach Arm, it is important that the aircraft be relatively close to and not making any turns away from the localizer. Side lobes or false echoes are often present from the localizer transmitter. These false signals may cause the autopilot to approach couple prior to reaching the actual localizer signal.*

4. At the point specified to begin the procedure turn inbound, select 103° with the heading bug for a 180° turn toward the localizer front course. The deviation bar shows pictorially the course you are to intercept and the angle of intercept. Depress the APR pushbutton to arm the Approach mode. Automatic capture will occur to direct the aircraft on the localizer.



5. The autopilot is following the flight director commands which maintain localizer centerline tracking. Once Approach Coupled, Glideslope is automatically armed. The point of glideslope capture is based on the glideslope deviation and the rate of change of glideslope deviation. Both pitch and roll are commanded by the flight director to maintain glideslope and localizer track.

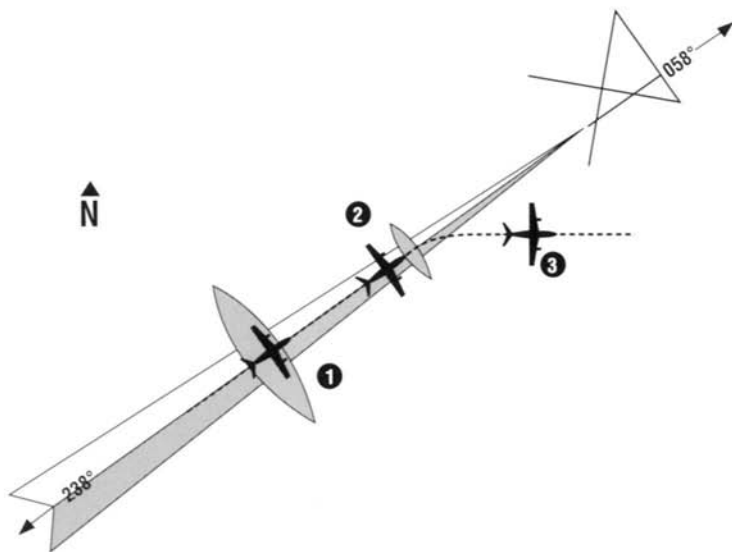
Consult your Aircraft Flight Manual Supplement for limitations such as flap extension amounts approved for coupled approaches.

6. At decision height, disengage the autopilot or press the Go-Around pushbutton while adding power. The autopilot is not to be coupled below 200 feet above the ground. The Go-Around button is generally found on the power lever, yoke, or panel.



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## ILS Transition to Missed Approach



Objective: Transition from an ILS approach to missed approach and go around. Continuing the maneuver on the preceding page, Approach Coupling occurs and the Glideslope mode is announced as it is coupled.

1. The autopilot is following the flight director commands which maintain localizer centerline tracking. At the outer marker the glideslope pointers are approximately at midpoint. At the Glideslope capture point, Glideslope automatically transitions from Arm to Coupled and Altitude Hold is disengaged. The capture point calculation is based on glideslope deviation and rate of deviation change. The flight director then commands tracking of glideslope and the autopilot follows by adjusting pitch attitude.



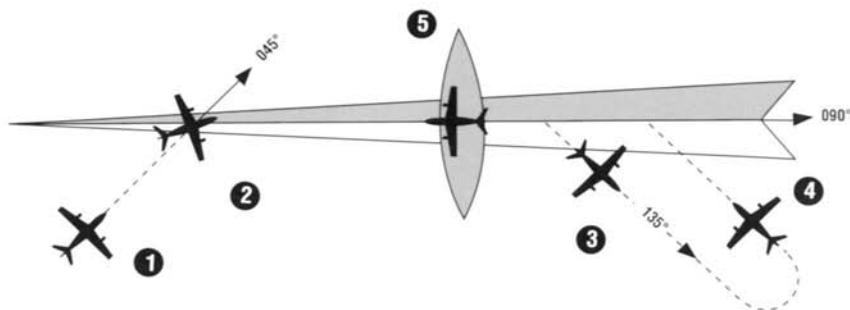
2. At Decision Height, a missed approach is initiated by pressing the Go-Around button as power is increased. The Go-Around button is generally located on the power lever, yoke, or panel. The Go-Around button disengages the autopilot and causes the flight director to command a specified nose-up and wings-level attitude. At the discretion of the crew, the autopilot may be reengaged by depressing the AP pushbutton on the mode controller.



3. The heading bug had previously been set to the missed approach heading of 90°. Depressing the HDG pushbutton activates Heading mode and causes the flight director to command a turn to the heading bug heading. Pitch attitude may be adjusted from the Go-Around angle by depressing the CWS (pitch sync) pushbutton and moving the control yoke, depressing the vertical trim control, engaging IAS Hold, or by activating vertical speed select. Any of these modes will cancel the Go-Around mode.



## Localizer Back Course Approach



**OBJECTIVE:** Fly outbound on the localizer, complete a procedure turn and fly the localizer back course approach to the airport.

1. In Heading Select and Altitude Hold mode with the localizer frequency selected in the active navigation receiver, the aircraft is flying 045° to intercept the localizer. The localizer front course of 090° is selected with the HSI course pointer. Remember that the course pointer is always selected to the localizer front course to obtain correct "fly to" indications on the HSI.

As the aircraft nears the localizer, the NAV pushbutton is depressed to arm the Nav mode so that the localizer will be captured and tracked. Nav mode inhibits glideslope coupling. The capture point computation is based on deviation and deviation rate of change.

**NOTE:** Always select the navigation course pointer or OBS to the inbound course of the localizer front course.



2. When the computed capture point is reached, the Nav mode is automatically activated and a right turn outbound on the localizer is commanded by the flight director and satisfied by the autopilot.



3. Prior to the procedure turn, the heading bug is positioned to 135° which is the 45° initial procedure turn heading. At the point where the procedure turn is to be initiated, depress the HDG pushbutton to engage Heading Select mode and the autopilot will turn the aircraft to the direction of the heading bug (135°).

During the procedure turn outbound, the deviation bar shows pictorially the aircraft flying away from the localizer centerline at a 45° angle.

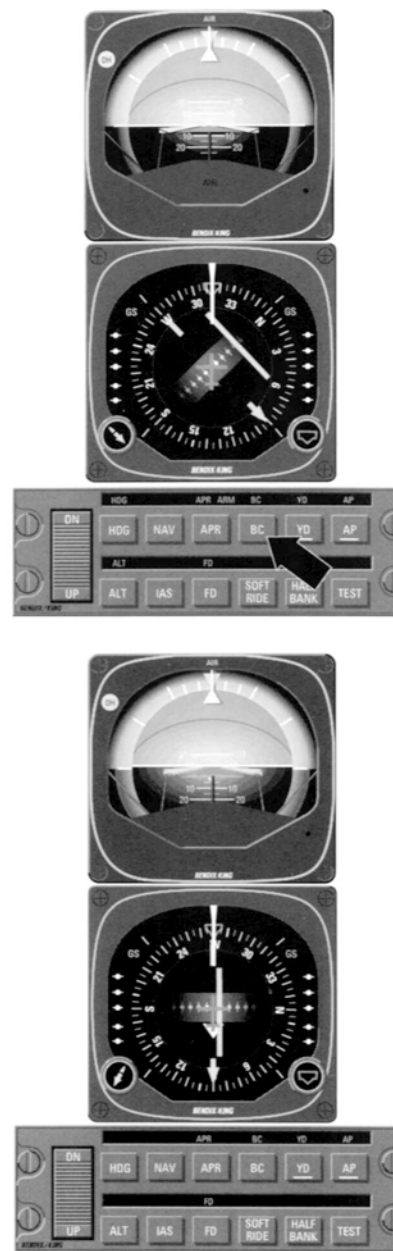


4. At the point specified to begin the procedure turn inbound, select 315° with the heading bug for a 180° turn toward the localizer. The deviation bar shows pictorially the course you are to intercept as well as the angle of intercept. Depress the BC pushbutton to arm the Back Course Approach mode. Note that the left/right deviations of the course deviation bar give “fly to” indications. Automatic capture will occur to direct the aircraft on the localizer.

5. The autopilot is following the flight director commands which maintain localizer centerline tracking. A number of options are available to help you descend while the autopilot remains coupled.

With Pitch Attitude Hold and Back Course Approach mode, the CWS button or vertical trim can be depressed for selection of desired pitch attitude during descent. Prior to reaching the minimum descent altitude, the ALT pushbutton can be depressed to activate Altitude Hold.

*Note: If intercepting the localizer without a procedure turn exercise judgement when arming the Back Course mode. Side lobes exist on many localizers which may cause the autopilot to capture the incorrect signal. Depress the BC pushbutton when your position is relatively close to the localizer.*



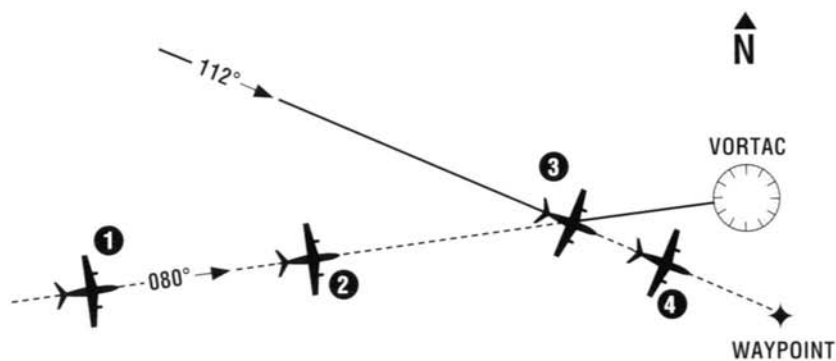
\*Using the altitude/vertical speed preselector, enter the vertical speed at which you wish to descend. Depress ENG to establish the constant vertical speed descent. Depress the ALT pushbutton on the mode controller prior to reaching the minimum descent altitude.

6. Disengage the autopilot or press the Go-Around pushbutton at the missed approach point. The Go-Around pushbutton will disengage the autopilot and command a specific climb attitude for the flight director. The Go-Around pushbutton is generally located on the power lever, yoke, or panel. At the pilots discretion, the autopilot may be reengaged. The autopilot is not to be coupled below 200 feet above the ground.



*Note: Consult your Aircraft Flight Manual Supplement for limitations such as flap extension approved for coupled approaches.*

## RNAV Capture



Objective: Intercept and track the 112° course to the RNAV waypoint.

1. The aircraft is flying to a VOR on an airway in HDG mode, heading 080°.

2. A waypoint has been established in the RNAV. The HSI course needle is selected to the desired 112° course to the waypoint. Nav Arm is activated so that the autopilot will automatically transition from Heading to Nav mode when the Nav deviation has entered the capture zone.



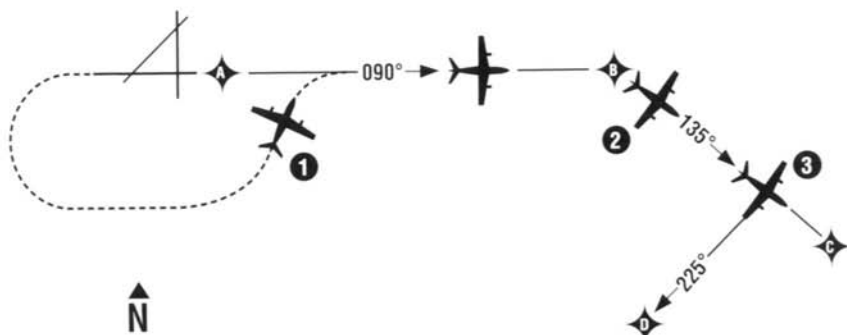
3. The capture sequence starts when Nav mode automatically couples, cancelling Nav Arm and Heading modes. The autopilot is turning the aircraft to the right.



4. The aircraft has completed its turn to the 112° course. A wind correction produces a heading of 105°. The HSI displays the seven degree “crab” angle required to maintain the 112° RNAV course.



## Long Range Nav Tracking



Objective: Intercept the desired course and complete a “direct to” or change of course operation after passing waypoint “B” while coupled to a Long Range Nav.

1. The autopilot is engaged in Heading Select and Altitude Hold mode. A flight plan from waypoint “A” to “B” to “C” is entered in the Long Range Nav. The course pointer is selected to 090° and Nav Arm is activated. The aircraft is heading 045° to intercept the course. As the course deviation bar moves toward the center, the Nav signal is captured and the autopilot tracks the course to the active waypoint.

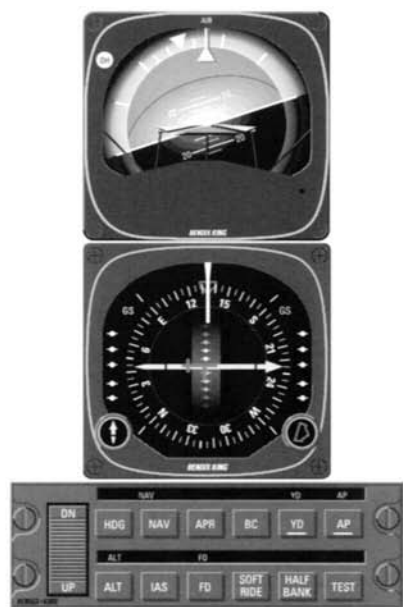




2. As the aircraft crosses waypoint "B", the course pointer must be rotated to reflect the course or bearing to the new active waypoint (135° in this case).



3. The pilot changes the active waypoint to "D" via a "Direct To" operation with the Long Range Nav. The HSI course pointer must be rotated to 225° to reflect the bearing to "D". The autopilot will then correctly track the course to waypoint "D".



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