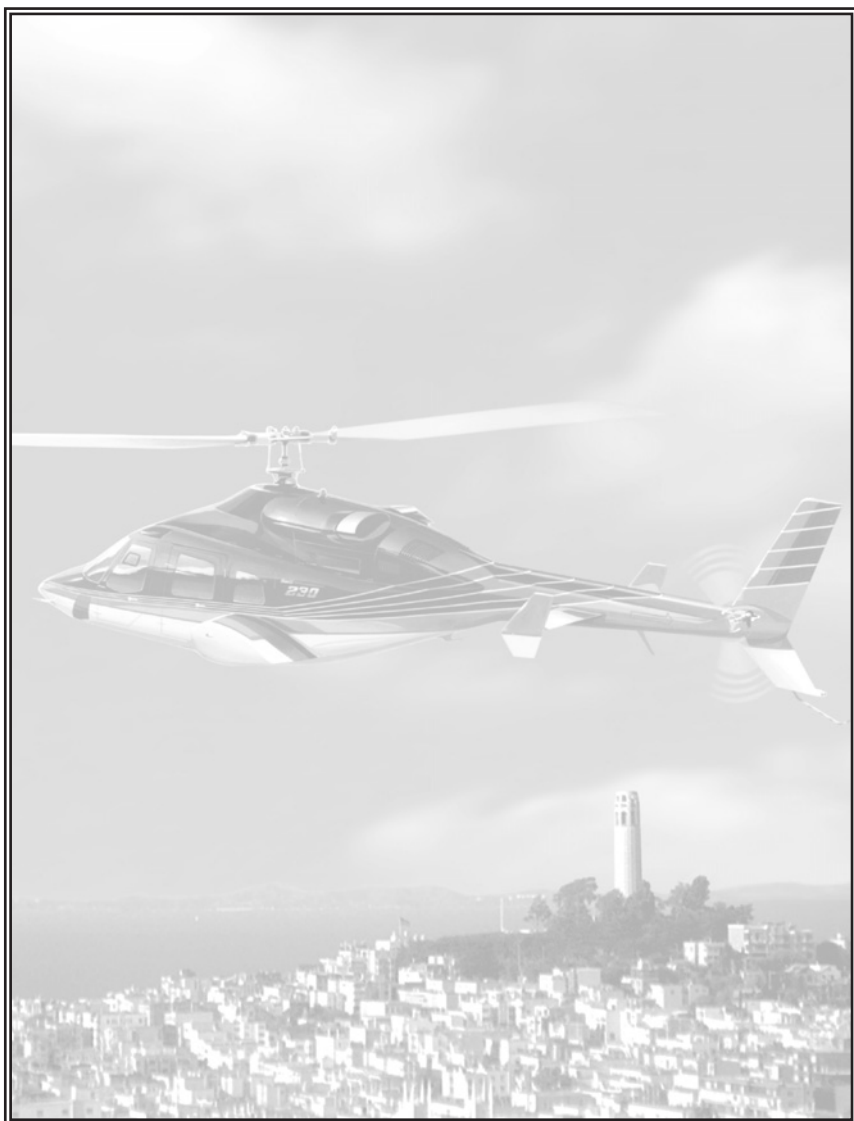


Pilot's Guide

# KFC 500

Bendix/King®  
Flight Control System



# Introduction

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The KFC 500 Automatic 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 500 to determine helicopter control requirements sooner, and to execute them with greater smoothness and accuracy than previous autopilot systems.

Due primarily to its dual channel flight computer design, the KFC 500 can more positively control the aircraft while providing a level of safety monitoring unavailable with single channel systems. Digital, solid-state design throughout the Flight Control System provides maximum reliability while economizing on system weight and required installation space.

The KFC 500 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 were determined for the Bell Model 230 during the aircraft certification process.

The KFC 500 is integrated with KAD 480 Central Air Data System and the EFS 40/50 Electronic Flight Instrument System to enhance user-friendliness as well as system annunciation.

Internal safety monitors and automatic self-test functions keep constant track of the KFC 500's status, and provide signals for automatic shutdown of impaired control axes or flight director functions. When the KFC 500 decouples an autopilot axis it both releases the affected servo brake and shuts off motor drive power, providing dual layers of protection against servo overcontrol.

In addition to reliability and light weight, the KFC 500 is designed to be easy to maintain in the field. Self-contained diagnostic tests assist troubleshooting done by maintenance personnel at Bendix/King® factory-approved service centers. The EFIS interface provides additional trouble-shooting access via the cockpit display units. The Built-In-Test functions enable a technician to trace a fault to the individual circuit board, or external sensor concerned. Circuit boards inside remote-mounted components are installed vertically, to prevent condensation pooling. Qualified Bendix/King® service centers around the world are ready to provide assistance whenever necessary.

The KFC 500 is integrated to the EFS 40/50 Electronic Flight Instrument System allowing a very flexible navigation system interface. All of the KFC 500's digital interfaces are based on ARINC 429 specifications, and analog/digital converters are supplied wherever necessary to provide the greatest interface versatility.

***Important:***

*This Pilot's Guide provides a general description of the various operational characteristics of the KFC 500 Flight Control System. However, operation of the system should not be attempted without first reviewing the applicable FAA Approved Rotorcraft Flight Manual Supplement for complete system familiarization and operating limitations.*

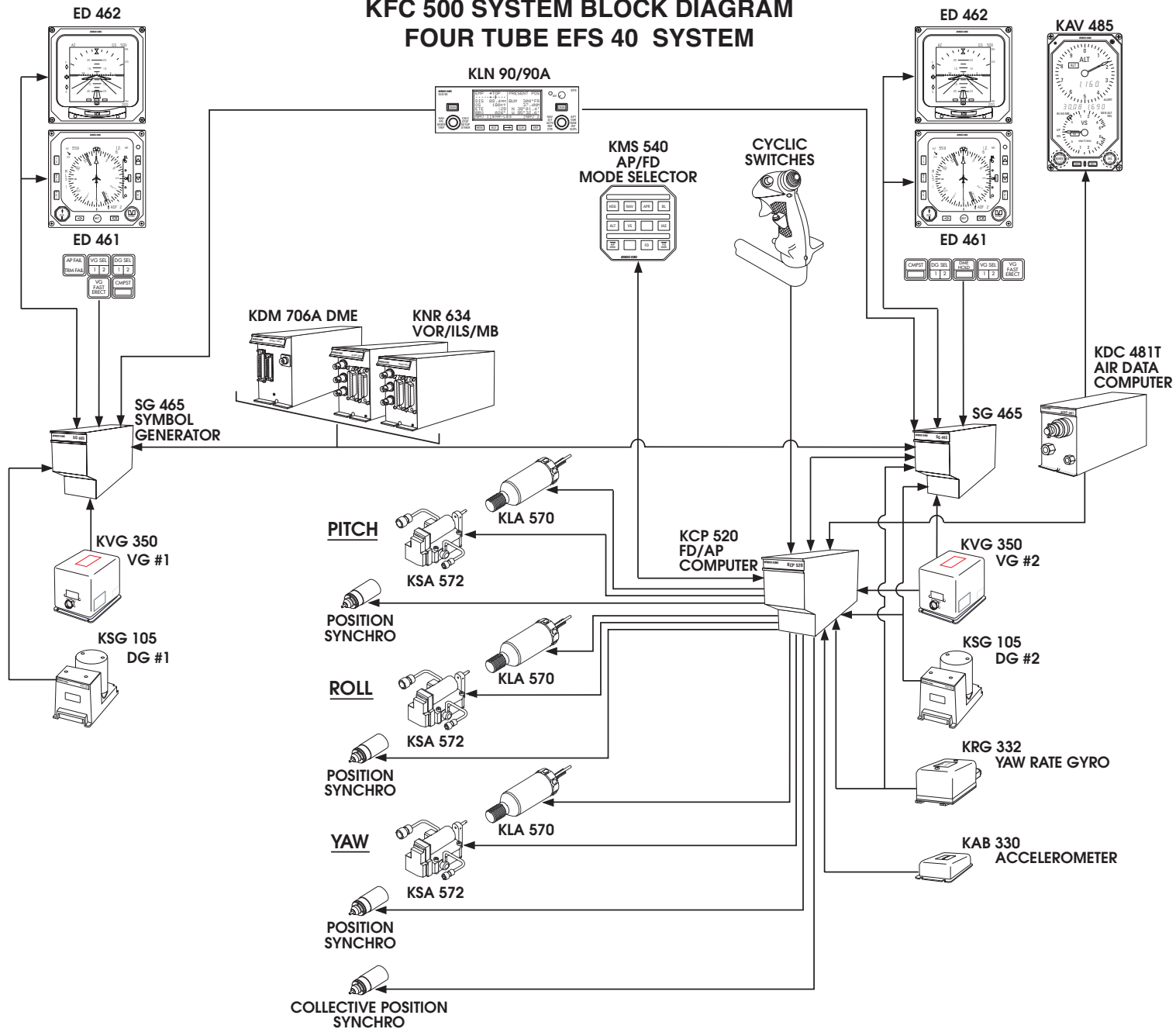
# Table of Contents

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<b>Introduction</b> .....	1
<b>System Components</b> .....	5
<b>System Description</b>	
<b>Normal Flight Control Operations</b>	
KMS 540 Flight Director Mode Select Panel .....	8
Basic Flight Director Mode .....	8
Pitch Attitude Hold/Roll Attitude/Heading Hold.....	9
Lateral Command Control .....	9
Vertical Command Control .....	10
Force Trim Release .....	11
Navigation Standby .....	11
Go-Around.....	11
Yaw Force Trim Release .....	12
Yaw Trim .....	12
KMS 540 Lateral Mode Selection	
Heading (HDG).....	13
Bank Angle Limit (BL).....	13
Navigation (NAV).....	14
Approach (APR) .....	14
KMS 540 Vertical Mode Selection	
Altitude Select (ALT SEL).....	16
Altitude Hold (ALT HOLD) .....	16
Indicated Airspeed (IAS) .....	17
Vertical Speed (VS).....	17
KMS 540 Autopilot and Yaw Damper Mode Selection	
Yaw Damper (YD) .....	19
Autopilot (AP) .....	19
<b>KFC 500 Equipment Descriptions</b>	
KSA 572 Trim Actuator.....	20
KLA 570 Linear Actuator .....	20
KVG 350 Attitude Gyro.....	20
KCS 305 Slaved Compass System.....	21
KRG 332 Yaw Rate Gyro .....	21
KAB 330 Triaxial Accelerometer .....	21
Control Position Transducer .....	21
<b>Autopilot/EFIS Switches Descriptions</b>	
KCP 520 Flight Computer .....	22
Autopilot/EFIS Master .....	22
CMPST .....	22
VG SEL 1-2 .....	23

DG SEL 1-2 .....	23
DME HOLD .....	23
VG FAST ERECT .....	23
Cyclic Grip Switch Assembly .....	24
Collective Switch Assembly .....	25
<b>Basic EFS 40 Description</b>	
ED 461 EFIS Display .....	26
EFS 40 Display Units .....	27
<b>KAD 480 Air Data System</b>	
KDC 481T Central Air Data Computer .....	32
KAV 485 Altitude/Vertical Speed Indicator .....	34
<b>Emergency Procedures</b> .....	39
<b>Preflight Procedures</b> .....	43
<b>Operational Examples</b>	
Attitude Hold .....	48
Navigation Standby .....	48
Force Trim Release .....	48
Heading Select .....	49
Go-Around Mode .....	50
Navigation Coupling .....	50
Yaw Force Trim Release .....	51
Yaw Trim .....	51
Takeoff and Climb .....	52
Front Course ILS Approach .....	54
Go-Around from an ILS Approach .....	56
Localizer Back Course Approach .....	58
<b>Performance Specifications</b> .....	62

# KFC 500 SYSTEM BLOCK DIAGRAM FOUR TUBE EFS 40 SYSTEM





# KFC 500

## Normal Operation





# Normal Operation

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## KMS 540 Flight Director Mode Select Panel



### Modes of Operation

The KMS 540 Mode Select Panel provides control and annunciation of the KFC 500's Flight Director, Autopilot, and Yaw Damper modes. Illumination of the annunciator lamps on the mode controller is adjusted automatically by a photocell located on the face of the unit. To activate flight director or autopilot modes using the Mode Select Panel, press the desired pushbutton. The corresponding mode lamp above the pushbutton will illuminate and the mode annunciation on the Electronic Attitude Director Indicator, EADI, will appear. Alternatively, to deactivate a flight director or autopilot mode when activated, depress the respective pushbutton.

The KFC 500 will engage in only one horizontal and one vertical tracking mode at a time. Flight director modes engaged in initial, arming sequences, however, do not conflict with tracking operations in other modes. For example, selecting a new course in the Nav Arm mode, or

a new altitude in Altitude Select, does not affect active tracking modes such as Heading or Vertical Speed Hold. It is often useful to engage a separate mode to provide flight guidance to the capture point for a course or altitude selected in an Arm mode. The Flight Control System will transition automatically to capture the armed mode, cancelling the previous selection. Examples of this operation are described in the Operational Examples section of this guide.

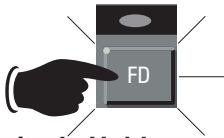
To cancel a flight director mode engaged in either capture or tracking operations, either select an alternate tracking mode or press the engaged mode's pushbutton on the mode select panel. The latter method also cancels modes while in their Arm phases. Go-Around is an exception. The collective-mounted pushbutton provides the engage function only.

When the flight director is operating with no horizontal or vertical mode selected, the KFC 500 automatically engages in Heading Hold and Pitch Attitude Hold. These default modes provide basic flight stability and serve as safety backups in the event that the flight computer cancels an active mode due to loss of required navigation signal or system malfunction. Engaging the KFC 500 in any tracking mode automatically cancels the corresponding default mode for that particular axis.

### Basic Flight Director Mode

Depressing the FD button on the Mode Select Panel will activate the basic Flight Director. Pitch Attitude

Hold and Roll Attitude/Heading Hold automatically engage unless other tracking modes are selected. Pitch Attitude Hold and Roll Attitude/Heading Hold are annunciated on the EADI as PIT and ROL, respectively.



### **Pitch Attitude Hold Roll Attitude/Heading Hold**

In the absence of any other selected Flight Director Modes, the Flight Director will provide commands to maintain current pitch attitude and establish a level roll attitude. When roll attitude approaches six degrees or less bank angle, the flight director will provide commands to maintain constant heading.

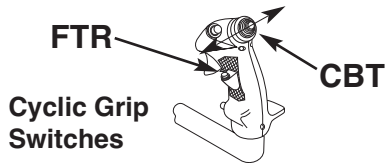
Target roll and pitch attitudes may be selected by several methods. Adjusting the helicopter's attitude manually may be accomplished by pressing the Force Trim Release (FTR) Switch to the first detent while moving the cyclic (and the helicopter) to the desired attitude. Upon release of the FTR switch, the Flight Director will provide commands to maintain the target Pitch and Roll attitude. Alternatively, Attitude Hold commands may be modified by moving the Cyclic mounted Beep Trim (CBT) switch in the appropriate directions.

If a target roll attitude of six degrees or less is selected, the Flight Director will provide commands to maintain the helicopter's current heading. Heading information from

the KSG 305 Compass System's Directional Gyro provides heading information to the Flight Director/Autopilot.

Selecting any horizontal or vertical tracking mode cancels Roll Attitude Hold 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.

### **Lateral Command Control**



Activated by the Cyclic Beep Trim (CBT) switch when the Flight Director or Autopilot is on, Lateral Command Control modifies the AFCS's reference attitude during operations in Roll Attitude Hold. Moving the four-way switch either right or left cancels any selected flight director horizontal mode and engages Roll Attitude Hold. Operating Lateral Command Control does not affect Arm operations in Nav or Approach modes, nor does it affect flight director vertical modes, with the exception of Glideslope, which it cancels along with Approach. When Lateral Command Control is used, the aircraft will be commanded to follow the pilot's input to roll left or right with a constant roll rate until the beep trim switch is released.

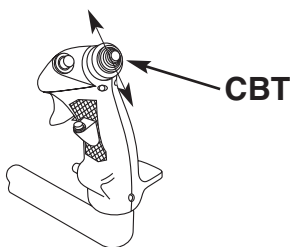
Upon release of the CBT switch, the flight director will command the aircraft to maintain the existing roll

attitude. Roll attitudes of less than six degrees of bank will cause the Flight Director to revert to commands for roll-level flight with heading hold.

Activating Discrete or Continuous Lateral Command has the following effect upon command values in flight director operations:

<b>Flight Director Lateral Command Values</b>	
<b>Discrete Command</b>	<b>System Response</b>
Roll Attitude Hold	First Click=6°, Subsequent=1° per click
Heading Select	1° Heading Bug Movement per click
<b>Continuous Command</b>	
Roll Attitude Hold	Constant Roll Rate
Heading Select	15° Heading Bug Movement per second

### Vertical Command Control



Using the same cyclic switch as mentioned in the previous paragraph, vertical commands can be modified by moving the vertical command switch fore and aft. Operation of the Vertical Command Control depends on the flight director or autopilot mode engaged. Moving

the switch forward adjusts the helicopter's pitch attitude downward, while moving it rearward adjusts the attitude upward.

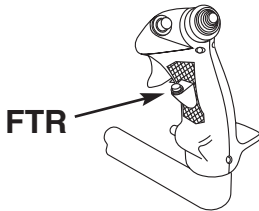
Activating Vertical Command cancels certain flight director vertical tracking modes, but has no effect on modes engaged in the Arm phase. The flight director will revert to Pitch Attitude Hold if it was coupled in Glideslope, Altitude Capture or Go-Around at the moment of command activation. Attitude Hold, Altitude Hold, Indicated Airspeed Hold and Vertical Speed Hold will remain coupled throughout Vertical Command operation.

Activating Discrete or Continuous

<b>Flight Director Vertical Command Values</b>	
<b>Discrete Command</b>	<b>System Response</b>
Pitch Attitude Hold	0.5° per click
Altitude Hold	10 feet per click
Indicated Airspeed Hold	1 knot per click
Vertical Speed Hold	100 fpm per click
<b>Continuous Command</b>	
Pitch Attitude Hold	Maintains const. acc. profile until release
Altitude Hold	50 feet per second
Indicated Airspeed Hold	Five knots per second until release
Vertical Speed Hold	300 fpm per second until release

Vertical Command has the effect upon command values in flight director operations shown in the preceding table.

### Force Trim Release (FTR)

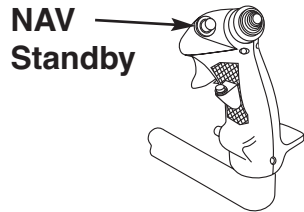


When the Flight Director is active, the Force Trim Release switch allows the crew to synchronize flight director commands in pitch and roll to the actual helicopter position. When the selected mode for flight director is pitch attitude hold, altitude hold, airspeed hold, roll level or roll attitude hold, FTR will cause a new flight director reference to be established upon release of the switch. All commands will then be directed to hold this new reference. When the autopilot is in Attitude Hold mode with no flight director, the AFCS synchronizes attitude with the present helicopter attitude when released.

When the FTR switch is depressed, the trim servo magnetic brakes release, eliminating the artificial feel system, allowing the pilot free movement of the cyclic. When the switch is released the trim brake re-engages. The FTR switch is double detent. Actuation to the first detent allows the pitch and roll brakes to release for free cyclic movement. Depressing through the second detent releases the yaw brake in addition to the pitch and roll, allowing free cyclic and pedal move-

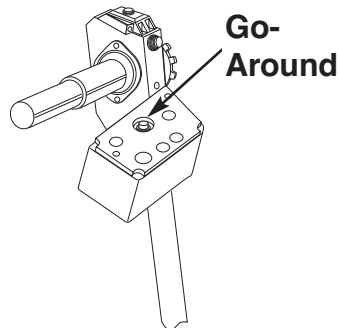
ment. The Force Trim System must be "ON" for the AFCS to operate.

### Navigation Standby



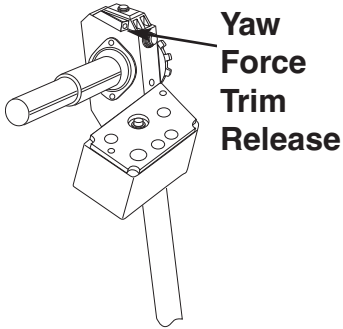
When the Navigation Standby Switch on the cyclic is momentarily depressed, the flight director deactivates and the flight computer commands attitude retention. Subsequent activation of the flight director modes may be accomplished by depressing the appropriate Mode Select Panel pushbuttons or by arming an altitude on the Altitude/Vertical Speed Indicator.

### Go-Around



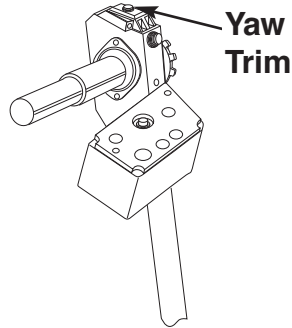
Pressing the Go-Around Pushbutton on the collective switch box activates the Go-Around mode in which the flight director commands a 750 feet per minute climb in a roll-level attitude. Any horizontal tracking mode may be subsequently reengaged without cancelling the Go-Around climb.

### Yaw Force Trim Release



A Collective mounted Yaw Force Trim Release is provided. Depressing this switch releases the Yaw brake, allowing free pedal movement when the autopilot or Yaw Damper is engaged. Upon release of the switch, the Autopilot/Yaw Damper will command ball centered flight.

### Yaw Trim

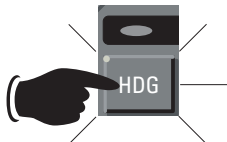


A Collective mounted Yaw Trim Switch is provided. Holding the switch to the right or left moves the Yaw Axis in the corresponding direction at a constant rate. Yaw Damper must be operational and active for Yaw Trim to function.

## KMS 540 Lateral Mode Selection

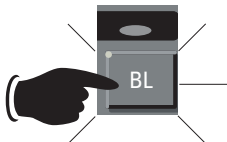
### HDG (heading select)

Depressing the HDG pushbutton on the mode select panel activates Heading Select mode. The Heading mode will provide flight director commands to track the heading bug on the EHSI. The heading lamp on the mode select panel illuminates and “HDG” is displayed on the EADI when the heading select mode is activated. Activating Heading Select cancels any other lateral tracking mode. If the Heading Select mode is active, depressing the HDG pushbutton will deactivate the the Heading



Select mode and revert the flight director commands to maintain a roll-level attitude that maintains the helicopter's present heading, the default mode. Flashing of the annunciator lamp indicates loss of a sensor required to hold the selected heading (e.g. invalid magnetic heading, invalid selected heading). The lamp continues flashing until a second push of the HDG pushbutton (pilot acknowledgement of mode loss) or until another lateral mode is activated.

### BL (bank angle limit)



This pushbutton allows the pilot to select the maximum commanded

### Heading Select Bug



### Heading Select Knob

bank angle to be used during the non-approach phases of flight. The Bank Angle Limit mode allows the maximum commanded bank angle to be 25°, 20°, 15°, or 10°. The value for the Bank Angle Limit is achieved by cycling the pushbutton until the desired value is displayed on the EADI. If the default value, 20°, is selected, the selected value declutters on the EADI. The default value, 20°, is obtained at power-up if no action is taken by the pilot to select another value.

In the coupled approach phases of flight, bank angle limiting is disabled to provide optimum flight performance. When coupled with the Approach mode Armed, all captures are made with a maximum bank angle of 20°. If lesser bank angles are required, the pilot may use the heading select mode (move the heading bug slowly) to capture the

### Bank Angle Limit Presentation

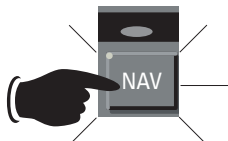


localizer and then depress the APR pushbutton to activate Approach Mode when tracking inbound on the appropriate course.

When the KFC 500 is coupled to a flight management system (FMS) that has a composite steering command to drive the flight director (ie. KLN 90, KNS 660), the flight management system has complete control of bank angles up to 25°. Bank limiting when coupled to a FMS is inhibited in this situation to prevent poor tracking performance.

Bank Angle Limit may be engaged in conjunction with any flight director tracking mode. However, it's operation will be inhibited in the Approach mode and when coupled to a FMS.

**NAV** (capture and track selected navigation sensor)



The nav lamp illuminates and “NAV” is displayed in the lateral mode window of the EADI when the NAV or NAV ARM mode is activated by depressing the NAV pushbutton on the KMS 540 Mode Select Panel. When the NAV mode is selected by the NAV pushbutton and course needle deflection exceeds the capture requirements of NAV mode (greater than 50% full scale needle deviation), the NAV ARM mode is activated and allows a compatible lateral mode to be used to intercept the desired course or track. If the aircraft’s deviation from the selected course centerline is sufficiently small (less than 50% full scale needle deviation), or if the rate of closure with the new course is sufficiently high, the flight director initiates the NAV Capture sequence immediately.

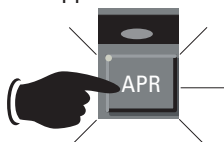
**Selected Course**    **Course Pointer**



**Course Select Knob**

A flashing NAV lamp indicates loss of a sensor required to capture or track the selected nav (e.g. invalid NAV, invalid selected course) and continues until a second push of the NAV pushbutton (pilot acknowledgement of mode loss). In the event of a sustained NAV invalid during NAV ARM, the current lateral mode will remain active until another mode is selected. The NAV pushbutton may also be used to deactivate the NAV mode.

**APR** (capture and track selected sensor with approach authority)



The approach lamp on the mode select panel illuminates when the approach or approach ARM mode is activated by depressing the APR pushbutton. 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. The flight director may initiate turn commands before the course deviation indicator displays movement. Selecting the Approach mode after the aircraft has already passed the point at which Approach Capture normally would begin may result initially in course overshoot due to the flight director's roll command limits. If APR mode is called for by the APR pushbutton and course needle deflection exceeds the capture requirements of the approach mode (greater than 50% full scale needle deviation), Approach ARM is activated and a compatible lateral mode may be used to intercept the desired course.

The KFC 500 discriminates automatically between front course and back course approaches, and VOR, LNAV, and MLS procedures. While the KFC 500 uses this information to determine the type of navaid involved, front course/back course selections are determined by the relative angle between the aircraft's heading and the course selected on the EHSI. Intercept angles between 0° and 105° cause the KFC 500 to select the ILS front course. Angles between 106° and 180° cause the flight director to command back course interception and tracking.

*It is essential that the course selector arrow on the navigation display always be aligned with the ILS front course. Failure to align the course arrow properly may result in erroneous front course/back course selection by the KFC 500.*

The flight director automatically

engages Glideslope Arm (GS ARM), Capture and Track (GS) sequences during ILS front course approaches. The localizer must be captured in order for glideslope to ARM or couple. Glideslope coupling is inhibited during back course procedures.

Any horizontal tracking mode may be employed during Approach Arm phases and will cancel automatically upon initiation of Approach Capture and Track. Any vertical mode may be used prior to glideslope capture or track and will automatically cancel upon initiation of glideslope capture. Activation of Approach Capture will automatically incorporate the default maximum commanded bank angle, 20°, for optimum comfort and performance.

A flashing APR lamp indicates the loss of a sensor required to capture or track the selected nav (e.g. invalid NAV, invalid selected course) and continues until a second push of the APR pushbutton (pilot acknowledgement of mode loss). The APR pushbutton also deactivates the approach and approach arm modes.



*When flying inbound on a Backcourse Approach, the selected course should be in the opposite direction of the helicopter's heading.*



## KMS 540 Vertical Mode Selection

KAV 485 Altitude Select



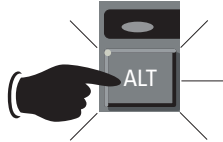
Selected  
Altitude  
Display

### ALT SEL (automatic capture of selected altitude)

“ALT” is annunciated in white on the EADI when the Altitude Select mode is armed by depressing the SEL pushbutton on the KAV 485 Altimeter/Vertical Speed Indicator. The selected altitude is displayed in the KAV 485’s altitude preselect window. Altitude Select will automatically Arm after a change in the altitude select value. The Altitude Select mode provides a method for selecting, capturing, and tracking another altitude. ALT SEL requires a compatible vertical mode to be used to acquire the selected altitude. Upon reaching the altitude capture point, the selected vertical mode will cancel and the flight director will engage Altitude Capture and then Altitude Hold. Altitude Select must be

deactivated to inhibit capture and tracking of the preselected altitude. If the value of selected altitude is changed while in altitude capture, the system reverts to pitch attitude hold mode. In the event of sustained invalid altitude, ALT SEL mode will deactivate. To disengage Altitude Select, press the SEL mode pushbutton on the KAV 485. Detailed operation of the KAV 485 is described on page 34.

### ALT HOLD (hold current reference altitude)



The light above the ALT pushbutton illuminates and “ALT” is displayed on the EADI in green when the Altitude Hold mode is activated by depressing the ALT pushbutton or by automatic sequencing through Altitude Arm and Altitude Capture. In the Altitude Hold mode, the flight director commands pitch attitudes for tracking of the helicopter altitude at the moment of mode selection. The system normally uses barometrically corrected altitude, but can use pressure altitude in the event barometric altitude is not available. Altitude Hold can be entered directly 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 return to the desired altitude from the other side. For this reason, the vertical speed should be limited to 500 fpm when this method

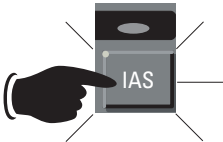
of Attitude Hold engagement is used.

Selecting Altitude Hold after the Altitude Select mode has been engaged cancels Altitude Select (white "ALT" on EADI). The flight director will command the aircraft to hold the altitude present at the moment of mode selection.

Altitude Hold commands may be modified by moving the CBT switch forward (decrease reference altitude) or rearward (increase reference altitude).

A flashing lamp above the ALT pushbutton indicates loss of a sensor required to hold current reference altitude (e.g. invalid altitude). The flashing continues until a push of the ALT pushbutton acknowledges automatic deactivation of the mode. The ALT pushbutton may also be used to deactivate the altitude hold mode.

**IAS** (hold current reference airspeed)



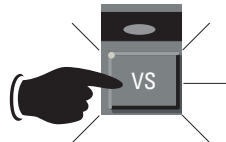
The lamp above the IAS pushbutton illuminates when the airspeed hold mode is activated by depressing the IAS pushbutton. Engaging the Indicated Airspeed Hold Mode causes the flight director to command pitch attitudes to maintain the indicated airspeed current upon selection. Airspeed commands may be altered through use of the flight director CBT switch.

## OVERSPEED PROTECTION

A flashing IAS lamp indicates loss of a sensor required to hold the current reference airspeed (e.g. invalid indicated airspeed). Flashing continues until a second push of the IAS pushbutton (pilot acknowledgment of mode loss). The IAS pushbutton may also be used to deactivate the IAS hold mode. The airspeed reference is provided by the KDC 481T central air data computer.

As a safety feature, the flight director automatically reverts to Indicated Airspeed Hold and flashes the IAS annunciator lamp (amber "IAS" on EADI) whenever the helicopter exceeds a stored maximum speed. Except in Altitude Hold and altitude capture modes, the flight director will command pitch attitudes to reduce indicated airspeed to  $V_{NE}$  and then resume the previous pitch mode.

**VS** (hold current or selected vertical speed)



Depressing the ENG pushbutton on the KAV 485 Altimeter/Vertical Speed Indicator or on the KMS 540 Mode Select Panel activates the flight director in Vertical Speed mode. In Vertical Speed mode, the flight director commands pitch attitudes to maintain the vertical speed selection displayed by the KAV 485 Altitude/Vertical Speed Indicator. In

the absence of a preselected vertical speed, engaging the mode will cause the flight director to command a climb or descent at the current helicopter vertical speed. In addition, vertical speed commands may be modified through use of the autopilot CBT switch. The vertical speed select (VS SEL) knob on the Altimeter/Vertical Speed Indicator changes selected vertical speed. The small knob changes the vertical speed 100 fpm per click and the large knob 1000 fpm per click.

When VS mode is engaged or the preselect function of the Altimeter/Vertical Speed Indicator is activated, an orange bug appears on the vertical speed scale. The vertical command switch or the VS SEL knob on the KAV 485 repositions the bug for reference for the pilot and autopilot (the small knob must be pulled out). A flashing VS Lamp on the mode select panel above VS indicates loss of a sensor required to hold selected vertical speed (e.g. invalid vertical speed). Flashing continues until the VS pushbutton is pushed (pilot acknowledgement of mode loss). The VS pushbutton may also be used to deactivate the vertical speed mode.

### KAV 485 Vertical Speed Select

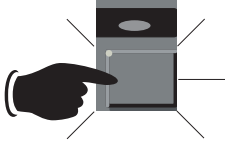


### Vertical Speed Bug

**Note:** A flashing lamp may also be extinguished by selecting another mode of the same axis. Depressing the pushbutton under the flashing annunciation verifies the acceptance of the default mode either wings level or pitch attitude hold.

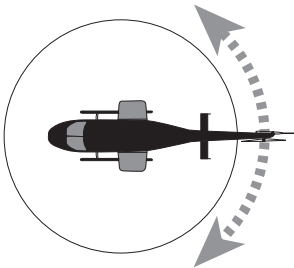
# KMS 540 Autopilot and Yaw Damper Mode Selection

## YD (yaw damper)

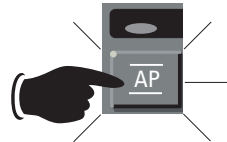


The lamp above the YD pushbutton illuminates and a green “YD” appears on the EADI when yaw damp is engaged. The YD pushbutton alternately engages and disengages yaw damper functions independently of autopilot operation. The yaw damper will automatically engage when the autopilot is engaged. Autopilot disengagement will NOT, however, disengage the yaw damper. Yaw damper disengagement is annunciated by a flashing red “YD” on the EADI.

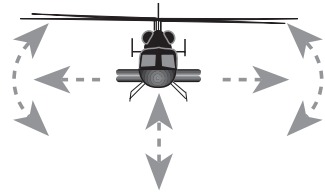
The yaw damper augments rotorcraft stability by opposing uncommanded yaw motion, while also offering turn coordination and ball centering. In case of hydraulic power loss, consult the Rotorcraft Flight Manual Supplement for the procedures specified for yaw damper operation. Loss of #1 hydraulic system automatically disconnects the YD.



## AP (autopilot)

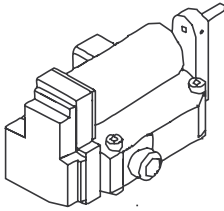


The lamp above the AP pushbutton illuminates when the autopilot is engaged. The AP pushbutton alternately engages and disengages the autopilot. Pressing the Autopilot pushbutton initiates autopilot control of the pitch, roll and yaw axes. The yaw damper, if not previously engaged, engages automatically upon autopilot activation. In the absence of any selected flight director modes, the autopilot will follow basic Roll Attitude Hold and Pitch Attitude Hold commands synchronized to the aircraft attitude current upon activation.



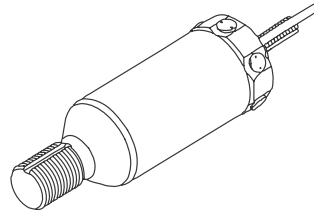
*Autopilot pushbutton engages all three axes with trim; pitch, roll, and yaw.*

## KSA 572 TRIM ACTUATOR



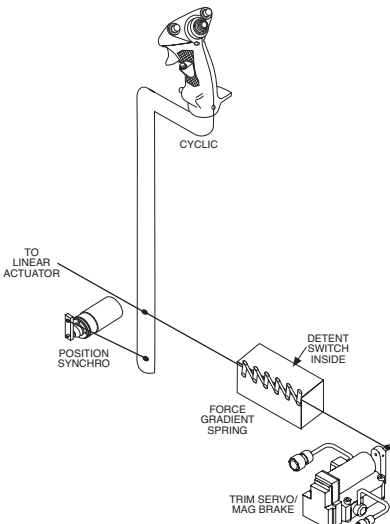
The KFC 500 incorporates three trim actuators (one per axis) in parallel with the helicopter control linkage to provide low-speed command inputs into the control system. The trim actuators provide the long-term control guidance by moving the control system to allow the linear actuators to maintain control authority. The artificial feel system incorporates a switch which allows pilot fly-through capability when the pilot moves the cyclic which actuates a detent switch. When the detent switch is activated, the trim and linear actuator drive is interrupted.

## KLA 570 LINEAR ACTUATOR



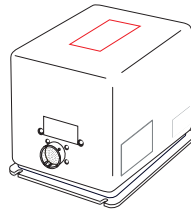
A KLA 570 Linear Actuator is installed in each axis of the control system. The linear actuator is placed in series with the control rods to provide limited authority high-speed damping of the helicopter. The linear actuator contains a position transducer for feedback of actuator position to the Flight Computer.

## AFCS TRIM INTERFACE



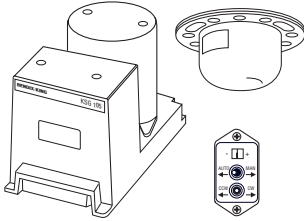
## SENSORS

### KVG 350 ATTITUDE GYRO



The KVG 350 Vertical Gyro provides attitude information to the EFS 40 Symbol Generator and KCP 520 Flight Computer for cockpit display, computations, and system monitoring. To enhance safety, the KFC 500 incorporates two vertical gyros for EFIS reversionary capability and monitoring. The EFS 40 installation allows the pilot to switch the displayed vertical gyro reference using the VG SEL pushbutton.

## KCS 305 SLAVED COMPASS SYSTEM

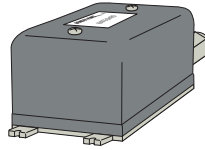


The KCS 305 system is comprised of the KSG 105 Directional Gyro, the KA 51B Slaving Accessory, and the KMT 112 Flux Valve. The slaved compass system provides directional information to the EFIS Symbol Generator and the Flight Computer.

The Free/Slave switch provides the pilot a means to manually compensate for magnetic effects in the vicinity of the Flux Valve. The switch allows the pilot to select either Free or Slaved Magnetic Heading mode. The slew switch is also utilized for manually correcting heading information during flight operations at higher latitudes.

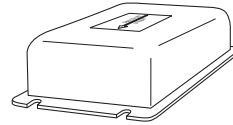
The Magnetic Slaving Unit, often referred to as the flux valve, is remotely mounted in the tailboom to sense the earth's magnetic field directions. By sensing the variation in the earth's magnetic fields, the slaving unit can correct the Directional Gyro for precession error.

## KRG 332 YAW RATE GYRO



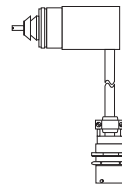
The KRG 332 is a remote mounted rate gyroscope used to provide yaw rate information to the Flight Computer and EFS 40 Symbol Generator. The Symbol Generator displays rate of turn on the EADI.

## KAB 330 TRIAXIAL ACCELEROMETER



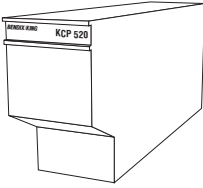
The KAB 330 is a three-axis accelerometer sensor that provides acceleration inputs to the Flight Computer for command calculation and monitoring.

## CONTROL POSITION TRANSDUCER



Each control axis (pitch, roll, yaw, and collective) has a control position transducer to feedback control position to the Flight Computer.

## KCP 520 FLIGHT COMPUTER



The KCP 520 Flight Computer provides all of the command computations for flight director and autopilot. The KCP 520 houses four processors. One Flight Director and two (redundant) Autopilot processors provide the helicopter control logic while a dedicated Maintenance processor assists in diagnostics and maintenance. Inputs to the Flight Computer include Navigation information from the EFS 40 Symbol Generator, Air Data from the Central Air Data Computer, control position feedback from the control position transducers, and Attitude, Directional, and Rate information from Vertical, Directional, and Rate gyros. The KCP 520 outputs servo drive to move the linear and trim actuators. Flight Director commands are provided to the symbol generator for display on the EADI.

## AUTOPILOT/EFIS MASTER



Independent power to each set of EFS 40 displays is provided through the EFS Master switch. LEFT EFIS MSTR (Co-pilot ) and RT EFIS

MSTR (Pilot) switching is located on the pedestal. EFS 40 EADI brightness is controlled via the respective ADI BRT knob located on switch panel.

The Autopilot Master switch provides the power input to the Automatic Flight Control System. Switching the AP MSTR to the "OFF" position while autopilot coupled will result in an autopilot disconnect. Flight director will remain operational when the AP MSTR is "OFF".

## PILOT SWITCH/ANNUNCIATORS


CMPST	DG SEL	DME HOLD	VG SEL	VG FAST ERECT
<input type="checkbox"/>	1 2	<input type="checkbox"/>	1 2	<input type="checkbox"/>

### CMPST




The CMPST switch/annunciator enables/disables the Composite Reversionary mode for the Electronic Flight Instrument System. When the Composite Mode is activated, the information on the EADI and EHSI are combined to provide a single reversionary display on both tubes. This mode is available in case an EFIS display unit becomes inoperable. The CMPST pushbutton illuminates an amber chevron-filled box to annunciate activation. On four-tube (both pilot's and co-pilot's) EFS 40 installations, both sets of displays offer this functionality independently. Please refer to the EFS 40/50 Pilot's Guide for detailed EFIS information.


## VG SEL 1-2

 The vertical gyro select switch/annunciator allows the pilot (co-pilot as well in a four-tube EFS 40 installation) to select an alternate vertical gyro reference for display on the EADI. The on-side vertical gyro is illuminated in green when activated for display. The cross-side vertical gyro is annunciated in amber when activated for display.


## DG SEL 1-2

 In four-tube EFS 40 installations, the pilot and co-pilot have directional gyro switching capability for display on their respective EFIS. Depressing the DG SEL 1-2 switch/annunciator switches the display reference between the two directional gyros. If the on-side directional gyro is selected, the respective "1" or "2" will annunciate in green. If the cross-side directional gyro is selected the appropriate annunciation will illuminate in amber. The selected DG source is also annunciated on the EHSI.

## DME HOLD

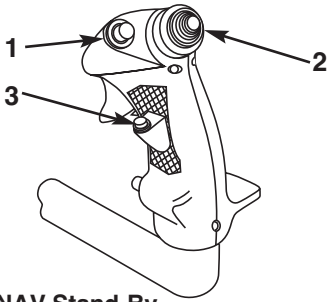
 The DME HOLD switch/annunciator allows the pilot to activate DME hold. When DME hold is activated, the DME will hold the frequency of the VOR/ILS station selected for NAV on the pilot's EHSI. The chevron-filled box is illuminated on the switch/annunciator.

## VG FAST ERECT

 The VG FAST ERECT switch activates the quick erect mode for the selected vertical gyro. The selected vertical gyro is noted by the VG SEL 1-2 switch annunciation.



## Cyclic Grip Switch Assembly



1. NAV Stand-By
2. Cyclic Beep Trim
3. Force Trim Release

**Cyclic Beep Trim Switch** — A cyclic mounted four-way barrel switch controls autopilot and flight director functionality for pitch and roll command trim. The barrel switch provides the function of vertical and lateral command modification for the autopilot and flight director modes. With the modes described below, the switch provides the following vertical command functions:

**NAV Stand-By Switch** — Located on the cyclic, the NAV Stand-By Switch disengages the flight director when pressed. The autopilot and yaw damper remain engaged in the default modes, Pitch Attitude Hold and Roll Attitude/Heading Hold.

**Force Trim Release Switch** — Mounted on each of the cyclics, the Force Trim Release (FTR) Switch provides synchronization of the flight director pitch and roll axes as well as releasing the magnetic brake in the trim actuator. Pressing the FTR pushbutton decouples autopilot actuators, if engaged, and synchronizes the current vertical and lateral flight director modes. Upon release of the pilot's FTR pushbutton, the autopilot servos reengage and the flight director commands the current values set in the active modes. The copilot's FTR switch functions the same as the pilot's. In addition, it cancels all flight director modes.

### Flight Director Vertical Command Values

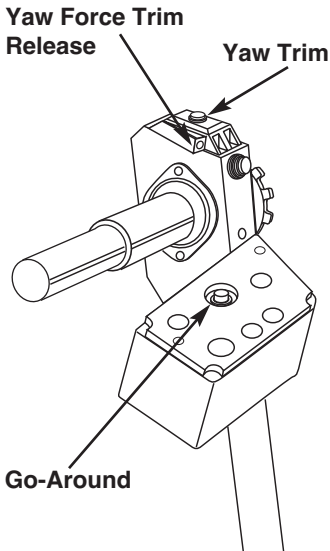
#### Discrete Command

Discrete Command	System Response
Pitch Attitude Hold	0.5° per click
Altitude Hold	10 feet per click
Indicated Airspeed Hold	1 knot per click
Vertical Speed Hold	100 fpm per click

#### Continuous Command

Pitch Attitude Hold	Maintains const. acc. profile until release
Altitude Hold	50 feet per second
Indicated Airspeed Hold	Five knots per second until release
Vertical Speed Hold	300 fpm per second until release

## Collective Switch Assembly



**Go-Around Pushbutton-** Go-Around mode cancels any lateral flight director mode and commands a pitch attitude necessary for 750 fpm rate of climb.

The autopilot if engaged remains engaged. Any lateral flight director mode can be subsequently reengaged without cancelling the Go-Around mode. Selecting any vertical mode, or pressing the FTR switch, cancels the Go-Around mode.

**Yaw Trim-** Commands trim drive for the yaw axis when the autopilot is engaged. Allows alternate yaw trim positions (ball not centered).

**Yaw Force Trim Release-** Depressing the Yaw Force Trim Release pushbutton disengages the yaw trim actuator's magnetic brake allowing the pilot to move the pedals without resistance while the autopilot is engaged.

### Flight Director Lateral Command Values

#### Discrete Command

Roll Attitude Hold  
Heading Select

#### System Response

First Click=6°, Subsequent=1° per click  
1° Heading Bug Movement per click

#### Continuous Command

Roll Attitude Hold  
Heading Select

Constant Roll Rate  
15° Heading Bug Movement per second

# EFS 40 Electronic Flight Instrument System



ED 461 EFIS Display

**“Push Sync”** – Syncs the heading bug with the lubber line.

**TST-SYS** – alternates display of time to station and ground speed. When depressed and held, the system activates preflight test.

**HSI** – selects 360° display combination of HSI, MAP, and WX .

**ARC** – selects the 85° display format of HSI, MAP, and WX.

Refer to the EFS 40 Electronic Flight Instrument System Pilot’s Guide for complete EFIS operation.

**Course knob** – when rotated repositions the course arrow on the EHSI.

**“Push Direct”** – Changes the course pointer to obtain a centered deviation indication. The course knob and "Push Direct" function are not functional when a Flight Management System or Long Range Navigator is selected as the primary NAV source on the EHSI.

**Heading knob** – when rotated repositions the heading bug on the EHSI.

**RNG** – Changes the display range in MAP and WX formats.

**NAV Source** – Alternates selection of active navigation source.

**No. 1 Bearing Pointer select** – selects the source to be displayed as the No. 1 bearing pointer.

**No.2 Bearing Pointer select** – selects the source to be displayed as the No.2 bearing pointer.

**Brightness Adjust** – independent control of EHSI brightness.

**1-2** – alternately selects the source (No. 1/No. 2) for navigation display on the EHSI.

## EADI 40 Electronic Attitude Indicator

EFS 40 is the state-of-the-art Electronic Flight Instrumentation System with four inch displays. Because EFS 40 is so broad in its capabilities, the following section attempts to describe only the information about the system that pertains to the KFC 500 Flight Control System.

### Normal Attitude Display

**Pitch Attitude** — Pitch scale reference marks extend above and below the horizon line indicating 10, 20, 25, 30, 40, 50, 60, 70, 80 and 90 degrees.

**Roll Attitude** — EFS 40 provides a movable index (sky) pointer for displaying roll attitude. The roll scale provides reference marks at 10, 20, 30, 45 and 60 degrees.

**Symbolic Aircraft** — Located in the center of the display is the fixed orange aircraft symbol. The pitch and roll attitudes of the aircraft are displayed by the relationship of the fixed symbolic aircraft and the moveable horizon. The symbolic aircraft is flown to satisfy the command cues of the flight director.

EFS 40 offers two symbolic aircraft symbols, the cross pointer and “v” bar. Selection of the single cue command bars will present a delta aircraft symbol, while selection of the double cue command bars will provide a traditional cross pointer aircraft symbol. The double cue command bars are the standard presentation. Single cue display is optional (EFS Configuration).

**Heading Tape** — A white heading tape is fixed along the top of the horizon line. Index marks appear every five degrees with heading values displayed every 30 degrees.

**Flight Director Command Bars** — Flight director commands are displayed as moving bar(s) when the flight director is engaged. Deactivating the flight director or an invalid “FD” command will cause the command bar(s) to be removed.

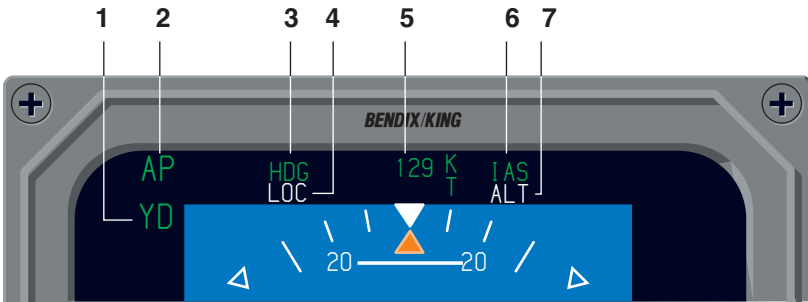
### Autopilot/Flight Director Mode Annunciation

The EFS 40 system will annunciate a combination of the KFC 500 autopilot and flight director modes. Engaged modes are annunciated in green along the top of the display and armed modes are annunciated in white. All ARM annunciations are displayed in white until they become active.

The following figure describes those modes supported and the location in which they may be displayed.

The following list of autopilot warning annunciations will be displayed in the Flight Control Annunciation field on the electronic attitude indicator.

- PTRM red=pitch trim fail
  - PTCH red=pitch servo failure
  - ROLL red=roll servo failure
  - YAW red=yaw servo failure
  - RTRM red=roll trim servo failure
  - YTRM red=yaw trim servo failure
  - AP red=autopilot disconnect
  - YD red=yaw damper disconnect
- Flashing amber is to annunciate automatically disconnected modes.



1. Yaw Damper Annunciator
2. Autopilot Annunciator
3. Active Lateral Mode
4. Armed Lateral Mode

5. Command Reference Value
6. Active Vertical Mode
7. Armed Vertical Mode

If the flight director data becomes invalid, a red “FD” enclosed in a red box will be displayed at the right center of the display and the command bars will be removed.

Autopilot engagement is annunciated by a green “AP”. A green “YD” is annunciated to indicate the yaw axis is engaged.

If the autopilot has been on and then is disengaged, a red “AP” annunciation will momentarily flash in the upper left hand corner of the display and then be removed. The yaw damper, if engaged, will provide a flashing red “YD” annunciation upon disengagement.

**Command Reference Data** — The following autopilot command reference data will be displayed in green on the electronic attitude indicator when interfaced with the KFC 500:

- Vertical Speed                    ± 3,500  
fpm in 100 fpm increments.
- Altitude                            0 to 65,536  
FT in 10 FT increments.
- Indicated Airspeed            50 to VNE  
KT in 1 KT increments.

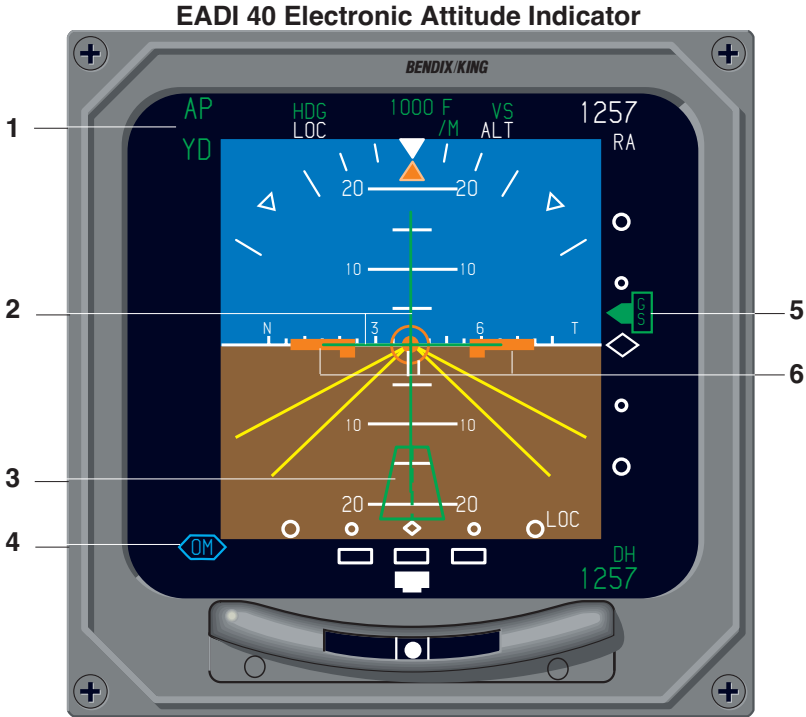
**Vertical Scale** — When the selected primary NAV sensor is ILS or MLS, a vertical deviation scale will appear on the right side of the EADI display. This scale provides a reference for the vertical deviation pointer and the center of the glide path. If the selected sensor is ILS or MLS, a “GS” annunciation appears. The vertical deviation scale is in view only when the selected course is within 105 degrees of the aircraft heading.

#### **Expanded Lateral Deviation Scale**

– Located at the bottom center of the EADI, the expanded lateral deviation scale provides a reference for ILS or MLS lateral deviation. The expanded scale represents 1/2 full scale deviation as displayed on the EHSI. When the selected course and aircraft heading differ by more than 105 degrees, the left/right directional display is reversed and a BC annunciation is displayed left of the center diamond to alert the pilot that back course information is being displayed.

**Marker Beacon Annunciation** — The three marker beacon annunciations are capable of being displayed on the EADI. Outer marker, “OM”, is displayed in cyan, middle marker, “MM”, is displayed in orange, and the inner marker, “IM”, is displayed in white.

**Rising Runway** — The display of the rising runway is available in the Approach mode when a localizer or MLS and radar altitude are available. The symbolic rising runway will be displayed in the lower center of the display just above the LOC/MLS lateral deviation scale.



- |                                      |                        |
|--------------------------------------|------------------------|
| 1. Flight Control Mode Annunciations | 4. Marker Annunciation |
| 2. Flight Director Command Bars      | 5. Vertical Scale      |
| 3. Rising Runway                     | 6. Symbolic Aircraft   |

## EHI 40 Electronic Horizontal Situation Indicator

The EHI 40 Electronic Horizontal Situation Indicator has capabilities far superior to any electromechanical HSI currently available. Because the EHI 40 is so broad in its capabilities, this section will only attempt to describe the EHI 40 features that apply to the KFC 500 Flight Control System. For additional information on the EHI 40, please refer to the EFS 40/50 Pilot's Guide.

**Compass Card** — Displays magnetic heading information received from the aircraft's compass system. Increments of the compass card are five degrees.

**Course Pointer** — Displays the magnetic course selected with the course selector knob of the EFS control panel. The selected course is displayed numerically in the upper left corner of the display.

**Course Deviation Indicator** — Indicates the aircraft deviation from the selected course with reference to the course deviation scale. If the Nav source is flagged, the D-bar is removed and a red "X" is annunciated.

**Course Deviation Scale** — Measures the displacement of the course deviation indicator in relation to a two-dot scale right and left of course centerline. The scale calibrations differ depending on the selected sensor. In VOR, full CDI deflection indicates an angular displacement of 10° from the selected course. Full-scale RNAV deflection indicates a five mile linear displacement. Localizer full scale deflection is 2.5° from centerline,

while RNAV approach indicates 1.25 mile linear displacement.

**Selected Primary Nav Sensor** — The selected primary NAV sensor will be annunciated just below the center of display on the opposite side from which the vertical deviation scale is displayed.

**Vertical Scale Pointer/Vertical Deviation Scale** — Indicates deviation from the beam centerline during an ILS or MLS approach.

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

**Nav Flag** — Warns that the received navigation signal is inadequate for course tracking. The invalid NAV is annunciated by removing the D-bar and displaying a red "X".

**To/From Indicator Flag** — Indicates the direction of nav reference relative to the selected course. The To/From flag is removed when the Nav signal is invalid.

**Symbolic Aircraft** — The stationary symbol is for display reference.

**Heading Bug** — Indicates selected heading for flight director tracking in the Heading mode, as selected with the heading selector knob on the EFS controller. Except during selection, the heading bug remains stationary with respect to the compass card. Selected Heading is displayed in orange in the lower right area of the EHSI.



- |                             |                                      |
|-----------------------------|--------------------------------------|
| <b>1. Heading Bug</b>       | <b>5. Course Deviation Indicator</b> |
| <b>2. Course Pointer</b>    | <b>6. Lubber Line</b>                |
| <b>3. Compass Card</b>      | <b>7. Vertical Scale Pointer</b>     |
| <b>4. Navigation Source</b> |                                      |

The EFS 40 Electronic Flight Instrument System is integrated with the KFC 500 to simplify the navigation interface and switching. The EFS 40 Symbol Generator provides the Flight Computer with all of the navigation receiver information via the ARINC 429 digital data bus. The Symbol Generator accepts all of the analog and digital navigation and DME information and concentrates it into a single data bus structure. The KFC 500 captures and tracks the navigation source selected on the pilot's EHSI if the Flight Director NAV mode is chosen. The EFS 40 Symbol Generator also provides redundant monitoring of attitude.

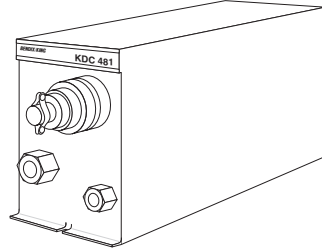


## **KAD 480 Air Data System**

The KAD 480 Digital Air Data System is comprised of the KDC 481T Central Air Data Computer, and the KAV 485 Altitude/Vertical Speed Indicator.

### **KDC 481T Central Air Data Computer**

The heart of the KAD 480 Air Data System, the KDC 481T Central Air Data Computer, processes pitot and static pressures and air temperature inputs, and supplies the processed information to the KCP 520 Flight Computer and KAV 485 Altimeter/ Vertical Speed Indicator. The Central Air Data Computer is also capable of supplying air data information to optional Flight Management Systems.



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# KAV 485 Altitude/Vertical Speed Indicator



- |  |                                       |
|--|---------------------------------------|
| 1. Hg/HPa Pushbutton                         | 9. Altitude Alert Annunciation        |
| 2. Altimeter Flag                            | 10. Altitude Select/Density Altitude  |
| 3. Altimeter                                 | 11. Altitude/Vertical Speed Selector  |
| 4. Barometric Pressure Setting               | 12. Vertical Speed Engage Pushbutton  |
| 5. Vertical Speed Bug                        | 13. Altitude Select Engage Pushbutton |
| 6. Vertical Speed Flag                       |                                       |
| 7. IVSI Display                              |                                       |
| 8. Barometric Pressure Setting Selector/Test |                                       |

## KAV 485 Altitude/Vertical Speed Indicator

The KAV 485 Altitude/Vertical Speed Indicator provides centralized display and control of some of the KFC 500's most commonly used altitude and vertical speed functions. Display features include an electrically driven altimeter and instantaneous vertical speed indicator (IVSI); altitude and vertical speed preselect; barometric correction; and an altitude alerter. Controls for altitude/vertical speed selection and barometric altimeter setting are included, along with mode selector keys for activating the functions of the Vertical Speed and Altitude Select.

The KAV 485 Altitude/ Vertical Speed Indicator includes a preflight/self-test function that ensures integrity of the display and command features. Illumination of the display is adjusted automatically by a photocell integrated into the top right portion of the unit.

### Display Features

A photocell is placed on the indicator bezel for automatic dimming of the display.

**Altimeter** — Displays barometric altitude information derived by the KDC 481T Central Air Data Computer. The digital portion of the display provides resolution to within 20 feet when the aircraft's vertical speed is less than 1000 fpm; and to within 100 feet when vertical speed is greater than 1000 fpm.

**ALT Flag** — The "ALT" flag and digital "FAIL" annunciator appear as necessary to indicate invalid altimeter information.

**Altimeter Setting** — Displays the current barometric pressure setting. Units are displayed in either inches of mercury (In Hg.) or hectoPascals (HPa), as annunciated beneath the numeric display. The display units are changed by depressing the pushbutton (1) in the upper left corner of the indicator.

**Altimeter Setting Selector/Push-to-Test Control** — Dual concentric rotary knobs, with the smaller, inside knob also featuring pushbutton operation, control the barometric altimeter setting. The smaller, inner knob adjusts the single-hectoPascal or hundredths-inch portion of the display with automatic rollover to higher digits. The larger, outer knob adjusts the altimeter setting in tens-of-hectoPascals or tenths-of-inches. It also features automatic roll-over.

Pressing the smaller knob activates the air data system's self-test feature, described in "Preflight Procedures" on page 44. Depressing again, terminates the self-test procedure.

**Inches of Mercury/HectoPascal Pushbutton** — Depressing the pushbutton alternates calibration of the altimeter setting display between inches of mercury (in HG) and hectoPascals (HPa), as annunciated.

**Altitude Select/Density Altitude** —

Provides continuous display of altitudes selected for altitude alerting and flight director capture and tracking, or momentary display of current density altitude derived by the Central Air Data Computer. Preselected altitudes are displayed in 100-foot increments.

The current density altitude displays for approximately five seconds at the end of the air data system's preflight test function. Pressing the Push Baro Test pushbutton twice in rapid succession summons the density altitude display at any time.

**Altitude/Vertical Speed Preselect Control** —

Dual, concentric knobs control altitude and vertical speed preselection. To preselect altitude, press the smaller knob to ensure it is in the inner position. Rotating the smaller knob adjusts the preselected altitude in 100-foot increments, with automatic roll-over to higher values. The outer knob adjusts altitude in 1000-foot increments. The aircraft may have only one selected altitude at a given time. The pilot has priority over the copilot controller if used at the same time, however, the last person to select the value provides the active selected altitude.

Pulling the smaller knob to its outer position initializes the vertical speed bug (5), synchronizing it with the last vertical speed selected and references the control knobs to vertical speed. The smaller knob adjusts selections in 100-fpm increments, with automatic rollover. The larger knob adjusts selections in 1000-fpm increments.

**Altitude Alert** — Illuminates when the aircraft's current altitude is within 200-1000 feet of the value specified in the altitude preselect display. Upon reaching the selected altitude, the Alert annunciator lights again, briefly. An aural alert sounds upon illumination of the pilot's annunciator at 1,000 feet before and 200 feet outside the selected altitude.

**Instantaneous Vertical Speed Indicator (IVSI)** —

Displays instantaneous vertical speed with 100-foot resolution for values less than 1000 fpm up or down; and with 500-foot resolution for larger values to 3,500 fpm.

**VS Flag** — Appearance of the "VS" flag indicates an invalid IVSI display.

**Vertical Speed Bug** —

Indicates present vertical speed selection. Concealed behind the shroud at the IVSI's three o'clock position prior to activation, upon activation the bug moves to the vertical speed reference. Vertical speed references may be selected with the KAV 485's Altitude/Vertical Speed Preselect Control; alternatively, pressing the Force Trim Release Pushbutton with the KFC 500 in the Vertical Speed mode synchronizes the bug with the aircraft's current vertical speed. The CBT switch may also be used to change the reference in Vertical Speed mode. The VS bug will move respectively.

**Vertical Speed Engage Pushbutton** — Pressing the Vertical Speed Engage pushbutton causes the flight director to command the aircraft to climb or descend at the rate indicated by the vertical speed bug on the IVSI.

**Note:** *If the VS bug is in view when VS is engaged, the preselected VS will be commanded. If the bug is not in view when VS is engaged, the helicopter's current VS will be maintained and the bug will come into view synchronized with the VS pointer.*

**Altitude Select Pushbutton** — When pressed, the altitude select key engages the flight director's Altitude Arm function in coordination with the digital altitude display in the KAV 485's altitude preselect window.



# KFC 500

## Emergency Procedures





# Emergency Procedures

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The KFC 500 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 500 detect a problem, the autopilot will disconnect, illuminate an AP annunciation, and provide an aural disconnect tone.

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. Do not reengage a malfunctioning autopilot until after it has been serviced.

The approved Flight Manual Procedures take precedent over the following procedures.

## Autopilot Emergencies

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

1. Helicopter Controls — GRASP AND REGAIN AIRCRAFT CONTROL.
2. PRESS AND HOLD the Force Trim Release Switch — located on the cyclic. Autopilot and yaw damper will be inhibited and Force Trim will be interrupted.
3. While HOLDING the Force Trim Release Switch — Select the AP and/or YD "OFF" on the KMS 540 Mode Select Panel.
4. Move the AP Master to the "OFF" position.
5. After the autopilot has been disengaged, DO NOT REENGAGE the failed autopilot. Resume normal manual flight operations.
6. Refer to the Rotorcraft Flight Manual Supplement for additional procedures.

## **Manual Autopilot Shutdown**

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

1. Autopilot Mode pushbutton — PRESS AP, THEN RELEASE.
2. Force Trim Release Switch — PRESS AND HOLD. Both autopilot and yaw damper will be inhibited while depressed through the second detent.
3. Move the AP Master to the "OFF" position.
4. AFCS Circuit Breaker — PULL.
5. Flight Director Circuit Breaker — PULL



# KFC 500

## Preflight Procedures



# Preflight Procedures

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**Caution:** Operation of the Autopilot on the ground may cause undesired rotor control/movement.

The Bell 230 has preflight test sequences required in addition to the general procedures described here. See the FAA approved Rotorcraft Flight Manual Supplement for particular details.

## Autopilot Automatic Self Test

1. Activate the inverter power for VG alignment and self test. When complete, the HDG and ATTITUDE flags displayed on the EFIS will be eliminated. Do not move the aircraft during VG erection.
2. AP Fail annunciation provided on the remote annunciator flashes upon initial application of power to the autopilot and then extinguishes after successful completion of the self test.
3. An aural tone sounds in headsets only (no speaker) upon completion of flight control preflight test.

## Air Data System Self Test

1. Verify correct altimeter setting on the altimeter/vertical speed indicator.
2. Press the PUSH TEST BARO control.
3. All digit segments should light, "ALT", "VS", and "IAS" flags appear. Upon completion of the test, the altimeter displays field elevation with all flags pulled. The density altitude is displayed on the altitude select display for approximately five seconds.

## **Electronic Flight Instrument Self Test**

*See EFS 40/50 Pilot's Guide and the Aircraft Flight Manual Supplement for procedures.*



# KFC 500

## Operational Examples

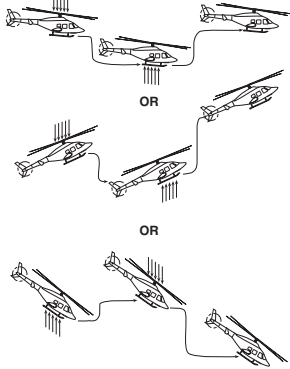




# Operational Examples

## Attitude Hold

Attitude Hold Operation maintains the helicopter's reference attitude (not altitude)

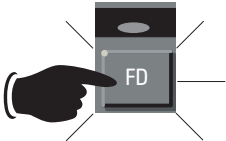


Note: Arrows indicate external force

1. Establish the desired pitch attitude.



2. Depress Flight Director pushbutton on the mode select panel.



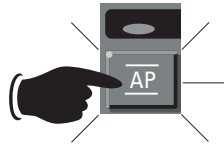
Flight Director command bars come into view with the reference pitch attitude commanded. Roll attitude is commanded to horizon level (roll-level)/heading hold).



3. The reference attitude may be modified using the vertical and lateral command control (Cyclic Beep Trim).

Alternatively: 1. Establish the desired pitch and roll attitude.

2. Depress the "AP" pushbutton on the mode select panel.



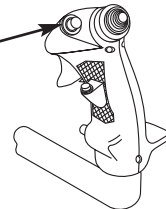
The Autopilot engages in Pitch Attitude Hold and Roll Attitude Hold with no flight director presentation.

## Navigation Standby

Navigation Standby causes the Flight Director to declutter and the autopilot to revert to Attitude Hold.

1. Depress the NAV STBY switch on the cyclic.

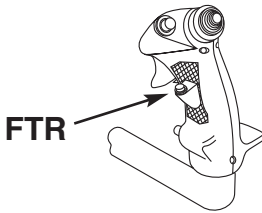
**NAV Standby**



2. All flight director modes deactivate and the command bars are removed from view.

If the autopilot is engaged, the pitch attitude present at selection of NAV STBY is maintained. Roll attitude defaults to roll-level/heading hold. Attitude Hold mode becomes active.

### Force Trim Release




Force Trim Release (FTR) temporarily disables the automatic flight control system to allow pilot maneuvering of the helicopter while FTR is depressed.

Flight Director commands are synchronized to the helicopter's vertical reference while FTR is depressed.

Once FTR is released, the flight director vertical command is synchronized to the vertical reference established when released:

- Attitude Hold: pitch attitude.
- Altitude Hold: reference altitude.
- Vertical Speed: reference vertical speed.
- Roll: sync to helicopter heading or roll attitude hold if bank angle is greater than six degrees.

### Heading Select

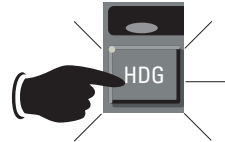
1. Position the Heading Bug  over the heading to be tracked by the flight director.



The HDG knob is used to move the heading bug on the HSI.



2. Depress the HDG pushbutton on the Autopilot Mode Select panel



to activate the flight director in Heading Select mode (HDG).

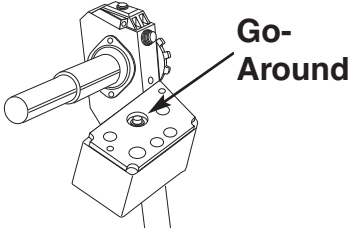


Flight director commands are provided to the selected heading.

Once HDG mode has been activated, the CBT switch can be used to move the Heading Bug.

## Go-Around Mode

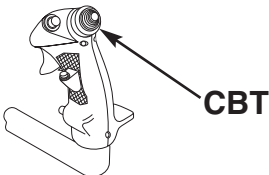
1. Prior to or when the MDA or DH is reached, add appropriate climb collective power and depress the GO-AROUND pushbutton on the collective switch panel.



2. The Flight Director will provide climb commands to climb at 750 feet per minute. The roll command will be for roll-level flight.



3. Using cyclic beep trim, the climb rate can be modified to desired helicopter performance.



4. When appropriate, a new lateral mode and/or vertical mode may be engaged to provide guidance.

## Navigation Coupling

1. Select the navigation source to be coupled to the AFCS by depressing the NAV pushbutton on the EHSI. The system will not couple to ADF.

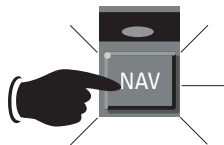


2. Use the COURSE knob to select the course to be tracked. (If coupling to GPS/LORAN in AUTO-LEG operation COURSE selection is automatic.)



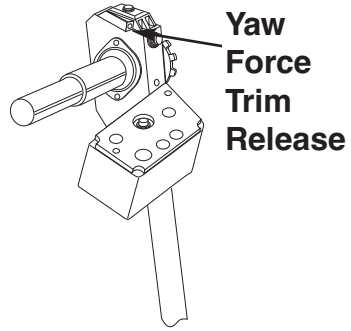
3. Heading mode can be engaged to provide intercept guidance to the selected course. Based on course and distance, choose a heading that provides an adequate intercept.

4. Depress the NAV pushbutton on the Mode Select Panel. The flight director will then be ARMED to capture the selected course when the capture criteria are satisfied.



### Yaw Force Trim Release

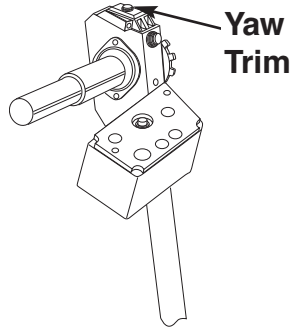
To reposition the pedals when the Yaw Damper is engaged, press and hold the Yaw Force Trim Release switch. The Yaw brake will disengage, allowing free pedal movement. Autopilot operation in the pitch and roll axes will not be disturbed. Upon release of the switch, the Yaw brake will reengage, and the Autopilot/Yaw Damper will command ball centered yaw axis.



**Yaw  
Force  
Trim  
Release**

### Yaw Trim

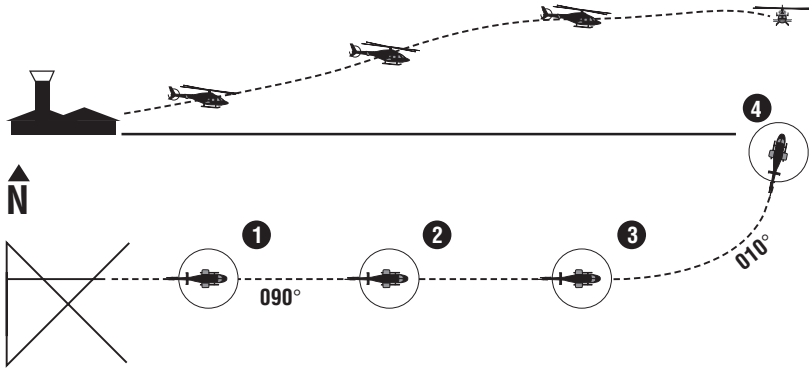
The Autopilot or Yaw Damper may be used to move the yaw axis of the helicopter to a target attitude. With the Yaw Damper engaged, moving the Yaw Trim switch to the left or right will adjust Yaw position in the corresponding direction.



**Yaw  
Trim**

## Take Off and Climb

The following examples describe possible applications of the KFC 500 Flight Control System, other applications may be available. Consult the Rotorcraft Flight Manual Supplement for specific operating instructions and limitations.



Objective: Depart the assigned runway, turn to a 010° heading and climb to 3000 feet. Prior to hover perform the autopilot preflight procedures as described on page 47.

1. Prior to takeoff, press the FD switch. Select the assigned altitude in the altitude selector of the altimeter/vertical speed indicator. ARM Altitude Select by depressing the ALT SEL pushbutton. Set the heading bug for the assigned departure heading.



2. After takeoff establish the appropriate climb attitude. When a safe altitude has been reached, activate the Heading Select mode by depressing the HDG pushbutton on the mode select panel. Activate the desired vertical mode by selecting the appropriate button on the mode select panel. This will result in flight director commands to turn to maintain (heading bug) heading and pitch to the appropriate vertical attitude. The aircraft will respond to the flight director commands as soon as the autopilot is engaged. The helicopter airspeed must be greater than 50 knots before the autopilot is engaged. Arm Altitude Select by depressing the SEL pushbutton.

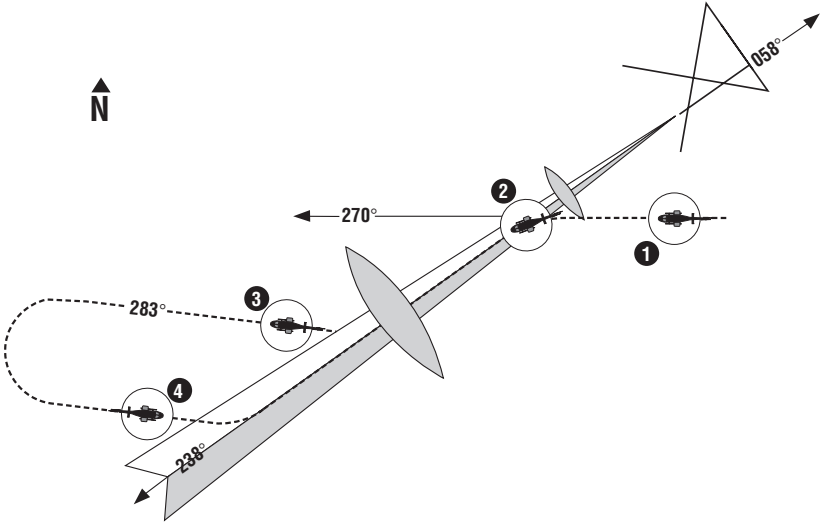
3. At a safe altitude, depress the AP pushbutton on the mode controller so the autopilot will engage and respond to the command bars. The autopilot then follows the HSI heading bug and adjusts pitch attitude to maintain the selected vertical mode.



4. A momentary tone and alert annunciation is initiated 1,000 feet prior to reaching the selected altitude. Prior to reaching the selected altitude, the autopilot 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 select is used. An ALERT annunciation will be momentarily present when the selected altitude is reached. The 010° heading has been acquired.



# 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 EHSI course pointer. EFS 40 automatically determines Back Course from the course selection and aircraft heading. Depress the APR pushbutton for flight director commands to capture and track the localizer outbound .





2. When the computed capture point is reached, the LOC 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 signals 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. Depress the APR pushbutton to arm the Approach mode. Automatic capture will occur to direct the aircraft on the localizer inbound.

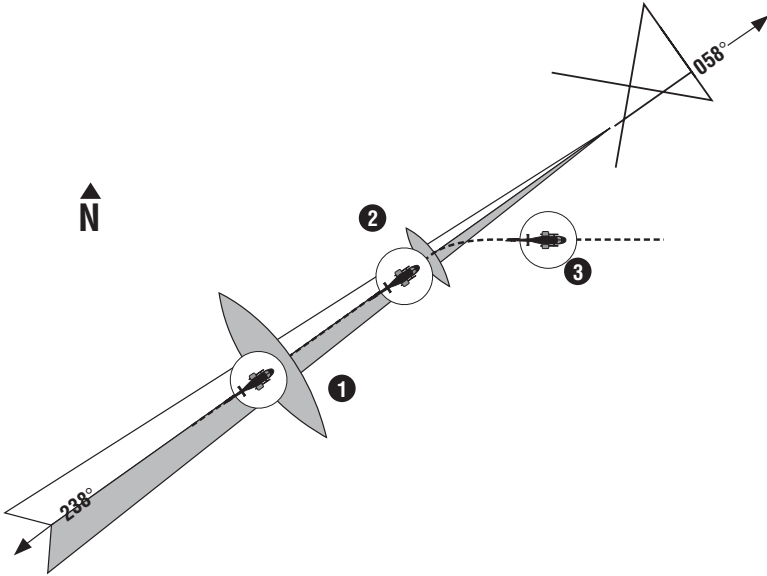
5. The autopilot is following the flight director commands which maintain localizer centerline tracking. Once Approach Coupled, Glideslope is automatically armed. The point of glideslope capture is based on the glideslope deviation and the rate of change of glideslope deviation. Both pitch and roll are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

6. Throughout the approach procedure, the airspeed must be controlled by the pilot via the collective.

*Note: The KFC 500 Autopilot/Flight Director will only maintain one pitch mode at a time: Pitch Attitude Hold, Altitude Hold, Vertical Speed Hold, Go Around, Indicated Airspeed Hold, or Glideslope. Airspeed or vertical rate must be maintained by the pilot via the collective.*



# 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 annunciated 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 or other vertical mode 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. Airspeed must be controlled by the pilot via the collective.

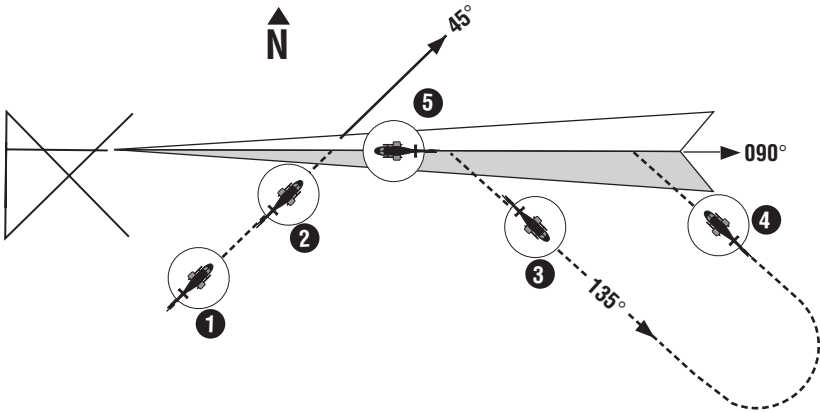


2. At Decision Height, a missed approach is initiated by pressing the Go-Around button as collective is added. The Go-Around button is located on the collective. The Go-Around pushbutton activates the Go-Around mode which provides flight director commands to certification specific vertical speed and roll-level attitude. At the discretion of the crew, another flight director mode may be activated to complete the missed approach.



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 CBT switch, or by activating any vertical mode. (Any of these modes will cancel the Go-Around mode.) Altitude select must be manually armed by depressing the ALT SEL pushbutton on the KAV 485 altimeter/vertical speed indicator. If the desired altitude was selected at this point, you would get an automatic altitude arm.

# 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 45° 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 APR pushbutton is depressed to arm the Approach mode so that the localizer will be captured and tracked. The capture point computation is based on deviation and deviation rate of change.



*Note: Always select the navigation course pointer to the localizer front course. (This course will be opposite helicopter heading when inbound on a back course approach.)*

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

*Note: The KFC 500 Autopilot/Flight Director will only maintain one pitch mode at a time: Pitch Attitude Hold, Altitude Hold, Vertical Speed Hold, Go Around, Indicated Airspeed Hold, or Glideslope. Airspeed or vertical rate must be maintained by the pilot via the collective.*

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 helicopter 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 APR 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 Indicated Airspeed Hold or Vertical Speed mode and Back Course Approach mode, the FTR button or CBT switch can be used for modification of pitch attitude for the desired 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 APR pushbutton when your position is relatively close to the localizer.*



6. Disengage the autopilot or press the Go-Around pushbutton at the missed approach point. The Go-Around pushbutton will activate the Go-Around mode in which the flight director commands a 750 fpm climb and roll-level flight. The Go-Around pushbutton is located on the collective. Altitude Select must be manually armed by depressing the ALT SEL pushbutton on the KAV 485. At the pilots discretion, the autopilot may be reengaged. The autopilot is not to be coupled below approved approach minimums.

*Note: Consult the Bell Model 230 Flight Manual Supplement for limitations.*



# Performance Specifications

Mode	Parameter	KFC 500 Value
<b>Attitude Hold</b>	Pitch Command Profile	0.1G or 2 Deg/Sec
	Pitch Hold Accuracy	± .3 Deg Smooth Air
	Roll Angle Limit	25 Deg
	Roll Command Rate Limit	4 Deg/Sec
	Roll Hold Accuracy	± 1 Deg
<b>Heading Hold</b>	Roll Angle Limit	10, 15, 20, or 25 Deg (Pilot Selectable)
	Roll Command Rate Limit Accuracy	4 Deg/Second ± 1 Deg
<b>NAV</b> (VOR Capt)	Beam Intercept Angle Capture Point	All Angle Function of DME, Deviation, Dev Rate & Course Error
	Roll Command Rate Limit	4 Deg/Second
<b>VOR Track</b> (Over Station)	Crosswind Correction	Up To 30 Deg
	Course Change	Up To 90 Deg
<b>Approach</b>  (LOC Capture)	Beam Intercept Angle	Up to 105 Deg Front Course
	Roll Angle Limit Roll Command Rate Limit Capture Point	20 Deg 10 Deg/Second Function of Deviation, Dev Rate & Course Error
(LOC Track)	Roll Angle Limit	10 Deg
	Cross Wind Correction	Up To 30 Deg
	Gain Programming	Function of Rad Alt or (time, TAS)
<b>GS</b>	Capture Point	Function of Deviation, (Dev Rate)
	GS Damping Pitch Rate Limit	Pitch Att, TAS, & Vert Acc. 0.25G
	Gain Programming	Function of Rad Alt or (time, TAS)

<b>Mode</b>	<b>Parameter</b>	<b>KFC 500 Value</b>
<b>Go-Around</b>	Pitch Up Command	Pitch to 750 fpm Climb
<b>Alt Sel</b>	Engage Range Engage Vert Spd Limit	0 to 55,000 Ft. Function of Vert. Speed Max "G" During Capture ± 0.1G
<b>Alt Hold</b>	Engage Range Engage Vert Spd Limit Accuracy Pitch Rate Limit	-1,000 to 20,000 Ft. ± 2,000 Ft/Min ± 40 Ft* 0.1G Vert Accel
<b>IAS Hold</b>	Engage Range Accuracy Pitch Rate Limit	50 Kts to VMO ± 3 Kts 0.1G Vert Accel
<b>Vert Spd</b>	Engage Range Accuracy Select Range Pitch Rate Limit	+10,000/-15,000 Ft/Min ± 100 Ft/Min* ± 7,000 Ft/Min 0.1G Vert Accel
<b>Flight Director</b>	Pitch Command Limit	+15 Deg, -10 Deg
<b>Autopilot</b>	Pitch Engage Limit	+25 Deg, -20 Deg

All accuracy specifications are based on aircraft operations in smooth air.

\* Indicates altitude below 9,000 Ft. MSL.

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006-08750-0000  
Rev. 0 Sept/93

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