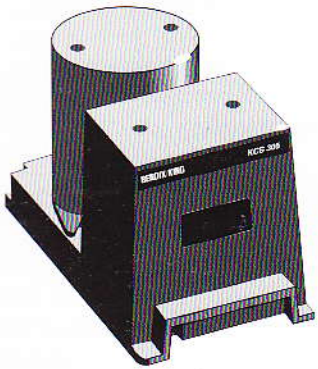
KCS 55A Compass System

The KCS 55A Compass System, which includes the KA 51B Slaving Control and Compensator Unit, the KMT 112 Magnetic Slaving Transmitter and the KG 102 Directional Gyro as well as the KI 525A Pictorial Navigation Indicator is an optional part of the KAP 140 Autopilot System.

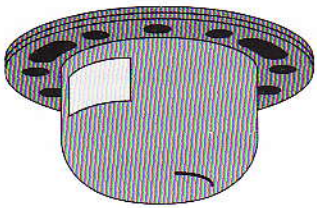
The panel-mounted KI 525A HSI combines the display functions of both the standard Directional Gyro and the Course Deviation Indicator's VOR/LOC/Glideslope information to provide the pilot with a single presentation of the complete horizontal navigation situation. This greatly simplifies course orientation, interception and tracking, while eliminating the need for scan coordination between two separate indicators.

KA 51B

KI 525A



KG 102A

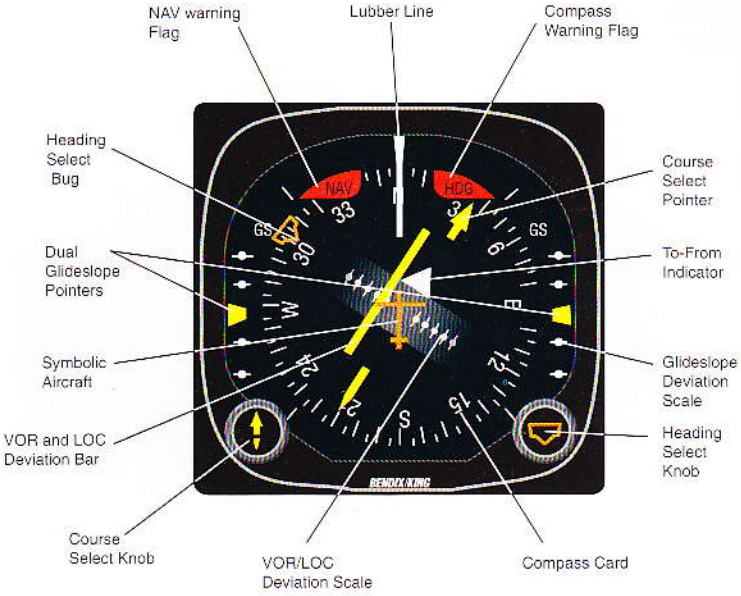


KMT 112

KCS 55A Compass System

KI 525A Indicator

The KI 525A Pictorial Navigation Indicator is the panel display for the KCS 55A Compass System. It replaces the standard Directional Gyro and Course Deviation Indicator (CDI) in the aircraft's panel, combining slaved heading and VOR/LOC/Glideslope information into one compact display. By providing a simple, comprehensive visual presentation of the aircraft's heading and position in relation to a desired course, the pilot's navigation workload is considerably reduced.



KI 525A Pictorial Navigation Indicator

Description of Indicator and Display Functions

Compass Card - Responding to the input from the slaved directional gyro, this card rotates within the display so that the aircraft heading is always at the top, under the lubber line.

Lubber Line - A fixed white marker at the top of the display that indicates aircraft magnetic heading on the compass card.

Symbolic Aircraft - A fixed representation of the actual aircraft. This miniature aircraft always points toward the top of the display and the lubber line.

Selected Course Pointer - On this two-part arrow, the "head" indicates the desired VOR or Localizer course and the "tail" indicates the reciprocal. This pointer is set by rotating the course select knob.

Course Select Knob - Used to rotate the course pointer to the desired course on the compass card. This knob corresponds to the Omni Bearing Selector (OBS) on standard NAV indicators.

VOR/RNAV and LOC Deviation - This bar corresponds to the "left/right" needle on standard course deviation indicators. When the aircraft is precisely on the VOR radial or Localizer course, it forms the center section of the selected course pointer and will be positioned under the symbolic aircraft. When off course or approaching a new course, it will move to one side or the other. Since the entire VOR and Localizer display rotates with the compass card, the angular relationship between the deviation bar and the symbolic aircraft provides a pictorial symbolic display of the aircraft's position with respect to the selected course.

Deviation Scale - When tuned to a VOR frequency, each white dot represents two degrees of deviation left or right of course. When tuned to a Localizer, the deviation is 1/2 degree per dot. (When GPS data is selected for presentation, refer to the Pilot's Guide for the GPS receiver.)

Heading Select Bug - A movable orange marker on the outer perimeter of the display, used primarily to select the desired heading you wish to fly. This desired heading is coupled to the KAP 140 Autopilot to provide the "Heading Select" function.

Heading Select Knob - Used to rotate the heading select bug to a desired point on the compass card.

To-From Indicator - A white triangle near the center of the display that indicates, with reference to the OBS setting, whether the course selected is "to" or "from" the selected VOR station and/or RNAV waypoint.

Dual Glideslope Pointers - Chartreuse triangular pointers on either side of the display drop into view when a usable glideslope signal is received and retract out of view when the glideslope signal becomes marginal. During an ILS approach, these pointers represent the vertical orientation of the aircraft with respect to the center of the glideslope beam. When on glideslope, the pointers will align with the center markers on the glideslope scale.

Glideslope Deviation Scale - White dots on each side of the display which, in conjunction with the glideslope pointers, indicate either "above", "below", or "on glideslope" during an ILS approach.

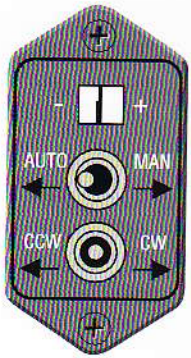
Compass Warning Flag - A red flag labeled "HDG" becomes visible in the upper right quadrant of the display whenever the electrical power is inadequate or the directional gyro is not up to speed. Compass failures can occur which will not be annunciated by the "HDG" flag. Therefore, periodic comparison with the standby compass is advised.

NAV Warning Flag - A red flag labeled "NAV" becomes visible in the upper left quadrant of the display whenever a usable signal is not being received.

Slaving Meter (KA 51B)

This meter indicates any difference between the displayed heading and the magnetic heading. Right or up deflection indicates a clockwise error of the compass card. Left or down deflection indicates a counterclockwise error of the compass card. Whenever the aircraft is in a turn and the card rotates, it is normal for this meter to show a full deflection to one side or another.

NOTE: During level flight it is normal for the meter needle to continuously move from side to side and to be fully deflected during a turn. If the needle stays fully deflected, left or right, during level flight, the free gyro mode can be used to center it, as follows:



KA 51B Slaving Meter

Slave and Free Gyro Switch - When the switch is in the AUTO position, the system is in the slaved gyro mode. When the switch is in the MAN position, the system is in the free gyro mode.

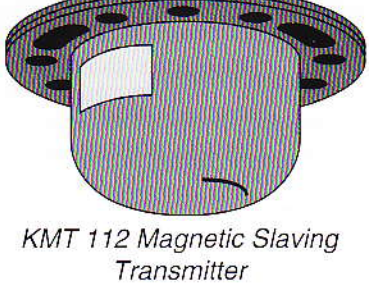
Clockwise Adjustment - When the system is in the free gyro mode, holding the manual heading switch to the CW position will rotate the compass card to the right to eliminate left compass card error.

Counterclockwise Adjustment - When the system is in the free gyro mode, holding the manual heading switch to the CW position will rotate the compass card to the left to eliminate right compass card error.

The KA 51B Slaving Control and Compensator Unit is a small slaving accessory which can be used in installations where panel space is limited. The KA 51B can be mounted either vertically or horizontally.

KMT 112 Magnetic Slaving Transmitter

This unit senses the direction of the earth's magnetic field and continuously transmits this information through the slaving circuitry to the directional gyro which is automatically corrected for precession or "drift". This sensor is mounted remotely – usually in a wingtip – to eliminate the possibility of magnetic interference.



KMT 112 Magnetic Slaving Transmitter

KG 102A Directional Gyro

The directional gyro provides gyro stabilization for the system and contains the slaving circuitry necessary for operation of the system. Power may be for either 14 or 28 volts DC. This sensor is also remote mounted.

KG 102A Directional Gyro

Operating Instructions

1. Until power is applied to the KCS 55A System, and the directional gyro is up to speed, a red flag labeled "HDG" will be visible in the upper right quadrant of the KI 525A Indicator. In operation, this warning flag will be visible whenever the power being supplied is inadequate or the gyro is not up to speed.
2. With the application of power to the KCS 55A System, and gyro up to operating speed, the red "HDG" flag should disappear from view.
3. If the KCS 55A System is in the slaved gyro mode, the compass card will automatically fast slave at the rate of 180 degrees per minute toward the aircraft's magnetic heading. (Immediately after applying power, this compass card movement should be quite visible.) It will continue to fast slave until the proper magnetic heading is indicated, after which it will slave at a constant rate of three degrees per minute to keep the system aligned with the earth's magnetic field.

Under some conditions it is possible for the system to stop slaving exactly 180 degrees from the correct heading. If this should occur, move the "Slave" switch on the KA 51B to the unslaved (free) position. Rotate the compass card ±10 degrees from the incorrect heading by using the manual rotation switch and then return the system to slaved operation. The system will then slave to the correct heading.

4. For the free gyro operation, check the magnetic compass to determine the correct magnetic heading. Then use the manual slave switch to align the system with the earth's magnetic field. Periodic checks with the standby compass are recommended to check and correct for gyro precession.

5. Until a usable navigation signal is being received by the NAV system, a red flag labeled "NAV" will be visible in the upper left quadrant of the KI 525A Indicator. In operation, this warning flag should be visible whenever an inadequate navigation signal is being received.

6. For normal navigation to or from a VOR or VORTAC, set the NAV receiver to the desired VOR or VORTAC frequency and the red navigation flag (NAV) should disappear from view if a usable signal is being received.

7. Rotate the course select knob to position the course pointer to the desired VOR course.

8. The VOR deviation bar represents the selected course, and the relationship of this bar to the symbolic aircraft in the center of the instrument visually presents the actual relationship of the selected course to your aircraft heading. (In other words, if the symbolic aircraft on the display indicates approaching the deviation bar at 45 degrees, that is the angle at which your aircraft is actually approaching the selected course.

9. To prepare for an ILS approach, tune the NAV receiver to the desired Localizer frequency. If a usable Localizer signal is being received, the NAV warning flag will disappear.

10. For a front or back course approach, rotate the course select knob to set the course pointer on the inbound Localizer course. As with normal navigation (#6 above), the LOC deviation bar represents the desired course. The relationship between this bar and the symbolic aircraft gives a true picture of your aircraft's position with respect to the Localizer course. Always setting the course pointer to the inbound Localizer course provides the correct deviation bar sensing whether flying a front or back course approach.

11. The glideslope deviation pointers should become visible on both sides of the display when a usable glideslope signal is received. If they do not come into view, a usable glideslope signal is not being received.

12. The glideslope pointers indicate the relative position of the glideslope path with respect to the aircraft. (In other words, if the pointers are above the center marker, the aircraft is below the glideslope.)

Abnormal Circumstances

If the Warning Flag (HDG) appears during operation, the compass card indications will be in error. Power may be removed from the KG 102A Directional Gyro by pulling the appropriate circuit breaker. The Selected Course, VOR/LOC Deviation Bar, the NAV flag, and the To/From Indicator will remain in operation.

If the Navigation Warning Flag (NAV) appears during operation, there are several possibilities: (1) the NAV receiver is not turned on, (2) the NAV receiver is improperly tuned, (3) the ground VOR or LOC station is malfunctioning, (4) the aircraft is out of range of the selected ground station, or (5) the aircraft NAV receiver has malfunctioned. (The compass card will continue to display the aircraft heading even if a usable NAV signal is not being received.

If the glideslope pointers remain out of view during a front course ILS approach, wither the aircraft glideslope receiver or the ground station glideslope transmitter is malfunctioning. Glideslope is usually not available during a back course approach. (The VOR and LOC course display will continue to function normally even if a usable glideslope signal is not being received.)

A continuous large deflection of the slaving meter or large discrepancies between the magnetic compass and the KI 525A compass card may indicate a failure in the slaving system. If a slaving failure should occur, the Slave/Free Switch should be moved to select the free gyro mode. Then, by using manual clockwise or counterclockwise corrections, the compass can be rotated to the correct heading as indicated on the standby compass. The KCS 55A system should continue to function normally except the heading information will be solely derived from the KG 102A Directional Gyro. There will be no automatic heading correction and periodic adjustments must be made manually to correct for precession by reference to the standby magnetic compass, as with any directional gyro.

Note: It is desirable to disconnect the autopilot under the following conditions:

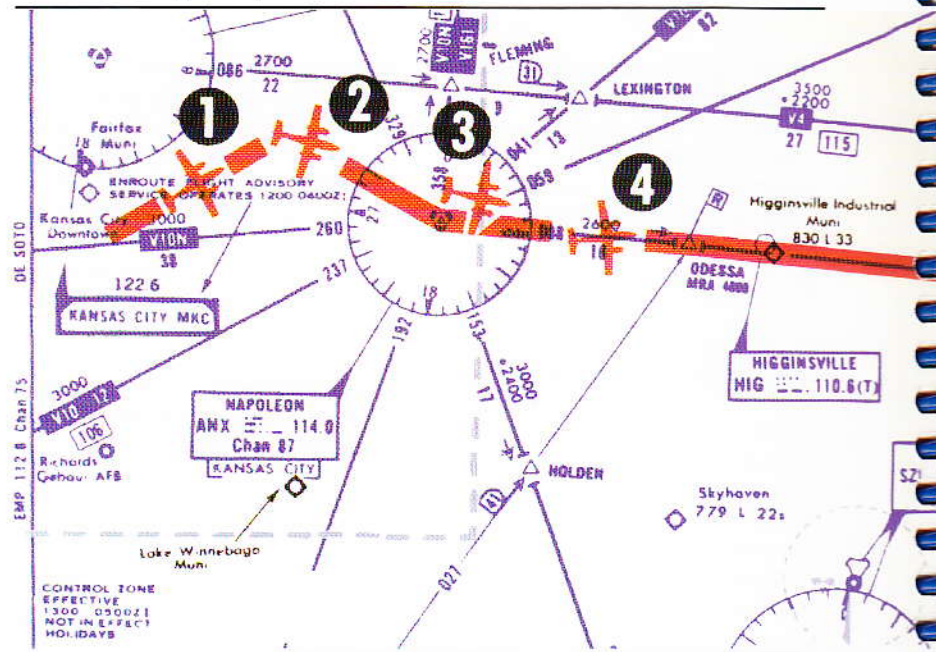
1. HDG flag comes into view.

2. System is in fast slave.

3. During manual slaving.

The system has the capability to supply the autopilot with an automatic disconnect signal under these conditions.

Note: For system limitations in your particular aircraft type, refer to your Flight Manual Supplement.



Flight Procedures with the KCS 55A

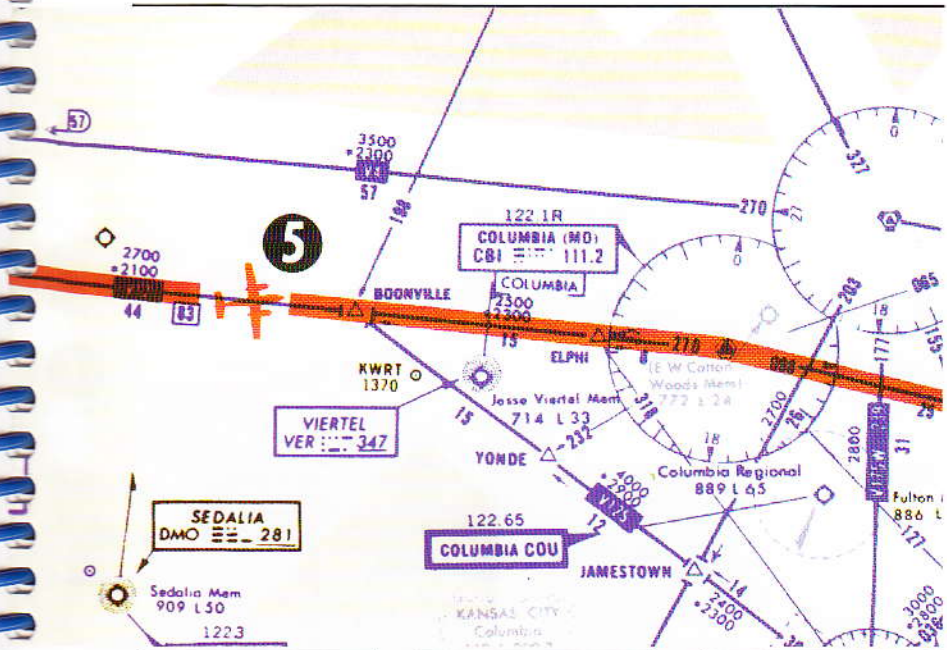
The next few pages depict a normal flight departure from MKC enroute to STL via Victor Airway V-12. (The charts shown here are for illustration purposes only, not to be used for navigation.) Careful study of these illustration of the KI525A HSI should give you a better idea of how simple and comprehensive the display is.

1. Vectors to Intercept a Radial

After takeoff from Kansas City, we select a heading of 060° with the heading bug to intercept the 110° course to Napoleon (ANX) VOR. Selected course pointer is set on 110° with the course knob. The KI 525A HSI conveniently and accurately displays the intercept angle.

2.

The VOR deviation bar begins to center as we approach the 110° course to Napoleon. The KI 525A HSI makes it possible to intercept the course smoothly, without overshooting or bracketing. One method of doing this is to adjust your heading so that the top of the deviation bar always touches the lubber line. As your aircraft heading approaches the new course, the deviation bar will swing towards the center and the angle of intercept will decrease.



3. Turn to Intercept a Victor Airway

The "TO" indicator starts to swing to "FROM" as you fly over the Napoleon VORTAC station. At this time, set the selected course pointer on the V-12 course of 088°.

As you begin your left turn to track V-12, notice that the KI525A HSI continuously displays an accurate picture of the relationship between your aircraft and the ANX 088 radial.

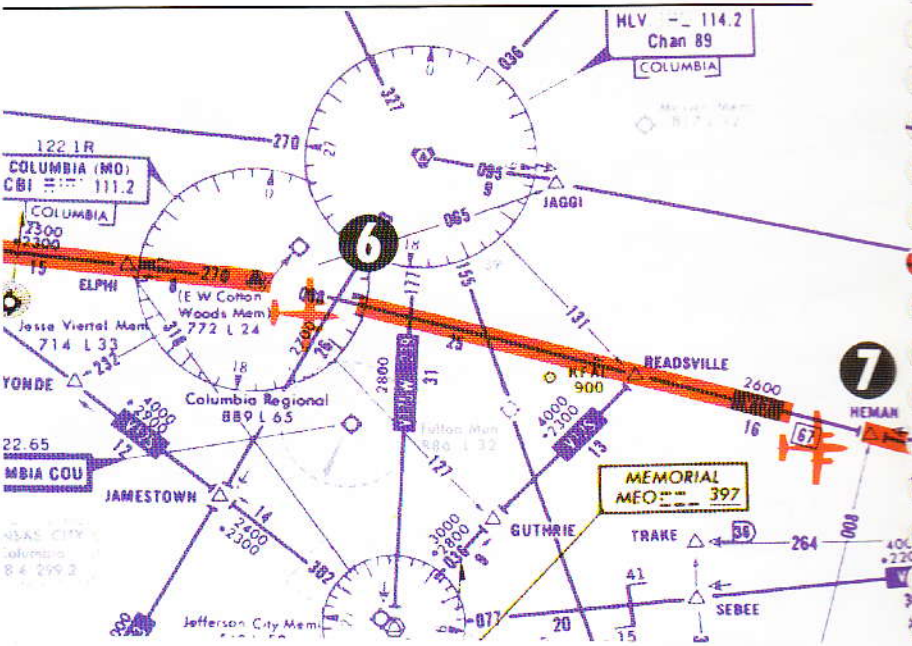
Once again, you can make a precise, coordinated course interception by adjusting your heading to keep the top of the deviation bar touching the lubber line.

4.

When the deviation bar is centered and aligned with the course arrow, you are on course. Notice that correction for wind drift - in this case, a 080° heading on a 088° course - is completely automatic as long as you keep the deviation bar centered.

5.

About midway between Napoleon and Columbia (CBI), you switch to the CBI VOR and the TO/FROM indicator immediately swings to "TO". Also note the course arrow should be moved from 088° to 090° which is the V-12 inbound course to CBI.

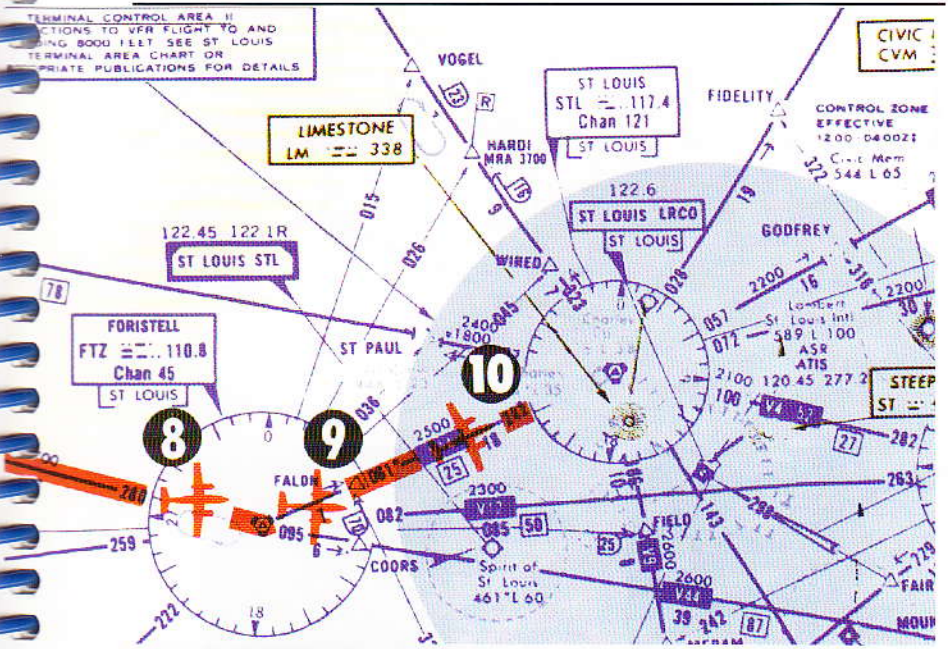


6.

As you fly over the Columbia station, the TO/FROM indicator changes to "FROM". Since the outbound course for V-12 from Columbia to Foristell (FTZ) is 098°, you now set the selected course pointer on 098° and fly to keep the deviation bar centered.

7.

Near the Herman intersection you switch to Foristell VOR-TAC and move the course arrow to 100°, which is the V-12 inbound course to FTZ. The TO/FROM indicator changes to "TO".



8. Airway Interception

Your clearance is V-12 to Foristell, then V-14 to the St. Louis (STL) VORTAC, direct Lambert Field. Approaching the FTZ station, the heading bug is on 100° as a reference for the V-12 course or as heading command for the autopilot, if used. Select the St. Louis VORTAC on the NAV receiver and set the course pointer on the STL 062° course.

9.

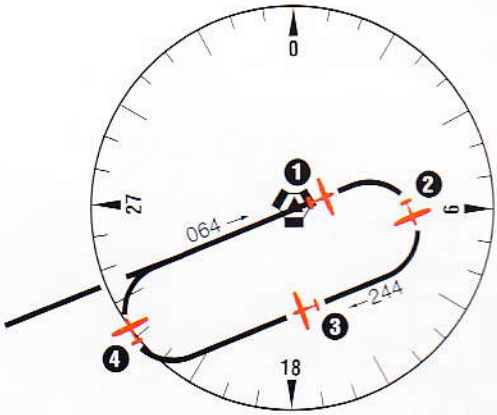
As you cross the Foristell VORTAC, the deviation bar will align with the course arrow. Now set the heading bug to 062° and turn left to follow V-14 to the STL VORTAC.

10.

You are now established on V-14, flying to the STL VORTAC. Once again, if you fly to keep the deviation bar centered, correction for wind drift will automatically be accomplished.

Note: For system limitations refer to your Flight Manual Supplement.

HOLDING PATTERN



1. Approaching the STL VORTAC, the controller asks you to hold southwest of the VORTAC on the 244° radial, right turns. You are now over the station with a 064° course selected (the TO/FROM indicator has swung to "FROM"). Set your heading bug to the reciprocal or outbound heading of 244° for easy reference and begin your right turn holding pattern.

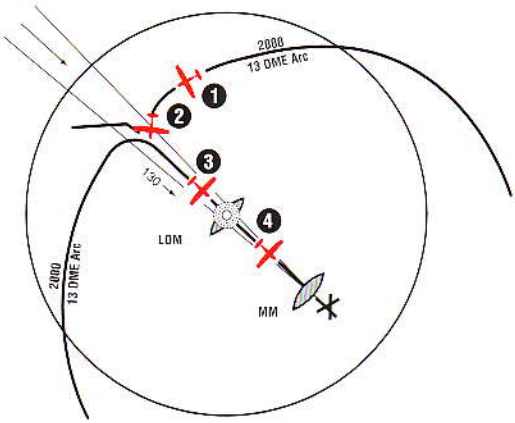
2. Halfway through the outbound turn, the KI 525A display shows the deviation bar behind the symbolic aircraft. You know, therefore, that you must eventually fly back to the radial in order to be on course during the inbound leg of the holding pattern.

3. Outbound, you are using the heading bug as reference for 244°. The 244° radial is off the right wing and parallel to your outbound course.

4. Halfway through your turn to the inbound 064° course, the KI 525A shows the symbolic aircraft approaching the deviation bar at a right angle. By keeping the top of the deviation bar on the lubber line, you can complete your turn and roll out precisely on course.

Note: For system limitations refer to your Flight Manual Supplement.

ILS APPROACH-FRONT COURSE



1. You are vectored from the holding pattern to the 13 DME arc. The aircraft is turning, with the heading bug set on 170° to intercept the localizer. You have already set the selected course pointer on the inbound ILS course 130° and the KI 525A shows the localizer course is directly ahead. The glideslope pointers came into view when the ILS frequency was tuned, since a usable glideslope signal is being received.

2. Capturing the ILS course can be accomplished without overshooting or bracketing with the same technique you used in intercepting an enroute course. Simply keep the top of the deviation bar on the lubber line and coordinate your turn until the bar is centered with the course arrow. Each dot on the LOC deviation scale represents 1/2 degree of deviation when tuned to an ILS frequency.

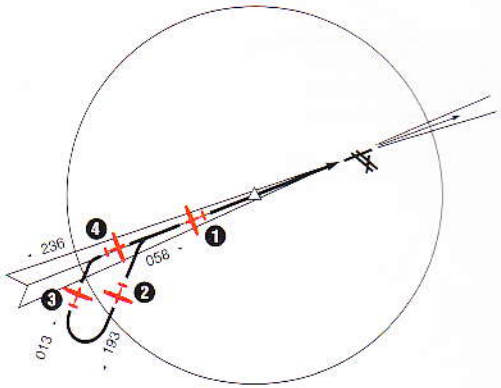
3. The KI 525A shows you that you have intercepted the localizer course. The glideslope pointers have started to center, although the display indicates your aircraft is still below the glidepath at this point.

4. You are now centered on the localizer and the glideslope. Once again, the KI 525A shows your aircraft is crabbed about 5° to the right to maintain the localizer course.

Note: For system limitations refer to your Flight Manual Supplement.

BACK COURSE APPROACH - (REV)

If a back course approach is required, it can be accomplished as easily as a front course approach. The course arrow should always be set on the front course inbound localizer course. This will result is conventional pictorial deviation sensing even on back course. The KI 525A display gives you an accurate picture of where you are at all times during the approach and procedure turn.



1. You are outbound on the back localizer course, having already set the course pointer to the inbound front course at 238°. The heading bug is preset at 193° for the procedure turn. (Since there is usually no glideslope signal on a back course, the glideslope pointers are out of sight.)

2. During the procedure turn outbound, the deviation bar shows pictorially that the aircraft (as represented by the symbolic aircraft in the center of the KI 525A) is flying away from the localizer centerline at a 45° angle when the heading bug is under the lubber line. Note that left-right deviations of the course bar give "fly-to" indicators, just as on the front course.

3. Now you've reset the heading bug to 013° and made a 180° turn to this heading. This 013° heading will intercept the back course. The KI 525A clearly pictures the course you are to intercept and the angle of interception.

4. You have smoothly intercepted the back course. Since the course arrow is set on the front course (238°), the KI 525A shows a true picture of the situation - flying inbound on the back course. You may reset the heading bug to 058° for easy reference.

Note: For system limitations refer to your Flight Manual Supplement.