Pilot's Guide

KNS 80

Bendix/King VOR/LOC/GS/DME/RNAV Integrated NAV System

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INTRODUCTION

The King KNS 80 Integrated Navigation System combines a 200-channel VOR/Localizer receiver, a 40-channel glideslope receiver, a 200-channel DME, and a digital RNAV computer with capability for preselection and storage of 4 VOR/LOC frequencies or RNAV waypoint parameters.

Add a course deviation indicator and Marker Beacon receiver display unit and you have a complete NAV/RNAV/ILS system.

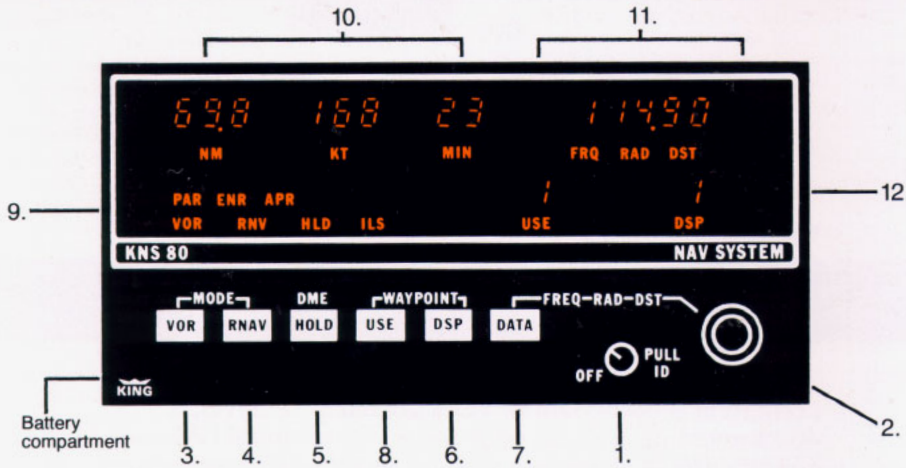
This remarkably compact and lightweight unit, just 3 inches high (7.6 cm) and weighing only 6 pounds (2.7 kg), is the product of full utilization of state-of-the-art electronics, including extensive use of Large Scale Integration (LSI).

The unit requires only 25 watts input power and will operate on any voltage from 11 to 33 volts with no modifications or accessories.

Two internal batteries provide the power to retain stored waypoint information separate from the aircraft electrical system. The batteries are accessible for replacement (approximately every 2 years) without removing the KNS 80 from the panel.

The purpose of this Pilot Guide is to acquaint you with the operation and controls of the KNS 80. You will be as impressed by the simplicity of its operation and the ease with which you can learn to use it as you will be pleased with its performance and capabilities.

Controls, functions and displays



Numerical displays are 7-segment gaseous discharge lights. Modes and operating status information are annunciated by individually lighted abbreviations.

The KNS 80 illustration above shows all display legends lighted. In actual operation, only the appropriate operating legends will be annunciated.

Using the illustration above as a reference, they are:

Controls:

1. **Power ON/OFF** and audio volume control. Pull out for VOR/LOC IDENT tone.

2. **Data input controls** for selection of VOR/LOC frequency, waypoint radial and waypoint distance. DME is automatically tuned with selection of the paired VOR frequency.

3. **VOR** is a momentary push button. Push for conventional VOR/DME operation. DME is automatically tuned and distance, groundspeed and time-to-station (TTS) to the VORTAC station will be displayed upon lock on. The Course Deviation Indicator (CDI) will display conventional angular crosstrack deviation from your selected course (±10° full scale).

Push **VOR** again for VOR/PAR function. Operation will be identical to VOR/DME operation except the CDI will display crosstrack deviation ±5 nm full scale from the selected course. Course width will be constant (linear) irrespective of distance from VORTAC.

Depressing **VOR** cycles between VOR and VOR/PAR operation.

4. **RNAV** is a momentary push button. Push for conventional RNAV Enroute (RNV/ENR) operation. Distance, groundspeed and TTS to the waypoint will be displayed. The CDI will display a linear crosstrack deviation ±5 nm full scale from selected course to waypoint.

Push **RNAV** again for RNAV Approach (RNV/APR) function. Operation in RNAV Approach is the same as RNV/ENR except the CDI will display crosstrack deviation as ±1¼ nm full scale. Both provide constant course width (linear) deviation.

Depressing **RNAV** cycles between RNV/ENR and RNV/APR.

5. **HOLD** is an alternate action push button. When in the depressed position, it retains the original DME frequency (HLD) so DME operation on the original frequency can be continued while selecting other VOR or ILS frequencies.

6. **DSP** is a momentary push button that selects for display (in order) any one of four "data storage bins" in which VOR/LOC frequencies, with or without waypoint parameters, may be inserted. Each "storage bin" can be called up as desired from 1 to 4, then back to 1.

7. **DATA** is a momentary push button that causes either frequency, waypoint radial or waypoint distance to be displayed, in that sequence, for

the "data storage bin" (1, 2, 3 or 4) which is being displayed.

DATA may be used for either loading data into a "storage bin" or checking previously loaded data.

8. USE is a momentary push button that selects the VOR/LOC frequency and waypoint parameters to be used for navigation. Pushing USE transfers the data displayed (DSP) to "in use" (USE). To "use" a waypoint, it must first be displayed by means of **DSP.** It may then be put into use by pushing **USE.** This is a safety procedure which requires the display of a frequency and waypoint parameters prior to actual use.

Anytime **USE** or **DSP** is pushed, frequency (FRQ) will be displayed. This is a safety feature which forces the frequency of the facility selected to be displayed before use. Radial (RAD) and distance (DST) may subsequently be displayed by use of the **DATA** button.

Displays:

9. Selected function (VOR, VOR/PAR, RNV/ENR, RNV/APR, HLD, ILS) are annunciated on the bottom left side of the display area.

10. Distance (NM), groundspeed (KT) and time-to-station (MIN) to VORTAC or waypoint are displayed in the upper left side of the display area. When the DME is not locked on due to no DME signal (VOR facility only; failure of the DME ground station; range beyond line of sight) or an airborne DME failure, dashes will appear in place of numbers.

11. The data selected by the data input controls is displayed in the upper right side of the unit. VOR/LOC frequency (FRQ), waypoint radial (RAD) and waypoint distance (DST) are displayed in sequence by pushing the DATA button. The "data storage bin" (1 through 4) is selected in sequence by pushing the DSP button.

12. The selected "data storage bin" in use (USE) and the "data storage bin" being displayed (DSP) are indicated by the two sets of numbers (from 1 to 4) displayed in the lower right side of the display area.

When the "data storage bin" "in use" is different from that displayed, the DSP number will flash to indicate that the system is navigating on data different from that being displayed.

13. Flag Operation (CDI or HSI)

VOR or ILS Mode: Invalid VOR/LOC operation is annunciated by the VOR/LOC flag in the CDI or HSI. Glideslope flag indicates invalid GS information. Dashes in the DME display annunciate invalid DME.

VOR/PAR Mode: VOR/LOC flag in the CDI or HSI annunciates VOR and/or DME invalid. Dashes in the DME display annunciate DME invalid.

RNAV Modes: CDI or HSI flags same as VOR/PAR Mode. Dashes in distance display annunciate invalid DME and/or invalid VOR.

Recommended course deviation indicators

The KI 525A is the slaved Pictorial Navigation Indicator for the KCS 55A Compass System. It provides a complete picture of the navigation situation . . . in VOR/DME, RNAV or ILS modes. It replaces the Directional Gyro and CDI in your panel.

The KI 206 is a VOR/LOC/GS Course Deviation Indicator that provides a rectilinear display of course deviation in VOR/DME, RNAV or ILS modes.

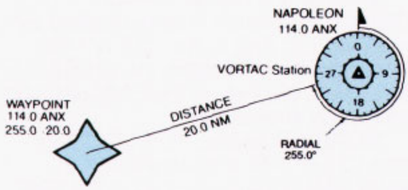
RNAV Review

Area navigation (RNAV) is a method of point-to-point navigation along any desired course within the service area of a VOR/DME (VORTAC) station, without the need for flight over the station. This course is defined by "waypoints"

What is a waypoint?

A waypoint is a predetermined geographic position located within the service area of a VOR/DME station. It may be used for route definition and/or progress reporting. A waypoint is often called a **phantom** station because it provides the same navigation information that a "real" VOR/DME station at that location would provide.

A waypoint is defined by its radial and distance from the selected VOR/DME station. The waypoint below is located on the 255.0° radial at a distance of 20.0 nautical miles from ANX VORTAC.



RNAV Geometry

Waypoint radial, waypoint distance and crosstrack deviation are supplied by the RNAV computer as solutions to continuously changing geometry.

Known inputs to the RNAV computer are:

Waypoint radial (VORTAC station radial passing through the waypoint).

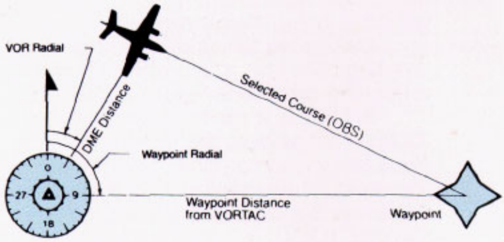
Waypoint distance from the VORTAC station.

Aircraft radial from the VORTAC station to the aircraft.

DME distance from VORTAC station to the aircraft.

Selected course (OBS) through the waypoint.

The RNAV computer continuously processes this information to supply the aircraft distance from the waypoint and crosstrack deviation of the aircraft from the selected course in nautical miles (linear deviation instead of conventional angular course deviation).

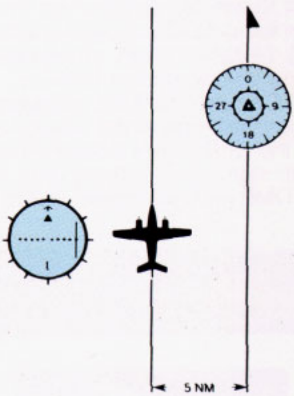


Linear or angular crosstrack deviation?

Linear crosstrack deviation on CDI or HSI permits flying parallel to a selected course by maintaining appropriate needle deflection. In RNAV/ENR function each dot represents one nm off course. In RNAV/APR function each dot represents 1/4 nm off course.

In VOR function the RNAV computer is by-passed so that deviation from selected course is conventional angular crosstrack deviation expressed in degrees off course (one dot equals 2°).

In VOR/PAR function you have, in effect, a waypoint located over the VOR/DME station and thus will be provided linear crosstrack deviation as in RNAV.



Linear Crosstrack Deviation

Variations in along-track distance while operating in RNAV modes

Under certain conditions, VOR scalloping can contribute significant variation in the smoothness of the along-track distance while operating in the RNAV modes.

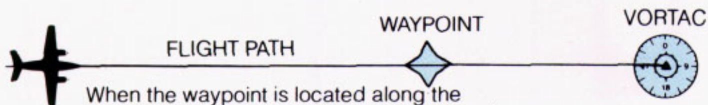
VOR scalloping is defined as imperfection or deviation in the received VOR signal which causes radials to deviate from a standard track. VOR scalloping is generally the result of reflection from buildings, terrain or other aircraft. This deviation or scalloping effect causes the CDI needle to slowly or rapidly shift from side to side.

Factors contributing to VOR scalloping are:

- The VORTAC is located in mountainous terrain and is not a Doppler VOR.
- Snow cover on the ground around the VORTAC station.

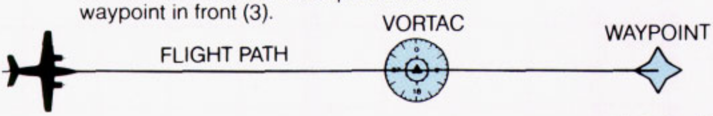
The effects of VOR scalloping are minimized under the following conditions:

1.



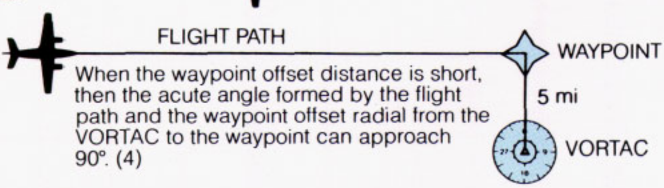
When the waypoint is located along the flight path either in front (1), behind (2) or at the VORTAC (not illustrated). The waypoint may also be located on the flight path with the VORTAC behind the airplane and the waypoint in front (3).

2.



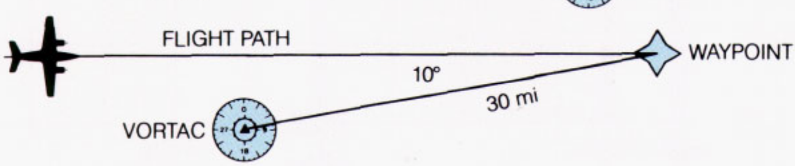
3.

4.

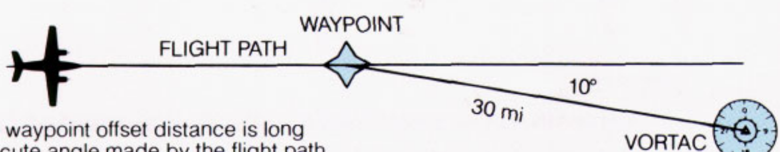


When the waypoint offset distance is short, then the acute angle formed by the flight path and the waypoint offset radial from the VORTAC to the waypoint can approach 90°. (4)

5.



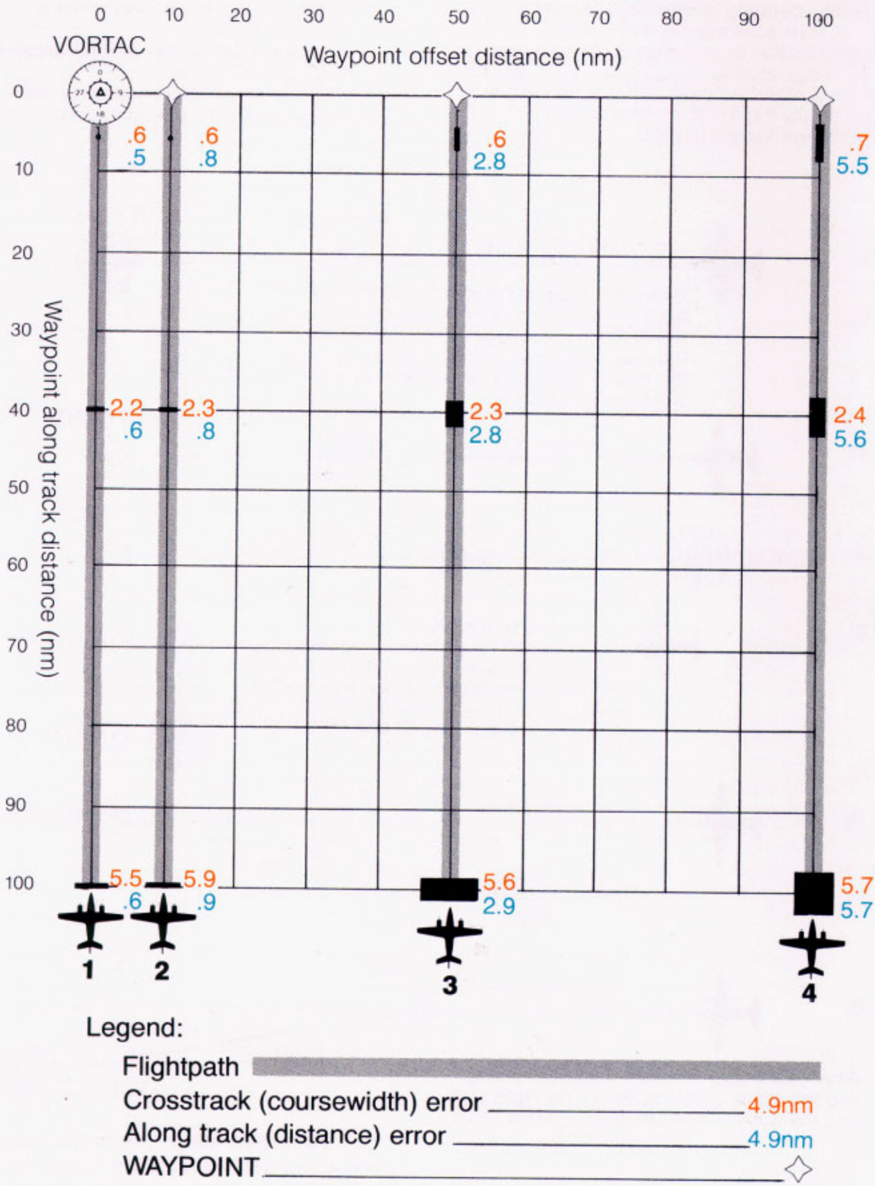
6.



When the waypoint offset distance is long and the acute angle made by the flight path and the waypoint offset radial is small (5) (6).

Note that, when the angle is large, the distance needs to be short; conversely, when the distance is long, the angle needs to be small. Another way of saying this is that the along-track distance will have the least variation if the geometry is such that DME information is the major factor in computing along-track distance.

Along Track/Crosstrack Error



This illustration shows the along track and crosstrack errors that can occur with the RNAV working with a conventional VORTAC ground station.

How to interpret the Along Track/Crosstrack Error chart

The illustration shows four (4) flight paths to waypoints being offset varying distances from the VORTAC. You will note that in flight path 1 the offset distance is zero. Or, in other words, the waypoint is located over the VORTAC. In this case the along-track and crosstrack error is minimum. This is because the along-track error is totally derived from the DME and the crosstrack error from the VOR.

Please note that the along-track and crosstrack errors increase in flight paths 2, 3 and 4, as the waypoint offset perpendicular to the flight path increases. For example, on flight path 4 where the waypoint is offset 100 nm perpendicular to the flight path and the aircraft is 100 nm from the waypoint, the aircraft can be anywhere within a 5.7 nm square when the crosstrack needle is centered and the along-track (distance) indicator is showing exactly 100 nm to go.

In summary, the illustration shows that the accuracy of the RNAV system is poorest when the waypoint offset distance and the aircraft distance from the VORTAC is large. On the other hand, the RNAV accuracy is greatest when the waypoint offset distance and the distance from the VORTAC is small.

CAUTION: Like all RNAV installations, each KNS 80 installation must be demonstrated to meet FAA Advisory Circular 90-45A for IFR approval.

KNS 80 System applications

The KNS 80 System, in addition to conventional VOR/DME/ILS navigation, provides many advantages related to its RNAV functions:

Direct route navigation from point of origin to destination without following the frequently circuitous Victor airways is a basic use of RNAV. Determine your most direct route and set up waypoints at intervals along that route. (Remember, the KNS 80 stores the frequency of each waypoint. You need only to change waypoints. Other systems require you to change waypoint **and** VORTAC frequency.)

Location of airfields that are not equipped with navigation aids is a common use of RNAV. Locate the airfield on your navigation chart and place a waypoint at that location.

Set up a holding pattern at any geographic point convenient to you or ATC. Simply establish a waypoint at that location, then fly your pattern just as if it were a real VOR station using your course deviation needle and DME for reference.

Locate weather breaks reported by an FSS or controller. Establish a waypoint at that location and fly directly to it.

Determine time of ADIZ or restricted area penetration. Establish a waypoint at your planned point of penetration. Fly directly to that waypoint and you will be provided continuous distance and time-to-waypoint on your KNS 80.

A route parallel to an airway may be established simply by using the KNS 80 in VOR/PAR function and maintaining a constant course deviation on your CDI (one nm per dot, up to ± 5 nm full scale).

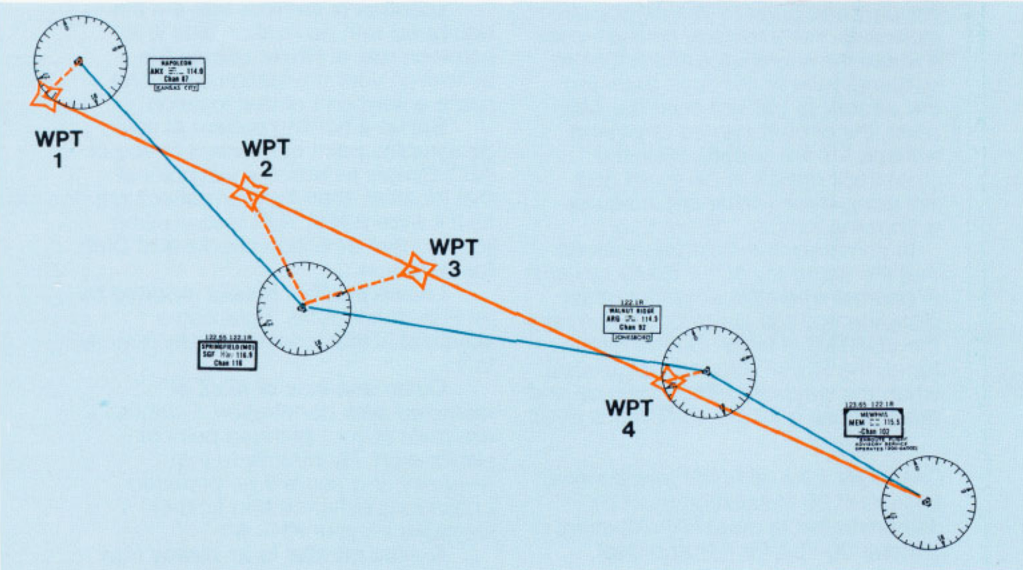
A route parallel to the airway but farther out may be accomplished by establishing waypoints the same distance out from each of the VOR/DME stations that define the airway.

RNAV charts for RNAV Airway (High Altitude), Approaches, SID'S and STAR's are available.

Learning to use the KNS 80 is easy

You can load your VOR/DME frequencies and RNAV waypoint information in flight as you proceed to your destination if you wish and, as you will see, do it easily.

For this demonstration of how to use the KNS 80 we have a flight plan from Kansas City direct to Memphis, for which we have charted our course and RNAV waypoints. We have been cleared, after takeoff, to hold a 210° heading until we reach 2,500 ft. MSL, then to Waypoint 1 and direct to Memphis.

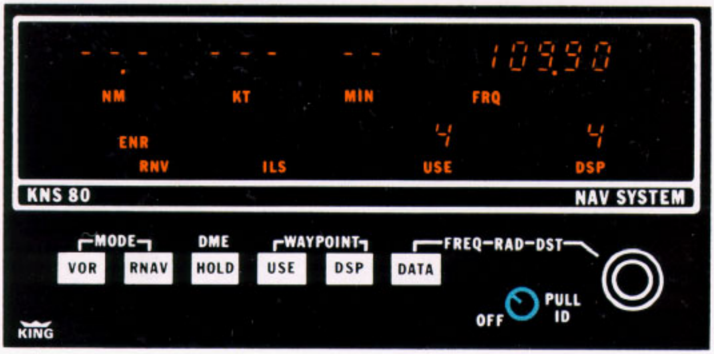


Not to be used for navigation.

The waypoints we have established are:

Waypoint 1.	Frequency	114.0 ANX
	Radial	255.0°
	Distance	20.0 nm
Waypoint 2.	Frequency	116.90 SGF
	Radial	350.0°
	Distance	40.0 nm
Waypoint 3.	Frequency	116.90 SGF
	Radial	80°
	Distance	39.0 nm
Waypoint 4.	Frequency	114.50 ARG
	Radial	280°
	Distance	14.0 nm

then to Memphis VORTAC 115.5 MEM



(1)

Pull out compartment
to replace batteries

Turn on the KNS 80

1. Turn the system on by rotating the ON/OFF switch clockwise. This control is also a push-pull switch. The "out" position allows you to hear VOR/LOC ident tones. The "in" position mutes the ident tones.

   When the system is turned ON, the last information being displayed before previous turn-off will again be displayed.

   We see here that following our previous RNV/ENR navigation on Waypoint 4 we had selected the ILS frequency (109.90) for approach, landed and turned the system off.

   The system will retain all waypoint data (for 4 waypoints) through a power shutdown. This is made possible through the use of two internal batteries which may be replaced without removing the KNS 80 from the panel. (See figure 1 above). These batteries have a nominal life of 2 years.
2. If the batteries should run down, the KNS 80 will, upon turn-on, automatically display a 110.00 frequency, waypoint 1 in USE and DSP, VOR mode, and dashes in the DME display. The unit may then be operated normally, but will not retain memory when turned off. (Figure 2.)

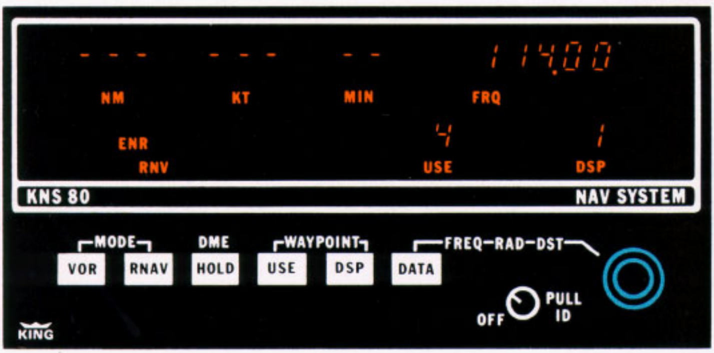
(2)

(3)

Load Waypoint 1 data (114.00 ANX/255.0°/20.0 nm)

3. Put waypoint "1" in the DSP window by depressing the DSP button. (If there is a "2" in the DSP window initially, you will push the DSP button three times to go through the 2-3-4-1 sequence to reach "1".)

   You will now have waypoint "4" in USE; waypoint "1" in DSP. The frequency for the old waypoint "1", that is in memory until changed, is displayed; and there are dashes instead of numbers in the DME display (showing that a valid DME signal is not being received). "1" will be flashing, since **USE** and **DSP** are not the same.



(4)

4. **Select your waypoint 1 frequency** (114.00) using the data input controls which are the two concentric knobs on the right. The smaller of the 2 knobs controls the .1 MHz and .05 MHz digits. The outer knob changes the 1 MHz and 10 MHz digits.

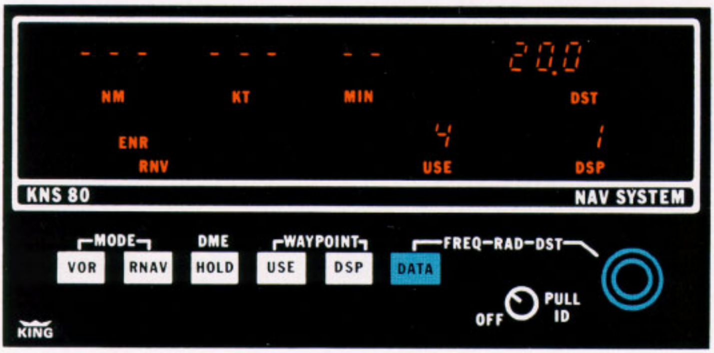
   Your selected frequency will appear in the data display (annunciated "FRQ"), replacing the previous frequency both in the display and in memory.

Dual KNS 80 Operation Caution

When operating dual KNS 80's, the respective DME's may interfere with each other when the NAV frequencies differ by 5.3 MHz (for example, 108.00 MHz and 113.3 MHz). This interference results in premature flags or loss of "lock-on." Should this occur, one of the KNS 80's should be either turned off or tuned to a different NAV frequency so that the 5.3 MHz difference is eliminated.

(5)

5. **Select your waypoint 1 radial** (255.0°) by first depressing the DATA button. This will cause the radial for the previous waypoint 1 to appear in the data display over the annunciation "RAD". Select your radial (255.0) with the data input controls. The outer knob controls the 10° and 100° digits; the center knob "in" position controls the 1° digit and the center knob "out" position controls the 0.1° digit.



(6)

6. **Select your waypoint 1 distance** (20.0 nm) by again depressing the DATA button, causing display of the previous waypoint 1 distance in the data display over the annunciation "DST". Select your distance (20.0 nm) with the data input controls. The outer knob controls the 10 nm digit, the center knob "in" position controls the 1 nm digit and the center knob "out" position controls the 0.1 nm digit.

Note that throughout this sequence, the number "1" over DSP annunciation will blink. It will stop blinking and remain steady only when the waypoint number in "DSP" is the same as the waypoint number in "USE". This is a safety feature.

That completes selection and storage of all data for waypoint 1.

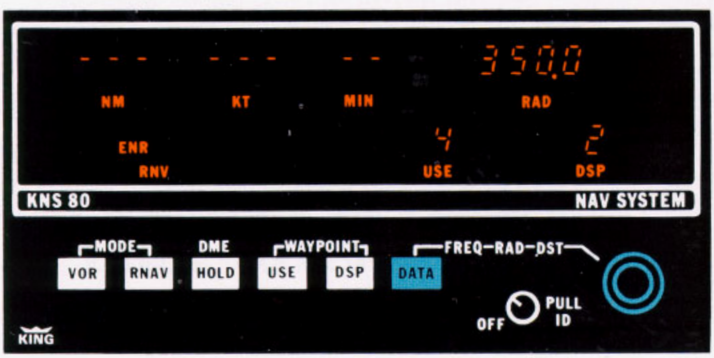
(7)

Load waypoint 2 data (116.90 SGF/350.0°/40.0 nm)

7. **Put waypoint "2" in the DSP window** by depressing the DSP button. The data display will automatically display the frequency of the last selected number 2 waypoint and "FRQ" will be annunciated. All other displays will remain as before.

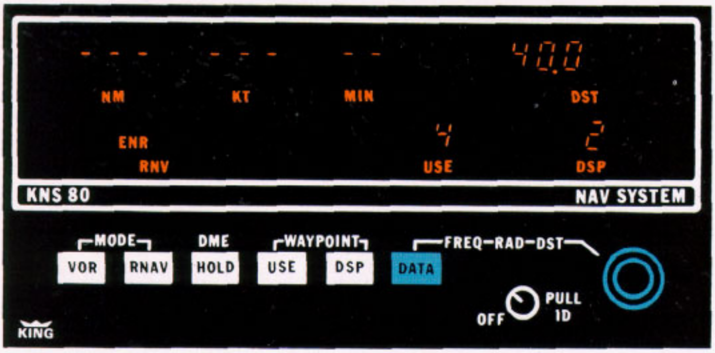
(8)

8. **Load waypoint 2 frequency** (116.90) using the data input controls as before. Your selected frequency will replace the previous frequency in the data display.



(9)

9. **Load waypoint 2 radial** (350.0°) by first pushing the DATA button. The last selected waypoint 2 radial will be displayed and "RAD" annunciated. Then select your new waypoint 2 radial using the data input controls.

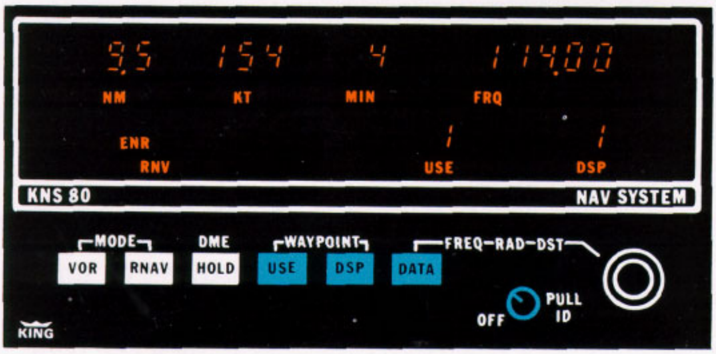


(10)

10. **Load waypoint 2 distance** (40.0 nm) by again pushing the DATA button. The last selected waypoint 2 distance will appear in the data display and "DST" annunciated. Then select your new waypoint 2 distance using the data input controls.

You now have all data for your second waypoint loaded and in memory. Following the same procedure you may load all four waypoints.

Remember—you can check or change **any** RNAV waypoint data, in **any** sequence simply by calling up (displaying) that data using the DSP and DATA buttons. Any displayed data can be changed by use of the data input controls.



(11)

Take off and fly to waypoint 1

11. Before takeoff, check to be sure that RNV/ENR is still the active mode, then depress the DSP button to place waypoint "1" in the DSP position. Your selected waypoint 1 frequency will automatically appear in the data display.

You may now want to depress the DATA button to check radial, and again to check distance in the data display.

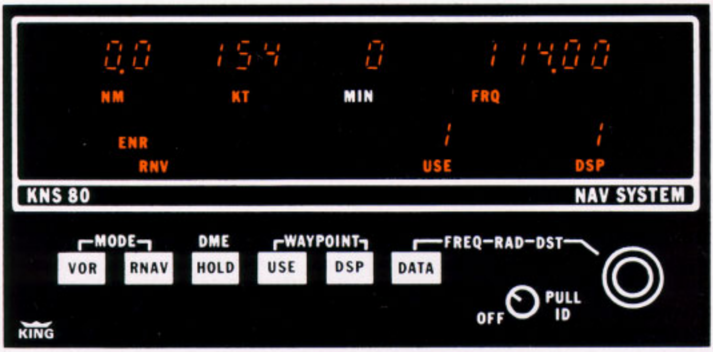
Now depress the USE button to place waypoint "1" in the USE position. The number "1" in the DSP position will stop blinking, indicating that the displayed data and "in use" data are the same.

You take off, and as you reach line-of-sight altitude your DME will lock on. The dashes that were present in the distance display of the KNS 80 will disappear and display distance to waypoint 1. CDI or HSI will also be flagged until **both** VOR and DME are valid.

Groundspeed and time-to-station information will not be accurate unless you are flying directly to or from the VORTAC or waypoint. You have determined that you want to fly a 112° course to the first waypoint, so you place 112° under the lubber line on your CDI (using the OBS knob on the CDI) and fly to center the needle.

Soon after you are on course direct to waypoint 1, your groundspeed and TTS will become accurate.

At this time you may also want to check the ident of the VOR by pulling the ON/OFF/Volume switch to place it in the "out" position. When satisfied, you can return the switch to the "in" position and mute the ident tones. DME ident is also available if connected to your aircraft audio system.

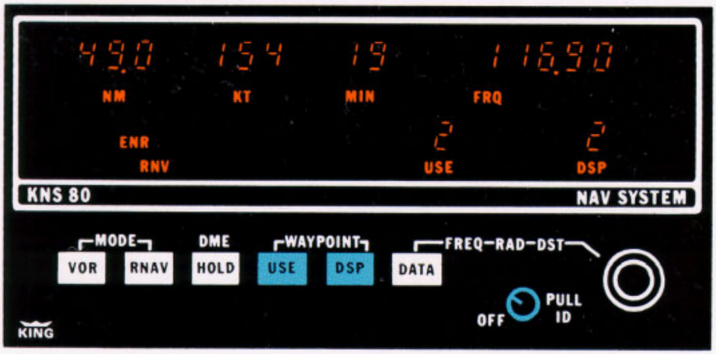


(12)

Waypoint passage

12. You are now passing over waypoint 1. The TO/FROM flag on your CDI will shift to the FROM position and the needle will hold steady. If Autopilot coupled to NAV, waypoint passage will be smooth (wings level).

Your flight plan calls for a course of 132° direct from waypoint 1 to Memphis, so you use your OBS knob to place 132° under the lubber line, fly to center the needle and continue your flight on the outbound course from waypoint 1.



(13)

Change over to waypoint 2

13. At 30 nm outbound from waypoint 1, you decide to change over to waypoint 2:

Depress the DSP button and the number 2 will appear (blinking) over the DSP annunciation and your waypoint 2 frequency will appear in the data display. Your DME display will not change because waypoint 1 data is still "in use." At this point, if you desire, you can recheck your waypoint 2 radial and distance data in the data display by depressing the DATA button for each.

When satisfied, depress the USE button to put waypoint 2 data "in use". The number 2 will appear in the USE annunciated space; the number 2 in the DSP space will stop blinking. Waypoint 2 frequency (116.90) will automatically appear.

Following VOR/DME receiver acquisition of your new VORTAC frequency, your distance display will begin reading distance (NM), groundspeed (KT) and TTS (MIN) to waypoint 2.

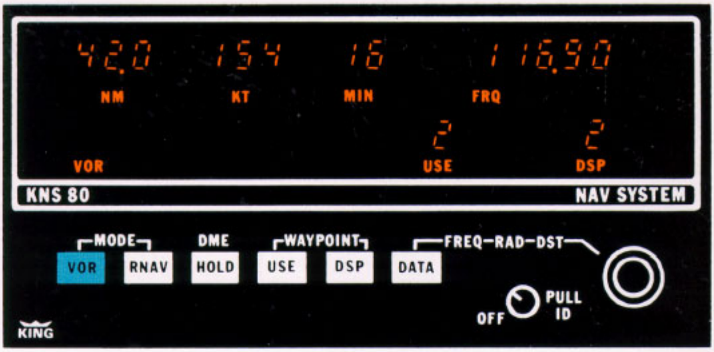
Your CDI TO/FROM flag will move to the TO position and you can continue flying your course directly to waypoint 2.

Flying direct to a VOR/DME facility

14. You are approaching waypoint 2 and decide (or are instructed) to fly direct to Springfield VORTAC.

You are already tuned to 116.90 SGF which is your waypoint 2 frequency, so all you do is depress the VOR button.

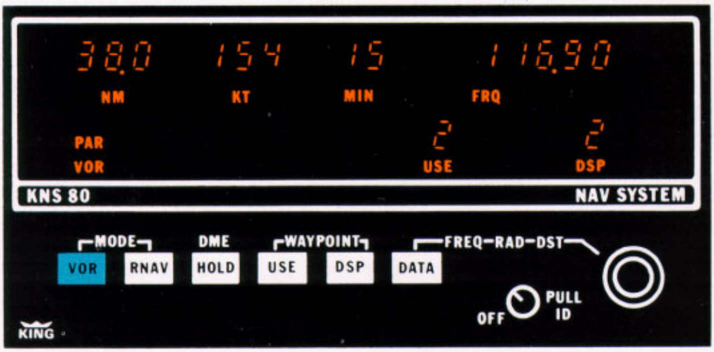
CAUTION: When flying directly to or from a VORTAC facility, it is preferable to select either the VOR or VOR/PAR mode.



(14)

RNV/ENR disappears from the mode annunciation space on your KNS 80 and VOR appears. The distance display will change to 42.0 (because it now shows distance to the VORTAC instead of to the waypoint). Groundspeed (KTS) and time-to-station (MIN) displays will also change accordingly.

Center the needle on your CDI to show the course direct to the SGF VORTAC. However, the CDI will display conventional (angular) crosstrack deviation of ±10° full scale.



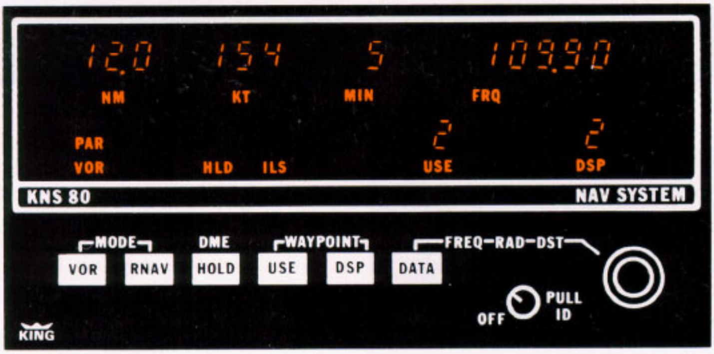
(15)

15. Push the VOR button again and you will have the convenience of VOR/PAR mode with linear crosstrack deviation displayed on your CDI as ±5 nm full scale (as in RNV/ENR). This permits you to fly accurately direct to the station or on a parallel course up to 5 nm either side of the direct course.

Tune an ILS frequency without losing DME

16. If you decide to land at Springfield Municipal but want to retain DME, depress the HOLD button. Now you can select your ILS frequency (109.90) using the data input controls and checking it in the data display. HLD will now annunciate. Your distance will continue to read to the VORTAC and VOR/PAR function will remain annunciated along with the active ILS function. If you're within receiving range of the LOC or GS, deviation will appear on the HSI or CDI.

    If you now reselect 116.90, the ILS annunciation will cancel and you will revert back to VOR/PAR mode. HLD will cancel since



(16)

VOR and DME frequency are again the same. The DME **HOLD** button will remain depressed (it is a two-position button). Thus the **HOLD** button functions as a Hold "ARM" when in the "in" position and actual Hold (HLD) annunciation occurs **only** when VOR/ILS and DME frequencies are different.

If you should mistakenly try to use the HOLD function in RNAV modes, as soon as the frequency is changed the **HLD** function will annunciate, DME displays (NM, KT and MIN) will flag (display dashes) and the CDI or HSI will flag since this is not a valid RNAV signal. Use of HOLD in VOR/PAR mode will result in a CDI or HSI flag (unless an ILS frequency is selected) and the DME displays will be to the VORTAC on "HOLD".

RNAV Approach

17. We have now touched on all modes and operations of the KNS 80 except RNAV Approach (RNV/APR).

The RNV/APR mode may be used for runway location (by placing a waypoint at the approach end of the runway) during an approach to an airport.

If you are in RNV/ENR mode, depress the RNAV push button and the RNV/APR mode is immediately activated. In RNV/APR the deviation needle on your CDI will display crosstrack deviation as ±1¼ nm full scale, or ¼ nm per dot. All other aspects of the RNV/APR mode are identical with the RNV/ENR mode.

(17)

KNS 80 integrated NAV system

SPECIFICATIONS

Size: (including mounting rack)
Length: 11.19" (28.4 cm), 11.99" (30.5 cm) with rear connector
Height: 3.0" (7.6 cm)
Width: 6.31" (16.0 cm)
Weight: 6 lbs. (2.7 Kg)
Power requirements: 11 to 33 VDC, 25 watts
1.8 A @ 13.75 VDC
.9 A @ 27.50 VDC
Batteries: 2 Silver Oxide Cells (Eveready 303BP or equiv.)

DME Section

Transmitter Power Output: 50 W min. (100 W typical)
Sensitivity: −82 dbm min. (−85 typical)
Range: 0-200 nm
DME Accuracy: 0 to 99.9 nm ± 2 nm displayed to nearest .1 nm
100 to 200 nm ± .3 nm displayed to nearest nm

NAV Receiver and Converter

Frequency Range: 200 channels, 108.00 to 117.95
Sensitivity: 2 uv Max. (hard) will provide a livable course indication
Selectivity: 6 db at ± 16 kHz, 65 db at ± 40 kHz
Spurious Responses: At least 50 db down
VOR Accuracy: Typically less than ± 1° error

RNAV Section

Waypoint Distance: Selectable on digital display, zero to 199.9 nm in .1 nm increments
Waypoint Angle: Selectable on digital display in .1° increments

Bearing and Distance Accuracy: Meets FAA Advisory Circular 90-45A accuracy requirements
Course Width:

Function	Course Width (+150 ua)
VOR	± 10°
VOR Parallel	± 5 nm
RNAV Enroute	± 5 nm
RNAV Approach	± 1.25 nm

External Outputs

RNAV, ILS, APP External Annunciator:
Active State 0.8 V @ 100 ma
OFF State: High Impedance
OBS Resolver: 30Hz OBS resolver meeting ARINC requirements
Course Deviation: Up to 5 floating 1,000 Ohm loads
VOR/LOC Warning Flags: Up to 3 floating 1,000 Ohm loads
TO/FROM Indication: Up to 3 floating 200 Ohm loads
DME Audio Output: 18 mw max. into 500 Ohm (internally adjustable)
NAV Audio Output: 50 mw max. into 500 Ohm (front panel adjustable)

Glideslope Section

Frequency Range: 40 channel, 329.15 to 335.00 MHz with 150 kHz spacing
Sensitivity: 16 uv (hard) for half flag
Selectivity: >6 db @ ± 25 kHz, >40 db @ 150 kHz
Number of Deviation Loads: Up to 5 floating 1,000 Ohm loads

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