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INSTALLATION MANUAL

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KNS 80

DIGITAL AREA NAVIAGTION SYSTEM

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KNS 80
DIGITAL AREA NAVIGATION SYSTEM

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PAGE	REASON FOR CHANGE
COVER	UPDATED
HISTORY REVISION	UPDATED
TABLE OF CONTENTS	UPDATED
SECTION I	UPDATED
2-5	UPDATED
2-11	UPDATED
2-13	UPDATED
2-15	UPDATED
2-17	UPDATED
2-19	UPDATED
2-21	UPDATED

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PAGE	REASON FOR CHANGE
COVER	UPDATED
HISTORY REVISION	UPDATED
TABLE OF CONTENTS	UPDATED
1-1	COSMETIC CHANGES
1-2	CHANGED NOTE 5
1-3	MISSPELLED WORD
1-6	NEW B/M
1-7	REPLACED PARAGRAPH
2-1	REWRITTEN
2-2	ELIMINATED PART NOS.
2-3	ADDED PARAGRAPH
2-4	MISSPELLED WORD
2-5	CHANGED DISTANCE TO STATION
2-6	COSMETIC CHANGES
2-7	COSMETIC CHANGES
2-8	COSMETIC CHANGES
2-9	COSMETIC CHANGES
2-13	REV. CHANGE
2-15	REV. CHANGE
2-17	ADDED SHEET 1
2-19	REV. CHANGE
2-21	PAGE NO. CHANGE
2-22	PAGE NO. CHANGE
2-23	PAGE NO. CHANGE
2-25	ADDED -01
SECTION III	REPLACE WITH NEW FORMAT

TABLE OF CONTENTS

SECTION I
GENERAL INFORMATION

SECTION II
INSTALLATION

SECTION III
OPERATION

TABLE OF CONTENTS

SECTION III
OPERATION

LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information relative to the physical, mechanical, and electrical characteristics and installation procedures of the King Radio Corporation Silver Crown KNS 80 Navigation System.

1.2 EQUIPMENT DESCRIPTION

The KNS 80 is a panel mounted navigation system consisting of a VOR/Localizer receiver, DME interrogator, RNAV computer, and glideslope receiver (optional) in a single unit. When combined with an appropriate CDI indicator, the unit becomes a complete navigation system featuring two modes of VOR, two modes of RNAV, and ILS. The unit also simultaneously displays distance to station (waypoint), velocity to station (waypoint), time to station (waypoint), and chosen parameter (frequency, radial or distance) of one of the four waypoints. Separate system flexibility is maintained with a DME "HOLD" button which allows "freezing" the DME frequency while tuning to a different ILS or VOR frequency.

Large scale integrated circuit technology has been utilized to produce an extremely compact unit only 3 inches in height, weighing 6 pounds, and using only 25 watts from any DC input from 11 to 33VDC.

Additional features include an automatic dimming circuit to compensate for changes in ambient light level, and a CMOS memory powered by two silver-oxide watch cells enabling long term waypoint storage (2 year typical cell life).

1.3 TECHNICAL CHARACTERISTICS

1.3.1 KNS 80 DIGITAL NAVIGATION SYSTEM (KPN 066-4008-00)

SPECIFICATION	CHARACTERISTIC
REFERENCE DOCUMENTS	
Environmental	RTCA--DO-160
Area NAV	FAA--AC 90-45A
ENVIRONMENTAL CATEGORIES	
Temperature & Altitude	A1 and C1 (-20° to +55°C, up to 35,000 feet)
Humidity	A
Vibration	SKP
Magnetic Effect	Z
Power Input	B
Voltage Spikes	B
AF Susceptibility	B
Electromagnetic Compatibility	A
PHYSICAL CHARACTERISTICS	
1. Weight: (including Rack & Connectors)	6.0 lbs/2.7Kg
2. Size: (including Mounting Rack)	Height: 3.00 inches (7.62cm) Width: 6.31 inches (16.03cm) Length: 11.99 inches (30.46cm) (From back of front panel to rear of mounting rack. See Figure 2-4)
3. Mounting:	Panel

SPECIFICATION	CHARACTERISTIC
COOLING	
Input Requirements	4CFM minimum into the port of the KNS 80 from a KA 20 Blower or equivalent
ELECTRICAL CHARACTERISTICS	
1. Maximum A-Line Power Consumption:	2.1 amp @ 13.75VDC 1.1 amp @ 27.5VDC
Button Lighting:	.32 amp @ 13.75VDC .16 amp @27.5VDC
2. Battery:	2 silver oxide cells: Eveready--303BP; Mallory--WS14; Timex--Type A.
INTERFACES	
NOTE: No external dummy loads or programming jumpers are required.	
1. Course Deviation Loads:	0 to 5-1K ohm loads, ±150uA full scale
2. VOR/LOC/RNAV Flag Loads:	0 to 5-1K ohm loads, 260uA for flag out of view
3. To/From Loads:	3-200 ohm loads, digital, current limited 600 to 800uA. ±200uA for indication.
4. Indicator:	(Indicators using an Omni-Range-Zeroed resolver) Compatible King Indicators: KI 206 KNI 510/KNI 510B KNI 520 KNI 525 KPI 550/KPI 551 factory modified to KPI 550A/KPI 551A KPI 550A/KPI 551A KPI 552/553 with course select knob
5. Outputs:	
ILS, RNAV, and APPROACH Annunciator	Active State: <.3V maximum @ 100mA maximum Off State: High Impedance (> 100K ohm), 33V max.
6. Glideslope Deviation Loads:	0 to 3-1K ohm loads, ±150uA full-scale deflection
7. Glideslope Flag Loads:	0 to 3-1K ohm loads, 190uA--half flag, 260uA flag out of view.
8. DME suppression output:	logic high: 8V min logic low: .5V max max load: 50Kohm

SPECIFICATION	CHARACTERISTIC
OPERATIONAL CHARACTERISTICS	
Distance to Station Range:	VOR Mode 200NM RNAV Mode 400NM
Groundspeed Range:	0 to 999 knots
Groundspeed Initialization:	Converges to within 10% of actual value within 70 seconds after DME locks on.
Time to Station Range:	0 to 99 minutes
Waypoint Data Range:	0 to 200NM in .1NM increments
Waypoint Radial Range:	0 to 360 degrees in .1° increments
CDI Full Scale Deflection:	VOR: ±10 degrees VOR Parallel: ±5NM RNAV Enroute: ±5NM RNAV Approach: 1.25NM
Number of Waypoints:	4 (push button operated) -- Waypoint data of waypoints not in use may be entered without affecting operation of the in use waypoint.

1.3.2 VOR CHARACTERISTICS (All signal levels are measured at signal generator into 6dB pad)

SPECIFICATION	CHARACTERISTIC
RECEIVER FREQUENCY RANGE	108.00MHz to 117.95MHz, 50KHz channel spacing
RECEIVER SENSITIVITY	
1. Audio	Requires input signal of 2.0uV or less for 6dB s+n/n.
2. VOR	Requires input signal of 2.0uV or less for flag out of view.
RECEIVER SELECTIVITY	
Bandwidth	6dB--31KHz minimum 60dB--46KHz maximum
VOR ACCURACY	Azimuth error of less than .6° under standard test conditions 25°C, 100uV. The azimuth error is less than 2.5° with a statistical probability of 95% as specified in RTCA DO-114.
SPURIOUS RESPONSES	Audio sensitivity is down more than 50dB for all signals more than 40KHz off channel.

SPECIFICATION	CHARACTERISTIC
CROSS MODULATION	With the simultaneous application of a desired signal and an undesired signal 100KHz off channel, 90° out of phase with the desired, and signal levels listed below, the resultant error shall be less than 1°. a. Desired signal level: 10uV Undesired signal level: 0 to 2000uV b. Desired signal level: 25uV Undesired signal level: 5000uV
DEFLECTION SENSITIVITY	A 10° difference between reference and variable phases shall produce a 150uA deflection.
AGC CHARACTERISTICS	Audio output varies less than 3dB with RF input levels between 5uV to 20KuV. Not more than 0.3° increase in azimuth error when RF input is varied from 10uV to 10KuV.
AUDIO	50mW minimum into 500 ohms with 20uV RF input, 30% modulated by 1000Hz (adjustable).
IDENT FILTER	With Ident switch in the IN position, Ident tones are attenuated at least 15dB.

1.3.3 LOCALIZER CHARACTERISTICS

SPECIFICATION	CHARACTERISTIC
RECEIVER SENSITIVITY	Requires input signal of 2.0uV or less for flag out of view.
CENTERING	The centering error is less than 5uA as the RF level is varied from 10uV to 20,000uV.
DEFLECTION	An RF signal of 100uV with a difference in depth of modulation of 0.093ddm (4dB) shall produce a deflection of 90uA ±10uA. The deviation under opposite polarity shall be within 4% of 90uA. Over the RF signal range of 10uV to 20,000uV, the deflection current shall not vary more than 14uA from standard deflection.
CROSS MODULATION	With simultaneous application of a 5000uV, +91KHz off resonance signal, amplitude modulated 30% at 150Hz and a 50 to 10,000uV desired standard localizer centering signal, the change in centering error shall be less than 1.0uA.

1.3.4 GLIDESLOPE CHARACTERISTICS

SPECIFICATION	CHARACTERISTIC
RECEIVER SENSITIVITY	Requires input signal of 16uV or less for 60% of standard deflection. (Standard deflection is 78uA at 700uV input, 2dB tone ratio.)
ACCURACY	
1. Centering	The centering error is less than 10uA as the RF is varied from 10uV to 10,000uV.
2. Deflection:	Over the signal range of 100uV to 10,000uV, the deflection current shall not vary more than ±12uA from standard deflection (78uA). Deflection balance is within 3uA.
SELECTIVITY	Less than a 6dB variation in sensitivity when the frequency is varied ±21KHz. At least 30dB down at ±150KHz off channel.
FREQUENCY RANGE	329.15MHz to 335.00MHz
NUMBER OF CHANNELS	40 channels, 150KHz spacing
SPURIOUS RESPONSE	All responses in the range from 90KHz to 1.5KHz at least 60dB below center frequency response, excluding the range from 329.00MHz to 335.15MHz.

1.3.5 RNAV COMPUTER CHARACTERISTICS

SPECIFICATION	CHARACTERISTIC
CROSS TRACK ACCURACY	Less than 0.5NM error contribution to CDI Left/Right needle signal.
ALONG TRACK ACCURACY	Less than 0.5NM error contribution in distance to waypoint signal.

1.3.6 DME CHARACTERISTICS

SPECIFICATION	CHARACTERISTIC
CHANNELS	200 channels
OUTPUT POWER AT ANTENNA TERMINAL	50 watts peak, pulsed power minimum; 100 watts nominal.
MAXIMUM DME RANGE	200NM
ACQUISITION SENSITIVITY	-82dBm minimum, -87dBm nominal

SPECIFICATION	CHARACTERISTIC
RANGE ACCURACY	±.2 nautical miles from 0 to 99.9 nautical miles; ±.3 nautical miles from 100 to 199 nautical miles (Display rounded to nearest NM above 100NM).
SEARCH TIME	1.0 second nominal
MEMORY TIME	11 to 13 seconds
AUDIO OUTPUT (IDENT)	Level adjustable up to 18mW into 500 ohm load, nominally set for 2mW.

1.4 UNITS AND ACCESSORIES SUPPLIED

KNS 80 INSTALLATION KIT (KPN 050-1644-00/03) (SEE FIGURE 2-5)

KING PART NUMBER	DESCRIPTION	QUANTITY			
		-00	-01	-02	-03
050-1644-00	INSTALLATION KIT	X			
050-1644-01	INSTALLATION KIT		X		
050-1644-02	INSTALLATION KIT			X	
050-1644-03	INSTALLATION KIT				X
006-0196-00	STC CERT GUIDE	1	1	1	1
030-0005-00	CONN BNC CA RG142	1	1	-	-
030-1107-30	TERM STRIP OF 30	1	1	1	1
047-4545-01	CVR PLT	1	-	1	-
047-5297-01	CVR CONN PLT	-	1	-	1
057-2111-00	TAG	1	1	1	1
071-1174-00	ANTENNA KA 60	1	1	-	-
089-1353-01	NUT CLIP 6/32	4	4	4	4
089-5907-04	SCR PHP 6-32X1/4	2	-	2	-
089-6012-08	SCR PHP 6-32X1/2	4	4	4	4
089-6127-04	SCR PHP 6-32X1/4	-	4	-	4
089-6293-03	SCR PHP 3-48X3/16	3	3	3	3
089-8108-34	WASHER S-L #3	-	3	-	3
150-0038-00	DUCTING FIBERGLASS	1	1	1	1
200-2391-00	CONN PLT ASSY	1	-	1	-
200-2391-01	CONN PLT ASSY	-	1	-	1

The connector plate assembly (KPN 200-2391-00/01) includes the following items: (See Figure 2-8).

KING PART NUMBER	DESCRIPTION	QUANTITY	
		-00	-01
200-2391-00	CONN PLT ASSY	X	
200-2391-01	CONN PLT ASSY		X
030-0101-02	CONNECTOR	3	3
030-1019-00	CLP CA HALF	4	4
030-1094-52	CONN W/KEY	1	1
047-4437-02	PLT CONN	1	-
073-0452-02	CONN PLT	-	1
076-1138-01	SPCR	1	-
088-0802-00	TUBE PLATE	1	-
089-2157-22	NUT HEX THIN 6-32	1	-
089-5523-05	SCR FHLP 4-40X5/16	4	4
089-5903-07	SCR PHP 4-40X7/16	-	1
089-5907-06	SCR PHP 6-32X3/8	-	
089-6123-07	SCR PHP 4-40X7/16	-	2
089-6293-03	SCR PHP 3-48X3/16	2	-
089-8260-30	WASHER	3	-
090-0019-07	RING RINK .438	3	3
091-0031-01	CLAMP CA	1	1

1.5 ACCESSORIES NOT SUPPLIED

RG58/U Cable

RG142U/B Cable (KPN 024-0002-00) should be used for the DME antenna system if the installation calls for more than 10 feet.

VOR Antenna

CDI Indicator: KI 206 (KPN 066-3034-04) or equivalent

Glideslope Antenna: KA 22 (KPN 071-1008-00) or equivalent

Cooling Accessories:

The KA 20 Cooling Blower Kit (KPN 071-4031-00) or equivalent, may be used to satisfy the cooling requirements. Ram air cooling is not recommended to cool the KNS 80 (See Figure 2-5).

KA 139 Diplexer (KPN 071-1185-00)

The KA 139 Diplexer should be connected directly to the NAV Antenna. Do not connect the KA 139 to the output of another NAV splitter. Some NAV splitters which are intended to drive 2 VOR/LOC NAV Receivers have a significant amount of insertion loss when used to drive a glideslope receiver. If a NAV antenna is used in common with two VOR/LOC NAV Receiver, the KA 139 is not recommended.

1.6 LICENSE REQUIREMENTS

The transmitter, as installed in the aircraft, requires an Aircraft Radio Station License. This license is obtained by filing FCC Form 404. The KNS 80 may be operated for up to 30 days without a station license, after filing the FCC Form 404 and while awaiting the receipt of the station license, if a copy of the FCC Form 404 is kept in the aircraft.

This equipment has been type accepted by the FCC and entered on their list of type accepted equipment as King KNS 80 and must be identified as King KNS 80 on your FCC Form 404, Aircraft Radio Station License Application.

1.7 FAA APPROVAL OF AREA NAVIGATION INSTALLATION

Refer to King Document 006-0196-00, King Radio Corporation recommended procedure for certification of the KNS 80 Area Navigation System. A copy of this document is located in the STC Documentation and Installation Data Section of the KNS 80 Maintenance/Overhaul Manual. A copy is also included with each KNS 80 installation kit.

SECTION II
INSTALLATION

2.1 GENERAL INFORMATION

This section contains information to the installation and wiring of the KNS 80, OBS indicator, and antennas. Section 2.3.1 contains information pertaining to the mechanical installation and placement requirements for the KNS 80. Refer to Section 2.3.2 for electrical harness and Molex connector construction details. The STC Documentation section of the maintenance manual contains the interconnect drawings. Section 2.3.4 and 2.3.5 pertain to antenna installation. For interfacing the KNS 80 to autopilot systems or external annunciators, consult the appropriate installation manual.

Before beginning installation, two factors should be considered:

A. The RNAV system installation and equipment location must be FAA approved. See Section 1.7 of this manual for FAA approval details and Section 2.3.1 and 2.3.4 for equipment location guidelines.

B. The KA 20 Cooling Blower Kit (KPN 071-4031-00) or an equivalent must be used to satisfy the cooling requirements of the KNS 80. Ram air cooling is no longer acceptable to cool the KNS 80.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Exercise extreme care when unpacking the equipment. Make a visual inspection of the unit for evidence of damage incurred during shipment. If a claim for damage is to be made, save the shipping container to substantiate the claim. The claim should be promptly filed with the transportation company. It would be advisable to retain the container and packaging material after all equipment has been removed in the event that equipment storage or reshipment should become necessary.

2.3 EQUIPMENT INSTALLATION

2.3.1 COOLING REQUIREMENTS

Installation of a KNS 80 requires that forced air cooling be provided for the KNS 80. This forced air cooling must provide a minimum of 4.0 cubic feet per minute of air flow through the cooling port located on the rear connector plate assembly. Use of ram air cooling is not acceptable with the KNS 80; dry cabin air must be provided as cooling for the KNS 80. Failure to provide forced air cooling for the KNS 80 will certainly lead to increased maintenance costs and may void the King warranty.

The King KA 20 part number 071-4032-00 or equivalent is recommended to meet this requirement.

2.3.2 KNS 80 INSTALLATION (Figures 2-1, 2-2, 2-3, 2-4)

A. Plan a location on the aircraft panel so that the KNS 80 is plainly visible to the pilot from his station with minimum practical deviation from his normal position and line of vision when he is looking forward along the flight path. Check to be sure that adequate depth behind the panel is available in the location chosen. Avoid mounting the KNS 80 close to heater vents or other high heat sources. Compass safe distance is 11 inches for worst case deflection of one degree.

B. Cut holes in instrument panel as required in Figure 2-4. To determine stack height use the height dimension for a front aircraft panel mount.

C. When installing two or more panel mounted units in a stack, the mounting trays shall be spaced .050 inches (.127 cm) apart. Newer style mounting trays have had .025 inch (.063 cm) dimples built-in, top and bottom, both sides, so that two new style trays will automatically be spaced properly.

D. Install the mounting rack in the aircraft using 6-32 x 1/2 flat head phillips screws and 6-32 clip nuts. The screws are inserted from the inside through the holes in the sides of the mounting rack (Figure 2-3).

E. Support the rear of the mounting tray using the two spare screw holes provided.

F. The DME audio output of the KNS 80 is set for approximately 3 ± .5V P-P into 500 ohms at the factory. If a different level is desired, readjust the audio level adjustment R305, accessible through the top cover.

G. When operating dual KNS 80's the respective DME's will interfere with each other when the NAV frequencies differ by 5.3MHz (for example, 108.00MHz and 113.3MHz). 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 5.3MHz difference is eliminated.

2.3.3 HARNESS AND CONNECTOR PLATE ASSEMBLY WIRING (Figures 2-2, 2-5, 2-7)

A. Connect the harness wires to the connector pins and insert the connector pins through the cable clamps and then into the rear of the Molex connector. See Section 2.3.4 for details of connecting the terminals to wires.

B. Route the DME cable through the plastic cable clamp shown in Figure 2-5.

C. If the KA 139 diplexer is not used, attach the NAV and glideslope cables to the connectors supplied with the KNS 80. Figure 2-2 shows cable preparation and soldering details. Figure 2-5 shows wiring details.

D. If the KA 139 diplexer is used attach the connectors supplied with the KNS 80 to the small shielded wires coming out of the diplexer and attach the BNC connector supplied with the KA 139 to the NAV/glideslope cable. Figure 2-5 shows wiring details. Figure 2-2 and 2-7 show cable preparation and soldering details for each connector. Next, connect the two BNC connectors together.

E. Attach the appropriate connectors to the antenna ends of the cable. Cable preparation details are given in Figure 2-7.

F. Mount connector cover to connector plate using 3 pan head 3-48 tap tite screws.

2.3.4 FINAL INSTALLATION

A. After all wiring is complete, attach the connector plate to back of rack. Tip top of rack and slide into grooves. Secure from inside of mounting tray with two pan head 6-32 x 1/4 screws. Pay special attention to the details 'A' and 'B' on Figure 2-5 to avoid an improper fit.

B. Attach the air hose to the air tube on the connector plate (See Figure 2-5 for cooling).

C. Install the KNS 80 into the mounting rack and secure by turning the hold down adjustment screw (accessible through a hole in the front panel, clockwise with an allen hex wrench until it is locked into place (Figure 2-4).

D. Update the KNS 80 Flight Manual Supplement and add it to the aircraft flight manual.

E. Use the system checkout of Section 2.4 to verify that the system works properly.

2.3.5 MOLEX CONNECTOR ASSEMBLY (Figure 2-1)

A. Solderless Contact Terminal Assembly using Molex Crimper

Refer to instructions in Figure 2-1.

B. Solderless Contact Terminal Assembly using Pliers

1. Strip each wire 5/32" for contact terminal (KPN 030-1107-30). (The last two digits of the contact terminal part number indicate the number of terminals furnished.)

2. Tin the exposed conductor.

3. Using needle nose pliers fold over each conductor tab in turn, onto the exposed conductor. When both tabs have been folded, firmly press the tabs against the conductor.

4. Repeat Step 3 for insulator tabs.

5. Apply a small amount of solder (using minimum heat) to the conductor/tab connection to assure a good electromechanical joint.

C. Contact Insertion into Molex Connector Housing

1. After the contact terminals have been installed on the wiring harness, the contact terminals can be inserted into the proper location in the connector housing (KPN 030-1094-53). The terminal cannot be inserted upside down. Be sure to push the terminal all the way in, until a click can be felt or heard.

2. The self locking feature can be tested by gently pulling on the wire.

D. Extraction of Contact from Molex Connector

1. Slip the flat narrow blade of a Molex contact ejector tool, KT-1884 (KPN 047-5099-01), under the contact on the mating side of the connector. By turning the connector upside down one can see the blade slide into the stop.

2. When the ejector is slid into place, the locking key of the contact is raised, allowing the contact to be removed by pulling moderately on the lead.

3. Neither the contact or position is damaged by removing a contact; however, the contact should be checked visually before reinstalling in connector, to be certain that retaining tab "A" extends as shown (see Figure 2-1) for retention in connector.

2.3.6 DME ANTENNA INSTALLATION

2.3.6.1 General

a. The antenna should be well removed from any projections, the engine(s), and propeller(s). It should also be well removed from landing gear doors, access doors, or other openings which will break the ground plane for the antenna.

b. The antenna should be mounted on a bottom surface of aircraft and in a vertical position when the aircraft is in level flight.

c. Avoid running other cables or wires near the antenna cable.

d. Avoid mounting the antenna near the ADF sense antenna, or near the transponder antenna (preferably more than 8 feet).

e. Where practical, plan the antenna location to keep cable lengths as short as possible, and avoid sharp bends in the cable to minimize the VSWR.

f. To prevent RF interference, the antenna must be physically mounted a minimum distance of three feet from the KNS 80.

g. A back-up plate should be used for added strength on thin-skinned aircraft.

h. The antenna should be kept clean. If left dirty (oil covered) the range of the DME may be affected.

i. All antennas should be sealed around the outside, the connector and the mounting hardware using RTV (KPN 016-1082-00) for moisture protection.

2.3.6.2 KA 60 Installation (Refer to Figure 2-6)

a. Peel the backing off the antenna template and apply template to the aircraft at the desired mounting location.

b. Drill or cut the proper size holes for mounting the antenna, then remove the template.

c. Using the antenna as a stencil, draw a line around the base of the antenna that will come into contact with the aircraft. Then carefully scrape off the paint within the stenciled area. Lightly sand the bare metal with fine sandpaper to insure removal of all paint and protective coatings.

d. Sand the inside area of the aircraft where the backing plate will be located to remove the chromate or other protective finish.

e. Apply Alumiprep No. 33 (KPN 016-1127-00) following the directions on the container to cleanse the metal of any residue.

f. Apply Alodine No. 1001 (KPN 016-1128-00) following the directions on the container.

g. Rivet the backing plate into place for additional strength, if necessary.

h. Mount the antenna using #8 star washers (KPN 089-8017-37) and 8-32 nuts (KPN 089-2148-32) included with the antenna.

i. Attach a BNC connector to the coaxial cable as shown in Figure 2-8. RG-58/U or equivalent coaxial cable is normally used on installations having a cable run of ten feet or less. For cable runs exceeding 10 feet, use RG-142B/U cable.

j. Inspect coaxial cable connector for proper center contact, then fasten it securely the antenna.

2.3.7 NAV AND GLIDESLOPE ANTENNA INSTALLATION

Performance of the KNS 80 is greatly dependent upon the quality of the antenna installation. The following items should be considered:

A. The VOR antenna should be well removed from any COMM antennas, 30dB isolation minimum.

B. Avoid running cables or wires, particularly COMM antenna cable, near the NAV antenna cable.

C. Locate the VOR antenna for optimum signal strength in all directions. Optimum location for a particular aircraft type is usually available from the aircraft manufacturer.

D. The glideslope antenna must be mounted in a clear unobstructed line to the glideslope ground station while on the glide path.

E. Use of a common antenna for both NAV and glideslope causes the antenna to be in a non-ideal location for at least one of the functions. Be aware that "shadowing" of the glideslope signal may take place if the antenna is located above the plane. If a common antenna is used, the signal splitter used which was specifically for the purpose of splitting NAV and glideslope signals and have an attenuation of less than 1dB.

F. Signal splitters that provide signals for two NAV receivers always have at least a 3dB loss and their use will result in a reduction of useable range.

2.4 SYSTEM CHECKOUT

2.4.1 REQUIRED EQUIPMENT

The following ramp test equipment or equivalent accuracy equipment is needed to properly ground test the KNS 80 installation.

A. DME Ramp Generator IFR ATC 600 or equivalent.

B. VOR/ILS Ramp Generator IFR 401L.

If ramp generators are not available, the system can be checked out using a VOR/DME station of known distance and bearing.

2.4.2 POST INSTALLATION CHECKOUT PROCEDURE

A. With the KNS 80 in VOR mode, and a generator setting of 90° TO, rotate the OBS until the D-bar centers with the TO/FROM indicator reading TO. The OBS reading should match the generator ±2° direction to station reading. Change the generator setting to 0° TO, center the D-bar, and check the OBS reading again.

B. Leaving the generator setting at 0° TO, check to see that the needle deflects 4 (±1/2) dots to the left when the OBS setting is 8° and that it deflects 4 (±1/2) dots to the right when the OBS setting is on 352°.

C. Rotate the OBS 360° and verify that the TO/FROM flag changes state only at the 270° ±10° and 90° ±10° OBS position.

D. Check to see that the flag change from a not flagged to a flagged state when the RF signal is removed.

E. Channel the KNS 80 to an ILS frequency. Deflection should be within 1/2 dot of the values listed below:

SIGNAL	MODULATION	PREDOMINANT MODULATION	DEFLECTION OF NEEDLE
Localizer	0dB (0ddm)		Centered
Localizer	+4dB (+.093ddm)	150Hz	3 dots to left
Localizer	-4dB (-.093ddm)	90Hz	3 dots to right
Glideslope	+2dB (>091ddm)	150Hz	2 1/2 dots up
Glideslope	-2dB (.091ddm)	90Hz	2 1/2 dots down
Glideslope	0dB (0ddm)		Centered

F. Remove the RF signal to check the change state of the localizer flag from a not flagged to a flagged condition.

G. Remove the glideslope RF signal to check the change of state of the glideslope flag to a flagged condition.

H. Check the brightness of the display at low ambient light levels. The factory adjusted level may be altered to match other aircraft lighting if desired.

I. If the ILS, RNAV, or APR annunciator outputs are used, check to see that they perform their intended function.

J. Lock the DME onto a 25NM reply. The KNS 80 should read within ±.2NM.

K. With the KNS 80 in RNAV mode, set up the following RNAV problems*.

1. Waypoint Radial 0°
   Waypoint Distance 140NM
   VOR Bearing 90° TO
   DME Distance 140NM

   The D-bar should center with an OBS reading 45° ±2.5° and the distance to station should be 198 ±4NM. The TO/FROM indicator should read TO.

2. Waypoint Radial 150°
   Waypoint Distance 50NM
   VOR Bearing 30° TO
   DME Distance 50NM

The D-bar should center with an OBS reading $90^{\circ} \pm 3^{\circ}$ and the distance to station should be 50NM ±1.2NM.

*** NOTE**

IF NO RAMP GENERATORS ARE AVAILABLE, PERFORM THE FOLLOWING RNAV PROBLEMS:

Problem 1

a. Place the KNS 80 in VOR mode.

b. Find an record the angle to the VOR station by centering the D-Bar with a TO TO/FROM flag.

c. Program a waypoint radial angle 90° greater than the indicated VOR radial.

d. Program a waypoint distance equal to the indicated DME value distance.

e. Place the KNS 80 in RNAV ENR.

f. Rotate the OBS until the D-Bar centers with a TO flag.

The KNS 80 distance-to-station should now read 2 (1.41) times the DME distance (±.5NM) and the indicated selected course should read 45° ($\pm 2^{\circ}$) greater than the recorded VOR angle to the station.

Problem 2

a. Place the KNS 80 in VOR mode.

b. Find and record the angle to the VOR station by centering the D-Bar with a TO TO/FROM flag.

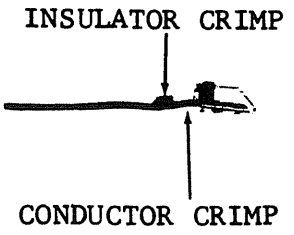
c. Program a waypoint radial angle 120° greater than the indicated VOR radial.

d. Program a waypoint distance equal to the indicated DME value.

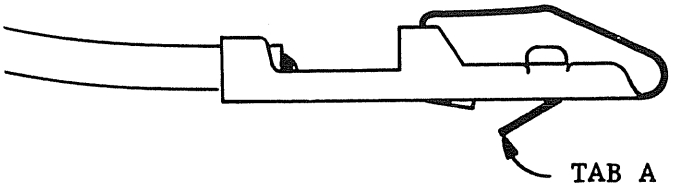
e. Place the KNS 80 in RNAV ENR.

f. Rotate the OBS until the D-Bar centers with a TO-flag.

The KNS 80 distance-to-station should now read a value equal to the DME distance (±.5NM) and the indicated selected course should read 60° greater than the recorded VOR angle to station.



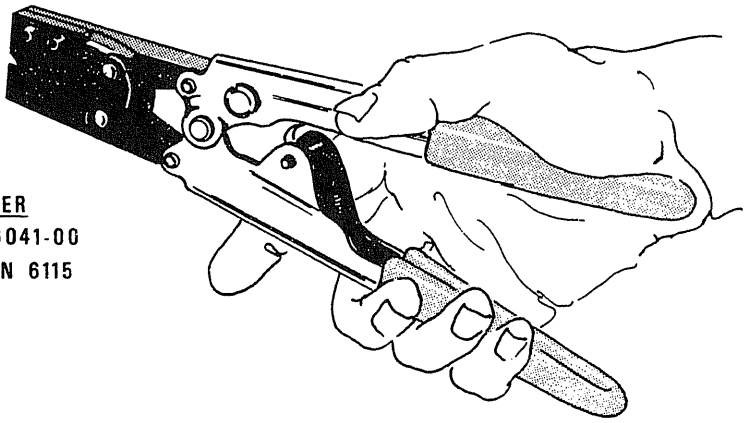
SOLDERLESS CONTACT TERMINAL
KPN 030-1107-30



HAND EJECTOR
KPN 047-5099-00/01
MOLEX PN HT-1884

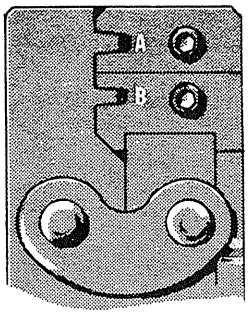
FIGURE 2-1 MOLEX TERMINALS AND TOOLS
(Dwg. No. 696-6333-00, R-1)
(Sheet 1 of 3)

Holding the hand crimpers as shown, release the crimper's ratchet pawl and open by squeezing tightly on the handles, and then releasing pressure.

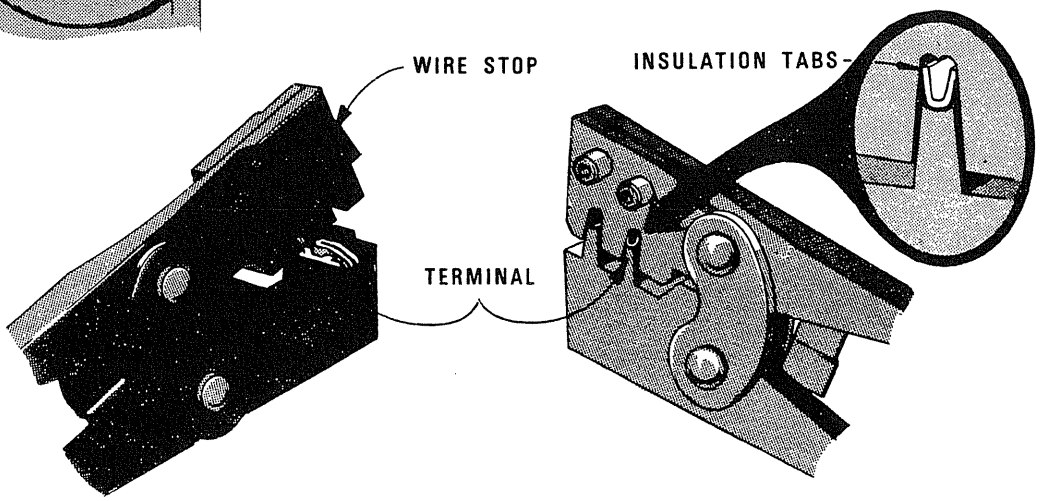


HAND CRIMPER
KPN 071-6041-00
MOLEX P/N 6115

Close crimpers until ratchet begins to engage. Then insert the terminal into the jaws from the back side. (See Figures at bottom of page) For 24 to 30AWG wire, it will be necessary to start the crimp in jaw A and then complete it in jaw B.



JAW	TERMINAL	WIRE SIZE	INSULATION RANGE
A	030-1107-30	18 to 24 AWG	.110 to .055
B	030-1107-30	24 to 30AWG	.055 to .030

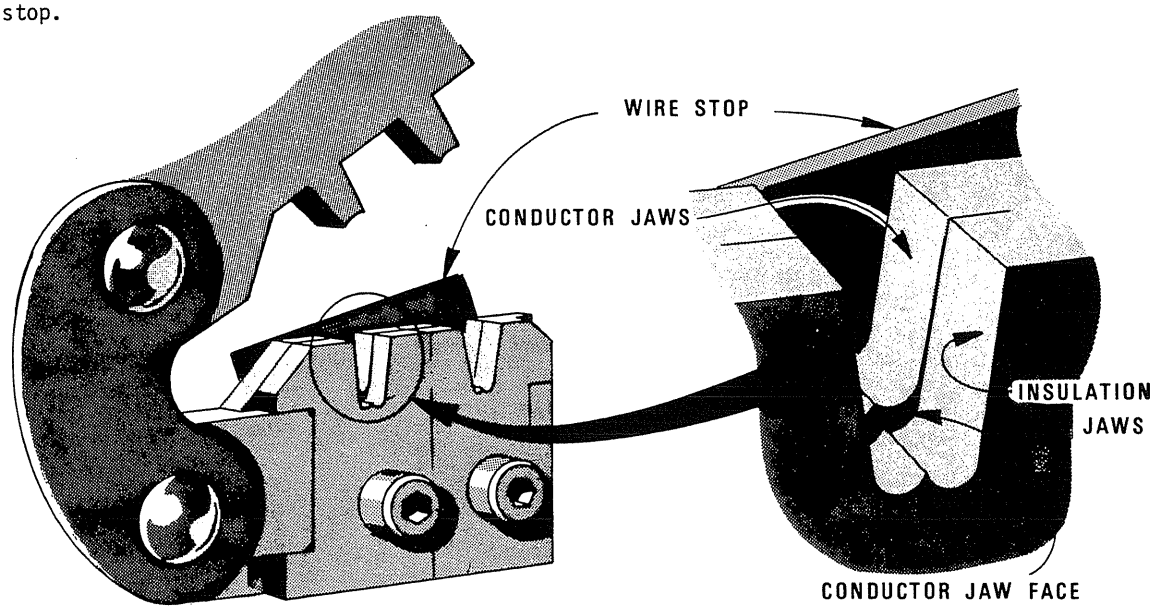


Terminal is in correct position when insulation tabs are flush with outside face of crimp jaws.

FIGURE 2-1 MOLEX TERMINALS AND TOOLS
(Sheet 2 of 3)

Once the terminal is in the correct position, close the jaws gently until the terminal is held loosely in place. Push wire stop down so that it rests snugly behind the contact portion of the terminal.

Strip the wire insulation back 1/8 inch and insert the wire through the insulation tabs into the conductor tabs until the insulation hits the conductor jaw face or until the conductor touches the wire stop.



Squeeze the handles until the crimp jaws close and the ratchet releases.

Straighten the terminal if necessary, then release the plier grips and remove the crimped terminal.

CRIMPING PRESSURE ADJUSTMENT

If too much or too little pressure is needed to release the crimper's ratchet pawl at the end of the crimp stroke, the ratchet can be easily adjusted. A spanner wrench provided with the tool can be used to loosen the lock nut, and rotate the keyed stud clockwise for increased pressure and counter-clockwise for decreased pressure. Once the desired pressure has been set, the lock nut must be tightened again. Newer models may have a screwdriver adjustment.

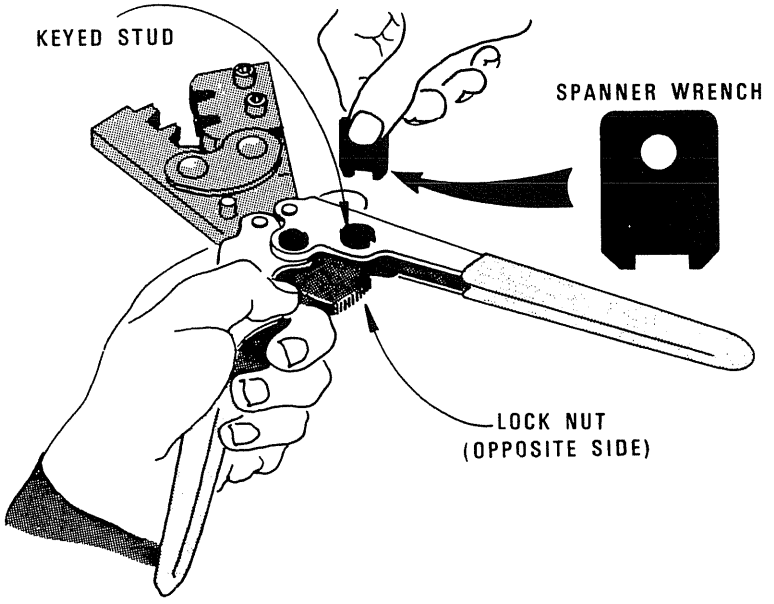
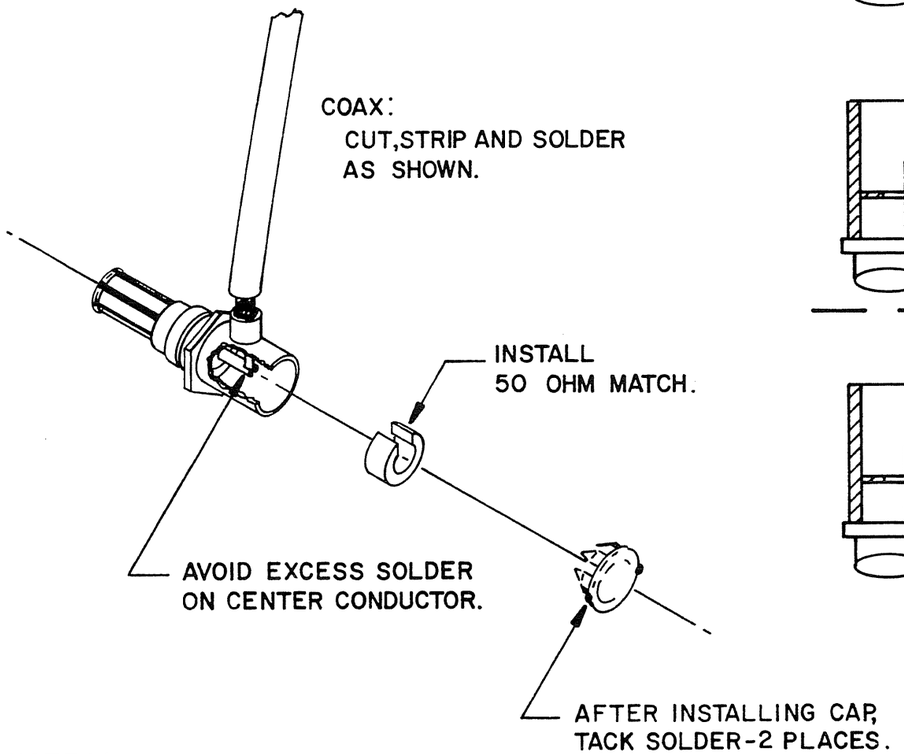
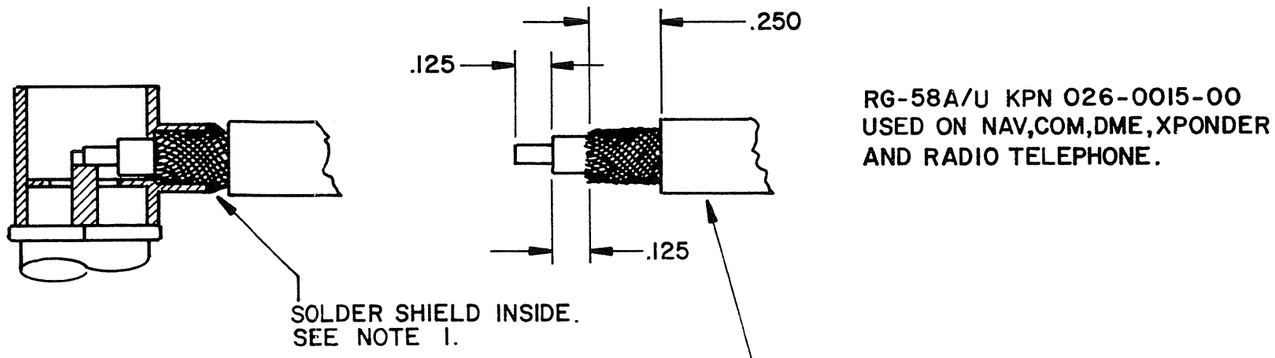
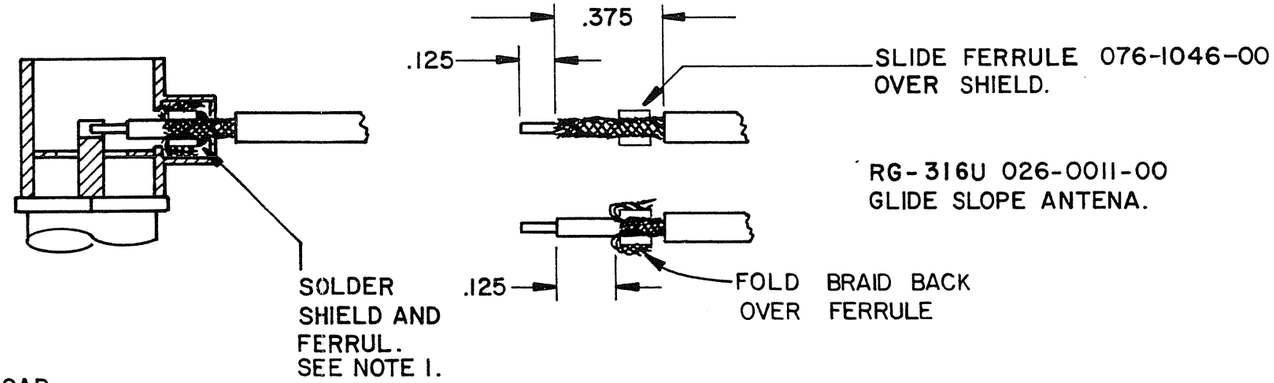


FIGURE 2-1 MOLEX TERMINALS AND TOOLS
(Sheet 3 of 3)







NOTES:

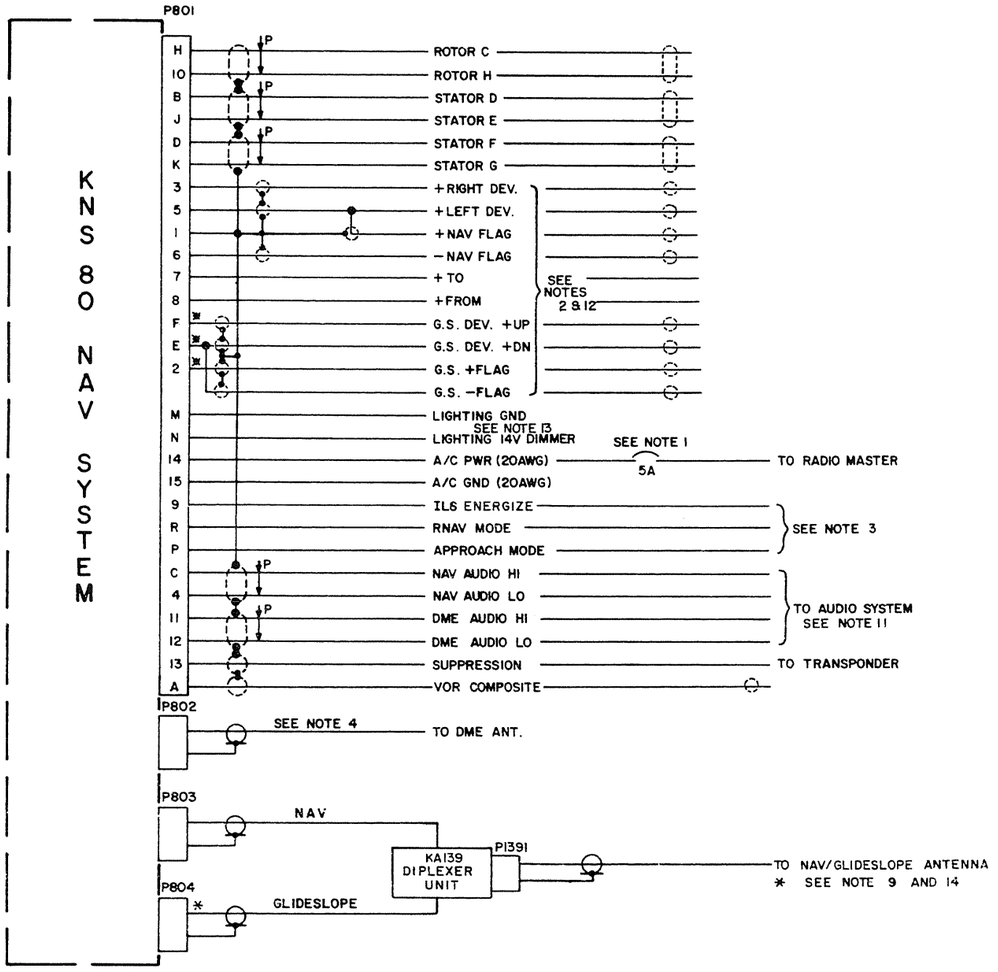
1. AVOID APPLYING EXCESSIVE HEAT TO CONNECTOR BODY. HEAT SINK SPRING CONTACTS DURING SOLDERING.

WARNING

CLOSE ADHERENCE TO THIS PROCEDURE IS NECESSARY FOR AN INTERFERENCE-FREE INSTALLATION.

FIGURE 2-2 ANTENNA CONN./CABLE ASSEMBLY
(Dwg. No. 030-0101-02, R-3)
(Sheet 2 of 2)

KING
KNS 80
DIGITAL AREA NAVIGATION SYSTEM

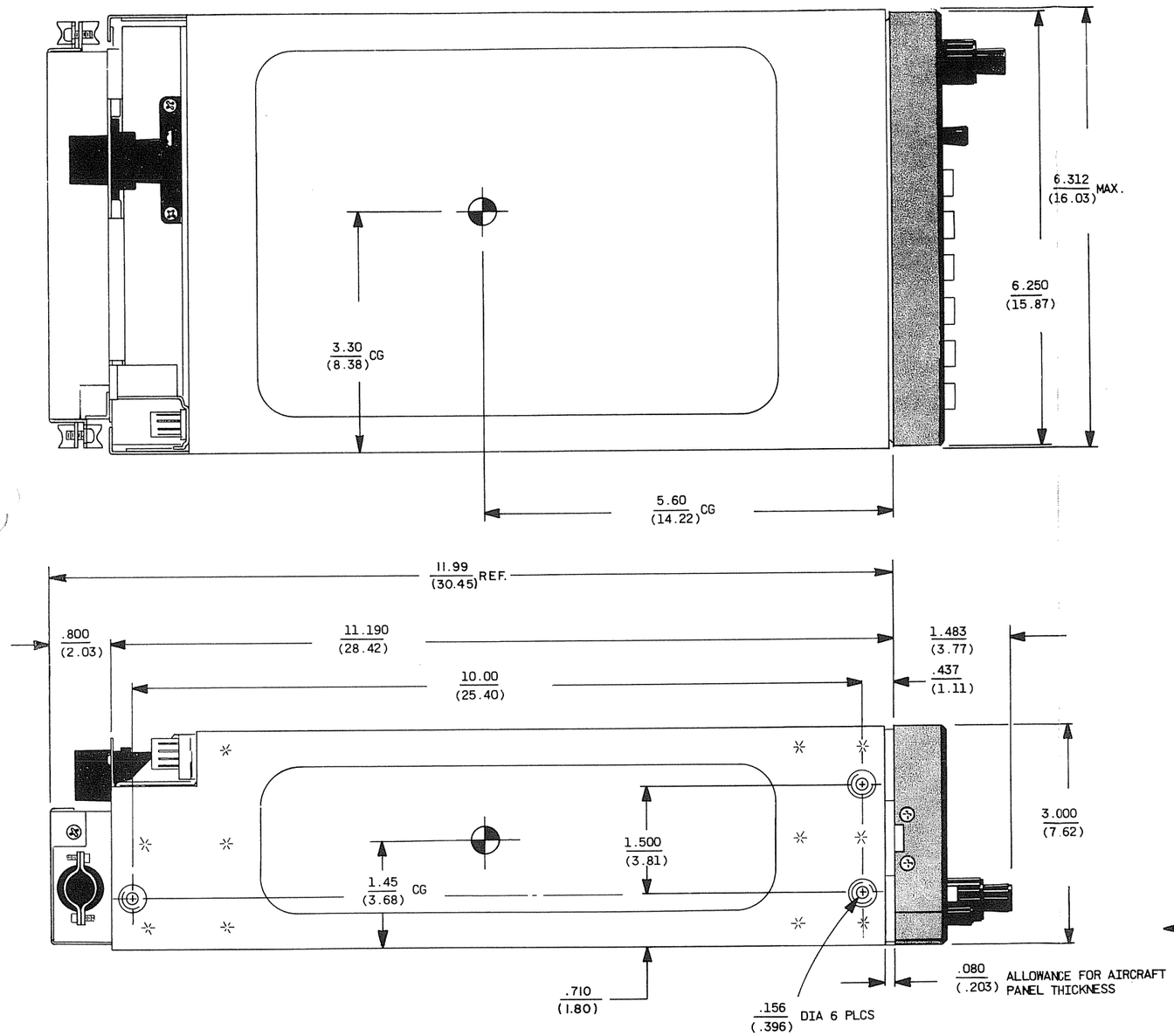


NOTES:

1. KNS 80 WILL ACCEPT EITHER 13.75VDC OR 27.5VDC.
2. EXTERNAL LOADS: (MAXIMUM - NO EXTERNAL DUMMY LOADS REQUIRED.)
   NAV DEV = FIVE 1000 OHM LOADS
   NAV FLAG = THREE 1000 OHM LOADS
   TO/FROM = THREE 200 OHM LOADS
   G.S. DEV. = FIVE 1000 OHM LOADS
   G.S. FLAG = THREE 1000 OHM LOADS
3. ILS, RNAV AND APPROACH ANNUNCIATORS:
   ACTIVE STATE: 0.3V MAX., 100ma MAX.
   OFF STATE: HIGH IMPEDANCE, 33V MAX.
4. RG58/U SHOULD BE USED TO CONNECT THE ANTENNA TO P802 UP TO A MAXIMUM LENGTH OF 10 FEET. FOR CABLE RUNS EXCEEDING 10 FEET, RG142B/U CABLE SHOULD BE USED (KPN 024-0002-00).
5. SHIELDED CABLES USED ON P803 AND P804 SHALL BE RG58/U OR EQUIVALENT.
6. UNLESS NOTED, ALL WIRES SHALL BE 24AWG.
7. SINCE THE KNS 80 METER OUTPUTS ARE INTERNALLY REFERENCED TO SPECIFIC VOLTAGES, CARE MUST BE TAKEN TO PREVENT LOW IMPEDANCE PATHS FROM THE METER TERMINALS TO GROUND OR OTHER VOLTAGES.
8. SHIELDED TWISTED PAIRS ARE HARBOUR 2XE-2634-SV OR EQUIVALENT.
9. IF A KA139 IS NOT USED, CONNECT THE NAV ANTENNA DIRECTLY TO P803 AND THE GLIDESLOPE ANTENNA DIRECTLY TO P804.
10. * - CONNECTION NOT REQUIRED FOR 066-4008-01.
11. DME AUDIO IS ADJUSTABLE THROUGH TOP COVER FOR DESIRED LEVEL
12. AUTOPILOT OUTPUTS ARE CONNECTED IN PARALLEL WITH DEVIATION OUTPUTS AND WILL BE REFERENCED TO 4.5 VDC.
13. FOR 27.5V LIGHTING, CONNECT 27.5V DIMMER TO PIN M AND PIN N IS N/C.
14. THE KA139 DIPLEXER SHOULD BE CONNECTED DIRECTLY TO THE NAV ANTENNA. DO NOT CONNECT THE KA139 TO THE OUTPUT OF ANOTHER NAV SPLITTER. SOME NAV SPLITTERS WHICH ARE INTENDED TO DRIVE TWO VOR/LOC NAV RECEIVERS HAVE A SIGNIFICANT AMOUNT OF INSERTION LOSS WHEN USED TO DRIVE A GLIDESLOPE RECEIVER. IF A NAV ANTENNA IS USED IN COMMON WITH TWO VOR/LOC NAV RECEIVERS, THE KA139 IS NOT RECOMMENDED.

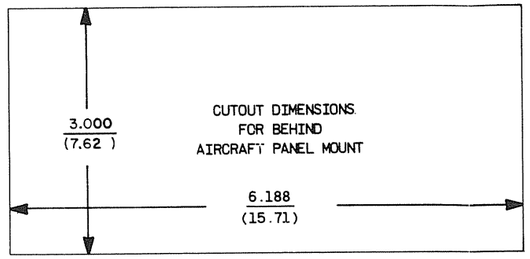
FIGURE 2-3 CONN PIN FUNCTIONS
(Dwg. No. 155-1318-00, R-4)

KING
KNS 80
DIGITAL AREA NAVIGATION SYSTEM

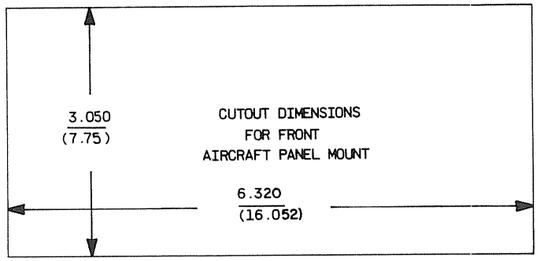


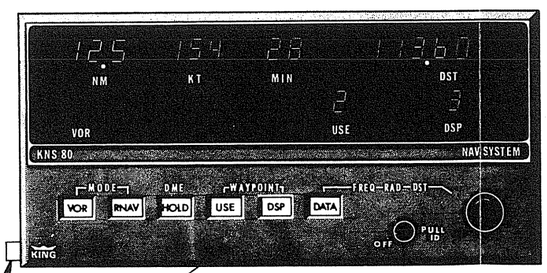
NOTES:

1. DIMENSIONS IN PARENTHESIS ARE IN CENTIMETERS.
2. WEIGHT: 5.3 LBS WITHOUT MTG. RACK.
   6.0 LBS WITH MTG. RACK AND CONNECTORS.
3. TOLERANCES FOR PANEL CUTOUTS: $^{+.010}_{-.000}$ ($^{+.025}_{-.000}$)
4. WHEN INSTALLING TWO OR MORE PANEL MOUNTED UNITS IN A STACK, THE MOUNTING TRAYS SHALL BE SPACED .050 INCHES (.127cm) APART. NEWER STYLE MOUNTING TRAYS HAVE HAD .025 INCH (.063cm) DIMPLES BUILT IN, TOP AND BOTTOM, BOTH SIDES, SO THAT TWO NEW STYLE TRAYS WILL AUTOMATICALLY BE SPACED PROPERLY.
5. TO DETERMINE STACK HEIGHT, USE THE HEIGHT DIMENSION FOR A FRONT AIRCRAFT PANEL MOUNT.



(SEE NOTE 5)





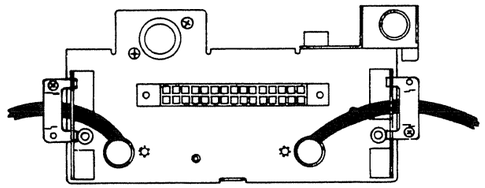
KNS 80

LOCK DOWN SCREW

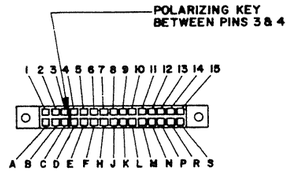
BATTERY COMPARTMENT

FIGURE 2-4 KNS 80 INSTALLATION DRAWING
(Dwg. No. 155-5261-00, R-6)

KING
KNS 80
DIGITAL AREA NAVIGATION SYSTEM



CONNECTOR PLATE ASS'Y WITHOUT KA 139
(071-1185-00)



CONNECTOR AS VIEWED FROM
REAR OF KNS 80

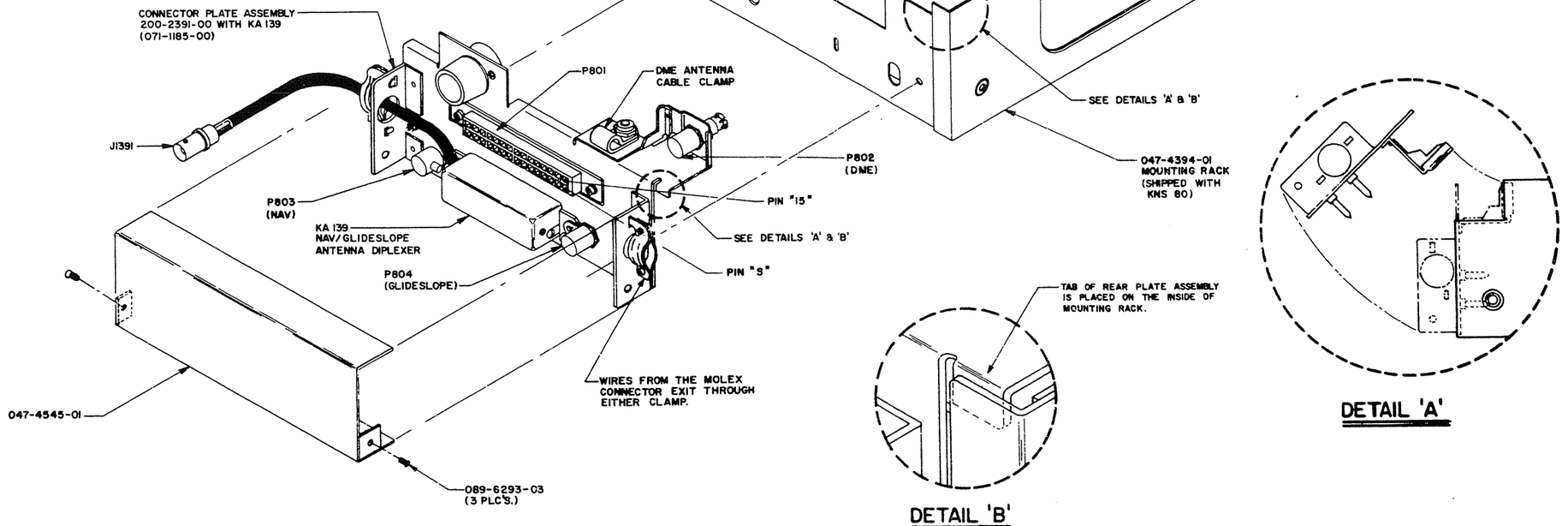
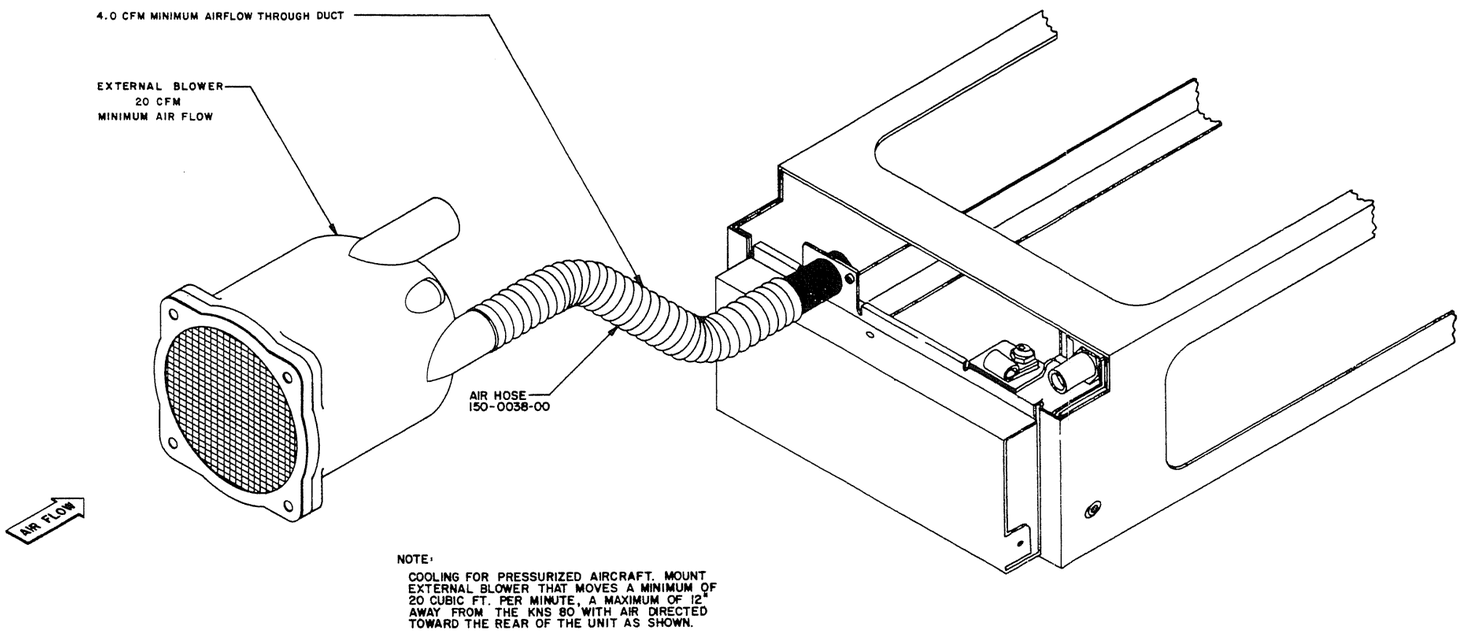


FIGURE 2-5 KNS 80 INSTALLATION ASSEMBLY
(Dwg. No. 155-5295-00, R-5)
(Sheet 1 of 2)



NOTE:
COOLING FOR PRESSURIZED AIRCRAFT. MOUNT EXTERNAL BLOWER THAT MOVES A MINIMUM OF 20 CUBIC FT. PER MINUTE, A MAXIMUM OF 12" AWAY FROM THE KNS 80 WITH AIR DIRECTED TOWARD THE REAR OF THE UNIT AS SHOWN.

FIGURE 2-5 KNS 80 COOLING FOR PRESSURIZED AIRCRAFT
(Dwg. No. 155-5295-00, R-5)
(Sheet 2 of 2)

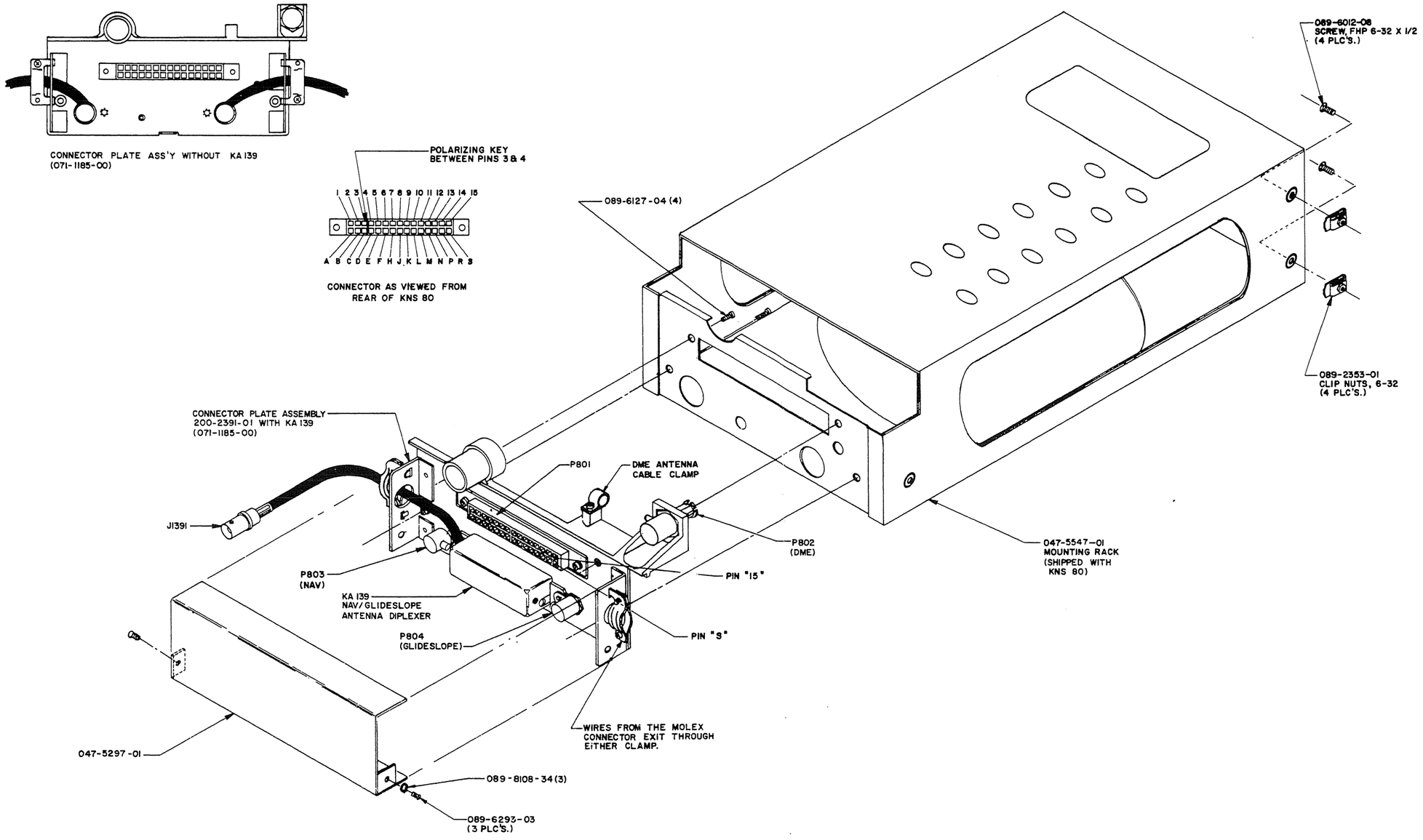
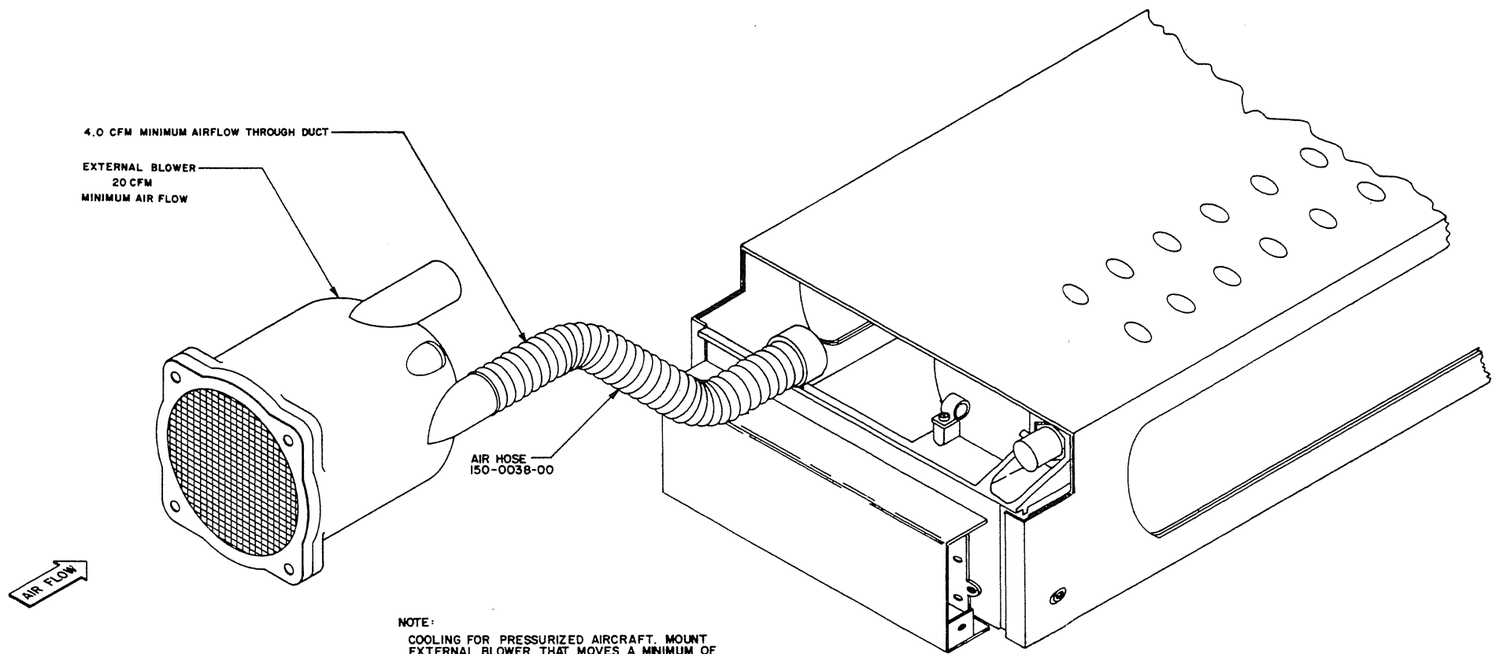


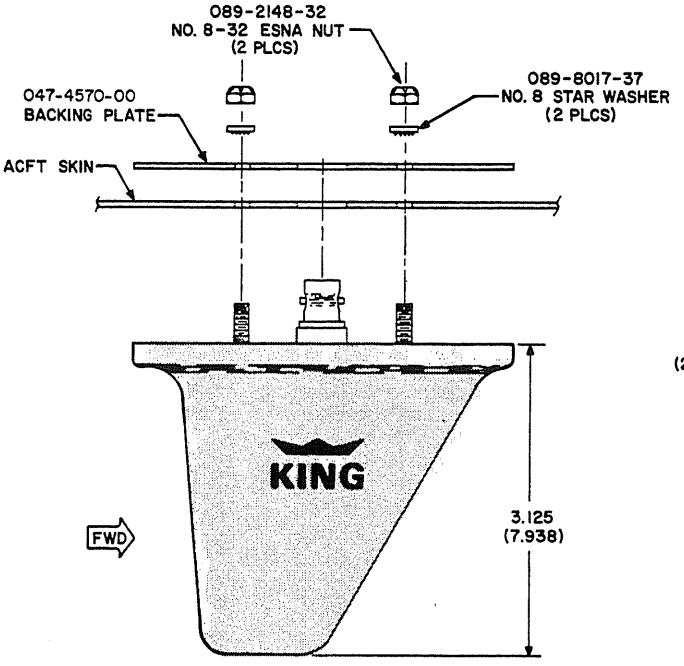
FIGURE 2-6 KNS 80 INSTALLATION DRAWING
(Dwg. No. 155-5295-01, R-4)
(Sheet 1 of 2)

KING
KNS 80
DIGITAL AREA NAVIGATION SYSTEM

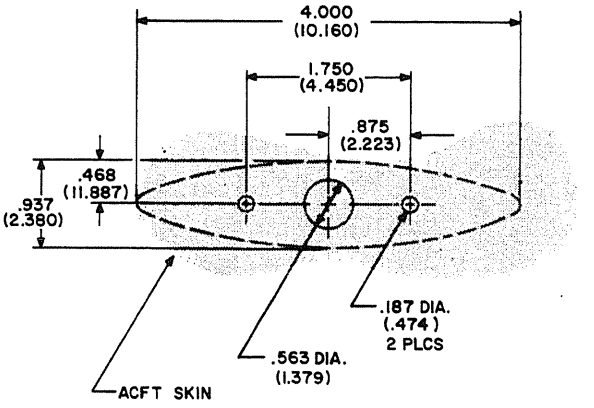


NOTE:
COOLING FOR PRESSURIZED AIRCRAFT. MOUNT EXTERNAL BLOWER THAT MOVES A MINIMUM OF 20 CUBIC FT. PER MINUTE, A MAXIMUM OF 12" AWAY FROM THE KNS 80 WITH AIR DIRECTED TOWARD THE REAR OF THE UNIT AS SHOWN.

FIGURE 2-6 KNS 80 COOLING FOR PRESSURIZED AIRCRAFT
(Dwg. No. 155-5295-01, R-4)
(Sheet 2 of 2)



MOUNTING
HOLE CUTOUT DIAGRAM



NOTE :
DIMENSIONS IN PARENTHESES ( ) ARE IN CENTIMETERS.

FIGURE 2-7 KA 60 ANTENNA INSTALLATION DRAWING
(Dwg. No. 155-5289-00, R-2)

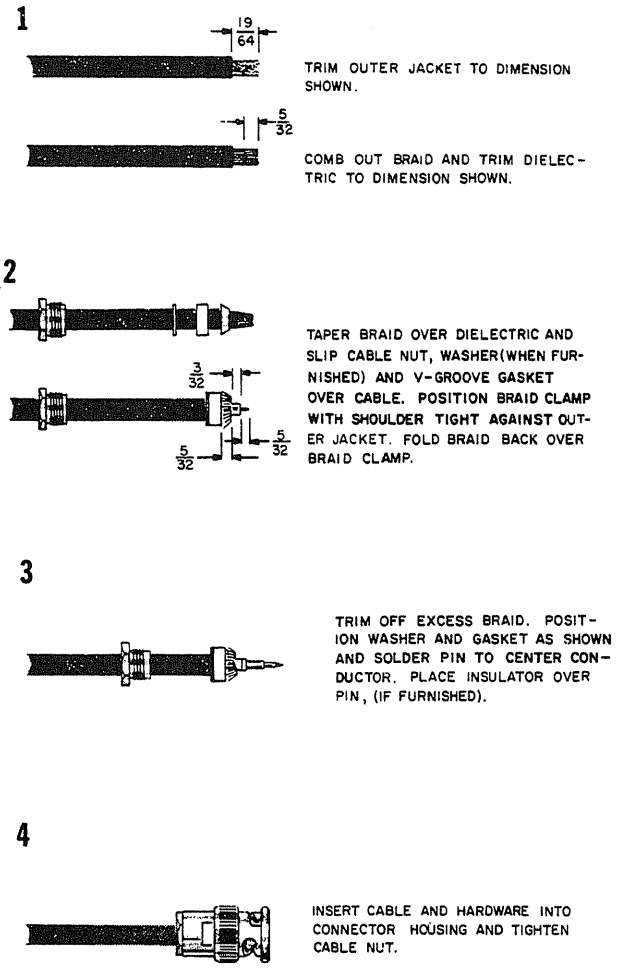
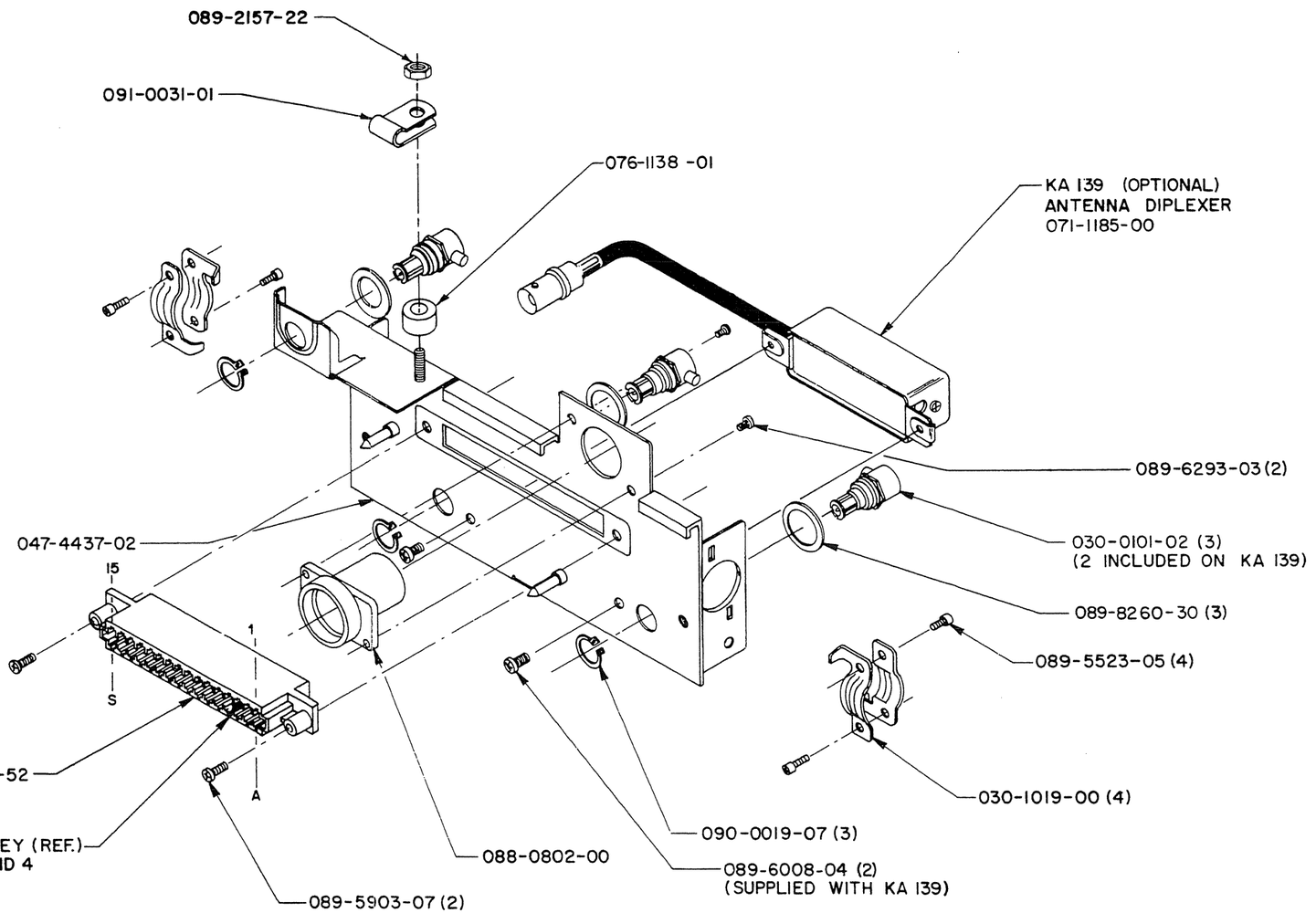


FIGURE 2-8 030-0005-00 CONNECTOR ASSEMBLY
(Dwg. No. 155-5267-00, R-0)

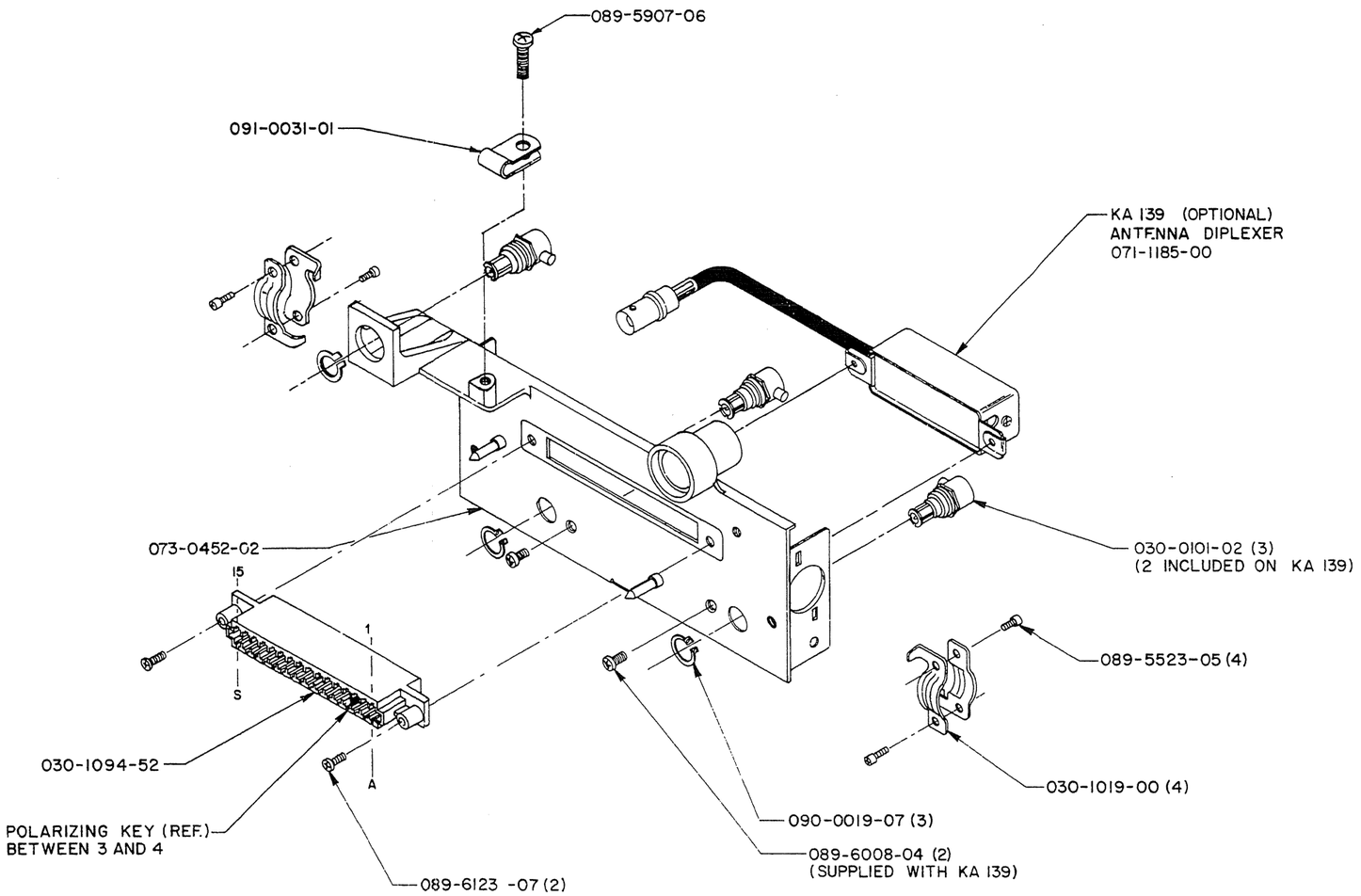


NOTES:

1. KA 139 MOUNTING IS SHOWN

-00 SHOWN

FIGURE 2-9 CONNECTOR PLATE ASSEMBLY
(Dwg. No. 300-2391-00, R-4)



NOTES:

1. KA 139 MOUNTING IS SHOWN

-01 SHOWN

FIGURE 2-10 CONNECTOR PLATE ASSEMBLY
(Dwg. No. 300-2391-01, R-2)

SECTION III
OPERATION

3.1 GENERAL

The KNS 80 can be operated in any one of 3 basic modes: (a) VOR, (b) RNAV, or (c) ILS. To change from one mode to another the appropriate pushbutton switch is pressed, except that the ILS mode is entered automatically whenever an ILS frequency is channeled. The display will annunciate the mode by lighting a message above the pushbutton. In addition to the standard VOR and RNAV enroute (RNV ENR) modes, the KNS 80 has a constant course width or parallel VOR mode (VOR PAR) and an RNAV approach mode (RNV APPR). To place the unit in either of these secondary modes the VOR pushbutton or the RNAV pushbutton, as the case may be, is pushed a second time. Repetitive pushing of the VOR button will cause the system to alternate between the VOR and VOR PAR modes, while repetitive pushing of the RNAV button causes the system to alternate between RNAV ENR and RNAV APR modes.

A description of the RNAV and VOR modes is as follows:

A. VOR

This is the conventional VOR/DME mode. The NM, KT and MIN displays are DME output and the CDI is displaying conventional cross track deviation information (i.e. $\pm 10^{o}$ full scale).

B. VOR, PAR

This is like the above mode except that the CDI is now displaying constant course width information with a full scale deflection of $\pm$5NM. In this mode a DME "unlock" will cause a CDI flag. It is recommended the VOR mode be used instead of VOR parallel for approach since the resolution of an off course indication increases with decreasing distance to the station in standard VOR, but remains a constant in VOR PAR.

C. RNV ENR

This RNAV mode has a CDI sensitivity of $\pm$5NM full scale. The NM, KT and MIN displays as well as the CDI are now with respect to the waypoint as defined by the data stored in the USE waypoint location.

D. RNV, APP

This is like the above except that the CDI sensitivity is $\pm$1.25NM full scale.

All waypoint information (station frequency, waypoint radial and distance) is entered with the increment/decrement rotary switch on the right side of the panel and displayed in the right hand readout. The small knob affects the lower significant digits while the large knob changes the most significant digits. The tenth's position of waypoint radial and distance can be changed by pulling the small knob to the out position. The type of data being displayed is indicated by the illuminated messages (FRQ, RAD, DST) located directly below the displayed data. Frequency, radial, or distance information for a waypoint can be displayed sequentially by pressing the "DATA" pushbutton. The increment/decrement switch changes only the information being displayed.

The KNS 80 can store frequency, radial, and distance information for up to 4 waypoints. The waypoint number of the data being displayed is located above the message DSP. The DSP waypoint number is changed by pressing the DSP button. The number of the waypoint being used for navigation is indicated by the number above the message USE. If the waypoint is different from the displayed waypoint, the DSP waypoint number blinks. Pressing the USE pushbutton causes the waypoint in use to match the displayed waypoint.

Normally, the DME is tuned to the station paired with the VOR frequency. The tuning of the DME may be frozen by depressing the HOLD button. Subsequency rechanneling of the NAV receiver will cause the HLD light to come on. The DME will "hold" the frequency it was tuned to at the time the button was depressed.

3.2 BATTERY REPLACEMENT

The waypoint memory is kept alive by two silver oxide watch cells located in the lower left hand corner of the front panel. Typical life of the cell is two years although high temperature and humidity conditions can shorten this period. If the battery should become weak, waypoint storage will be lost and the radio will "wake up" tuned to 110.00MHz in the VOR mode. The cells can be replaced from the front panel by opening the battery pocket with a thin blade screwdriver. The holder was designed so that the cells can only be inserted with the correct polarity. (See Paragraph 1.3.1, Electrical Characteristics, for approved battery types.)

3.3 DETAILED FUNCTION DECRIPTION

3.3.1 SYSTEM MODES

VOR, VOR PAR, RNV ENR, and RNV APR are selected modes and have equal presidence. If an ILS frequency is placed in the active data, the system will automatically go to the ILS mode. When switched out of an ILS frequency the system will revert back to the mode in which it was at the time the ILS frequency was selected.

When energized, the system will go to the mode in which it was when switched off. In addition, it will retain all waypoint data through a power shut down.

3.3.2 DISPLAYS

3.3.2.1 NM Display

a. VOR and VOR, PAR Modes

Displays DME distance
0 to 99.9NM in 0.1NM steps, 100 to 200NM in 1NM steps.
Most significant digit is zero blanked.
Displays dashes whenever DME goes into search.

b. RNAV APR and RNV ENR Modes

Displays RNAV distance to waypoint.
0 to 99.9NM in 0.1NM steps, 100 to 400NM in 1NM steps.
Displays dashes if DME is in search, if VOR flags, if DME and VOR tuned to different frequencies.

3.3.2.2 KT Display

a. VOR and VOR, PAR Modes

Displays ground speed to the DME ground station.
0 to 999 knots in 1 knot steps.
Update rate is once per second.
Most significant digit is zero blanked.
Displays dashes whenever DME goes into search.

b. RNV APR and RNV ENR Modes

Displays ground speed to the active waypoint.
0 to 999 knots in 1 knot steps.
Update rate is once per second.
Most significant digit is zero blanked.
Displays dashes whenever DME goes into search.

3.3.2.3 ILS Display

Indicates that the frequency in use is an ILS frequency.

3.3.2.4 MIN Display

a. VOR and VOR, PAR Modes

Displays time to DME ground station.
0 to 99 minutes in 1 minute steps.
Most significant digit is zero blanked.
Displays dashes whenever DME goes into search or when calculated value exceeds 99 minutes.

b. RNV APR and RNV ENR Modes

Displays time to the active waypoint.
0 to 99 minutes in 1 minute steps.
Most significant digit is zero blanked.
Displays dashes if DME is in search, if VOR flags, if DME and VOR are tuned to different frequencies, or if calculated value exceeds 99 minutes.

3.3.2.5 FRQ, RAD, DST Display

a. FRQ Mode

Displays frequency from 108.00 to 117.95MHz.
1MHz digit overflows into (or underflows from) 10MHz digit.
Rolls over from 117 to 108 or vice versa.
Least significant digit displays only zero or five.

b. RAD Mode

Displays ground station radial on which the waypoint is located from 0.0 to 359.9 degrees.
The two most significant digits are zero blanked.
10 degree digit overflows into (or underflows) from 100 degree digit.

c. DST Mode

Displays the distance offset of the waypoint from the ground station over range of 0.0 to 199.9NM.
The two most significant digits are zero blanked.
10NM digit overflows into (or underflows from) 100NM digit.
The two most significant digits roll over from 190 to 0NM and vice versa.

3.3.2.6 USE Display

Displays waypoint number of data actually being used by system.
In VOR MODES only the frequency has meaning.
Range 1 to 4.
When changed always takes on new value equal to DSP value.

3.3.2.7 DSP Display

Displays waypoint number of data being displayed.
Range 1 to 4.
When changed increments by 1.
Rolls over at 4 and blinks when not equal to USE value.

3.3.2.8 PAR, VOR, ENR, APR, RNV Displays

System status lights.

3.3.2.9 HLD Display

Indicates when the frequency to which the DME is actually tuned is different that the frequency to which the VOR is actually tuned.

3.3.2.10 Course Deviation

Located on remote indicator. When flagged, the needle centers.

a. VOR Mode

Full scale sensitivity equals $\pm 10^{o}$.

b. VOR PAR Mode

Full scale sensitivity equals ±5NM.
Flagged if VOR or DME data is invalid, or if VOR and DME tuned to different channels.

c. RNV ENR Mode

Full scale sensitivity equals ±5NM.
Flagged if VOR or DME data is invalid, or if the VOR and DME are tuned to different channels.
Full scale sensitivity equals ±1.25NM.
Flagged if the VOR or DME data is invalid, or if the VOR and DME are tuned to different channels.

d. ILS Mode

Full scale sensitivity equals 3 to 6 degrees (depending upon ground facility).
Flagged if localizer data is invalid.

3.3.3 CONTROLS

3.3.3.1 VOR Button

Momentary pushbutton.
When pushed while system is in either RNV mode causes system to go to VOR mode.
When pushed while system is in either VOR mode causes system to toggle between VOR and VOR PAR modes.

3.3.3.2 RNAV Button

Momentary pushbutton.
When pushed while system is in either VOR mode causes system to go to RNV/ENR mode.
When pushed while system is in either RNV mode causes system to toggle between RNV ENR and RNV APR modes.

3.3.3.3 HOLD Button

Two position pushbutton.
When in depressed position inhibits DME from channeling to new frequency.

3.3.3.4 USE Button

Momentary pushbutton.
Causes active waypoint to take on same value as displayed waypoint and data display to go to FRQ mode.

3.3.3.5 DSP Button

Momentary pushbutton.
Causes displayed waypoint to increment by 1 and data display to go to FRQ mode.

3.3.3.6 DATA Button

Momentary pushbutton.
Causes waypoint data display to change from FRQ to RAD to DST and back to FRQ.

3.3.3.7 OFF/ON/Ident Control

a. Power OFF-ON/Volume Function

Rotate clockwise for power ON.

b. VOR Audio Level Control

Rotate clockwise for increased audio level.

c. VOR IDENT Mute Function

Push-Pull switch.
Enables the VOR Ident tone to be heard in out position.

3.3.3.8 Data Input Control

Dual concentric knobs. Center knob has "in" and "out" positions.

a. Frequency Data

Outer knob varies 1MHz digit.
A carry occurs from units to tens position.
Rollover occurs from 117 to 108.
Center knob varies frequency in 50KHz steps.

b. Radial Data

Outer knob varies 10 degree digit.
A carry occurs from the tens to hundreds position.
A rollover to zero occurs at 360 degrees.
Center knob "in" position varies 1 degree digit.
Center knob "out" position varies 0.1 degree digit.

c. Distance Data

Outer knob varies 10NM digit.
A carry occurs from the tens to hundreds place.
A rollover to zero occurs at 200NM.
Center knob "in" position varies 1NM digit.
Center knob "out" position varies 0.1NM digit.

3.3.3.9 Course Select Knob

Located in remote unit.
Selects desired course through the VOR ground station or waypoint.

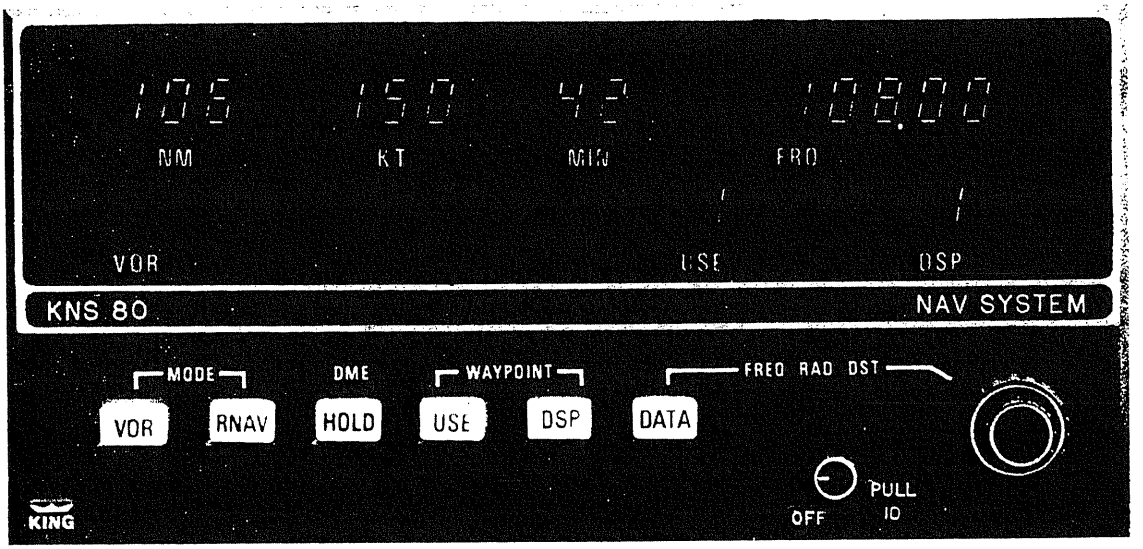


FIGURE 3-1 KNS 80 INTEGRATED NAVIGATION SYSTEM (VOR/DME/RNAV/ILS)