



## **INSTALLATION MANUAL**

***BENDIX/KING®***

***KLN 89/89B***

***GPS RNAV***

**MANUAL NUMBER 006-10522-0003**

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ENVIRONMENTAL QUALIFICATION FORMS

## SECTION I GENERAL INFORMATION

### 1.1 INTRODUCTION

This manual contains information relative to the physical, mechanical, and electrical characteristics of the BENDIX/KING KLN 89/89B Global Positioning System (GPS) Receiver. General installation procedures are also included.

### 1.2 EQUIPMENT DESCRIPTION

The KLN 89/89B are panel mounted, long range, GPS based airborne navigation systems with a data base. The KLN 89 is a VFR only device while the KLN 89B provides VFR, IFR enroute, and IFR non-precision approach functions. The primary purpose of the equipment is to provide the pilot with present position information and to display guidance information with respect to a flight plan defined by the pilot. Flight plan information is entered by the pilot via various knobs and buttons on the front panel.

The unit can use its present position information to determine crosstrack error, distance-to-waypoint, ground speed, track angle, time to waypoint, bearing to waypoint, and advisory VNAV guidance. The internal data base of the KLN 89/89B contains information concerning airports, VORs, NDBs, intersections, SIDs/STARs, and outer markers throughout the world. Waypoints are stored in the data base by their ICAO identifiers. The ICAO identifiers are in most cases taken directly from Jeppesen Sanderson or government aeronautical charts. The KLN 89B has instrument approach capabilities.

The information stored in the data base eventually becomes out of date; therefore, to provide a means of updating the information, the database is housed in a data card which plugs into the front of the KLN 89/89B. It is designed so that the user may easily remove the old database and install a current database. A secondary method of updating the database is by loading the information via an IBM compatible laptop computer. For more information on availability and cost of updating the database of the KLN 89/89B refer to the KLN 89/89B Pilots Guide P/N 006-08786-0000.

### 1.3 TECHNICAL CHARACTERISTICS

#### 1.3.1 UNIT TECHNICAL CHARACTERISTICS

##### KLN 89/89B

TSO Compliance:	SEE TSO APPENDIX
Physical Dimensions:	Refer to KLN 89/89B installation drawing, figure 2-3
Mounting:	Panel mounted with AlliedSignal supplied mounting rack
Cooling Requirements:	4 CFM (cubic feet per minute) provided by blower motor such as KA 33 or equivalent

#### OPERATIONAL CHARACTERISTICS:

Temperature Range:	-40° C to +55° C
Altitude Range:	Up to 35,000 FT

Power Inputs:	11 to 33 VDC at 3.0 A MAX (-40° C to +55° C) 13.75 VDC @ 2.5 A Nominal 27.5 VDC @ 1.25 A Nominal
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Panel Lighting Current Requirements:

28 VDC Lighting:	110 mA max
14 VDC Lighting:	220 mA max

**SIGNAL INPUTS:**

<u>GPS DISPLAYED:</u>	OPEN = GPS displayed (when an indicator resolver is connected to the OBS resolver inputs) GND = GPS not displayed (when an indicator resolver is not connected)
<u>TAKE HOME:</u>	OPEN = Normal Operation GND = Take Home Mode
<u>SPARE IN 0:</u>	These are reserved pins for future use.
<u>SPARE IN 1:</u>	
<u>SPARE IN 2:</u>	
<u>SPARE IN 3:</u>	
<u>SPARE IN 4:</u>	
<u>TEST:</u>	OPEN = normal operation GND = test mode
<u>APPROACH ARM IN:</u>	This pin is normally open with a momentary low while the panel button is pressed
<u>DATA LOADER RS 232 IN:</u>	The Data Loader RS 232 input is designed to communicate with the dataloader
<u>GENERAL RS 232 IN:</u>	This RS 232 input is designed to communicate with devices, i.e. air data and fuel flow sensors via RS 232 format (refer to RS 232 format definitions appendix)
<u>SPARE RS 232 IN:</u>	This RS 232 input is reserved for future use.
<b>Gray Code Inputs:</b> (A1,A2,A4,B1,B2,B4,C1,C2,C4,D4)	Gray Code Altitude Signals (0 V. to 28 V.) These inputs are diode isolated inside the KLN 89/89B
<u>OBS SIN:</u>	OBS resolver sine, nominal input impedance = 33.8 K ohms (ac) and 100 K ohms (dc)
<u>OBS COS:</u>	OBS resolver cosine, nominal input impedance = 33.8 K ohms (ac) and 100 K ohms (dc)
<u>A/C POWER MONITOR</u>	This pin senses the aircraft power bus voltage. This high impedance input operates from 0 to 33 V with accuracy of 0.1 V
<u>CONFIGURATION MODULE</u>	Refer to section 2.3.6.2
<b>SIGNAL OUTPUTS:</b>	
<u>OBI SYNC, OBI CLOCK, &amp; OBI DATA:</u>	AlliedSignal Serial Data containing bearing to the active waypoint



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DATA LOADER RS 232 OUT:	The Data Loader RS 232 output is designed to communicate with an IBM compatible personal computer
GENERAL RS 232 OUT:	The RS232 output is designed to interface with certain ARNAV ELTs and certain moving map displays, and Shadin fuel flow systems (refer to RS 232 format definitions appendix)
SPARE RS 232 OUT:	This RS 232 output is reserved for future use
<u>WAYPOINT ANNUNCIATE:</u>	OPEN = Inactive LOW = Active (Output can sink up to 250 mA)
<u>MESSAGE ANNUNCIATE:</u>	OPEN = Inactive LOW = Active (Output can sink up to 250 mA)
<u>APPROACH ACTIVE ANNUNCIATE:</u>	OPEN = Inactive LOW = Active (Output can sink up to 250 mA)
<u>APPROACH ARM ANNUNCIATE:</u>	OPEN = Inactive LOW = Active (Output can sink up to 250 mA)
<u>SPARE ANNUNCIATE 1:</u>	Spare annunciators are reserved for future use
<u>SPARE ANNUNCIATE 2:</u>	
<u>SPARE ANNUNCIATE 3:</u>	
<u>SPARE ANNUNCIATE 4:</u>	
<u>FCS LOC ENG:</u>	OPEN = Inactive LOW = Active (Output can sink up to 250 mA)
LATERAL DEV FLAG +:	Valid: 350 to 900 mV (high) Flag in view: $\leq$ 50 mV (low) Output is capable of driving five 1k ohms parallel loads
LATERAL DEV FLAG -:	
VERTICAL DEV FLAG +:	Reserved for future use
VERTICAL DEV FLAG -:	
LATERAL SUPERFLAG:	Valid = $\geq$ 18 V in 28 VDC aircraft installations; $\geq$ 10 V in 14 VDC aircraft installations. Invalid = $\leq$ 3.5 V in all installations while sinking 1 mA Output can source at least 250 mA
VERTICAL SUPERFLAG:	Reserved for future use
LATERAL DEV +L:	These outputs are differential pairs (+L and +UP are positive). Output range is $\pm$ 300 mV and is capable of driving five 1k ohms parallel loads.
LATERAL DEV +R:	
VERTICAL DEV +UP:	Reserved for future use
VERTICAL DEV +DOWN:	
OBS OUT:	Used to excite the OBS resolver rotor. Nominal output frequency = 450 Hz. Nominal unloaded peak amplitude = 6 V. Output drive capability = 40 mA

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**+TO/+FROM Flag Outputs:**

To Indication:

+100 to +900 mV on +TO with respect to +FROM when desired course is within  $\pm 85^\circ$  of the bearing to the active waypoint.

From Indication:

-100 to -900 mV on +TO with respect to +FROM when desired course is within  $180 \pm 85^\circ$  with respect to the bearing to the active waypoint. Outputs are capable of driving up to five 200  $\Omega$  parallel loads

**ALTITUDE ALERT ANNUNCIATE:**

HIGH = Inactive

LOW = Active (can sink up to 250 mA).

**ALT ALERT AUDIO:**

This output is active whenever ALTITUDE ALERT ANNUNCIATE is active, Signal is 1 KHz., 3.5 V rms max into 500  $\Omega$  Refer to paragraph 2.4.4.9 for the procedure to adjust the volume.

**KA 91 ANTENNA**

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TSO Compliance:	SEE TSO APPENDIX
Physical Dimensions:	Refer to KA 91 installation drawing, figure 2-5.
Airspeed Rating:	600 Kts. TAS
Output Impedance:	50 Ohms (nominal)
DC Voltage:	5 Volts $\pm 0.5$ Volt
DC Current:	50 mA maximum

**KA 92 ANTENNA**

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TSO Compliance:	SEE TSO APPENDIX
Physical Dimensions:	Refer to KA 92 installation drawing, figure 2-8.
Airspeed Rating:	600 Kts. TAS
Output Impedance:	50 Ohms (nominal)
DC Voltage:	5 Volts $\pm 0.5$ Volt
DC Current:	50 mA maximum

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**KA 198 COMM FILTER**  
**(P/N 071-01565-0000)**

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Center Notch Frequency:	1575.42 MHz.
Attenuation at 1575.42 ±1.5 MHz:	35 dB min.
Insertion loss from 118.00 to 137.00 MHz:	.3dB Max.
Impedance from 118.00 to 137.00 MHz:	50 ohms
VSWR from 118.00 to 137.00 MHz:	1.5:1

**NOTE**

The conditions and tests performed on this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within these performance standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

## 1.4 UNITS AND ACCESSORIES SUPPLIED

### 1.4.1 KLN 89/89B GPS RECEIVER

The KLN 89/89B is available in the following versions:

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PART NUMBER	14V/28V LAMPS	BLACK BEZEL	CERTIFICATION	VERSION
066-01148-0101	X	X	VFR/IFR	KLN 89B
066-01148-0102	X	X	VFR/IFR (BRNAV)	KLN 89B
066-01148-1111	X	X	VFR ONLY	KLN 89
066-01148-1112	X	X	VFR ONLY (BRNAV)	KLN 89

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### 1.4.2 GPS ANTENNA

The KA 91 antenna is available by ordering P/N 071-01545-0200. The KA 92 antenna is available by ordering P/N 071-01553-0200.

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**1.4.3 KLN 89/89B INSTALLATION KITS**

The KLN 89/89B Installation Kit (P/N 050-03321-0000) is available with crimp connectors only. A list of the required crimp tools and insertion/ extraction tools can be found in Section 2 of this manual. The kit and a complete list of the items contained in the kit is given below.

P/N	DESCRIPTION	UM	-0000	VENDOR NAME & P/N
050-03321-0000	KLN 89/89B INSTALL-CRIMP		X	
030-00101-0002	PANEL MOUNT PLUG	EA	1	TED Mfg. 9-30-10
030-01157-0011	SOCKET CRMP 20G	EA	62	Positronic FC6020D-14
030-03271-0000	CONN SUB-D 37P SKT	RF	1	
030-03272-0000	CONN SUB-D 25P SKT	RF	1	
033-00230-0000	TELEPHONE JACK	EA	1	
047-05959-0002	STRAIN RELIEF W/H	EA	2	
047-05960-0001	STRAIN RELIEF W/F	EA	2	
057-05621-0000	DATA LOADER DECAL	EA	1	
057-05628-0000	DISCLAIMER TAG	EA	1	
073-00629-0002	CONNECT,MTG BRACKET	EA	1	
089-02353-0001	NUT CLIP 6-32	EA	6	
089-05903-0004	SCR PHP 4-40X1/4	EA	8	
089-05903-0007	SCR PHP 4-40X7/16	EA	2	
089-05907-0004	SCR PHP 6-32X1/4	EA	4	
089-06012-0006	SCR FHP 6-32X3/8	EA	6	
089-08252-0030	WASHER	EA	1	
090-00019-0007	RING RTNR .438	EA	1	
187-01352-0000	GASKET	EA	1	
200-08334-0000	CONFIG MODULE	EA	1	

**1.4.4 KA 91/92 INSTALLATION KIT**

THE KA 91 INSTALLATION KIT (P/N 050-03195-0000), INCLUDING ITS CONTENTS, IS SHOWN BELOW.

P/N	DESCRIPTION	UM	-0000	VENDOR NAME & P/N
050-03195-0000	KA91 INSTALL		X	
030-00134-0001	RIGHT ANGLE CONN COAX	EA	1	TED MFG 5-30-102
047-10130-0002	BACKPLATE, ANTENNA	EA	1	
089-06908-0012	SCREW, AIRCRAFT	EA	4	
187-01807-0000	KA 91 GASKET	EA	1	

Earlier installation kits included a straight TNC coax connector, P/N 030-00134-0000.

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The KA 92 Installation Kit (P/N 050-03318-0000), including its contents, is shown below.

P/N	DESCRIPTION	UM	-0000	VENDOR NAME & P/N
050-03318-0000	KA92 INSTALL		X	
030-00134-0001	RIGHT ANGLE CONN COAX	EA	1	TED MFG 5-30-102
047-10735-0002	BACKPLATE, ANTENNA	EA	1	
089-05909-0012	SCREW, PHP 8-32x3/4	EA	4	
187-01831-0000	KA 92 GASKET	EA	1	

#### 1.4.5 DATABASE

The KLN 89/89B database cartridge and diskettes are available for three separate geographic areas. Database cartridges are available only for users in the United States Of America and Canada. Diskettes are available to all users. Also database files can be dowloaded via the Internet at the following address:

<http://www.gpsdatabase.com>

	CARTRIDGE	DISKETTE
Atlantic International Database	071-00094-0101	223-08500-0000
Pacific International Database	071-00094-0102	223-08600-0000
Americas Database	071-00094-0103	223-08700-0000

### 1.5 ACCESSORIES REQUIRED, BUT NOT SUPPLIED

#### A. Forced Air Cooling

A KA 33 Cooling Kit or equivalent is required for the KLN 89/89B installation.

1. KA 33 Blower for 14 VDC installations is available under P/N 071-4037-00.
2. KA 33 Blower for 28 VDC installations is available under P/N 071-4037-01.
3. The installation kit for the KA 33 Blower is available under P/N 050-02204-0000.

#### B. Indicators and HSIs

An indicator, CDI or HSI, is required for IFR. Listed below are common AlliedSignal models that are available.

1. KI 202 or KI 206 (P/N 066-3034-XX) Navigation Indicator and installation kit (P/N 050-01524-0000).
2. KI 208A or KI 209A (P/N 066-3056-XX) Navigation Indicator and installation kit (P/N 050-01524-0000).
3. KPI 553A (P/N 066-3045-XX) Horizontal Situation Indicator and installation kit (P/N 050-01791-XXXX).
4. KPI 553B (P/N 066-3069-XX) Horizontal Situation Indicator and installation kit (P/N 050-02167-XXXX).

#### NOTE

The KPI 553A/553B DME distance display is not compatible with the KLN 89/89B.

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5. KI 525A (P/N 066-3046-XX) Horizontal Situation Indicator and installation kit (P/N 050-01344-XXXX).

C. CDI Indicator with "MSG" and "WPT" Annunciators.

Some standalone CDI indicators are available with WPT/MSG annunciators built in. One commonly used is the Model MD40-39, manufactured by Midcontinent Instrument, telephone (316) 683-5619. These devices have no resolver interface. The use of an OBS resolver will reduce pilot workload.

## 1.6 OPTIONAL ACCESSORIES

A. PC Interface Kit

To load the database from a personal computer via diskettes, order interface kit P/N 050-03213-0000. The kit contains a ready to use cable which connects between the aircraft connector and the computer's 9 pin or 25 pin serial connector. The kit is necessary whether the user is loading from an AlliedSignal diskette or a database obtained via the INTERNET.

The database may be loaded directly from the PC to the KLN 89/89B installed in an aircraft (refer to section 2.4.4.8 and Figure 2-18 for details).

Laptop computers used to load the data base require the following:

1. IBM compatibility
2. An available Com 1,2,3, or Com 4 serial port

### NOTE

If loading the database from a diskette sent from AlliedSignal then the PC must have a 3.5" high density diskette drive. Also a few select BIOS services are incompatible with the AlliedSignal diskettes. If there is uncertainty relating to this, contact AlliedSignal Product Services by telephoning (913) 782-0600.

B. Annunciators and Switch/Annunciators

(Refer to I.B. 363 for additional information pertaining to switch/annunciators for GPS systems)

The devices shown below are Eaton 582/584 series switch/annunciators and are representative of those used in our original certification. They were chosen because of their excellent sunlight readable characteristics and meet or exceed the requirements of Advisory Circular 20-138. These are high quality devices and we encourage their use. However, there are other comparable devices on the market that may be substituted at the installer/customers choice.

These switch/annunciators are available through AlliedSignal Service Stock or direct from our supplier, LCOMP Inc. It is advantageous to order direct from LCOMP, if possible, in order to avoid additional price mark-ups. On international orders, it may be necessary to order through AlliedSignal as LCOMP, at the time of this publication, is not prepared to handle international orders. LCOMP's address and telephone numbers are listed as follows:

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LCOMP Aerospace Controls  
c/o Carlton-Bates Co.  
9214 Bond St.  
Overland Park, KS 66214

Telephone:  
(800) 786-0617  
(913) 438-4848  
(913) 438-4839 Fax

**NOTE**

The switch/annunciators listed below in many cases show two numbers. The part numbers that are shown in parentheses are devices previously called out and may be used until supply is depleted. The 031-00785-XXXX are the preferred Switch/Annunciator assemblies.

**KLN 89/89B Enroute/Terminal Set for CDI or Elect. Mech. HSI Installations**

The following switch/annunciators are being offered for CDI or HSI switching and annunciation in the KLN 89B IFR enroute/terminal installations. They are optional for KLN 89/89B VFR installations.

KLN 89/89B Ann. Set	(28 V. Itg.)
NAV/GPS Sw. Ann.	031-00785-0711 or (031-00763-0711)
WPT/MSG Ann.	031-00785-0505 or (031-00763-0505/-0718)

KLN 89/89B Ann. Set	(14 V. Itg.)
NAV/GPS Sw. Ann.	031-00785-0712 or (031-00763-0712)
WPT/MSG Ann.	031-00785-0762 or (031-00763-0762/-0719)

**KLN 89B Approach Set for CDI or Elect. Mech. HSI Installations**

The following switch/annunciators are being offered for CDI or HSI switching, APR switching, and annunciation in KLN 89/89B non-precision approach installations.

KLN 89B Ann. Set	(28 V. Itg.)
NAV/GPS Sw. Ann.	031-00785-0711 or (031-00763- 0711)
WPT/MSG Ann.	031-00785-0505 or (031-00763- 0505/-0718)

GPS APR ARM/ACT  
Sw. Ann. 031-00785-0766

KLN 89B Ann. Set	(14 V. Itg.)
NAV/GPS Sw. Ann.	031-00785-0712 or (031-00763- 0712)
WPT/MSG Ann.	031-00785-0762 or (031-00763- 0762/-0719)

GPS APR ARM/ACT  
Sw. Ann. 031-00785-0767

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**NAV/GPS Switch/Annunciator**

Installations where the outputs from KLN 89/89B and an existing navigation system are switched between a common indicator or HSI may require some type of annunciation. A NAV/GPS switch/annunciator is available that provides both the annunciation and a switch contact to energize the switching relay(s) required for the switching of the outputs. This Switch/Annunciator is available in 5 V, 14 V, or 28 V versions as shown below.

LIGHTING	ALLIEDSIGNAL P/N	ALLIEDSIGNAL P/N
28 V	031-00763-0711	031-00785-0711
14 V	031-00763-0712 (Eaton Series 584) Old Style	031-00785-0712 (Eaton Series 582) Preferred

**WPT/MSG Remote Annunciators**

**TWO FIELD ANNUNCIATORS (WPT/MSG)**

LIGHTING	ALLIEDSIGNAL P/N	ALLIEDSIGNAL P/N
28 V	031-00763-0505	031-00785-0505
14 V	031-00763-0506 (Eaton Series 584) Old Style	031-00785-0506 (Eaton Series 582) Preferred

**NOTE**

(WPT) AND (MSG) will be in amber color. These annunciators will be deadface and readable only when lit.

**GPS APR, ARM/ACTV Switch/Annunciator**

A switch/annunciator can be used for arming or activating the approach mode. It will provide remote annunciation of ARM and ACTV and provide a momentary switch function to arm, disarm, or deactivate the Approach Mode and change the CDI scale factors. The KLN 89B requires an annunciator to display when approach is armed or active.

LIGHTING	ALLIEDSIGNAL P/N
28V	031-00785-0766
14V	031-00785-0767 (Eaton Series 582)

**C. NAV/GPS Switching**

Installations in which the outputs from a KLN 89/89B and an existing navigation system are being switched onto a common indicator will require some remote relay switching that is controlled by the NAV/GPS switch/annunciator.



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D. Right Angle Connector

The part number for a right angle connector for the KA 91 or KA 92 antenna connection is 030-00134-0001. This right angle connector was originally an option but has been included in the installation kit as the standard connector.

## 1.7 LICENSE REQUIREMENTS

None.

## 1.8 RECOMMENDATIONS FOR IFR APPROVAL

1. Aircraft Logbook Entry
2. Aircraft Installation Requirements

### NOTE

For the following subsections, refer to sections 1.5 and 1.6 for allowable configurations where applicable. Refer to section II for illustrations.

• TSO'd Antenna

The antenna must be a TSO'd KA 91, P/N 071-01545-0200 or KA 92 P/N 071-01553-0200. If the P/N of the KA 91 is not available, it may be identified by the serial number as the TSO'd antennas have a five digit serial number.

• Nav Instrumentation

The navigation information (D-Bar, Nav Flag, and To-From) must be displayed on an instrument in the pilot's panel.

Electromechanical indicators are capable of displaying the variable scale factors of enroute, terminal, and approach modes.

• OBS Interface

The use of an OBS resolver will reduce pilot workload during an instrument approach. It allows the OBS setting to be changed on the navigation indicator when the KLN 89/89B is operating in the OBS mode. Without the OBS resolver connection, the OBS may be changed from the KLN89/89B controls. OBS mode is commonly used during procedure turns and holding patterns.

Some certification agencies may require the use of the OBS resolver for approach certification. Consult your approval agency for additional information. Refer to sections 1.3 and 2.3.6 for additional OBS information.

• Switch/Annunciators:

NAV/GPS (Switch/Annunciator)

If the navigation information is displayed on a shared primary indicator a switch/annunciator will be required to select and annunciate the source.

WPT/MSG (Annunciator)

The required annunciators are "WPT" and "MSG" only. Even though the information is available on the KLN 89/89B display, a remote annunciator is also required in the pilots panel.

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**GPS APR, ARM/ACT (Switch/Annunciator)**

A switch/annunciator can be used for arming, disarming, or deactivating the approach mode. It will provide remote annunciation of ARM and ACTV and provide a momentary switch function to arm and activate the Approach Mode and change the CDI scale factors. The KLN 89B requires an annunciator to display when approach is armed or active.

Refer to section 1.6 for additional switch/annunciator information.

**Altitude Source**

An altitude source is required for IFR certification. The altitude may be derived from a compatible encoding altimeter, and some RS 232 air data systems.

**3. Approved Airplane Flight Manual Supplement**

A flight manual supplement will need to be prepared and approved. The supplement may be prepared based on the sample, P/N 006-00839-0000. Refer to the flight manual supplement procedures appendix for information on preparing a flight manual supplement and a copy of the STC approval.

**4. Pilot's Guide**

The KLN 89/89B pilots' guide must be placed in the aircraft in a location that is accessible to the pilot. The pilot's guide is P/N 006-08786-0000 and the quick reference is P/N 006-08787-0000.

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## 1.9 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

The instructions for continued airworthiness given in the TC or STC approvals for this product supplements or supercedes the instructions for continued airworthiness in this manual.

Most AlliedSignal products are designed and manufactured to allow "on condition maintenance." On condition maintenance is described as follows; There are no periodic service requirements necessary to maintain continued airworthiness. No maintenance is required until the equipment does not properly perform it's intended function. When service is required, a complete performance test should be accomplished following any repair action. Consult the appropriate unit Maintenance/Overhaul Manual for complete performance test information.

## **SECTION II INSTALLATION**

### **2.1 GENERAL INFORMATION**

This section contains general suggestions and information to consider before installation of the KLN 89/89B GPS RNAV. Close adherence to these suggestions will assure optimum performance from the equipment.

#### **NOTE**

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

### **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 AVIONICS COOLING REQUIREMENTS FOR PANEL MOUNTED EQUIPMENT**

The greatest single contributor to increased reliability of all modern day avionics is to limit the maximum operating temperature of the individual units whether panel mounted or remote mounted. While modern day individual circuit designs consume much less electrical energy, watts per cubic inch dissipated within the avionics unit remains much the same due to the high density packaging techniques utilized. Consequently, the importance of providing cooling to the avionics stack is still with us today.

While each individual unit may or may not require forced air cooling, the combined heat load of several units operating in a typical avionics location will significantly degrade the reliability of the avionics if provisions for cooling are not incorporated in the initial installation. Failure to provide cooling to the equipment will lead to increased avionics maintenance costs and may also void the AlliedSignal warranty.

In the case of the KLN 89/89B, installation of a KA 33, (P/N 071-4037-XX), or equivalent cooling system is required. Ram air cooling is not acceptable. For installation information on the KA 33 refer to the KA 33 installation manual, P/N 006-01069-XXXX or Installation Bulletin 258.

#### **2.3.2 KLN 89/89B MECHANICAL INSTALLATION**

The KLN 89/89B installation will conform to standards designated by the customer, installing agency, and existing conditions as to the unit location and type of installation. However, the following suggestions will assure a more satisfactory performance from the equipment.

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A. Plan a location on the aircraft panel so that the KLN 89/89B is plainly visible to the pilot and so that he has complete access to all front panel controls. Check to be sure that there is adequate depth behind the panel for the mounting rack and all the connectors and cabling. Be sure that the mounting location is not close to heater vents or other sources of high heat.

B. Refer to figure 2-3 for the panel cutout dimensions. Mark and cut the panel opening.

**2.3.3 ANTENNA SELECTION**

The KA 91 and KA 92 GPS active antennas, P/N 071-01545-0200 and 071-01553-0200 respectively, are the designated antennas for the KLN 89/89B.

**2.3.4 ANTENNA INSTALLATION CONSIDERATIONS**

The antenna should be mounted on top of the fuselage near the cockpit. Avoid mounting the antenna near any projections, the propeller, and the T-tail of the aircraft, where shadows could occur. It is recommended that there be a separation of at least 3 ft between the KLN 89/89B GPS antenna and any VHF Comm antenna on the aircraft. Antenna baseplate must be level within  $\pm 5^\circ$  in both axes when the aircraft is in level flight. If the antenna is tilted more than  $5^\circ$  or is mounted close to other objects that shadow it, loss of some of the satellites will occur and system performance may be degraded. Antenna cable and connector information, including vendor information, is listed below. Refer to figure 2-10 (TNC) and figure 2-11 (BMA) for cable/connector assembly instructions for the 0 to 40 feet category using RG 400/U or RG 142B/U. Refer to figure 2-12 (for both TNC and BMA) for the 0 to 80 feet and 0 to 100 feet categories.

**NOTE**

KA 91/92 nominal gain and noise figures are 26.5 dB and 2.3 dB respectively. With 0.050 ice on radome, gain will not decrease by more than 2.0 dB when viewing a satellite from  $30^\circ$  above the horizon to zenith, as compared to a no ice condition.

CABLE LENGTH	CABLE PART NUMBER	BMA CONNECTOR	TNC CONNECTOR	MAX. ALLOWABLE LOSS (dB)
0 to 40 ft.	P/N: 024-00002-0000	P/N: 030-00101-0002	P/N: 030-00134-0000	8.0
	VPN: RG142B/U	VPN: TED Mfg. 9-30-10	VPN: TED Mfg. 5-10-30	
	P/N: 024-00051-0060	P/N: 030-00101-0002	P/N: 030-00134-0000	
	VPN: RG400/U	VPN: TED Mfg. 9-30-10	VPN: TED Mfg. 5-10-30	
0 to 80 ft.	P/N: 024-00072-0000	P/N: 030-00452-0000	P/N: 030-00108-0002	8.0
	VPN: ECS 311601	VPN: TED Mfg. 9-30-26	VPN: TED Mfg. 5-10-307	
0 to 100 ft.	P/N: 024-00071-0000	P/N: 030-00452-0001	P/N: 030-00108-0003	8.0
	VPN: ECS 311201	VPN: TED Mfg. 9-30-25	VPN: TED Mfg. 5-10-306	

100 to 165 ft. Contact TED, ECS or PIC for complete cable/connector assembly.

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**NOTE**

A right angle antenna connector is available from AlliedSignal  
(P/N 030-00134-0001) or from TED.

TED Manufacturing Corp.  
11415 Johnson Drive  
Shawnee, Kansas 66203  
Tel: (913) 631-6211

Electronic Cable Specialists (ECS)  
11227 W. Forest Home Avenue  
Franklin, Wisconsin 53132  
Tel: (800) ECS-WIRE  
or (414) 421-5300

PIC Wire and Cable  
N63 W 22619 Main Street  
P.O. Box 330  
Sussex, Wisconsin 53089  
Tel: (800) 742-3191  
or (414) 246-0500

### 2.3.5 ANTENNA MECHANICAL INSTALLATION

#### 2.3.5.1 General

To maintain good performance from the antenna system, do not wax or paint the antenna.

#### 2.3.5.2 Installation Procedure

- A. Using the correct template for the antenna chosen, mark the mounting holes on the aircraft fuselage.
- B. Drill and/or punch the required holes.
- C. Use a piece of fine sandpaper or emery cloth to sand the area on the fuselage skin on which the doubler plate for the antenna is to be mounted and on the aircraft skin under where the antenna will be mounted.
- D. Apply Alumiprep No. 33, P/N 016-01127-0000, to both the inside and outside areas of the fuselage and to the back of the doubler plate. Follow the directions on the container to cleanse the metal of any left over residue.
- E. Apply Alodine, P/N 016-01128-0000, to both locations following the directions on the container. This is used to ensure good bonding of the antenna and to prevent oxidation.
- F. Refer to figure 2-5 for the KA 91 installation drawing or figure 2-8 for the KA 92 installation drawing and mount the antenna as shown. First rivet the doubler plate in place. It is imperative that the doubler plate make a good electrical bond with the inside of the aircraft skin and that the antenna itself be well bonded to the aircraft.
- G. When installing the KLN 89/89B antenna do not exceed 50 inch/lbs of torque on the antenna mounting screws.
- H. Apply a bead of sealant around the base of the antenna and seal the antenna mounting screw holes to prevent water damage.

### 2.3.6 ELECTRICAL INSTALLATION

#### 2.3.6.1 General Information

The KLN 89/89B will operate with an input voltage from 11 to 33 VDC, but the front panel lighting circuit must be wired for either +14 VDC or +28 VDC depending on the aircraft lighting bus. Refer to the KLN 89/89B interconnect diagram for wiring details.

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- A. The installing facility will supply and fabricate all external cables. The required connectors are supplied as part of the installation kit.
- B. The length and routing of the external cables must be carefully planned before attempting the actual installation. Avoid sharp bends or locating the cable near aircraft control cables.
- C. The KLN 89/89B and associated wiring must be kept at least a minimum of 3 ft. from high noise sources and not routed with cables from high power sources to insure optimum performance from the system.
- D. Do not route the antenna cable near any cable used for a transmitting antenna.  
Prior to installing the KLN 89/89B itself, a point to point continuity check of the wiring harness should be done to verify proper wiring. The aircraft power input to the unit should be made to insure that power is applied to only the specified power pin(s).

#### 2.3.6.2 Functional Pinout Descriptions

This section gives a brief description of some of the inputs and outputs of the KLN 89/89B. It is provided so the installer can determine what specific wiring needs to be done to the aircraft in which the unit is to be installed. Unless otherwise specified, pins not used are to be left open.

#### CONNECTOR P891

##### Pin 1; GENERAL RS 232 IN

Pin 1 is the RS 232 input. The KLN 89/89B must be configured correctly for the type of equipment (or no equipment) connected to this input. Refer to section 2.4.1 for the configuration procedure. It is not necessary to connect this input to the GENERAL RS 232 OUT when this input is not used as the "No Fuel Mgt Sys" and "No Air Data" configuration choices indicate this input is unused and inhibit the "No RS-232 Data" message. For specific label information, refer to RS 232 format definitions appendix.

##### Pin 2; GENERAL RS 232 OUT

The KLN 89/89B outputs data in RS 232 format on this pin. It can be used to interface with certain types of ELT's, fuel sensors, moving map displays, and fuel management systems. For specific label information, refer to RS 232 format definitions appendix.

##### Pin 3; DATA LOADER RS 232 IN

Pin 3 inputs Data Loader information in RS 232 format. It can be used to interface with a laptop IBM compatible PC to load the database.

##### Pin 4; DATA LOADER RS 232 OUT

Pin 4 outputs Data Loader information in RS 232 format. It can be used to interface with a laptop IBM compatible PC to load the database.

##### Pin 5; SPARE LOADER RS 232 IN

Pin 5 is a spare RS 232 input.

##### Pin 6; SPARE RS 232 OUT

Pin 6 is a spare RS 232 output.

##### Pin 7; OBI SYNC

##### Pin 8; OBI CLOCK

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Pin 9; OBI DATA

This is a three wire data bus that provides bearing to the active waypoint. The data is in AlliedSignal format and can be used to drive certain AlliedSignal RMI units. The output can also be converted by a AlliedSignal KDA 692 which provides standard 4-wire SINE/COSINE OBI information.

Pin 10; LATERAL DEV FLAG+

Pin 11; LATERAL DEV FLAG-

Pin 12; VERTICAL DEV FLAG+

Pin 13; VERTICAL DEV FLAG-

These are deviation flag outputs. DEV FLAG+ outputs with respect to DEV FLAG-. For the specifications on these outputs refer to section 1.3 of this manual.

Pin 14; A/C GROUND

Pin 14 is tied to aircraft ground. Wiring harness shields are not to be terminated on this pin. Refer to figure 2-17.

Pin 15; WAYPOINT ANNUNCIATE

Pin 15 is the Waypoint Alert annunciator output. This output is tied to a remote annunciator lamp. When the line is pulled low the annunciator lamp will illuminate. The annunciator will be on whenever waypoint alerting is occurring. For more complete information refer the KLN 89/89B Pilots Guide, P/N 006-08786-0000.

Pin 16; MESSAGE ANNUNCIATE

Pin 16 is the Message annunciator output. This output is tied to a remote annunciator lamp. When the line is pulled low the annunciator lamp will illuminate. The annunciator will be on whenever the message prompt on the KLN 89/89B is on. For more complete information refer to the KLN 89/89B Pilots Guide, P/N 006-08786-0000.

Pin 17; APPROACH ARM ANNUNCIATE

Pin 17 is the Approach Arm annunciator output. This output is tied to a remote annunciator lamp. When the line is pulled low the annunciator lamp will illuminate. The annunciator will be on whenever the unit is in the approach arm mode. For more complete information refer the KLN 89/89B Pilots Guide, P/N 006-08786-0000.

Pin 18; APPROACH ACTIVE ANNUNCIATE

Pin 18 is the Approach Active annunciator output. This output is tied to a remote annunciator lamp. When the line is pulled low the annunciator lamp will illuminate. The annunciator will be on whenever the unit is in the approach active mode. For more complete information refer the KLN 89/89B Pilots Guide, P/N 006-08786-0000.

Pin 19; ALTITUDE ALERT ANNUNCIATE

Pin 19 is the Altitude Alert output pin. The altitude alert feature can be enabled or disabled at installation time from the maintenance configuration pages as described in section 2.4.1 This feature is normally disabled if another altitude alerter (selector) is already installed in the aircraft. If altitude alerting is enabled, the pilot can choose to turn it on or off. If it is disabled, the pilot is not able to turn it on.

Pin 20; SPARE ANNUNCIATOR 1

Pin 21; SPARE ANNUNCIATOR 2

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Pin 22; SPARE ANNUNCIATOR 3

Pin 23; SPARE ANNUNCIATOR 4

These pins are spare annunciator outputs.

Pin 24; LIGHTING 28V/LO

Pin 25; LIGHTING 14V

The lighting bus will use the DC power input pin as lighting low. For 14 V operation, LIGHTING 28V/LO is connected to ground and LIGHTING 14V is connected to the 14 V panel lighting bus. For 28 V operation, LIGHTING 28V/LO is connected to the 28 V panel lighting bus and LIGHTING 14V is not connected.

### CONNECTOR P892

Pin 1; TEST

Pin 1, when grounded on power-up, will place the unit in the test mode. Once in the test mode, the unit will remain in that mode until power to the unit is turned off. Test mode is provided to assist in manufacturing and field service troubleshooting.

Pin 2; TAKE HOME

Pin 2, when grounded, places the KLN 89/89B in Take-Home mode which is used for trip planning and flight simulation. It performs as if it is receiving adequate GPS signals to determine its position. It displays the latitude and longitude of its last known position or of whatever position it is initialized to on the Setup Page. Pin 2 should always be left open in the aircraft installation. Take-Home mode must not be allowed during actual flight.

Pin 3; SPARE IN 1

Pin 4; SPARE IN 2

Pin 5; SPARE IN 3

Pin 6; SPARE IN 4

Pin 7; SPARE IN 0

These pins are spare inputs.

Pin 8; APPROACH ARM IN

Pin 8 is used as a select input. If the installation is not certified for approach, the external switch/annunciator is not needed. If the installation is approved for approach and the external switch/annunciator is installed, then a momentary ground on pin 8 will alternately arm or disarm the approach mode.

Pin 9; LATERAL SUPER FLAG

Pin 10; VERTICAL SUPER FLAG

On superflag outputs, a logic high shall be  $\geq 18$  VDC when the voltage at pin 19 is  $\geq 24.8$  VDC. A logic high shall be  $\geq 10$  VDC when the voltage at pin 19 is  $\geq 12.4$  VDC. A logic high shall be  $\geq 20$  VDC when the voltage at pin 19 is  $+ 27.5$  VDC.  
A logic low shall be  $\leq 3.5$  VDC.

Pin 11; LATERAL DEV +L

Pin 12; LATERAL DEV +R

Pin 13; VERTICAL DEV +UP



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Pin 14; VERTICAL DEV +DOWN

These are deviation outputs and function as differential pairs. For the specifications on these outputs refer to section 1.3 of this manual.

Pin 15; ALTITUDE ALERT AUDIO

Pin 16; ALTITUDE ALERT AUDIO LO

These pins represent the Altitude Alert Audio output which is active whenever ALTITUDE ALERT ANNUNCIATE is active.

Pin 17; FCS LOC ENG

This annunciator is active when the lateral deviation scale factor is 0.3 nm. It is also active while the scale is transitioning from 1.0 nm down to 0.3 nm.

Pin 18; A/C POWER MONITOR

Pin 18 is the aircraft power monitor. It senses voltages ranging from 0 to 33 V. The KLN89/89B can be configured to allow the selection of a voltage alert set point and a voltage alert delay interval for use with this input. Refer to section 2.4.1 for the configuration procedure. The "Low Bus Voltage, Check Charging System" message is displayed when voltage at this pin is below the voltage alert set point for greater than the voltage alert delay interval.

Pin 19; 11-33 VDC A/C POWER

Pin 19 is the DC aircraft power input. The KLN 89/89B will accept from 11 VDC to 33 VDC input power.

Pin 20; A/C GROUND

Pin 20 is tied to aircraft ground. Wiring harness shields are not to be terminated on this pin. Refer to figure 2-17.

Gray Code Inputs

Pin 21; D4

Pin 22; A1

Pin 23; A2

Pin 24; A4

Pin 25; B1

Pin 26; B2

Pin 27; B4

Pin 28; C1

Pin 29; C2

Pin 30; C4

These pins are gray code altitude inputs from an encoding altimeter. If the KLN 89/89B is paralleled with another unit such as a transponder, it may be necessary to install isolation diodes between one or both units and the encoder. The KLN 89/89B has diodes already installed internally.

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**Pin 31; GPS DISPLAYED**

This pin is used as an input to tell the unit whether an external indicator is connected to the analog OBS resolver inputs, in which case it will be high. This pin will be grounded if an indicator is not connected or coupled to the unit.

**Pin 32; +TO**

**Pin 33; +FROM**

These outputs function like the outputs from standard navigation converters. For the specifications on these outputs refer to section 1.3 of this manual.

**OBS Resolver Interface**

**Pin 34; OBS OUT**

**Pin 35; OBS SIN**

**Pin 36; OBS COS**

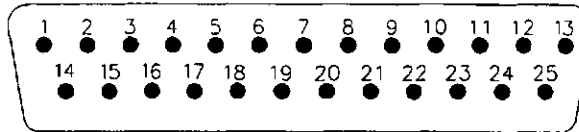
**Pin 37; OBS RETURN**

This interface is compatible with indicators that are electrically zeroed (EZ) at 300 degrees and indicators that are omni-ranged zero at 300 degrees. This interface will operate properly with either "0.85 gain" resolvers or "0.41 gain" resolvers with no special programming requirements. OBS Resolver Out is a 450 Hz output used to excite the resolver. The resolver output voltage is then received by the OBS Resolver sine and cosine inputs.

**CONFIGURATION MODULE**

The configuration module is a separate module from the main rear I/O connector. It is a serial EEPROM containing at least 16 bytes of capacity.

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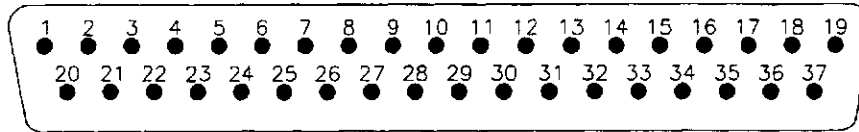
P891

1	← -----	GENERAL RS 232 IN
2	----- →	GENERAL RS 232 OUT
3	← -----	DATA LOADER RS 232 IN
4	----- →	DATA LOADER RS 232 OUT
5	← -----	SPARE RS 232 IN
6	----- →	SPARE RS 232 OUT
7	----- →	OBI SYNC
8	----- →	OBI CLOCK
9	----- →	OBI DATA
10	----- →	LATERAL DEV FLAG +
11	----- →	LATERAL DEV FLAG -
12	----- →	VERTICAL DEV FLAG +
13	----- →	VERTICAL DEV FLAG -
14	← -----	A/C GROUND
15	----- →	<u>WAYPOINT ANNUNCIATE</u>
16	----- →	<u>MESSAGE ANNUNCIATE</u>
17	----- →	<u>APPROACH ARM ANNUNCIATE</u>
18	----- →	<u>APPROACH ACTIVE ANNUNCIATE</u>
19	----- →	<u>ALTITUDE ALERT ANNUNCIATE</u>
20	----- →	<u>SPARE ANNUNCIATE 1</u>
21	----- →	<u>SPARE ANNUNCIATE 2</u>
22	----- →	<u>SPARE ANNUNCIATE 3</u>
23	----- →	<u>SPARE ANNUNCIATE 4</u>
24	← -----	LIGHTING 28V/LO
25	← -----	LIGHTING 14V

← INPUTS    OUTPUTS    →

**FIGURE 2-1 KLN 89/89B CONNECTOR PIN FUNCTIONS**  
(Pg. 1 of 3)

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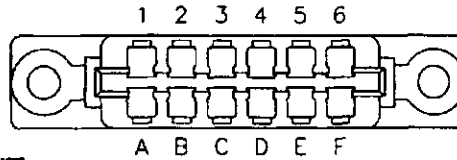
<b>P892</b>		
1	← -----	<u>TEST</u>
2	← -----	<u>TAKE HOME</u>
3	← -----	<u>SPARE IN 1</u>
4	← -----	<u>SPARE IN 2</u>
5	← -----	<u>SPARE IN 3</u>
6	← -----	<u>SPARE IN 4</u>
7	← -----	<u>SPARE IN 0</u>
8	← -----	<u>APPROACH ARM IN</u>
9	----- →	LATERAL SUPER FLAG
10	----- →	VERTICAL SUPER FLAG
11	----- →	LATERAL DEV +L
12	----- →	LATERAL DEV +R
13	----- →	VERTICAL DEV +UP
14	----- →	VERTICAL DEV +DOWN
15	----- →	ALTITUDE ALERT AUDIO
16	----- →	ALTITUDE ALERT AUDIO LO
17	----- →	FCS LOC ENG
18	← -----	A/C POWER MONITOR
19	← -----	11-33 VDC A/C POWER
20	← -----	A/C GROUND
21	← -----	D4
22	← -----	A1
23	← -----	A2
24	← -----	A4
25	← -----	B1
26	← -----	B2
27	← -----	B4
28	← -----	C1
29	← -----	C2
30	← -----	C4
31	← -----	GPS DISPLAYED
32	----- →	+TO
33	----- →	+FROM
34	----- →	OBS OUT
35	← -----	OBS SIN
36	← -----	OBS COS
37	----- →	OBS RETURN
	← INPUTS    OUTPUTS    →	

**FIGURE 2-1 KLN 89/89B CONNECTOR PIN FUNCTIONS**  
**(Pg. 2 of 3)**

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**GPS RNAV**

**PKT702 (Configuration Module Connector)**

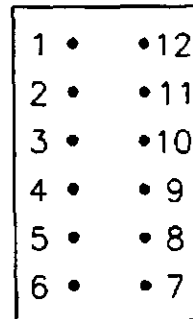
1	----->	EXT_EEPRM_CS
2	←-----	EXT_EEPRM
3	-----	N/C
4	----->	+5 V
5	-----	N/C
6	-----	N/C
A	----->	SERIAL_OUT
B	←-----	SERIAL_IN
C	←-----	SERIAL_CLK
D	-----	GROUND
E	-----	N/C
F	-----	N/C



← INPUTS    OUTPUTS    →

**P1011 (Software Programming Connector)**

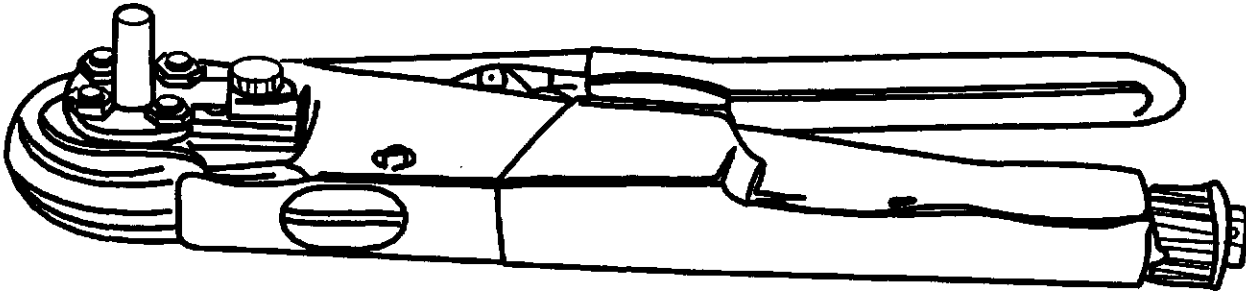
1	----->	VPP
2	----->	VCC
3	←-----	EXT_BOOT
4	----->	HRESET
5	←-----	HD(0)
6	←-----	BFWR
7	----->	BF_WR
8	----->	EXT_BOOT_EN
9	----->	VBAT
10	←-----	BOOT_VPP
11	-----	GROUND
12	←-----	FLASH_VPP



← INPUTS    OUTPUTS    →

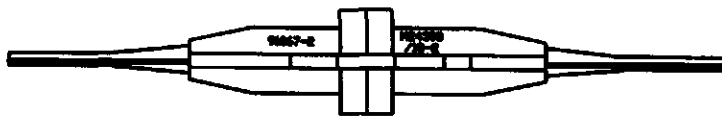
**FIGURE 2-1 KLN 89/89B CONNECTOR PIN FUNCTIONS**  
**(Pg. 3 of 3)**

**AlliedSignal**  
BENDIX/KING KLN 89/89B  
GPS RNAV



CRIMPING TOOL P/N: 005-02012-0021  
BUCHANAN P/N 612118  
POSITRONIC P/N: 9508

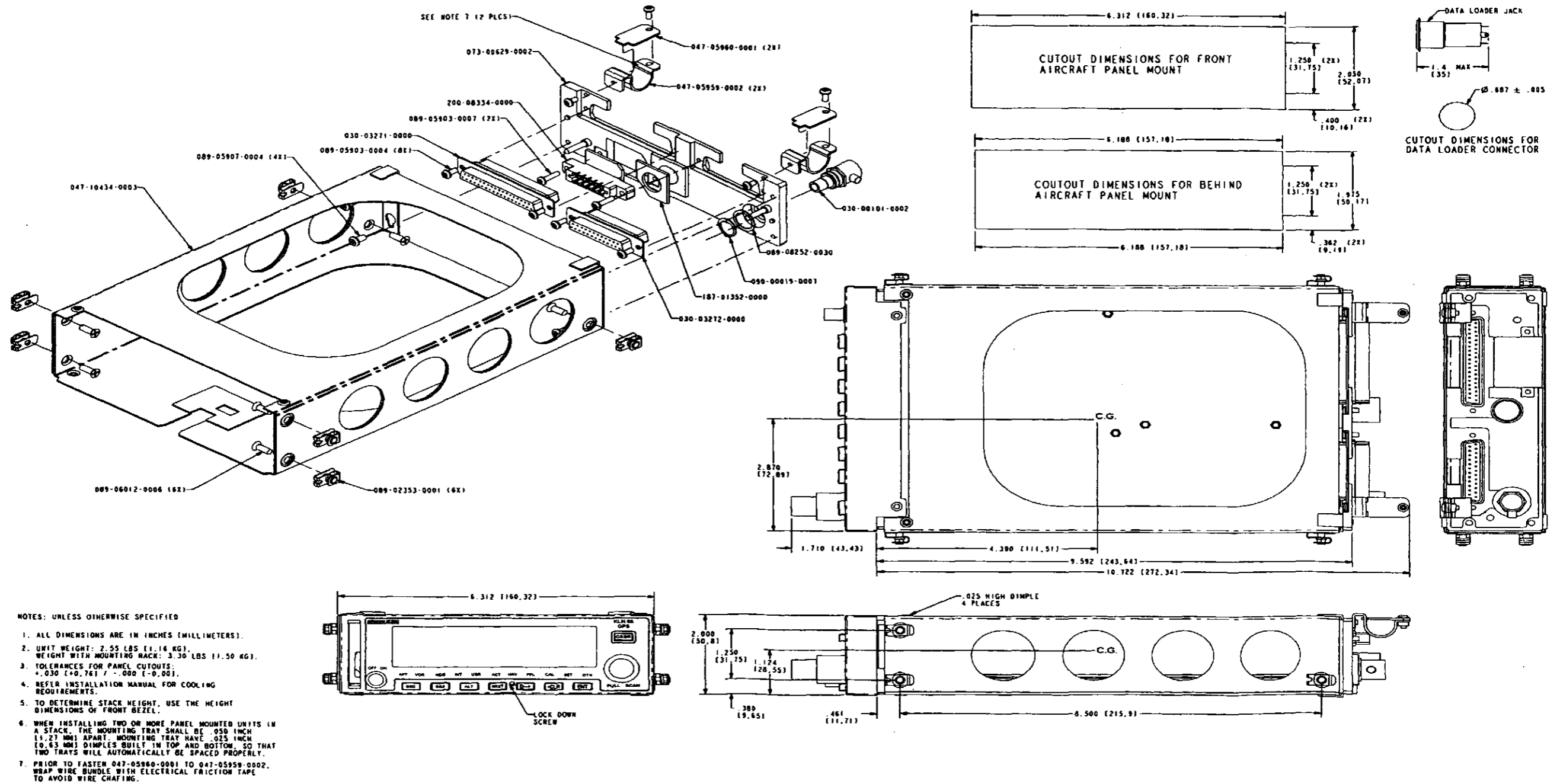
POSITIONER P/N: 005-02012-0023  
BUCHANAN P/N 612513  
POSITRONIC P/N: 9502-7



INSERTION/EXTRACTION TOOL P/N: 005-02012-0025  
AMP P/N 91067-2  
MIL SPEC P/N: M24308/18-12

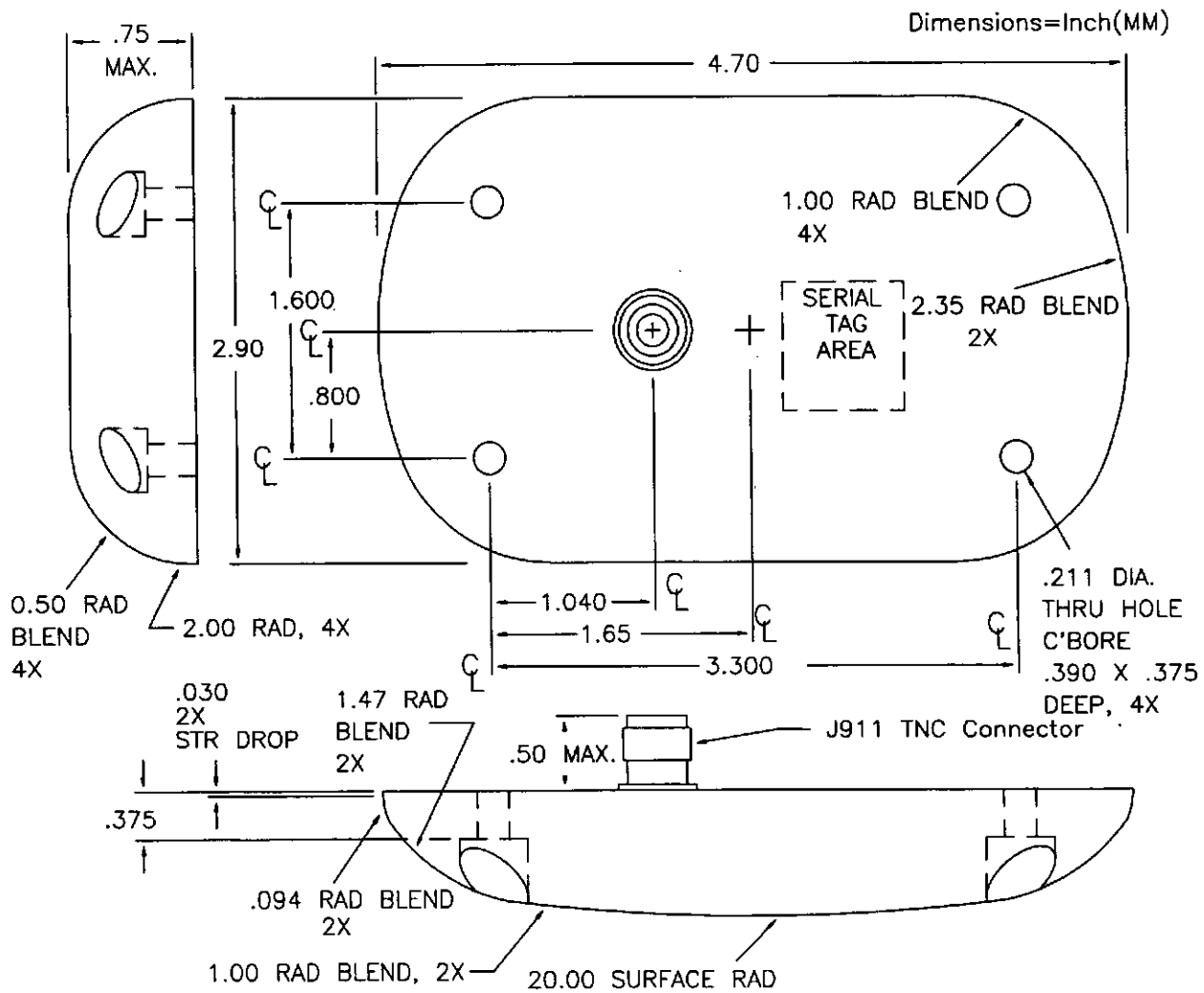
**FIGURE 2-2 KLN 89/89B CRIMPING AND INSERTION/EXTRACTION TOOLS**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-3 KLN 89/89B INSTALLATION DRAWING**  
**(DWG. NO. 155-06020-0000 REV 3)**

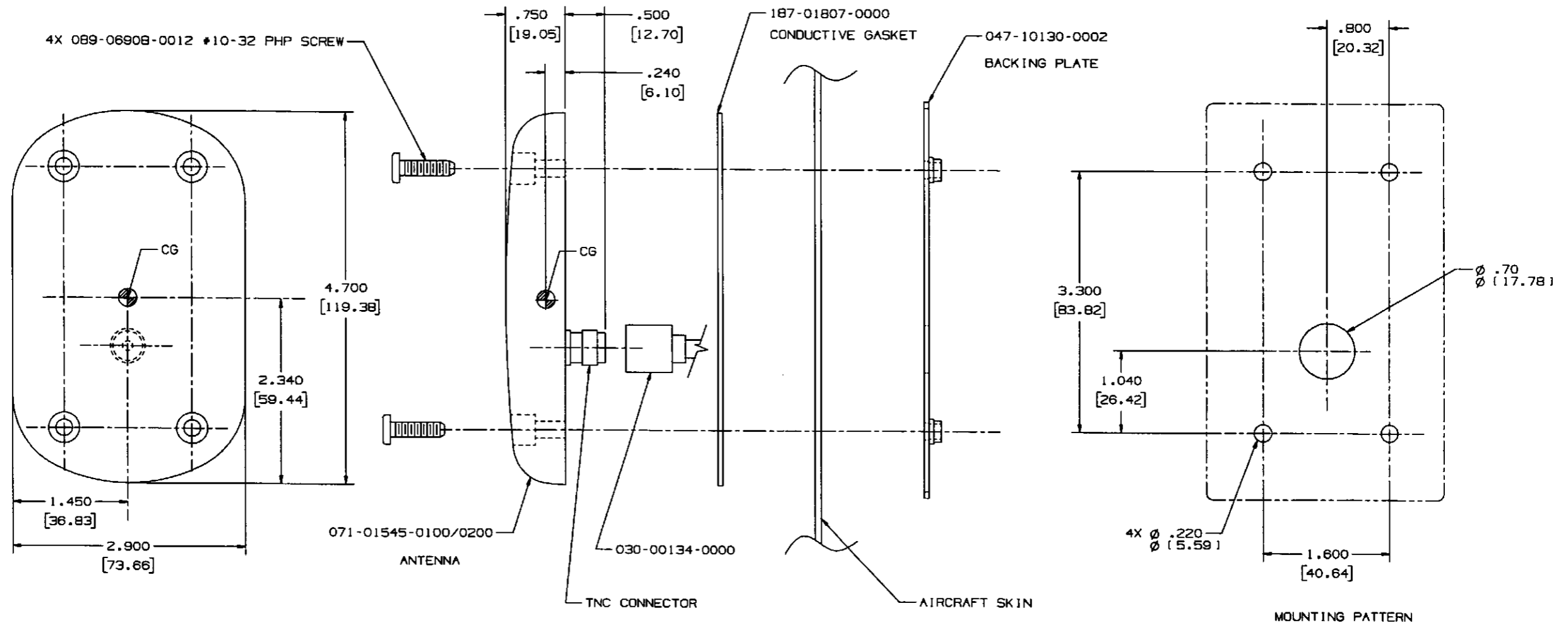
**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-4 KA 91 OUTLINE**  
**Dwg. No. 071-01545-0200, R-4**



**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

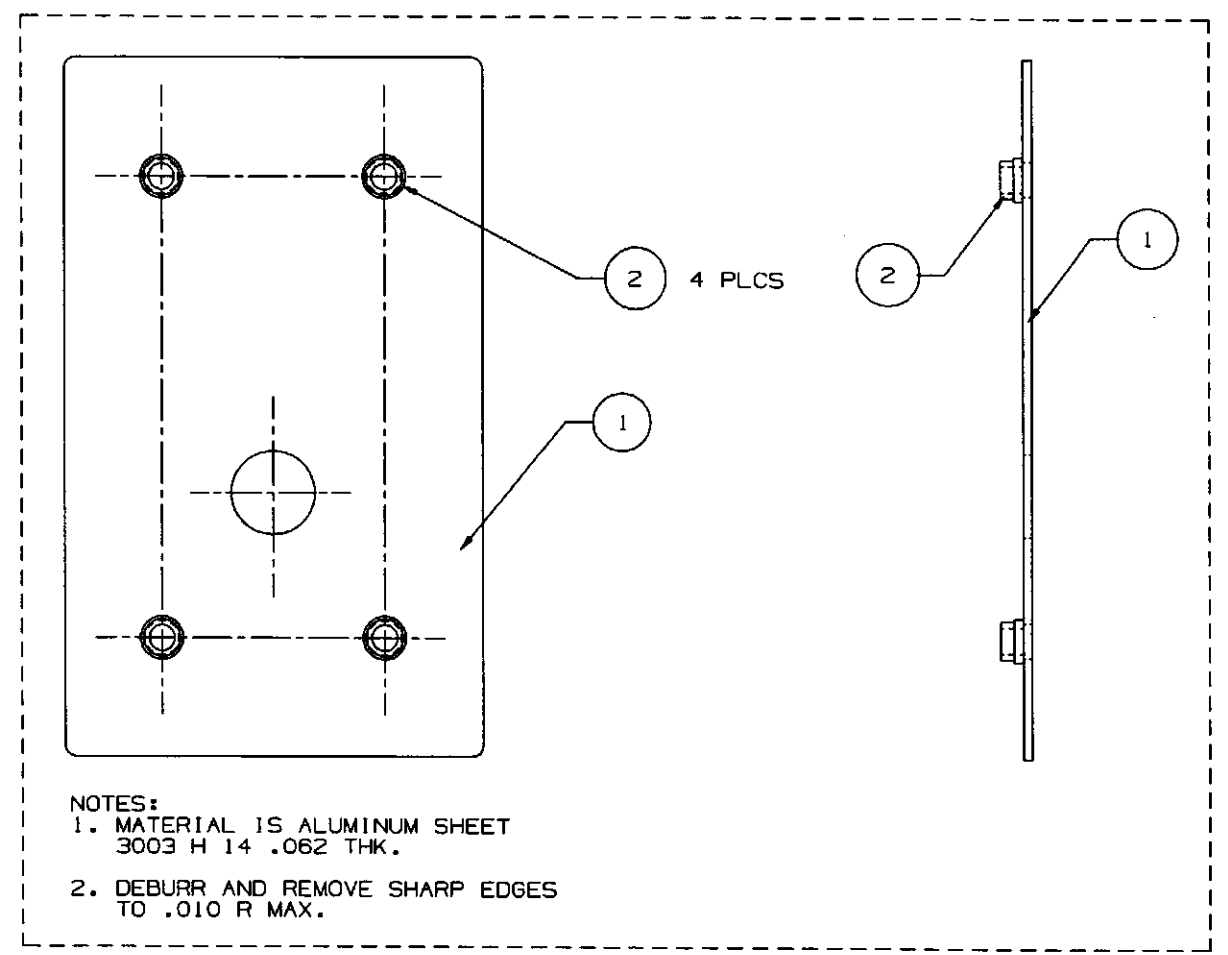
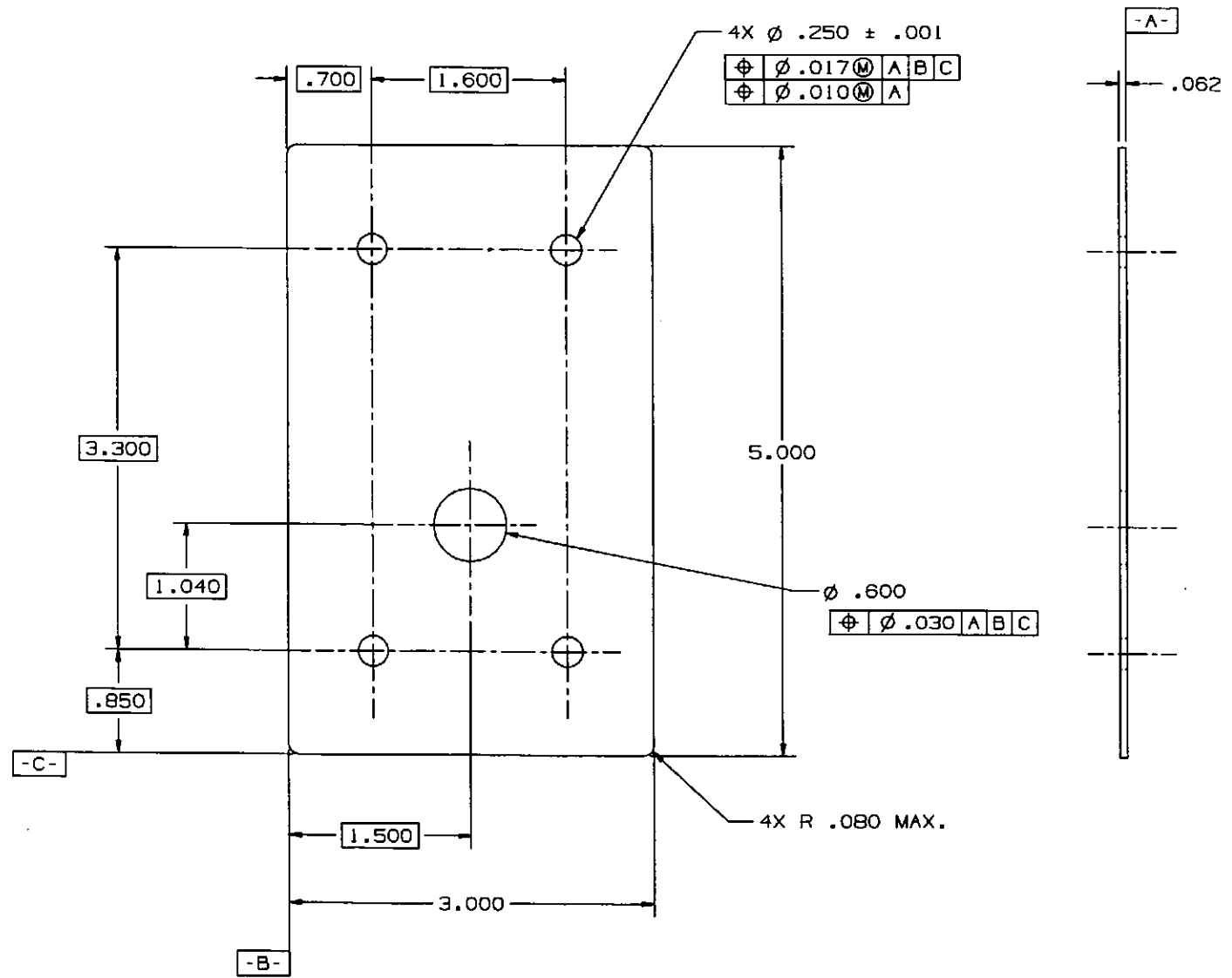


**NOTES:**

1. REMOVE PAINT IN AREA OF ANTENNA INSTALLATION.
2. DIMENSIONS IN INCHES ( MILLIMETERS )
3. FOR BEST PERFORMANCE, BOND BETWEEN AIRCRAFT AND ANTENNA TO BE 10 MILLIOHMS RESISTANCE OR LESS.
4. UNIT WEIGHT .5 LBS ( .227 KG. )
5. FILL MOUNTING SCREW HOLES WITH RTV SEALANT. APPLY WHITE RTV SEALANT AROUND BASE OF INSTALLED ANTENNA. KPN 016-01129-0000 OR EQUIVALENT.
6. ANTENNA SHOULD BE MOUNTED ±5° WITH AIRCRAFT AT LEVEL FLIGHT ATTITUDE.
7. DO NOT PAINT ANTENNA
8. AIRSPEED RATING 600 KTS MAX TAS.

155059990000-----05.prt

**FIGURE 2-5 KA 91 OUTLINE AND MOUNTING**  
**Dwg. No. 155-05999-0000, R-5**

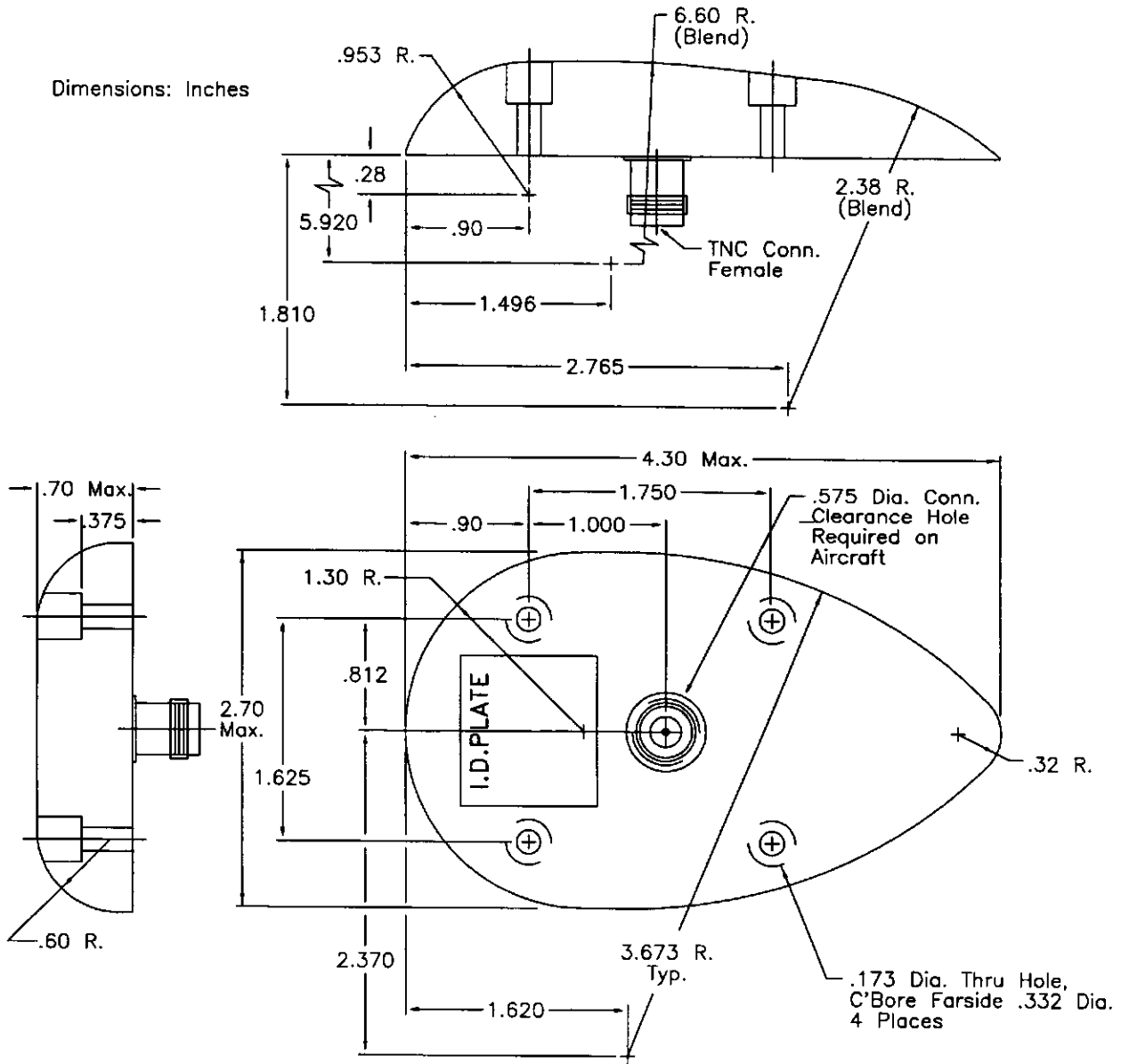


- NOTES:
1. MATERIAL IS ALUMINUM SHEET 3003 H 14 .062 THK.
  2. DEBURR AND REMOVE SHARP EDGES TO .010 R MAX.

ALTERNATE VIEW

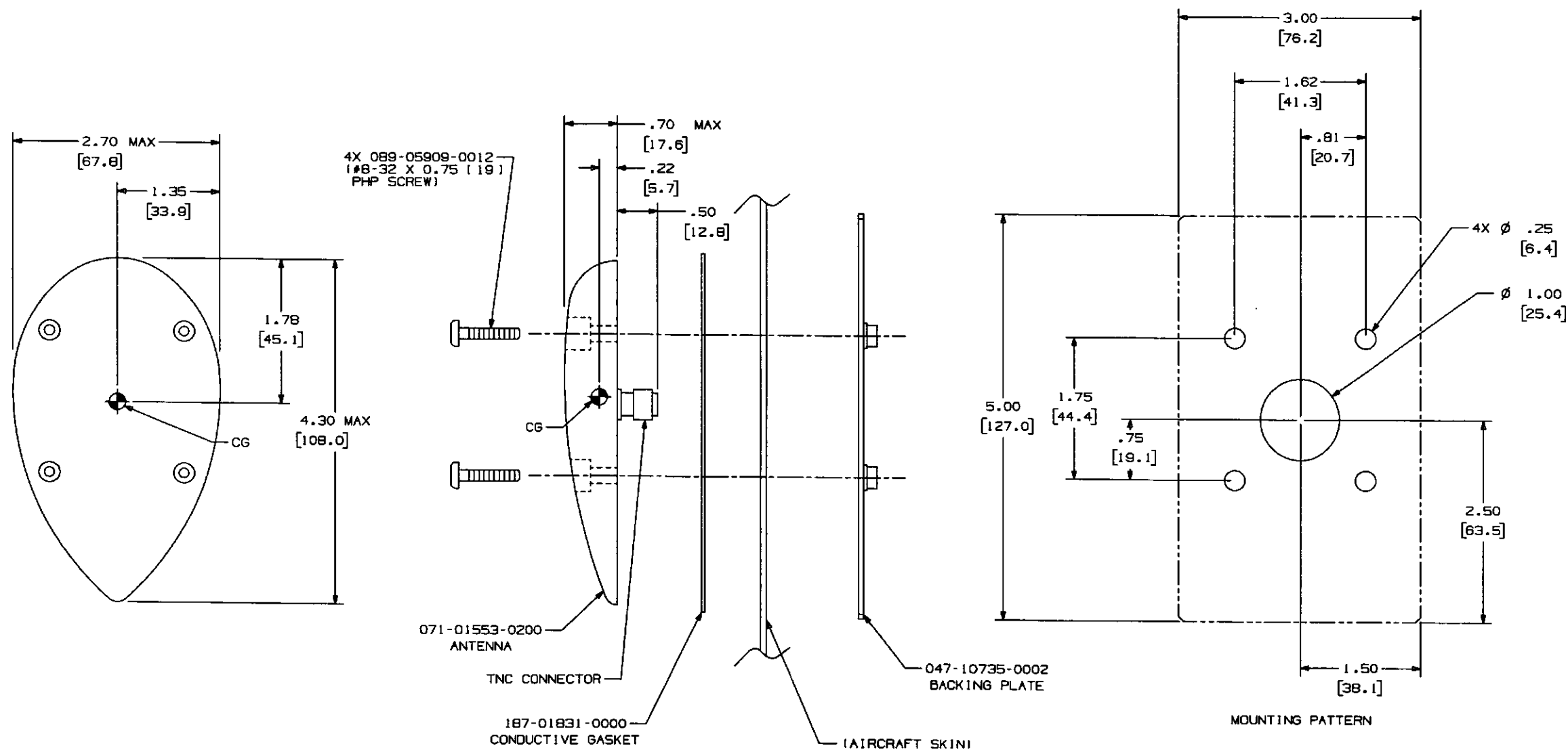
FIGURE 2-6 KA 91 BACKPLATE OUTLINE  
 Dwg. No. 047-10130-0000/0002, R-2

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-7 KA 92 OUTLINE**  
**Dwg. No. 071-01553-0200, R-1**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

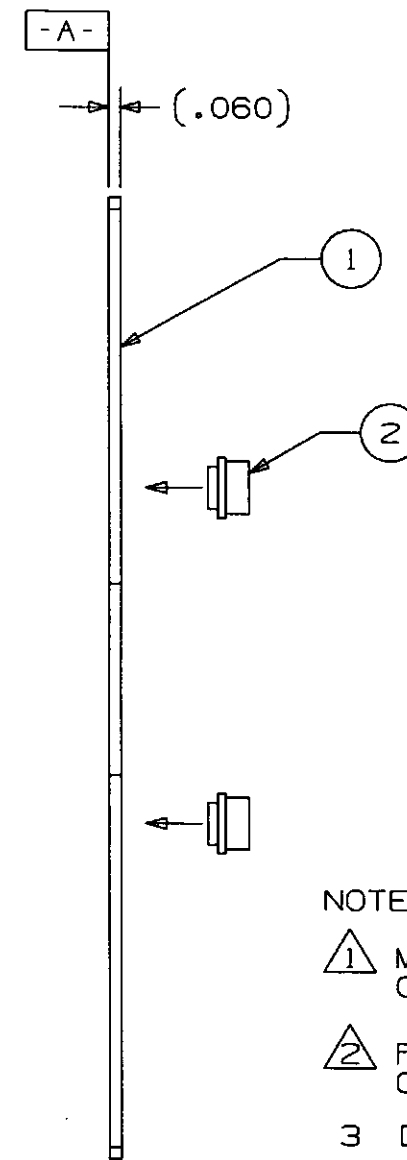
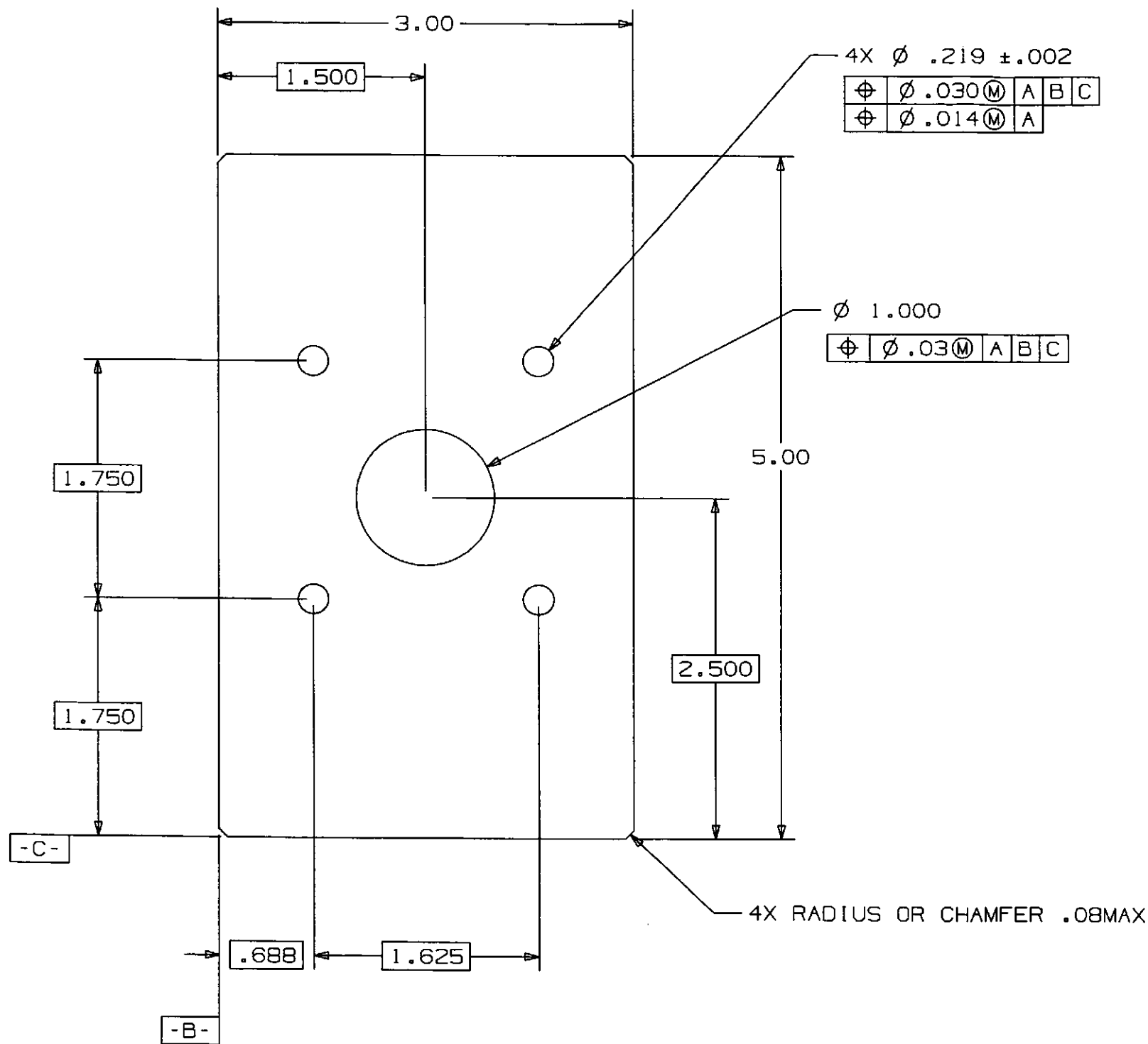


**NOTES UNLESS OTHERWISE SPECIFIED:**

1. REMOVE PAINT IN AREA OF ANTENNA INSTALLATION.
2. DIMENSION IN INCHES (MILLIMETERS)
3. FOR BEST PERFORMANCE, BOND BETWEEN AIRCRAFT AND ANTENNA TO BE 10 MILLIOHMS RESISTANCE OR LESS.
4. UNIT WEIGHT IS .27 LBS ( .12 KG )
5. APPLY WHITE RTV SEALANT AROUND BASE OF INSTALLED ANTENNA. FILL MOUNTING SCREW HOLES WITH RTV SEALANT. (KPN 016-01129-0000 OR EQUIVALENT)
6. ANTENNA SHOULD BE MOUNTED LEVEL ±5° WITH AIRCRAFT AT LEVEL FLIGHT ATTITUDE.
7. DO NOT PAINT ANTENNA.
8. AIRSPEED RATING 800KTS MAX TAS.

**FIGURE 2-8 KA 92 INSTALLATION DRAWING**  
**Dwg. No. 155-06019-0000, R-2**

155060190000-----02.prt

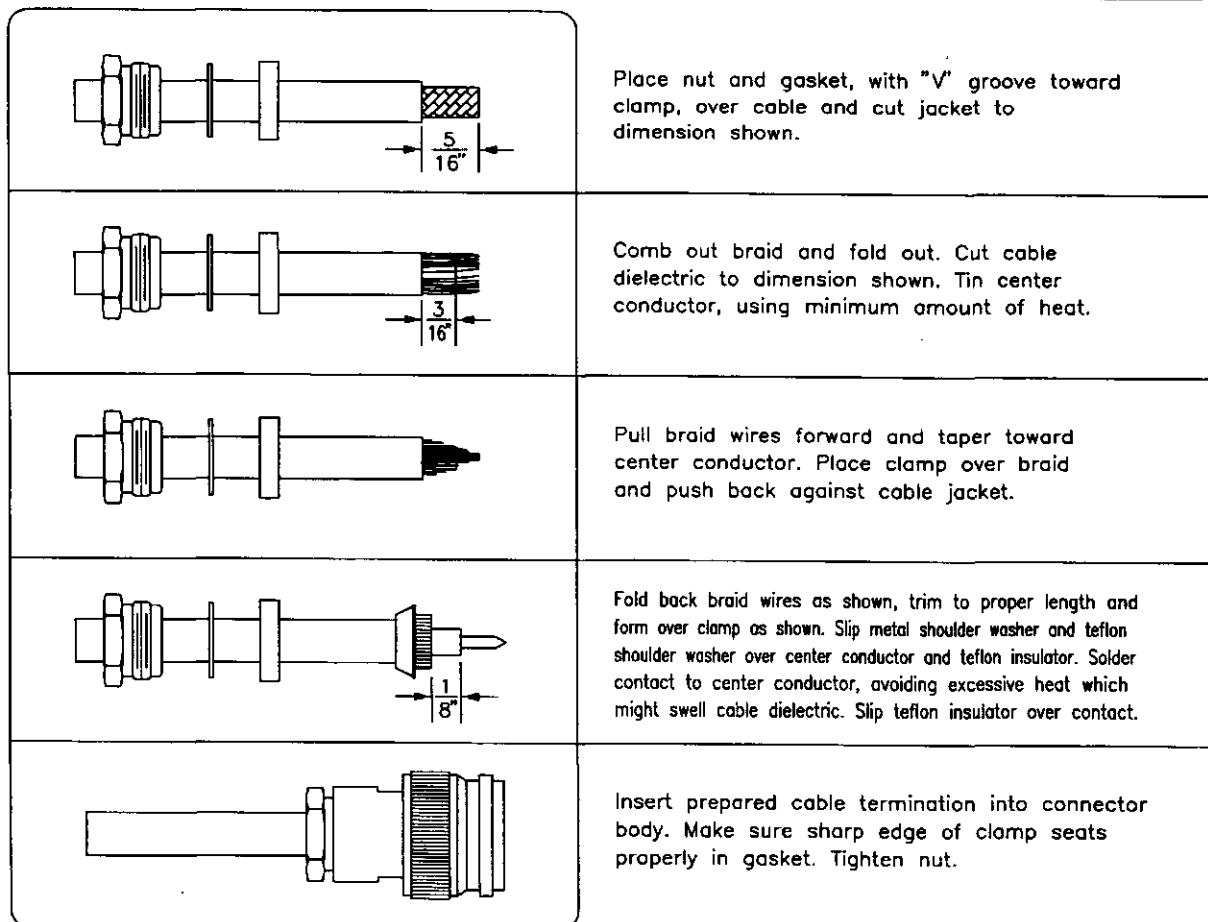
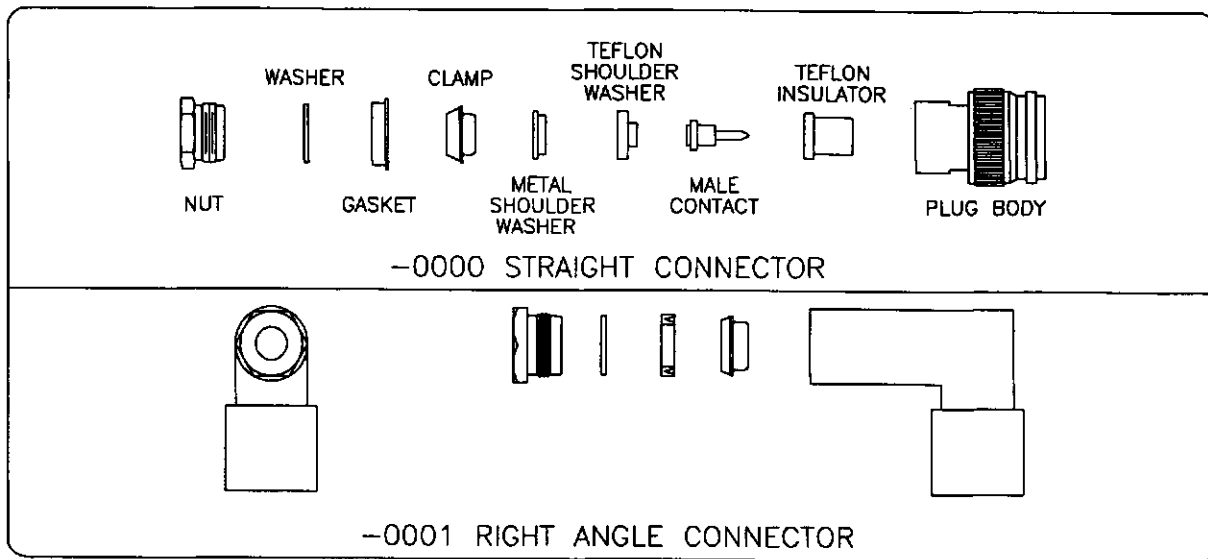


- NOTES UNLESS OTHERWISE SPECIFIED:
- ① MATERIAL IS ALUMINUM 2024-T3 QQ-A-250/4, .063 STOCK THICK
  - ② FINISH IS GOLD IRIDITE MIL-C-5541 CLASS 1A
  - ③ DEBURR AND REMOVE SHARP EDGES .01R MAX

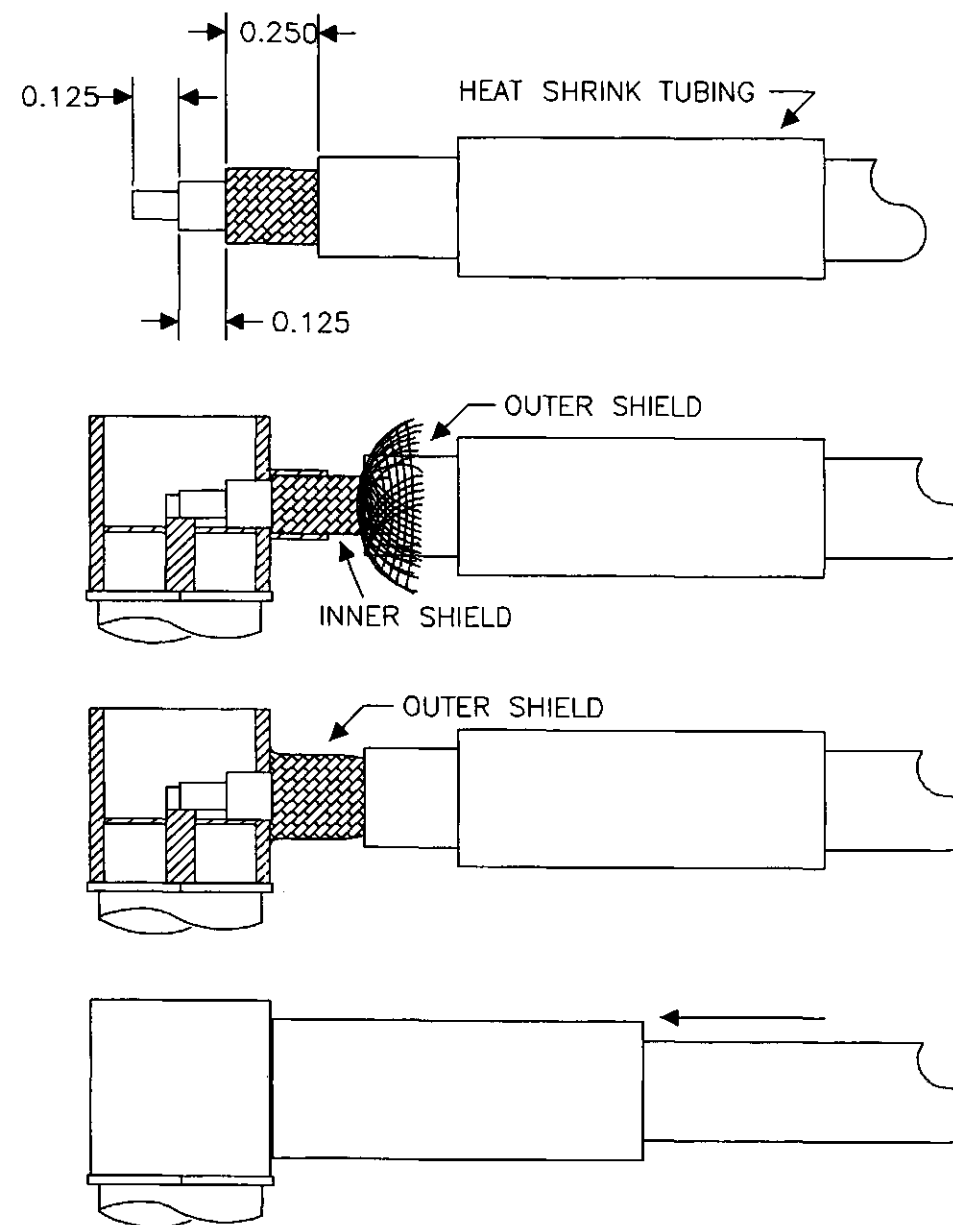
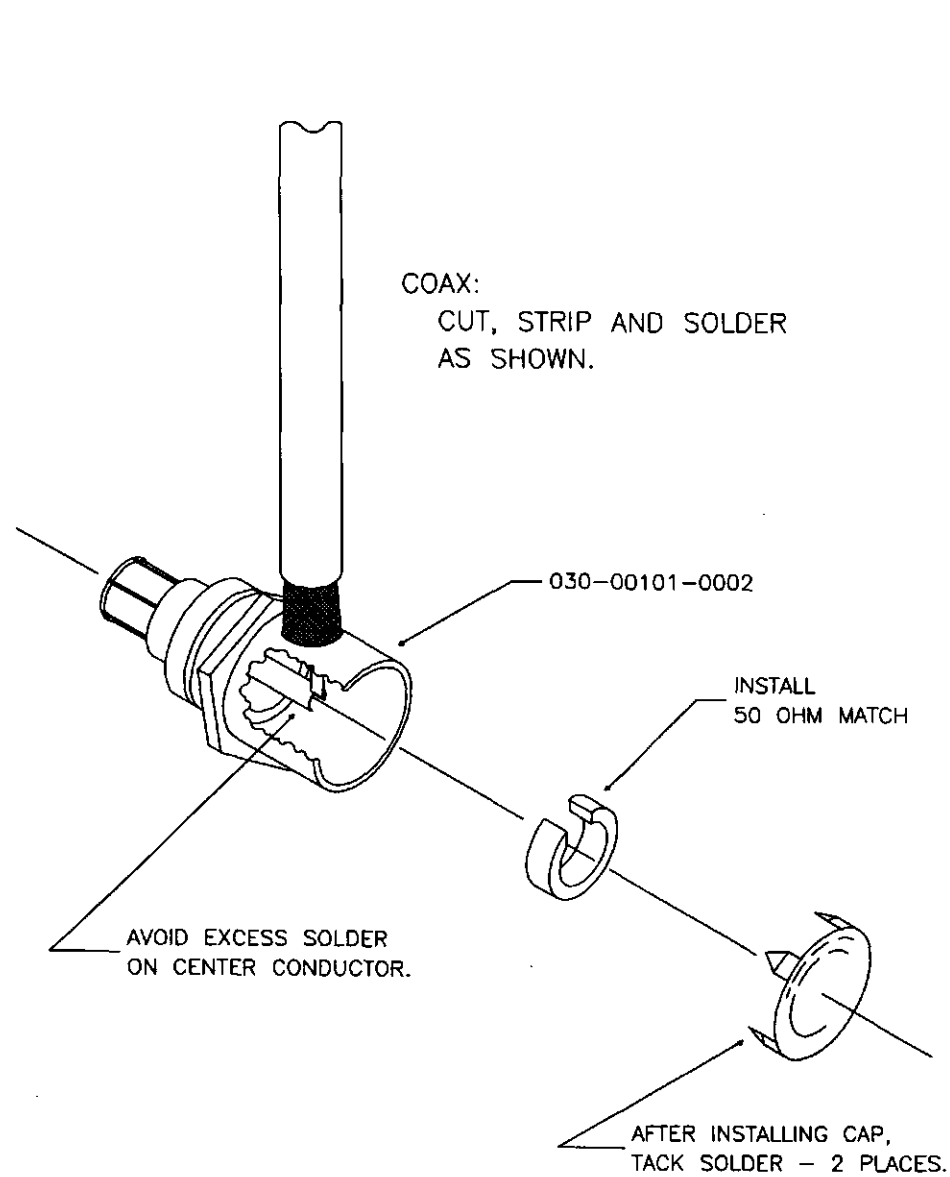
**FIGURE 2-9 KA 92 BACKPLATE OUTLINE**  
 Dwg. No. 047-10735-0000/0002, R-1

047107350000-0002--01.prt

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-10 KA 91/92 TNC ANTENNA COAX/CONNECTOR ASSEMBLY**  
**RG142B/U OR RG400 0 to 40 ft.**  
**(P/N 030-00134-0000, R-3 / 030-00134-0001, R-0)**



1. STRIP RG-142B/U  
 (P/N 024-00002-0000)  
 AND PLACE 1" HEAT SHRINK  
 TUBING (P/N 150-00025-0010)  
 OVER COAX.

2. SOLDER CENTER CONTACT AND  
 SOLDER INNER SHIELD INSIDE.  
 SEE NOTE 1.

3. SOLDER OUTER SHIELD OUTSIDE.  
 SEE NOTE 1.

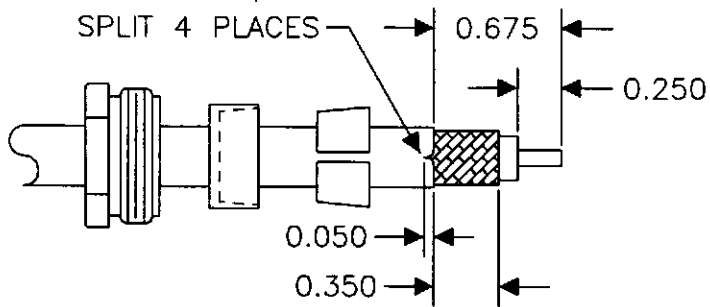
4. SLIDE HEAT SHRINK TUBING  
 FORWARD (FLUSH WITH CONNECTOR)  
 AND ADD HEAT TO SHRINK  
 THE TUBING.

NOTES:

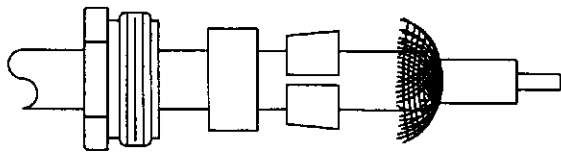
1. WHEN SOLDERING, AVOID APPLYING EXCESS HEAT TO CONNECTOR BODY, HEAT SINK SPRING CONTACTS, AND CENTER CONDUCTOR INSULATOR.

**FIGURE 2-11 KA 91/92 BMA ANTENNA COAX/CONNECTOR ASSEMBLY**  
**(RG142 B/U OR RG400 0 to 40 FT.)**  
**(Dwg. No. 030-00101-0002 Rev. 9)**

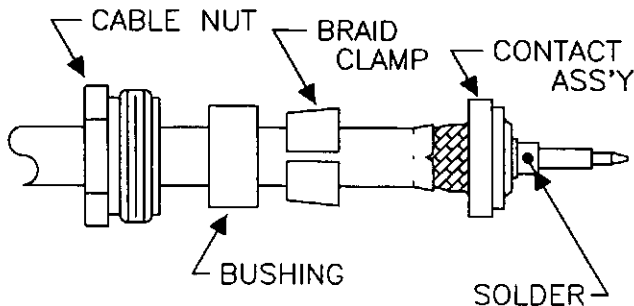
**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



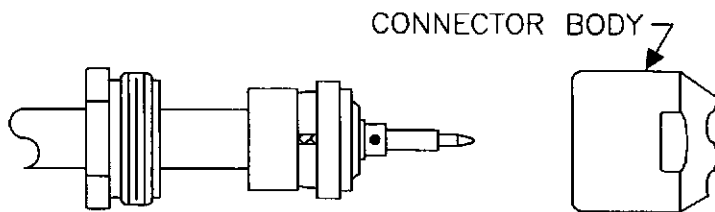
1. Place cable nut, bushing and braid clamp over outer jacket. Trim cable jacket, braid and dielectric to dimensions shown. Split outer jacket in 4 places (approx. 90° apart) to dimension. Lightly tin center conductor.



2. Fold back braid, foil and inner shield to expose dielectric.



3. Slide contact assembly (pin or socket) between inner dielectric and foil shield. Make certain contact assembly is pushed on cable to flare outer jacket and center conductor is visible through inspection hole. Smooth shields back over contact assembly and solder center contact as shown.

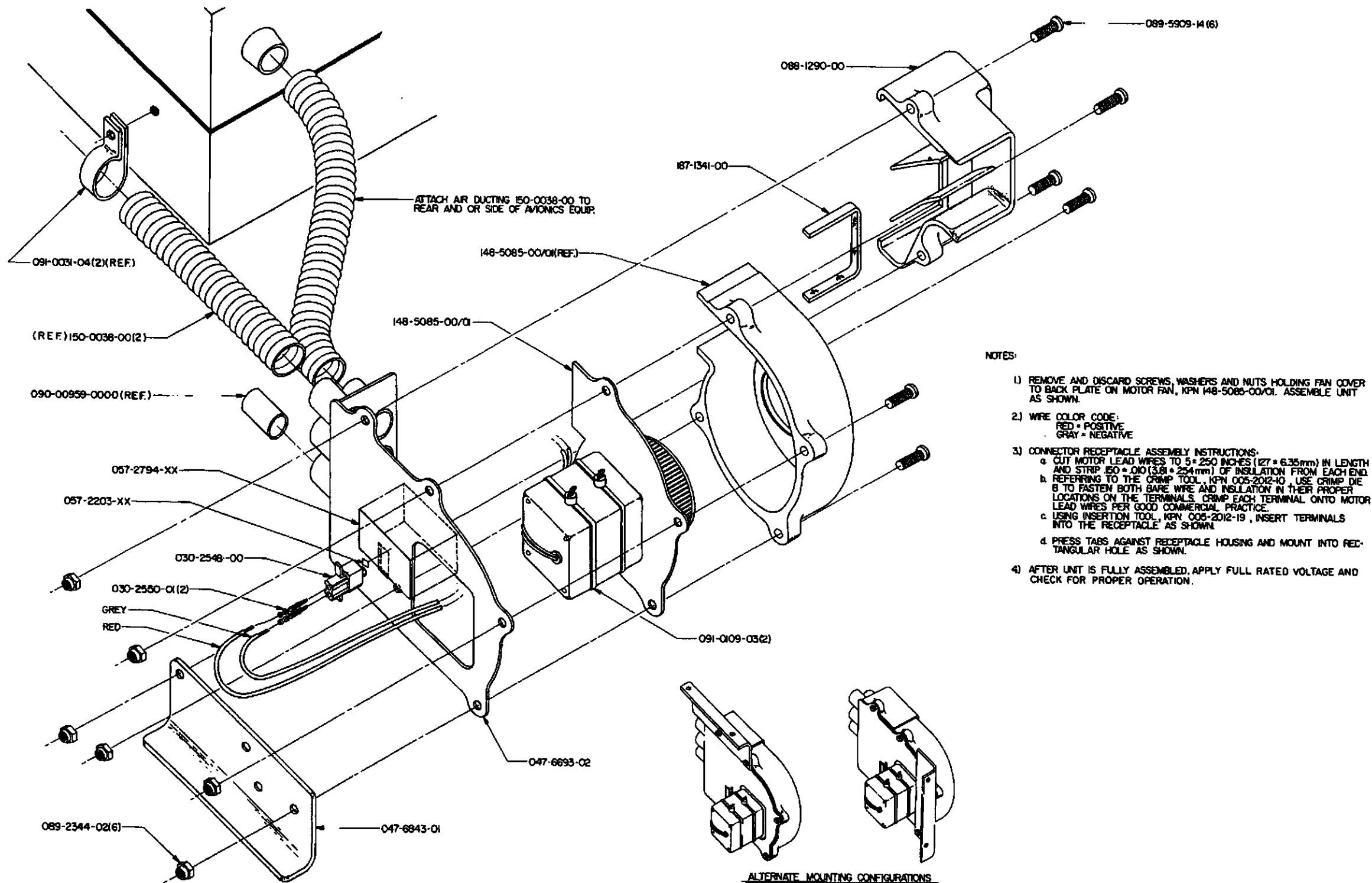


4. Push braid clamp and bushing forward over shield as far as possible. Slide cable nut over bushing and insert finished assembly into connector body. Tighten cable nut completely to seal cable assembly.

**FIGURE 2-12 KA 91/92 TNC ANTENNA COAX/CONNECTOR ASSEMBLY**  
**0 to 80 ft. / 0 to 100 ft.**  
**(For Cable P/N's 024-00071-0000, R-0 / 024-00072-0000, R-0)**

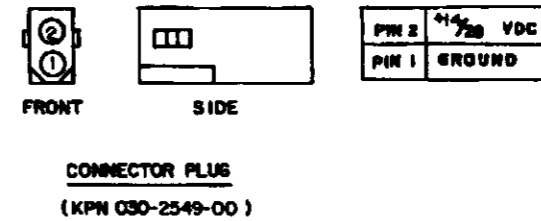
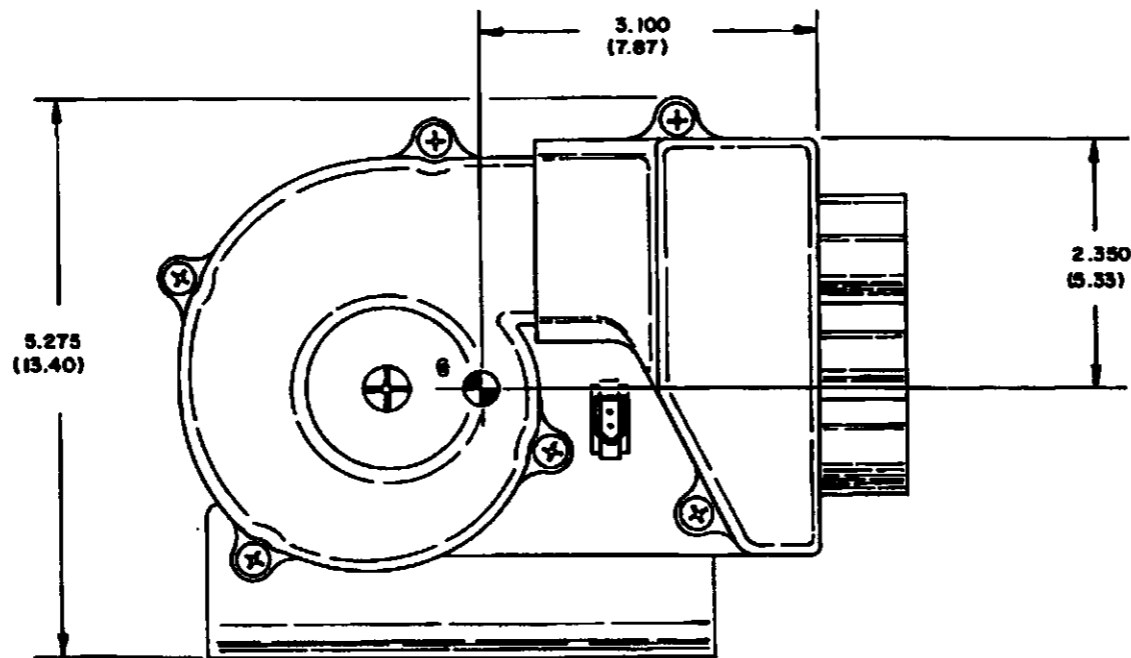
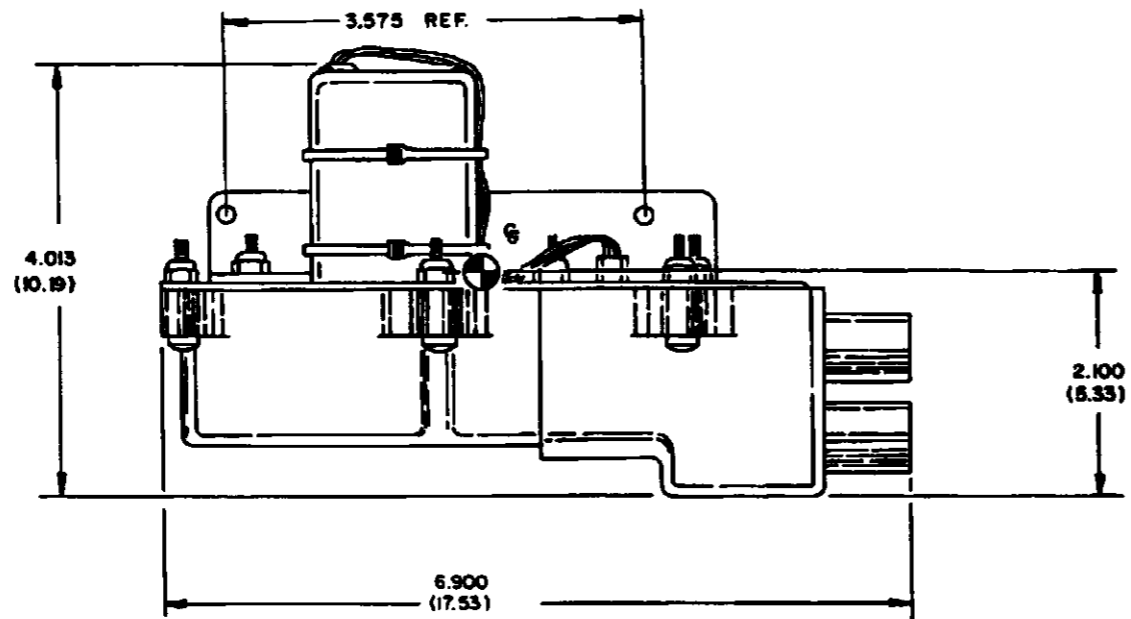


**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-13 KA 33 P/N 071-4037-00/01 FINAL ASSEMBLY**  
**Dwg. No. 300-03256-0000, R-6**

AlliedSignal  
 BENDIX/KING KLN 89/89B  
 GPS RNAV



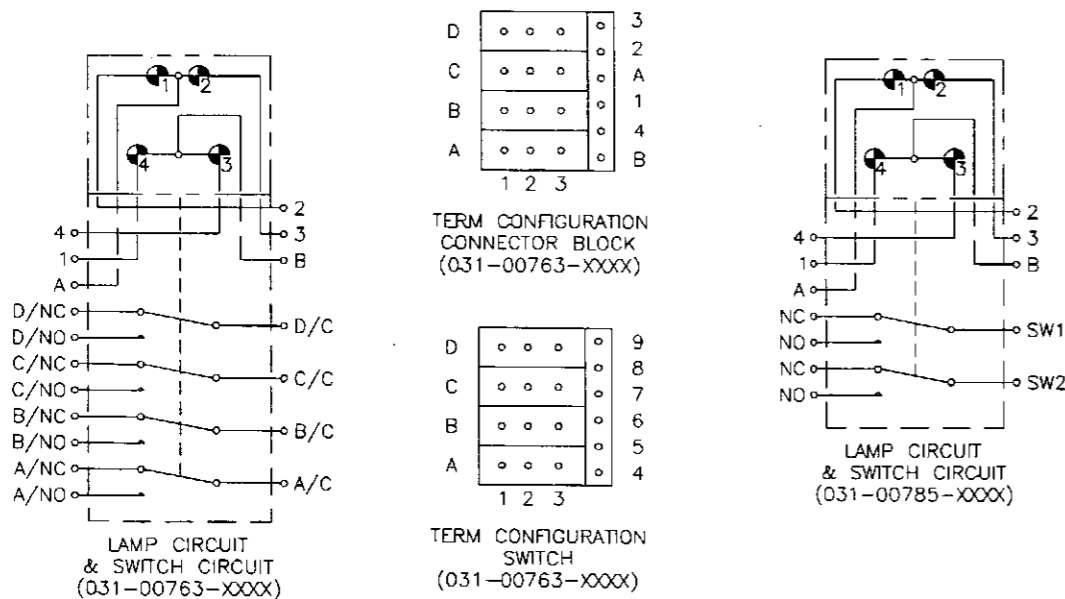
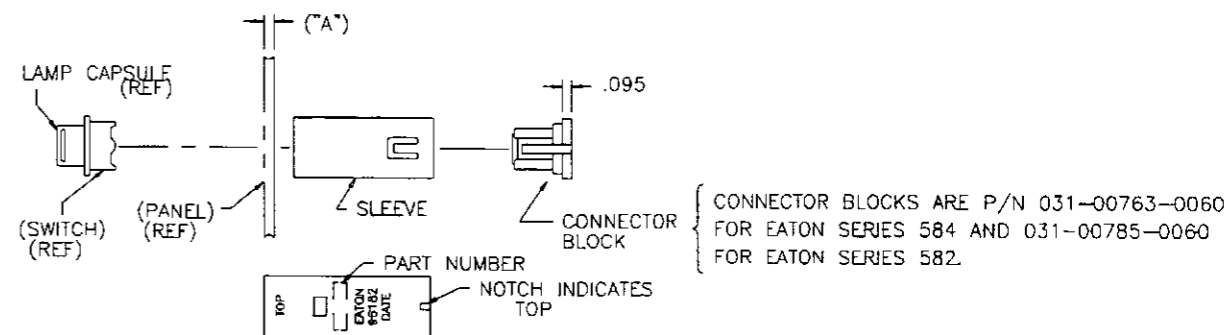
- NOTES: 1. DIMENSIONS IN ( ) ARE IN CENTIMETERS.  
 2. USE KA33 BLOWER KIT, KPN 071-4037-00 FOR 14V AIRCRAFT AND KPN 071-4037-01 FOR 28V AIRCRAFT.  
 3. WEIGHT: 1.25 LBS. (0.57 KG.)

FIGURE 2-14 KA 33 P/N 071-4037-00/01 OUTLINE AND MOUNTING  
 Dwg. No. 155-05574-0000, R-5

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

INSTALLATION AND REMOVAL TOOLS (AVAILABLE FROM LCOMP)

TYPE	EATON PART NUMBER
CONNECTOR PIN CRIMP TOOL	58T-103
CONNECTOR PIN REMOVAL TOOL	58T-104
CONNECTOR PIN REMOVAL TOOL TIP	58T-105-2



MOUNTING SLEEVES		
PANEL THICKNESS DIMENSION "A"	ALLIEDSIGNAL PART NUMBER	VENDOR PART NUMBER
.052" TO .072"	031-00763-0029	4686-29
.083" TO .103"	031-00763-0030	4686-30
.115" TO .135"	031-00763-0031	4686-31
USE THE ABOVE WITH EATON SERIES 584		
.052" TO .072"	031-00785-0029	4686-29
.083" TO .103"	031-00785-0030	4686-30
.115" TO .135"	031-00785-0031	4686-31
USE THE ABOVE WITH EATON SERIES 582		

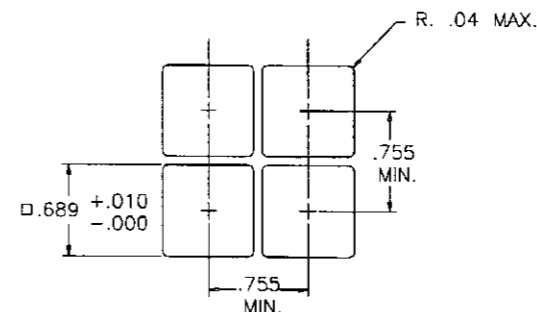
THREE SLEEVES AND A CONNECTOR BLOCK ARE PROVIDED WITH EACH ANNUNCIATOR/SWITCH ASSEMBLY TO ACCOMMODATE A FULL RANGE OF PANEL THICKNESSES.

NOTES:

- MOMENTARY SWITCH TRAVEL IS SUCH THAT THE CAPSULE IS FLUSH WITH, OR RECESSED INTO, THE BEZEL OF THE SWITCH BODY WHEN FULLY ACTUATED.
- ALTERNATE ACTION SWITCH TRAVEL AND RETAINED POSITION ARE SUCH THAT THE CAPSULE IS FLUSH WITH, OR RECESSED INTO, THE BEZEL OF THE SWITCH BODY WHEN ACTUATED.
- COMPLETE ANNUNCIATORS/SWITCHES ARE AVAILABLE FROM LCOMP. PARTS FOR CONVERSION OR REPAIR ARE ALSO AVAILABLE.

LCOMP Aerospace Controls  
 9214 Bond  
 Overland Park, KS 66214

TELEPHONE:  
 (913) 438-4848  
 (800) 821-2915  
 (913) 438-4839 (FAX)



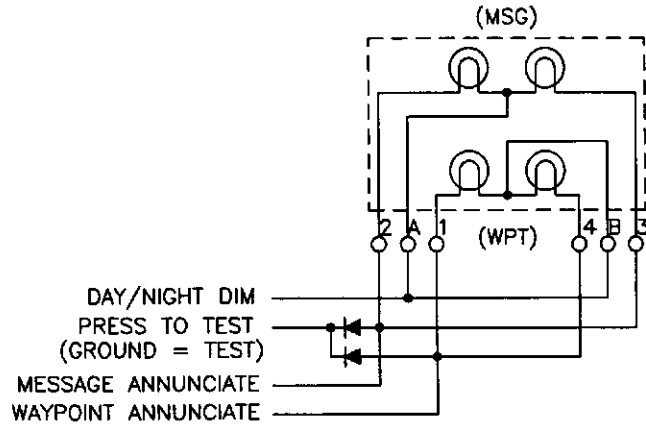
RECOMMENDED PANEL CUTOUT

**FIGURE 2-15 CUTLER-HAMMER SWITCH/ANNUNCIATOR MOUNTING**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

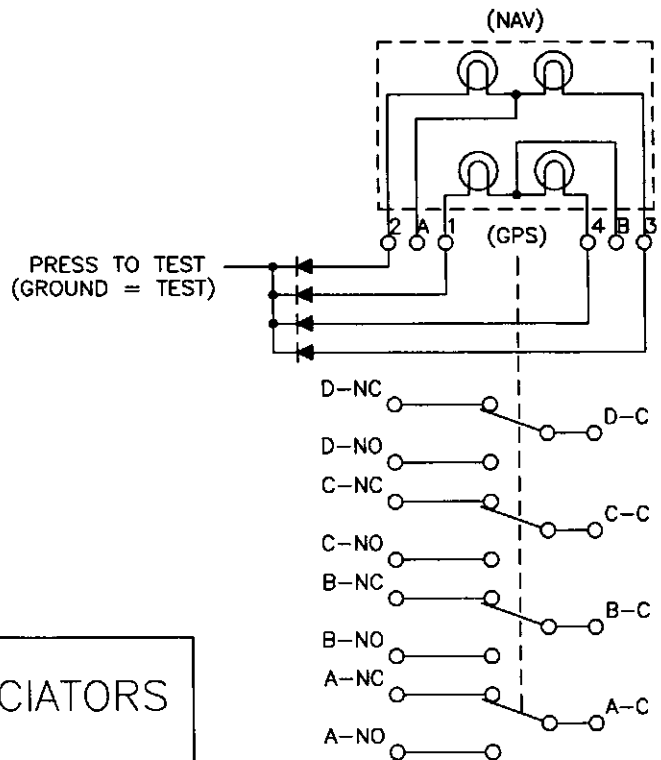
GPS STATUS	MSG	(AMBER)
	WPT	(AMBER)

ANNUNCIATOR  
 28 V -0505  
 14 V -0762  
 5 V -0506



GPS SWITCHING	NAV	(GREEN)
	GPS	(BLUE)

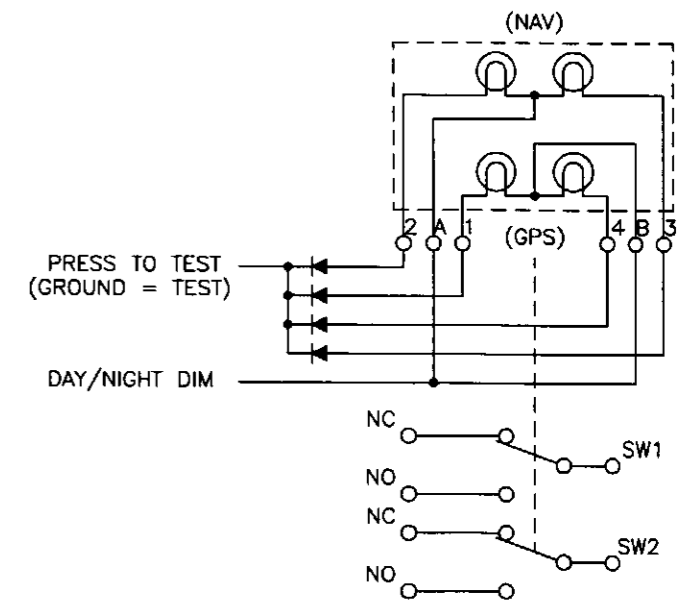
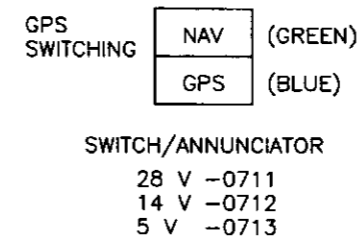
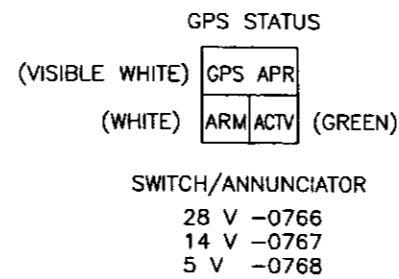
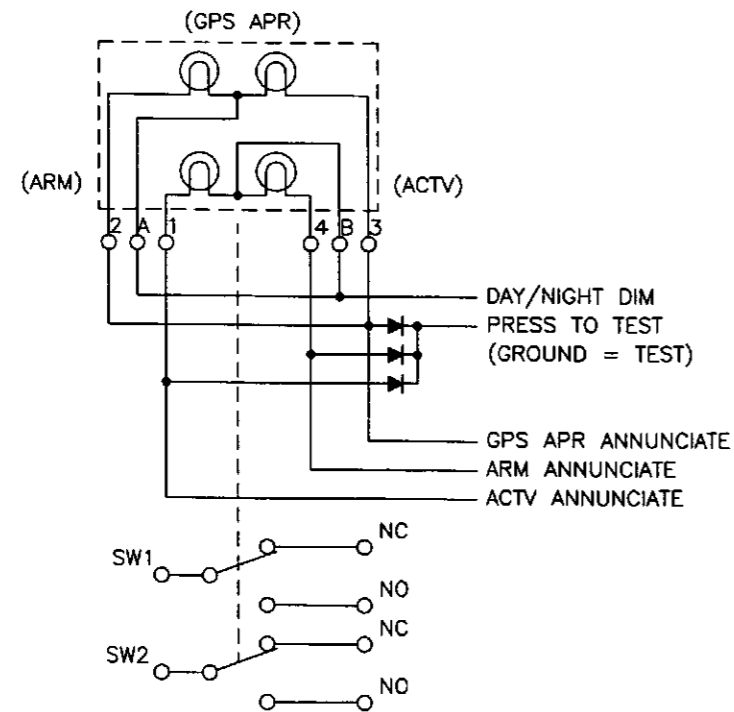
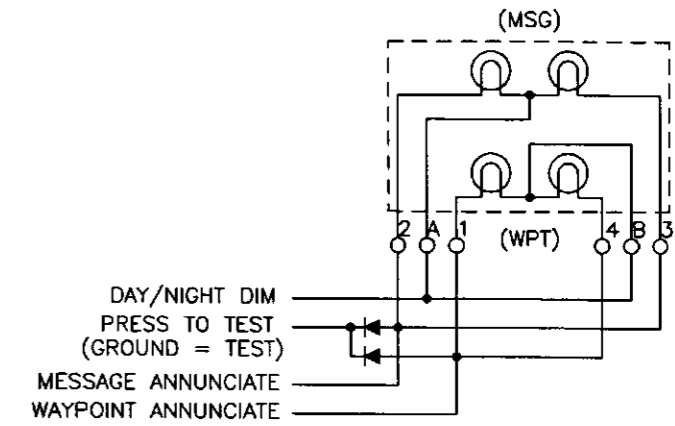
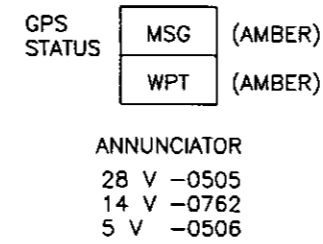
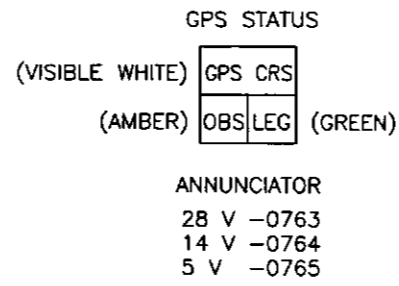
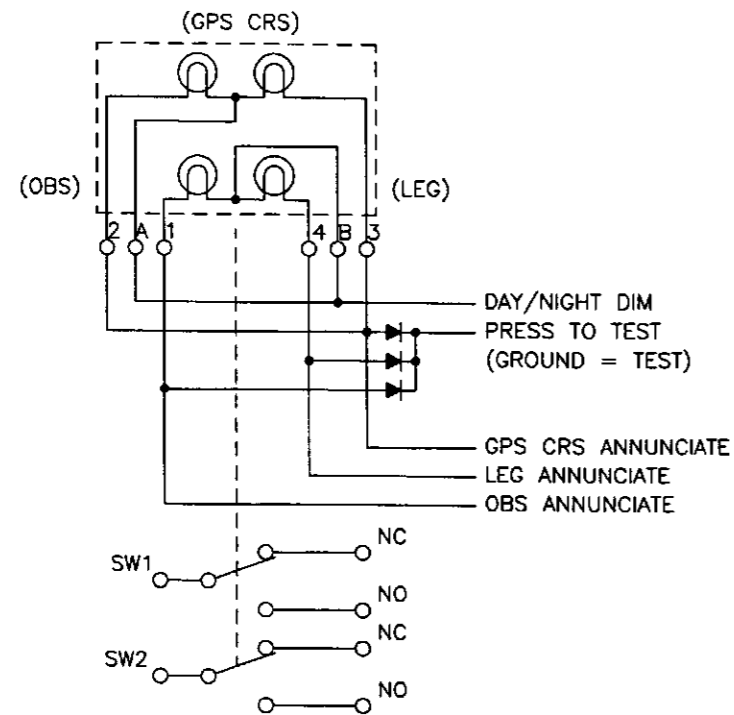
SWITCH/ANNUNCIATOR  
 28 V -0711  
 14 V -0712  
 5 V -0713



GPS SWITCHES/ANNUNCIATORS  
 031-00763-XXXX

**FIGURE 2-16 CUTLER-HAMMER SWITCH/ANNUNCIATOR INTERNAL SCHEMATIC**  
 (Sheet 1 of 2)

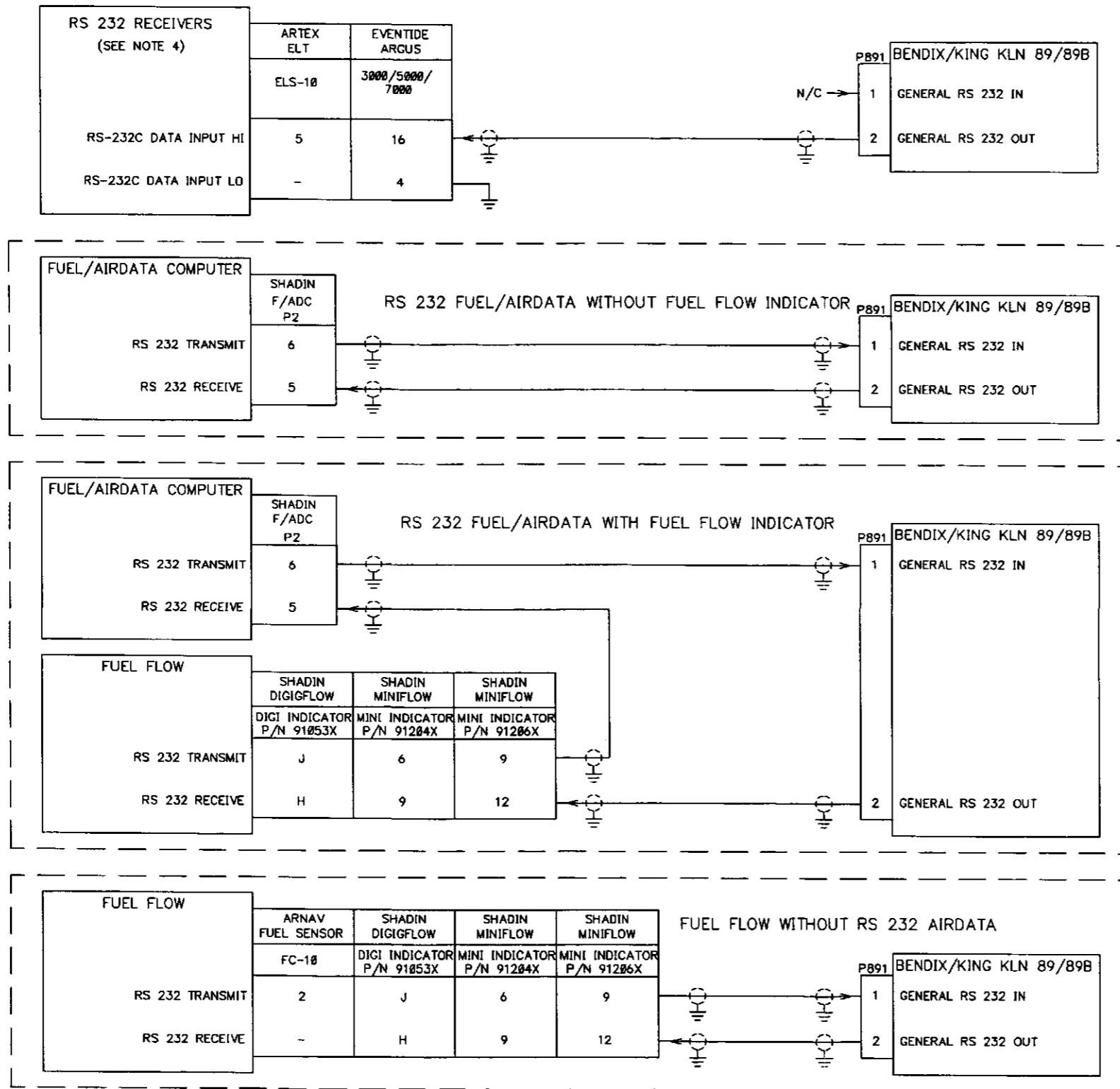
**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



GPS SWITCHES/ANNUNCIATORS  
 031-00785-XXXX

**FIGURE 2-16 CUTLER-HAMMER SWITCH/ANNUNCIATOR INTERNAL SCHEMATIC**  
 (Sheet 2 of 2)

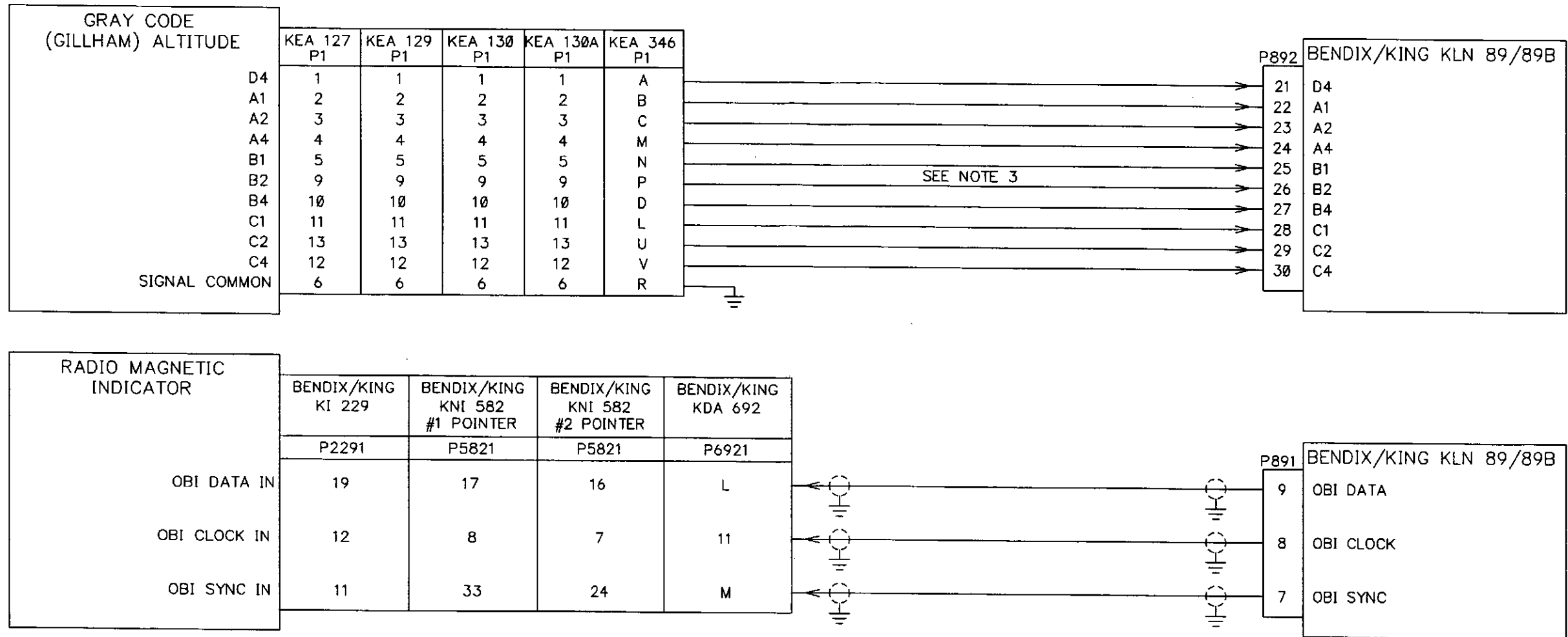
**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



- NOTES:
1. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
  2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
  3. GENERAL RS 232 OUT CAN DRIVE SEVERAL INPUTS. ONLY ONE TRANSMITTER CAN BE CONNECTED TO GENERAL RS 232 IN AT A TIME.
  4. RS 232 RECEIVERS MAY NOT BE USED AS THE PRIMARY FLIGHT DISPLAY FOR THE KLN 89.
  5. CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 1 of 8)**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

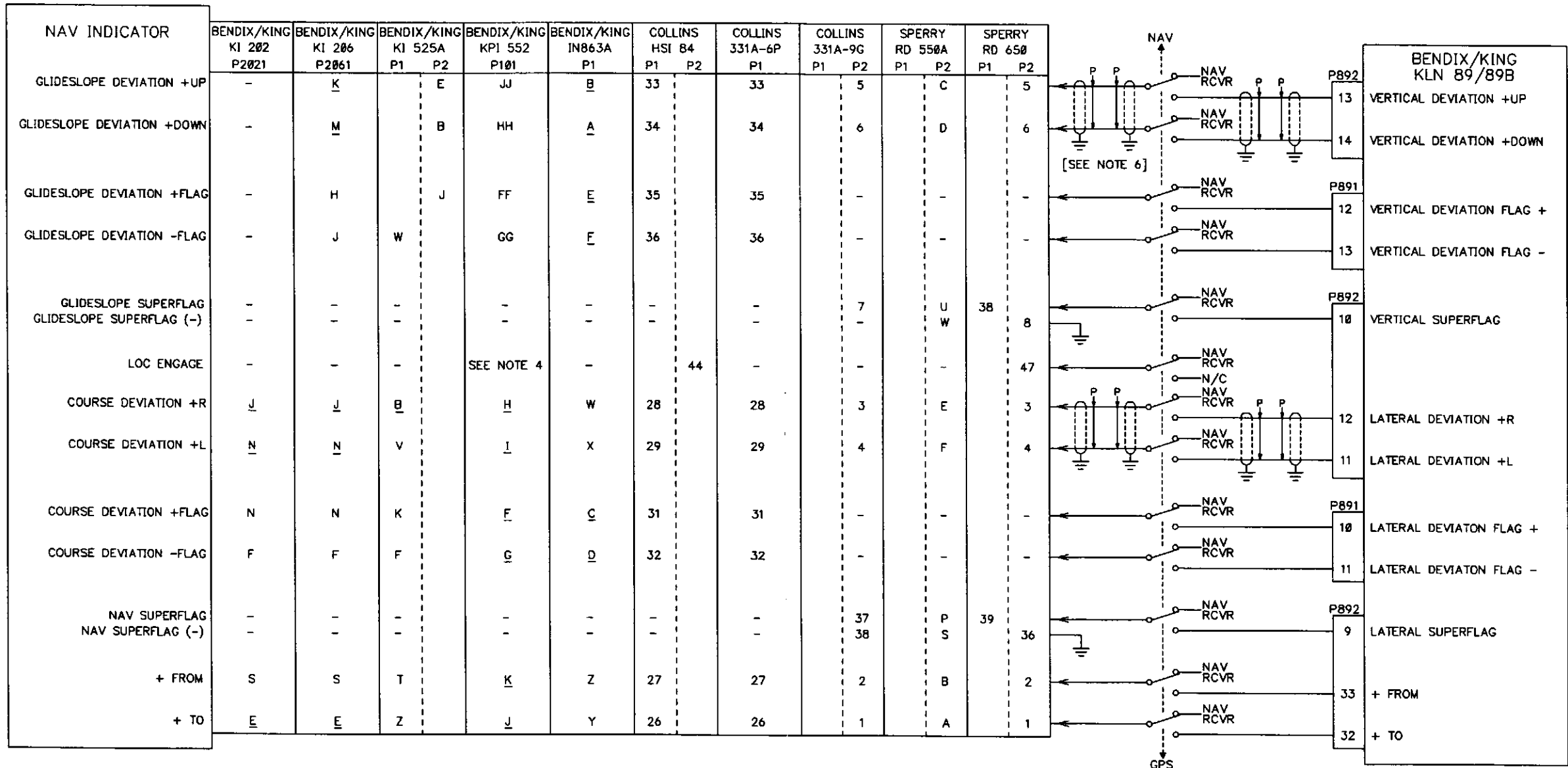


**NOTES:**

1. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
3. SOME RECEIVERS OF THE ALTITUDE ENCODER DO NOT HAVE INTERNAL ISOLATION DIODES TO PREVENT THE UNIT FROM PULLING THE ENCODER LINES TO GROUND WHEN THE UNIT IS OFF. SOME TRANSPONDERS AND OTHER DEVICES DO NOT HAVE THE INTERNAL DIODES. THESE UNITS REQUIRE A DIODE TO BE ADDED TO THE INSTALLATION HARNESS FOR EVERY ENCODER LINE. THE DIODES ARE INSERTED AT THE CONNECTION TO THE UNIT THAT DOES NOT HAVE INTERNAL DIODES. THE ANODE IS ON THE RECEIVING UNITS SIDE AND THE CATHODE IS ON THE ENCODER SIDE. A 1N4007, OUR PART NUMBER 007-06048-0000, MEETS HIRF AND LIGHTNING REQUIREMENTS. A SET OF DIODES IS REQUIRED FOR EACH UNIT WITHOUT INTERNAL DIODES.
4.  $\perp$  CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 2 of 8)**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

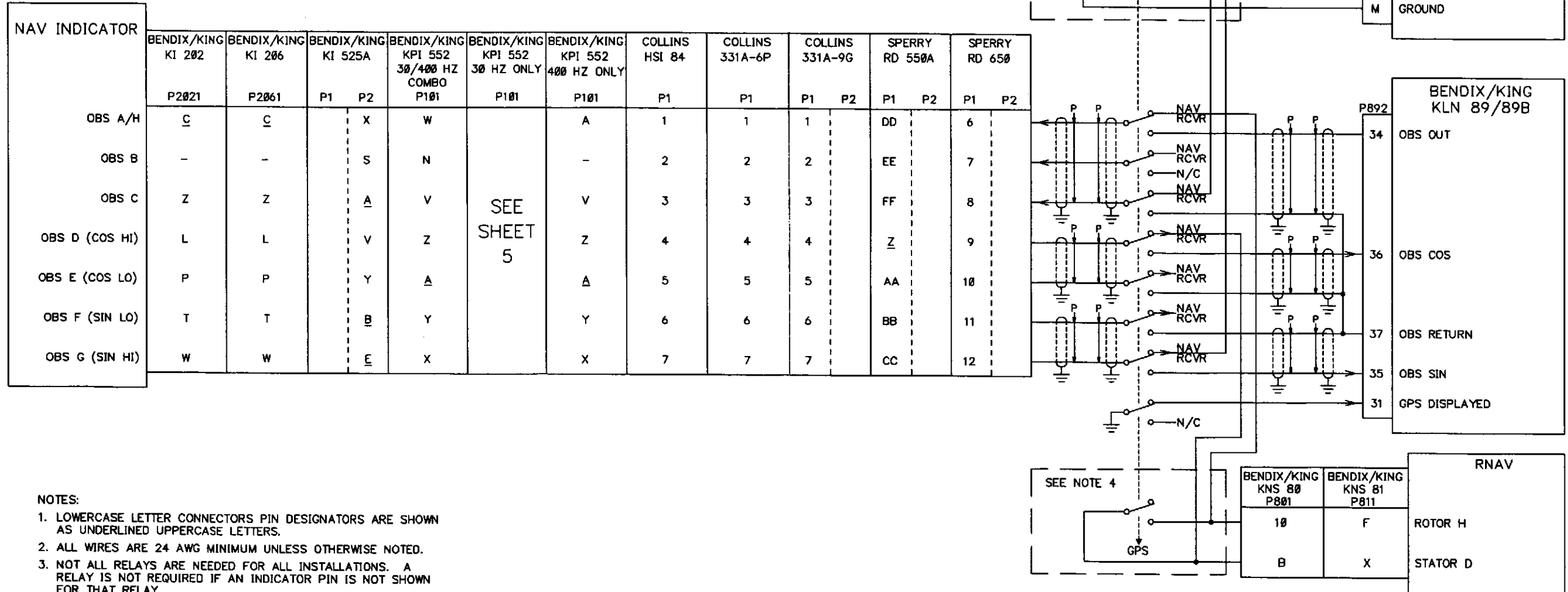


- NOTES:
1. LOWERCASE LETTER CONNECTORS PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
  2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
  3. NOT ALL RELAYS ARE NEEDED FOR ALL INSTALLATIONS. A RELAY IS NOT REQUIRED IF AN INDICATOR PIN IS NOT SHOWN FOR THAT RELAY.
  4. A RELAY IS NOT REQUIRED FOR THE LOC ENGAGE CONNECTION TO THIS INDICATOR AS THIS PIN DOES NOT HAVE A COURSE DEVIATION FUNCTION; IT IS USED TO PARK THE RMI NEEDLE.
  5. ⊥ CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.
  6. THE GLIDESLOPE DEV. AND FLAG SHOULD BE SWITCHED SO THAT IT IS DISCONNECTED FROM THE NAV INDICATOR AND AUTOPILOT IN THE GPS MODE.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 3 of 8)**

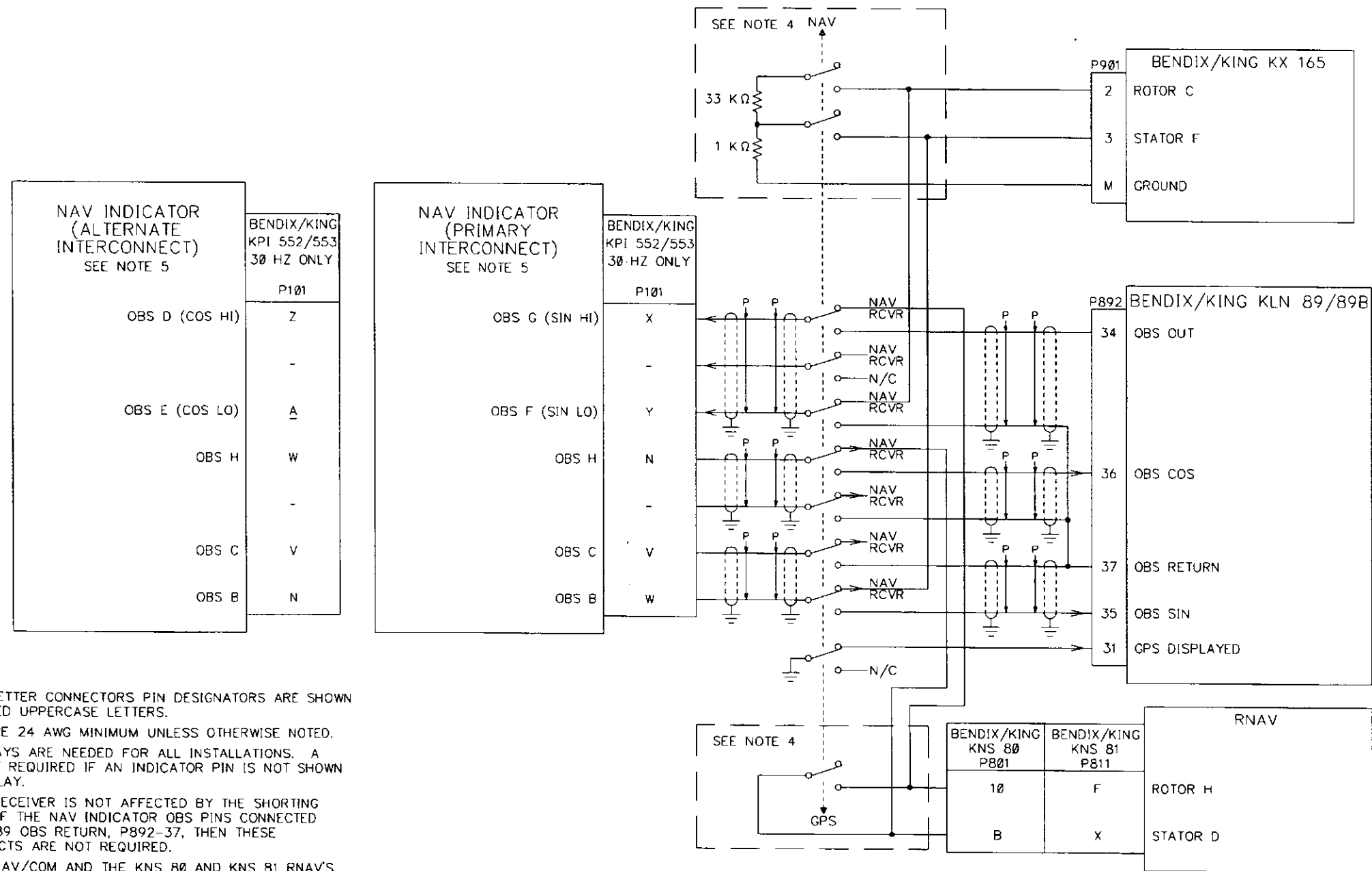


**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 4 of 8)**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**



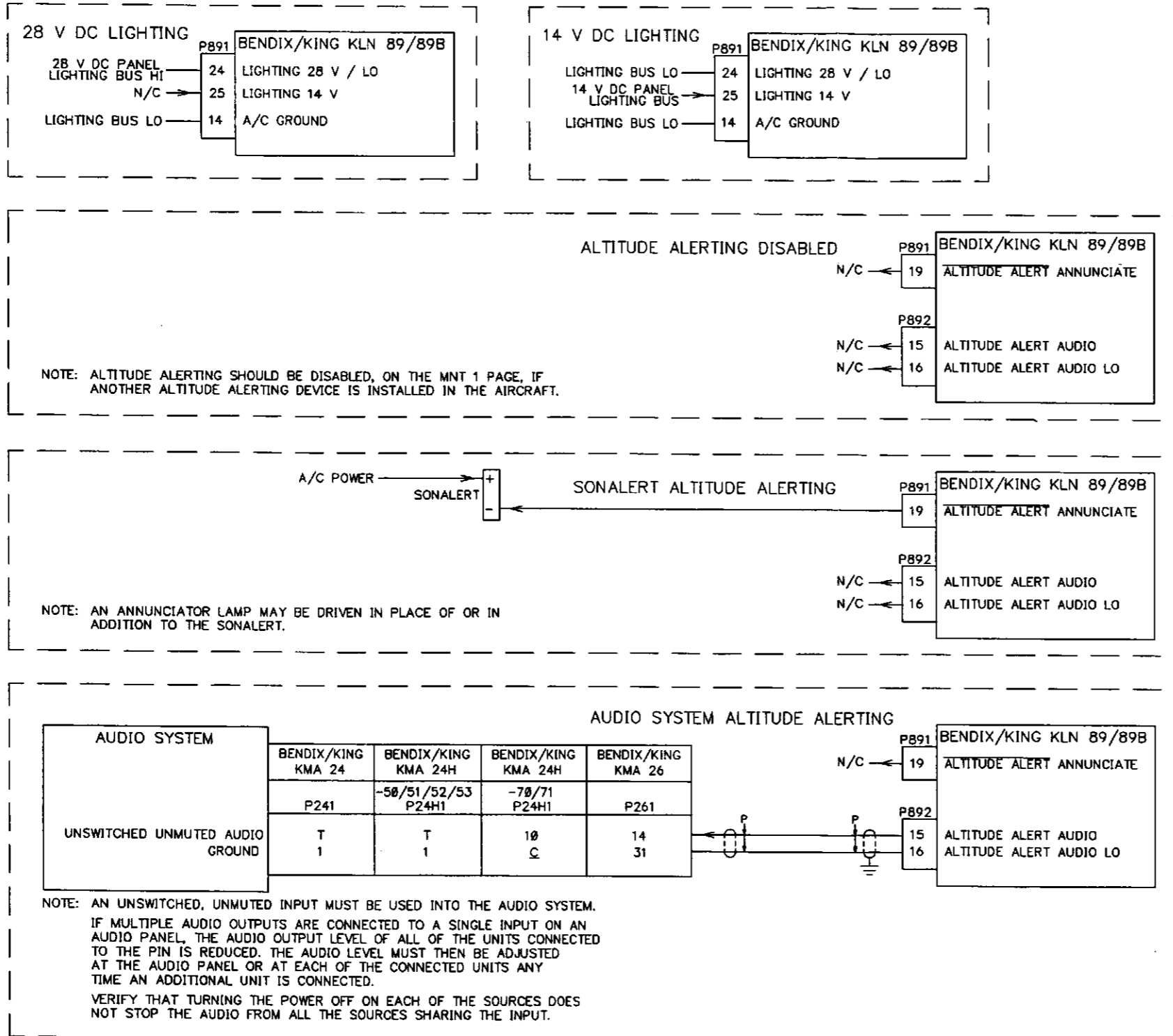
**NOTES:**

1. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
3. NOT ALL RELAYS ARE NEEDED FOR ALL INSTALLATIONS. A RELAY IS NOT REQUIRED IF AN INDICATOR PIN IS NOT SHOWN FOR THAT RELAY.  
 IF THE NAV RECEIVER IS NOT AFFECTED BY THE SHORTING TO GROUND OF THE NAV INDICATOR OBS PINS CONNECTED TO THE KLN 89 OBS RETURN, P892-37, THEN THESE RELAY CONTACTS ARE NOT REQUIRED.
4. THE KX 165 NAV/COM AND THE KNS 80 AND KNS 81 RNAV'S WILL FLAG SOME OF THEIR OUTPUTS WHEN THEY ARE NOT CONNECTED TO AN OBS RESOLVER. IF THE KLN 89 SHARES THE NAV INDICATOR WITH ONE OF THESE UNITS THROUGH THE NAV/GPS RELAY, THE NAV RECEIVER'S OBS RESOLVERS MUST BE LOADED AS SHOWN. RESISTORS ARE 1/4 W, 5%. OMISSION OF THESE JUMPERS WILL RESULT IN A FLAGGED RADIAL DISPLAY AND FROZEN GROUND SPEED IN RNAV MODES.

5. SOME KPI 552/553'S MAY HAVE LEFT THE FACTORY WITH A RESOLVER WINDING REVERSED. THE MAJORITY OF THE UNITS WILL WORK CORRECTLY IF WIRED PER THE PRIMARY INTERCONNECT. USE THE ALTERNATE INTERCONNECT IF THE PRIMARY DOES NOT WORK. USE OF THE WRONG INTERCONNECT RESULTS IN THE KLN 900 OBS DISPLAY INCREMENTING WHEN THE INDICATOR OBS DECREMENTS AND VICE VERSA.
6.  $\perp$  CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 5 of 8)**

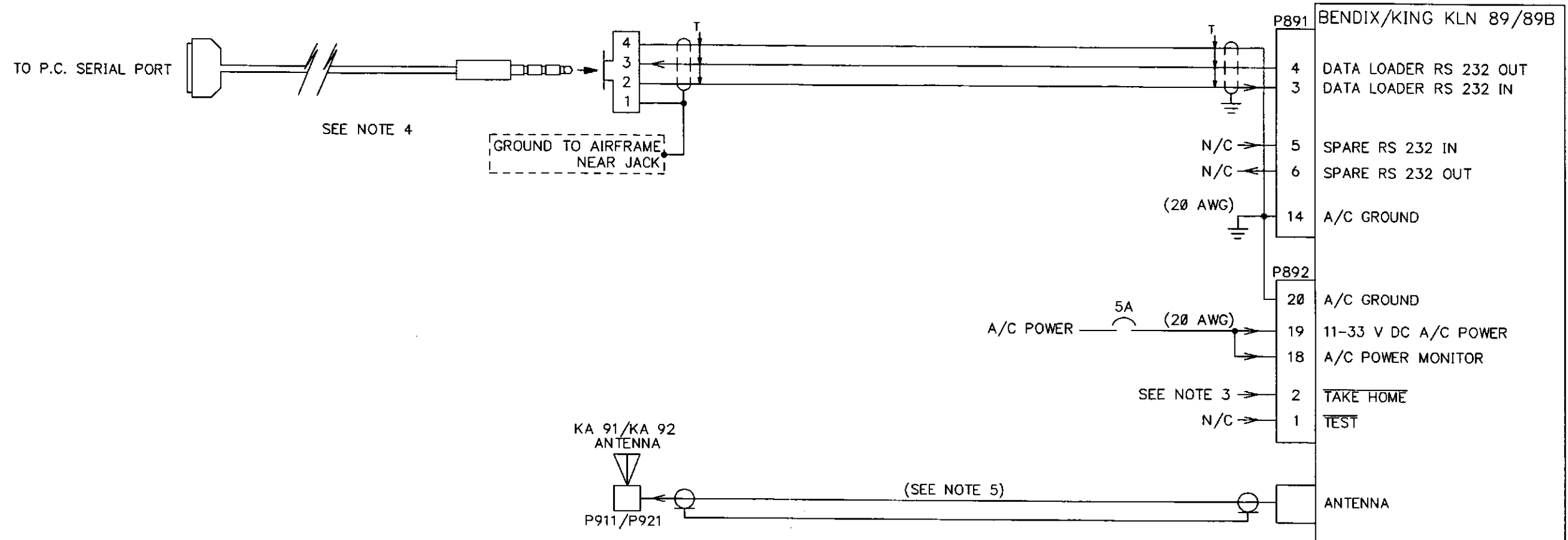
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- NOTES:
1. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
  2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
  3.  $\perp$  CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 7 of 8)**

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**NOTES:**

1. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
2. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
3. THIS PIN MUST ALWAYS BE OPEN WHEN THE UNIT IS USED FOR NAVIGATION. THIS PIN IS CONNECTED TO GROUND TO PLACE THE UNIT IN THE TAKE HOME FLIGHT SIMULATION MODE.
4. PART OF 050-03213-0000 INTERFACE KIT.
5. WIRE TYPE VARIES WITH WIRE LENGTH. REFER TO ANTENNA INSTALLATION CONSIDERATIONS SECTION OF INSTALLATION MANUAL FOR DETAILS.
6.  $\perp$  CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-17 KLN 89/89B INTERCONNECT DRAWING**  
**DWG. NO. 155-06023-0000, REV. AB**  
**(Sheet 8 of 8)**

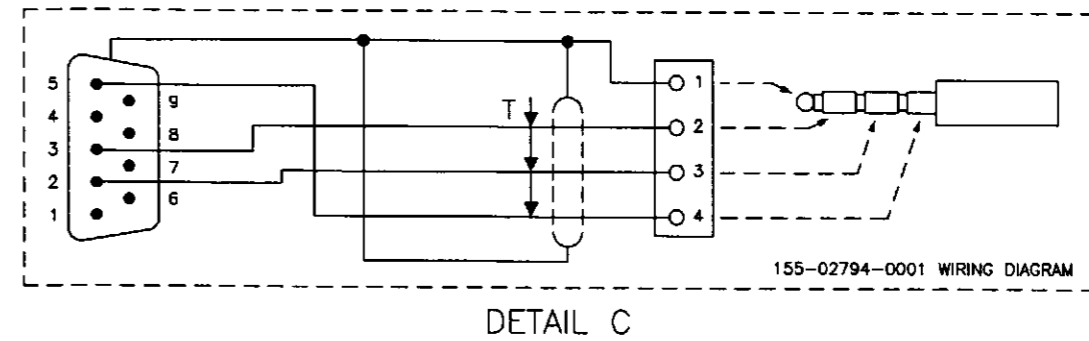
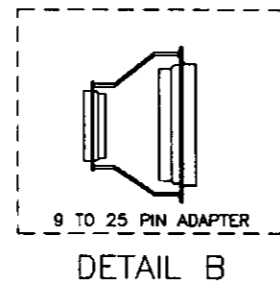
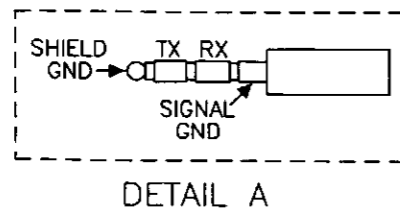
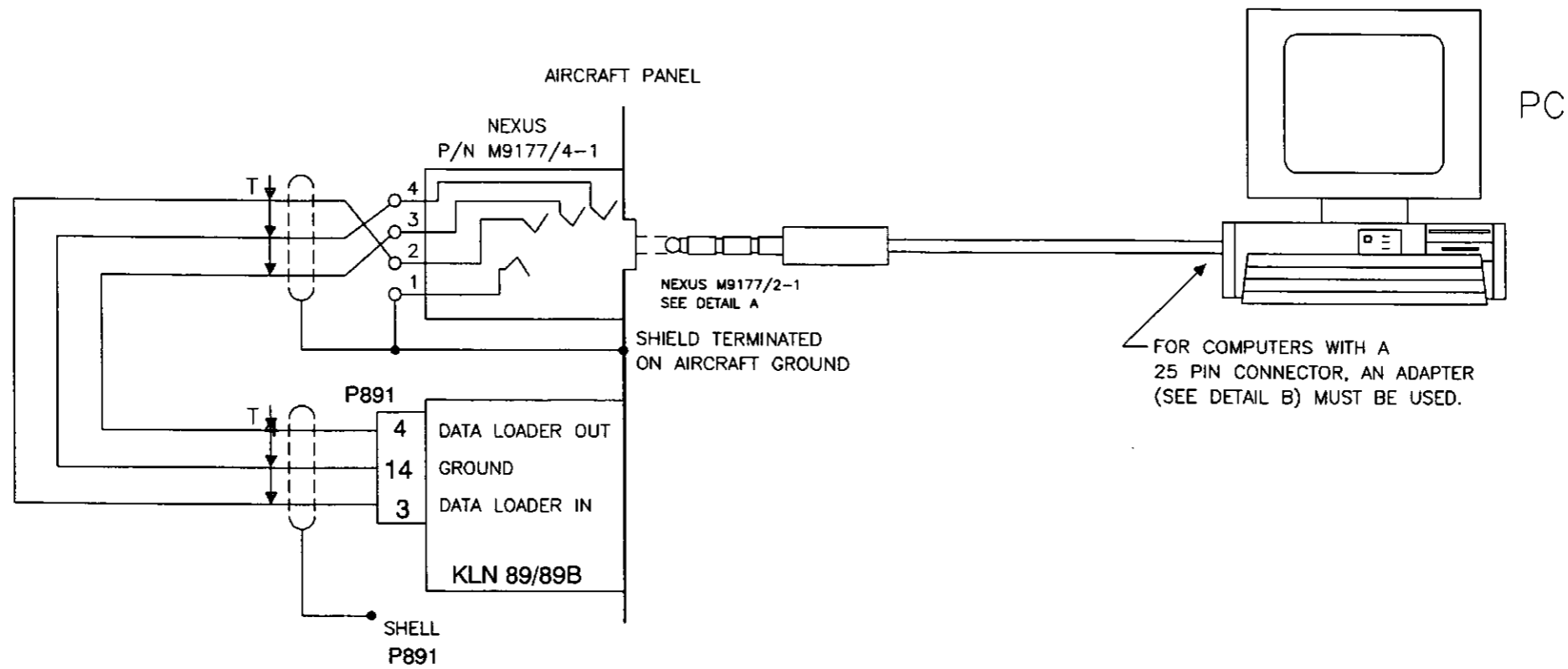


FIGURE 2-18 KLN 89/89B DATA LOADER/PC INTERFACE DRAWING

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## 2.4 POST INSTALLATION CHECK OUT INFORMATION

### 2.4.1 Maintenance Pages

As part of every KLN 89 and KLN 89B installation it is necessary to enter the Maintenance (MNT) pages in order to configure the unit properly for the specific installation. Electronically configuring the units replaces the need of installing strapping or configuration wires in the harness. This makes it easier to configure the unit at the time of initial installation and also later on if changes are made to the aircraft such as the later addition of a fuel management system, air data system, or upgrade from VFR to IFR.

This configuration data is stored both in the external configuration module (mounted in the back plate of the mounting tray) and in memory internal to the KLN 89/B. When the KLN 89/B is initially shipped from the factory, the configuration data is set to the same default values/status in both the external configuration module and the units internal memory. The initial defaults are specified below. When the Maintenance pages are entered and changes made to the configuration data, the changes are stored both in the external configuration module and the internal memory. If the configuration data differs in the external configuration module from the units internal memory, the external configuration module data is automatically used. Differences could occur if after configuring the KLN 89/B the initial unit was removed and a second unit inserted into the rack. For example, if the KLN 89/B is initially configured correctly and a loaner unit is later installed in the aircraft, the external configuration module would ensure that the proper configuration data was used. The external configuration module is part of the installation kit and should be utilized in every installation to make sure that proper operation occurs regardless of the unit that may later be inserted into the mounting tray.

To enter the Maintenance pages, the MSG button must be depressed before the unit is turned on and continue to be depressed for 10 seconds (+/- 2 seconds) after turn on. At the end of the 10 second period, release the MSG button for 1 second and momentarily press the MSG button again. Following this sequence, the unit will automatically enter the Maintenance (MNT) pages.

After entering the Maintenance pages if the configuration data is different between the external module and the units internal memory, the following page is displayed (this page will not be displayed if they are the same):

#### CONFIGURATION

1. Copy Module to Unit?
2. Copy Unit to Module?

Select: 1    OK?

If you wish to copy the configuration data from the external configuration module to the units internal memory OR if you plan to manually change the configuration data, simply press the ENT button.

If you wish to copy the configuration data from the units internal memory to the external module, turn the large outer knob counterclockwise to position the flashing cursor over the 1. Turn the small inner knob to select a 2. Turn the large outer knob one step clockwise to position the cursor back over the OK? and then press the ENT button.

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**2.4.1.1 Maintenance 1 (MNT 1) pages**

The MNT+1 page is now displayed. There are three MNT+1 pages. The + sign indicates that there is more than one MNT 1 page. The first MNT 1 page has the following selection choices and format:

1. Whether the unit is certified as IFR or VFR (KLN 89B only, KLN 89 does not offer this choice since it is always VFR).
2. Whether the unit is certified for IFR en route/terminal use only or for both en route/terminal and non-precision approach (applicable to KLN 89B only).
3. Whether the altitude alerting feature is enabled or disabled. If the aircraft has another source of altitude alerting such as that associated with a flight control preselector, this feature should be disabled.

<u>First MNT+1 Page format</u>	<u>Selection Choices</u>	<u>Default</u>
IFR/VFR: IFR	IFR (KLN 89B only) or VFR	VFR
IFR Apr/Enr: Apr	Apr or Enr (KLN 89B only - blank if line one above is VFR)	Enr
ALT alt: Enabled	Enabled or Disabled	Disabled

To change a selection:

Press the CRSR button to bring the flashing cursor on the screen. Turn the larger outer knob to position the cursor over the desired selection. Turn the small inner knob to change the selection. Make any additional changes on this page at this time. When finished, press the CRSR button to turn off the cursor.

To select different MNT pages:

Turn the small inner knob (the flashing cursor must be off the page. If it is on, press the CRSR button to turn it off). Select the second MNT+1 page.

The second MNT+1 page has the following selection choices and format. Changes are made using the CRSR button and concentric knob as described above.

1. Whether the KLN 89/B is interfaced with a fuel management system.
2. Whether the fuel management system includes it own control/indicator used to enter fuel quantity. (Not a choice if there is no fuel management system).
3. What is the full fuel quantity of the aircraft. (Not a choice if there is no fuel management system or if the fuel management system has its own control/indicator used to enter fuel quantity).

<u>Second MNT+1 Page format</u>	<u>Selection Choices</u>	<u>Default</u>
Installed Equip		
Fuel Mgt Sys: Y	Y or N for yes and no	N
Fuel Mgt Ind: N	Y or N (this line blank if N is selected above)	N
Full Fuel: 0064	0000 to 9999 (this line blank if no fuel mgt sys or if fuel mgt sys has its own control/indicator)	0000

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2.4.1.4 Maintenance 4 (MNT 4) Page

The MNT 4 page is used to set the bus monitor voltage and alert delay so that if the aircraft's charging system were to fail (i.e. generator/alternator failure) the pilot would be given timely notification of the failure. The alert delay is selected so that momentary voltage drops which could be caused by such things as cycling the aircraft's gear or flaps do not cause nuisance notifications to the pilot. When the bus voltage falls below the selected alert voltage for the selected alert delay time the unit notifies the pilot with the following message that is displayed on the message page:

Low Bus Voltage  
Check Charging System

This Power Monitor feature can be turned on and off by the pilot on the SET 10 page but actual configuration can only be done from the MNT 4 page. The SET 10 page displays to the pilot the actual bus voltage to the KLN 89/B as well as the alert voltage and alert delay that have been configured on the MNT 4 page. Changes are made to the MNT 4 page using the CRSR button and the concentric knobs as described in section 2.4.1.1.

The MNT 4 page has the following format and choices:

<u>MNT 4 Page format</u>	<u>Selection Choices</u>	<u>Default</u>
BUS MONITOR		
Alert Volt 12.8V	0.0 - 33.0V	10.0V
Alert Delay 15S	0 - 99 seconds	15 seconds

The following procedure is suggested as a means of determining what voltage to use for the alert voltage. Cycle power to the KLN 89/B to exit the Maintenance pages. View the SET 10 page to determine the actual voltage being supplied to the KLN 89/B while the engine is running (alternator/generator supplying the bus voltage). You may want to do this with the engine at idle so that you see the lowest possible voltage supplied by the alternator/generator. Next, determine the actual voltage being supplied to the KLN 89/B when only the battery is supplying the voltage (alternator/generator turned off or engine not running).

The alert voltage should be chosen to be about half way between these two voltages. For example, in a 14 volt aircraft say the alternator supplied voltage is 13.8 volts as displayed on the SET 10 page with the engine running. The battery supplied voltage with the engine not running is 12.0 volts. An appropriate alert voltage in this case would be 12.9 volts. If an alternator were to fail in flight and the voltage drop to 12.0 volts for at least 15 seconds (or whatever alert delay time was selected), the pilot would be notified of the problem.

**NOTE**

In order to prevent nuisance messages, this feature should be disabled (Alert Volt OFF) on the SET 10 page on aircraft where the alternator/generator output drops down to a voltage close to the battery voltage during engine idle.

When the maintenance pages are configured as desired, it is necessary to cycle power to the unit in order to leave the maintenance pages and allow normal operation.



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The third MNT+1 page has the following selection choices and format.

1. Whether the KLN 89/B is installed with an air data computer.
2. Whether the KLN 89/B is installed with a back-up emergency battery (not available from AlliedSignal).
3. Below what aircraft bus voltage should the back-up battery be used. (Not a choice if there is no emergency battery).

<u>Third MNT+1 Page format</u>	<u>Selection Choices</u>	<u>Default</u>
Installed Equip		
Air Data: Y	Y or N for yes and no	N
Emerg Bat: Y	Y or N	N
Use Bat: 10.2V	0 - 33 volts (this line blank if no emerg bat)	10.2V

#### 2.4.1.2 Maintenance 2 (MNT 2 ) Page

The MNT 2 page displays hours and number of power cycles on the KLN 89/B and is not configurable.

#### 2.4.1.3 Maintenance 3 (MNT 3) Page

The MNT 3 page is used to calibrate the OBS setting of the aircraft's HSI or CDI to the KLN 89/B so that the KLN 89/B reads the value the pilot selects on the HSI or CDI. It is necessary to configure this page only if the KLN 89/B is interfaced to an HSI or CDI resolver such that the KLN 89/B is able to read the course selected on the HSI or CDI. To calibrate the OBS:

1. Select a course using the course select/OBS knob on the HSI or OBS that is interfaced with the KLN 89/B . It is suggested that a course increment of 10 degrees (example 10,150, 270, etc.) be used so that the course can be selected as precisely as possible.
2. Press the CRSR button to turn on the cursor.
3. Use the small inner knob to select the exact course that is selected on the HSI or CDI in step 1 above.
4. Adjust the HSI or CDI to another course which is NOT 180° away from the original course, and verify the correct course is displayed within 2° . If not, the OBS resolver interface may be miswired.
5. Press the CRSR button to turn off the cursor. The calibration is now complete.

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#### 2.4.2 POST INSTALLATION CHECKOUT PROCEDURE

This procedure is divided into two major sections. The first section deals with "Stand Alone" installations in which none of the signal Input/Output capability of the unit is utilized, (except for the RF input signal from the antenna). In this type of installation the only connections to the KLN 89/89B are the cable from the GPS antenna, the aircraft power and ground leads, and the lighting bus wires.

#### **NOTE**

All output data is read from the unit front panel display and all input to the unit is via the front panel controls.

The second part of this procedure deals with an installation in which some or all of the electrical signal I/O have been utilized. This second section is divided in such a way that each input or output signal is treated separately, and hence only those subsections that apply to a given installation will be conducted.

It is assumed that the operator's manual for the various units connected to the KLN 89/89B (as well as the manual for the KLN 89/89B itself), are available or that the installer is familiar with operating the units.

#### 2.4.3 INSTALLATION CHECK OUT

Before inserting the unit into the mounting rack, verify that at the rear connector of the mounting rack, aircraft power is present on P892 pin 19, and that there is a ground on P891 pin 14 and P892 pin 20. In installations using 28 V lighting, lighting bus voltage should be present between P891 pins 24 and 14. In installations using 14 V lighting, lighting bus voltage should be present between P891 pins 25 and 14. Verify that there are no voltages or grounds present on any other pins of P891 and P892.

- A. Making sure that the power On/Off switch, located on the front panel of the KLN 89/89B, is rotated the "off" position (power off), plug the unit into the mounting rack and verify that the panel lighting works properly.
- B. Energize the unit by rotating the power control switch to the "on" position.
- C. Manipulate the controls as necessary to display the Set 1 Page on the right half of the screen. On the Set 1 Page, enter the airport name or the present position (latitude and longitude) for the installation location accurate to within 60 nautical miles.  
Display the Set 2 Page. Verify that the date and time are correct to within 10 minutes and update if necessary.
- D. At this point the aircraft will have to be moved to a location known to have reasonable GPS signal coverage. This implies an outside location away from tall structures that could mask low elevation satellites. (To speed up the next test it is helpful to turn unit power off then on again once the system is away from structures)

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- E. Proceed to the OTH 1 page. The State shown on the display should change to Acquire (ACQ) from INIT and after a period of not more than 5 minutes, (typically two minutes depending on the satellite coverage), the unit should display Latitude and Longitude values on the Nav 2 Page that are correct for the installation location. If the unit has not been turned on for 6 months, the unit will take up to 20 minutes to calculate a position.
- F. Select the OTH 2 page, verify that no asterisks appear next to any satellite with an elevation greater than 25°. Select 121.15 MHz on COMM 1. Transmit on COMM 1 for a period of 20 seconds and verify that no asterisks appear indicating satellites with an elevation of greater than 25°. Repeat for the following frequencies 121.175, 121.20, 131.250, 131.275 and 131.30 MHz. Repeat the above procedure for all VHF COMM's on board the aircraft.
- If any of the above tests do not pass (any asterisks appear on satellites with greater than 25° during the above tests), it will be necessary to identify the source of the interference. There are two common sources of interference:
1. The 12th and 13th harmonics of the above mentioned frequencies can be radiated from the VHF COMM at a level strong enough to be a problem to the GPS but still be well low enough to meet TSO requirements for the VHF COMM. If the interference is from the radiating VHF COMM, an optional notch filter (i.e. the KA 198 P/N 071-01565-0000 or TED Mfg 4-70-54) will need to be installed. The recommended location for the inline filter should be as close to the VHF RT as practical.

**NOTE**

The conditions and tests performed on this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within these performance standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

2. The other possibility is re-radiation from an ELT. The radiated RF from the VHF COMM can excite the output tank circuit of the ELT and cause it to oscillate and radiate RF strong enough to interfere with the GPS. If disconnecting the ELT antenna eliminates the GPS interference, the manufacturer of the ELT should be contacted for a recommended solution.

#### 2.4.4 INTEGRATED INSTALLATION CHECK OUT

The following paragraphs define checkout procedures for all possible Input/Output signals that can be connected to the KLN 89/89B. It should be clearly determined which of the signals are intended to be used in any given installation and then only the paragraphs pertaining to those signals should be performed.

##### 2.4.4.1 All Installations

Perform all steps defined in Paragraph 2.4.3 and leave the system energized with a valid GPS signal being received.

##### 2.4.4.2 CDI/HSI Interface

Cycle the power on the KLN 89/89B which will cause the self test page to be displayed. Verify that the CDI needle, after it has settled, is indicating half scale right deflection. Verify that the TO/FROM flag is indicating FROM. Verify that the nav flag is pulled from view.

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Verify the selected course from the CDI/HSI is interfaced properly to the KLN 89/89B in the OBS Mode.

You must create an active waypoint on the Flightplan 0 page to check the following function. The OBS/LEG selection is controlled through the OBS button located on the front panel of the KLN 89/89B. Pressing this button toggles between LEG and OBS with the normal position being LEG. During OBS mode, the LEG indication (located left of the vertical page divider) will change to a three digit course value.

Verify that the selected course value agrees with the value displayed on the HSI Course Pointer. Change the selected course value on the HSI or CDI using the OBS knob. Verify that the selected course value displayed on the KLN 89/89B tracks the new value selected.

In the OBS mode with the GPS displayed on the CDI/HSI, the resolver is disconnected from the NAV converter. Verify that the KNS 80 or 81 groundspeed is still functional and the Radial display for the KX 165 or KNS 81 is still functional. These units must have jumpers or resistors across them when the resolver is removed.

In the OBS mode with the GPS not displayed on the CDI/HSI, the resolver is reconnected to the NAV converter. Verify that change in the OBS resolver will not affect the selected OBS on the KLN 89/89B.

#### 2.4.4.3 Gray Code Altitude Inputs

With gray code altitude being supplied by a compatible encoding altimeter, verify that the proper altitude is indicated on the ALT page (provided no other altitude sources are active and that proper baro setting has been entered).

Verify that there is no interference between the KLN 89/89B, transponder, and any other loads on the encoding altimeter output. Remove power from each of the loads on the encoder to verify that the remaining equipment still performs properly. If interference exists, one or more of the units are not diode isolated and isolation diodes will need to be added to the aircraft wiring.

#### 2.4.4.4 RMI Interface

Cycle power on the KLN 89/89B which will cause the self test page to be displayed. Verify that the RMI indicates 130°.

#### 2.4.4.5 ELT Interface

The following test must be conducted within five minutes after the hour with ELT transmissions limited to 3 (Three) sweeps. A sweep occurs each time there is a voice transmission. Verify that the present position is displayed on the KLN 89/89B Nav 2 page. Activate the Comm Receiver and tune it to 121.5 MHz. Switch The ELT cockpit toggle switch to TEST. The ELT light should flash and the "sweeping" sound of the ELT should be heard on the Comm Receiver. Within 1 (one) minute, a voice transmission should be heard which contains the present position displayed on the KLN 89/89B Nav 2 page. Switch the toggle switch to AUTO and push the reset button until it stops flashing.

#### 2.4.4.6 Moving Map Interface

If the KLN 89/89B is interfaced to a moving map display, verify operation by moving the aircraft out to an open location to acquire a satellite position. Enter some active flightplan or waypoint to develop a presentation on the map. Some moving maps require 2 kts of ground speed to display as the sense track angle is used instead of the heading. The KLN 89/89B does not output track angles when the groundspeed is below 2 kts.

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#### 2.4.4.7 External Annunciators

Recycle the power on the KLN 89/89B which will cause the Self Test Page to be displayed. Verify that all external annunciators are energized. Cycle the KLN 89/89B display past all initialization pages. Verify all external annunciators are extinguished. If the message light comes on, view the Message Page to verify that there is a message. If any other annunciator remains lighted, review the status of the KLN 89/89B to determine if the lighted annunciator is justified.

**NOTE**

Annunciators should be checked one at a time in order to verify that the correct one lights.

#### 2.4.4.8 Dataloader

The data base cartridge may be updated with a new database using a laptop computer. The laptop computer must be IBM compatible, have an open COM port (1,2,3, or 4).

##### Internet Update

A new database can be obtained via the INTERNET at the following address:

**<http://www.gpsdatabase.com>**

Store the new database on the hard drive of the PC. Then connect the laptop via the PC loader kit PN 050-03213-0000 (ref. figure 2-18). Turn on the KLN 89/89B to the SET 3 page. Then run the program NETLOAD.EXE and follow the appropriate instructions.

##### Diskette Update

Connect the laptop via the PC loader kit PN 050-03213-0000 (ref figure 2-18). Turn on the KLN 89/89B to the SET 3 page. Insert the 3.5" Database diskette into the PC. Cycle the power of the PC and follow the menu driven instructions. (A small number of PC's may exhibit problems during the load because a few select BIOS services are incompatible with the AlliedSignal diskettes. If there is uncertainty relating to this, contact AlliedSignal Product Services (913) 782-0600.)

**NOTE**

The KLN 89/89B database may be updated using a PC with the KLN 89/89B mounted in an aircraft (ref. figure 2-18).

#### 2.4.4.9 ALT ALERT, ALT ALERT AUDIO

Upon approval of the self test page, five (5) beeps will be issued on the audio output and five (5) sonalert bursts will be produced by the ALT ALERT output, if ALT ALERT has been configured "Enable".

#### 2.4.4.10 Heading Interface

Heading information may be interfaced to the KLN 89/89B by RS 232 to aid in the calculation of wind vectors and for heading orientation of the NAV 4 or moving map. RS 232 heading information may be provided from an analog to RS 232 converter, such as the Shadin fuel/air data device, through the RS 232 input.

Display the NAV 4 page and select the HDG orientation to test the heading function. If a valid heading source is available, HDG orientation will be selectable. Turn the cursor on the Nav 4 page to display the heading value when the HDG orientation is selected.

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## 2.5 ERROR CODES

The KLN 89/B provides numeric error codes and text messages for certain failures. The following table may assist in identifying the root cause of these problems.

Table 2-1

GPS Rec. Error Codes	Definition	Suggested Action
RCVR HW Error: XXXX:  RCVR Hardware Error: 0002  RCVR Hardware Error: 0004  RCVR Hardware Error: 0008   RCVR Hardware Error: 0010   RCVR Hardware Error: 0080	<p>This message appears when the KLN 89/B fails a specific internal test for the GPS receiver. The possible failure codes are described below.</p> <p><b>ROM Failure:</b> The ROM memory has failed self-test.</p> <p><b>RAM Failure:</b> The RAM memory has failed self-test.</p> <p><b>Nonvolatile Memory Failure:</b> The battery-backed RAM has failed a checksum test. Non-volatile memory will be cleared.</p> <p><b>RF Failure:</b> This means the receiver is not sensing a proper RF signal from the satellites/ antenna.</p> <p><b>ASIC Failure:</b> The GPS Correlator ASIC fails self-test.</p>	<p>Bad ROM. Return for service.</p> <p>Bad RAM. Return for service.</p> <p>It could be one of the following, in the order of probability:</p> <ol style="list-style-type: none"> <li>1. The battery-backup power to the GPS Receiver was lost. This could be due to either a dead internal battery or a bad connection on the cable to the receiver.</li> <li>2. The RAM memory is bad.</li> </ol> <p>It could be one of the following, in the order of probability:</p> <ol style="list-style-type: none"> <li>1. Coax open or shorted. Confirm the 5 volts at the antenna end.</li> <li>2. Bad antenna. Substitute the antenna or inject signal at the coax.</li> <li>3. Bad Receiver Module in GPS. Substitute the GPS unit or inject signal at the input.</li> </ol> <p>It could be one of the following, in the order of probability:</p> <ol style="list-style-type: none"> <li>1. The flex cable between the Receiver and Main Board may have come out of the socket in the GPS.</li> <li>2. Bad ASIC on receiver module in GPS. Substitute the GPS unit.</li> </ol>

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Table 2-1 (cont.)

<b>GPS Rec. Error Codes</b>	<b>Definition</b>	<b>Suggested Action</b>
RCVR Hardware Error: 0100	<b>BBP Timeout:</b> The 1 mS baseband processing timer has failed self-test.	It could be one of the following, in the order of probability: <ol style="list-style-type: none"> <li>1. The 5 volt supply to the antenna could be shorted out in the coax. This disables the oscillator in the GPS.</li> <li>2. The flex cable between the Receiver and Main Board may have come out of the socket in the GPS.</li> <li>3. Bad TCXO or ASIC on receiver module in GPS. Substitute the GPS unit.</li> </ol>
RCVR Hardware Error: 0400	<b>RS-232 Receive Failure:</b> The GPS Receiver did not receive any initialization data from the host computer on the RS-232 port.	It could be one of the following, in the order of probability: <ol style="list-style-type: none"> <li>1. The flex cable between the Receiver and Main Board may have come out of the socket in the GPS.</li> <li>2. Bad 32KHz crystal, UART, or processor on Receiver Module in GPS. Substitute the GPS unit.</li> </ol>
RCVR Hardware Error: 0800	<b>EEPROM Failure:</b> The EEPROM memory has failed its checksum.	Bad EEPROM. Return for service.
RCVR Hardware Error: 1000	<b>RS-232 Channel 2 Failure:</b> The second RS-232 UART on the receiver has failed the loop back test. This self-test can only be enabled during test mode on the receiver, and should not be seen in normal operation.	It could be one of the following, in the order of probability: <ol style="list-style-type: none"> <li>1. The receiver was put in test mode without looping back the two serial ports.</li> <li>2. Bad ASIC or Microprocessor on the receiver.</li> </ol>

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Table 2-2

GPS Page Messages	Definition	Suggested Action
Altitude Fail	<p>Indicates a missing or erroneous altitude</p> <ul style="list-style-type: none"> <li>· The altitude input on the gray code input from the encoder is wrong.</li> <li>· The GPS is configured for IFR, and there is no altitude source available.</li> </ul>	<p>The altitude from the encoder may be in error due to a miswire, or the absence of isolation diodes between the encoder and the transponder.</p> <p>If the GPS is configured for IFR, it must have a valid altitude. Verify the presence of altitude on the Self-Test or Altitude Pages (press the ALT button).</p>
NAV Superflag Failure	<p>Indicates an internal test of the NAV Superflag output has failed.</p>	<p>When the flag is supposed to be valid, it should reach a minimum voltage. Usually a failure is due to overloading of the output. The output can be tested when the Self-Test Page is displayed.</p>
RAIM position error Cross check position	<p>RAIM is a method of calculating integrity in the GPS position. It calculates the position multiple times using different sets of satellites and compares the answers. If they have excessive difference, the message appears.</p>	<p>It could be one of the following, in the order of probability:</p> <ol style="list-style-type: none"> <li>1. This probably is a GPS receiver failure. Cross check your position by other means of navigation. Return for service.</li> <li>2. The GPS has detected a problem with one of the satellites, and cannot be assured to be within IFR limits.</li> </ol>
No RS-232 Data	<p>There is no RS-232 data at the RS-232 input port.</p>	<p>The Air Data/Fuel Flow source is not outputting RS 232 data to the GPS. If no source of RS-232 is interfaced, the receiver input must be jumpered back to the RS-232 Output.</p>
RAIM not available Cross check position	<p>This means there are not enough satellites available to compute integrity (RAIM).</p> <ol style="list-style-type: none"> <li>1. The satellites are blocked from view by obstructions.</li> <li>2. They are too low on the horizon for use or too high for adequate geometry.</li> <li>3. There is a loss of sensitivity in the antenna, the coax or receiver module.</li> </ol>	<p>The aircraft should be in an open area with good visibility, and the SNR's (Signal to Noise Ratio) on the STA 1 or OTH 2 should be:</p> <p>A KLN 89/B will usually have 6-8 satellites shown, and the majority of their SNR's will be 7 to 9. SNR's of 3 and below are unusable, 4 is marginal, and 5-9 are considered good.</p> <p>If the SNR's are low, it could be one of the following, in the order of probability:</p> <ol style="list-style-type: none"> <li>1. Check the antenna coax and connection for problems.</li> <li>2. Verify that 5 volts is present at the antenna end of the coax.</li> <li>3. Substitute the receiver to check for sensitivity.</li> <li>4. Substitute the antenna to check for sensitivity.</li> </ol>



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Table 2-2 (cont.)

GPS Page Messages	Definition	Suggested Action
RAIM not available Approach mode inhibited Predict RAIM on OTH 3	This is a calculated prediction of RAIM availability. The message appears when integrity monitoring (RAIM) is predicted to not be available at either the FAF or MAP.  The GPS will not allow the unit to go into APR ACTV mode until conditions improve.	This is a feature, not a system failure.  Turn to the OTH 3 page to perform a RAIM prediction. It will give you an indication of how long it will be until RAIM is available.  This prediction can also be performed prior to departure to insure RAIM at your arrival.

Table 2-3

GPS System Error Codes	Definition	Suggested Action
KLN89(B) System Error Code XXX	System Error Codes reflect an error detected deep in the system. Some of the numeric codes will be described below	Most of the System Errors require the attention of a service center. Please note as many details as possible when the failure occurred and identify if it is repeatable.
001	Initialization Failure	
003	Failed Powerup Self Test	
006	Exception Interrupt Detected. The processor received an undesirable interrupt request	Cycle the power and see if the error is repeatable. If repeatable take the unit to a Service Center.
017	Run Time Database Checksum Failed. An error was detected on the database cartridge	The database cartridge needs replacement. Simply reloading a database into the cartridge will not fix the problem long-term.
025	ADC reference failed. The reference voltage to the Analog to Digital Converter is not at a proper level	
046	VCC Failed	
047	Reference 5V Failed	
048	13V bus Failed	
049	-12V bus Failed	
050	High Voltage bus Failed	
051	Filtered power bus Failed	
052	OBS Signal Error	
053	OBS Overcurrent detected	

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GPS RNAV

**SECTION III**  
**OPERATION**

**3.1 GENERAL INFORMATION**

For an explanation of the operating controls of the KLN 89/89B GPS RNAV refer to the KLN 89/89B pilots guide (P/N 006-08786-0000) or the aircraft's flight manual supplement.

**APPENDIX A**  
**RS-232 FORMAT DEFINITIONS**

## 1.0 GENERAL RS-232 IN

The RS-232 interface will have the following characteristics:

Byte format

Electrical per EIA RS232C

9600 baud, 8 bits, 1 stop bit, no parity

MARK is a logical 1 (one) and SPACE is a logical 0 (zero)

START bit begins as MARK, goes to SPACE

The receiving order of data bits within each data byte shall be:

START bit

Data bit 0 (lsb)

Data bit 1

Data bit 2

Data bit 3

Data bit 4

Data bit 5

Data bit 6

Data bit 7 (msb)

STOP bit

### Fuel/air data input protocol

Fuel/air data sent by the Airdata computer shall be received in block having one of the following format:

#### FORMAT A ( 13 BYTES ASCII STRING)

<u>Byte</u>	<u>Description\Format</u>
-------------	---------------------------

1	STX (ASCII code 02H)
---	----------------------

2	Unit of Measure
---	-----------------

G = .1 gallon

I = .1 imperial gallon

L = 1 liter

K = 1 kilogram

B = 1 pound

3-6	Fuel Remaining
-----	----------------

ASCII-coded decimal format, LSB first.

Example:

A fuel remaining value of 432 would be sent as "2340" (32H, 33H, 34H, 30H).

<u>Byte</u>	<u>Description\Format</u>
7	Fuel Remaining Checksum Break each decimal value into its BCD representation. Using BCD arithmetic, sum the 4 BCD values and convert the lower-order BCD digit to an ASCII coded numeric digit. Example: The checksum for a value of 432 would be "9" (39H).
8-11	Fuel Flow Rate (units/hours) ASCII-coded decimal format as for Fuel Remaining.
12	Fuel Flow Rate Checksum Sum of fuel flow rate bytes computed as for Fuel Remaining.
13	ETX (ASCII code 03H)

**NOTE**

1. Fuel remaining and fuel flow rate information shall be for the complete aircraft.
2. This 13 byte record shall be transmitted every 1.6 sec  $\pm$  .16 sec.

FORMAT B ( 52 BYTE ASCII STRING)

<u>Byte</u>	<u>Description\Format</u>
1	STX (ASCII code 02H)
2	Unit of Measure G = .1 gallon I = .1 imperial gallon L = 1 liter K = 1 kilogram B = 1 pound
3-8	Total Fuel Remaining ASCII-coded decimal format (least significant digit is tenths), LSB first. Example: A fuel remaining value of 543.2 would be sent as "2.3450" (32H, 2EH, 33H, 34H, 35H, 30H).

<u>Byte</u>	<u>Description\Format</u>
9	Total Fuel Remaining checksum Break each decimal value into its BCD representation. Using BCD arithmetic, sum the 4 BCD values and convert the lower-order BCD digit to an ASCII coded numeric digit. Example: The checksum for a value of 543.2 would be "4" (34H).
10-15	Total Fuel Flow Rate ASCII-coded decimal format as for Total Fuel Remaining.
16	Total Fuel Flow Rate Checksum Sum of fuel flow bytes computed as for Total Fuel Remaining.
17-22	Engine One Fuel Flow Rate ASCII-coded decimal format as for Total Fuel Remaining.
23	Engine One Fuel Flow Rate Checksum Sum of Left Engine Fuel Flow Rate bytes computed as for Total Fuel Remaining.
24-29	Engine Two Fuel Flow Rate ASCII-coded decimal format as for Total Fuel Remaining.
30	Engine Two Fuel Flow Rate Checksum Sum of Right Engine Fuel Flow Rate bytes computed as for Total Fuel Remaining.
31-36	Total Fuel Used ASCII-coded decimal format as for Total Fuel Remaining.
37	Total Fuel Used Checksum Sum of Total Fuel Used bytes computed as for Total Fuel Remaining.
38-43	Engine One Fuel Used ASCII-coded decimal format as for Total Fuel Remaining.
44	Engine One Fuel Used Checksum Sum of Left Engine Fuel Flow Rate bytes computed as for Total Fuel Remaining.
45-50	Engine Two Fuel Used ASCII-coded decimal format as for Total Fuel Remaining

<u>Byte</u>	<u>Description\Format</u>
51	Engine Two Fuel Used Checksum Sum of Left Engine Fuel Flow Rate bytes computed as for Total Fuel Remaining.
52	ETX (ASCII code 03H)

**NOTE**

1. In the case of single engine aircraft, all Engine One and Engine Two data (including checksums) shall be asterisks (ASCII code 2AH).
2. This 52 byte record shall be transmitted every 1.6 sec  $\pm$  .16 sec.

FORMAT C (108 BYTES ASCII STRING)

<u>Byte</u>	<u>Description/Format</u>
1-51	Same as Format B described above except that in the Units of Measured field, "I = Imperial Gallons" is undefined.
52-54	Indicated Airspeed (IAS, knots) ASCII-coded decimal format (least significant digit is units), LSB first. Example: An IAS of 298 knots would be sent as "892" (38H, 39H, 32H).
55	Indicated Airspeed Checksum Break each decimal value into its BCD representation. Using BCD arithmetic, sum the 3 BCD values and convert the lower-order BCD digit to an ASCII coded numeric digit. Example: The checksum for "892" would be "9" (39H).
56-58	True Airspeed (TAS, knots) ASCII-coded decimal format as for IAS.
59	True Airspeed Checksum Sum for TAS bytes computed as for IAS.
60-62	MACH (airspeed/speed of sound) ASCII-coded decimal format with an implicit leading decimal point (least significant digit is thousandths). Example: A MACH value of .492 would be sent as "294"(32H, 39H, 34H).

<u>Byte</u>	<u>Description\Format</u>
63	MACH checksum Sum for MACH bytes computed as for IAS.
64-69	Pressure Altitude (PALT, feet) ASCII-coded decimal format with a sign character. Example: A PALT of 34500 feet would be sent as ""00543+" (30H, 30H, 35H,34H,33H, 2BH).
70	Pressure Altitude Checksum Sum for PALT bytes, excluding the sign character. Example: The sum for -850 feet would be "3" (33H).
71-76	Density Altitude (DALT, feet) ASCII-coded decimal format with a sign character, as for PALT.
77	Density Altitude Checksum Sum for DALT bytes, excluding the sign character, as for PALT.
78-80	Total Air Temperature ( C) ASCII-coded decimal format with a sign character. Example: An OAT of 25° C would be sent as "52+".
81	Total Air Temperature Checksum Sum for total air temperature bytes, excluding the sign byte, as for PALT.
82-84	Wind Direction (degrees from true North) ASCII-coded decimal format. Example: 122° C would be sent as "221" (32H, 32H, 31H).
85	Wind Direction Checksum Sum for wind direction bytes, as for IAS.
86-88	Wind Speed (knots) ASCII-coded decimal format, as for IAS.
89	Wind Speed Checksum Sum for wind speed bytes, as for IAS.



<u>Byte</u>	<u>Description\Format</u>
90-92	Drift (degrees) ASCII-coded decimal format with a direction character. Example: 7 right would be sent as "70R", 14 left would be sent as "41L".
93	Drift checksum Sum for drift bytes, excluding the direction character. Example: The sum for "41L" would be "5" (35H).
94-98	Rate of change of PALT (feet/minute) ASCII-coded decimal format with a sign character. Example: A PALT rate of change of -210 ft/min (descent), would be "0120-" (30H, 31H, 32H, 30H, 2DH).
99	Rate of change of PALT Checksum Sum for PALT rate of change bytes, excluding the sign character, as for PALT.
100-102	Magnetic Heading (degree from magnetic North) ASCII-coded decimal format, as for wind direction.
103	Magnetic Heading Checking Sum for magnetic heading bytes, as for IAS.
104-106	Static Air Temperature ( C) ASCII-coded decimal format with a sign character. Example: A static air temperature of -2° C would be sent as "20-".
107	Static Air Temperature Checksum Sum for static air temperature bytes, excluding the sign character, as PALT.
108	ETX (ASCII code 03H)

**NOTE**

1. This 108 byte record shall be transmitted every 1.6 sec ± .16 sec.

## FORMAT D (121 BYTES ASCII STRING)

<u>Byte</u>	<u>Description/Format</u>
1-107	Same as Format C described above except that bytes 3 through 9 shall be filled with asterisks if total fuel remaining is not available and consequently must be entered through the KLN 89.
108-112	Barometric setting (Inches HG) ASCII-coded decimal format (least significant digit is hundredth of inches), LSB first. Example: An barometric setting of 29.83 inches hg would be sent as "38.92" (33H, 38H, 2EH, 39H, 32H).
113	Barometric setting Checksum Break each decimal value into its BCD representation. Using BCD arithmetic, sum the 4 BCD values and convert the lower-order BCD digit to an ASCII coded numeric digit. Example: The checksum for a value of 29.83 would be "2" (32H).
114-119	Baro-corrected altitude (feet) ASCII-coded decimal format with a sign character. Example: A baro-corrected altitude of +11000ft, would be "00011+" (30H, 30H, 30H, 31H, 31H, 2BH);
120	Baro-corrected altitude Checksum Sum for baro-corrected altitude bytes computed, excluding sign character, as for pressure altitude.
121	ETX (ASCII code 03H)

## FUEL FLOW & AIR DATA CONFIGURATION

The Fuel flow and Air data equipment configuration can be setup on MNT 1 page.

1. Fuel flow equipment installed and Air data equipment not installed

Any of the above Formats may be received. If format C or D is received, the airdata portions are ignored, the fuel data portions are used, and no error message is given.

2. Fuel flow equipment not installed and Air data equipment installed  
If format C or D is received, fuel data portions are ignored, the airdata portions are used, and no error message is given. If format A or B is received, the "GEN RS-232 In Data Error" message is displayed.
3. Both Fuel flow equipment and Air data equipment not installed  
If no data is received for this setup, the "No GEN RS-232 In Data" message will be displayed.

#### Fuel/Air Data Timing Requirement

A grace periods of 2.4 sec, in addition to the 1.6 sec transmission interval, shall be given to every Fuel/air data transmission. The unit invalidates all local copies if fuel/air data is not received for 4.0 sec  $\pm$  .40 sec.

## 2.0 GENERAL RS232 OUT

### Functional Description

#### Byte format

Electrical per EIA RS232C

9600 baud, 8 bits, 1 start bit, 1 stop bit, no parity

MARK is a logical 1 (one) and SPACE is a logical 0 (zero)

START bit begins as MARK, goes to SPACE

The order of transmission within each data byte shall be:

- START bit
- Data bit 0 (lsb)
- Data bit 1
- Data bit 2
- Data bit 3
- Data bit 4
- Data bit 5
- Data bit 6
- Data bit 7 (msb)
- STOP bit

## Data Protocol

Data shall be sent in blocks having the following format:

```
<STX><id><dddd><it><id><dddd><it>...<id><dddd><it><ETX>
```

```
<STX>  ASCII start of text character
<id>   item designator
<dddd> item data
<it>   item terminator:
<CR>   ASCII carriage return character
<STX>  ASCII end of text character
<STX>  ASCII start of text character
<id>   item designator
<dddd> item data
<it>   item terminator:
<CR>   ASCII carriage return character
<STX>  ASCII end of text character
```

Any data which is invalid or exceeds the data format will be filled with dashes.

### RS 232 Output Data Item Definitions

Item Designator	Data Format	Data Field Width	Description
A	s dd mmhh	9	present latitude; dash if position flag is set. s=sign: N for north, S for south dd=degrees mm=minutes hh=hundredths of minutes
B	s ddd mmhh	10	present longitude; dash if position flag is set. s=sign: E for east, W for west ddd=degrees mm=minutes hh=hundredths of minutes
C	ddd	3	magnetic track, degrees; dash if GS is set.

Item Designator	Data Format	Data Field Width	Description
D	ddd	3	groundspeed, knots; dash if position flag is set.
E	ddddd	5	10 x distance to active waypoint, nm; dash if nav flag is set.
G	sdddd	5	crosstrack error; dash if nav flag is set. s=sign: R for aircraft position right of course, L for aircraft position left of course dddd=100 x crosstrack error, nm
I (upper case INDIA)	dddd	4	10 x magnetic desired track, degrees (use selected course in OBS mode); dash if nav flag is set.
K	ddddd	5	active waypoint identifier
L	dddd	4	10 x magnetic bearing to active waypoint, degrees (use radial from active waypoint 180 in OBS mode); dash if position flag is set.
Q	sddd	4	magnetic variation; dash if position flag is set. s=sign: E for east, W for west ddd=10 magnetic variation, degrees
T	---A-----	9	warnings; 4th character is "A" if estimated position error exceeds 3.8 nm, otherwise "-"

Item Designator	Data Format	Data Field Width	Description
l (lower case LIMA)	dddddd	6	10 x distance to destination, nm; dash if nav flag is set.
u	free format		for development testing only
w	ddsiiiiiiLLLLmm	17	flight plan waypoint data; this item is sent for each waypoint in the active flight plan dd=waypoint number (01 ~ 25) s=sequence number bits: 76543210 xlannnn x=unused, l=1 if last waypoint, a=1 if active wpt nnnn=sequential number, unsigned binary iiii=identifier (ASCII characters); a value of 7F hex in first byte indicates unknown ident, remaining bytes should be ignored. lll=waypoint latitude; packed, unsigned binary values: 76543210 76543210 76543210 sddddddd xmmmmmm xhhhhhh s=sign: 0 for north, 1 for south ddddddd=degrees x=unused mmmmm=minutes hhhhhh=hundredths of minutes A value of 7F hex in the first byte indicates that latitude and longitude are unknown, and remaining bytes should be ignored. LLLL=waypoint longitude; packed, unsigned binary values: 76543210 76543210 76543210 76543210

Item Designator	Data Format	Data Field Width	Description
			<p>sxxxxxxx dddddddd xxmmmmmm            xhhhhhhh            s= sign: 0=East 1=West, x=unused,            d=degrees, m=minutes, h=hundredth            mm=magnetic variation at waypoint            76543210 76543210            nnnnnnnn nnnnnnnn            nnnnnnnnnnnnnnnn=Magnetic variation            at waypoint            Two's complement binary in sixteenths of            degrees.            Easterly variation is positive.            A value of 7FH in byte 14 indicates that            magnetic variation is not presently            available and bytes 14 and 15 should be            ignored.</p>
a	Snnnnn	17	<p>baro-corrected external altitude input            S = sign: + or -            nnnnn = altitude, feet (to nearest foot);            dash if not valid</p>
j	hh:mm:ss	8	<p>UTC time of data            hh=hours; mm=minutes; ss=seconds</p>
t	abcdefghij	10	<p>GPS discrettes            a=W for waypoint alert; T for turn; else dashed            b=N for new message; P for persistent            message; else dashed            c=E for en route; T for terminal; R for approach            arm; or A for approach active            d=L for LEG; D for Direct-to; O for OBS; T for            OBS-&gt;LEG transition            e=T for TO; F for FROM; else dashed            fghij=reserved for future use;            currently dashed</p>

## SPECIAL HANDLING:

### 1. Active flight plan data in LEG mode

A maximum of 25 flight plan waypoints shall be transmitted. When the number of flight plan waypoints exceeds 25, 25 of the waypoints will be broadcast. Except for the special cases of fences and DME arcs, all the flight plan waypoints will be broadcast when the number of flight plan waypoints does not exceed 25. When the number of flight plan waypoints exceeds 25, the first waypoints in the flight plan shall be omitted as necessary, unless a waypoint in the active leg would be omitted. In this case, the first waypoint in the active leg and the subsequent 24 waypoints shall be transmitted, eliminating waypoints from the end of the flight plan.

No information shall be transmitted for waypoints beyond a fence in a flight plan when the active waypoint is before the fence. Likewise, when a DME arc is present in FPL 0, only the straight segments of FPL 0 adjacent to the active waypoint will be transmitted. This means waypoints prior to the active waypoint will only be transmitted from the previous DME arc end point or beginning of FPL 0, whichever is later. Also, waypoints following the active waypoint will only be transmitted to the beginning of the next DME arc, the end of FPL 0 or the MAP fence, whichever is next.

### 2. Active flight plan data in DIRECT-TO mode or OBS-TO-LEG mode,

(i) if the "direct-to" waypoint is in the active flight plan, the "direct-from" waypoint, the "direct-to" waypoint and those waypoints, if any, coming after the "direct-to" waypoint in the active flight plan should be transmitted, the sequence and waypoint numbers should start from "1".

(ii) if the "direct-to" waypoint is not in the active flight plan, only the "direct-from" waypoint and the "direct-to" waypoint should be transmitted. The sequence and waypoint numbers, in this case, should start from "1".

(iii) identifier field of the "direct-from" waypoint shall always be blanked.

### 3. Active flight plan data in OBS mode,

(i) no flight plan data shall be transmitted.

## Performance

All RS232 data shall be transmitted at least once every 2 sec.



## **APPENDIX B**

Includes the following:

KLN 89/B SUPPLEMENTAL PROCEDURES MANUAL

KLN 89/B AIRPLANE FLIGHT MANUAL SUPPLEMENT

KLN 89/B SUPPLEMENTAL TYPE CERTIFICATE

## FLIGHT MANUAL SUPPLEMENT PROCEDURE

For the installation of the KLN 89B GPS to be FAA approved for enroute and approach IFR operation, it is necessary for the installer to create a flight manual supplement that is unique for the installation and to submit that supplement to the FAA for approval.

Following, you will find a copy of the flight manual supplement created by AlliedSignal Avionics Inc. for the initial STC installation of the KLN 89B in Mooney model M20C. Use this supplement as a guide in creating the supplement for your installation (do not copy the 006- part number in the footer). If your installation is interfaced to the same equipment (i.e. switches, annunciators, RMI, autopilot, etc.) as the initial installation, copy the guide supplement in its entirety, changing only the installers name and address, aircraft make and model, approval authorization and section titles/numbers to suit your circumstances as detailed below. More likely, if your installation is not identical to the initial installation, it will be necessary for you to determine the differences and alter your supplement accordingly. Elements of the supplement which may need to be altered for your installation are as follows:

### 1. FORMAT

The format of the finished supplement should match, as closely as possible, the format of the aircraft's flight manual and/or pilot's operating handbook. Sizing of your manual to match the aircraft's flight manual is most easily accomplished by creating it first as an 8 1/2" X 11" (standard typewriter size paper) document and then reducing that on a reducing copier to the size required before submitting it to the FAA for approval. (Most small aircraft have flight manuals of 5 1/2" X 8 1/2" size. This size has a different height/width ratio than the 8 1/2" X 11" size; the width is narrower. The guide supplement is proportioned correctly for reduction to 5 1/2" X 8 1/2" size; copy its proportions if you are planning to reduce your supplement).

The headers and footers of the guide supplement may be rearranged to match the format of your aircraft's flight manual; however, most of the information shown is required on every page. The AlliedSignal part number, 006-00839-0000, should not appear in your supplement, but the footer should include the page number, in the format "PAGE \_ OF \_", and the words "FAA APPROVED" and a blank space for the date of the approval in place of the "ORIGINAL ISSUE" of the guide supplement. The aircraft for which the supplement applies should also be identified by manufacturer and model number as shown on the aircraft's serial data plate, i.e. Beech A36 or Piper PA-46-310P (not marketing name like Bonanza, Malibu, etc.).

Headers must identify the section of the supplement for that page. Additionally, we have found it useful to include identification of the system in the header for ease of pilot reference.

The section numbers and names in the guide supplement are typical of many aircraft; however, you should check the aircraft's flight manual and match those section numbers and names when organizing your supplement.

### 2. COVER

The cover page for your supplement should essentially be identical to the guide supplement with the following exceptions:

A. In the header, substitute the installers name and address (whoever is writing the flight manual supplement) in place of the name and address of AlliedSignal Avionics Inc.

B. Substitute the manufacturer's name and model number (as shown on the serial data plate) for your aircraft in place of the Mooney models listed.

C. In the second line of text, where the sample supplement states "is installed in accordance with STC SA00244WI-D.", substitute "is installed in accordance with unit Installation Manual 006-\_\_\_\_ -\_\_\_\_, Rev. \_\_, and FAA Form 337 dated ." (Insert the part number and revision of the manual you have used).

D. Remove "CHRIS DURKIN, DAS Coordinator, AlliedSignal Avionics Inc." and "DAS4CE" from below the FAA APPROVED line. (Your supplement will be approved by an FAA representative).

E. Remove the footer on the cover page. (The footer on the guide supplement cover page is for AlliedSignal internal reference only).

### 3. TABLE OF CONTENTS

If the section names and numbers of your aircraft's flight manual do not match those of the sample flight manual supplement, you should arrange your Table of Contents and your supplement in accordance with the format of your aircraft's flight manual.

### 4. BODY OF TEXT

The body of text for all sections other than NORMAL PROCEDURES should be copied in its entirety. The text for the NORMAL PROCEDURES section may vary depending on the equipment interfaced with the KLN 89B. Some of the annunciators, switches and/or controls described in paragraph B may differ slightly or may not be included as part of your installation. Should this be the case, you will need to alter the text of this paragraph and its subparagraphs to accurately describe the operation of the KLN 89B as it exists in your installation. Do not include descriptions of annunciators, switches or controls not present in your installation. Make sure that the nomenclature on the items you do use matches the description in your flight manual supplement.

This concludes the procedure for writing a KLN 89B GPS Aircraft Flight Manual Supplement. Reduce the pages as required to match the format of your aircraft's flight manual, and you are ready to submit the new document to your local FAA representative for approval.

**BENDIX/KING® KLN 89B SUPPLEMENT**

AlliedSignal Avionics Inc.  
Olathe, Kansas 66062

**FAA APPROVED**  
**AIRPLANE FLIGHT MANUAL SUPPLEMENT**  
**FOR**  
**MOONEY MODEL M20C**  
**WITH**  
**KLN 89B GPS NAVIGATION SYSTEM**

Reg. No. \_\_\_\_\_  
Ser. No. \_\_\_\_\_

This supplement must be attached to the FAA Approved Airplane Flight Manual when the Bendix/King KLN 89B GPS is installed in accordance with STC SA00244WI-D. The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement; consult the basic Airplane Flight Manual.


FAA APPROVED: Chris Durkin

CHRIS DURKIN  
DAS Coordinator  
AlliedSignal Avionics Inc.  
DAS4CE

DATE: 2-23-96

**BENDIX/KING** KLN 89B SUPPLEMENT

**LOG OF REVISIONS**

REV	PAGE(S)	DESCRIPTION	APPROVED/DATE
1	4 8 9 All	Added turn anticipation warning to Section IV, paragraph A. Added turn anticipation warning to paragraph 4.a. Removed third GENERAL NOTE, "If the destination airport is the active waypoint...". Repaginated to include additional material.	 Chris Durkin DAS Coordinator AlliedSignal Avionics Inc. DAS4CE DATE: <u>2-23-96</u>

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**BENDIX/KING® KLN 89B SUPPLEMENT**

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**SECTION I - GENERAL**

The KLN 89B GPS panel mounted unit contains the GPS sensor, the navigation computer, a CRT display, and all controls required to operate the unit. It also houses the data base card which plugs directly into the front of the unit.

The data base card is an electronic memory containing information on airports, náavids, intersections, SID's, STAR's, instrument approaches, special use airspace, and other items of value to the pilot.

Every 28 days, Bendix/King receives new data base information from Jeppesen Sanderson for the North American data base region. This information is processed and downloaded onto the data base cards. Bendix/King makes these data base card updates available to KLN 89B GPS users.

Provided the KLN 89B GPS navigation system is receiving adequate usable signals, it has been demonstrated capable of and has been shown to meet the accuracy specifications of:

VFR/IFR en route oceanic and remote, en route domestic, terminal, and instrument approach (GPS, Loran-C, VOR, VOR-DME, TACAN, NDB, NDB-DME, RNAV) operation within the U.S. National Airspace System, North Atlantic Minimum Navigation Performance Specifications (MNPS) Airspace and latitudes bounded by 74° North and 60° South using the WGS-84 (or NAD 83) coordinate reference datum in accordance with the criteria of AC 20-138, AC 91-49, and AC 120-33. Navigation data is based upon use of only the global positioning system (GPS) operated by the United States.

**NOTE**

Aircraft using GPS for oceanic IFR operations may use the KLN 89B to replace one of the other approved means of long-range navigation. A single KLN 89B GPS installation may also be used on short oceanic routes which require only one means of long-range navigation.

**NOTE**

FAA approval of the KLN 89B does not necessarily constitute approval for use in foreign airspace.

**BENDIX/KING® KLN 89B SUPPLEMENT**

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**SECTION II - LIMITATIONS**

- A. The KLN 89B GPS Pilot's Guide, P/N 006-08786-0000, dated May, 1995 (or later applicable revision) must be immediately available to the flight crew whenever navigation is predicated on the use of the system. The Operational Revision Status (ORS) of the Pilot's Guide must match the ORS level annunciated on the Self Test page.
- B. IFR Navigation is restricted as follows:
1. The system must utilize ORS level 01 or later FAA approved revision.
  2. The data on the self test page must be verified prior to use.
  3. IFR en route and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
  4. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the KLN 89B data base. The KLN 89B data base must incorporate the current update cycle.
    - (a) The KLN 89B Quick Reference, P/N 006-08787-0000, dated 5/95 (or later applicable revision) must be immediately available to the flight crew during instrument approach operations.
    - (b) Instrument approaches must be conducted in the approach mode and RAIM must be available at the Final Approach Fix.
    - (c) APR ACTV mode must be annunciated at the Final Approach Fix.
    - (d) Accomplishment of ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches are not authorized.
    - (e) When an alternate airport is required by the applicable operating rules, it must be served by an approach based on other than GPS or Loran-C navigation.
    - (f) The KLN 89B can only be used for approach guidance if the reference coordinate datum system for the instrument approach is WGS-84 or NAD-83. (All approaches in the KLN 89B data base use the WGS-84 or the NAD-83 geodetic datums.)
  5. The aircraft must have other approved navigation equipment appropriate to the route of flight installed and operational.



**BENDIX/KING® KLN 89B SUPPLEMENT**

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**SECTION III - EMERGENCY PROCEDURES  
ABNORMAL PROCEDURES**

- A. If the KLN 89B GPS information is not available or invalid, utilize remaining operational navigation equipment as required.
- B. If a "RAIM NOT AVAILABLE" message is displayed while conducting an instrument approach, terminate the approach. Execute a missed approach if required.
- C. If a "RAIM NOT AVAILABLE" message is displayed in the en route or terminal phase of flight, continue to navigate using the KLN 89B or revert to an alternate means of navigation appropriate to the route and phase of flight. When continuing to use GPS navigation, position must be verified every 15 minutes using another IFR approved navigation system.
- D. Refer to the KLN 89B Pilot's Guide, Appendices B and C, for appropriate pilot actions to be accomplished in response to annunciated messages.

**SECTION IV - NORMAL PROCEDURES**

**WARNING**

**Familiarity with the en route operation of the KLN 89B does not constitute proficiency in approach operations. Do not attempt approach operations in IMC prior to attaining proficiency in the use of the KLN 89B.**

**A. OPERATION**

Normal operating procedures are outlined in the KLN 89B GPS Pilot's Guide, P/N 006-08786-0000, dated May 1995, (or later applicable revision). A KLN 89B Quick Reference, P/N 006-08787-0000 dated 5/95 (or later applicable revision) containing an approach sequence, operating tips and approach related messages is intended for cockpit use by the KLN 89B familiar pilot when conducting instrument approaches.

**SECTION IV  
NORMAL PROCEDURES**

**WARNING**

To prevent the possibility of turn anticipation causing potentially misleading navigation when the aircraft is not on course:

- Verify the HSI course and D-BAR presentation is proper prior to takeoff.
- Do not switch from OBS to LEG with greater than 1 nm cross track error (XTK).

If misleading data is suspected, a Direct-To operation to your desired waypoint will clear any previous OBS course, and cancel turn anticipation.

**NOTES**

- After the above Direct-To operation, further reorientation to the nearest leg of the active flight plan may be accomplished by pressing **[→]**, **[CLR]**, **[ENT]**.
- Refer to the Pilot's Guide section 4.2.2 for an explanation of turn anticipation, and Appendix A - Navigation Terms for the definition of cross track error (XTK).

**B. SYSTEM ANNUNCIATORS/SWITCHES/CONTROLS**


1. HSI NAV presentation (**NAV/GPS**) switch annunciator - May be used to select data for presentation on the pilot's HSI; either NAV data from the number one navigation receiver or GPS data from the KLN 89B GPS. Presentation on the HSI is also required for autopilot coupling. **NAV** is green. **GPS** is blue.
2. Message (**MSG**) annunciator - Will flash to alert the pilot of a situation that requires attention. Press the MSG button on the KLN 89B GPS to view the message. (Appendix B of the KLN 89B Pilot's Guide contains a list of all of the message page messages and their meanings). **MSG** is amber.

**SECTION IV  
NORMAL PROCEDURES**


3. Waypoint (WPT) annunciator - Prior to reaching a waypoint in the active flight plan, the KLN 89B GPS will provide navigation along a curved path segment to ensure a smooth transition between two adjacent legs in the flight plan. This feature is called turn anticipation. Approximately 20 seconds prior to the beginning of turn anticipation the WPT annunciator will flash, going solid upon initialization of the turn, and extinguishing upon turn completion. **WPT** is amber.

**WARNING**

Turn anticipation is automatically disabled for FAF waypoints and those used exclusively in SID/STARS where overflight is required. For waypoints shared between SID/STARS and published en route segments (requiring overflight in the SID/STARS), proper selection on the presented waypoint page is necessary to provide adequate route protection on the SID/STARS.

4. HSI course control  knob - Provides analog course input to the KLN 89B in **OBS** when the NAV/GPS switch/annunciator is in **GPS**. When the NAV/GPS switch annunciation is in **NAV**, GPS course selection in **OBS** mode is digital through the use of the controls and display at the KLN 89B. The HSI course control knob must also be set to provide proper course datum to the autopilot if coupled to the KLN 89B in **LEG** or **OBS**.

**NOTE**

Manual HSI course centering in **OBS** using the control knob can be difficult, especially at long distances. Centering the dbar can best be accomplished by pressing  and then manually setting the HSI pointer to the course value prescribed in the KLN 89B displayed message.

**SECTION IV  
NORMAL PROCEDURES**

5. GPS approach (**GPS APR ARM/ACTV**) switch/annunciator - Used to a) manually select or deselect approach **ARM** (or deselect approach **ACTV**) and b) annunciate the stage of approach operation either armed (**ARM**) or activated (**ACTV**). Sequential button pushes if in **ACTV** would first result in approach **ARM** and then approach arm canceled. Subsequent button pushes will cycle between the armed state (if an approach is in the flight plan) and approach arm canceled. Approach **ACTV** cannot be selected manually. **GPS APR** and **ARM** are white. **ACTV** is green.
6. RMI NAV presentation switch - May be used to select data for presentation on the RMI; either NAV 1 data from the number one navigation receiver, **NAV 2** data from the number two navigation receiver or GPS data from the KLN 89B GPS.

**C. PILOT'S DISPLAY**

Left/right steering information is presented on the pilot's HSI as a function of the NAV/GPS switch position.

**D. AUTOPILOT COUPLED OPERATION**

The KLN 89B may be coupled to the autopilot by first selecting **GPS** on the NAV/GPS switch. Manual selection of the desired track on the pilot's HSI course pointer is required to provide course datum to the autopilot. (Frequent manual course pointer changes may be necessary, such as in the case of flying a DME arc.) The autopilot approach mode (**APR**) should be used when conducting a coupled GPS approach.

**NOTE**

Select HDG mode for DME arc intercepts. NAV or APR coupled DME arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

**E. ALTITUDE ALERT AURAL TONES**

- 1000 feet prior to reaching the selected altitude - three short tones.
- Upon reaching the selected altitude - two short tones.
- Deviating above or below the selected altitude by more than the warn altitude - four short tones.

**SECTION IV  
NORMAL PROCEDURES**

**F. APPROACH MODE SEQUENCING AND RAIM PREDICTION**

**NOTE**

The special use airspace alert will automatically be disabled prior to flying an instrument approach to reduce the potential for message congestion.

1. Prior to arrival, select a STAR if appropriate from the **APT 7** page. Select an approach and an initial approach fix (IAF) from the **APT 8** page.

**NOTES**

- Using the outer knob, select the **ACT** (Active Flight Plan Waypoints) pages. Pull the inner knob out and scroll to the destination airport, then push the inner knob in and select the **ACT 7** or **ACT 8** page.
  - To delete or replace a **SID**, **STAR** or approach, select **FPL 0** page. Place the cursor over the name of the procedure, press **ENT** to change it, or **CLR** then **ENT** to delete it.
2. En route, check for RAIM availability at the destination airport ETA on the **OTH 3** page.

**NOTE**

RAIM must be available at the FAF in order to fly an instrument approach. Be prepared to terminate the approach upon loss of RAIM.

3. At 30 nm from the airport:
  - a. Verify automatic annunciation of **APR ARM**.
  - b. Note automatic dbar scaling change from  $\pm 5.0$ nm to  $\pm 1.0$  nm over the next 30 seconds.
  - c. Update the KLN 89B altimeter baro setting as required.
  - d. Internally the KLN 89B will transition from en route to terminal integrity monitoring.

**SECTION IV  
NORMAL PROCEDURES**

4. Select **NAV 4** page to fly the approach procedure.
  - a. If receiving radar vectors, or need to fly a procedure turn or holding pattern, fly in **OBS** until inbound to the **FAF**.

**NOTE**

OBS navigation is **TO-FROM** (like a **VOR**) without waypoint sequencing.

**WARNING**

To prevent the possibility of turn anticipation causing potentially misleading navigation when the aircraft is not on course, do not switch from **OBS** to **LEG** with greater than 1 nm cross track error (**XTK**).

- b. **NoPT** routes including **DME** arc's are flown in **LEG**. **LEG** is mandatory from the **FAF** to the **MAP**.

**NOTE**

Select **HDG** mode for **DME** arc intercepts. **NAV** or **APR** coupled **DME** arc intercepts can result in excessive overshoots (aggravated by high ground speeds and/or intercepts from inside the arc).

**WARNING**

Flying final outbound from an off-airport vortac on an overlay approach; beware of the **DME** distance increasing on final approach, and the **GPS** distance-to-waypoint decreasing, and not matching the numbers on the approach plate!

5. At or before 2 nm from the **FAF** inbound:
  - a. Select the **FAF** as the active waypoint, if not accomplished already.
  - b. Select **LEG** operation.

**SECTION IV  
NORMAL PROCEDURES**

6. Approaching the FAF inbound (within 2 nm.):
  - a. Verify **APR ACTV**.
  - b. Note automatic dbar scaling change from  $\pm 1.0$  nm to  $\pm 0.3$  nm over the 2 nm inbound to the FAF.
  - c. Internally the KLN 89B will transition from terminal to approach integrity monitoring.
7. Crossing the FAF and **APR ACTV** is not annunciated:
  - a. Do not descend.
  - b. Execute the missed approach.
8. Missed Approach:
  - a. Climb
  - b. Navigate to the MAP (in **APR ARM** if **APR ACTV** is not available).

**NOTE**

- There is no automatic **LEG** sequencing at the MAP.
- c. After climbing in accordance with the published missed approach procedure, press **↵**, verify or change the desired holding fix and press **ENT**.

**GENERAL NOTES**

- The data base must be up to date for instrument approach operation.
- Only one approach can be in the flight plan at a time.
- Checking RAIM prediction for your approach while en route using the **OTH 3** page is recommended. A self check occurs automatically within 2nm of the FAF. **APR ACTV** is inhibited without RAIM.
- Data cannot be altered, added to or deleted from the approach procedures contained in the data base. (DME arc intercepts may be relocated along the arc through the **NAV 4** or the **FPL 0** pages).

**SECTION IV  
NORMAL PROCEDURES**

- Some approach waypoints do not appear on the approach plates (including in some instances the FAF).
- Waypoint suffixes in the flight plan:
  - i - IAF
  - f - FAF
  - m - MAP
  - h - missed approach holding fix.
- The DME arc IAF (arc intercept waypoint) will be a) on your present position radial off the arc VOR when you load the IAF into the flight plan, or b) the beginning of the arc if currently on a radial beyond the arc limit. To adjust the arc intercept to be compatible with a current radar vector, bring up the arc IAF waypoint in the **NAV 4** page scanning field or under the cursor on the **FPL 0** page, press **CLR**, then **ENT**. Fly the arc in **LEG**. adjust the **HSI** or **CDI** course pointer with reference to the desired track value on the **NAV 4** page (it will flash to remind you). Left/right dbar information is relative to the arc. Displayed distance is not along the arc but direct to the active waypoint. (The **ARC** radial is also displayed in the lower right corner of the **NAV 4** page.)
- The DME arc IAF identifier may be unfamiliar. Example: D098G where 098 stands for the 098° radial off the referenced VOR, and G is the seventh letter in the alphabet indicating a 7 DME arc.



**SECTION IV  
NORMAL PROCEDURES**

- **APR ARM** to **APR ACTV** is automatic provided:
  - a. You are in **APR ARM** (normally automatic).
  - b. You are in **LEG** mode!
  - c. The **FAF** is the active waypoint!
  - d. Within 2 n.m. of the FAF.
  - e. Outside of the FAF.
  - f. Inbound to the FAF.
  - g. RAIM is available.
- Direct-To operation between the FAF and MAP cancels **APR ACTV**. Fly the missed approach in **APR ARM**.
- Flagged navigation inside the FAF may usually be restored (not guaranteed) by pressing the GPS APR button changing from **ACTV** to **ARM**. Fly the missed approach.
- The instrument approach using the KLN 89B may be essentially automatic starting 30 nm out (with a manual baro setting update) or it may require judicious selection of the OBS and LEG modes.
- **APR ARM** may be canceled at any time by pressing the GPS APR button. (A subsequent press will reselect it.)

**SECTION V - PERFORMANCE**

No change.

United States of America  
Department of Transportation — Federal Aviation Administration  
**Supplemental Type Certificate**

*Number* SA00244WI-D

*This certificate, issued to* AlliedSignal Avionics Inc.  
400 N. Rogers Road  
Olathe, KS 66062

*certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 3 of the Civil Air Regulations and additional requirements as specified in TCDS 2A3.*

*Original Product — Type Certificate Number:* 2A3  
*Make:* Mooney  
*Model:* M20C

*Description of Type Design Change:*

Installation of the Bendix/King KLN 89 GPS (Global Positioning System) Navigation Receiver for VFR operations; installation of the KLN 89B GPS Navigation Receiver for IFR enroute and non-precision approach operations.  
**REQUIRED DATA:** 1) Master Drawing List 159-08139-0001, Revision 4, dated 5-15-95; 2) For the KLN 89B only, Airplane Flight Manual Supplement 006-00839-0000, Revision 0, dated 6-23-95. Later FAA approved revisions to the above listed data are incorporated without further revision to this Supplemental Type Certificate.

*Limitations and Conditions:*

1. The KLN 89 GPS NAV is limited to use for visual flight rules operation only. A placard stating this limitation is required to be affixed to the instrument panel.

(Continued on Continuation Sheet)

*This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.*

*Date of application:* 3-30-95

*Date issued:*

*Date of issuance:* 6-23-95

*Date amended:*



*By direction of the Administrator*

*Chris Durkin*  
(Signature)

DAS Coordinator, DAS4CE

(Title)

*Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.*

*This certificate may be transferred in accordance with FAR 21.47.*

United States of America  
Department of Transportation—Federal Aviation Administration  
**Supplemental Type Certificate**  
(Continuation Sheet)

*Number* SA00244WI-D

Limitations and Conditions (continued):

2. This approval should not be extended to other specific airplanes of this model on which other previously approved modifications are incorporated, unless it is determined that the interrelationship between this change and any of those other previously approved modifications will introduce no adverse effect upon the airworthiness of that airplane.
3. The KLN 89 and 89B GPS have been evaluated as a navigation input source for the KFC 150 Series Automatic Flight Control System and found to be compatible; the interface of these systems is approved.
4. Additional equipment required for the specific type of operation must be installed and operational prior to use of the KLN 89B under Instrument Flight Rules (IFR).
5. The Shadin Fuel Air Data Computer has been evaluated as a fuel flow, temperature, and altitude input source for the KLN 89 and KLN 89B GPS and found to be compatible.

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*Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.*

**TSO APPENDIX**

**RTCA DO-160C**

**ENVIRONMENTAL QUALIFICATION**

**FORMS**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA/DO-160C  
ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: KLN 89B GPS RECEIVER

PART NUMBER: 066-01148-0101  
066-01148-0102

TSO NUMBER: C129 Class A1

MANUFACTURER'S SPECIFICATION: 004-00979-0000

MANUFACTURER: ALLIEDSIGNAL AVIONICS INC

ADDRESS: 400 N ROGERS ROAD  
OLATHE, KS 66062  
USA

CONDITIONS	SECTION	CONDUCTED TESTS																																	
TEMPERATURE AND ALTITUDE	4.0	CATEGORY A1, B4 and C1 -40°C TO +55°C																																	
IN-FLIGHT LOSS OF COOLING	4.5.4	CATEGORY V																																	
TEMPERATURE VARIATION	5.0	CATEGORY B																																	
HUMIDITY	6.0	CATEGORY A																																	
SHOCK / OPERATIONAL CRASH SAFETY	7.0	SHOCK / OPERATIONAL CRASH SAFETY																																	
VIBRATION	8.0	CATEGORIES B, M, N, P and S Note: No changes in critical frequencies observed during testing. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">Critical Vibration Frequencies (Hz)</th> </tr> <tr> <th colspan="3">Axis</th> </tr> <tr> <th>Lateral</th> <th>Vertical</th> <th>Longitudinal</th> </tr> </thead> <tbody> <tr> <td>227</td> <td>321</td> <td>93</td> </tr> <tr> <td>274</td> <td>398</td> <td>101</td> </tr> <tr> <td>602</td> <td>851</td> <td>130</td> </tr> <tr> <td>973</td> <td>1322</td> <td>155</td> </tr> <tr> <td></td> <td></td> <td>170</td> </tr> <tr> <td></td> <td></td> <td>220</td> </tr> <tr> <td></td> <td></td> <td>467</td> </tr> <tr> <td></td> <td></td> <td>493</td> </tr> </tbody> </table>	Critical Vibration Frequencies (Hz)			Axis			Lateral	Vertical	Longitudinal	227	321	93	274	398	101	602	851	130	973	1322	155			170			220			467			493
Critical Vibration Frequencies (Hz)																																			
Axis																																			
Lateral	Vertical	Longitudinal																																	
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602	851	130																																	
973	1322	155																																	
		170																																	
		220																																	
		467																																	
		493																																	
EXPLOSION	9.0	CATEGORY X (NOT TESTED)																																	
WATERPROOFNESS	10.0	CATEGORY X (NOT TESTED)																																	
FLUIDS SUSCEPTIBILITY	11.0	CATEGORY X (NOT TESTED)																																	
SAND AND DUST	12.0	CATEGORY X (NOT TESTED)																																	
FUNGUS	13.0	CATEGORY X (NOT TESTED)																																	
SALT SPRAY	14.0	CATEGORY X (NOT TESTED)																																	
MAGNETIC EFFECT	15.0	CLASS Z																																	
POWER INPUT	16.0	CATEGORY B																																	
VOLTAGE SPIKE	17.0	CATEGORIES A and B																																	
AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	18.0	CATEGORY B																																	
INDUCED SIGNAL SUSCEPTIBILITY	19.0	CATEGORY A																																	
RADIO FREQUENCY SUSCEPTIBILITY	20.0	CATEGORY T																																	
RADIO FREQUENCY EMISSION	21.0	CATEGORY A																																	
LIGHTNING SUSCEPTIBILITY	22.0	CATEGORY X (NOT TESTED)																																	
LIGHTNING DIRECT EFFECTS	23.0	CATEGORY X (NOT TESTED)																																	
ICING	24.0	CATEGORY X (NOT TESTED)																																	

004-00979-4800  
Revision AA  
Page 1 of 2

**AUTHORIZED PRINT**

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA/DO-160C  
ENVIRONMENTAL QUALIFICATION FORM

REVISION HISTORY

REV NUMBER	ECO NUMBER	DATE	DESCRIPTION OF CHANGE
0	Original Issue	10/94	
1	101883	12/94	
2	102398	2/95	
3	102827	4/95	
4	103027	5/95	
AA	138232	2/98	Updating to include -0102 part number

004-00979-4800  
Revision AA  
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**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA/DO-160C  
ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE:	KA 91 GPS ANTENNA
PART NUMBER:	071-01545-0100/0200
TSO NUMBER:	NOT AVAILABLE for 0100, C129 for 0200
MANUFACTURER'S SPECIFICATION:	See Specification Control Dwg. 071-01545-0100
MANUFACTURER:	KING RADIO CORPORATION
ADDRESS:	400 N. ROGERS OLATHE, KS 66062 USA

CONDITIONS	PARA	CONDUCTED TESTS
TEMPERATURE AND ALTITUDE	4.0	CATEGORY A2 and F2
TEMPERATURE VARIATION	5.0	CATEGORY A
HUMIDITY	6.0	CATEGORY C
SHOCK	7.0	PER SHOCK TEST
VIBRATION	8.0	CATEGORIES C,L,M, and Y
EXPLOSION	9.0	CATEGORY X (NOT TESTED)
WATERPROOFNESS	10.0	CATEGORY R
FLUIDS SUSCEPTIBILITY	11.0	CATEGORY F
SAND AND DUST	12.0	CATEGORY X (NOT TESTED)
FUNGUS	13.0	CATEGORY X (NOT TESTED)
SALT SPRAY	14.0	CATEGORY S
MAGNETIC EFFECT	15.0	CLASS A
POWER INPUT	16.0	CATEGORY X (NOT TESTED)
VOLTAGE SPIKE CONDUCTED	17.0	CATEGORY A & B
AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	18.0	CATEGORY B & Z
INDUCED SIGNAL SUSCEPTIBILITY	19.0	CATEGORY A
RADIO FREQUENCY SUSCEPTIBILITY	20.0	CATEGORY U *
RADIO FREQUENCY EMISSION	21.0	CATEGORY A
LIGHTNING INDUCED TRANSIENT SUSCEPTIBILITY	22.0	CATEGORY L
LIGHTNING DIRECT EFFECTS	23.0	CATEGORY 1B
ICING	24.0	CATEGORY C

\* Additional HIRF testing conducted, see test report 707-00615-0000

004-09100-0000  
Revision 1  
Page 1 of 2

**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA DO-160  
ENVIRONMENTAL QUALIFICATION FORM  
REVISION HISTORY

REVISION	CHANGE ORDER NO.	DATE
1	ECO 98584	July 1993

004-09100-0000  
Revision 1  
Page 2 of 2



**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA/DO-160C  
ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: KA 92 ANTENNA  
PART NUMBER: 071-01553-0200  
TSO NUMBER: C129  
MANUFACTURER'S SPECIFICATION: See Specification Control Dwg.  
071-01553-0200  
MANUFACTURER: ALLIEDSIGNAL GENERAL AVIATION AVIONCS  
ADDRESS: 400 N. ROGERS ROAD  
OLATHE, KS 66062  
USA

CONDITIONS	PARA	CONDUCTED TESTS
TEMPERATURE AND ALTITUDE	4.0	Category A2 and F2
TEMPERATURE VARIATION	5.0	Category A
HUMIDITY	6.0	Category C
SHOCK	7.0	Operational Shock Test
VIBRATION	8.0	Categories C, L, M and Y
EXPLOSION	9.0	Category X (NOT TESTED)
WATERPROOFNESS	10.0	Category R
FLUIDS SUSCEPTIBILITY	11.0	Category F
SAND AND DUST	12.0	Category X (Not Tested)
FUNGUS	13.0	Category X (Not Tested)
SALT SPRAY	14.0	Category S
MAGNETIC EFFECT	15.0	Class Z
POWER INPUT	16.0	Category A and B
VOLTAGE SPIKE CONDUCTED	17.0	Category A and B
AUDIO FREQUENCY CONDUCTED SUSCEPTIBILITY	18.0	Category A, B and Z
INDUCED SIGNAL SUSCEPTIBILITY	19.0	Category A
RADIO FREQUENCY SUSCEPTIBILITY	20.0 Change 3	Category R
RADIO FREQUENCY EMISSION	21.0 Change 3	Category A
LIGHTING INDUCED TRANSIENT SUSCEPTIBILITY	22.0 Change 2	Category XXE3
LIGHTING DIRECT EFFECTS	23.0 Change 1	Category 1B
ICING	24.0	Category C

004-09130-4800  
Revision 1  
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**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

RTCA/DO-160C  
ENVIROMENTAL QUALIFICATION FORM  
REVISION HISTORY

REV NUMBER	ECO NUMBER	DATE
0	ORIGINAL ISSUE	DECEMBER 1994
1	102111	JANUARY 1995

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**AlliedSignal**  
**BENDIX/KING KLN 89/89B**  
**GPS RNAV**

REMARKS

-Fluids Susceptibility

Fluids Used:

Ethylene Glycol  
Isopropyl Alcohol  
Denatured Alcohol  
1,1,1 Trichloroethane  
Jet A Fuel  
Aviation Fuel  
Skydrol, Type IV  
Dichlorvos (DDVP)  
Pyrethrum - Based Insecticide  
AEA Type 1  
AEA Type 2

Swelling of KA 92 observed when exposed to Dichlorvos (DDVP).

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