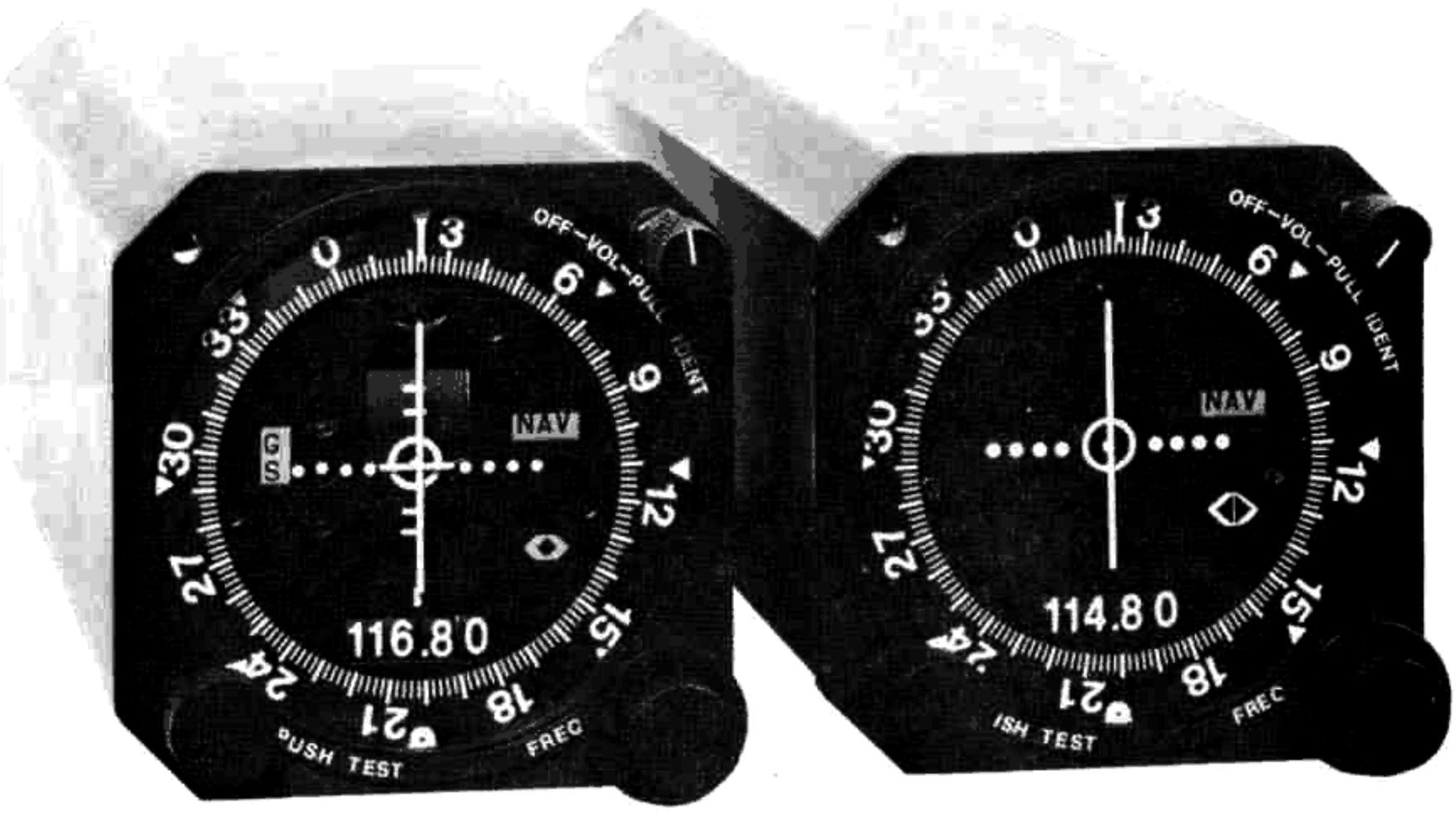
NARCO AVIONICS

NAV 121, 122, AND 122A NAVIGATION SYSTEMS



INSTALLATION MANUAL

03723-0620

NARCO AVIONICS
DIVISION OF NARCO SCIENTIFIC INDUSTRIES
FORT WASHINGTON, PENNSYLVANIA, 19034 U.S.A.

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1.6.1 Miscellaneous Items NOT Supplied

a) Number 24 AWG stranded wire, as required.
b) Number 20 AWG stranded wire, as required.
c) Coaxial cable RG 58 C/U, as required.
d) Mounting hardware; refer to Section 2.

1.7 OPERATOR LICENSE REQUIREMENT

There are no operator license requirements for this type of equipment.

1.8 OPERATION

ON-OFF, Volume, Ident Knob

Rotating the knob clockwise, past the "click", applies power to the NAV circuits; continued clockwise rotation increases audio volume. Pulling this knob allows the 1020 Hz Ident code to be heard. Since the knob is spring loaded in the time-shared NAV 122, it must be held in the Ident position. A detent is provided for the Ident mode in the NAV 121 and NAV 122A.

Receive Frequency Channeling
Receive frequency is selected by the concentric knobs at the Units lower right corner. Whole megahertz frequencies are selected by the large knob while fractional megahertz frequencies are selected by the small knob. Clockwise rotation of either knob increases selected frequency. Continuous tuning is permitted with both knobs.

FRONT VIEW NAV 121

FRONT VIEW NAV 122 AND NAV 122A

1.8 Continued

Omni Bearing Selection

A desired omni bearing is obtained by turning the OBS knob to set that bearing, shown on the Omni Bearing Card, under the yellow Selected Bearing Indicator. Pushing the OBS knob activates the Self Test Function. With a VOR signal (of any bearing) applied to the receiver, rotate the OBS knob to set a 0° bearing,under the Selected Bearing Indicator, then push in the OBS knob. If the Unit is operating properly, the VOR/LOC Deviation Indicator will center and VOR/LOC Flag will show TO. The three marker lamps also will light when the OBS knob is depressed.

VOR/LOC Deviation Indicator

In VOR mode, the vertically oriented Indicator moves left or right to indicate location of selected VOR bearing relative to actual aircraft heading. When centered, the Indicator shows on-course condition.

In LOC mode, the Indicator moves left or right to locate the center of the horizontal component of a ILS glide path relative to actual aircraft heading.

GS Deviation Indicator

Orange horizontal Deviation Indicator moves up or down to locate the center of the vertical component of an ILS glide path relative to actual aircraft position. In the NAV 122, the glideslope needle will stow up when in VOR mode or when the IDENT knob is pulled.

Acquisition of the ILS glide path will be shown when the GS and LOC Deviation Indicators cross and center within the circle.

Warning Flags

TO-FROM Flag - Red OFF Flag alerts the pilot to either loss of signal or inadaquate signal level. A TO or FROM Flag shows whether the selected course will take the aircraft to or from the station.

GS Flag - Red OFF Flag alerts the pilot to either loss of signal or inadaquate signal level.

Marker Beacon (NAV 122 and NAV 122A)

Three Marker lamps are located to the left of the VOR Deviation Indicator. Depressing the OBS knob will light and test all three lamps. Rear connector pins are provided for the following Marker features: HI-LO sensitivity, lamp dimming, and audio mute.

1.4 PRODUCT SPECIFICATIONS

TABLE 1.2 GENERAL SPECIFICATIONS

General	NAV 121	NAV 122	NAV 122A
Mechanical	Figure 2-3	Figure 2-3	Figure 2-3
Physical Dimensions	Figure 2-3	Figure 2-3	Figure 2-3
Weight	2.5 lbs (1.13 kg)	3.0 lbs (1.36 kg)	2.9 lbs (1.32 kg)
Electrical			
NAV, P810, Pins 7 and 26			
Supply Voltage (see note 1)	13.75 Vdc	13.75 Vdc	13.75 Vdc
Current, less pilot lamps, 14V	0.55 Ampere	0.55 Ampere	0.55 Ampere
Current, less pilot lamps, 28V	(see note 2)	(see note 2)	(see note 2)
Pilot lamp current 14V	0.32 Ampere	0.32 Ampere	0.32 Ampere
28V	0.32 Ampere	0.32 Ampere	0.32 Ampere
Circuit Breaker Rating	2 Amperes	2 Amperes	2 Amperes
Marker Beacon, P810 Pin 3			
Supply Voltage	----------	13.75 or 27.5 Vdc	13.75 or 27.5 Vdc
Current 14V	----------	0.25 Ampere	0.25 Ampere
28V	----------	0.29 Ampere	0.29 Ampere
Circuit Breaker Rating	----------	1.0 Ampere	1.0 Ampere

Notes: 1. Voltage Converter required for 28 Vdc installations.
2. With MP 11, 28 to 14 Vdc Voltage Converter - 0.60 Ampere.

TABLE 1.3 VOR/LOC RECEIVER

	NAV 121	NAV 122	NAV 122A
VOR/LOC Receiver			
Frequency Range (in MHz)	108.00 to 117.95	108.00 to 117.95	108.00 to 117.95
	200 channels	200 channels	200 channels
Sensitivity (6 dB S + N/N)	1.0 uV	1.0 uV	1.0 uV
(Full VOR Flag)	1.0 uV	1.0 uV	1.0 uV
Spurious and Image Rejection	80 dB min	80 dB min	80 dB min
Selectivity 6 dB	$\pm$ 19 kHz	$\pm$ 19 kHz	$\pm$ 19 kHz
60 dB	$\pm$ 42 kHz	$\pm$ 42 kHz	$\pm$ 42 kHz
AVC Flatness (10 uV to 10 kuV)	1.0 dB max	1.0 dB max	1.0 dB max
Audio Output (500 ohm load)	50 mW	50 mW	50 mW
VOR Accuracy	2.7°	2.7°	2.7°
LOC Accuracy	$\pm$ 5 ua	$\pm$ 5 ua	$\pm$ 5 ua
DME/GS Channeling Code	ARINC 2 out of 5	ARINC 2 out of 5	ARINC 2 out of 5

1.4 Continued

TABLE 1.4 MARKER BEACON

	NAV 121	NAV 122	NAV 122A
Marker Beacon Receiver			
Antenna Input Impedance	-------	50 ohms	50 ohms
Sensitivity, for lamp threshold, HI	-------	200 uV	200 uV
LO	-------	1000 uV	1000 uV
Selectivity 6 dB	-------	± 10 kHz min	± 10 kHz min
60 dB	-------	± 310 kHz max	± 310 kHz max
AVC (200 uV to 50 kuV)	-------	10 dB	10 dB
Audio Output (500 ohm load)	-------	8 mW (2V rms)	8 mW (2V rms)
Audio Amplifier Output Impedance	-------	200 ohms	200 ohms
Dimming Voltage	-------	+2 to +30 Vdc	+2 to +30 Vdc

TABLE 1.5 GLIDE SLOPE

	NAV 121	NAV 122	NAV 122A
Glide Slope Receiver			
Frequency Range (in MHz)	-------	329.150 to 335.00	-------
Sensitivity (Full GS Flag)	-------	20 uV	-------
Spurious And Image Rejection	-------	60 dB	-------
Selectivity 6 dB	-------	± 19 kHz	-------
60 dB	-------	± 42 kHz	-------
AVC Flatness (10 uV to 10 kuV)	-------	3 dB	-------
GS Accuracy	-------	± 5 ua	-------
Glide Slope Indicator Specifications	-------	-------	
Up-Down	-------	-------	150-0-150 ma 1000 ohms
GS Flag	-------	-------	250 mV 1000 ohms

1.4 Continued

TABLE 1.6 TSO ENVIRONMENTAL

Environmental, Procedure DO 160	NAV 121	NAV 122	NAV 122A
C36c A2C1/A/PKS/XXXXXXXZBBBA Class C	LOC	LOC	LOC
C40a A2C1/A/PKS/XXXXXXXZBBBA	VOR	VOR	VOR
C34c A2C1/A/PKS/XXXXXXXZBBBA Class D	----	GS	GS (Indicator)
C35d A2C1/A/PKS/XXXXXXXZBBBA Class A	----	MKR	MKR
C66a A2C1/A/PKS/XXXXXXXZBBBA	DME	DME	DME

TABLE 1.7 EXTERNAL INDICATOR AND AUTOPILOT LOADS

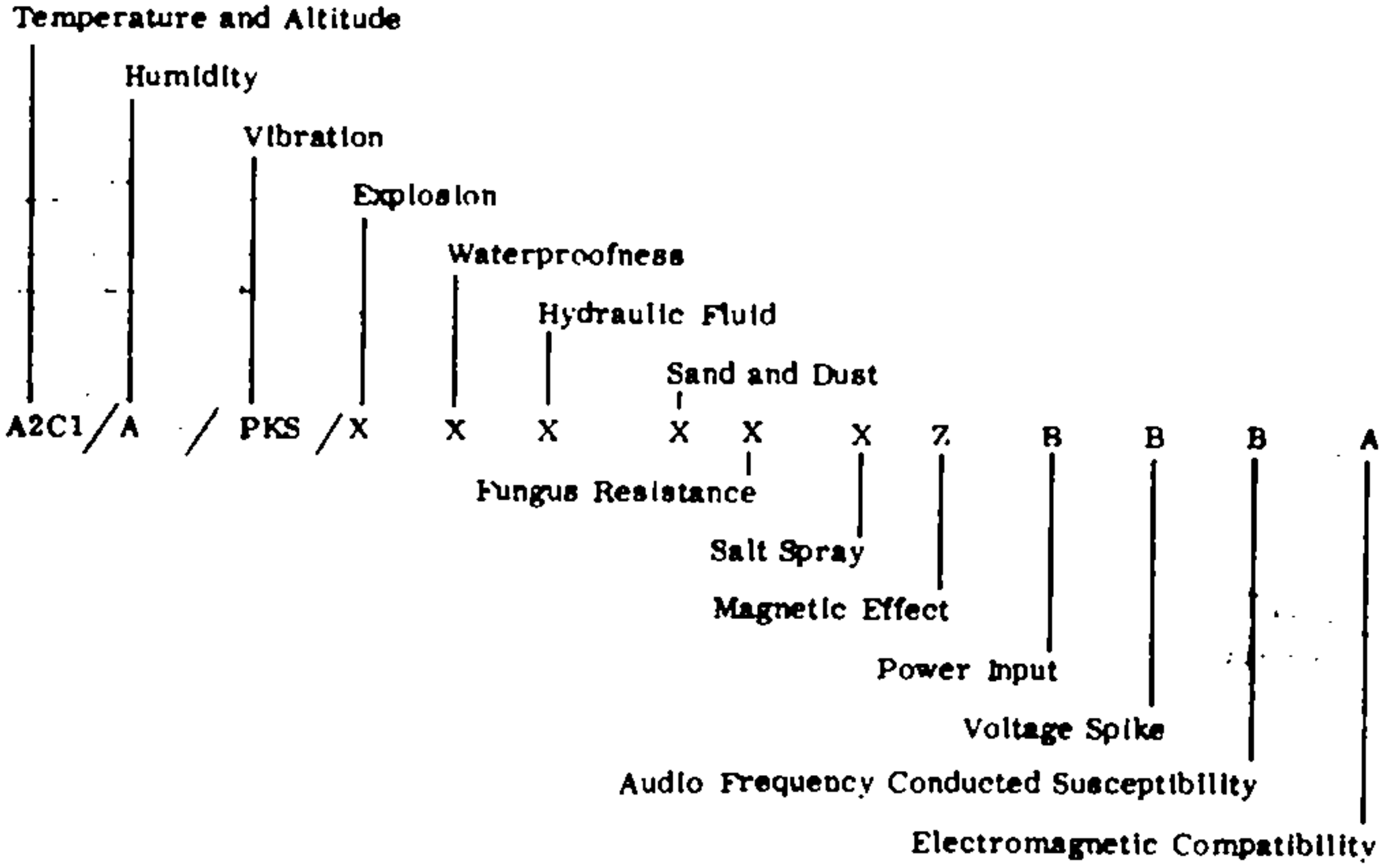
		NAV 121	NAV 122	NAV 122A
Autopilot / Indicator				
Loading				
VOR-LOC:	Left-Right	two, 1K ohm loads	two, 1K ohm loads	two, 1K ohm loads
	To-From Flag	two, 1K ohm loads	two, 1K ohm loads	two, 1K ohm loads
GS:	Up-Down	----------	two, 1K ohm loads	----------
	Warning Flag	----------	one, 1K ohm loads	----------
Output				
VOR-LOC:	Left-Right LOC	90 mV for 4 dB ddm	90 mV for 4 dB ddm	90 mV for 4 dB ddm
	VOR	150 mV for 10^{o} course change	150 mV for 10^{o} course change	150 mV for 10^{o} course change
	To-From Flag	250 mV	250 mV	250 mV
GS:	Up-Down	----------	78 mV for 2 dB ddm	----------
	Warning Flag	----------	250 mV	----------

ddm - Difference in depth of modulation

1.4.1 TSO Explanation

The NAV 121, NAV 122, and NAV 122A are designed to be instrument panel mounted within the cabin environment of fixed and rotary wing aircraft using piston or turbine engines, in single and multiengine configurations. They are designed for non-pressurized aircraft operating up to 35,000 feet as well as for pressurized aircraft. This equipment requires direct current power, but may be installed in aircraft having additional on-board alternating current sources.

There are fourteen Environmental Test Procedures established in RTCA Document DO 160. These are identified on the TSO Nameplate(s). Following are the Environmental Categories to which the Units are designed and an explanation of each category.



1.4.1 Continued

Temperature And Altitude - Category A2C1

Temperature, Operating:		
Low Operating Temperature	-20°C	(-4°F)
High Operating Temperature	+70°C	(+158°F)
Short Time Operating Temperature, High	+70°C	(+158°F)
Temperature, Non-Operating:		
Ground Survival Temperature, Low	-55°C	(-67°F)
Ground Survival Temperature, High	+85°C	(+185°F)
Altitude, Non-Pressurized:		
Maximum Operating Altitude	+11,000m	(+35,000 ft.)
Altitude, Pressurized:		
Not affected by decompression to	+12,000m	(+40,000 ft.)
Not affected by overpressurization to	-5,000m	(-15,000 ft.)

Humidity - Category A

These units have been tested under the Standard Humidity Environment of: +50°C (+122°F) at 95% relative humidity, reduced to +38°C (+100°F) with relative humidity maintained in excess of 85%.

This cycle was repeated twice for a total of 48 hours of exposure. Within 15 minutes* after exposure, the units were operated and met all specifications.

*TSO requires that all specifications be met within 4 hours after exposure.

Vibration - Categories PKS

Maximum vibration limits are: 0.08" double amplitude from 5 Hz to 22 Hz.
2.0G constant acceleration from 22 Hz to 200 Hz.
1.5G constant acceleration from 200 Hz to 500 Hz.
0.25G constant acceleration from 500 Hz to 2000 Hz.

Not Applicable - Category X

The following six Environmental Conditions do not normally exist in Civil Aircraft, when recognized installation practices are adhered to, and are therefore not tested.

Explosion - Category X
Waterproofness - Category X
Hydraulic Fluid - Category X
Sand And Dust - Category X
Fungus Resistance - Category X
Salt Spray - Category X

1.4.1 Continued

Magnetic Effect - Category Z

With this equipment operating, it may be placed at a distance less than 0.3 meter from a free magnet with a 1^{o}, or less, deflection of the magnet.

Power Input - Category B

This equipment is designed for use in aircraft electrical systems supplied by an engine driven alternator/rectifiers or DC generator with a battery of significant capacity floating on the DC bus at all times.

		28V System	14V System
Normal Operating Conditions (Vdc) are:	Maximum	30.3	16.1
	Nominal	27.5	13.8
	Minimum	24.8	12.4

Voltage Spike - Category B

This equipment has been designed to withstand the transient voltage characteristics specified by RTCA Document DO 160.

Audio Frequency Conducted Susceptibility - Category B

This equipment has been designed and tested to assure compliance with the requirements of RTCA Document DO 160.

Electromagnetic Compatibility - Category A

Note: For this series of tests, equipment interconnecting Cables and RF transmission lines were constructed in accordance with Section 2 of this manual.

1. Induced Signal Susceptibility - This equipment has been designed to withstand the effects of audio frequency electric and magnetic fields and induces voltage spikes as specified by Category A.
2. Radio Frequency Susceptibility - This equipment has been tested and is not affected by interference from other on board electronic equipment which meet Category A, Emission of Radio Frequency Energy Test of RTCA Document DO 160.
3. Emission of Radio Frequency Energy - This equipment has been tested and does not emit radio frequency energy in excess of that specified.

1.5 UNITS AND ACCESSORIES SUPPLIED

The following listings may be used to: 1) check the contents of your order and, 2) to order additional Units or components.

Table 1.8 is used for ordering Units, refer to the Units Part Number and its' Description. There is no need to order an Installation Kit as it is automatically included with its associated Unit.

1.5 Continued

Additional Installation Kits or detail parts of a Kit may be ordered from the Installation Kit Parts List. Item Part Numbers are provided for service replacement purposes and are not used when ordering a complete Installation Kit.

Table 1.10 furnishes an Optional Kits Parts List which includes a Maintenance Kit highly desired for NAV maintenance.

Refer to Section 1.6, Optional Accessories, for additional items to complete the avionics system.

TABLE 1.8 UNITS AND ACCESSORIES SUPPLIED

Unit Part Number	Unit And Description*	Supplied With Installation Kit Part Number
03723-0300	NAV 121 VOR, LOC, System	03723-0500
03723-0301	NAV 122 VOR, LOC/GS, MKR System	03723-0501
03723-0302	NAV 122A VOR, LOC, MKR System with GS Display	03723-0502

*NAV's are 14V only. Refer to Section 1.6 for 28 Vdc to 14 Vdc Voltage Converter.

TABLE 1.9 INSTALLATION KIT PARTS LIST

Item	Item Part No.	Description	Quantity 03723-		
			0500	0501	0502
1	41364-0008	Connector, P810, 37 Pin	1	1	1
2	41307-0004	Hood, P810, Straight	1	1	1
3	41308-0004	Locking Assembly, P810	1	1	1
4	41152-0003	Connector, BNC	1	3	2
5	84160-0002	Tool, Zero Set	1	1	1
6	41372-0004	Contacts, Socket, Qty 37	1	1	1

TABLE 1.10 OPTIONAL KITS PARTS LIST

Kit Part Number		Item Part Number	Qty
03723-0503	Dual Channeling Kit	----------	
	Connector, 24 Pin	41285-0006	1
	Connector, 14 Pin	41285-0003	1
	Cable Assembly	90736-0101	1
03723-0504	Maintenance Kit	----------	
	Zero Set Tool	84160-0002	1
	Extender Board (20 Pin)	56163-0101	1
	Extender Board (26 Pin)	56162-0101	1

1.6 OPTIONAL ACCESSORIES

a) Power Converter... required only for 28 volt installations:
Narco Voltage Converter(s)
MP 10 Voltage Converter, P/N 03710-0500 - see details elsewhere in this manual
OR
MP 15 Voltage Converter (Dual) P/N 03223-0302 (TSO'd to DO-160 - A2C2/A/JY/XXXXXXZBBBA
This TSO'd Dual Converter consists of two 28 Vdc to 14 Vdc Voltage Converters, each capable of 2.0 Amperes, on a single heat sink. Intended for use in 28V aircraft, the MP-15 will supply 14V to two navigation units (NAV's, ADF's, Transponders, etc.).

b) Antenna Splitter, Model VRP 48. Directs VOR and ILS signals from a single Nav antenna to a VOR/LOC receiver, a glideslope receiver, a marker beacon receiver, plus a 2nd VOR/LOC receiver. Two models are available: 1) receiver mounted or 2) remote mounted.

c) NAV (VOR/LOC) Antenna (see note)
Non TSO'd 1) Narco VRP 37, tail mounted, with 30 feet of RF cable and balun.
2) Narco VNA 10, vertical stabilizer mounted.

d) Glide Slope Antenna (see note)
Non TSO'd 1) Narco UGA 1.
2) Narco UGA 10.

e) Marker Beacon Antenna (see note)
Non TSO'd Narco VMA 15.

f) Headphones - low impedance type, 300 to 1000 ohms.

g) Audio Control Panel - Narco CP 135 or CP 136.

h) Glide Slope Receiver - Narco UGR 2A 2/5 with ARINC 2-out-of-5 channel coding. For use with GS display in NAV 122A.

i) Marker Audio Mute Switch - Supplied by installing agency: spring loaded, single pole, normally open, pushbutton or toggle switch.

j) Circuit Breaker - Supplied by installing agency; two ampere.

k) RS 42 Remote Selector - Used for channeling a single DME 190 (TSO) or UGR 2A from either of two NAV receivers; throw-over capability is provided with an external switch supplied by the installing agency. The RS 42 is required for channeling DME's which use relays for channel coding.

l) Dual Channeling Kit - Recommended when channeling both a DME and a Glide Slope receiver. Order part number - 03723-0503.

m) Right Angle, P810, Connector Hood - For use where depth behind the instrument panel is restricted. Order part number - 41307-0008.

n) Maintenance Kit - Contains two extender board assemblies and one alignment screwdriver. Extender assemblies allow circuit board operation with the board removed from the main chassis. Order part number 03723-0504.

Note: To insure complete FAA Part 37 TSO compliance as applied to Air Carrier operation, these equipments must be used with antennas meeting TSO's C34c, C35d, C36b and/or C40a as applicable. Where Part 37 compliance is not required, a non TSO'd antenna will suffice.

2.1 INTRODUCTION

This section provides all the electrical and mechanical installation information. Electrical Installation and Mechanical Installation Sections are independent and self supporting. This permits their removal from the manual allowing the electrical and mechanical installation efforts to proceed in parallel.

Interconnect cables are to be constructed by the installing agency. Refer to Section 2.4 for details.

Printed circuit board assemblies may be removed from the main chassis and electrically operated with the Maintenance Kit (part number 03723-0504). The Kit contains two board extender assemblies and one alignment screwdriver.

2.2 PRELIMINARY PROCEDURES

2.2.1 Preliminary Inspection

Carefully unpack the equipment noting any damage to shipping cartons or avionics. If damage is noted, retain the cartons to coroborate damage claims.

Inventory received items against the lists in Section 1.5 to assure a complete order.

2.2.2 Pre Installation Bench Test

The purpose of this sub-section is to determine that the Unit meets factory performance specifications.

2.2.2.1 Test Equipment Required

TYPE	CHARACTERISTIC	EXAMPLE
Regulated DC Power Supply	Voltage Range: 0 to 30 Vdc Current Range: 0 to 1 Ampere	Power Designs Model 5015
VHF Signal Generator	Frequency Range: 10 MHz to 400 MHz Modulation: AM, 0 to 95%	Hewlett Packard Model 608D
VOR/LOC Generator		IFR Model N-750 or Collins 479S-3 with Boonton 211A
Glideslope Generator		Boonton Model 232A
Audio Generator	Frequency Range: 400 Hz to 3000 Hz	Hewlett Packard Model 200CD
Volt-Ohmmeter	DC Ranges: Input Impedance: 10 megohms min. Ranges: 0.1V to 100V Accuracy: 2% of range AC Ranges: Input Impedance: 1 megohm min. Ranges: 0.01V to 100V rms Frequency Range: 10 Hz to 1 MHz Accuracy: 2% of range Ohmmeter Range: 1 ohm to 10 megohms Accuracy: 5% of reading	Hewlett Packard Model 427A
Audio Wattmeter	Load Range: 100 to 1000 ohms min. Power Range: 0 to 100 milliwatts min.	General Radio Model 1840-A
Attenuator	6 dB, 50 ohms	

2.2.2.2 Bench Test Wiring Harness

The harness shown in Figure 2-1 will permit bench testing of either a NAV 121, 122, or 122A. Alternatively, the cable to be installed in the aircraft may be used, providing in addition, a checkout of avionics and cabling.

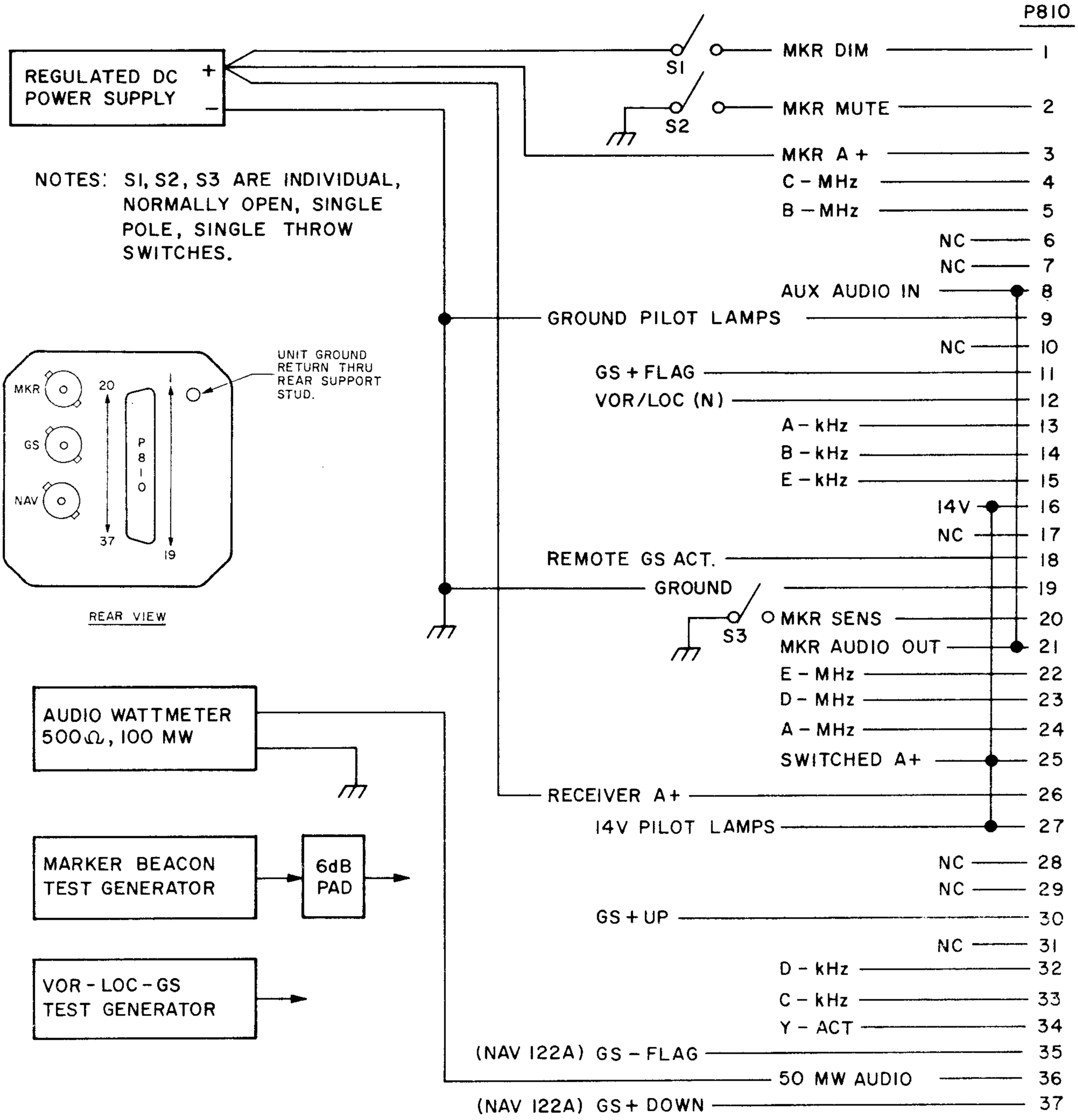


FIGURE 2-1. BENCH TEST HARNESS

2.2.2.3 Test Procedure

Bench tests are conducted in the following sequence: A) VOR/LOC receiver and audio circuits; B) VOR converter; C) LOC converter; D) GS receiver and converter; E) Marker Beacon receiver; and F) DME and GS channeling. All versions are tested by this procedure: simply bypass those procedures which do not apply.

A. VOR/LOC Receiver
   1) Connect the test equipment (Section 2.2.2.1) as shown in Figure 2-1.
   2) Connect the VOR generator's RF output to the NAV connector at the rear of the NAV Receiver.
      Generator Settings: RF output attenuator - 4 uV
      Modulation - 1020 Hz, 30%
   3) Set generator and receiver to a desired frequency.
   4) Turn receiver volume control maximum CW and pull to "IDENT" position; note audio output.
      Audio: 50 mW minimum across 500 ohms.
   5) Reduce generator RF attenuator to 1 uV.
   6) In "IDENT" mode, reduce audio power output to 2 mW (or a convenient reference); remove modulation from generator and observe decrease in audio output.
      S+N/N: 6 dB minimum
   7) Set generator RF attenuator to 10 uV; set modulation to 30%, 1020 Hz.
   8) In "IDENT" mode, set audio power output to 20 mW (or a convenient reference); increase generator RF attenuator to 10 kuV: note increase in audio power output.
      AGC: +1 dB maximum
   9) Modulate generator 30% with 1020 Hz audio; set generator attenuator to 500 uV.
   10) In "IDENT" mode, set power output to 20 mW; depress NAV Receiver VOL-IDENT knob and note decrease in audio output.
      Ident Filter: 19 dB minimum

B. VOR Converter*
   1) Modulate generator with a composite VOR signal; set RF attenuator to 500 uV.
   2) Check VOR accuracy at the four cardinal points (0^{o}, 90^{o}, 180^{o}, 270^{o}).
      VOR Accuracy: Error shall not exceed $\pm 1.5^{o}$.
   3) Rotate OBS + 10^{o} then - 10^{o}.
      Course Width: full scale deflection
   4) Decrease generator RF attenuator to less than 0.2 uV; increase RF attenuator slowly and note appearance of a full TO or FROM indication.
      VOR Flag Sensitivity: 1.0 uV maximum
   5) Set generator attenuator to 500 uV; set bearing to 90^{o}.
   6) Rotate NAV Receiver OBS to 0^{o} then push-in OBS knob.
      TEST mode: Left-Right needle must center within $\pm 1^{o}$ with a full TO flag.

*If VOR Zero Set is adjusted the SELF TEST must also be re-zeroed. Refer to Figure 2-14 for location of electrical adjustments.

2.2.2.3 Continued

C. LOC Converter

1) Set generator and receiver to a LOC frequency.
2) Modulate generator with a composite LOC signal; set RF attenuator to 500 uV.
   LOC Accuracy Centering: $\pm$ 1 needle width
   $\pm$ 4 dB ddm*: 3 dots $\pm$ 1 needle width
3) Apply centering LOC signal; decrease RF attenuator to less than 0.2 uV; increase attenuator slowly and note appearance of a full TO indication.
   LOC Flag Sensitivity - 1.0 uV maximum

D. NAV 122 Glide Slope Receiver and Converter

1) Connect GS generator's RF output to the GS connector at the rear of the NAV Receiver.
2) Modulate generator with a composite GS signal; set RF attenuator to 500 uV.
   GS Accuracy, Centering: $\pm$ 1 needle width
   GS Accuracy, $\pm$ 2 dB ddm*: 1.5 dots $\pm$ 1 needle width
3) Apply centering GS signal; decrease RF attenuator to less than 0.2 uV; increase attenuator slowly and note appearance of a full TO indication.
   GS Flag Sensitivity - 20 uV

NAV 122A Glide Slope Meters

1) Refer to Figures 2-1 and 2-2.
2) Connect test battery and resistor as shown in 2-2.
   Specification - GS Up/Down needle should deflect 5 dots.
   GS Flag should indicate full TO.

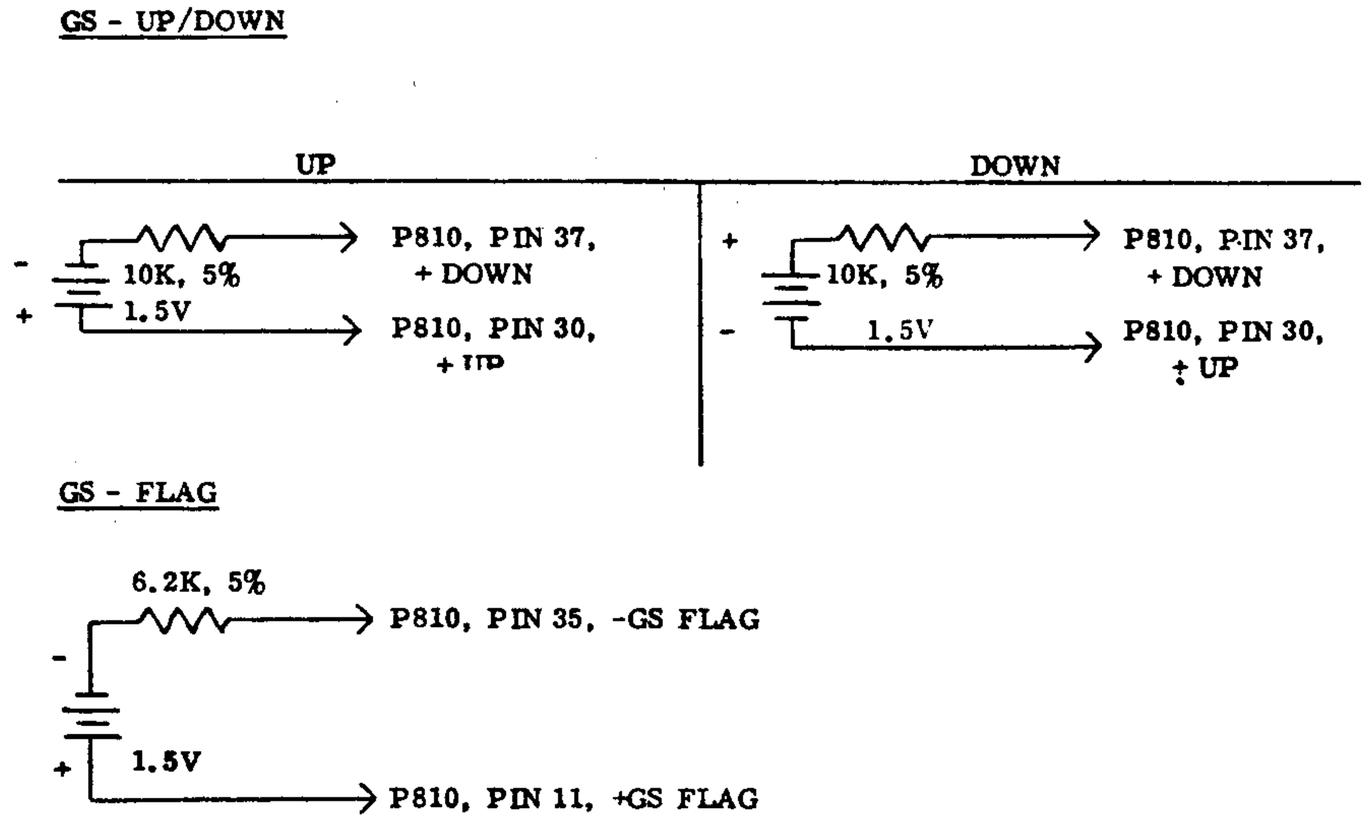


FIGURE 2-2. GS METER TEST, NAV 122A ONLY

2.2.2.3 Continued

E. Marker Beacon

1) Connect Marker Beacon generator's RF output to the MKR connector at the rear of the NAV Receiver.
2) Refer to Figure 2-1 and set S1, S2, and S3 as shown.
3) Tune generator to 75 MHz $\pm$ 1 kHz; modulate generator 95% with 1300 Hz; set generator RF attenuator to minimum.
4) Increase generator attenuator until amber lamp just begins to glow.
   HI Sensitivity - 400 uV $\pm$ 2 dB.
5) Set S3 to open circuit position; amber lamp must extinguish.
6) Increase generator attenuator until amber lamp just begins to glow.
   LO Sensitivity - 2,000 uV $\pm$ 2 dB
7) Perform step 6 with 400 Hz modulation to light the blue lamp, then 3,000 Hz modulation to light the white lamp.
8) Set switch S3 to the closed position. Set generator attenuator to 4000 uV.
   Audio Specification - 50 mW (3.1V rms) across 500 ohms
9) Set generator attenuator to 400 uV. In the "Ident" mode, set audio output to 2.0 mW. While observing audio wattmeter and marker lamps, increase generator attenuator to 100,000 uV.
   AGC: Audio output shall not increase more than 10 dB; only one lamp may light; lamp brilliance shall not decrease.
10) Set generator attenuator to 2,000 uV. In the "Ident" mode, set audio output to 20 mW. Momentarily close S2.
   Audio Mute: Audio output should decrease 40 dB minimum gradually returning over a 10 to 14 second period to 20 mW.
11) Observe lamp brilliance, then close S1.
   Dimming: Lamp brilliance should decrease.
12) Depress the OBS knob.
   TST mode: All three lamps must light.

F. DME and GS Channeling

1) Refer to Table 2.1 for channel coding. Using an ohmmeter, check for continuity of code bits to ground.
2) With power applied to the NAV Receiver, connect a voltmeter between P810 pin 18 and ground.
   VOR Channel: +4V minimum
   LOC/GS Channel: +1V maximum.

*ddm - Difference in depth of modulation.

TABLE 2.1 DME/GS 2-Out-Of-5 CHANNEL CODE

MHz Channels

MHz ARINC	P810 PIN	108	109	110	111	112	113	114	115	116	117
A	24	X	X		X	X					
B	5			X	X		X	X			
C	4					X	X		X	X	
D	23	X						X	X		X
E	22		X	X						X	X

kHz Channels

kHz ARINC	P810 PIN	.00	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
A	13			X	X	X	X											X	X	X	X
B	14	X	X	X	X			X	X	X	X										
C	33					X	X	X	X			X	X	X	X						
D	32									X	X	X	X			X	X	X	X		
E	15	X	X											X	X	X	X			X	X
Y	34		X		X		X		X		X		X		X		X		X		X
Common	19																				

Note: "X" indicates continuity to Common.

2.3 MECHANICAL INSTALLATION

The NAV 121, 122, and 122A are intended to be instrument panel mounted. When mounted from behind the panel, two screws (6-32 x 7/16) and the NAV's VOL-IDENT bushing secure the Unit (see Figure 2-3). Mounting through the front of the panel requires the use of a Marman Clamp, see Figure 2-5. In either case, rear support should be supplied using the stud extending from the rear of the Unit.

Connector P810 incorporates a "slide lock" mechanism. Before installing the connector, move the slide to position the slide's longer tab away from the connector, mate J810 and P810, then push slide to lock connector to NAV Unit. To remove P810 from the NAV Receiver, by feel, determine which end of the slide extends beyond the connector body, press this end toward the connector until it is flush, then remove the connector.

BNC connectors are located on the rear of the NAV Receiver. When attaching antenna cables, refer to Figure 2-3 for connector identification.

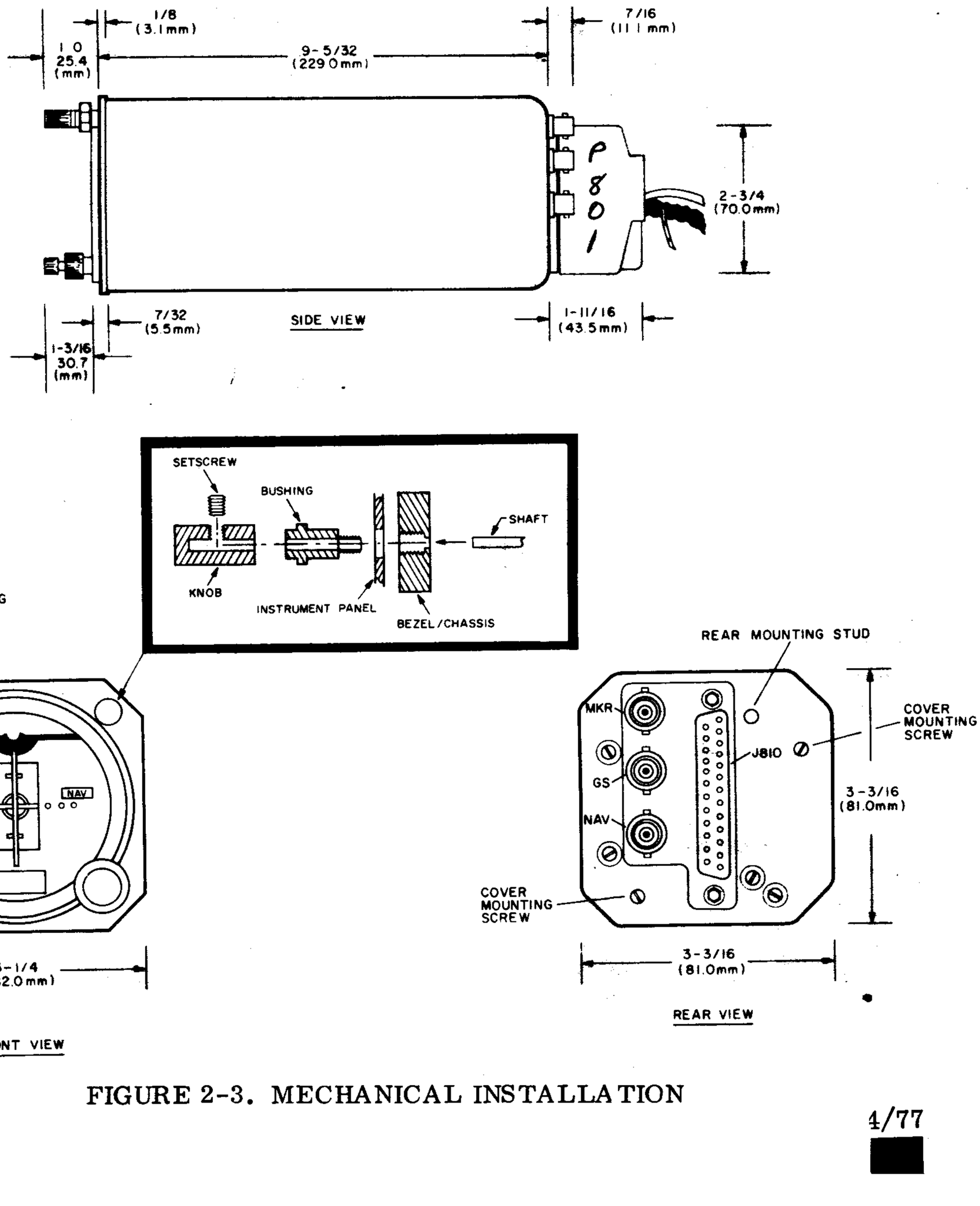


FIGURE 2-3. MECHANICAL INSTALLATION

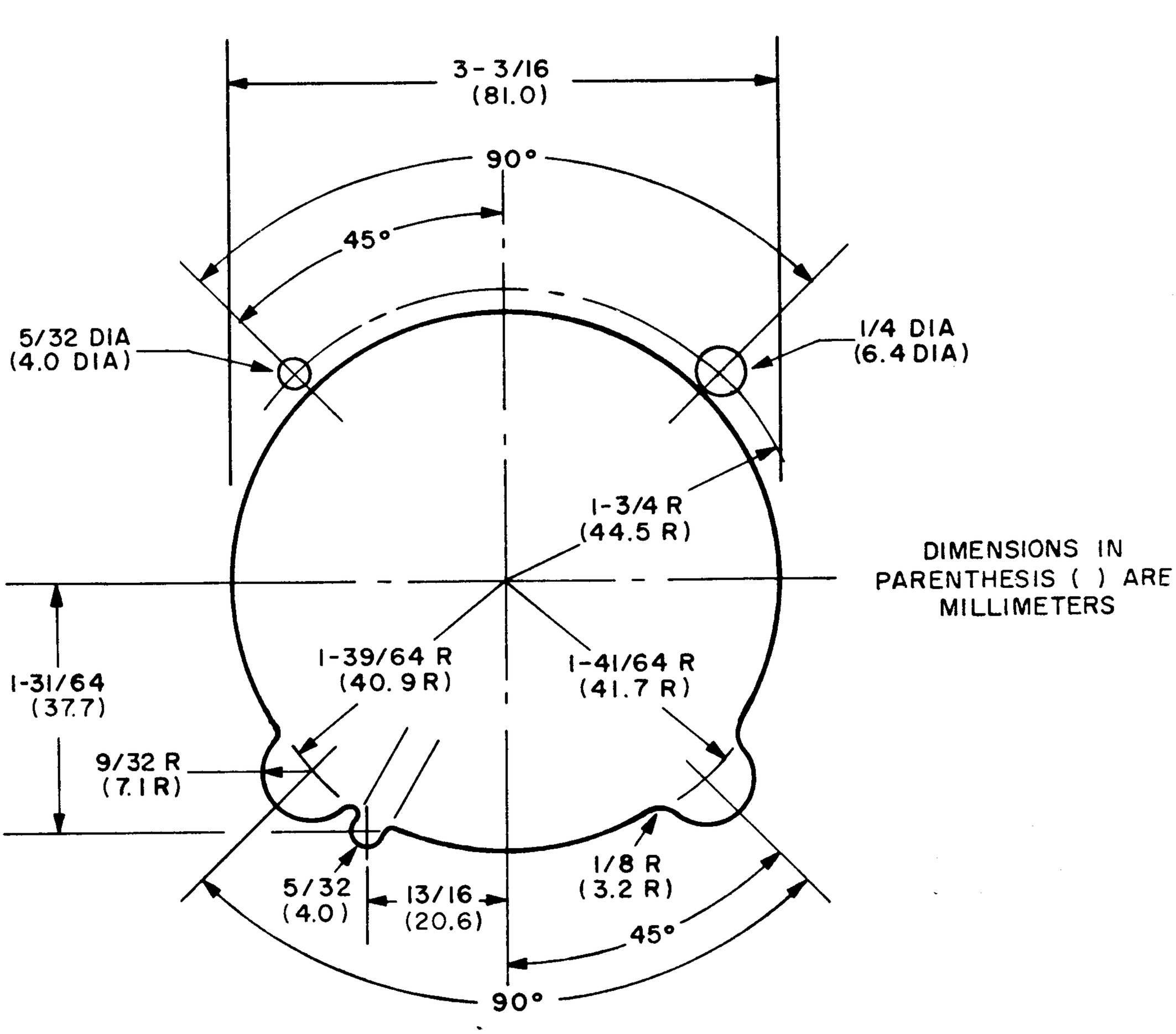
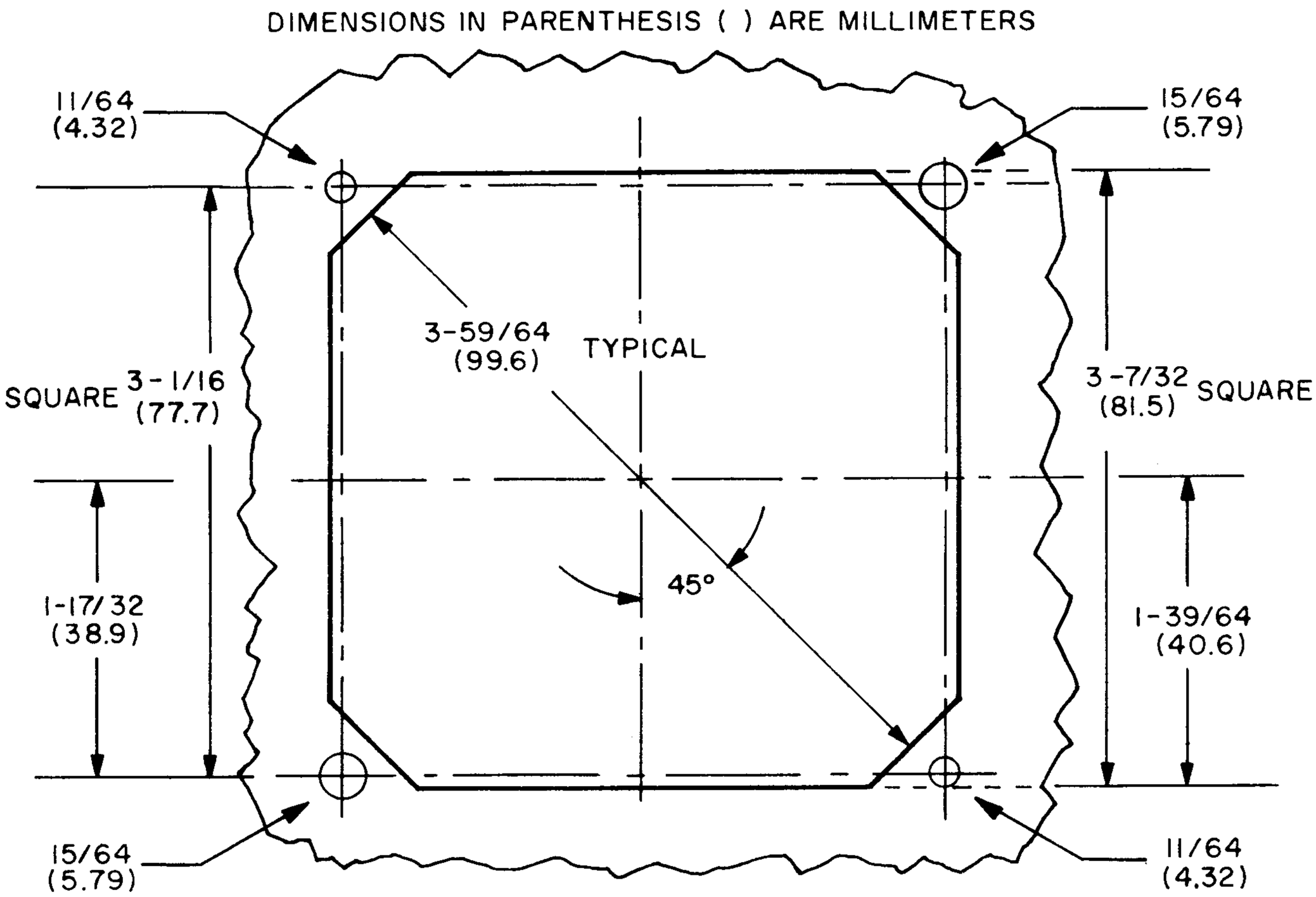


FIGURE 2-4. MOUNTING TEMPLATE, REAR MOUNT



Installation:

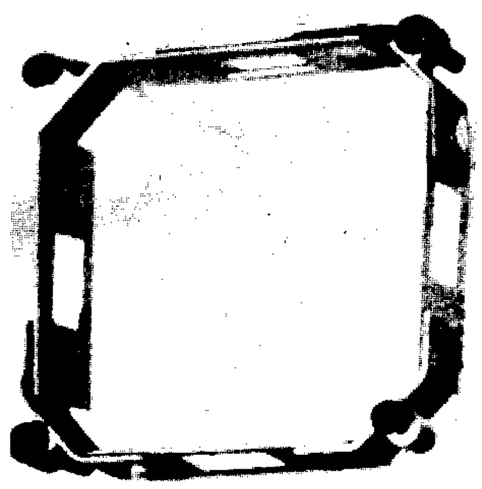
The clamp is installed from behind the panel.

1. Install the two #6 "fixed" corner screws but do not tighten.
2. Install, by only several threads, the two #8 "clamping" screws.
3. Slide the NAV Unit into position.
4. Tighten the "fixed" corner screws.
5. Tighten the "clamping" screws.

Removal:

Loosen the two larger (#8) screws until the NAV Unit may be pulled through the clamp.

1. Be sure cables attached to rear of Unit are either disconnected or are of sufficient length to accompany Unit through the clamp.
2. In some cases it will be necessary to loosen the two #6 fixed corner screws.



NOTES:
1. FRONT MTG: USE MARMAN DIV., AERO-QUIP CORP. CLAMP PART NO. 54621, OR USE ADAPTER PLATE AND MOORING PLATE IN ACCORDANCE WITH ARINC SPECIFICATION NO. 408, ATTACHMENT 386.

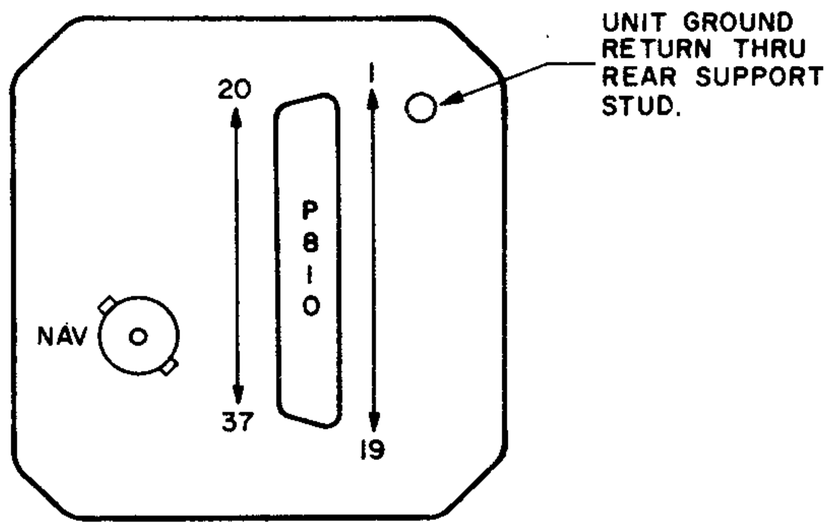
FIGURE 2-5. MOUNTING TEMPLATE, FRONT REMOVAL FOR USE WITH MARMAN CLAMP

2.4 ELECTRICAL INSTALLLATION

Interconnect cables must be constructed by the installing agency. Table 2.2 shows the rear panel connections for each of the NAV units described in this manual. Before building the cable, pursue Section 2.4, determine required cable length, and note wire gauge.

TABLE 2.2A NAV 121 REAR PANEL CONNECTIONS

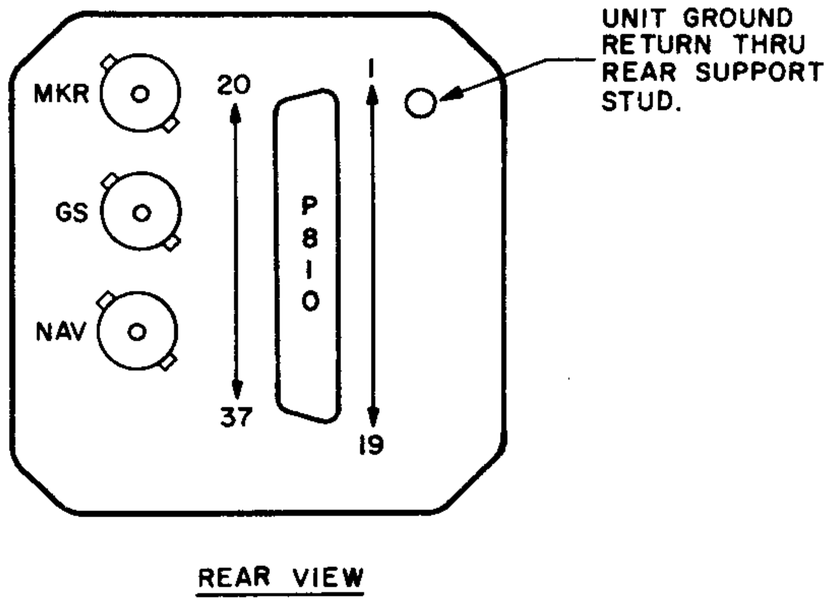
Connection See Note 1	Function
NAV Power	
Refer to Section 2.4.3.1	
6 and 25	Switched 14/28V Output
7 and 26	14/28 Vdc Input From Circuit Breaker
9	Pilot Lights, 28V
16	14V Input
19	Ground (REAR SUPPORT STUD)
27	Pilot Lights, 14V
Audio	
Refer to Section 2.4.2.2	
8	Auxiliary Audio Input
31	30 mW Audio Output
36	50 mW Audio Output
ARINC Channeling	
Refer to Section 2.4.2.3	
4	C MHz
5	B MHz
13	A kHz
14	B kHz
15	E kHz
22	E MHz
23	D MHz
24	A MHz
32	D kHz
33	C kHz
34	Y Channel
Autopilot And Indicators	
Refer to Section 2.4.2.7	
10	+FROM
28	+LEFT
29	4V Reference (+ TO and + Right)
Miscellaneous	
Refer to Section 2.4.2.4 and 2.4.2.6	
12	VOR/LOC (NARCO)
17	VOR/LOC (ARINC)
18	GS/LOC Activate



REAR VIEW

TABLE 2.2B NAV 122 REAR PANEL CONNECTIONS

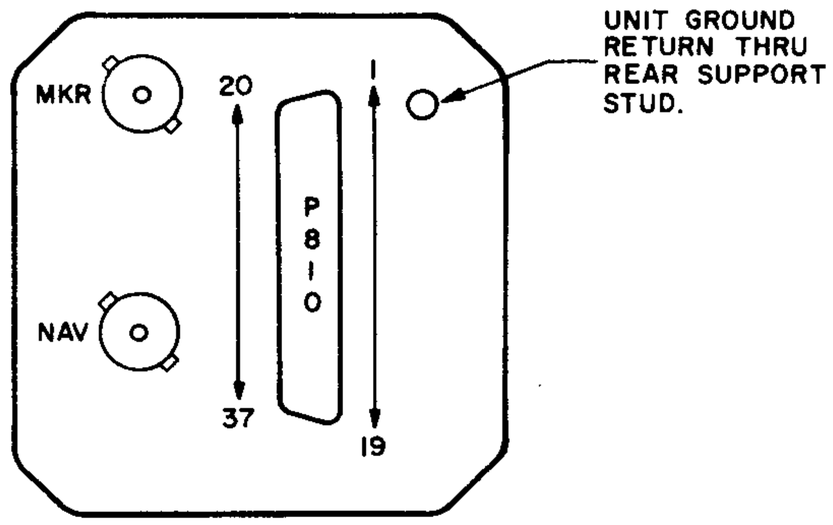
Connection See Note 1	Function
NAV Power Refer to Section 2.4.2.1	
6 and 25	Switched 14/28V Output
7 and 26	14/28 Vdc Input From Circuit Breaker
9	Pilot Lights, 28V
16	14V Input
19	Ground (REAR SUPPORT STUD)
27	Pilot Lights, 14V
Audio Refer to Section 2.4.2.2	
8	Auxiliary Audio Input
31	30 mW Audio Output
36	50 mW Audio Output
ARINC Channeling Refer to Section 2.4.2.3	
4	C MHz
5	B MHz
13	A kHz
14	B kHz
15	E kHz
22	E MHz
23	D MHz
24	A MHz
32	D kHz
33	C kHz
34	Y Channel
Marker Beacon Refer to Section 2.4.2.5	
1	Lamp Dimming
2	Audio Mute
3	14/28 Vdc Input From Circuit Breaker
20	HI-LO Sensitivity
21	Audio Output
Autopilot and Indicators Refer to Section 2.4.2.5 and 2.4.2.7	
10	+FROM
11	+GS Flag
28	+LEFT
29	4V Reference (+ TO, - GS Flag, + Right, and + GS Down)
30	+GS UP
Miscellaneous Refer to Sections 2.4.2.4 and 2.4.2.6	
12	VOR/LOC (NARCO)
17	VOR/LOC (ARINC)
18	GS/LOC Activate



REAR VIEW

TABLE 2.2C NAV 122A REAR PANEL CONNECTIONS

Connection See Note 1	Function
NAV Power	
Refer to Section 2.4.2.1	
6 and 25	Switched 14/28V Output
7 and 26	14/28 Vdc Input From Circuit Breaker
9	Pilot Lights, 28V
16	14V Input
19	Ground (REAR SUPPORT STUD)
27	Pilot Lights, 14V
Audio	
Refer to Section 2.4.2.2	
8	Auxiliary Audio Input
31	30 mW Audio Output
36	50 mW Audio Output ..... to CP
ARINC Channeling	
Refer to Section 2.4.2.3	
4	C MHz
5	B MHz
13	A kHz
14	B kHz
15	E kHz
22	E MHz
23	D MHz
24	A MHz
32	D kHz
33	C kHz
34	Y Channel
Marker Beacon	
Refer to Section 2.4.2.5	
1	Lamp Dimming
2	Audio Mute
3	14/28 Vdc Input From Circuit Breaker
20	HI-LO Sensitivity
21	Audio Output
Autopilot And Indicators	
Refer to Sections 2.4.2.5 and 2.4.2.7	
10	+FROM
11	+GS Flag
28	+LEFT
29	4V Reference (+ TO and + RIGHT)
30	+GS UP
35	-GS Flag
37	+GS DOWN
Miscellaneous	
Refer to Sections 2.4.2.4 and 2.4.2.6	
12	VOR/LOC (NARCO)
17	VOR/LOC (ARINC)
18	GS/LOC Activate



2.4.1 Antenna Connections

Antenna connections to the NAV Receiver are shown in Figure 2-6. Also shown in this figure, is the use of a VRP 48 Antenna Splitter, which permits use of a NAV antenna for VOR/LOC, GS, and Marker Beacon signal reception.

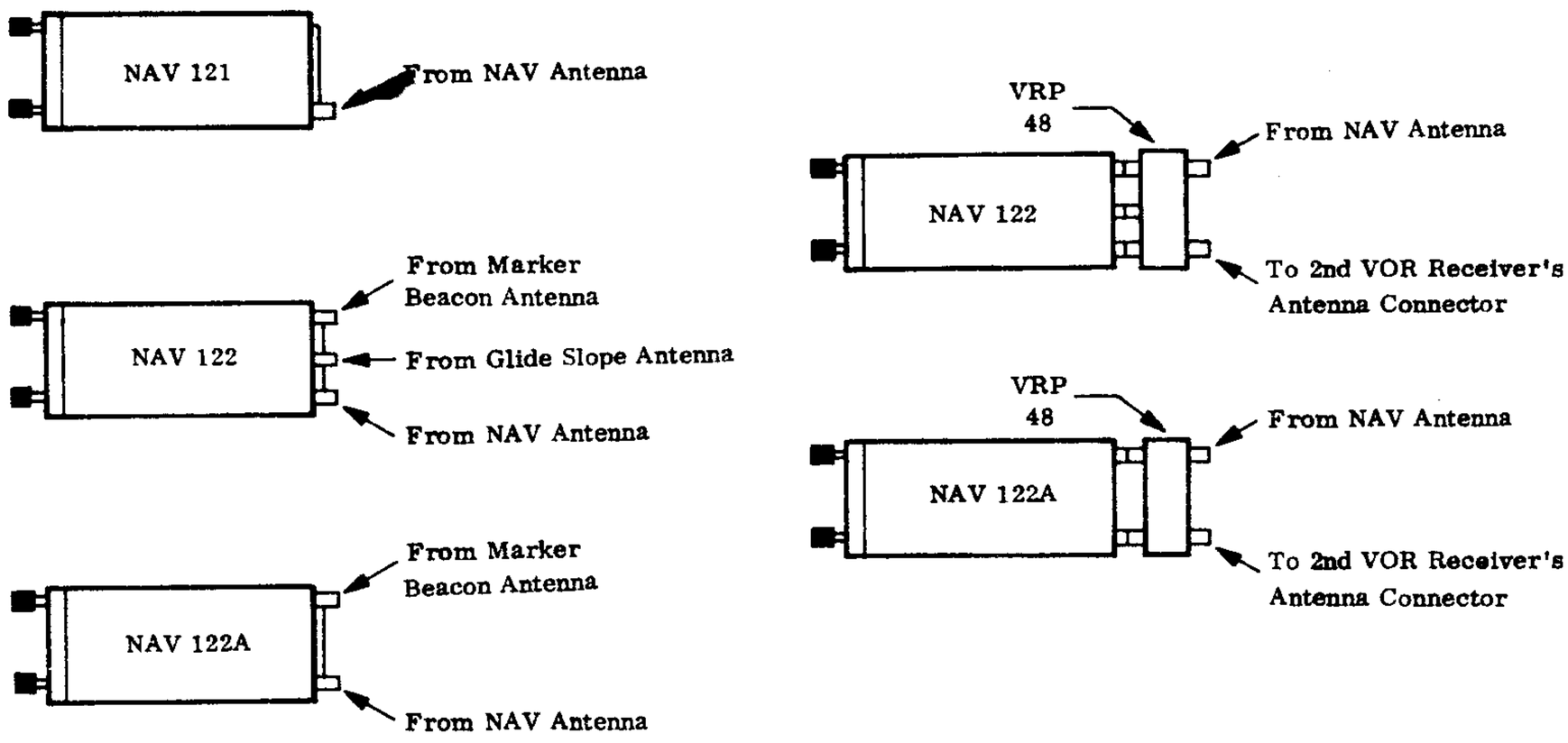
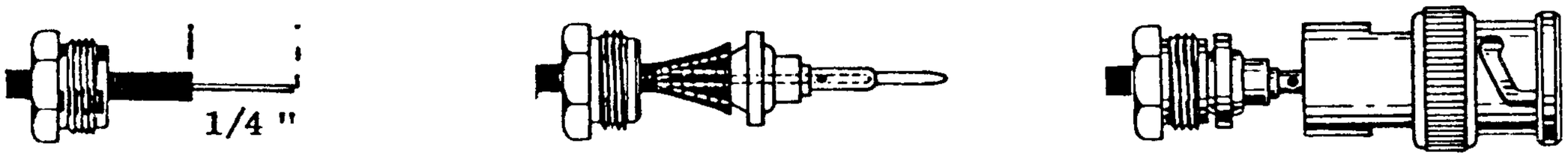


FIGURE 2-6. ANTENNA CONNECTIONS

BNC connector(s) are provided in the Installation Kit. Coaxial cable should be RG58 A/U or C/U.



1. Take one clean square cut through cable insulation, braid and dielectric, exposing ¼" of conductor. Slip nut onto cable.

2. Insert conductor into tapered, self-clamping sleeve and contact sub-assembly; force edge of sleeve between dielectric and braid until insulation rides well onto taper. Solder conductor to contact at solder hole.

3. Fit contact sub-assembly into connector body; screw nut into body, binding insulation and braid tightly against tapered sleeve . . . thus forming a strong, weatherproof connection.

Courtesy of Bendix Corp.

All illustrations enlarged for clarity

FIGURE 2-7. BNC CABLE CONNECTOR

2.4.2 Interconnect Cable (P810)

Tables 2.2 list rear panel connections to a NAV Receiver. Connector P810 may be considered to carry following groups of interconnections.

1. Power - DC input, ground and pilot lamps.
2. Audio - Receiver and Marker Beacon.
3. Channeling - DME and GS.
4. NAV 122A Glide Slope metering.
5. External Marker Beacon controls - Audio mute, HI-LO sensitivity, and lamp dimming.

2.4.2 Continued

P810 is assembled as shown in Figure 2-8. While constructing the cable, be sure to pass wires through the hood before inserting pins into the connector.

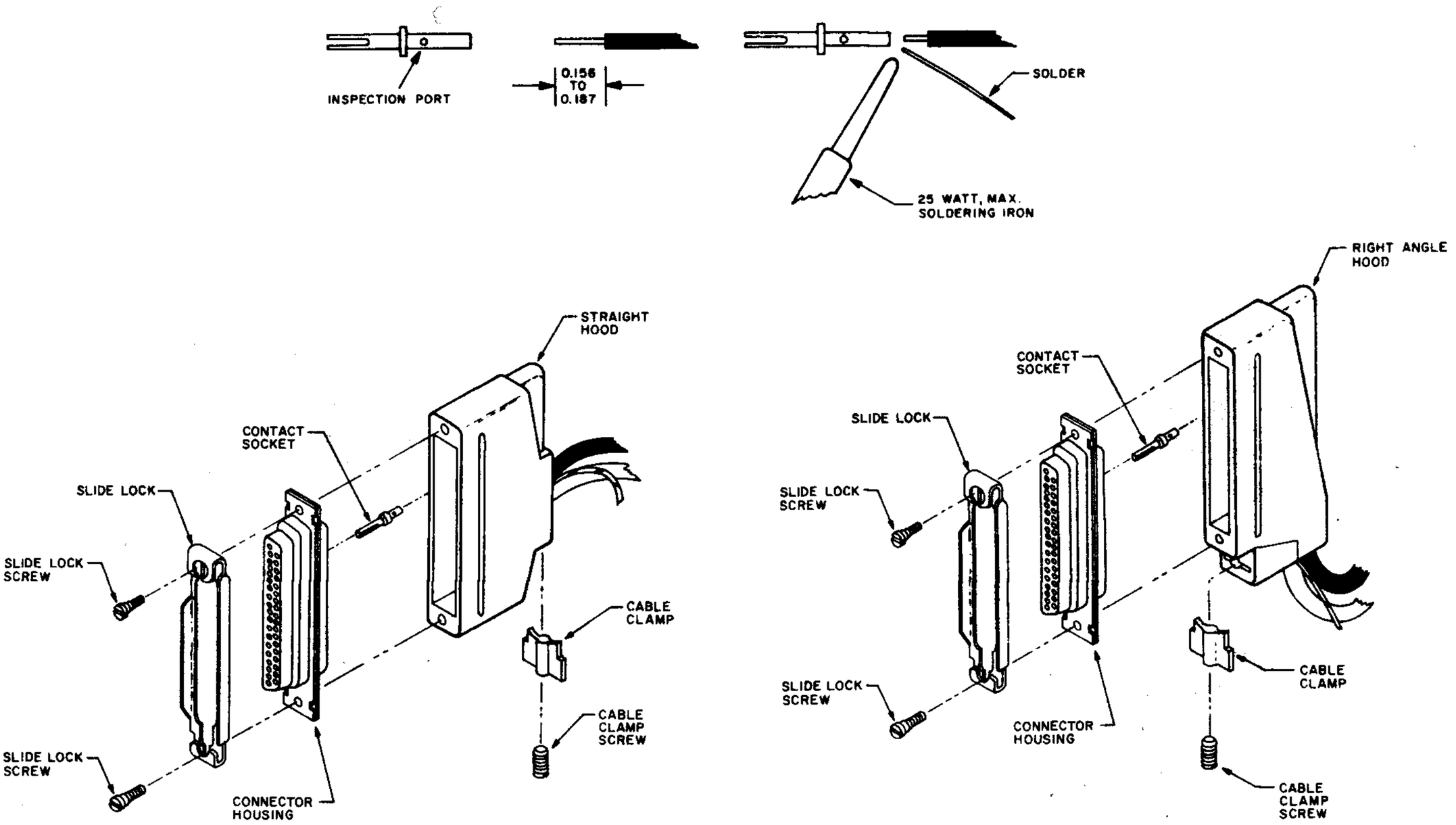


FIGURE 2-8. P810 ASSEMBLY

Connector Assembly Procedure (Solder)

Note: Crimping tools are available from ITT Cannon, if desired.

1. Strip wire as shown in Figure 2-8. Maximum wire size is No. 20AWG.
2. Tin exposed lead. Be sure no individual wire strands are free to cause shorts when connector is assembled.
3. Insert lead into connector pin until lead is visible at inspection port.
4. Heat pin and apply solder as shown until solder wicks into pin cavity and becomes visible through inspection port. Be careful not to overheat pin or melt insulation on wire.
5. Pass pin through hood and insert pin in connector until a "click" is heard or felt; exert a slight pull on the wire to assure pin seating.
6. During final assembly:
   a. Inspect all wires for individual strands of wire shorting to adjacent terminals.
   b. Ease hood into place, do not force.

Connector P810 incorporates a "slide lock" mechanism. Before installing the connector, move the slide to position the slide's longer tab away from the connector, mate J810 and P810, then push slide to lock connector to NAV Unit. To remove P810 from the NAV Receiver, by feel, determine which end of the slide extends beyond the connector body, press this end toward the connector until it is flush, then remove the connector.

2.4.2.1 Power Input Wiring

Figure 2-9 illustrates the connections to P810 for 14 and 28 Volt aircraft systems. Circuit protection, fuse or circuit breaker, must be supplied by the installing agency. Please read all notes on Figure 2-9.

Ground return for the NAV Unit is completed through the rear support stud. Normally a metal rear support strap, connected to the airframe, will provide a good ground path. If the support strap does not furnish a satisfactory ground, add a ground wire from the airframe to a solder lug and additional nut on the NAV's rear support stud.

2.4.2.2 Audio Interconnections

Pin 8 - Marker Audio Input - receives marker audio from pin 21 when separate marker audio is not required.

Pin 21 - Marker Audio Output - may be routed to audio panel for separately switched marker audio or jumpered to pin 8 to be combined with VOR/LOC audio. Output impedance is approximately 200 ohms. Power out, 8 mW.

Pin 31 - 30 mW to COM Aux Audio - when an audio panel is NOT used, Pin 31 is connected to COM Aux Audio input. VOR/LOC audio (with MKR audio if pins 8 and 21 are jumpered) is present at Pin 31. Output impedance is approximately 3K ohms.

Pin 36 - 50 mW audio - same audio as Pin 31 but intended for audio panel use. Output impedance is approximately 500 ohms.

2.4.2.3 DME/Glide Slope Channeling And LOC/GS Activate

DME/GS Channeling

ARINC 2-out-of-5 channel coding is provided by the NAV units. Table 2.1 furnishes the connector pin numbers for cable construction.

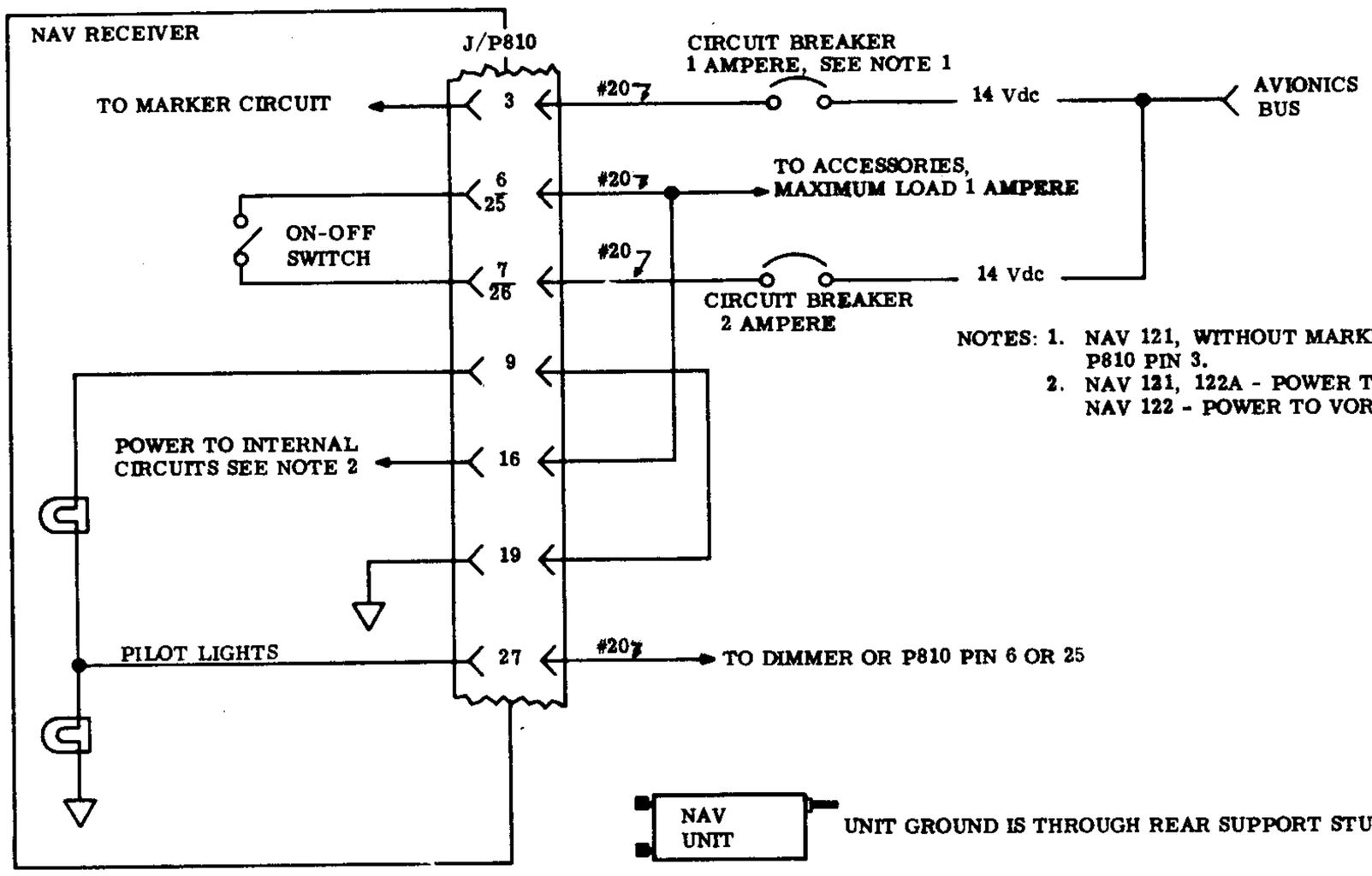
Channel line isolation is not required with the DME 190, DME 190 TSO, DME 195 or UGR 2A with 2-out-of-5 coding. When channeling avionics not produced by Narco, an isolation diode must be in series with each channeling line. If isolation diodes are not within the equipment being channeled, diodes must be added externally.

Avionics which use relays in their channeling circuits, such as the Narco UDI 2AR, should not be directly channeled by a NAV unit. A Narco RS 42 Remote Selector will interface these units.

Dual Channeling Kit

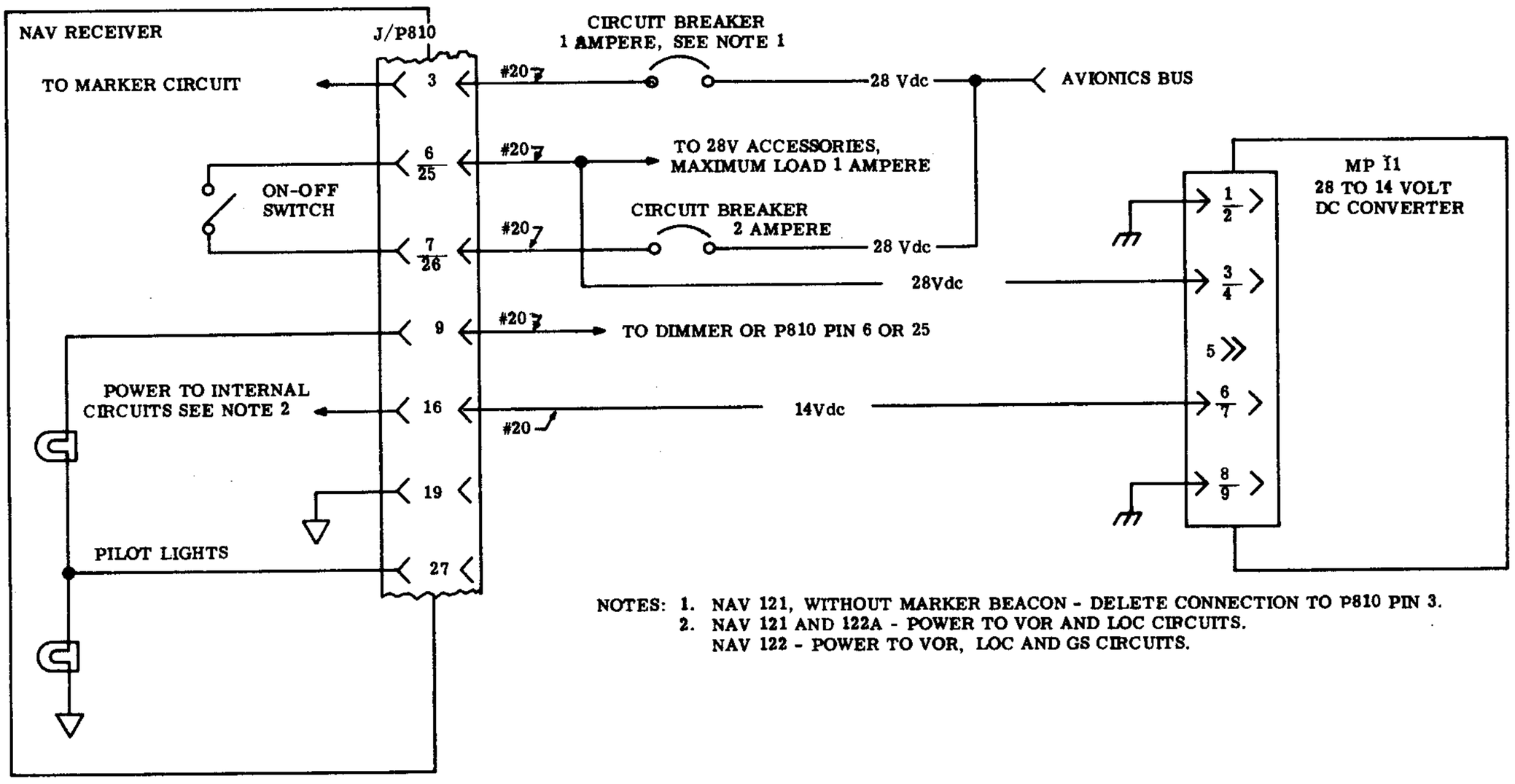
When a NAV is to channel both a DME and Glide Slope Receiver, the Dual Channeling Kit is recommended. Refer to the Optional Accessories Section for the Kit part number. Figure 2-10 illustrates the Kit with the Kit's wiring shown in Table 2.3. Table 2.4 furnishes the interconnections from the Kit to Narco Glide Slope and DME equipments.

A. 14 V AIRCRAFT SYSTEMS



NOTES: 1. NAV 121, WITHOUT MARKER BEACON DELETE CONNECTION TO P810 PIN 3.
2. NAV 121, 122A - POWER TO VOR, LOC CIRCUITS.
NAV 122 - POWER TO VOR, LOC, AND GS CIRCUIT.

B. 28V AIRCRAFT SYSTEMS



NOTES: 1. NAV 121, WITHOUT MARKER BEACON - DELETE CONNECTION TO P810 PIN 3.
2. NAV 121 AND 122A - POWER TO VOR AND LOC CIRCUITS.
NAV 122 - POWER TO VOR, LOC AND GS CIRCUITS.

FIGURE 2-9. POWER INPUT CONNECTIONS

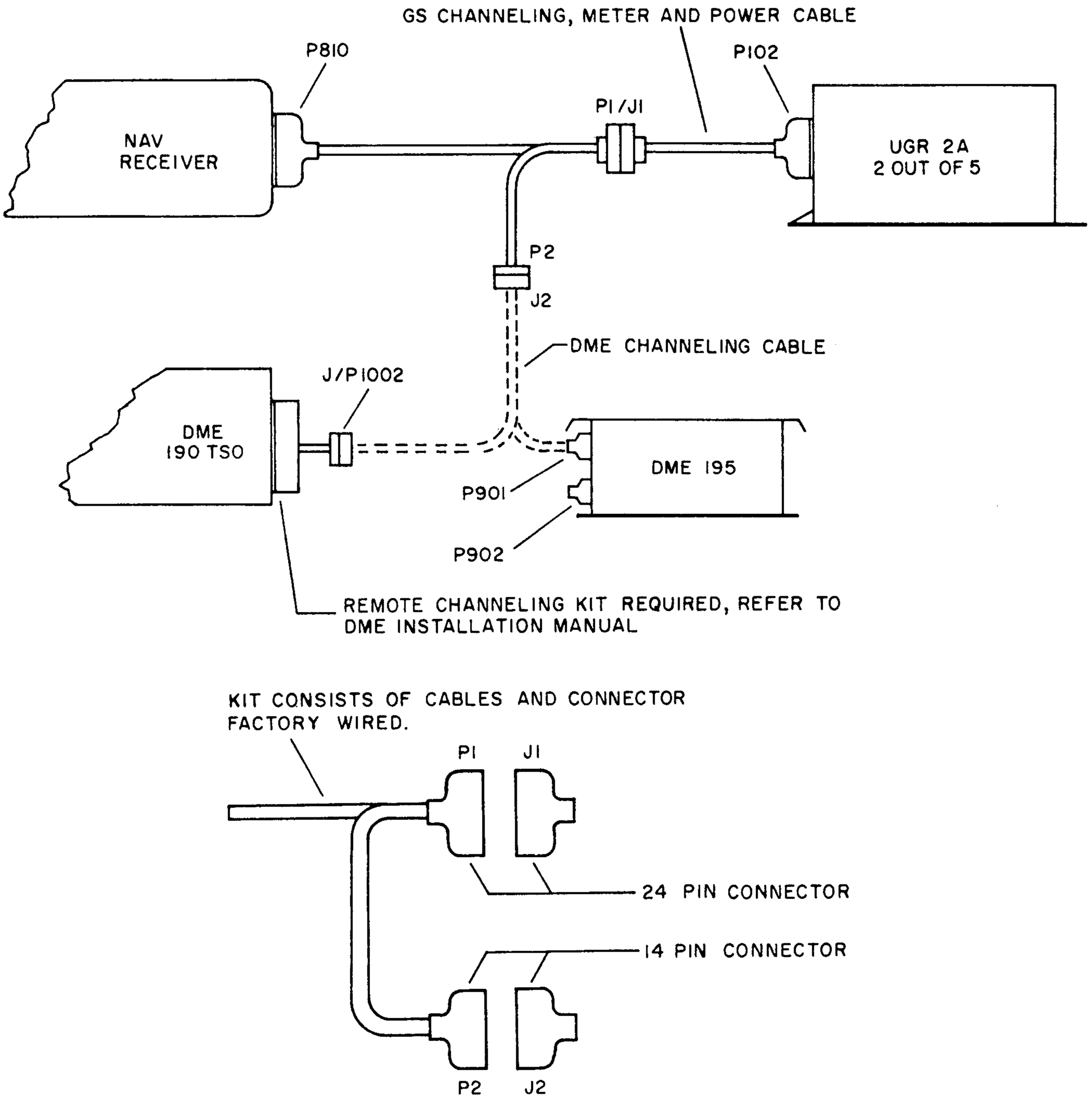


FIGURE 2-10. DUAL CHANNELING KIT

TABLE 2.3 DUAL CHANNELING KIT TO P810 WIRING

From P1	Function	Wire Color To NAV	To NAV P810	Wire Color To P2	To P2
17	C MHz	white/red/yellow	4	white	3
16	B MHz	white/red/brown	3	white/brown	2
20/21	SW 14/28V	(2) white/blue/black	6 or 25	----------	-
19	GS + Flag	white/green/black	11	----------	-
6	A kHz	white/blue	13	blue	6
1	B kHz	white/green	14	green	7
2	E kHz	white/red/green	15	red	10
24	LOC/GS ACT	white/yellow/black	18	----------	-
12	Ground	white/black	19	black	12
22	E MHz	white/violet	22	violet	5
13	D MHz	white gray	23	gray	4
9	A MHz	white/red/orange	24	white/red	1
14	GS + UP	white/red/black	30	----------	-
5	D kHz	white/orange	32	orange	9
4	C kHz	white/yellow	33	yellow	8
3	Y Channel	white/brown, black	34	brown	11
23	GS - Flag	white/gray/black	35	----------	-
18	GS + Down	white/orange/black	37	----------	-

TABLE 2.4 DUAL CHANNELING KIT TO DME/GS WIRING

Glide Slope (See Notes 4 and 5)

From J1	Function	To UGR 2A P102
1	B kHz	1
3	Y Channel	3
4	C kHz	4
6	A kHz	6
12	Ground	12
14	GS + UP	14
16	B MHz	16
18	GS + DOWN	18
19	GS + Flag	19
20/21	SW. 14/28	See Note 1
22	E MHz	22
23	GS - Flag	23
24	GS ACT.	24
--	----------	8-See Note 5

From J2	Function	To DME See Notes 2 and 3
1	A MHz	1
2	B MHz	2
3	C MHz	3
4	D MHz	4
5	E MHz	5
6	A kHz	6
7	B kHz	7
8	C kHz	8
9	D kHz	9
10	E kHz	10
11	Y Channel	11
12	Common	12

Notes:

1.

Aircraft Bus	P102
14 Volt	20/21
28 Volt	10/11

2. DME 190 and 190 TSO requires Remote Channeling Kit; refer to the DME Installation Manual.
3. DME 190 and 190 TSO - P1002.
   DME 195 - P901 or P902.
4. ARINC Channel Code.
5. P102 pin 8 must be jumpered to P102 pin 12.

2.4.2.3 Continued

LOC/GS Activate (EXT)

The LOC/GS Activate signal is generated by an active device as shown in Figure 2-11. Interconnecting the NAV unit with a Glide Slope or Localizer not produced by Narco will require observance of the following:

1) VOR mode - V_1 maximum is 30 Vdc (U316A off).
2) LOC/GS mode - I maximum is 250 ma; value of R must limit I (U316A saturated).

Reactive loads (relay coils) must be shunted with transient suppression.

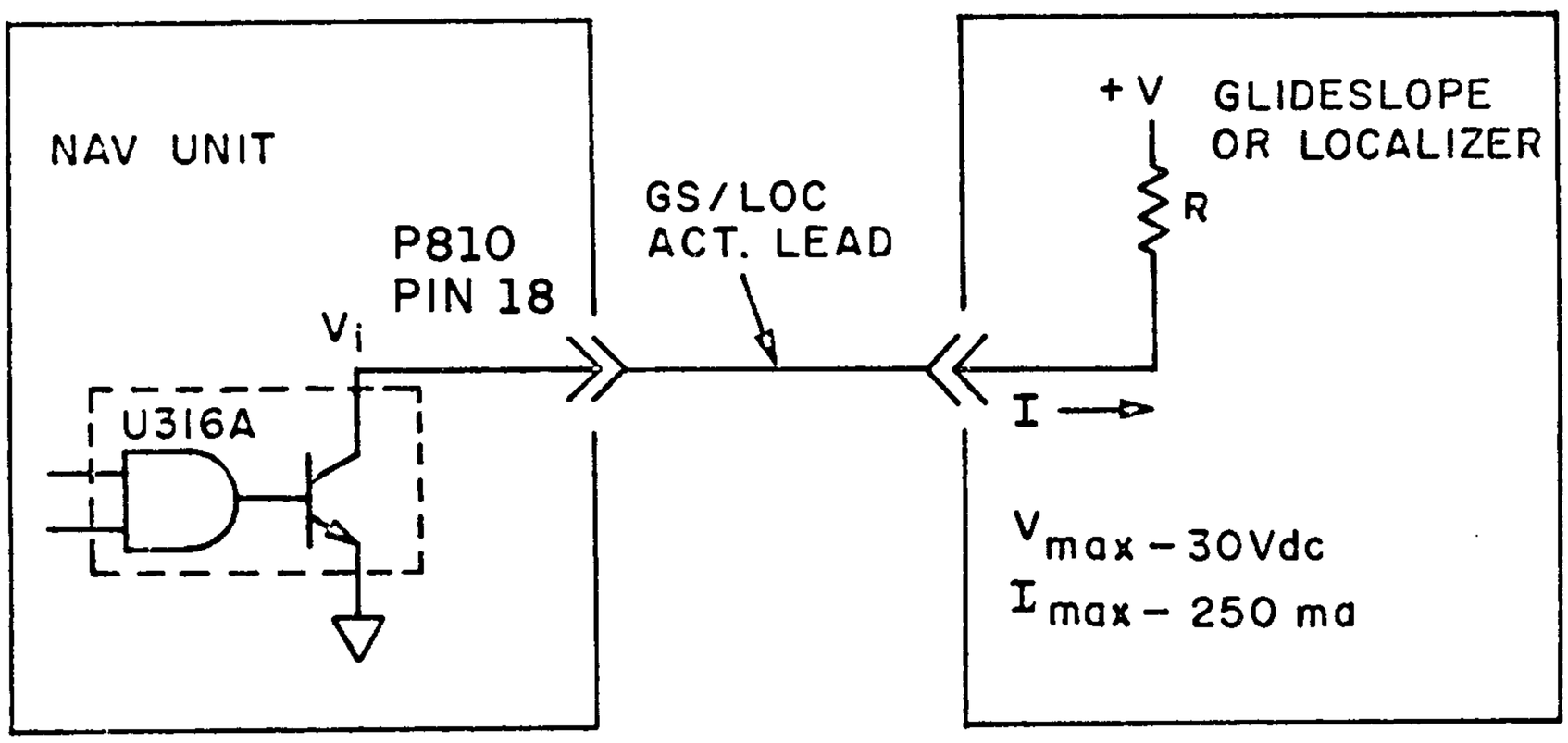


FIGURE 2-11. LOC/GS ACTIVATE

2.4.2.4 NAV 122A To External GS Receiver Interconnections

The NAV 122A contains Glide Slope Up-Down and Warning Flag meters, but requires meter drive signals from an external GS receiver.

Shown in Table 2.5 are the interconnections required for mating a NAV 122A to a UGR 2A Glide Slope receiver with 2-out-of-5 channeling. Refer to Section 2.4.2.3 for a discussion of frequency channeling. If the NAV 122A Glide Slope meters are to be driven from a receiver not produced by Narco, refer to Section 1.4, Specifications, to assure compatibility.

TABLE 2.5 NAV 122A TO UGR 2A (2-out-of-5) INTERCONNECTIONS

NAV 122A P810 Pin	Function	UGR 2A 2/5 P102 Pin
5	MHz B	16
11	+GS Flag	19
13	kHz A	6
14	kHz B	1
6/25	Switched A+	See Note 2
18	LOC/GS Act.	24
19	Ground	12
22	MHz E	22
30	+GS Up	14
33	kHz C	4
34	Y Channel	3
35	-GS Flag	23
37	+GS Down	18
--	---------	8 See Note 4

Notes:

1. NC indicates NO CONNECTION.
2.

Aircraft Bus	P102, Pin
14 Volt	20/21
28 Volt	10/11

3. ARINC Channel Code.
4. P102 pin 8 must be jumpered to P102, pin 12.

2.4.2.5 External Marker Beacon Controls

The NAV 122 and 122A contain marker beacon receiving and display circuits. The following comments relate to instrument panel mounted switches, supplied by the installing agency, to control some marker beacon functions.

Marker Beacon receiving and display circuits are not part of a NAV 121.

A. HI-LO Sensitivity

Connect a single pole, double throw, toggle switch as shown in Figure 2-12. Locate and label the switch on the instrument panel near the NAV Receiver. Label the switch (MKR SENS) and toggle positions (HI and LO). The switch must be supplied by the installing agency.

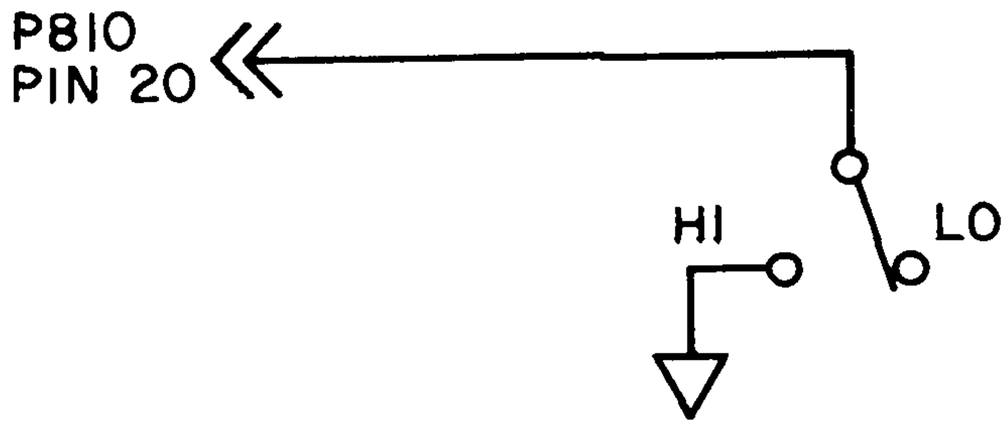


FIGURE 2-12. HI-LO SENSITIVITY

B. Marker Audio Mute

Audio muting serves to remove or turn OFF the marker beacon audio for a period of approximately 10 to 14 seconds. This time period is long enough to allow the MKR audio to remain muted as the aircraft passes over a marker beacon transmitter, yet is short enough to permit reactivation of the MKR audio before the next marker beacon is reached. Thus the audio can serve as an alert when muted, and the MKR lamps are monitored.

The installing agency must supply a spring loaded, normally open, pushbutton or toggle switch. Mount the switch on the aircraft instrument panel adjacent to the NAV Unit. Regardless of location, the switch must be labeled as to its function (example: MKR AUDIO MUTE).

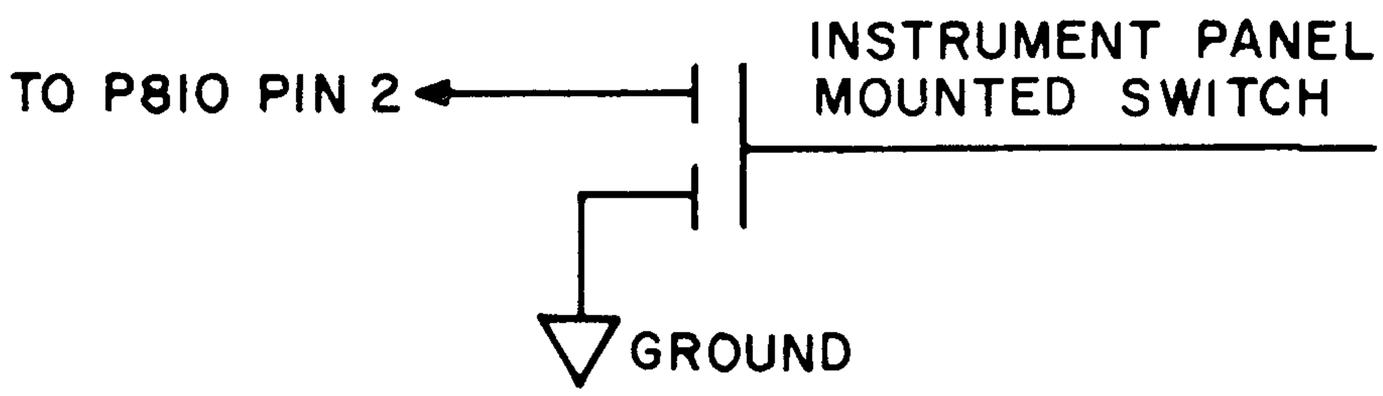


FIGURE 2-13. MKR AUDIO MUTE WIRING

2.4.2.5 Continued

C. Marker Lamp Dimming

Two discrete levels of marker lamp brightness are provided. Marker lamps will be dimmed whenever a positive DC voltage, between 2 and 30 volts, is applied to P810, pin 1.

Full lamp brilliance will be achieved with any of the following conditions:

a. P810, pin 1 shorted to ground.
b. P810, pin 1 open circuited.
c. P810, pin 1 resistively terminated with less than 0.25 Vdc applied from an external source.

Throughout this manual the aircraft's instrument light bus is referred to as the source of lamp dimming voltage. Two additional sources of dimming voltage could be the navigation light bus and the avionics lamp bus.

2.4.2.6 Radio Magnetic Indicator Outputs

Two detected VOR/LOC outputs are available for driving an RMI. A typical system could include an AIM* RC75 or SC12 Converter with a Narco Avionics HSI 100 or AIM 800 Series Indicator.

ARINC levels and phasing are present at P810 pin 17 while Narco levels and phasing are available at P810 pin 12.

*Aviation Instrument Manufacturing Corp.
Houston, Texas

2.4.2.7 Autopilot And Additional Indicator Loads

NAV Units autopilot output characteristics are shown in Table 2.6.

Recall that the NAV 122 is a time shared receiver and that it's Ident knob is spring loaded. When the Ident knob is pulled "out", the time sharing is defeated and the NAV Unit is held in the Localizer mode. There is, therefore, no GS information to either the NAV indicator or an autopilot during this time. To indicate loss of information, the UP-DOWN needle will slowly rise and the GS flag will show "red". Upon release of the Ident knob, normal LOC-GS operation will resume.

The NAV 122A is not a time shared receiver and when operated with a remote Glide Slope receiver, the Ident mode has no effect on Glide Slope operation.

All autopilot and indicator drives from a NAV are referenced to the +4V REFERENCE line (Pin 29). Therefore, do not ground any of the connector pins in Table 2.6.

TABLE 2.6 AUTOPILOT OUTPUT CHARACTERISTICS

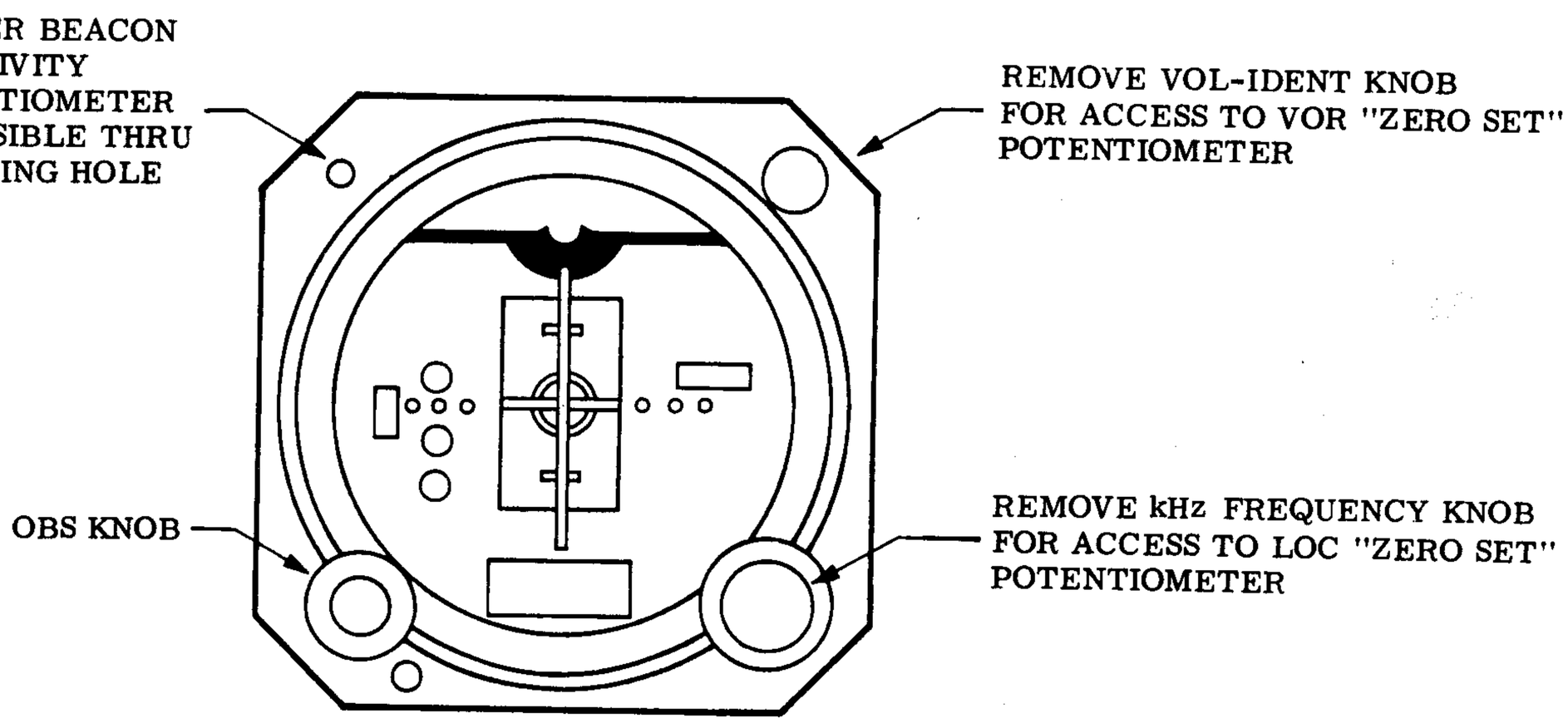
Mode	Function	Pins	Loading	Output
VOR	Left-Right	28 and 29	two, 1K ohm	150 mV for 10^{o} course change
	To-From	10 and 29	two, 1K ohm	250 mV at full TO or FROM
LOC	Left-Right	28 and 29	two, 1K ohm	90 mV for 4 dB ddm*
	Warning-TO	10 and 29	two, 1K ohm	250 mV at full TO
GS (NAV 122 only)	Up-Down	29 and 30	two, 1K ohm	78 mV for 2 dB ddm*
	Warning-TO	11 and 29	two, 1K ohm	250 mV at full TO

*ddm - Difference in depth of modulation.

2.5 POST INSTALLATION TESTS

The purpose of this series of tests is to assure proper operation of the installed avionics equipment. First, and most important, is a complete inspection of the installation to be sure that all aircraft flight controls operate freely and with full travel or deflection.

Since these procedures cover all three NAV Receivers, simply bypass those functions (marker, etc.) which do not apply to the system being tested. A remote mounted Glide Slope Receiver whose operation is dependent upon the NAV Receiver being tested, should be considered as an integral part of the system and included in this procedure. If an audio control panel is part of the installation, remember to select the NAV and MKR audios at the appropriate points in the procedure.



NOTE: 1. KNOBS ARE REMOVED USING A NO. 2 ALLEN WRENCH.
2. POTENTIOMETERS ARE ADJUSTED USING THE SCREW DRIVER SUPPLIED IN THE DEALER STARTER KIT - INSTALLATION KIT.

Note: 1. Knobs are removed using a No. 2 Allen wrench.
2. Potentiometers are adjusted using the screwdriver supplied in the Maintenance Kit.

FIGURE 2-14. LOCATION OF ELECTRICAL ADJUSTMENTS

2.5.1 Pre Flight Tests

For this series of in-aircraft tests, the aircraft's engines, rotating beacon, electrical and avionics equipments should be operating. Note any abnormal interaction or interference (ignition or rotating beacon noise, abnormal meter deflection, compass deviation, etc.) observed during these tests.

The following procedure requires ramp type test equipment such as that offered by Tel-Instrument Corp. or IFR Inc.

A. General

1. Set NAV Receiver to a VOR frequency.
2. Rotate the VOL-IDENT control clockwise until NAV Receiver noise is heard in the speaker and headphones. Note presence of NAV and GS warning flags and centered Left-Right (and Up-Down needle in NAV 122A).
3. Modulate test equipment 30% with 1020 Hz.
4. Pull VOL-IDENT knob and note presence of adequate volume level. (NAV 122 - knob is spring loaded and must be held in outer position). Depress VOL-IDENT knob and note decrease in volume level.

NAV 122 only

5. Set NAV Receiver to a LOC frequency.
6. Pull VOL-IDENT knob and note gradual rise of Glide Slope UP-DOWN needle. Approximately 5 seconds is required for full UP deflection.

B. VOR*

1. Set test equipment and NAV Receiver to a VOR frequency. Modulation should be a composite VOR signal.
2. Set test equipment and NAV Receiver OBS to 0^{o} course.
   Spec: Left-Right needle must center within $\pm 1.5^{o}$ with a TO flag.
   VOR "zero set" adjustment is shown Figure 2-14.
3. Turn NAV Receiver OBS knob to first 10^{o} then 350^{o}.
   Spec: Left-Right needle should deflect full scale (5 dots).
4. Check remaining three cardinal points (90^{o}, 180^{o}, and 270^{o}).
   Spec: Left-Right needle must center within 1.5^{o} with a TO flag.
5. Set OBS to 0^{o} and depress knob.
   Spec: Left-Right needle must center within 1.5^{o} with a TO flag.

C. LOC

1. Set test equipment and NAV Receiver to a LOC frequency.
   Modulation should be a standard LOC centering signal.
   Spec: Centering, $\pm$ 1 needle width with a TO flag.
   LOC "zero set" adjustment is shown in Figure 2-14.
2. Change modulation to 4 dB ddm left then right.
   Spec: deflection, 3 dots, $\pm$ 1 needle width.
3. Remove modulation or decrease test equipment RF output to minimum.
   Spec: LOC warning flag shall be full.

*If VOR Zero Set is adjusted, the SELF TEST must also be re-zeroed.

2.5.1 Continued

D. Glide Slope

1. Set test equipment and NAV Receiver to a GS frequency. Modulation should be a standard GS centering signal.
   Spec: Centering, $\pm$ 1 needle width with a TO flag.
2. Change modulation to 2 dB ddm Up then Down.
   Spec: Deflection, 1.5 dots, $\pm$ 1 needle width with a TO flag.
3. Remove modulation or decrease test equipment RF output to minimum.
   Spec: GS warning flag shall be full.

E. Marker Beacon

Note: Do Not adjust Marker sensitivity during this procedure.

1. Depress OBS knob to activate marker lamp test.
   Spec: All three lamps must light.
2. Modulate Marker test equipment 90% with 3,000 Hz.
   Spec: White lamp must light.
3. Change modulation frequency to 400 Hz then 1300 Hz.
   Spec: First the blue than the amber lamp must light.
4. Check marker audio for adequate volume. If Marker Audio Mute is provided, momentarily depress mute switch.
   Spec: Audio shall remain muted for a 10 to 14 second period.
5. Check Marker dimming by turning ON instrument panel lights.
   Spec: Marker lamp brilliance should decrease. Turn OFF instrument panel lights.
6. If a Marker HI-LO sensitivity switch is provided, set the switch to the LO position: decrease test equipment RF output (or move test set away from aircraft) until marker lamp dims; set Marker sensitivity switch to HI.
   Spec: Lamp brilliance should increase.

2.5.2 Flight Test

A flight test is recommended to perform the following checks and adjustments.

A. Check all avionics under actual operating conditions for abnormal indications (ignition noise, audio distortion at in-flight volume settings, rotating beacon noise, interference between avionics equipments, etc.).
B. Proportion audio volume levels.
C. In-flight setting of marker beacon sensitivity (requires small straight slot screwdriver).
D. Look for variations in performance due to various landing gear and flight control surface configurations.
E. Good excuse to go flying.

All of these tests must be performed at an ILS facility, on an airway, or in an area where the ground station signal quality and strength has been verified.

VOR

A. Flying at an altitude of 6000 feet above ground level (AGL) channel the NAV Receiver to a VOR facility 50 nm away.
   1. Check course accuracy, warning flag indication, and left-right needle sensing.
   2. Check the antenna pattern by flying the aircraft in a 10^{o} bank completing a 360^{o} turn: the warning flag should remian out of view throughout the turn and audio should remain intelligible.
B. Flying at an altitude of 6000 feet AGL, channel the NAV Receiver to a VOR facility 10 nm away and fly inbound.
   1. Check course width ($\pm 10^{o}$ of selected radial).
   2. Observe the VOR warning flag while approaching, passing over, and flying outbound: TO-FROM indicator shall indicate correctly and the warning flag must not be observed except when passing directly over the station.
C. Flying at an altitude of 6000 feet AGL, channel the NAV Receiver to a VOR facility 25 nm away and fly inbound.
   1. Operate the communication transceiver: VOR left-right indicator transient deviations should not exceed 2 dots and steady state errors should not exceed 0.5 dot.
D. Engage autopilot and couple to VOR. Check tracking and intercept performance.

2.5.2 Continued

LOC and GS

Flying at an altitude of 3000 feet AGL, channel the NAV Receiver to a LOC frequency and fly inbound to intercept ILS.

1. From point of intercept to termination of test neither LOC or GS warning flags should appear.
2. Establish glide path and fly the ILS approach: request ground control confirmation of on-glide path condition.
3. While on-glide path, maneuver aircraft through normal pitch and roll altitudes: Left-right and up-down indicators should perform normally and a warning flag shound not be visible at any time.
4. Engage autopilot and fly a coupled ILS approach.

Marker Beacon

Receiver sensitivity has been adjusted at the factory for satisfactory performance with a standard marker beacon antenna. Should further adjustment be required, refer to Figure 2-14 for access to sensitivity potentiometer, and perform the following adjustments.

Sensitivity adjustment procedure:

1. If included, set panel mounted marker HI-LO switch to LO.
2. Fly at a known ground speed, 1000 feet above ground level (AGL).
3. On LOC centerline, measure time (in seconds) that the marker lamp remains lighted.
4. Refer to Table 2.7.

To calculate light time for ground speeds other than those tabled:

$$\text{Minimum Light Time (Seconds)} = \frac{1775}{\text{Ground Speed In Knots}}$$

$$\text{Maximum Light Time (Seconds)} = \frac{1183}{\text{Ground Speed In Knots}}$$

TABLE 2.7 LO SENSITIVITY LIGHT TIME AT 1,000 FEET (AGL)

GROUND SPEED, In Knots	LIGHT TIME, In Seconds	
	Minimum	Maximum
90	13	20
110	11	16
130	9	14
150	8	12

2.6 AIRCRAFT LICENSE REQUIREMENTS

A. Form 337
NAV [insert model number] was installed in accordance with Narco Avionics Manual part number [refer to cover].
Enter electrical load as specified in Table 2.8.
Enter actual circuit breaker or fuse values used.

B. Log Book
Calculate weight and balance using values from Table 2.8 plus cable and accessory weights.

TABLE 2.8 GENERAL SPECIFICATIONS

General	NAV 121	NAV 122	NAV 122A
A. Mechanical			
Physical Dimensions	Figure 2-3	Figure 2-3	Figure 2-3
Weight	2.5 lbs (1.13 kg)	3.0 lbs (1.36 kg)	2.9 lbs (1.32 kg,
B. Electrical			
NAV, P810, Pins 7 and 26			
Supply Voltage (see note 1)	13.75 Vdc	13.75 Vdc	13.75 Vdc
Current, less pilot lamps, 14V	0.55 Ampere	0.55 Ampere	0.55 Ampere
Current, less pilot lamps, 28V	(see note 2)	(see note 2)	(see note 2)
Pilot lamp current 14V	0.32 Ampere	0.32 Ampere	0.32 Ampere
28V	0.32 Ampere	0.32 Ampere	0.32 Ampere
Circuit Breaker Rating	2 Amperes	2 Amperes	2 Amperes
Marker Beacon, P810 Pin 3			
Supply Voltage	----------	13.75 or 27.5 Vdc	13.75 or 27.5 Vdc
Current 14V	----------	0.25 Ampere	0.25 Ampere
28V		0.29 Ampere	0.29 Ampere
Circuit Breaker Rating	----------	1.0 Ampere	1.0 Ampere

Notes: 1. Voltage Converter required for 28 Vdc installations.
2. With MP 11, 28 to 14 Vdc Voltage Converter - 0.60 Ampere.