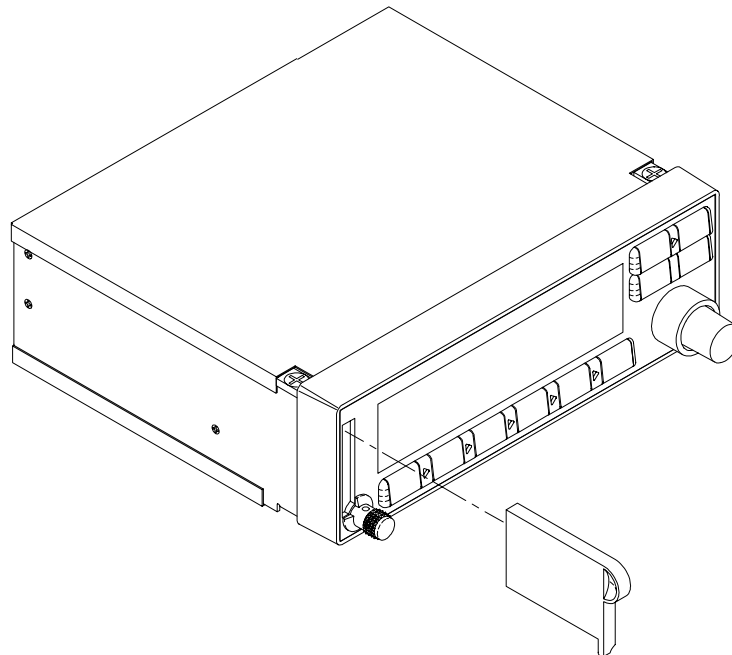




GARMIN®

GPS 150 INSTALLATION MANUAL



GARMIN INTERNATIONAL, INC.
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REVISION RECORD

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2351	Rev. G, 18 Aug 1993	Add Altitude Serializer interface details.
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SECTION 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual describes the physical, mechanical, and electrical characteristics and the installation requirements for the GPS 150 Aviation Kit.

After installation of the GPS 150 system, FAA Form 337 must be completed by an appropriately certificated agency to return the aircraft to service.

1.2 TECHNICAL CHARACTERISTICS

The GPS 150 offers the versatility of fixed installation in a panel mounted aviation rack as well as complete portability.

1.2.1 PHYSICAL CHARACTERISTICS

Width:	6.25 Inches
Height:	2 inches
Depth:	5.65 inches
GPS 150 Weight:	2.14 lbs.
GA 56 Antenna Weight:	4 oz.
Aviation Rack Weight:	14 oz.
Max Air Speed:	Subsonic
(Structural rating for antenna)	

1.2.2 OPERATIONAL CHARACTERISTICS

Operating Temperature Range:	-20 °C to +55 °C
Humidity:	95% non-condensing
Altitude Range:	-1,500 to 50,000 ft.
Power Input:	10 to 33 VDC, 5 watts Max.

1.2.3 INTERFACES

The GPS 150 provides interfaces to various general aviation instruments. Figure 1-1 defines the function of each pin on the 37 pin DSUB connector located at the back of the rack. Figure 1-2 depicts the interconnects between the rack and other instruments. The following interfaces are provided.

CDI: (Pins 1 and 5)	Capable of driving up to three 1000 ohm parallel loads, +150 millivolts full scale deflection with a maximum output of +300 millivolts.
To/From: (Pins 2 and 6)	Capable of driving up to three 200 ohm parallel loads, +82 millivolts full scale deflection. Units with Mod Status 1: +190 millivolts full scale deflection.

Nav Flag: (Pins 3 and 4) Capable of driving up to three 1000 ohm parallel loads, 375 millivolts for flag out-of-view, and +40 millivolts for flag in-view.

OBI data: (Pins 7, 8, and 23) Output providing bearing to waypoint data for a Bendix/King RMI (KI 229 or equivalent).

Message annunciators: (Pin 20) Output capable of driving negative logic message annunciators by sinking up to 500mA.

RS232 chan 1 output data: (Pin 24) Output capable of driving ARGUS3000/5000/7000, STORMSCOPE SERIES II with NAVAID moving map displays, Shadin 91204X[T]/91053X[T], Electronics International FP-5L fuel flow systems, or Shadin 962801 Fuel/Airdata Computer. Conforms to the EIA specification RS-232C.

RS232 chan 2 output data: (Pin 19) Output capable of driving real-time plotting interface on GARMIN PC software or NMEA 0183 version 2.0 compatible mapping device. Conforms to the EIA specification RS-232C.

RS232 chan 1 input data: (Pin 17) Input capable of receiving serial altitude data from either an ICARUS Instruments 3000, Shadin Company (formerly Rosetta MicroAvionics) 8800T, 9000T, or 9200T series altitude serializer/encoder, Shadin 91204XT/91053XT Series Fuel management system, Arnav FC-10/FT-10 fuel computer/totalizer, Electronics International FP-5L fuel flow system, or Shadin 962801 Fuel/Airdata Computer. Conforms to the EIA specification RS-232C.

Arrival alarm annunciator: (Pin 12) Output capable of driving negative logic annunciator by sinking up to 500mA.

ARINC 429 Output A & B: (Pins 15 and 16) Output capable of interfacing with any device that has an input conforming to the GAMA ARINC 429 specification.

NAV Super Flag Output: (Pin 10) Output capable of driving positive logic NAV Super Flag by sourcing up to 500mA for flag out of view (NAV valid).

SECTION 2 INSTALLATION CONSIDERATIONS

Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability from the GPS 150.

2.1 ANTENNA CONSIDERATIONS

2.1.1 SATELLITE VISIBILITY

The GPS 150 GA 56 Antenna must be mounted on top of the aircraft. For best performance select a location with an unobstructed view of the sky above the aircraft when in level flight. Figure 2-1 illustrates a typical antenna installation.

For rotorcraft, locate the GA 56 antenna:

- 1) As far from the main rotor hub as possible. This reduces the percentage of time the blade blocks the antenna.
- 2) As far below the blade surface as possible if installing the antenna under the blade. This reduces signal distortion caused by the blades.

2.1.2 NOISE SOURCES

The antenna should be located at least 3 ft from transmitting antennas such as VHF Comm, HF transmitter, DME, Transponder, and Radar. Cabling for the GPS 150 should not be routed near components or cabling which are sources of electrical noise.

2.1.3 ELECTRICAL BONDING

No special precautions need to be taken to provide a bonding path between the antenna and the aircraft structure.

2.1.4 ANTENNA LIMITATIONS

GARMIN'S GA 56 Antennas are recommended for installations where the airspeed of the aircraft will be subsonic.

2.1.5 VHF COMM INTERFERENCE

On many panel-mounted aircraft the VHF COMM radiates strong harmonics from the unit and the antenna. If the antenna is found to be the problem, a 1.57542 GHz notch filter (GPN 330-00067-00) may be installed in the VHF COMM coax, as close to the COMM as possible. If the box is found to be radiating, the following can be done:

- 1) Place the antenna as far from the VHF COMM unit and antenna as possible.

- 2) Replace or clean VHF COMM rack connector to assure good coax ground.
- 3) Place a grounding brace between the GPS 150, VHF COMM, and ground.
- 4) Shield the VHF COMM wiring harness.

2.2 RACK CONSIDERATIONS

2.2.1 ACCESSIBILITY

Plan a location which gives the pilot complete and comfortable access to the entire keypad and which is plainly visible from the pilot's perspective. Check that there is adequate depth for the rack in the instrument panel. A location away from heating vents or other sources of heat generation is optimal. Figure 2-2 illustrates a typical aviation rack installation.

2.3 CABLING AND WIRING

The recommended antenna cable type is M17/155-0001 (RG-58A/U) per MIL-C-17. Maximum allowable length for this cable type is 40 feet. Other cable types with 50 ohms nominal impedance and longer lengths can be used, provided the installer insures that the attenuation does not exceed 10dB at 1.5 GHz for the specific installation. Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling and routing near aircraft control cables.

2.4 COOLING AIR

Cooling air is not required for the GPS 150, however as with any electronic equipment, reduced operating temperature can contribute to increased reliability. Additionally, location of the GPS 150 in a stack of other power dissipating equipment can produce unacceptably high ambient air temperatures around the unit. A 5/8 inch diameter air fitting is provided on the rear of the mounting rack for the purpose of admitting cooling air under such conditions.

2.5 ANNUNCIATORS

If the installation includes any electrical interface with other flight instruments, an annunciator may be required. Refer to current FAA directives.

2.6 EXTERNAL ALTITUDE INPUT

Pressure altitude input from an external source may benefit GPS 150 system performance during times of minimal satellite coverage or poor satellite geometry. Provisions for RS-232 compatible serial altitude input are described in the Interfaces section (Section 1.2.3) of this manual.

SECTION 3 INSTALLATION PROCEDURE

3.1 INSTALLATION ACCESSORIES

The following installation accessories are available:

ANTENNA AND RACK OPTIONS

010-10040-01	GA 56 LOW PROFILE ANTENNA KIT (Stud-mount GA 56 antenna, mounting hardware, no cable)
010-10040-02	GA 56 FLANGE MOUNT ANTENNA KIT (Flange-mount GA 56 antenna, mounting hardware, no cable)
011-00059-00	MOUNTING RACK w/CONNECTOR
310-00006-00	RG-58A/U CABLE
320-00003-00	15 FT. LOW-LOSS AVIATION ANTENNA EXTENSION CABLE w/RIGHT ANGLE BNC CONN.
320-00003-02	30 FT. LOW-LOSS AVIATION ANTENNA EXTENSION CABLE w/RIGHT ANGLE BNC CONN.
325-00014-00	GPS 100 to GPS 150 WIRING HARNESS ADAPTER
330-00087-00	CONNECTOR, BNC, MALE, CLAMP
011-00313-01	CONNECTOR (J1 only)KIT

The mounting rack is required for approved installations. The following hardware is required for installation of the mounting rack, but is not provided:

#6-32 Flat Head Screw (4 ea.) #6-32 Self-locking Nut (4 ea.)

Cable and two BNC connectors are required to make the antenna cable, or it can be fabricated by the installer from materials meeting the requirements of paragraph 2.3.

DATA BASE OPTIONS

010-10038-00	MEMORY CARD - AMERICAS DATABASE
010-10038-01	MEMORY CARD - INTERNATIONAL DATABASE
010-10038-02	MEMORY CARD - WORLDWIDE DATABASE
010-10032-03	MEMORY CARD - USER

MISCELLANEOUS OPTIONS

190-00048-00	GPS 150 PILOT'S GUIDE
190-00048-01	GPS 150 QUICK REFERENCE GUIDE
330-00067-00	GPS 1.57542 GHZ NOTCH FILTER
362-00010-00	WALL CHARGER - 110/220VAC

3.2 ANTENNA INSTALLATION

The GA 56 Antenna outline and footprint dimensions are shown in Figures 3-1 and 3-2.

- A. Using the backing plate as a template, mark the location of the mounting holes and the through hole for coax cable. Drill or punch the holes.
- B. The antenna installation must provide adequate support for the antenna considering a maximum drag load of 5 lbs. for the GA 56 antennas (at subsonic speed). Install a doubler plate to reinforce thin skinned aircraft. Observe guidelines for acceptable installation practices as outlined in AC 43.13-2A.
- C. Seal the antenna and gasket to the fuselage using a good quality electrical grade sealant. Use caution to insure that the antenna connector is not contaminated

with sealant. Insure that the mounting screws are fully tightened and that the antenna base is well seated against the gasket. CAUTION: Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

3.3 CABLE INSTALLATION

- A. Route the coax cable to the rack location keeping in mind the recommendations of Section 2. Secure the cable in accordance with good aviation practice.
- B. Trim the coaxial cable to the desired length and install the BNC connector (330-00087-00) per the cabling instructions on Figure 3-3. If the connector is provided by the installer, follow the connector manufacturer's instructions for cable preparation.
- C. Contacts for the 37-pin connector must be crimped into the individual wires of the aircraft wiring harness. The following table lists recommended crimp tools:

Contacts	
	Standard Density Connectors
	37 socket connector (J1 on unit)
	20-24 AWG socket contact
Garmin p/n	336-00022-00
military p/n	M39029/63-368
Amp	205090-1
Positronic	M39029/63-368
ITT Cannon	031-1007-042

Tools			
	Hand Crimping Tool	Standard Density Connectors (size 20 contacts)	
		pin or socket contacts (20-24 AWG)	
		positioner	insert/extract
military p/n	M22520/2-01	M22520/2-08	M81969/1-02
Positronic	9507	9502-5	M81969/1-02
ITT Cannon	995-0001-584	995-0001-604	980-2000-426*
Amp	601966-1	601966-5	91067-2
Daniels	AFM8	K13-1	M24308/1-02
Astro	615717	615725	M81969/1-02

* Insert/extract tools from ITT Cannon are all plastic, others are plastic with metal tip.

Non- GARMIN part numbers shown are not maintained by GARMIN and consequently are subject to change without notice.

See Appendix B for information regarding obsolete stamped type contacts.

3.4 RACK INSTALLATION

- A. Figure 3-4 shows outline dimensions for the aviation rack. Install the rack in a rectangular 6.320" x 2.000" hole in the instrument panel. Exercise caution when installing the rack into the instrument panel. The rack is designed to facilitate removal of the GPS 150 for portable use. Deformation of the rack may make it difficult to install and remove the GPS 150.
- B. Install the rack in the aircraft panel using four #6-32 countersunk screws and four self-locking nuts. The screws are inserted from the inside through the holes in the sides of the rack (see Figure 3-5).

3.5 GPS 150 INSTALLATION AND REMOVAL

The GPS 150 is installed in the rack by sliding it straight in until about 1 inch short of the final position. A 3/32 inch hex drive tool is then inserted into the access hole at the bottom of the unit face. Rotate the hex tool clockwise while pressing on the left side of the Bezel until the unit is firmly seated in the rack. It may be necessary to insert the hex drive tool into the access hole and rotate the mechanism 90° counter-clockwise to insure correct position prior to placing the unit in the rack.

To remove the unit from the rack, insert the hex drive tool into the access hole on the unit face and rotate counter-clockwise until the unit is forced out about 3/4 inch and can be freely pulled from the rack.

Be sure not to over tighten the unit into the rack. The application of hex drive tool torque exceeding 15 in*lbs can damage the locking mechanism.

3.6 PLACARD

After completing the installation, a placard stating that the GPS 150 is limited to VFR use must be installed on the panel in clear view of the pilot. The placard may be Garmin p/n 161-00024-00 as supplied with the unit, or a suitable equivalent.

SECTION 4 CHECKOUT PROCEDURE

The GPS 150 ground test procedure incorporates a series of four (4) display pages to test CDI/flag, OBI, annunciator, and power functions of the unit. These pages can be selected by ensuring the flashing cursor is off and rotating the outer knob either direction. To change data on the displayed test page, depress the CRSR key and the cursor will begin flashing on the first selectable field on the page. The inner knob will change data on the selected field. The ENT key or the outer knob will advance to the next field on the page. Pressing the CRSR key again will stop the current field from flashing, allowing the outer knob to select the next test page (see Chapter 2 of the GPS 150 Pilot's Guide for more information on page and data selection).

Arrival

OFF	Ensure the Arrival Annunciator is OFF
ON	Ensure the Arrival Annunciator is ON

Select the Power Test Page by removing the cursor from the Annunciator Test Page and turning the outer knob one detent to the right. Verify the following status is displayed:

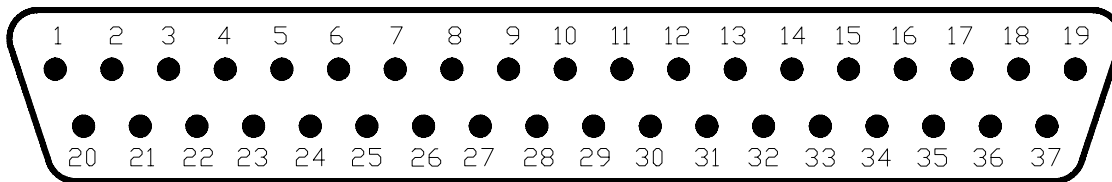
Using EXTERNAL POWER
Memory Batt OK
Intrnl Batt OK

Note: Depending on the power source for the unit (aircraft, wall charger, or internal battery) and the status of battery charging, the top line may read: “Battery power”, “charger power”, “external power”.

Turn the GPS 150 off in preparation for a signal acquisition test.

The following tests assume that the aircraft is outside the hangar facility and well away from buildings or other obstructions that might interfere with satellite signal reception. With power applied to the aviation rack, turn the GPS 150 on. The Self Test Page will be displayed followed by the Data Base Page. Upon approval of the Data Base Page, the Satellite Status Page will be displayed. If unable to acquire satellites, relocate the aircraft away from obstructions which might be shading reception. If the situation does not improve, check the antenna installation.

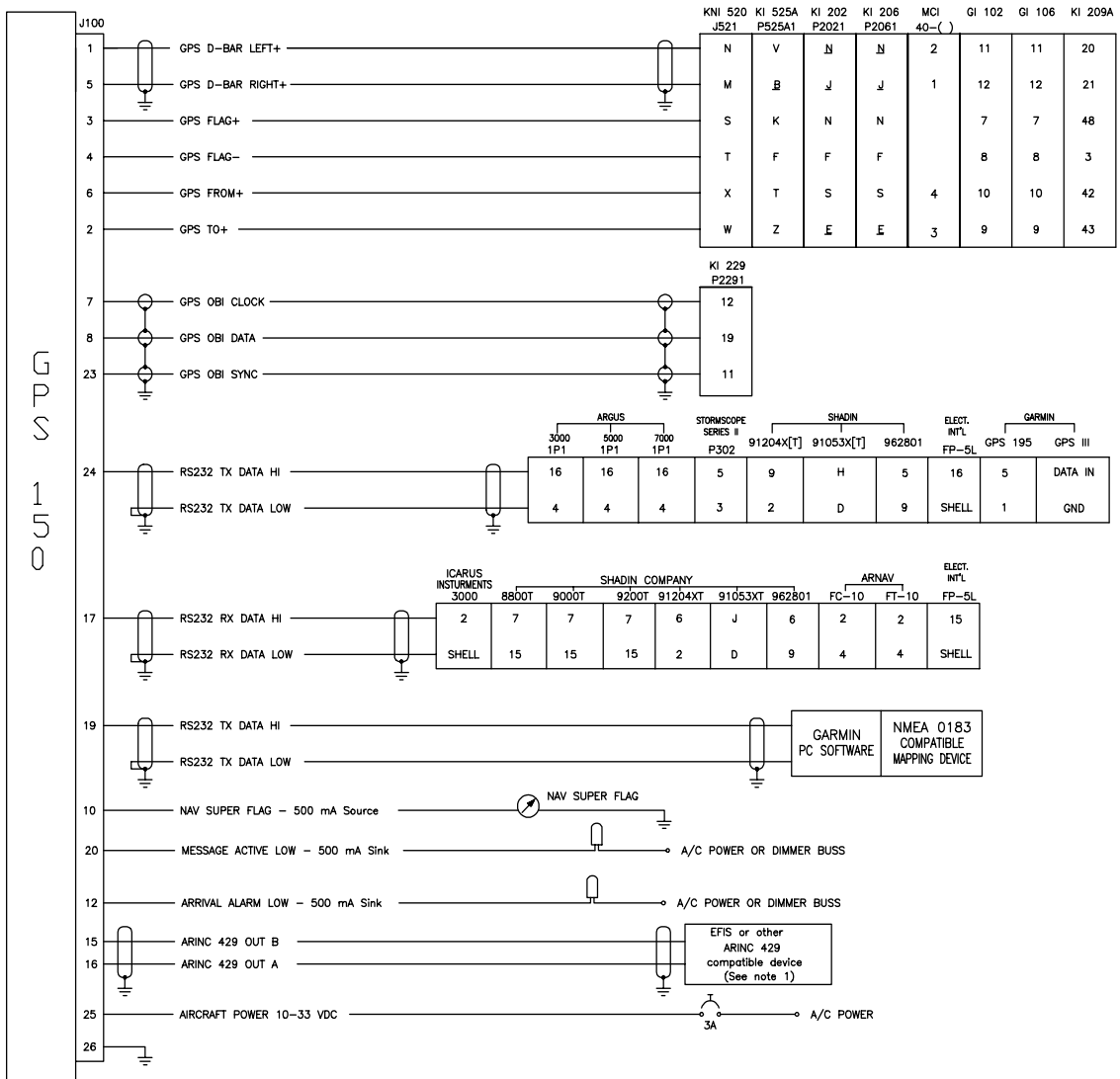
Once GPS position information is available, use the DIRECT key to activate the navigation function to a nearby NAVAID, intersection, or airport. Ensure the ARGUS, STORMSCOPE, EFIS, fuel management system or other mapping device is receiving data from the GPS 150 and is functioning properly (see Chapter 5 of the GPS 150 Pilot's Guide for more information on the Direct function).



VIEW OF J101 CONNECTOR
FROM BACK OF RACK

J101		
PIN NO.		
1	-----	D-BAR LEFT +
2	-----	TO +
3	-----	FLAG +
4	-----	FLAG -
5	-----	D-BAR RIGHT +
6	-----	FROM +
7	-----	OBI CLOCK
8	-----	OBI DATA
9	-----	not used
10	-----	NAV SUPER FLAG
11	-----	RESERVED
12	-----	ARRIVAL ALARM LOW
13	-----	RESERVED
14	-----	not used
15	-----	ARINC 429 OUT B
16	-----	ARINC 429 OUT A
17	-----	RS232 IN 1
18	-----	RESERVED
19	-----	RS232 OUT 2
20	-----	MESSAGE LOW
21	-----	RESERVED
22	-----	RESERVED
23	-----	OBI SYNC
24	-----	RS232 OUT 1
25	-----	AIRCRAFT POWER 10-33 VDC
26	-----	GROUND
27	-----	not used
28	-----	RESERVED
29	-----	RESERVED
30	-----	RESERVED
31	-----	RESERVED
32	-----	RESERVED
33	-----	RESERVED
34	-----	RESERVED
35	-----	not used
36	-----	RESERVED
37	-----	RESERVED

FIGURE 1-1 PINOUT DEFINITION



NOTES:

1. THE FAA HAS EVALUATED THE ARINC 429 INTERFACE WITH A BENDIX/KING EFIS 40 AND FOUND IT TO BE ACCEPTABLE. OTHER EFIS INSTALLATIONS WOULD REQUIRE FAA EVALUATION.

FIGURE 1-2 INTERCONNECT SCHEMATIC

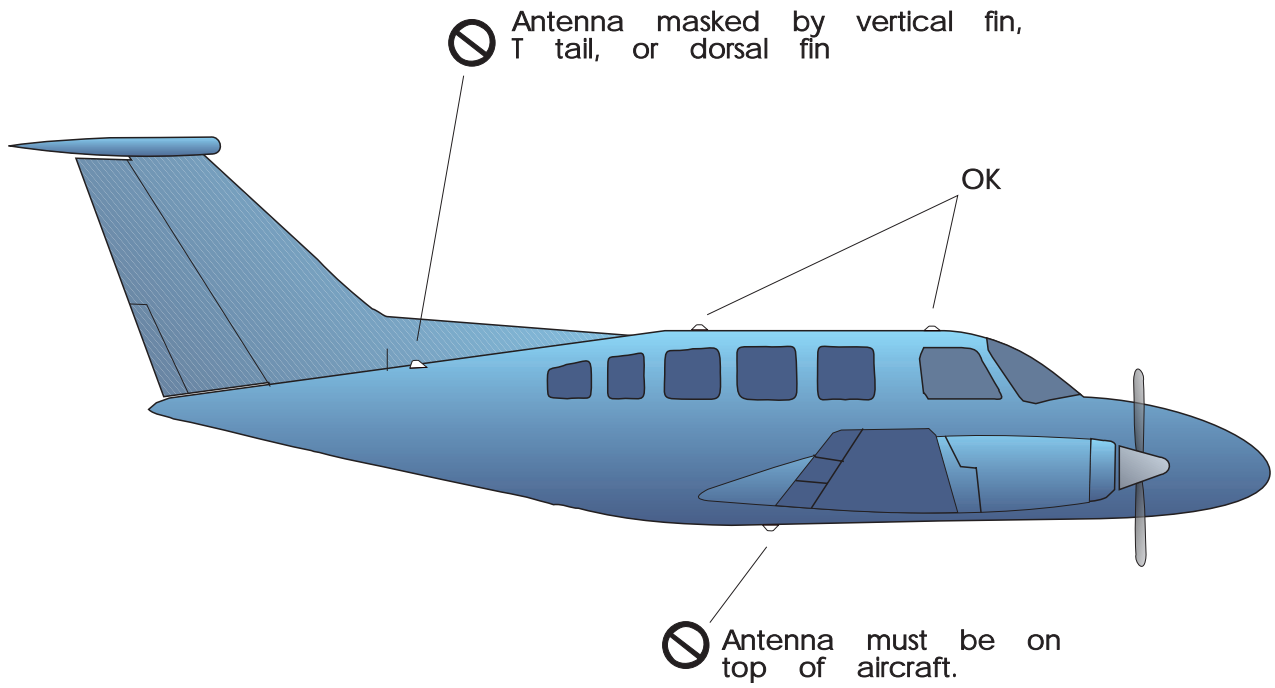


FIG 2-1
ANTENNA INSTALLATION CONSIDERATIONS

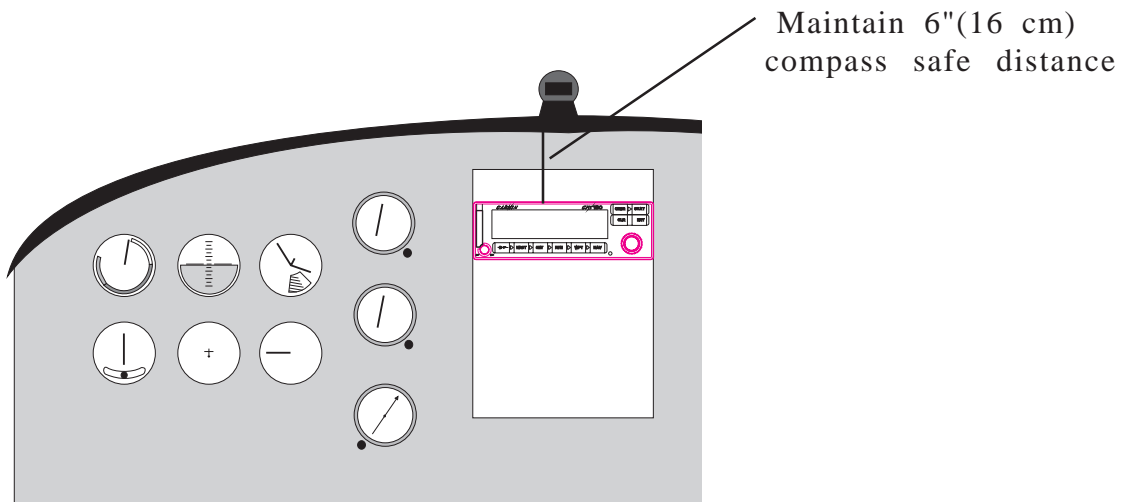


FIG 2-2
GPS INSTALLATION CONSIDERATIONS

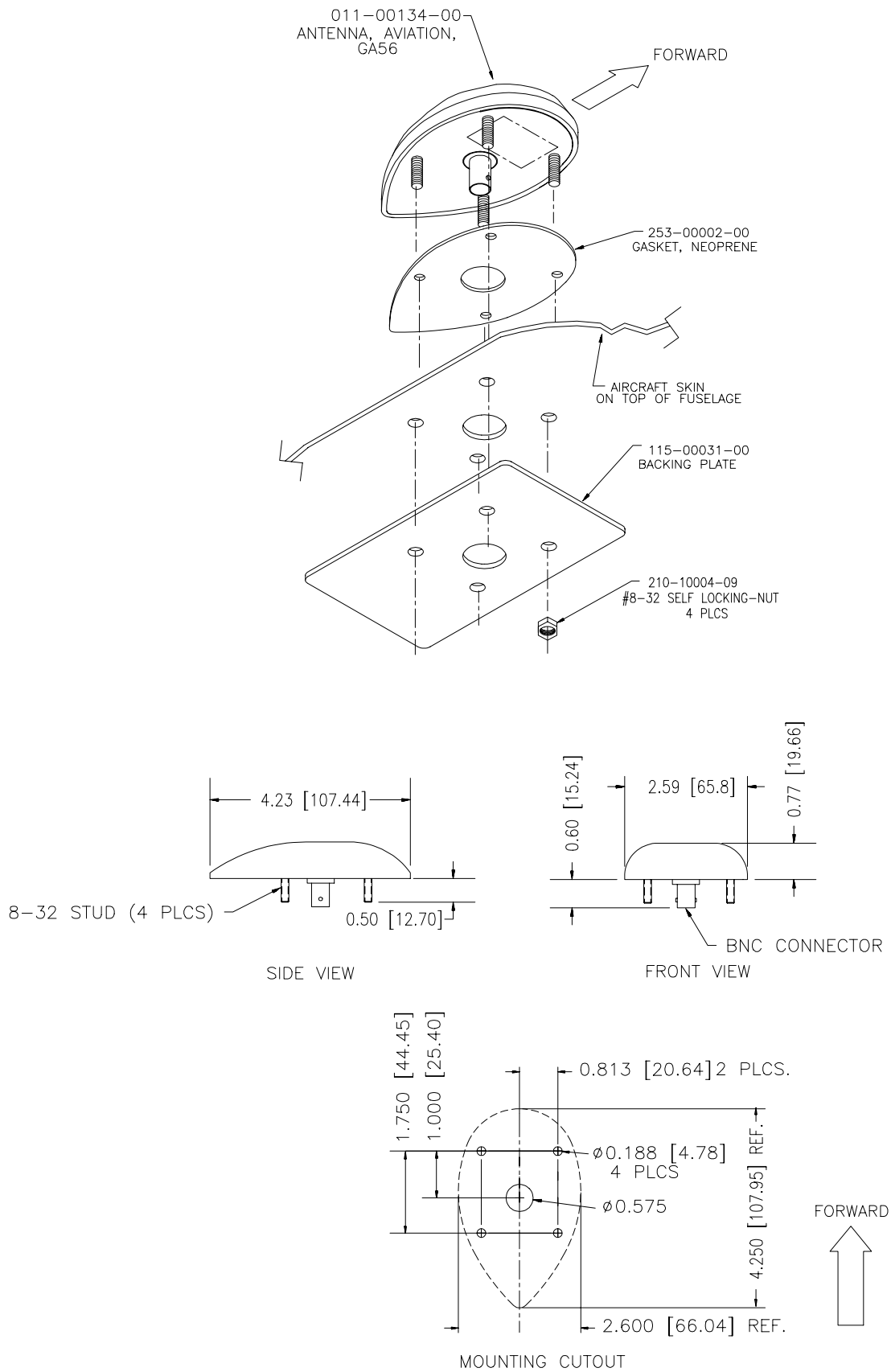
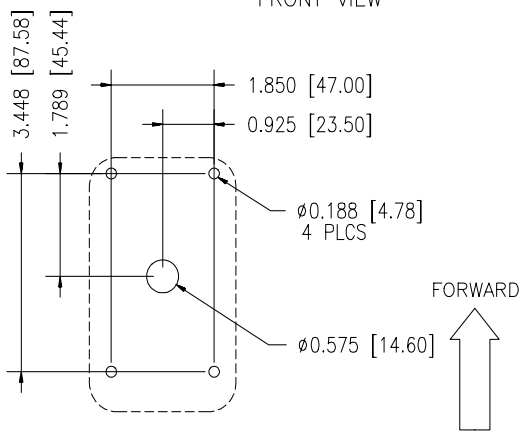
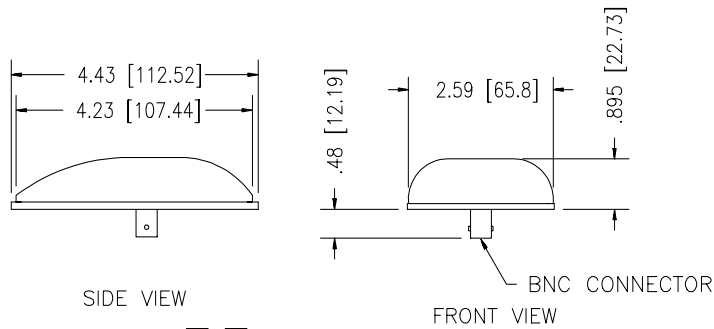
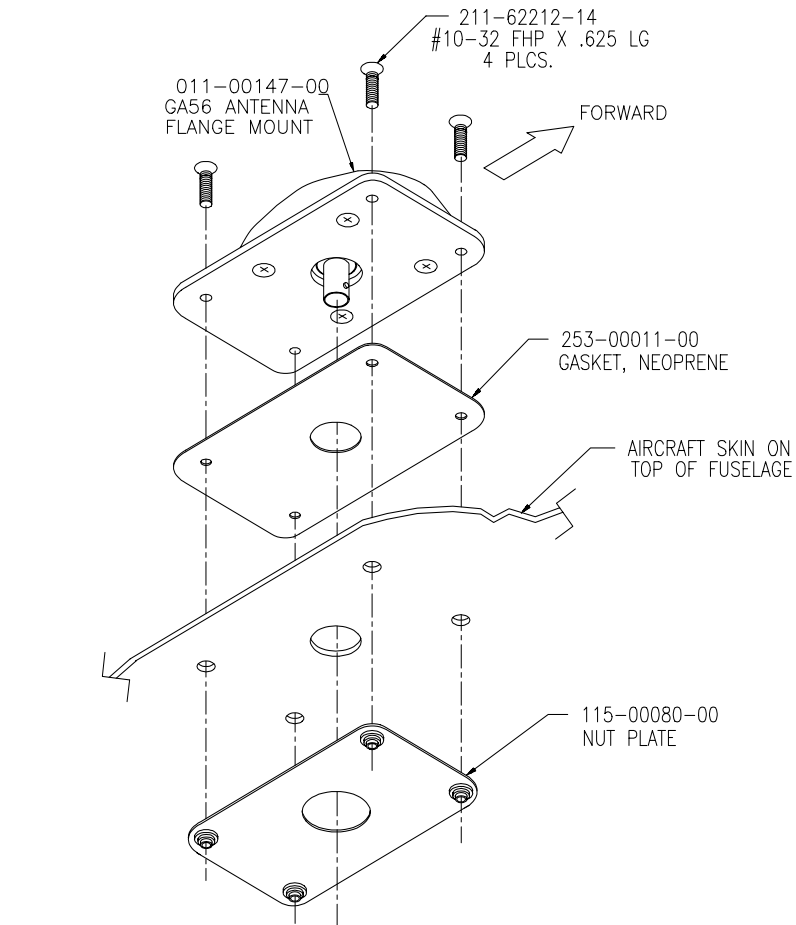


FIG 3-1
STUD MOUNT GA 56 ANTENNA INSTALLATION



MOUNTING CUTOUT

FIGURE 3-2
FLANGE MOUNT GA 56 ANTENNA INSTALLATION

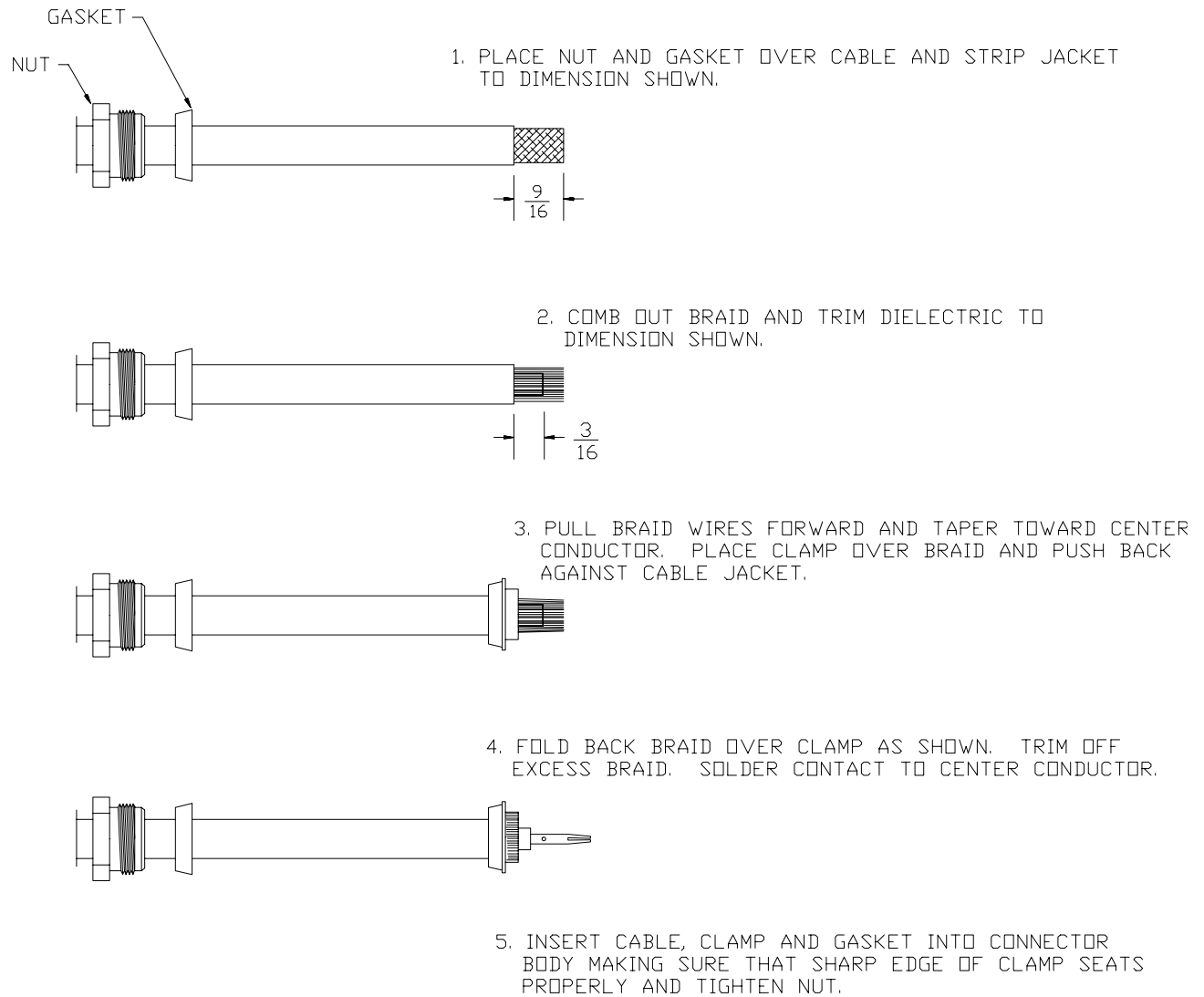


FIGURE 3-3 COAX CABLE INSTALLATION

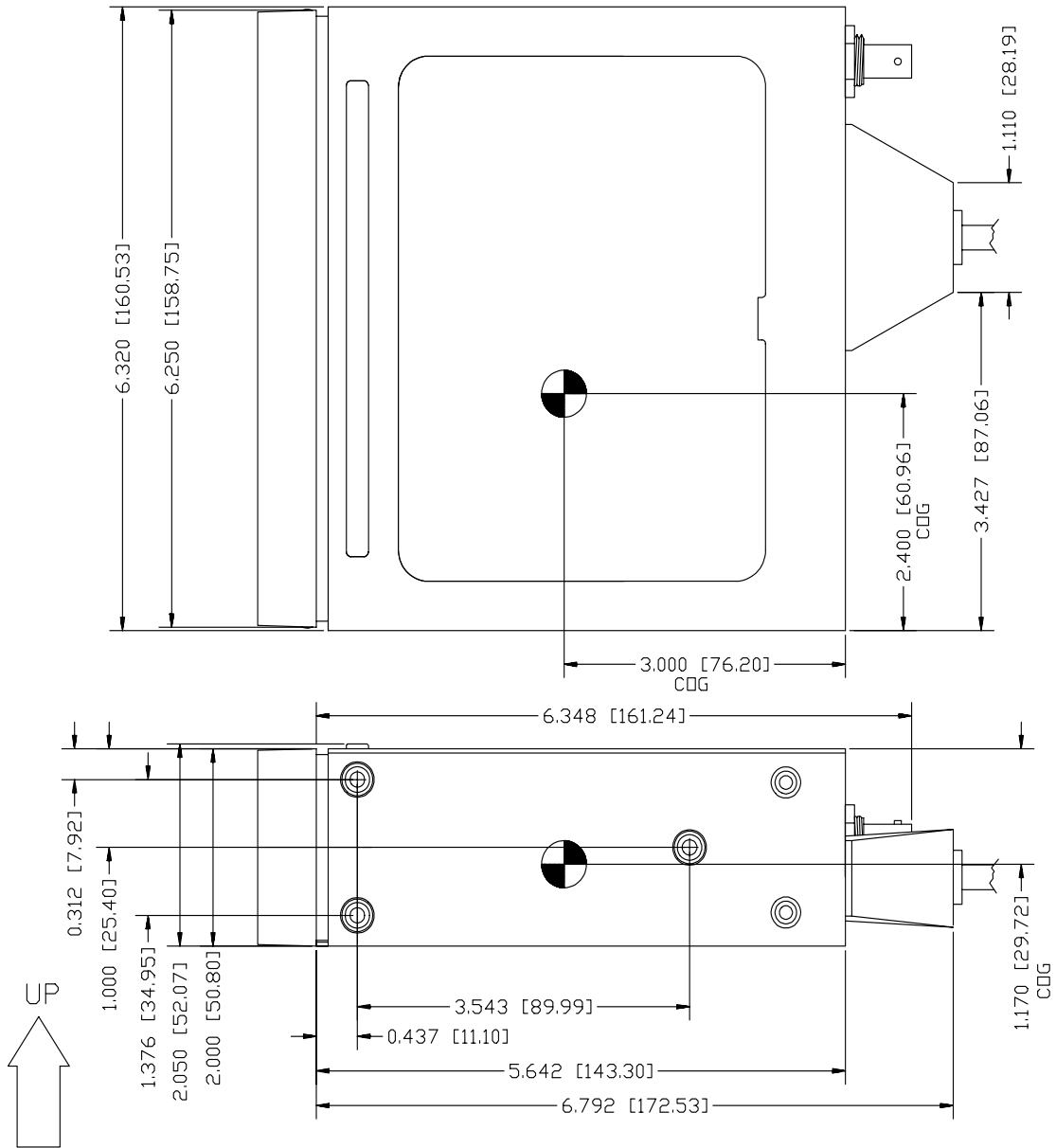


FIGURE 3-4 AVIATION RACK DIMENSIONS

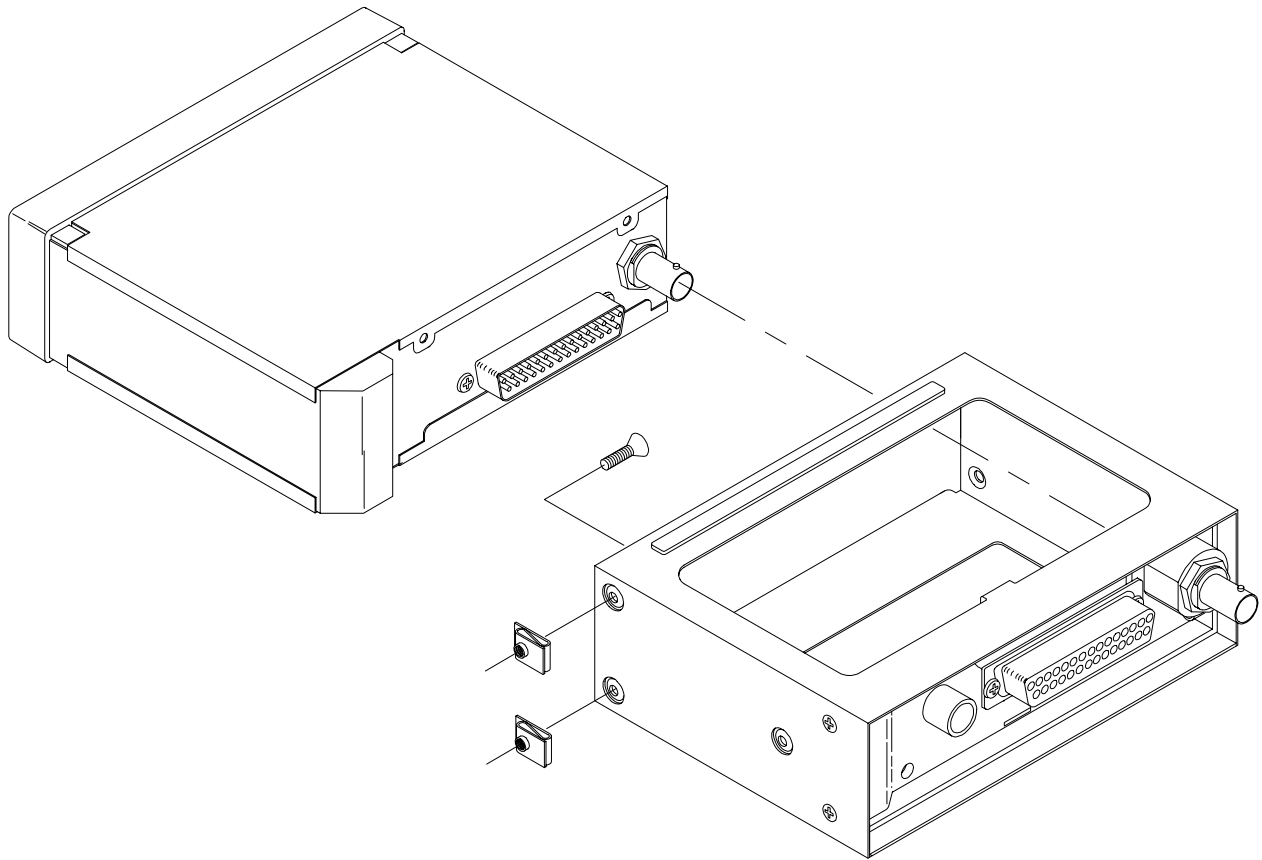


FIGURE 3-5 AVIATION RACK INSTALLATION

APPENDIX A INSTALLATION DETAILS FOR BEECH V35B

1.0 INTRODUCTION

This appendix provides airframe specific information which is necessary to install the GARMIN GPS 150 navigation system in the Beech Bonanza Model V35B in accordance with STC SA00066WI. See Appendix C for copy of STC. When so installed, the GPS 150 system is approved for use as a supplementary navigation system under Visual Flight Rules (VFR) only. A functional block diagram of the system is shown in Figure A-1.

The information provided herein is to be considered supplemental to the information contained in the GARMIN GPS 150 Aviation Kit Installation Manual, P/N 190-00026-00. Within this appendix, the base document will be referred to as the "Installation Manual".

2.0 INSTALLATION INSTRUCTIONS

2.1 ANTENNA

The GPS 150 antenna is to be installed on top of the cabin on the aircraft centerline at fuselage station 130. Figure A-2 illustrates the proper antenna positioning. Refer to section 2.1 of the Installation Manual for general antenna mounting requirements.

2.2 AVIATION RACK INSTALLATION

The GPS 150 aviation rack is to be installed in the instrument panel radio rack as shown in figure A-3. The controls and display of the GPS 150 must be readily visible to the pilot when seated at the controls.

To install the aviation rack, position it in the instrument panel in the desired position, assuring that the front is not twisted out of square. Match drill the flanges on the radio rack to the installation holes on the GPS 150 aviation rack. Using 4 each #6-32 screws and self locking nuts, attach the aviation rack to the aircraft panel. For additional information, refer to the Installation Manual.

2.3 WIRING

Fabricate an appropriate cable to connect the GPS 150 aviation rack to 28VDC power, a message annunciator, a remote switch (for selecting between GPS and standard navigation equipment), a transfer switch with integral white, illuminated annunciators with black markings (to control and indicate the status of the remote switch). Wiring connections are to be made in accordance with Figure A-4. Breaker locations are to be as shown in Figure A-3. Route and connect the wiring in accordance with Advisory Circular AC-43.13-2A. After the wiring installation is complete, carefully check the operation of all flight controls throughout their range to assure that no operational interference exists.

2.4 PLACARDS

After completion of the GPS 150 system installation, affix a durable placard on the instrument panel in the location shown in Figure A-3 which states "GPS limited to VFR use only". GARMIN placard p/n 161-00024-00 or an appropriate equivalent should be used for this purpose.

3.0 OPERATIONAL CHECKOUT

When the installation is complete, conduct a post installation checkout as specified in section 4 of the Installation Manual, being sure to check the proper operation of all connected instruments.

4.0 RETURN TO SERVICE

After installation, a new weight and balance must be computed to show the GPS 150 components. The aircraft should then be returned to service by completion of FAA form 337 by an appropriately certificated person.

5.0 CONTINUED AIRWORTHINESS

Maintenance of the GPS 150 is on condition only. Periodic maintenance of the GPS 150 is not required.

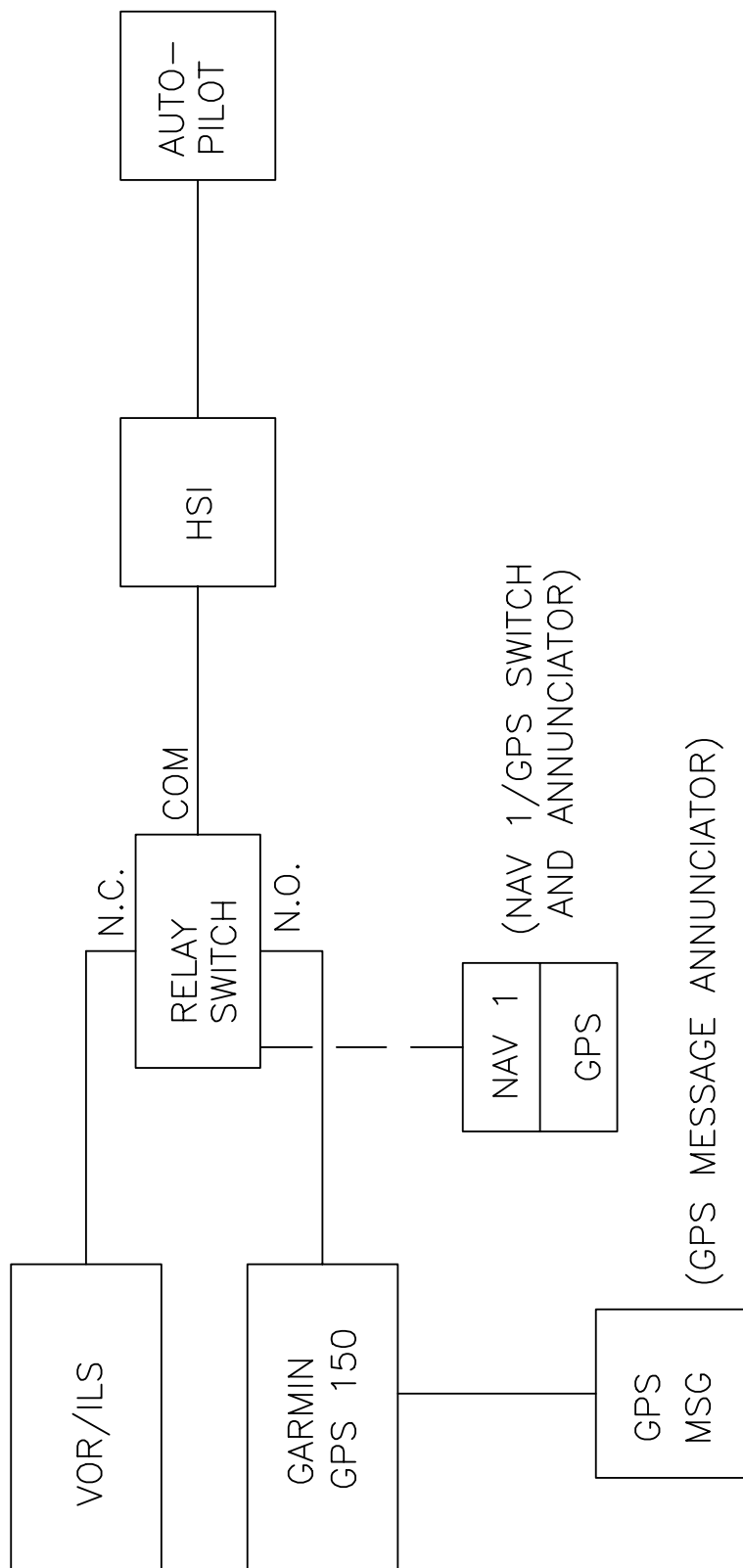


FIG A-1
FUNCTIONAL BLOCK DIAGRAM

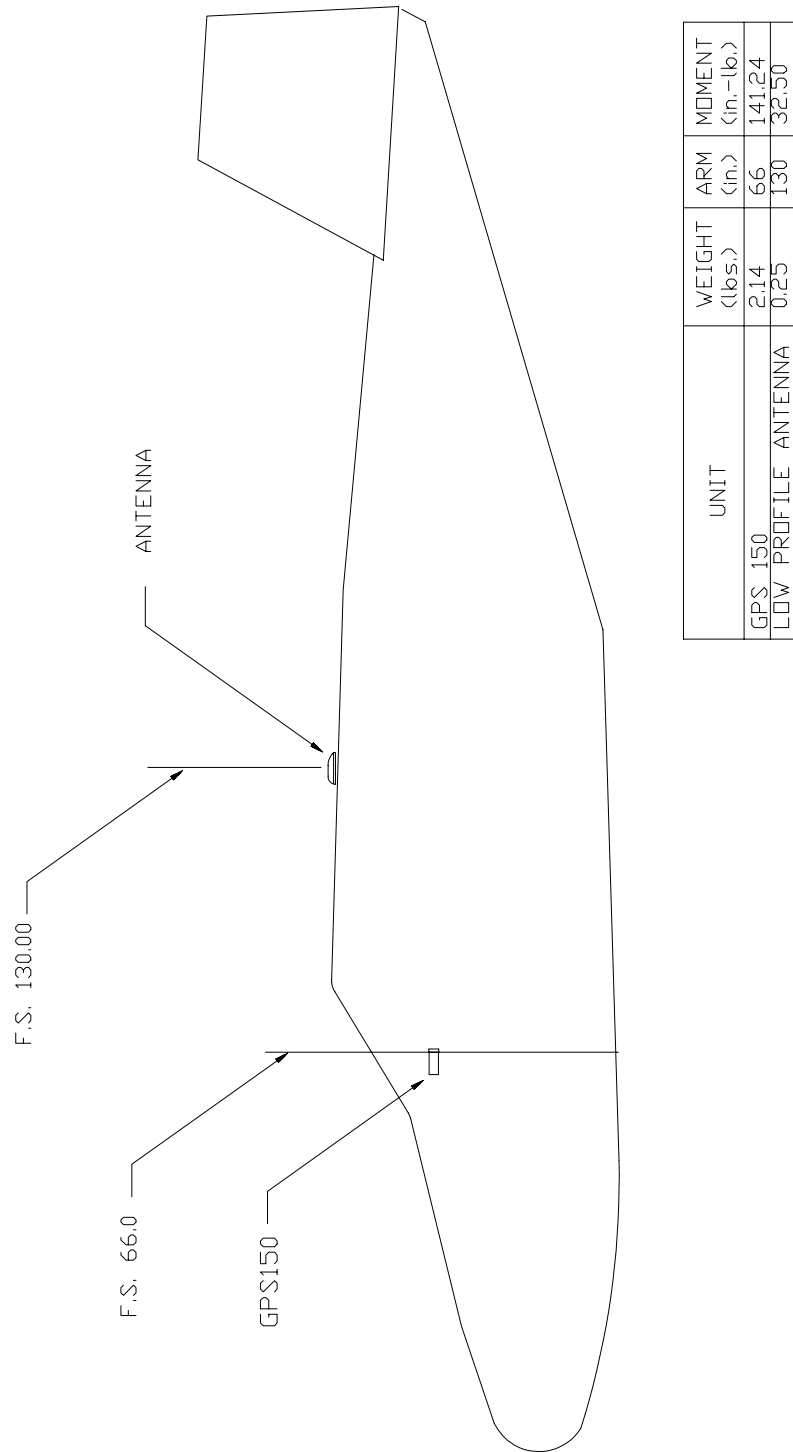


FIG A-2
FUSELAGE STATIONS AND WEIGHT AND BALANCE DATA

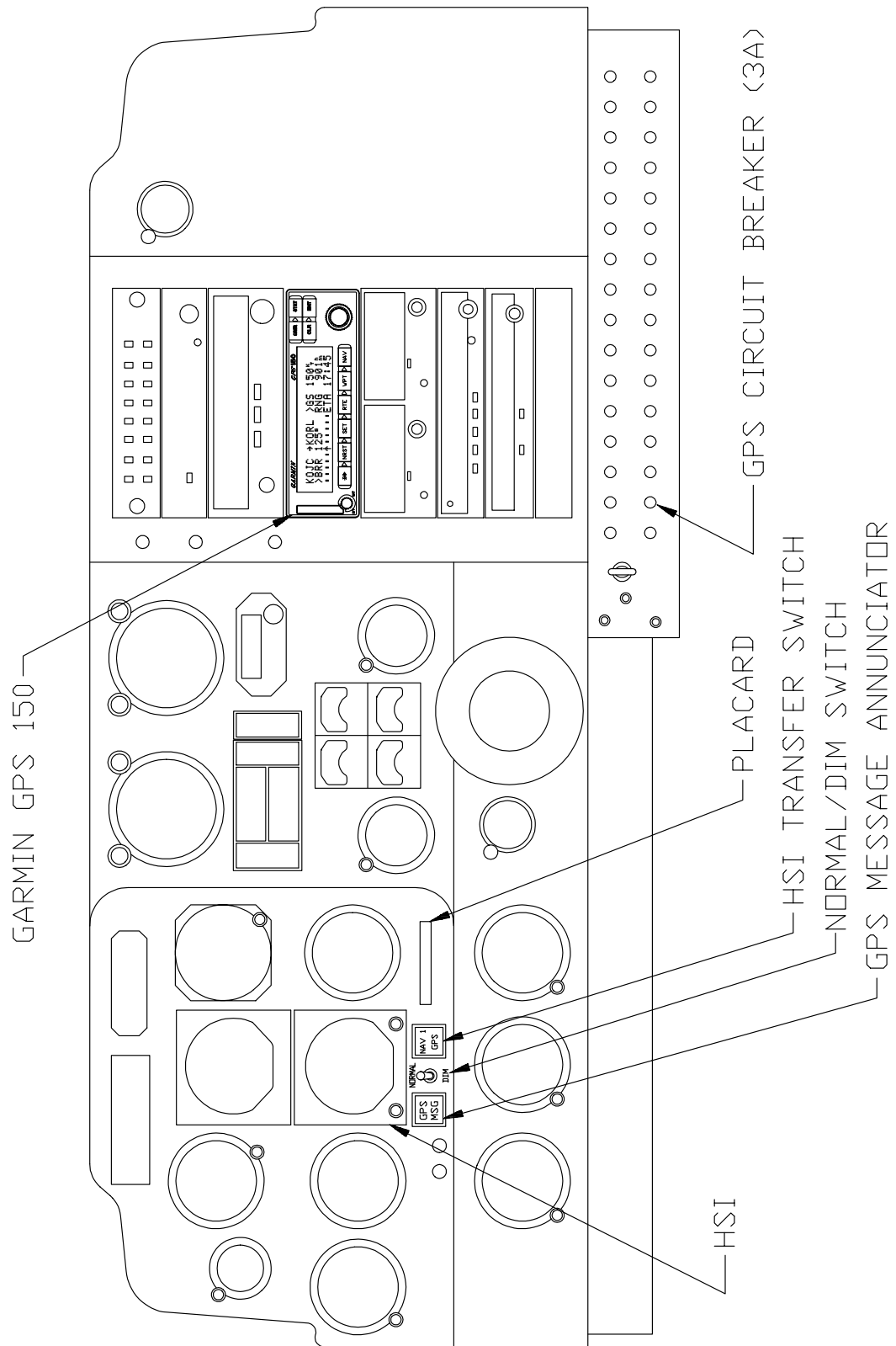
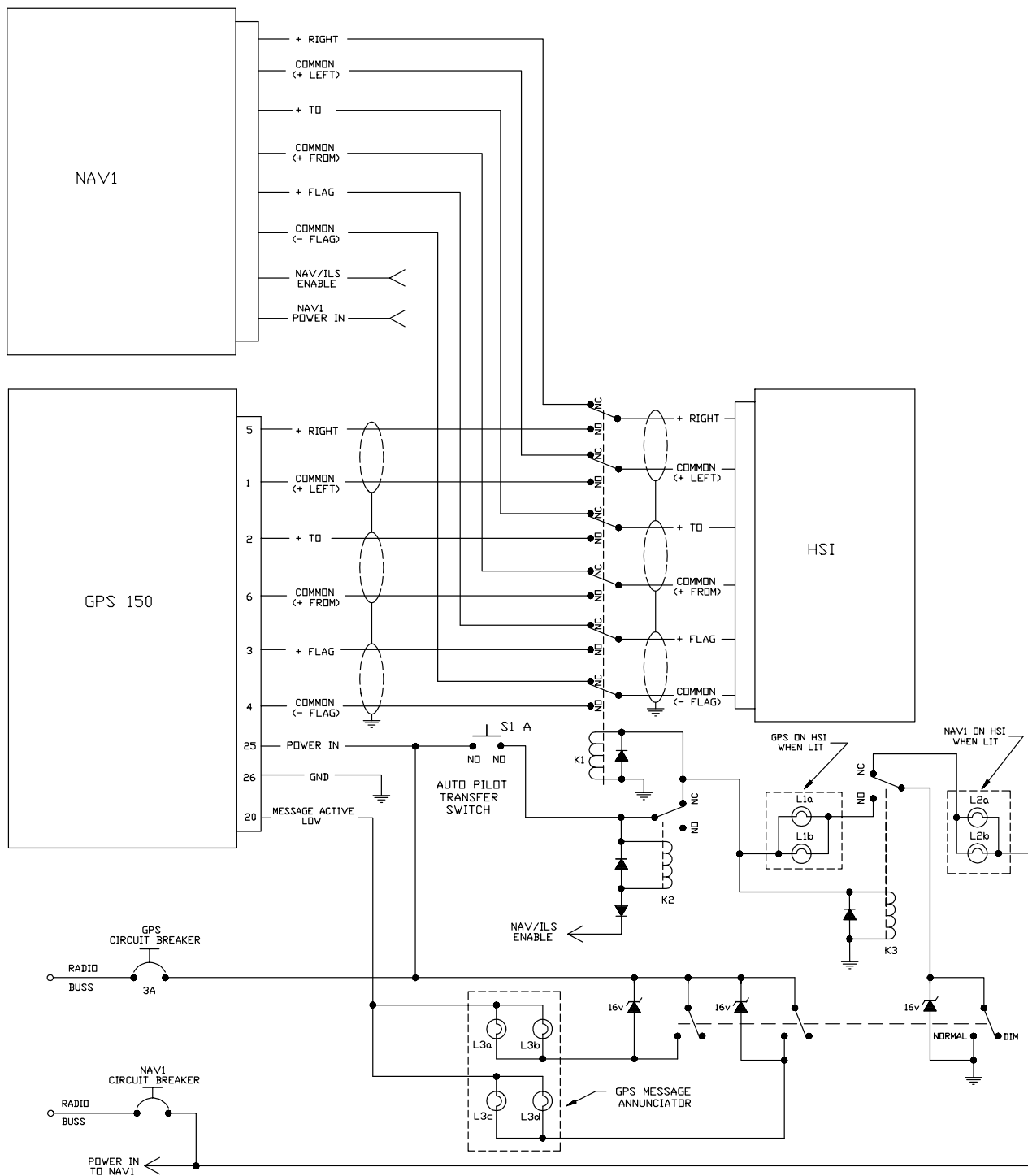


FIG A-3
 PANEL LAYOUT AND BREAKER LOCATION



NOTES:

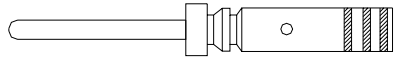
1. GPS CIRCUIT BREAKER TO BE MS26574-3 OR EQUIVALENT.
2. TRANSFER SWITCH (S1) TO BE AEROSPACE OPTICS 95-43-15-B6-58823, OR EQUIVALENT.
3. ANNUNCIATOR LAMPS L1 AND L2 ARE PART OF TRANSFER SWITCH S1.
4. MESSAGE ANNUNCIATOR (L3) TO BE AEROSPACE OPTICS 95-40-17-H6-58824 OR EQUIVALENT.
5. ALL WIRING TO BE 24 AWG UNLESS OTHERWISE NOTED.

FIG A-4
WIRING DIAGRAM

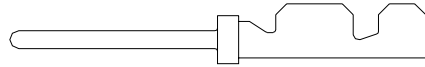
APPENDIX B CONNECTOR CHANGES

STAMPED CONTACT CONNECTOR USAGE

Garmin panel mount GPS radios have previously been shipped with stamped crimp type contacts. All products are now being shipped with machined mil-spec contacts with color-coded barrels. The following figures can be used to identify which type contact you have:



NEW MACHINED CONTACT



OLD STAMPED CONTACT

When working with the stamped crimp type contacts, the following tools should be used:

Tools	37 position connectors	
Supplier	Crimp Tool	Extraction Tool
Amp	58448-2	91067-22
ITT Cannon	995-2000-000	980-0008-124
Cinch	HTD-544	CIET-20-HDB

Part numbers shown are not maintained by Garmin and consequently are subject to change without notice.

APPENDIX C STC PERMISSION

Consistent with N8110.69 or Order 8110.4, Aviation Authority approved installers are hereby granted permission to use STC# SA00066WI data to modify aircraft.

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

Number SA00066WI

This certificate issued to GARMIN International
9875 Widmer Road
Lenexa, Kansas 66215

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified herein meets the airworthiness requirements of Part 3 of the Civil Air Regulations.

Original Product — Type Certificate Number: 3A15"
Make: Beech
Model: V35B

Description of Type Design Change: Installation of GARMIN Global Positioning System GPS 150. Data Required: (1) GARMIN Master Drawing List 005-00007-00, Revision B, dated May 14, 1993, (2) GARMIN International, Inc. Drawing No. 190-00025-00, Revision A, dated May 24, 1993, or later FAA approved revisions of (1) or (2).

Limitations and Conditions:

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 by the installer 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.

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

Date of application: December 23, 1992 *Date issued:*

Date of issuance: May 24, 1993 *Date amended:*



By direction of the Administrator
Ronald K. Rathgeber
(Signature)
for Ronald K. Rathgeber, Acting Manager
Wichita Aircraft Certification Office
(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 21.67.

FAA FORM 8110-2 (10-84)

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