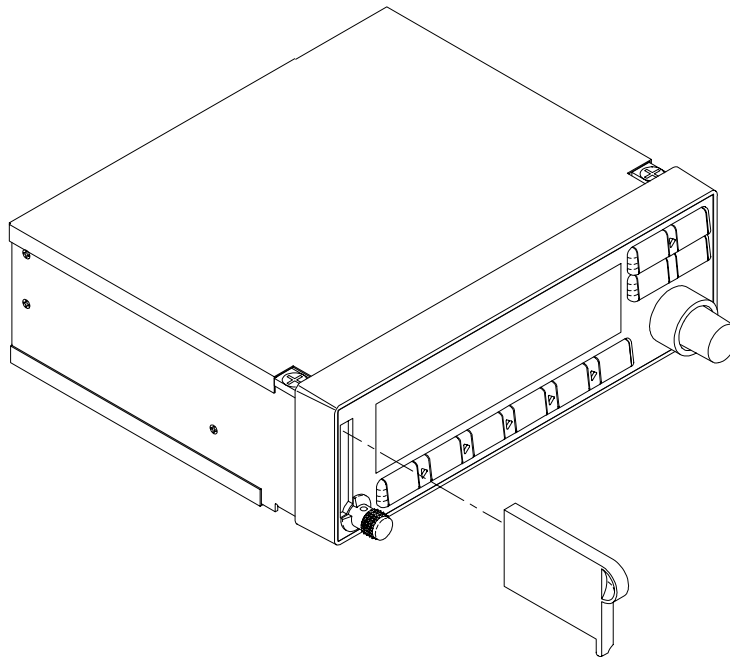




# **GARMIN®**

## **GPS 155 INSTALLATION MANUAL**



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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 155 Aviation Kit.

After installation of the GPS 155 system, FAA Form 337 must be completed by an appropriately certificated agency to return the aircraft to service.

## 1.2 TECHNICAL CHARACTERISTICS

The GPS 155 offers the versatility of fixed installation in a panel mounted aviation rack as well as complete portability.

For TSO Compliance, see Appendix A.

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 the TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

### 1.2.1 PHYSICAL CHARACTERISTICS

Width:	6.25 inches
Height:	2 inches
Depth:	5.65 inches
GPS 155 Weight:	2.14 lbs.
Low Profile Antenna Weight:	4 oz.
Aviation Rack Weight:	14 oz.
Max Air Speed: (Structural rating for antenna)	Subsonic

### 1.2.2 OPERATIONAL CHARACTERISTICS

Operating Temperature Range:	-20 °C to +55 °C
Humidity:	95% non-condensing
Altitude Range:	0 to 50,000 ft.
Power Input:	10 to 33 VDC, 5 watts Max.

### 1.2.3 INTERFACES

The GPS 155 provides interfaces to various general aviation instruments. Figure 1-1 defines the function of each pin on the 37 pin DSUB connector (J101) located at the back of the rack. Figure 1-2 depicts the function of each pin in 26 pin HD-DSUB

connector (J102) located above the 37 pin connector at the back of the rack. Figure 1-3 depicts the interconnects between the rack and other instruments. Appendix C depicts the interconnect between the rack and other instruments using discrete switch/annunciators. The following interfaces are provided.

### 1.2.3.1 37 PIN CONNECTOR (J101)

CDI: (Pins 1 and 5)	Capable of driving up to three 1000 ohm parallel CDI loads.
To/From: (Pins 2 and 6)	Capable of driving up to three 200 ohm parallel to/from loads. Units without Mod Status 1: +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 flag loads.
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. Indicates a message is available for viewing.
RS232 chan 1 output data: (Pin 24)	Output capable of driving devices as listed in Section 4. Conforms to the EIA specification EIA-232C.
RS232 chan 2 output data: (Pin 19)	Output capable of driving devices as listed in Section 4. Conforms to the EIA specification EIA-232C.
RS232 chan 1 input data: (Pin 17)	Input capable of receiving data from devices as listed in Section 4. Conforms to the EIA specification EIA-232C.
GPS arrival alarm: (Pin 12)	Output capable of driving negative logic annunciator by sinking up to 500mA. Indicates arrival at a prescribed GPS waypoint
GPS approach annunciator: (Pin 13)	Output capable of driving negative logic annunciator by sinking up to 500mA. See GPS 155 Pilot's Guide, (GPN 190-00065-00), for more information.
ARINC 429 Output A & B: (Pins 15 and 16)	Output capable of driving ARINC 429 devices as listed in Section 4.
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).

RS422 input: Input capable of receiving serial OBS data from  
(Pins 11 and 27) Collins Pro Line 2 EFIS DSP unit.

GPS approach select switch: Input, when grounded, arms approach mode.  
(Pin 9)

GPS OBS: Capable of interfacing with a standard OBS  
(Pins 14,35, and 37) resolver.

ARINC 429 Input A & B: Input capable of receiving data from ARINC 429  
(Pins 32 and 33) devices as listed in Section 4.

### 1.2.3.2 26 PIN CONNECTOR (J102)

Altimeter input: Capable of receiving encoded output data from any  
(Pins 14-24) parallel altimeter device. (Gillham/Greycode).

GPS Sequence Switch: Input, when grounded, activates HOLD mode. See  
(Pin 13) the GPS 155 Pilot's Guide (GPN 190-00065-00) for more information.

## **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 155.

### 2.1 ANTENNA CONSIDERATIONS

#### 2.1.1 SATELLITE VISIBILITY

The GPS 155 Low Profile 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 155 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 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 155, 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 155, however as with any electronic equipment, reduced operating temperature can contribute to increased reliability. Additionally, location of the GPS 155 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 EXTERNAL ALTITUDE INPUT

Pressure altitude input from an external source may be derived from a RS-232 compatible serial altitude input or Parallel Greyscale/Gillham Altitude as described in Section 4 of this manual. Gillham Altitude is not required when serial altitude is used.

## 2.6 MINIMUM INSTALLATION REQUIREMENTS

Below is a list of required devices for A1 and A2 certification. Figure 1-3 shows various equipment that can be used. For a specific list of equipment used in the initial STC see GPN 190-00065-07. Deviations from this equipment should be approved by the FAA or the governing organization.

### Pressure Altitude Device

This device delivers pressure altitude data to the GPS 155. This data can come from an encoder or serializer.

### Manual Course Device

This device delivers the manual course selected to the GPS 155. Course information can come from an analog resolver or from an EFIS via the ARINC 429 bus or RS-422 bus.

### HSI/CDI Device

This device displays Nav Flag, Left/Right and To/From. This can be displayed on an EFIS or HSI.

### External Annunciators and Switches

NAV/GPS	Switch/Annunciator
GPS Sequence	Switch/Annunciator
Approach	Switch/Annunciator (not required for A2)
Message	Annunciator
Arrival	Annunciator

The installer is advised to ensure that the switches and annunciators are the functional equivalent to and perform at least as well as the GARMIN devices used in the initial STC. The GARMIN switches and annunciators are sunlight readable and in the primary view of the pilot. See Appendix C for what GARMIN used in the initial STC installation. For other information concerning switch/annunciators see the Generic Airplane Flight Manual Supplement (190-00065-04) as well as current FAA directives.

### Qualified GPS Antenna

This antenna must be one of those listed in the accessories list.

## 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, W/O CABLE	
Includes:	011-00134-00 LOW PROFILE ANTENNA SUB-ASSEMBLY	1
	115-00031-00 BACKING PLATE	1
	210-10004-09 NUT, SELF-LOCKING, #8-32	4
	253-00002-00 ANTENNA GASKET	1
010-10040-02	GA 56 FLANGE MOUNT ANTENNA	
Includes:	011-00147-00 FLANGE MOUNT LOW PROFILE ANTENNA SUB-ASSEMBLY	1
	115-00080-00 NUT PLATE	1
	211-62212-14 SCREW, #10-32 X 5/8	4
	253-00011-00 ANTENNA GASKET	1
320-00003-00	15 FT LOW-LOSS AVIATION ANTENNA EXTENSION CABLE WITH RIGHT ANGLE BNC CONNECTOR	
320-00003-02	30 FT LOW-LOSS AVIATION ANTENNA EXTENSION CABLE WITH RIGHT ANGLE BNC CONNECTOR	
330-00087-00	CONNECTOR, BNC, MALE, CLAMP	
	Note: One cable assembly and one BNC connector are required to make the antenna cable, or it can be fabricated by the installer from materials meeting the requirements of paragraph 2.3.	
011-00313-00	CONNECTOR (J1 and J2) KIT	
011-00145-00	MOUNTING RACK, W/O CONNECTORS	
011-00160-00	GPS 150 TO GPS 155 RACK UPGRADE KIT	
	Note: A 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.)

#### DATA BASE OPTIONS

010-10051-00	MEMORY CARD - WORLDWIDE DATABASE
010-10051-01	MEMORY CARD - AMERICAS DATABASE
010-10051-02	MEMORY CARD - INTERNATIONAL DATABASE
010-10032-03	MEMORY CARD - USER

#### ANNUNCIATOR OPTIONS

GPN	MID-CONTINENT P/N	DESCRIPTION
013-00029-00	MD41-428	INTEGRATED SW/ANN UNIT, HOR, 28V
013-00029-01	MD41-424	INTEGRATED SW/ANN UNIT, HOR, 14V
013-00029-02	MD41-428 (5V)	INTEGRATED SW/ANN UNIT, HOR, 28V (5V LIGHTING)
013-00029-05	MD41-438	INTEGRATED SW/ANN UNIT, VERT, 28V
013-00029-06	MD41-434	INTEGRATED SW/ANN UNIT, VERT, 14V
013-00029-07	MD41-438 (5V)	INTEGRATED SW/ANN UNIT, VERT, 28V (5V LIGHTING)

#### MISC OPTIONS

190-00065-00	GPS 155 PILOT'S GUIDE
190-00065-01	GPS 155 QUICK REFERENCE GUIDE
330-00067-00	GPS 1.57542 GHZ NOTCH FILTER
362-00010-00	WALL CHARGER - 110/220VAC

### 3.2 ANTENNA INSTALLATION

The Low Profile 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 low profile antenna (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 and 26 pin connectors must be crimped into the individual wires of the aircraft wiring harness. The following tables list contact part numbers (for reference) and recommended crimp tools:

Contacts			
	Standard Density Connectors		Hi Dens. Connector
	37 socket connector (J1 on unit)		26 pin connector (J2 on unit)
	20-24 AWG socket contact		22-28 AWG pin contact
Garmin p/n	336-00022-00		336-00021-00
military p/n	M39029/63-368		M39029/58-360
Amp	205090-1		204370-2
Positronic	M39029/63-368		M39029/58-360
ITT Cannon	031-1007-042		030-2042-000

Tools					
	Hand Crimping Tool	Standard Density Connectors (size 20 contacts)		Hi Dens. Connector (size 22D)	
		pin or socket contacts (20-24 AWG)		pin contacts (22-28 AWG)	
		positioner	insert/extract	positioner	insert/extract
military p/n	M22520/2-01	M22520/2-08	M81969/1-02	M22520/2-09	M81969/1-04
Positronic	9507	9502-5	M81969/1-02	9502-3	M81969/1-04
ITT Cannon	995-0001-584	995-0001-604	980-2000-426*	995-0001-739	n/a
Amp	601966-1	601966-5	91067-2	601966-6	91067-1
Daniels	AFM8	K13-1	M24308/1-02	K42	M24308/18-1
Astro	615717	615725	M81969/1-02	615724	M81969/1-04

\* 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 155 for portable use. Deformation of the rack may make it difficult to install and remove the GPS 155.
- 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 155 INSTALLATION AND REMOVAL

The GPS 155 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 overtighten the unit into the rack. The application of hex drive tool torque exceeding 15 in\*lbs can damage the locking mechanism.

### 3.6 GPS 150 CONVERSION

GARMIN recommends replacing the current 011-00059-00 rack with the new 011-00125-00 rack. The kit part number is 011-00160-00. However, GPS 150 installation may be converted to accommodate a GPS 155 unit by performing the following modifications.

#### 3.6.1 ELECTRICAL MODIFICATIONS

##### 3.6.1.1 J101 MODIFICATIONS

The added features found on the GPS 155 were placed on reserve or unused GPS 150 pins. All pins in the GPS 150 installation shown in Figure 1-2 of the GPS 150 Installation Manual, (GPN 190-00026-00), remain unchanged. Therefore, J101 modifications are limited to adding pins for any required features.

### 3.6.1.2 J102 ADDITION

The GPS 155 has an additional 26 pin connector. This connector must be added per Figure 1-2.

### 3.6.1.3. ANTENNA MODIFICATION

See Antenna Considerations and Antenna Installation sections.

### 3.6.1.4 OTHER MODIFICATION CONSIDERATIONS

See rack consideration and the remainder of the Installation Procedure sections.

## 3.6.2 MECHANICAL MODIFICATIONS

The GPS 155 installation involving an upgrade from an existing GARMIN GPS 150 installation can be made without removing the GPS 150 rack from the instrument panel. The GPS 155 has an additional rear connection (J102) which can be incorporated into the existing GPS 150 rack with the addition of an adapter plate (115-00067-00). The addition of the adapter plate and the mounting of the additional rear connector can generally be performed from the front of the rack using a long Phillips head screwdriver. Refer to Figure 3-6 for the mounting rack modification drawing.

## **SECTION 4 POST INSTALLATION CONFIGURATION & CHECKOUT PROCEDURE**

Before starting the below operations, unit initialization must occur. Do this by first removing any data cards and then turning the unit on. Press enter in response to "Select operating mode Normal ok?". Press enter in response to "No Jeppesen database rte/prx limited to user wpts ok?". After the satellite status page is displayed for 5 seconds the unit may be turned off. Proceed with the following steps.

### 4.1 TEST MODE OPERATIONS

With power applied to the aviation rack and the GPS 155 unit off, depress and hold the ENT key and turn the unit on (release the ENT key when the display activates). While in TEST MODE, test 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 the 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. The ENT key is used to enter a new value into the OBI data field after selecting the desired value using the inner and outer knobs (see Chapter 2 of the GPS Pilot's Guide for more information on page and data selection).

## 4.2 INSTALLATION CONFIGURATION

### 4.2.1 SELECTED COURSE CALIBRATION

Select the test page displaying the selected course input. Using an extremely accurate input source, input 150° to the GPS 155. The input course will indicate close to 150° and a “Calib?” field will appear in the lower right corner. Selecting the “Calib?” field will calibrate the GPS 155 to match the input source. Verify OBS operation by checking that the bearing displayed on the GPS 155 is within 2° of the selected bearing. Do this for every multiple of 30° around the OBS.

### 4.2.2 I/O CHANNEL 1

Select the I/O CHANNEL 1 Test Page. Change the selectable input and output to match that of the installed equipment. The available options are:

Input:	<u>Field</u>	<u>Description</u>
	off	No units connected to Channel 1 input
	icarus-alt	Serial altitude received from: Icarus, Model 3000, Mode C Serializer
	shadin-alt	Serial altitude received from: Shadin 9000T Serializer System (Non-TSO'd) Shadin 9200T Series Serializer System (Non-TSO'd) Shadin 8800T Series Encoder System (TSO'd)
	shadin-fuel	Fuel information received from: Shadin 91204XT Series Digital Fuel Management System (TSO'd) Shadin 91053XT Series Digital Fuel Management System (TSO'd)
	arnav/ei-fuel	Fuel information received from: Arnav, Model FC-10, Fuel Computer (TSO'd) Arnav, Model FT-10, Fuel Totalizer (TSO'd) Electronics International, Model FP-5L, Fuel Flow Computer (Non-TSO'd)
	shadin-fac	Fuel/Air data information received from: Shadin, Model 962801 Fuel/Airdata Computer (TSO'd)

Note: Verify with manufacturer of data input device that unit supports GARMIN interface.

Output:	<u>Field</u>	<u>Description</u>
	off	No units connected to Channel 1 input
	aviation	Serial position, velocity and navigation data to: Argus, Model 3000, Moving Map Argus, Model 5000, Moving Map Argus, Model 7000, Moving Map Stormscope, Series II with Navaid, Moving Map Shadin, 91204X[T] Digital Fuel Management System (TSO'd)

Shadin, 91053X[T] Digital Fuel Management System  
 Electronics International, Model FP-5L, Fuel Flow  
 Computer (Non-TSO'd)  
 Shadin, Model 962801 Fuel/Airdata Computer (TSO'd)  
 GARMIN, GPS 195  
 GARMIN, GPS III

#### 4.2.3 RS-422 CHANNEL

Select the RS-422 Channel Test Page. Change the selectable input and output to match that of the installed equipment. The available options are:

Input:	<u>Field</u>	<u>Description</u>
	off	No units connected to the RS-422 input
	Collins PL2 DSP	Collins Pro Line 2 Display Select Panel connected
Output:	<u>Field</u>	<u>Description</u>
	off	NO AVAILABLE SELECTIONS

#### 4.2.4 ARINC 429 CHANNEL

Select the ARINC 429 Channel Test Page. Change the selectable input and output to match that of the installed equipment. The available options are:

Input:	<u>Field</u>	<u>Description</u>
	off	No units connected to ARINC 429 input
	Selected Course	Any ARINC 429 compatible unit that transmits the "Selected Course" word (label 100)
	*Course/heading	Any ARINC 429 compatible unit that transmits the "Selected Course" word (label 100) and at least one heading label (true heading, label 314; magnetic heading, label 320)
	*Heading	Any ARINC 429 compatible unit that transmits at least one heading label (true heading, label 314; magnetic heading, label 320)
	* Software version 3.07 or later.	
Output:	<u>Field</u>	<u>Description</u>
	off	No units connected to ARINC 429 output
	Collins PL2 EFS	Collins Pro Line 2 EFIS connected (w/ GAMA)
	King EFS 40/50	King Radio EFIS 40 or 50 connected (w/ GAMA)
	w/o GAMA labels	Any unit that receives standard 429 output

Below is a list of labels output by the GPS 155:



## Navigation/position data

Label (octal)	Description
100	Selected course
114	Desired track
115	Bearing to waypoint
116	Cross track error
121	Horizontal command (to autopilot)
251	Distance to go
252	Time to go
310	Present position latitude
311	Present position longitude
312	Ground speed
313	Ground track
314	True heading
320	Magnetic heading
147*	Magnetic variation
261*	GPS navigation mode
275*	Navigation status
326*	Lateral scale factor
351*	Distance to destination
352*	Time to destination

## Flight plan data

Label (octal)	Description
074*	Flight plan header
075*	Active from/to waypoints
113*	Message checksum
300*	Station magnetic variation/type/class
303*	Message length/type/number
304*	Waypoint identifier characters 1-3
305*	Waypoint identifier characters 4-6
306*	Waypoint latitude
307*	Waypoint longitude

## Identification data

Label (octal)	Description
377	Equipment identifier
371*	General Aviation equipment identifier

\*These labels are formatted per the General Aviation Manufacturers Association (GAMA) definition. Note that the use of a 429 device w/o GAMA will cause the loss of the above asterisked labels. Some may be required for A1 certification. For example, label 326 changes the CDI scale for approach.

#### 4.2.5 CONFIGURATION

Select the Configuration Test Page. Change the selectable Strap and Fuel selections to match that of the installed equipment. The available options are:

Strap:	<u>Field</u>	<u>Description</u>
	Lnav 1	Number 1 (Pilot) long range NAV
	Lnav 2	Number 2 (Co-Pilot) long range NAV
	common	Common long range NAV
	NOTE: The Strap option affects the interpretation of RS-422 and ARINC 429 input data.	

For RS-422 input data the following applies:

Lnav 1	Only data marked for Lnav 1 is used
Lnav 2	Only data marked for Lnav 2 is used
common	Data marked for either Lnav 1 or Lnav 2 is used

For ARINC 429 input data the following applies

Lnav 1	Only data with SDI=0 or SDI=1 is used
Lnav 2	Only data with SDI=0 or SDI=2 is used
common	Only data with SDI=0 is used

NOTE: SDI=0 is an "all call".

Fuel:	av gas	Using Aviation gas (5.8 lbs/gal)
	jet A	Using Jet A/Jet A-1 fuel (6.7 lbs/gal)
	jet B	Using Jet B (JP-4) fuel (6.5 lbs/gal)

NOTE: The Fuel option is used to designate the type of fuel used so that the correct fuel density will be used in calculations.

#### 4.2.6 I/O CHANNEL 2

Note: This page is not found in the Test Pages of units with software version 3.07 or later, but is included here to aid installation. For more information see SET pages in the Pilot's Guide (GPN 190-00065-00).

Select the I/O CHANNEL 2 Set Page. Change the selectable input and output to match that of the installed equipment. The available options are:

Input:	<u>Field</u> off	<u>Description</u> NO AVAILABLE SELECTIONS
Output:	<u>Field</u> off plotting	<u>Description</u> No units connected to Channel 2 output Serial position, velocity, navigation and satellite data to: NEMA 0183 Version 2.0 compatible mapping device or GARMIN PC software.

NOTE: Below is a list of the NEMA 0183 sentences (with maximum number of characters) that the GNC 300 transmits.

- RMC -70 characters
- GGA -72 characters
- GSA -57 characters
- GSV -140 characters (70 characters x 2 sentences)
- RMB -70 characters
- BOD -35 characters
- WPL -38 characters
- \*PGRME -35 characters
- \*GARMIN proprietary accuracy error sentence that is not a part of the NMEA 0183 standard.

### 4.3 GROUND TEST

The GPS 155 ground test procedure incorporates a series of six (6) display pages to test CDI/flag, OBI, annunciator, external switches, altitude inputs, and power functions of the unit.

#### 4.3.1 CDI AND FLAG TEST

With power applied to the aviation rack and the GPS 155 unit off, depress and hold the ENT key and turn the unit on (release the ENT key when the display activates). Rotate the outer knob, and the CDI Test Page will be displayed. Using the controls on the GPS 155 front panel, make the selections indicated below and verify the interfaces as appropriate:

#### CDI

- |                  |   |
|------------------|---|
| Full scale left  | Ensure the CDI is deflected full scale left (5 dots)  |
| Full scale right | Ensure the CDI is deflected full scale right (5 dots) |
| Centered         | Ensure the CDI is centered                            |

#### TO/FROM/FLAG

- |      |                                    |
|------|------------------------------------|
| TO   | Ensure TO flag is visible          |
| FROM | Ensure FROM flag is visible        |
| FLAG | Ensure TO and FROM are NOT visible |

## CDI FLAG

IN VIEW

Ensure CDI flag is in view

OUT OF VIEW

Ensure CDI flag is out of view

## SUPERFLAG

IN VIEW

Ensure superflag in view

OUT OF VIEW

Ensure superflag out of view

### 4.3.2 OBI TEST

Select the OBI Test Page by removing the cursor from the CDI Test Page and turning the outer knob one detent to the right. Using the controls on the GPS 155 front panel, make the selections indicated below and verify the interfaces as appropriate:

#### OBI Data

VALID

Ensure that the OBI indicates the proper value

INVALID

Ensure the OBI is invalid

#### OBI Value

Ensure that the OBI displays the value entered when the VALID option is selected

NOTE: The 3 lines that make up the OBI interface may be toggled individually. This may be done from the "Value" field. Cycle this field to the desired line (either CLOCK, DATA or SYNC) and toggle the output to HIGH or LOW.

### 4.3.3 COMMUNICATIONS LOOPBACK TEST

This page displays the results of communication loop back tests. Four channels are tested: RS232 channels 1 and 2, RS422 and ARINC 429. Results of the test are either "OPEN" or "OK". Open means the channel's transmitter and receiver are not connected or the test failed. The tests are performed continuously while on this page except for RS232 channel 2. This channel is only tested at power on and the results displayed on this page. Therefore the unit must be turned off and the receiver/transmitter connected or disconnected and then turn the unit on to perform the test. To test the channels:

RS232 channel 1: Connect RS232 channel 1 receiver and transmitter

RS232 channel 2: Connect RS232 channel 2 receiver and transmitter

RS422: Connect RS232 channel 1 to RS422 LOW (pin 27) and ground RS422 HI (pin 11)

ARINC 429: Connect ARINC 429 receiver and transmitter

### 4.3.4 ANNUNCIATOR TEST

Select the Annunciator Test Page by removing the cursor from the OBI Test Page and turning the outer knob one detent to the right. Using the controls on the GPS 155 front panel, make the selections indicated below and verify the interfaces as appropriate:

MSG Annunciator	
OFF	Ensure the Message Annunciator is OFF
ON	Ensure the Message Annunciator is ON
Arrival Annunciator	
OFF	Ensure the Arrival Annunciator is OFF
ON	Ensure the Arrival Annunciator is ON
Approach Annunciator	
OFF	Ensure the Approach Annunciator is OFF
ON	Ensure the Approach Annunciator is ON

#### 4.3.5 EXTERNAL SWITCH TEST

Select the External Switch Test Page. Verify that the GPS approach switch and the GPS WPT switch toggles.

#### 4.3.6 ALTITUDE INPUT TEST

Select the Greyscale Altitude Test Page. Verify that the altitude input is reading the correct altitude. NOTE: This does not display serial altitude.

#### 4.3.7 POWER TEST

Select the Power Test Page by turning the outer knob on 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 - Trickle Chrg", "Ext Pwr - Rapid Charge", "Ext Pwr - Maint Charge", "Ext Pwr - No Charge".

Turn the GPS 155 off in preparation for a signal acquisition test.

#### 4.3.8 SIGNAL ACQUISITION TEST

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 or fuel management system is receiving data from the GPS 155 and is functioning properly (see Chapter 5 of the GPS 155 Pilot's Guide for more information on the Direct function).

#### 4.3.9 VHF COMM INTERFERENCE CHECK

- a) Go to the Satellite Status Page, verify that 7 to 8 satellites have been acquired
- b) See that the “NAV” flag is out of view
- c) Select 121.15 MHZ on COMM1
- d) Transmit for a period of 20 seconds
- e) Verify that the flag does not come into view
- f) Repeat steps d) and e) for the following frequencies:  
121.175, 121.20, 131.250, 131.275 and 131.300
- g) Repeat steps c-f for all COMMs installed in the aircraft
- h) If the “NAV” flag comes into view, the comm transmitter used may require additional RF shielding to control the excessive radiation. Refer to Section 2.1.4 for such modifications.

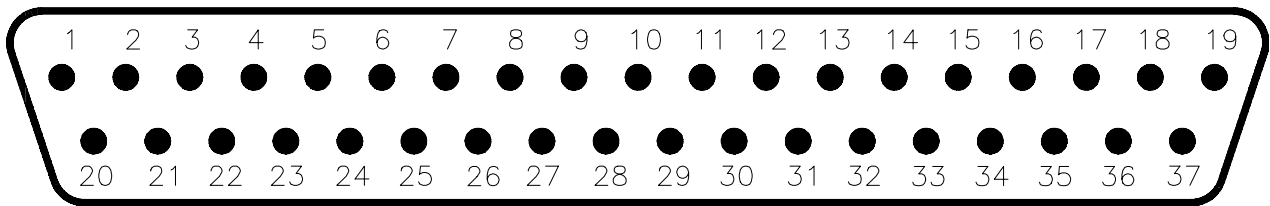
### **SECTION 5 CERTIFICATION**

The GPS 155 has been certified for IFR enroute, terminal and non-precision approaches by GARMIN in a Mooney M20J. See Appendix D for a copy of the STC.

All installations must be certified. For more information, see FAA Advisory Circular “Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for use as a VFR and IFR Supplemental Navigation System”, Appendix 1. All new certifications after GARMIN's Mooney installation will be “Follow-On”.

### **SECTION 6 CONTINUED AIRWORTHINESS**

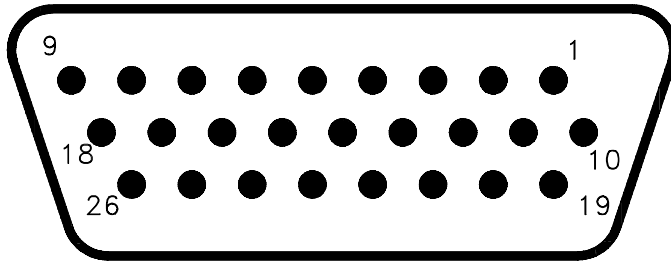
Maintenance of the GPS 155 is on condition only. Periodic maintenance of the GPS 155 is not required.



VIEW OF J101 CONNECTOR  
FROM BACK OF RACK

J101 PIN NO.		
1	-----	GPS D-BAR LEFT +
2	-----	GPS TO +
3	-----	GPS FLAG +
4	-----	GPS FLAG -
5	-----	GPS D-BAR RIGHT +
6	-----	GPS FROM +
7	-----	GPS OBI CLOCK
8	-----	GPS OBI DATA
9	-----	GPS APPROACH ARM LOW
10	-----	GPS SUPER FLAG HIGH
11	-----	RS422 IN HI
12	-----	GPS ARRIVAL ALARM LOW
13	-----	GPS APPROACH ACTV LOW
14	-----	GPS ROTOR C
15	-----	ARINC 429 OUT B
16	-----	ARINC 429 OUT A
17	-----	RS232 IN 1
18	-----	RS232 IN 2
19	-----	RS232 OUT 2
20	-----	GPS MESSAGE ACTV LOW
21	-----	RESERVED
22	-----	RESERVED
23	-----	GPS OBI SYNC
24	-----	RS232 OUT 1
25	-----	AIRCRAFT POWER 10-33 VDC
26	-----	GROUND
27	-----	RS422 IN LO
28	-----	RESERVED
29	-----	RESERVED
30	-----	RESERVED
31	-----	RESERVED
32	-----	ARINC 429 IN A
33	-----	ARINC 429 IN B
34	-----	RESERVED
35	-----	GPS STATOR D
36	-----	RESERVED
37	-----	GPS STATOR F

**FIGURE 1-1 PINOUT DEFINITION, 37 PIN DSUB**



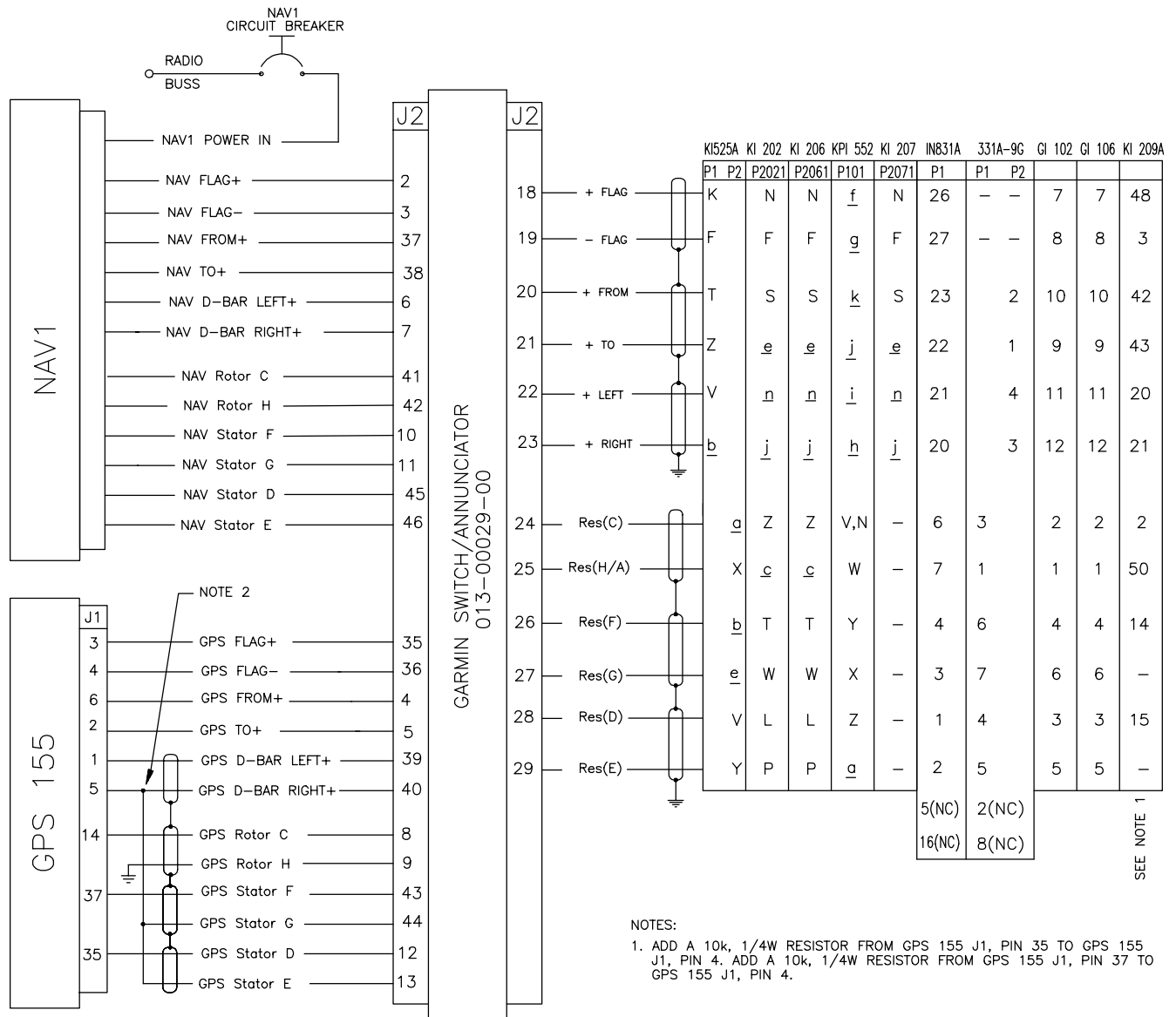
VIEW OF J102 CONNECTOR  
FROM BACK OF RACK

J102  
PIN NO.

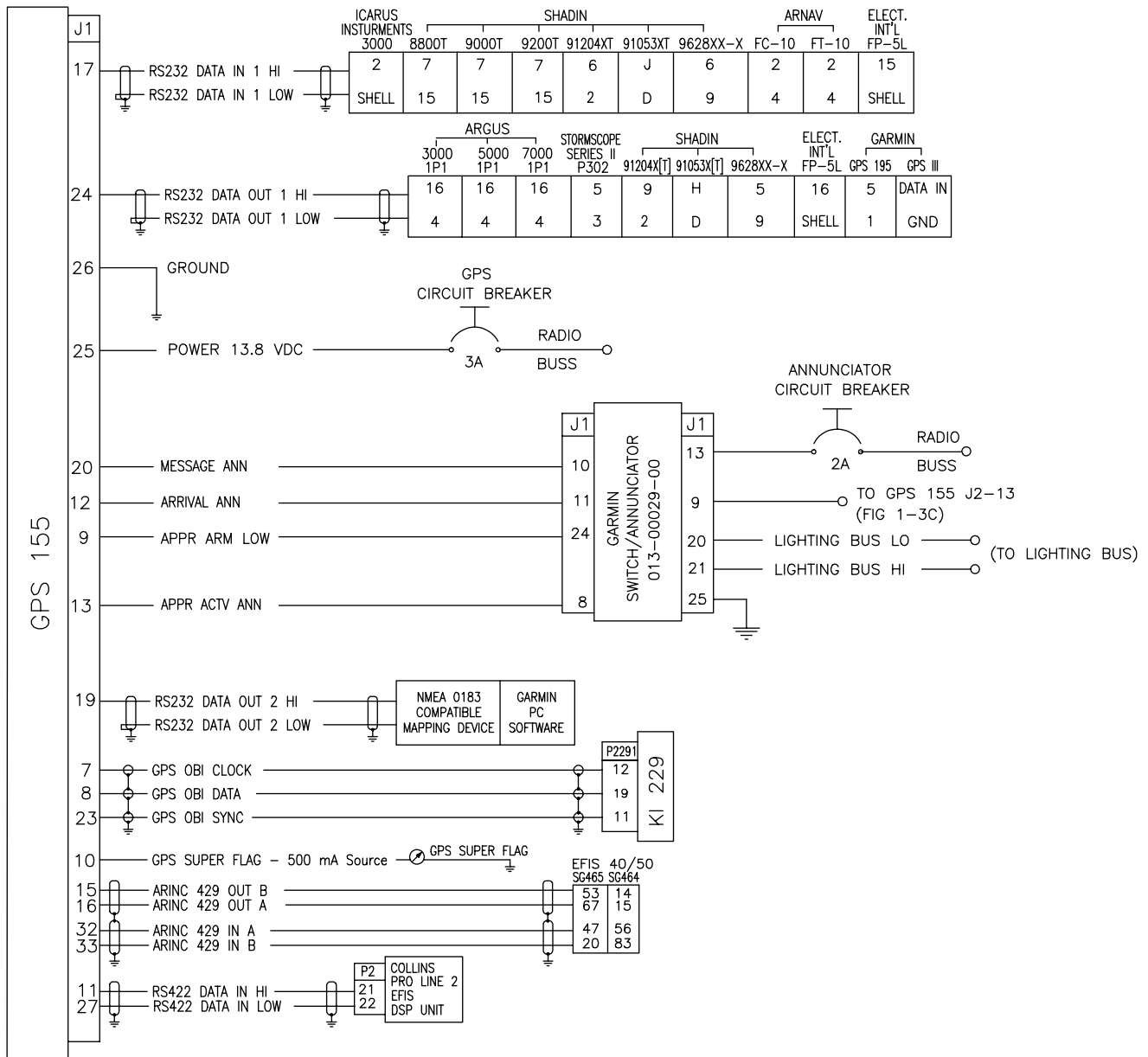
1	-----	RESERVED
2	-----	RESERVED
3	-----	RESERVED
4	-----	RESERVED
5	-----	RESERVED
6	-----	RESERVED
7	-----	RESERVED
8	-----	RESERVED
9	-----	RESERVED
10	-----	RESERVED
11	-----	RESERVED
12	-----	RESERVED
13	-----	GPS SEQUENCE HOLD LOW
14	-----	ALTITUDE D4
15	-----	ALTITUDE A1
16	-----	ALTITUDE A2
17	-----	ALTITUDE A4
18	-----	ALTITUDE B1
19	-----	ALTITUDE B2
20	-----	ALTITUDE B4
21	-----	ALTITUDE C1
22	-----	ALTITUDE C2
23	-----	ALTITUDE C4
24	-----	ALTITUDE COMMON
25	-----	RESERVED (A/C GROUND)
26	-----	RESERVED (SPARE INPUT)

**FIGURE 1-2 PINOUT DEFINITION, 26 PIN HD-DSUB**

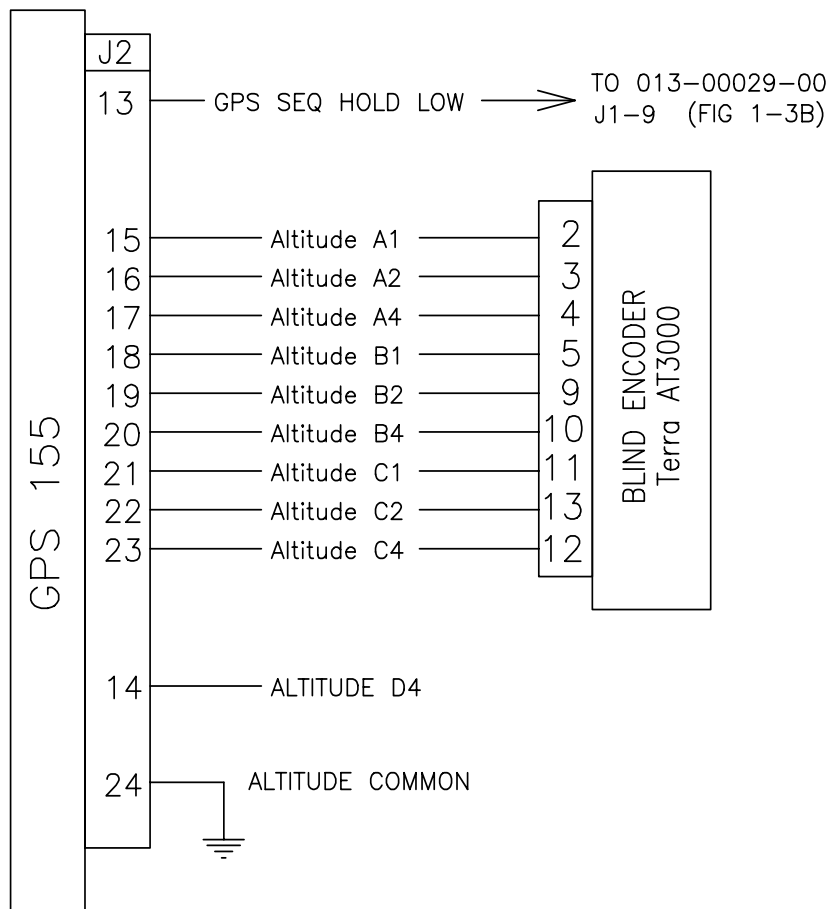




**FIGURE 1-3A INTERCONNECT SCHEMATIC**



**FIGURE 1-3B INTERCONNECT SCHEMATIC**



NOTES:

1. A 1.575 GHZ NOTCH FILTER (GARMIN P/N 330-00067-00) SHOULD BE INSTALLED IN THE COMM1 & COMM2 ANTENNA COAX AS CLOSE TO THE COMM TRANSMITTER AS POSSIBLE.
2. TO AID SPLICING, THE GPS 155 WITH RACK, AND THE CONNECTOR KIT 011-00313-00 INCLUDE SOLDERLESS CONNECTORS WHICH MAY BE USED AS FOLLOWS.

GPN	SIZE	CONDUCTOR RANGE	CRIMP TOOL
330-00165-00	SMALL	#24 AWG: 3 (MIN) TO 8 (MAX)	JST P/N YS2216 OR EQUIVALENT
330-00165-01	LARGE*	#18 AWG: 2 (MIN) TO 4 (MAX)	JST P/N YS1614 OR EQUIVALENT

\* LARGE SOLDERLESS CONNECTOR SUPPLIED WITH CONNECTOR KIT ONLY & NOT REQUIRED FOR GPS 155 INSTALLATION.

3. EQUIVALENT PARTS MAY BE USED.
4. ALL WIRING SHALL BE 24 AWG UNLESS OTHERWISE NOTED.

**FIGURE 1-3C INTERCONNECT SCHEMATIC**

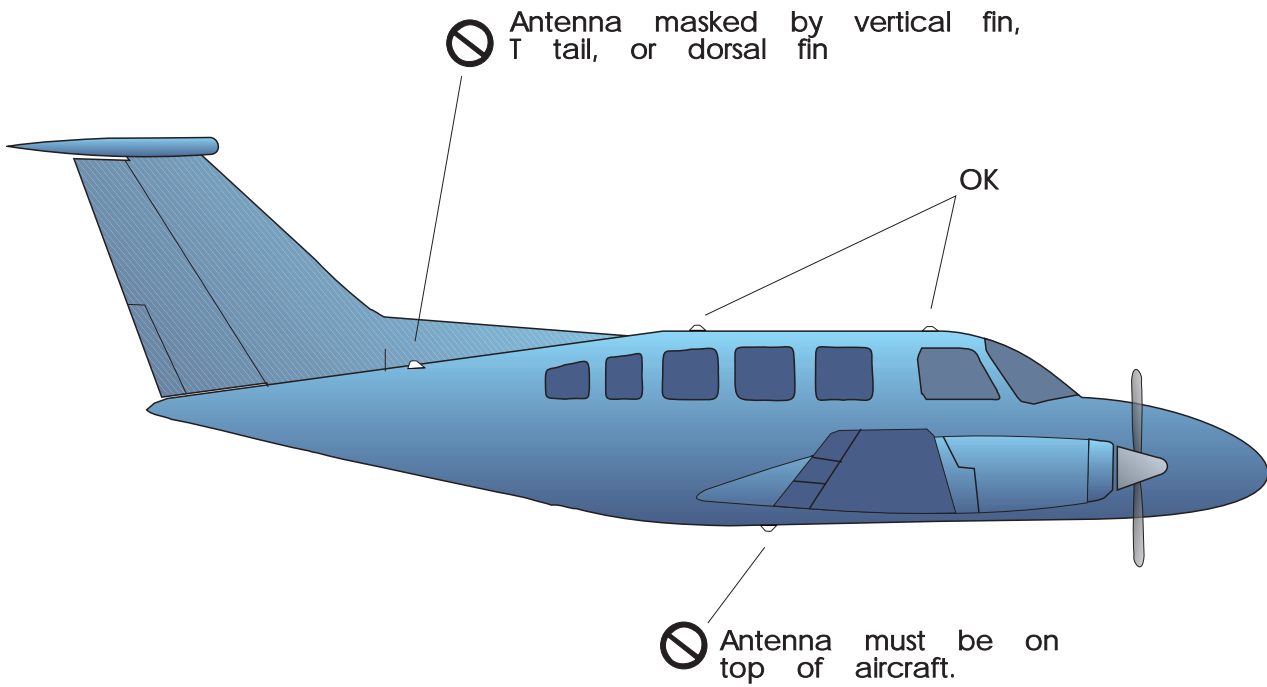


FIG 2-1  
ANTENNA INSTALLATION CONSIDERATIONS

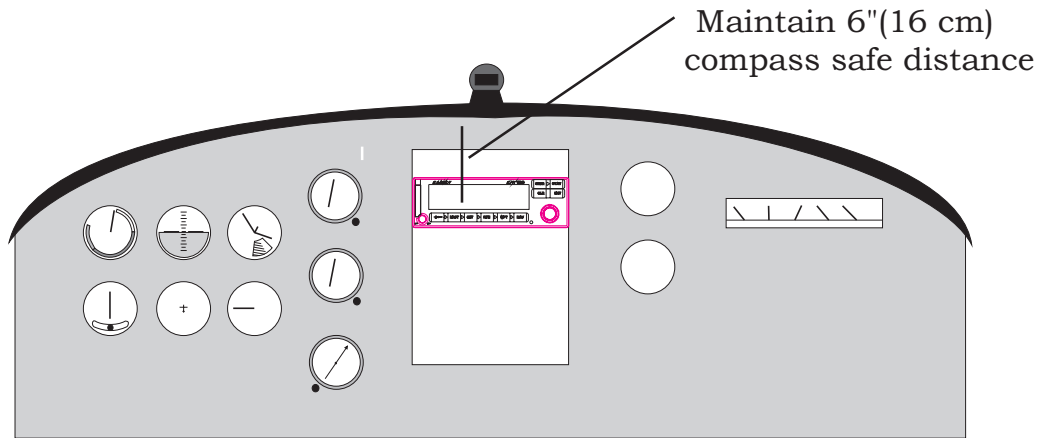
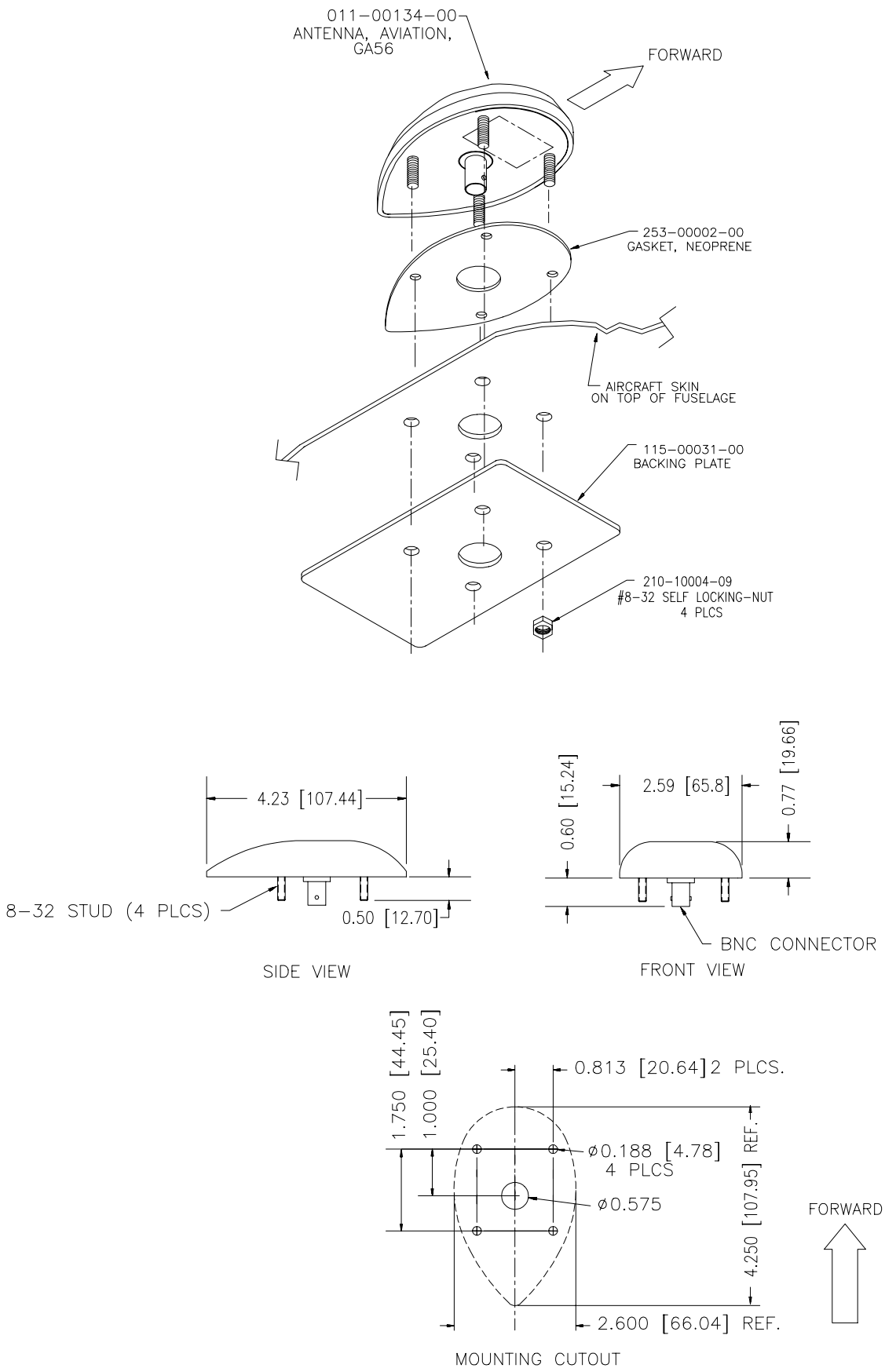
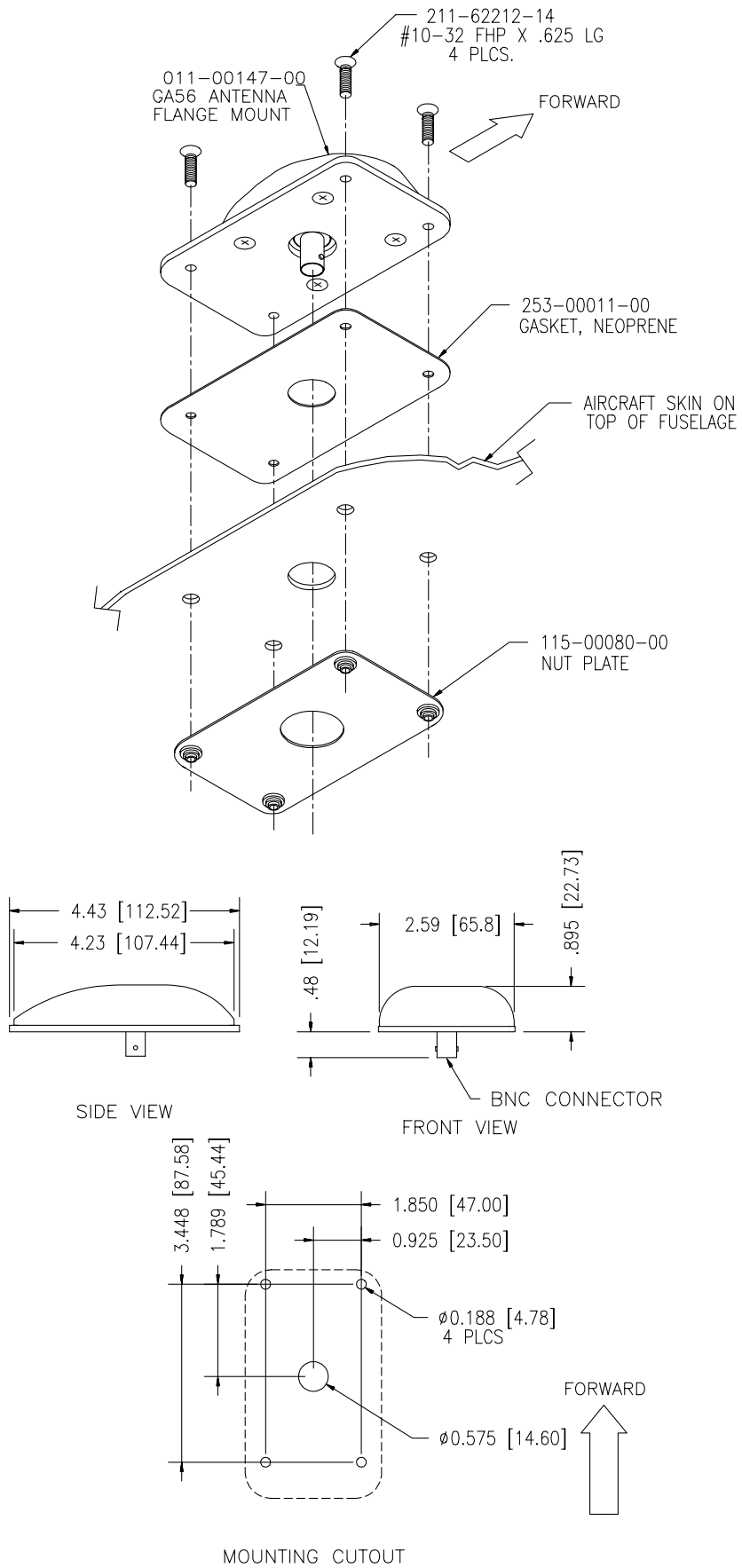


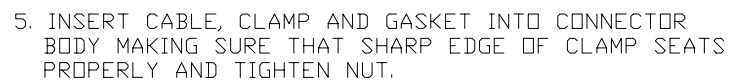
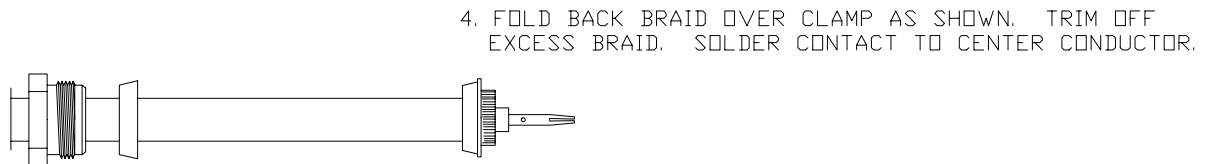
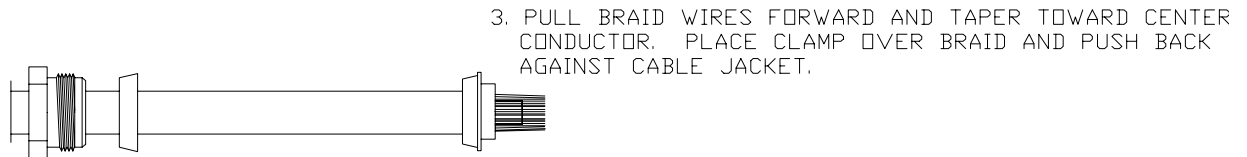
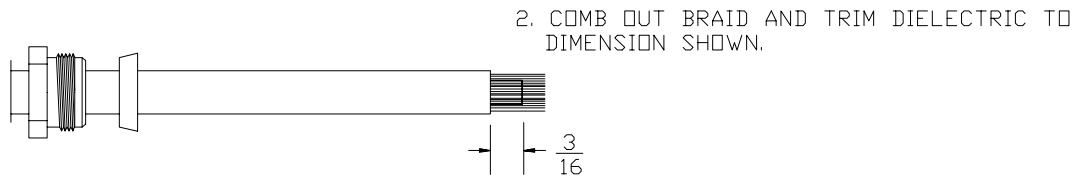
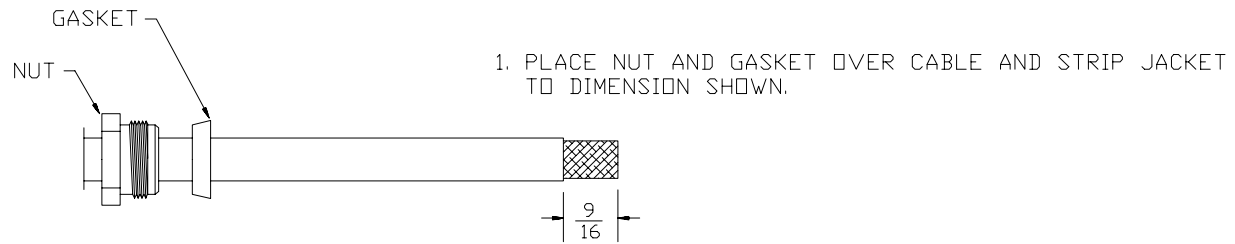
FIG 2-2  
GPS INSTALLATION CONSIDERATIONS



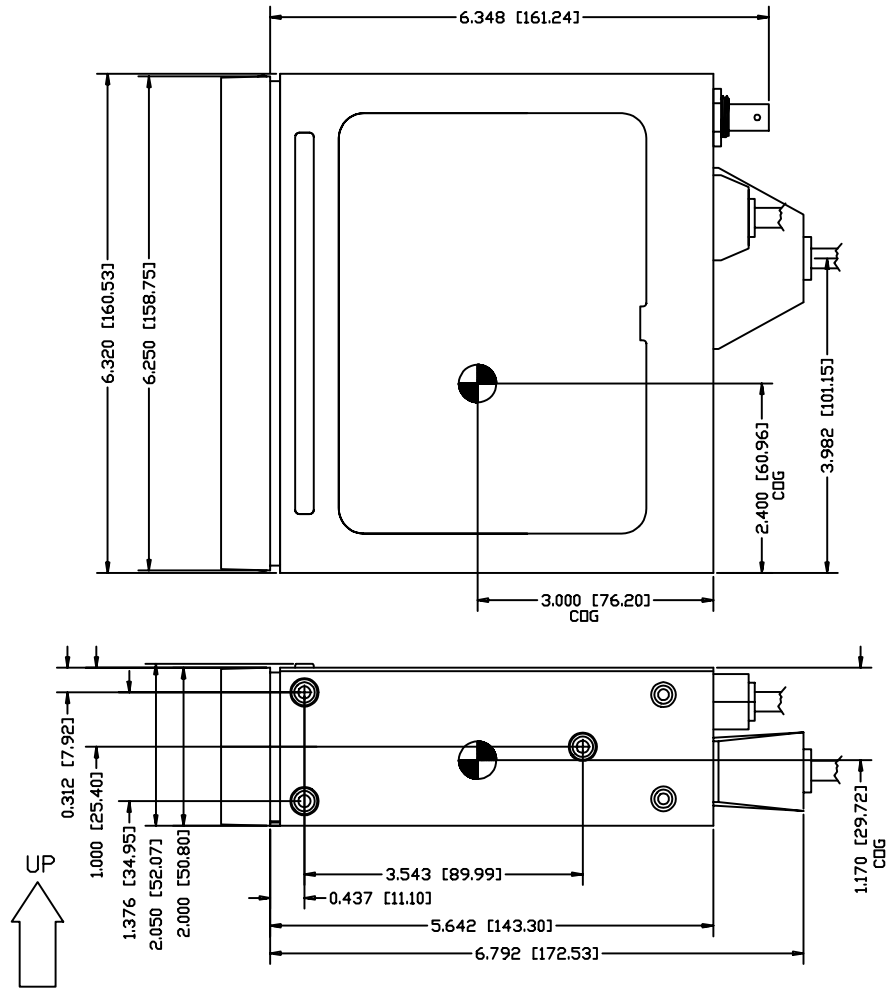
**FIGURE 3-1 GA 56 ANTENNA INSTALLATION**



**FIGURE 3-2 FLANGE MOUNT GA 56 ANTENNA INSTALLATION**

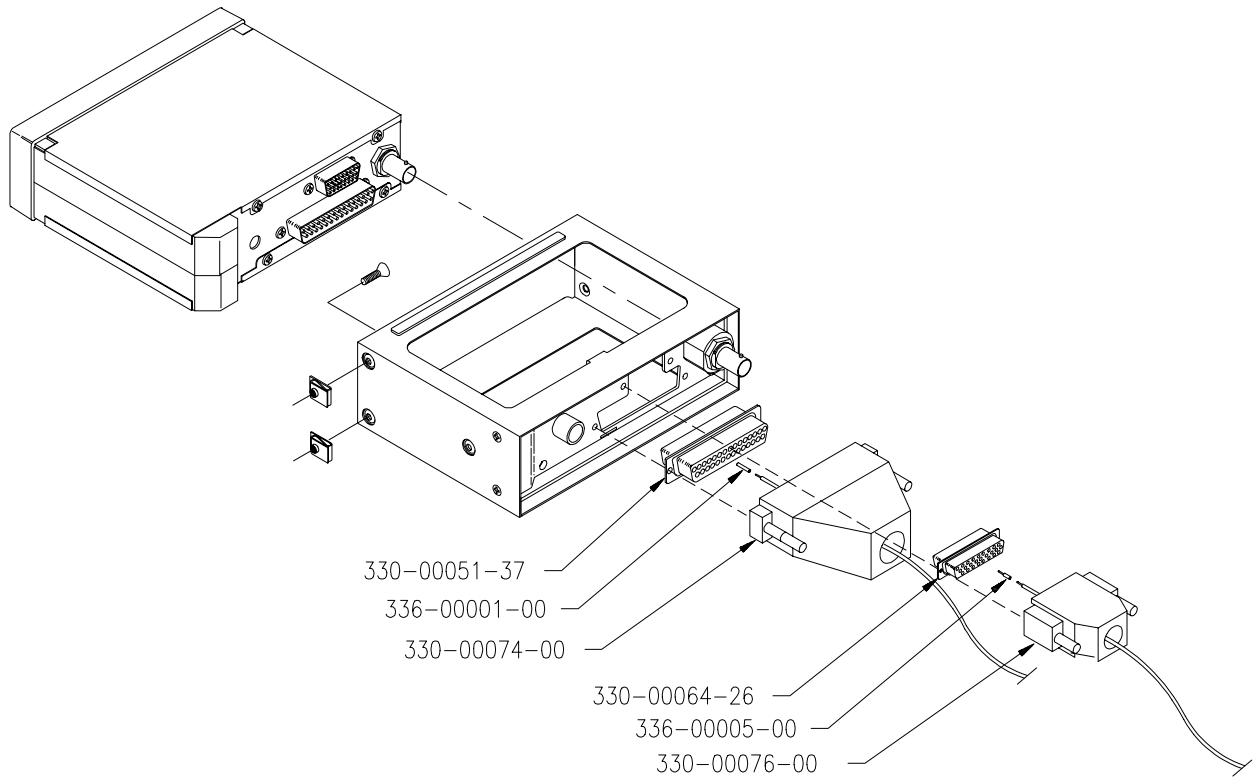


**FIGURE 3-3 COAX CABLE INSTALLATION**

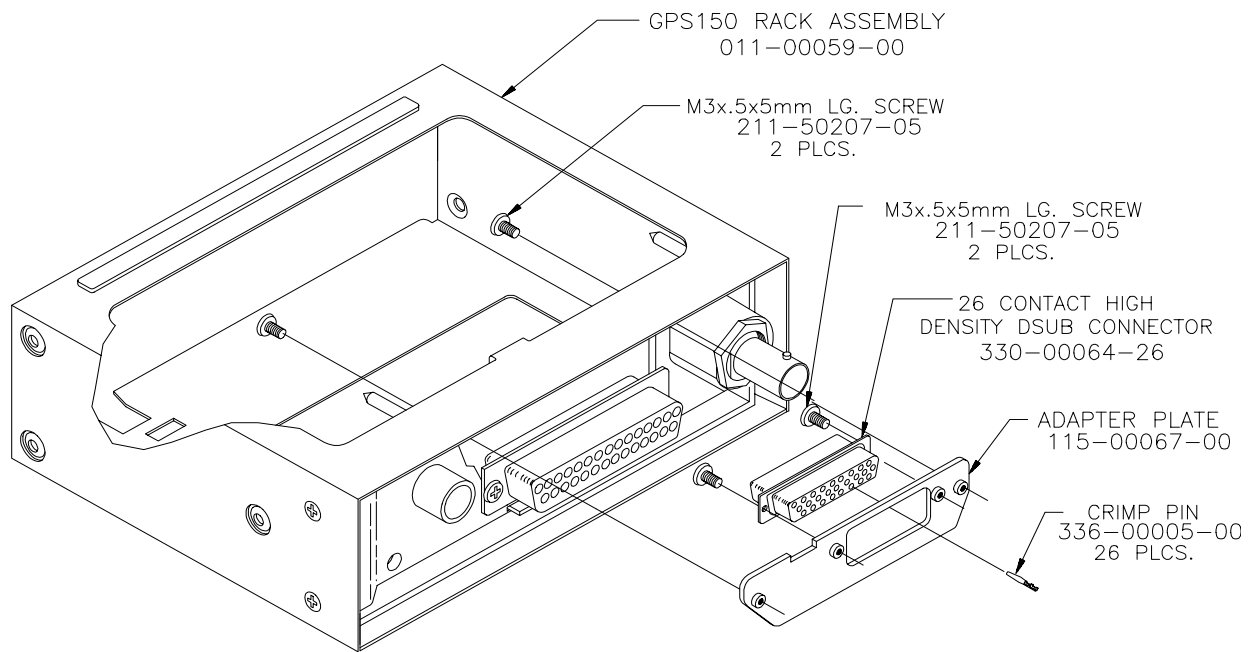


**FIGURE 3-4 AVIATION RACK DIMENSIONS**





**FIGURE 3-5 AVIATION RACK INSTALLATION**



**FIGURE 3-6 GPS 150 TO GPS 155 UPGRADE**

## APPENDIX A CERTIFICATION DOCUMENTS

### ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: GPS 155, GPS AIRBORNE RNAV SYSTEM

TYPE/MODEL/PART NO.: 011-00104-00

TSO NUMBER: C129  
CLASS A(1)

MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION: 004-00011-00

MANUFACTURER: GARMIN INTERNATIONAL, INC.

ADDRESS: 1200 E. 151st STREET, OLATHE, KANSAS 66062

Conditions 1/	Section	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to Categories A1 & D1 except as noted
Low Temperature	4.5.1	
High Temperature	4.5.2. & 4.5.3	
In-Flight Loss of Cooling	4.5.4	Cooling air not required
Altitude	4.6.1	
Decompression	4.6.2	
Overpressure	4.6.3	
Temperature Variation	5.0	Equipment tested to Category C
Humidity	6.0	Equipment tested to Category A
Shock	7.0	Equipment tested per DO-160C, Par. 7.2.1
Operational	7.2	
Crash Safety	7.3	
Vibration	8.0	Equipment tested without shock mounts to Categories B, M and N (Table 8-1)
Explosion	9.0	Equipment identified as Category X, no test required
Waterproofness	10.0	Equipment identified as Category X, no test required
Fluids Susceptibility	11.0	Equipment identified as Category X, no test required

Conditions 1/	Section	Description of Conducted Tests
Sand and Dust	12.0	Equipment identified as Category X, no test required
Fungus	13.0	Equipment identified as Category X, no test required
Salt Spray	14.0	Equipment identified as Category X, no test required
Magnetic Effect	15.0	Equipment tested is Class Z
Power Input	16.0	Equipment tested to Category B
Voltage Spike	17.0	Equipment tested to Category A
Audio Frequency Susceptibility	18.0	Equipment tested to Category B
Induced Signal Susceptibility	19.0	Equipment tested to Category A
Radio Frequency Susceptibility	20.0	Equipment tested to Category T
Radio Frequency Emission	21.0	Equipment tested to Category Z
Lightning Induce Transient Susceptibility	22.0	Equipment identified as Category X, no test required
Lightning Direct Effects	23.0	Equipment identified as Category X, no test required
Icing	24.0	Equipment identified as Category X, no test required
Other Tests		
Remarks: Software: DO-178B, Level C (Major)		

1/ The information listed below provides examples only. It is not intended to be a comprehensive listing of all test conditions.

# ENVIRONMENTAL QUALIFICATION FORM

NOMENCLATURE: GA 56, GPS AVIATION ANTENNA

TYPE/MODEL/PART NO.: 011-00134-00/01/02

TSO NUMBER: C129  
CLASS A(1)

MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION: 004-00015-00

MANUFACTURER: GARMIN INTERNATIONAL, INC.

ADDRESS: 1200 E. 151st STREET, OLATHE, KANSAS 66062

Conditions 1/	Section	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to Category F2
Low Temperature	4.5.1	
High Temperature	4.5.2. & 4.5.3	
In-Flight Loss of Cooling	4.5.4	Cooling air not required
Altitude	4.6.1	
Decompression	4.6.2	Not tested
Overpressure	4.6.3	Not tested
Temperature Variation	5.0	Equipment tested to Category A
Humidity	6.0	Equipment tested to Category C
Shock	7.0	Equipment tested per DO-160C, Par. 7.2.1
Operational	7.2	
Crash Safety	7.3	Not applicable
Vibration	8.0	Equipment tested without shock mounts to Categories C, L, M and Y (Table 8-1)
Explosion	9.0	Equipment identified as Category X, no test required
Waterproofness	10.0	Equipment tested to Category S
Fluids Susceptibility	11.0	Equipment tested to Category F with Ethylene Glycol De-Icing Fluid

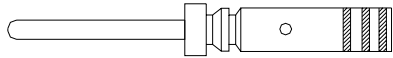
Conditions 1/	Section	Description of Conducted Tests
Sand and Dust	12.0	Equipment identified as Category X, no test required
Fungus	13.0	Equipment identified as Category X, no test required
Salt Spray	14.0	Equipment identified as Category X, no test required
Magnetic Effect	15.0	Equipment identified as Category X, no test required
Power Input	16.0	Equipment identified as Category X, no test required
Voltage Spike	17.0	Equipment identified as Category X, no test required
Audio Frequency Susceptibility	18.0	Equipment identified as Category X, no test required
Induced Signal Susceptibility	19.0	Equipment identified as Category X, no test required
Radio Frequency Susceptibility	20.0	Equipment identified as Category X, no test required
Radio Frequency Emission	21.0	Equipment identified as Category X, no test required
Lightning Induce Transient Susceptibility	22.0	Equipment identified as Category X, no test required
Lightning Direct Effects	23.0	Equipment identified as Category X, no test required
Icing	24.0	Equipment tested to Category C
Other Tests		
Remarks:		

1/ The information listed below provides examples only. It is not intended to be a comprehensive listing of all test conditions.

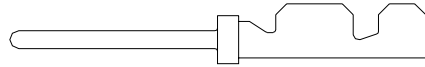
## APPENDIX B CONNECTOR CHANGES

### 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

Some contacts are pins as shown, while others are the socket type. The type used will vary with the installation. When working with the stamped crimp type contacts, the following tools should be used:

Tools	37 position connectors		26 position connector	
	Crimp Tool	Extraction Tool	Crimp Tool	Extraction Tool
Amp	58448-2	91067-22	90430-1	91285-1
ITT Cannon	995-2000-000	980-0008-124	995-2000-022	980-00004-804
Cinch	HTD-544	CIET-20-HDB	HTD-544	HTD-520

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

# APPENDIX C REFERENCE DISCRETE SWITCH/ANNUNCIATOR INSTALLATION

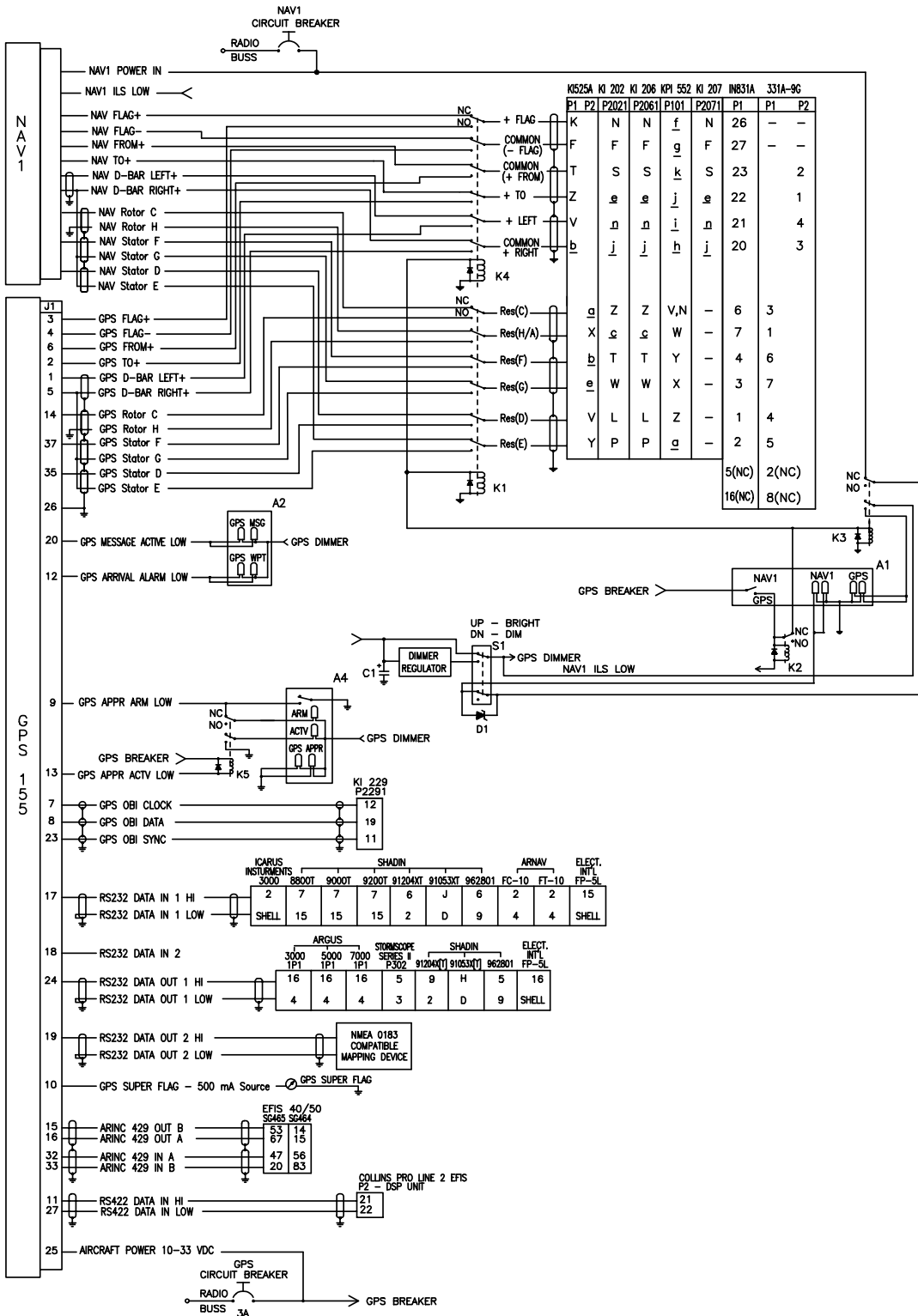
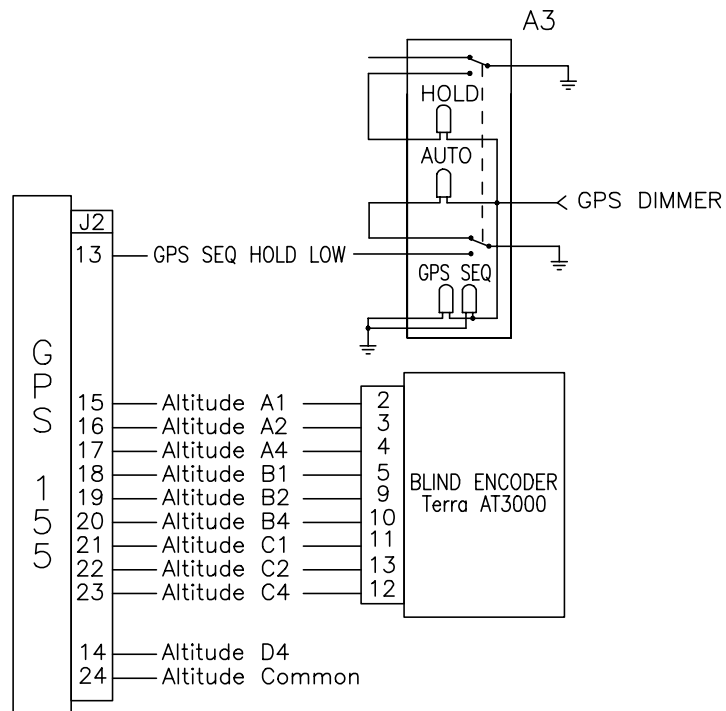


FIGURE C-1 INTERCONNECT SCHEMATIC





Notes:

- 1) Equivalent parts may be used.
- 2) A 1.575 GHz Notch Filter (GARMIN p/n 330-00067-00) should be installed in the Comm 1 and 2 antenna coax as close to the Comm transmitter as possible.
- 3) All wiring shall be 24 AWG unless otherwise noted.
- 4) Miscellaneous Parts:
  - A1, A2, A3, A4 – DISCRETE SWITCH ANNUNCIATOR UNITS WITH NOMENCLATURE & COLORS PER FIGURE C-3.
  - C1 – 1uF @ 50v capacitor
  - D1 – Zener diode
  - K1, K4 – 6PDT relay
  - K2, K3, K5 – 2PDT relay
  - S1 – DPDT switch
- 5) (NC) = No connection
- 6) To aid splicing, connector kit 011-00313-00 includes solderless connectors which may be used as follows.

GPN	Size	Conductor Range	Crimp Tool
330-00165-00	Small	#24 AWG: 3(min) to 8(max)	JST p/n YS2216 or equivalent
330-00165-01	Large	#18 AWG: 2(min) to 4(max)	JST p/n YS1614 or equivalent

FIGURE C-2 INTERCONNECT SCHEMATIC

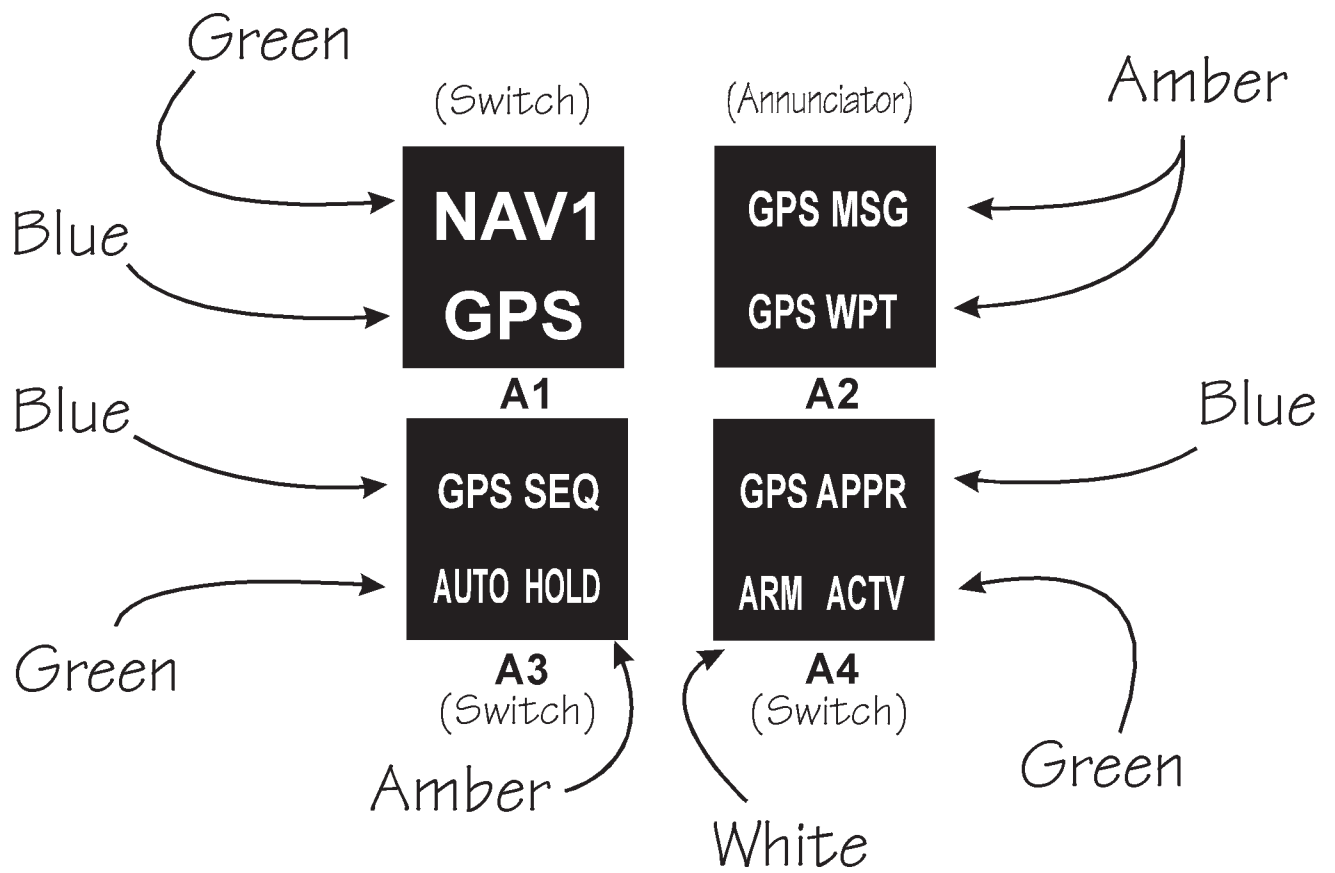


FIGURE C-3 SWITCH/ANNUNCIATOR LAYOUT

## **APPENDIX D STC PERMISSION**

Consistent with N8110.69 or Order 8110.4, Aviation Authority approved installers are hereby granted permission to use STC# SA00133WI data to modify aircraft.

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

*Number* SA00133WI

*This certificate is issued to* GARMIN International  
9875 Widner Road  
Lenexa, KS 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:* 2A3  
*Make:* Mooney  
*Model:* M20J

*Description of Type Design Change:* Installation of GARMIN Global Positioning System GPS 155 in accordance with (1) GARMIN Master Drawing List, GPS 155 Installation in Mooney Model M20J, Rev F, dated February 7, 1994, and (2) FAA Approved Airplane Flight Manual Supplement (AFMS) for Mooney M20J with GARMIN GPS 155 Global Positioning System, dated February 14, 1994, or later FAA approved revisions to (1) or (2).

*Limitations and Conditions:* This approval should not be extended to other specific airplanes of these models 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 surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.*

*Date of application:* July 16, 1993

*Date issued:*

*Date of issuance:* February 16, 1994

*Date amended:*



*Signature of the Administrator*

*James M. Peterson*  
(Signature)

James M. Peterson  
Manager, Systems & Equipment  
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 21.47.*

FAA Form 8130-2 (10-88)