GARMIN

G900X

Installation Manual

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Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
Aviation Dealer Technical Support Line (Toll Free): (888) 606-5482
www.garmin.com

Garmin (Europe) Ltd.
Unit 5, The Quadrangle
Abbey Park Industrial Estate
Romsey, SO51 9DL U.K.
Telephone: 44/0870.851241

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TABLE OF CONTENTS

1 G900X Installation Overview

1.1 Introduction

This manual provides an overview of the G900X Integrated Flight Deck and its mechanical and electrical installation aspects. The system design is flexible and can accommodate different aircraft applications.

The following outline describes the organization of this manual:

Section 1:	This section contains a basic overview of the G900X system and interface. Block diagrams are given to aid in the understanding of the system.
Section 2:	This section describes the mechanical, electrical, and installation aspects of the GDU 1040.
Section 3:	This section describes the mechanical, electrical, and installation aspects of the GMA 1347.
Section 4:	This section describes the mechanical, electrical, and installation aspects of the GIA 63W.
Section 5:	This section describes the mechanical, electrical, and installation aspects of the GEA 71.
Section 6:	This section describes the mechanical, electrical, and installation aspects of the GDC 74A.
Section 7:	This section describes the mechanical, electrical, and installation aspects of the GRS 77/GMU 44.
Section 8:	This section describes the mechanical, electrical, and installation aspects of the GTX 33.
Section 9:	This section describes the mechanical, electrical, and installation aspects of the GCU 476.
Section 10:	This section describes the mechanical, electrical, and installation aspects of the GDL 69A.
Section 11:	This section describes the mechanical, electrical, and installation aspects of the Garmin GPS WAAS antennas.
Section 12:	This section describes the non-LRU specific installation aspects of the G900X.
Section 13:	This section contains general guidance for 3rd party LRU and discrete interfaces.
Section 14:	This section contains software/configuration loading and calibration procedures.
Appendix A:	This section contains pinout information for all G900X LRUs.
Appendix B:	This section contains airframe specific installation instructions for the G900X.
Appendix C:	This section contains outline and installation drawings for the G900X.
Appendix D:	This section contains G900X interconnects.

1.2 System Overview

The G900X is an advanced technology avionics suite designed to integrate pilot/aircraft interaction into one central system. The system combines primary flight instrumentation, aircraft systems instrumentation, and navigational information, all displayed on two large color screens. The G900X system is composed of several sub-units or Line Replaceable Units (LRUs). LRUs have a modular design and can be installed directly behind the instrument panel or in a separate avionics bay if desired. This design greatly eases troubleshooting and maintenance of the G900X system. A failure or problem can be isolated to a particular LRU, which can be replaced quickly and easily. Each LRU has a particular function, or set of functions, that contributes to the system's operation. For additional information on LRU functions, see the applicable section of this manual.

1.2.1 System Architecture

The following diagram illustrates the redundant communication paths that are in place in a typical G900X installation. Refer to Appendix D for actual interconnects.

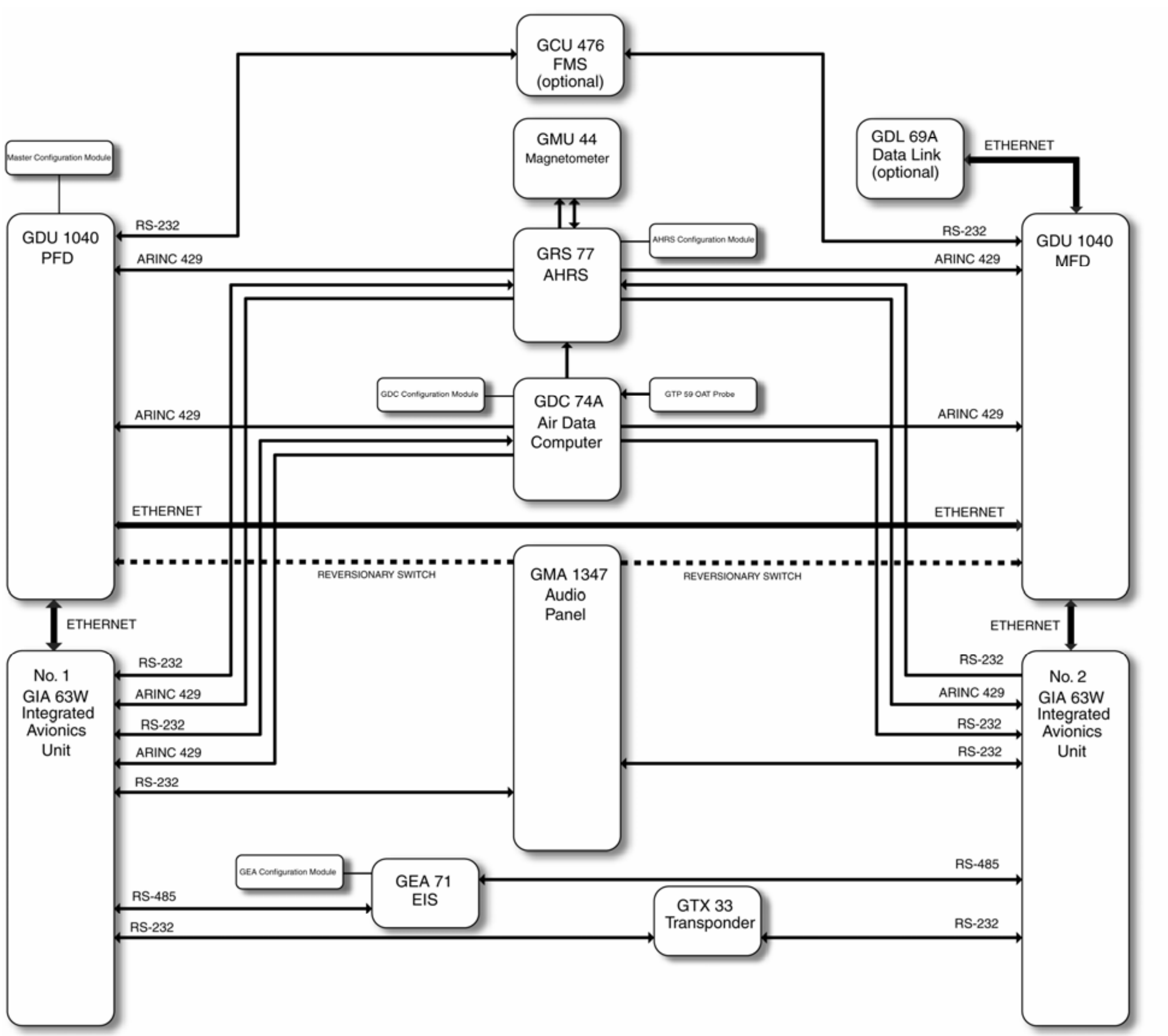


Figure 1-1. G900X Interconnect Summary

1.3 General G900X LRU Specifications

1.3.1 Garmin LRU Part Numbers

Table 1-1. G900X LRU Part Numbers

LRU	Assembly Part Number	Unit Only Part Number
GDU 1040	011-00972-03	010-00337-03
GIA 63W	011-01105-00	010-00386-00
GEA 71	011-00831-00	010-00283-00
GDC 74A	011-00882-10	010-00336-10
GTP 59	011-00978-00	011-00978-00
GRS 77	011-00868-10	010-00295-10
GMU 44	011-00870-00	010-00296-00
GMA 1347	011-00809-00	010-00276-00
GTX 33	011-00779-10	010-00267-10
GCU 476	011-01237-00	010-00457-00
GDL 69A	011-00987-00	010-00339-00
GA 35	013-00235-00	013-00235-00
GA 56A	011-01154-00	010-10599-00
GA 56W	011-01111-00	010-10561-01
GA 57	011-01032-00	010-10604-00

1.3.2 Power Specifications

With the exception of J605 of the GIA 63W, all LRUs are capable of operating at either 14 or 28 VDC. See the individual LRU specific Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1.2 for current draw specifications.

Table 1-2. G900X LRU Current Specifications

LRU	Maximum14 Volt Current Draw	Maximum 28 Volt Current Draw
GDU 1040	3.36 A	2.50 A
GMA 1347	3.75 A	1.75 A
GEA 71	1.00 A	0.50 A
GDC 74A	410 mA	200 mA
GRS 77/ GMU 44	600 mA	300 mA
GTX 33	3.10 A	1.60 A
GCU 476	277 mA	140 mA
GDL 69A	650 mA	350 mA
GIA 63W (J601)	N/A	0.3 A (not transmitting) 4.3 A (transmitting)
GIA 63W (J605)	2.0 A	1.0 A

1.3.3 Physical Specifications

All width, height, and depth measurements are taken with unit rack (if applicable) and connectors.

Table 1-3. G900X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Unit Weight w/Rack & Connector Weight
GIA 63W	3.83 inches (9.73 cm)	7.26 inches (18.44 cm)	10.00 inches (25.39 cm)	5.3 lbs. (2.40 kg)	7.2 lbs. (3.26 kg)
GEA 71	1.23 inches (3.12 cm)	7.26 inches (18.44 cm)	9.07 inches (23.04 cm)	1.75 lbs. (0.721 kg)	2.53 lbs. (1.011 kg)
GTX 33	1.72 inches (4.37 cm)	7.26 inches (18.44 cm)	11.05 inches (28.07 cm)	3.10 lbs. (1.41 kg)	3.86 lbs. (1.75 kg)
GDL 69A	1.23 inches (3.12 cm)	7.26 inches (18.44 cm)	9.07 inches (23.04 cm)	1.86 lbs. (0.84kg)	2.83 lbs. (1.27kg)
GDU 1040	11.80 inches (29.97 cm)	7.70 inches (19.59 cm)	3.77 inches (9.58 cm)	6.29 lbs. (2.85 kg)	6.53 lbs. (2.96 kg)
GMA 1347	1.35 inches (3.43 cm)	7.70 inches (19.56 cm)	7.79 inches (19.79 cm)	1.70 lbs. (0.77 kg)	2.40 lbs. (1.09 kg)
GCU 476	3.66 inches (9.30 cm)	5.43 inches (13.76 cm)	2.31 inches (5.88 cm)	0.72 lbs. (0.33 kg)	0.94 lbs. (0.43 kg)
GDC 74A	3.10 inches (7.87 cm)	3.23 inches (8.20 cm)	9.64 inches (24.49 cm)	1.58 lbs. (0.72 kg)	2.30 lbs. (1.04 kg)
GRS 77	3.62 inches (9.19 cm)	3.32 inches (8.43 cm)	9.84 inches (24.99 cm)	2.80 lbs. (1.27 kg)	3.46 lbs. (1.57 kg)
GMU 44	N/A	2.10 inches (5.33 cm)	N/A	0.35 lbs. (0.16 kg)	0.48 lbs. (0.22 kg)

1.3.4 Environmental Specifications

Refer to the applicable environmental qualification form (Table 1-4) for a complete list of environmental characteristics.

Table 1-4. G900X LRU Environmental Qualification Forms

Document	Garmin Part Number
GDU 1040 Environmental Qualification Form	005-00150-02
GMA 1347 Environmental Qualification Form	005-00155-79
GEA 71 Environmental Qualification Form	005-00147-02
GDC 74A Environmental Qualification Form	005-00191-77
GRS 77 Environmental Qualification Form	005-00165-31
GMU 44 Environmental Qualification Form	005-00164-31
GTX 33 Environmental Qualification Form	005-00131-03
GCU 476 Environmental Qualification Form	005-00299-01
GDL 69A Environmental Qualification Form	005-00217-33
GIA 63W Environmental Qualification Form	005-00148-02
GA 56A Environmental Qualification Form	005-00240-00
GA 56W Environmental Qualification Form	005-00232-00
GA 57 Environmental Qualification Form	005-00240-00

1.3.5 Cooling Requirements

External cooling is required for the GIA 63W, GDU 1040, and GTX 33. External cooling is optional for all other G900X LRUs. When external cooling is required the following guidelines should be followed:

- All external cooling fans should be connected to their own circuit breaker. If this is not possible, all external cooling fans should be combined on the same circuit breaker as the LRU they are cooling (proper circuit breaker sizing considerations must be taken into consideration).
- If a form of forced air cooling is installed, make certain that rainwater or condensation cannot enter and be sprayed on the equipment.

1.3.5.1 GDU 1040 Cooling Requirements

External cooling of the GDU 1040 is required. A fan bracket (Garmin P/N 115-00973-00) is available to mount an axial fan (Garmin recommended fan 013-00102-00, See Table 1-6) to the system rack. The bracket is designed to secure a 2.36 x 2.36 inch (60 x 60 mm) axial fan. See Appendix C for dimensions and assembly instructions. Alternate fans can be found in Table 1-6.

Table 1-5. GDU 1040 Cooling Fan (013-00102-00) Specifications

Characteristic	Specification
Operating Voltage	22-31 VDC
Current	100 mA (nominal) 250 mA (maximum)
Air Flow (no load)	20 CFM (10 CFM @ .08” H_2O)
Operating Temperature	-20 to +55°C
Maximum Operating Altitude	55,000 feet
Weight	0.25 lb

Alternatively, the following fans have been evaluated and reportedly meet the minimum specification of 20 cfm airflow. This information is provided for reference only. Garmin makes no claims on the quality or performance of these alternate cooling fans.

Table 1-6. Alternate GDU 1040 Cooling Fans and Specifications

Manufacturer	Part Number	Operating Voltage (VDC)	Power (W)	Max Airflow (cfm)	Noise (dBA)
NMB-MAT	2410ML-05W-B40-BOO0	24	2.16	21.5	33.5
NMB-MAT	2410ML-05W-B50-BOO0	24	2.40	23.3	35.0
NMB-MAT	2410RL-05W-B50-C00	24	2.88	24.0	33.5
NMB-MAT	2410ML-04W-B40-BOO0	12	2.04	21.2	33.5
NMB-MAT	2410ML-04W-B50-BOO0	12	2.40	23.3	35.0
NMB-MAT	2410RL-04W-B50-C00	12	1.80	24.0	33.5
Comair Rotron	032710(CR0624HB-A)	24	3.60	23.2	32.3
Comair Rotron	032704(CR0612HB-A)	12	2.76	23.2	32.3

1.3.5.2 GIA 63W and GTX 33 Cooling Requirements

External cooling of the GIA 63W and GTX 33 is required. A 5/8” diameter air fitting is provided on the rear of the mounting rack for the purpose of admitting cooling air. It is recommended that a 3 port blower fan is used with an airflow rating of 5 cfm per port or greater. See Table 1-7 for Garmin recommended fans.

Table 1-7. Recommended GIA/GTX Cooling Fan Specifications

Manufacturer	Part Number	Operating Voltage (VDC)	Operating Current (mA)	Weight (lbs)
Garmin	013-00067-00	14	1000	1.18
Garmin	013-00067-01	28	500	1.18

1.4 Mechanical Aspects

1.4.1 G900X Rack System

The G900X mounting system is designed to simplify the installation, removal, and servicing of G900X LRUs. The system typically consists of a main system rack, LRU racks, and any required cooling accessories or other structural supports mounted behind the instrument panel. The GDU 1040 PFD and MFD mount to the instrument panel cutout directly in front of the main system rack. In this way, LRUs are quickly accessible by removing and disconnecting the display.

1.4.2 Rack/Remote Mounting

Not all airframes allow for conventional panel installation. It may be necessary to mount certain LRUs remotely due to spacing/accessibility concerns, or due to weight/balance requirements. If adequate space does not exist to mount the main system rack and LRU racks behind the instrument panel, the main system rack can be remotely mounted. Any modifications to aircraft structures and components must be done in accordance with kit plane manufacturer requirements and FAA standards. Use the provided installation and outline drawings in each LRU installation manual to fabricate any additional mounting equipment as required.

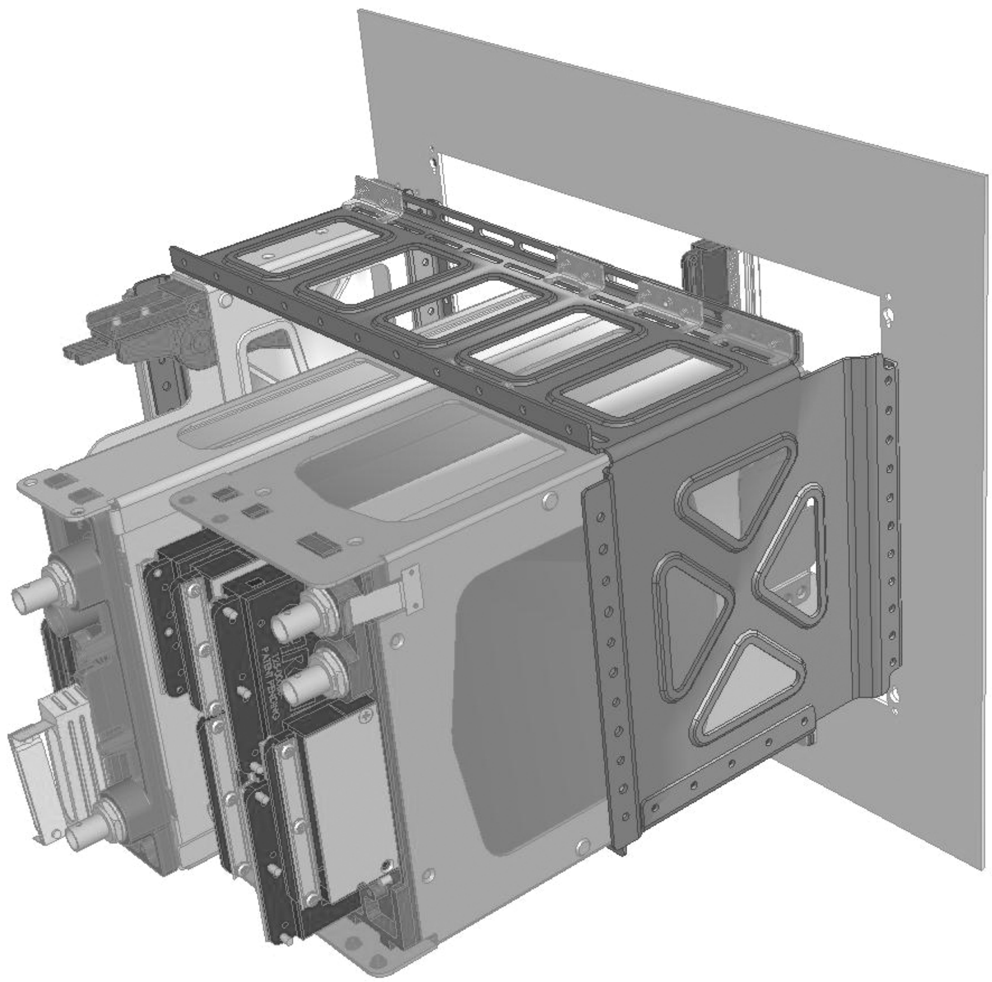


Figure 1-2. Example G900X Panel Installation

1.4.3 Main System Rack

The main system rack can be mounted directly behind the instrument panel (behind the GDU 1040 displays), or at a remote location. Two racks are available under the following part numbers (Refer to Figure 1-4 and Appendix C for pictures and dimensions). The Standard Main System Rack is included in the basic G900X installation kit. The Truncated Main System Rack can be purchased separately.

Table 1-8. Main System Racks

Item	Garmin Part Number
Standard Main System Rack	115-00413-00
Truncated Main System Rack	115-00635-00

1.4.4 Specifications

Table 1-9. Main System Rack Specifications

Specification	Description
Weight	0.84 lbs. (0.381 kg)
Material	0.059 inch (1.50 mm) Thick Stamped Sheet Aluminum w/ Nickel Finish.
Dimensions	See Appendix C for rack dimensions.

1.4.5 Rack Installation

The rack should be fastened to the panel and other structural support(s) using the standard mounting hardware (see Appendix C). **Always provide adequate support at the rear of the rack when mounting to the aircraft panel.**

The truncated rack is available for applications where a glare-shield or other obstruction interferes with the upper corner of a standard system rack.

If mounting directly to the panel, mounting location should correspond with the panel cutout for the GDU 1040 display. See Appendix C for rack and panel cutout dimensions. The main system rack can be moved 0.46” higher or lower than shown in the cutout drawing to suit a particular panel.

The rack can be attached to the aircraft panel using nutplates as shown in Figure 1-3 and Appendix C or riveted using AN426 flush rivets..

Table 1-10. Nutplates

Item	Description	Garmin Part Number
3 Position Nutplate Kit	3 Position Nutplate 115-00510-00 (Qty. 2) Use with #4-40 screws (not provided)	011-01622-00
5 Position Nutplate Kit	5 Position Nutplate 115-00510-01 (Qty. 2) Use with #4-40 screws (not provided)	011-01622-01

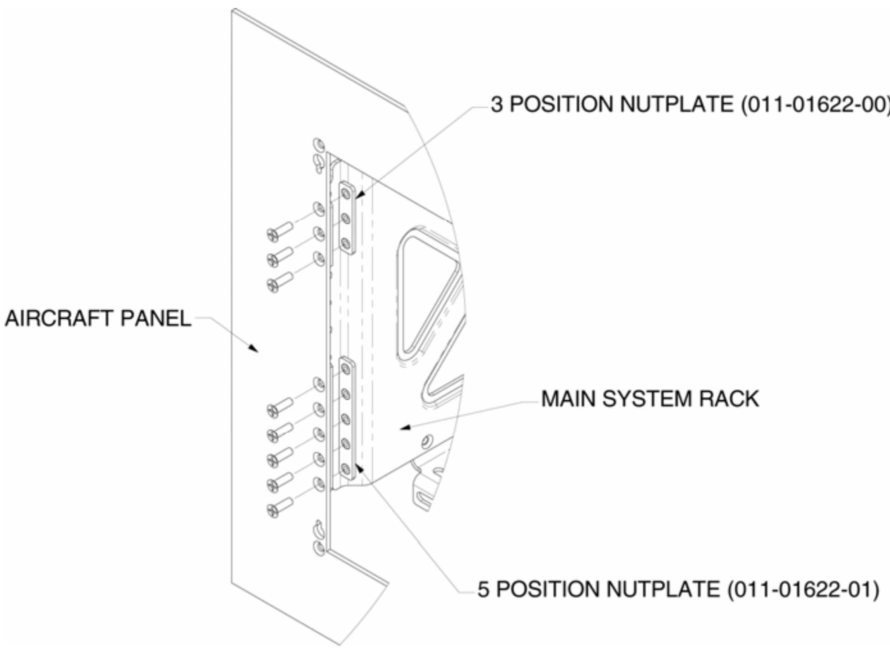


Figure 1-3. Example of Main System Rack Nutplates

LRU racks are inserted into the main rack with a vertical orientation and are fastened to the rack flanges using nutplate kits (see Appendix C). It is strongly recommended that all LRU racks be assembled to the main rack before mounting the main rack to the aircraft.

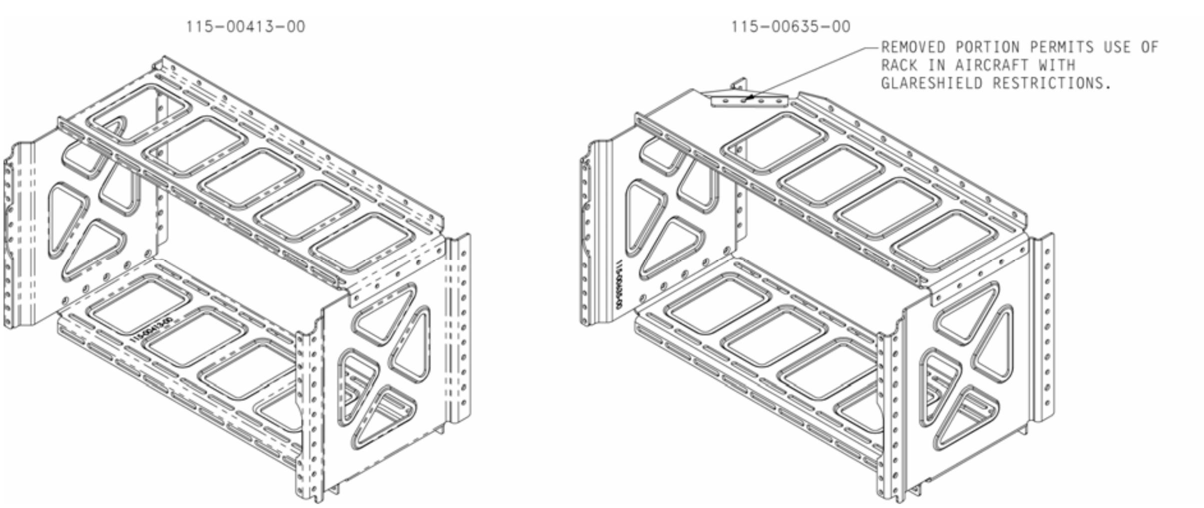


Figure 1-4. Main System Racks

1.4.6 LRU Racks

Each LRU uses a specially designed rack (except the GDU 1040). LRUs can be easily removed and replaced without the use of specialized tools (a #2 Phillips screwdriver is required). It is recommended that racks be fastened to the main system rack before the main system rack is mounted. LRU racks can also be mounted independently of the main rack.

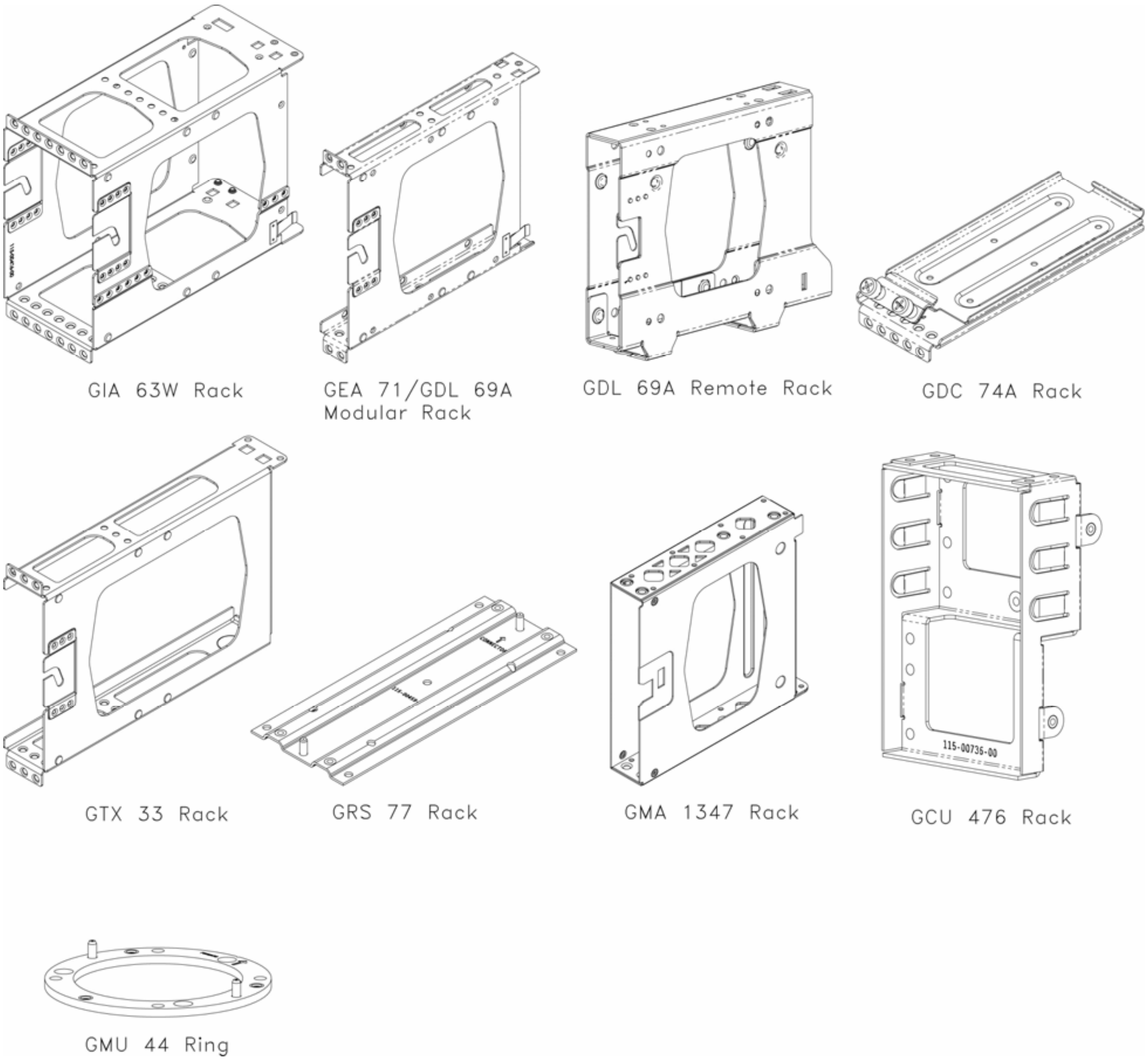


Figure 1-5. LRU Racks

1.4.7 Rear Connector Plates

Cast rear plates serve as connection junctions to the GTX 33, GIA 63W, GEA 71, and GMA 1347. Rear plate part numbers are available in individual LRU sections of this manual.

GMA 1347 and GTX 33 rear plates are attached to the LRU rack with screws. Connectors are then fastened to the rear plate using either screws or slide locking clips.

Rear plates for the GEA 71, GIA 63W, and GDL 69A attach to the rack with cast locking tabs and a spring release clip as shown in Figure 1-6. The spring clip should be moved slightly outward, to aid in rear plate installation.

NOTE

GIA 63W, GEA 71, and GDL 69A rear plates are designed to 'float' slightly in the back of the rack. This is extremely important when inserting an LRU into the rack. Damage may result if the plate binds or is not correctly installed. Ensure that the wire harness is properly attached to the rear plate and does not hinder the slight movement of the plate.

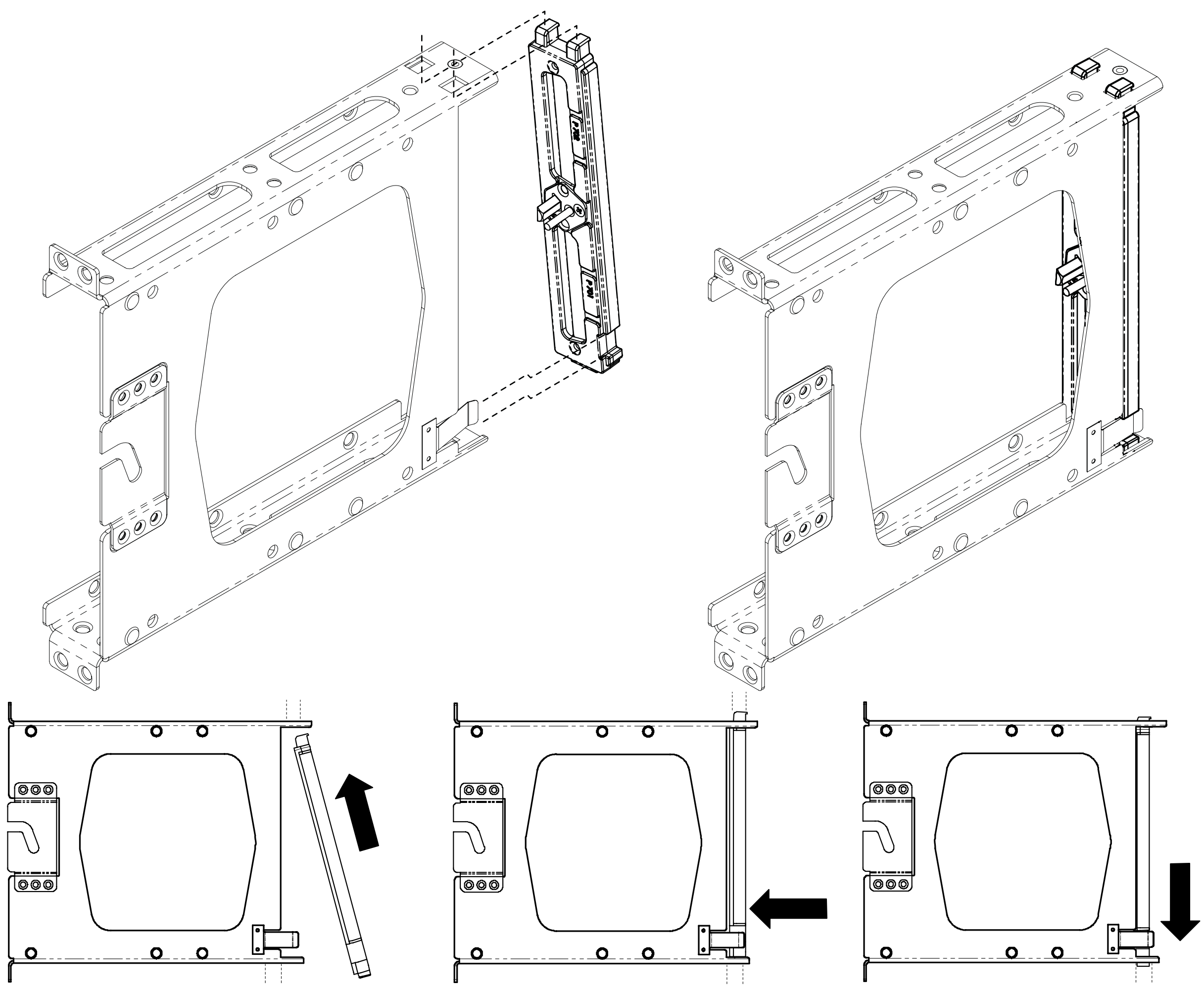


Figure1-6. Floating Rear Plate Installation

1.4.8 Nutplate Fasteners

Most LRU racks are attached to the main system rack or remote location using nutplate fasteners as shown in Table 1-11 and Figure 1-7. Refer individual LRU installation drawings for exact nutplate positions.

Table 1-11. Nutplate Fastners

Item	Description	Garmin Part Number
2 Position Nutplate Kit (Preferred)	2 Position Nutplate (Qty. 2) 6-32 100° Flathead Phillips Screw (Qty. 8)	011-00915-00
3 Position Nutplate Kit (Preferred)	3 Position Nutplate (Qty. 2) 6-32 100° Flathead Phillips Screw (Qty. 12)	011-00915-01
2 Position Nutplate Kit (Alternate)	2 Position Nutplate 115-00511-00 (Qty. 4) 6-32 100° Flathead Phillips Screw (Qty. 8)	011-01148-00
3 Position Nutplate Kit (Alternate)	3 Position Nutplate 115-00511-01 (Qty. 4) 6-32 100° Flathead Phillips Screw (Qty. 12)	011-01148-01

Preferred nutplate kits (011-00915-XX) are best suited for use with a Garmin system rack. Alternate nutplate kits (011-01148-XX) are typically used when the LRU rack is not mounted in a Garmin system rack or other constraints do not allow the use of the preferred nutplate kits.

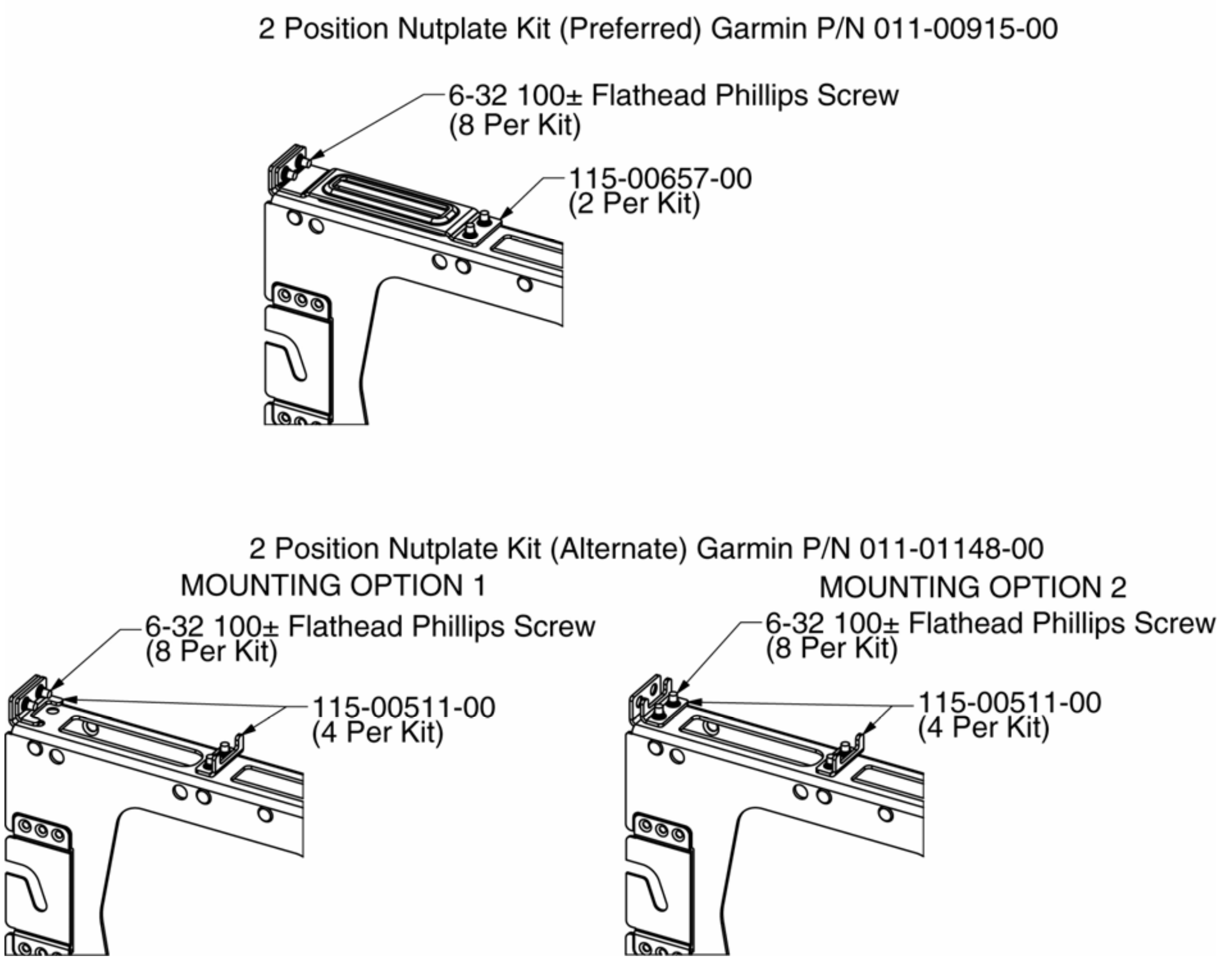


Figure 1-7. Example of Two Position Nutplates

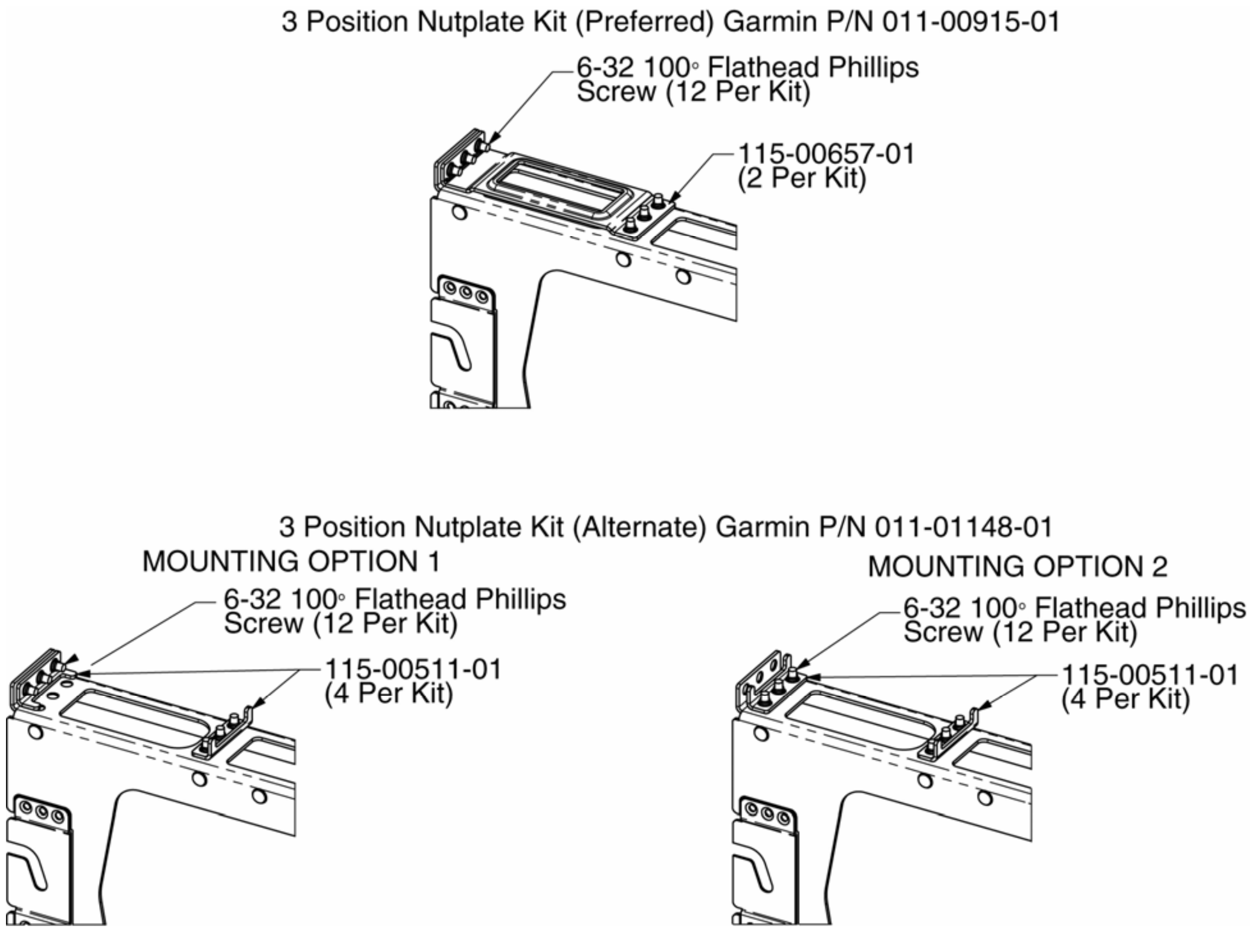


Figure 1-8. Example of Three Position Nutplates

1.4.9 LRU Handles

A handle-lock mechanism is used to guide and lock LRUs into place. The handle has a locking stud that engages a dogleg-shaped track on the LRU rack. After engaging the dogleg, the handle can be pushed down and locked. This action seats the LRU against the rear plate and connectors. A single Phillips screw is used to fasten the lever to the LRU body. (Early LRUs may use a D-ring ¼-turn fastener in lieu of the screw). Figure 1-9 illustrates the locking handle motion.

CAUTION

Some pressure is required to seat the LRU and lock the handle. The unit should be gently worked into position using the lever. Do not use excessive force inserting the LRU. If the LRU binds or is caught, stop and remove it. Check and ensure that the rear plate and connectors are floating freely in the LRU rack before attempting to re-install.

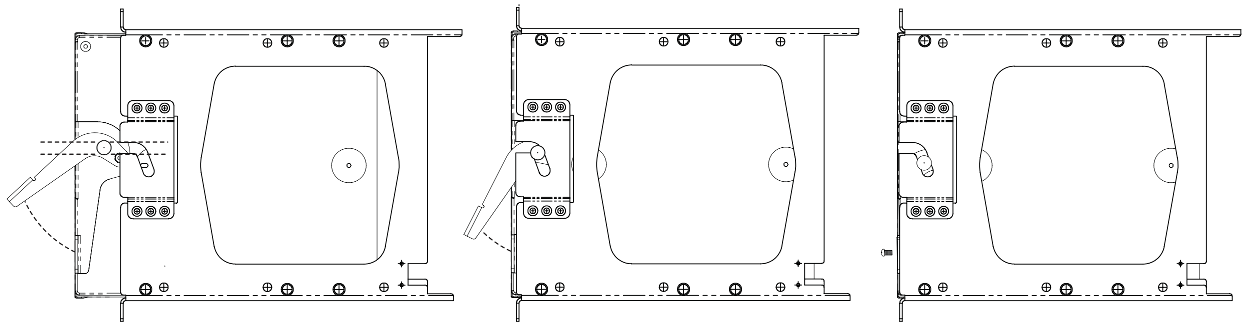


Figure 1-9. Locking System

1.4.10 Keyplates

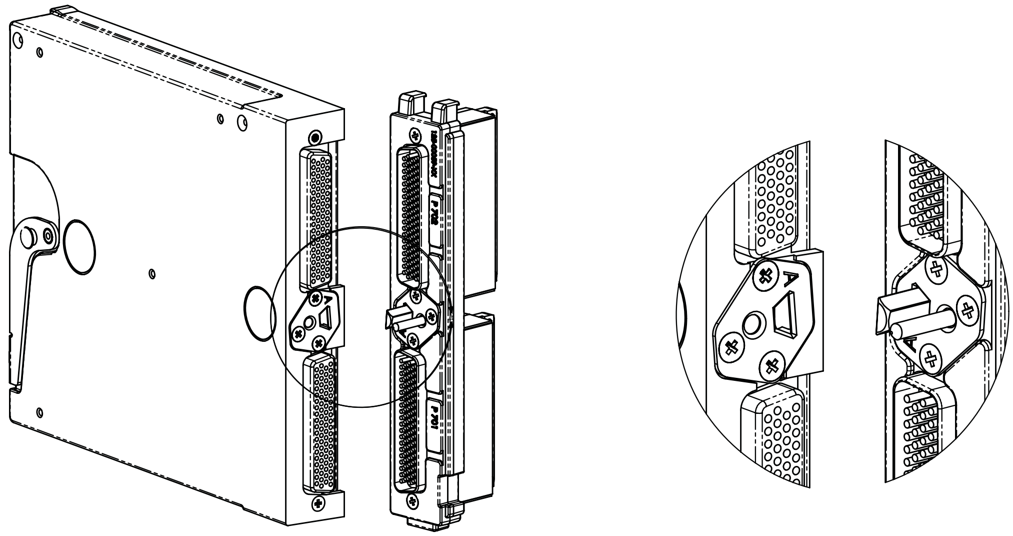
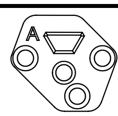
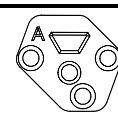
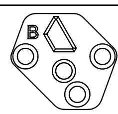
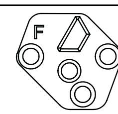
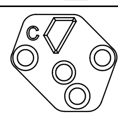
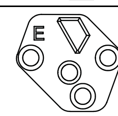
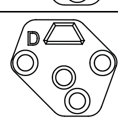
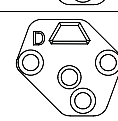
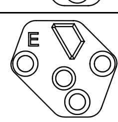
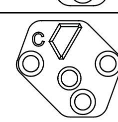
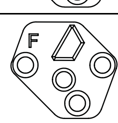
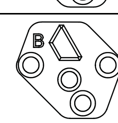
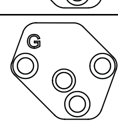
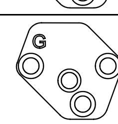


Figure 1-10. Keyplate/LRU Relationship

Some G900X LRU racks employ a keyplate/hex-dowel system that mates with the back of certain units and their rear plates. This prevents another similarly sized unit from being inserted into the incorrect rack and potentially damaging the connectors. Each keyplate is paired with an opposite mating plate as shown in Figure 1-10 and Table 1-12.

Table 1-12. Keyplate Compatibility Chart

LRU Keyplate	Rack Keyplate
	
	
	
	
	
	
	

1.4.11 CHiPS System (optional)

The optional CHiPS system provides a means of securing the display harness when the display is mounted in front of the main system rack. The flexible conduit protects the harness and also eases the retraction of the harness into the rack when installing the display. The CHiPS harness is installed into its own rack (see Figure 1-11), which is attached to the right-most slot on the main system rack. This aligns the harness with the GDU 1040 display's connector. For CHiPS installation instructions and drawings, refer to Appendix C.

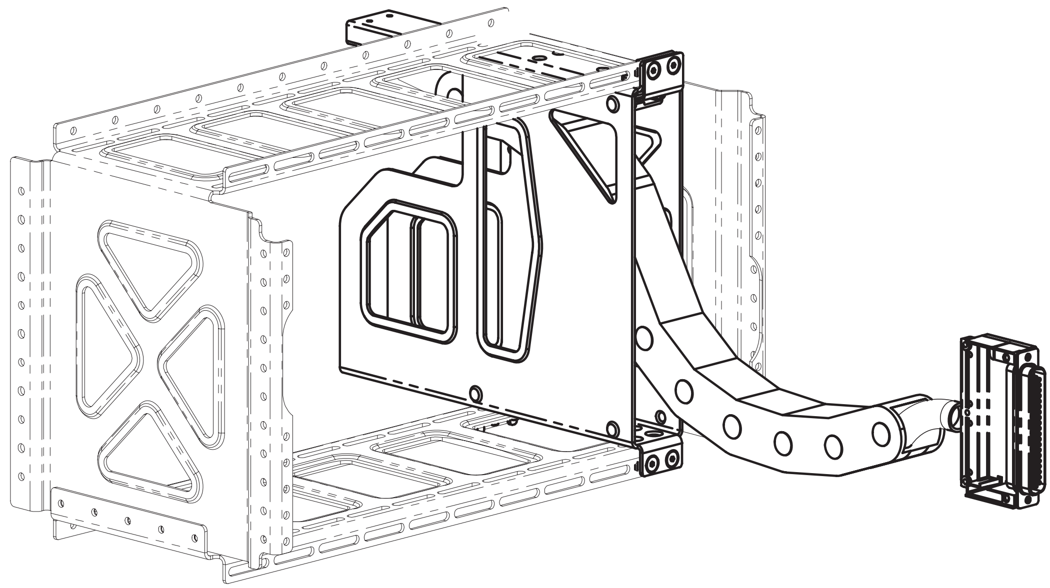


Figure 1-11. CHiPS Harness

1.5 Wiring Considerations

Use AWG #24 or larger wire for all connections unless otherwise specified. The standard pin contacts supplied in the connector kit are compatible with up to AWG #22 wire. In cases where some installations have more than one LRU sharing a common circuit breaker, sizing and wire gauge is based on aircraft circuit breaker layout, length of wiring, current draw on units, and internal unit protection characteristics.

In these cases, a larger gauge wire such as AWG #16, #18, or #20 may be needed for power connections. Special thin-wall heat shrink tubing is also provided to insulate the extended barrels inside the backshell. If using AWG #16 or #18 barrel contacts, ensure that no two contacts are mounted directly adjacent to each other. This minimizes the risk of contacts touching and shorting to adjacent pins and to ground.

Ensure that routing of the wiring does not come in contact with sources of heat, RF or EMI interference. Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling and routing near aircraft control cables.

RG400 or RG142 coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation. A typical maximum cable length for the GPS antenna is 40 feet. The installer should insure that the attenuation does not exceed 10 dB and falls between 3 dB and 7 dB inclusive at 1.5 GHz for the GIA63W.

Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling, particularly the COM antenna cable, and routing near aircraft control cables. Cabling for the GIA 63W should not be routed near components or cabling which are sources of electrical noise. Do not route the COM antenna coax near any ADF antenna cables. Route the GPS, VOR/LOC, and Glideslope antenna cables as far as possible away from all COM transceivers and antenna cables.

1.5.1 Wiring Harness Installation

Allow adequate space for installation of cables and connectors. The installer shall supply and fabricate all of the cables. All electrical connections are made through 44, 62, and 78-pin D subminiature connectors. Appendix A defines the electrical characteristics of all input and output signals. Required connectors and associated hardware are supplied with the connector kit.

Table 1-13. Pin Contact Part Numbers

Manufacturer	44 pin connectors , 62 pin connectors, 78 pin connectors		
	16 AWG (Power Only)	18-20 AWG (Power Only)	22-28 AWG
Garmin P/N	336-00044-01	336-00044-00	336-00021-00
Military P/N	N/A	N/A	M39029/58-360
AMP	N/A	N/A	204370-2
Positronic	N/A	N/A	MC8522D
ITT Cannon	N/A	N/A	030-2042-000

Table 1-14. Recommended Crimp Tools

Manufacturer	Hand Crimping Tool	18-20 AWG		22-28 AWG	
		Positioner	Insertion/ Extraction Tool (note 2)	Positioner	Insertion/ Extraction Tool
Military P/N	M22520/2-01	N/A	M81969/1-04	M22520/2-09	M81969/1-04
Positronic	9507	9502-11	M81969/1-04	9502-3	M81969/1-04
ITT Cannon	995-0001-584	N/A	N/A	995-0001-739	N/A
AMP	601966-1	N/A	91067-1	601966-6	91067-1
Daniels	AFM8	K774	M81969/1-04	K42	M81969/1-04
Astro	615717	N/A	M81969/1-04	615725	M81969/1-04

NOTES

1. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.
2. Extraction of 16 and 18 AWG contacts requires cutting off the wire barrel from the contact. It may also be necessary to push the pin out from the face of the connector when using an extractor.
3. For applications using 16 AWG wire, contact Garmin for information regarding connector crimp positioner tooling.

1.5.2 Cable Installation

1. Route the coaxial cable to the rack location. Secure the cable in accordance with good aviation practice.

2. Trim the coaxial cable to the desired length and install the BNC connector (330-00087-00) per the cabling instructions on Figure 1-12. If the connector is provided by the installer, follow the connector manufacturer's instructions for cable preparation.

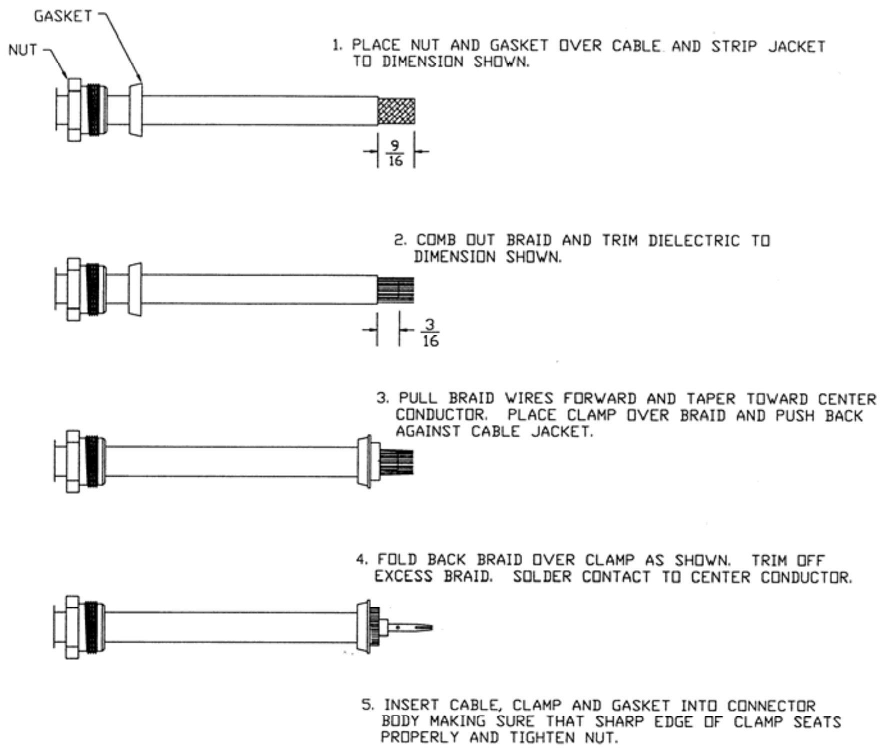


Figure 1-12. Coaxial Cable Installation

3. Contacts for the 78, 62, and 44 pin connectors must be crimped onto the individual wires of the aircraft wiring harness. Tables 1-12 and 1-13 list contact part numbers (for reference) and recommended crimp tools.

1.5.3 Backshell Assemblies

Connector kits include backshell assemblies. Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds at the backshell housing. To assemble the backshell connectors and Shield Block grounding system, refer to Section 12 for Shield Block installation instructions.

1.5.4 Electrical Noise

Because the audio panel is a point in the aircraft where signals from many pieces of equipment are brought together, take care to minimize effects from coupled interference and ground loops.

Coupled interference can sneak into audio system interconnecting cables when they are routed near large AC electric fields, AC voltage sources and pulse equipment (strobes, spark plugs, magnetos, EL displays, CRTs, etc). Interference can also couple into audio system interconnecting cables by magnetic induction when they are routed near large AC current-carrying conductors or switched DC equipment (heaters, solenoids, fans, autopilot servos, etc).

Ground loops are created when there is more than one path in which return currents flow or when signal returns share the same path as large currents from other equipment. These large currents create differences in ground potential between the various equipment operating in the aircraft. These differences in potential can produce an additive effect on audio panel input signals.

The audio panel may "see" the desired input signal plus an unwanted component injected by ground differentials, a common cause of alternator-related noise. This is the main reason why all audio jacks should be isolated from ground. Terminating audio shields just at one end eliminates another potential ground loop injection point.

Single-point grounding cannot be overstressed for the various avionics producing and processing audio signals. Single-point, in this context, means that the various pieces of equipment share a single common ground connection back to the airframe. Good aircraft electrical/charging system ground bonding is also important.

The wiring diagrams and accompanying notes in this manual should be followed closely to minimize noise effects.

1.6 Antenna Considerations

1.6.1 Antenna Installation

Follow the manufacturers' instructions. Avoid running other wires and coaxial cables near the VOR/LOC antenna cable.

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.

1.6.2 GPS Antenna Location

The GPS antenna is a key element in the overall system performance and integrity for a GPS/WAAS navigation system. The mounting location, geometry, and surroundings of the antenna can affect the system performance and/or availability. The following guidance provides information to aid the installer in ensuring that the most optimum location is selected for the installation of the GPS antenna. The installation guidelines presented here meet the intent of AC 20-138A section 16. The greater the variance from these guidelines, the greater the chance of decreased availability. Approach procedures with vertical guidance are the most sensitive to these effects. LNAV only approaches, terminal operations, and enroute operations may also be affected. Because meeting all of these installations guidelines may not be possible on all aircraft, these guidelines are listed in order of importance to achieve optimum performance. Items 3 below are of equal importance and their significance may depend on the aircraft installation. The installer should use their best judgment to balance the installation guidelines.

1. Mount the antenna as close to level as possible with respect to the normal cruise flight attitude of the aircraft. If the normal flight attitude is not known, substitute the waterline, which is typically referenced as level while performing a weight and balance check.
2. The GPS antenna should be mounted in a location to minimize the effects of airframe shadowing during typical maneuvers. Typically mounting farther away from the tail section reduces signal blockage seen by the GPS antenna.

3a. The GPS antenna should be mounted no closer than two feet from any VHF Com antenna or any other antenna which may emit harmonic interference at the L1 frequency of 1575.42 MHz. An aircraft EMC check (reference VHF Com interference check in Post Installation Checkout procedures) can verify the degradation of GPS in the presence of interference signals. If an EMC check reveals unacceptable interference, insert a GPS notch filter in line with the offending VHF Com or the (re-radiating) ELT transmitter.
Note: This does not apply to GPS and Com combination antennas, provided the antenna model is TSO authorized and has been tested to meet Garmin's minimum performance standards. The separating requirement includes the combination with an XM antenna element as well.

3b. The GPS antenna should be mounted no closer than two feet from any antennas emitting more than 25 watts of power. An aircraft EMC check can verify the degradation of GPS in the presence of interference signals.

3c. To minimize the effects of shadowing at 5° elevation angles, the GPS antenna should be mounted no closer than 6 inches (edge to edge) from other antennas, including passive antennas such as another GPS antenna or XM antenna.

4. To maintain a constant gain pattern and limit degradation by the windscreen, avoid mounting the antenna closer than 3 inches from the windscreen.

5. For multiple GPS installations, the antennas should not be mounted in a straight line from the front to the rear of the fuselage. Also varying the mounting location will help minimize any aircraft shading by the wings or tail section (in a particular azimuth, when one antenna is blocked the other antenna may have a clear view).

Figure 1-13 shows the recommended placement of antennas.

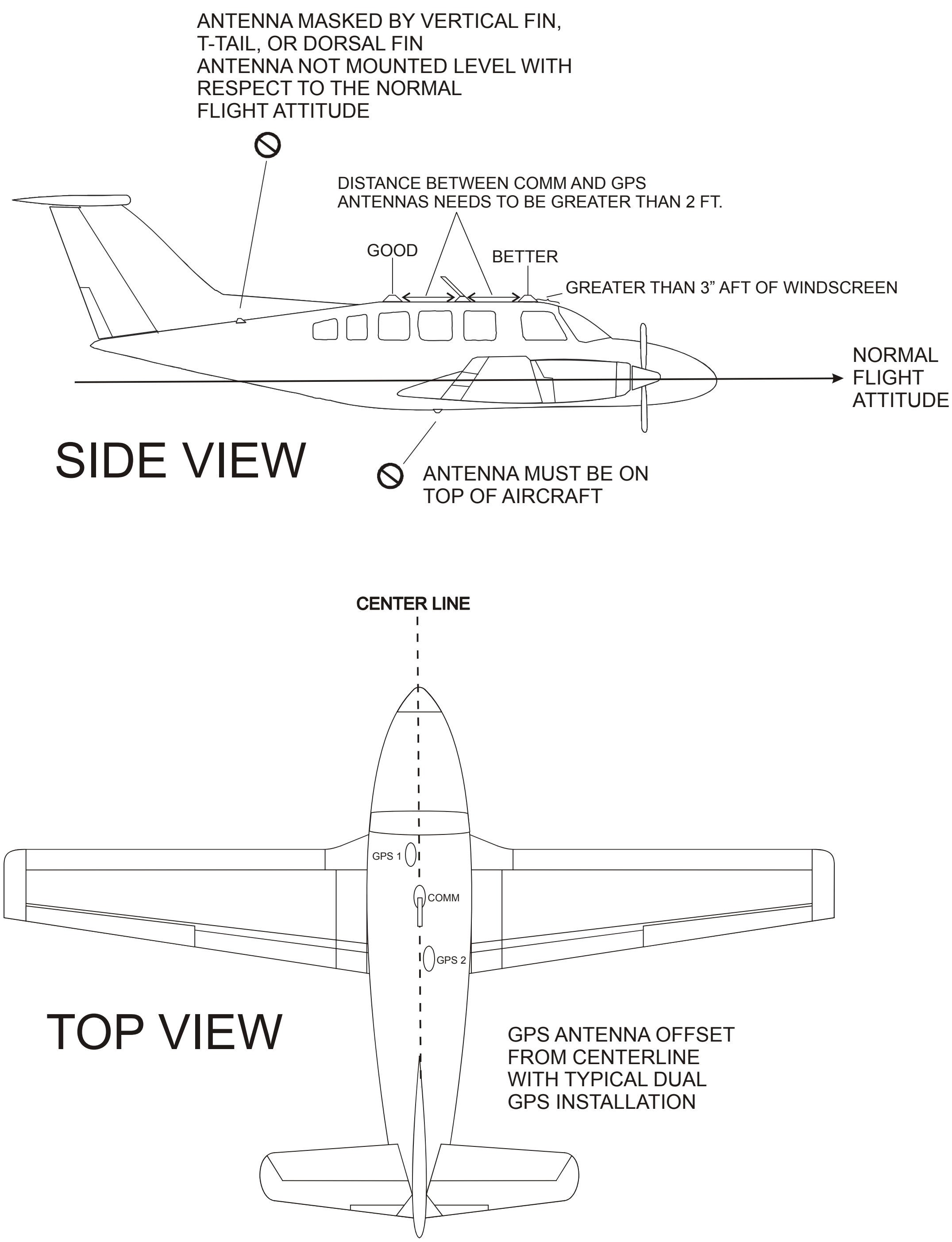


Figure 1-13. Antenna Installation Considerations

1.6.3 COM Antenna Location

The GIA 63W COM antenna should be well removed from all projections, engines and propellers. The ground plane surface directly below the antenna should be a flat plane over as large an area as possible (18 inches square, minimum). The antenna should be mounted a minimum of six feet from any DME or other COM antennas, four feet from any ADF sense antennas, and three feet from the GIA 63W and its GPS antenna.

If simultaneous use of two COM transceivers is desired (split- COM or simulcomm), use of the TX interlock function is mandatory. In addition, the COM antennas should be spaced for maximum isolation. A configuration of one topside antenna and one bottom side antenna is recommended.

1.6.4 VOR/LOC Antenna Location

The GIA 63W VOR/LOC antenna should be well removed from all projections, engines and propellers. It should have a clear line of sight if possible. The antenna must be mounted along the centerline of the aircraft, minimizing the lateral offset.

1.6.5 Glideslope Antenna Location

The GIA 63W Glideslope antenna should be well removed from all projections, engines and propellers. It should have a clear line of sight if possible.

1.6.6 Marker Beacon Antenna Location

The marker beacon antenna should be mounted on a flat surface on the underside of the aircraft. Mount the antenna so that there is a minimum of structure between it and the ground radio stations. Locate it as far away as possible from transmitter antennas.

1.6.7 Transponder Antenna Location

The antenna installation should be installed in accordance with AC 43.12-2A Chapter 3. Note that penetration of the pressure vessel on the pressurized aircraft requires additional data not contained in this manual.

A. The antenna(s) (Garmin P/N 010-10160-00) or equivalent should be mounted away from major protrusions, such as engine(s), propeller(s), and antenna masts. It should also be as far as practical from landing gear doors, access doors, or other openings that could affect the radiation pattern.

B. The antenna should be mounted vertically on the bottom of the aircraft.

C. Avoid mounting the antenna within three feet of the ADF sense antenna or any other communication antenna and six feet from the DME antenna.

D. To prevent RF interference, the antenna must be physically mounted a minimum distance of three feet from the GTX 33.

NOTE

If the antenna is being installed on a composite aircraft, sufficient ground plane material must be added. Conductive wire mesh, radials, or thin aluminum sheets embedded in the composite material provide the proper ground plane allowing the antenna gain pattern to be maximized for optimum transponder performance.

1.6.8 Electrical Bonding

No special precautions need to be taken to provide a bonding path between the GPS antenna and the aircraft structure. Follow the manufacturers' instructions for the COM, VOR/LOC and Glideslope antennas.

1.6.9 VHF COM/GPS Interference

On some installation VHF COM transceivers, Emergency Locator Transmitter (ELT) antennas, and Direction Finder (DF) receiver antennas can re-radiate through the GPS antenna. The GIA 63(W) COM does not interfere with its own GPS section. However, placement of the GPS antenna relative to a COM transceiver and COM antenna (including the GIA 63W COM antenna), ELT antenna, and DF receiver antenna is critical.

Use the following guidelines, in addition to others in this document, when locating the GIA 63W and its antennas.

- GPS Antenna—Locate as far as possible from all COM antennas and all COM transceivers (including the GIA 63W COM), ELT antennas, and DF antennas. The GPS antenna is less susceptible to harmonic interference if a 1.57542 GHz notch filter is installed on the COM transceiver antenna output.
- Locate the GIA 63W as far as possible from all COM antennas.

If a COM antenna is found to be the problem, a 1.57542 GHz notch filter (Garmin P/N 330-00067-00) may be installed in the VHF COM coax, as close to the COM as possible. This filter is not required for the GIA 63(W) transmitter.

If a COM is found to be radiating, the following can be done:

1. Replace or clean the VHF COM rack connector to ensure good coax ground.
2. Place grounding straps between the GIA 63(W) unit, VHF COM and a good ground.
3. Shield the VHF COM wiring harness.

1.7 Warranty

Garmin products are warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, Garmin will at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

Garmin retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local Garmin Authorized Service Center. For assistance in locating a Service Center near you, call Garmin Customer Service at one of the numbers listed below.

Products sold through online auctions are not eligible for rebates or other special offers from Garmin. Online auction confirmations are not accepted for warranty verification. To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. Garmin will not replace missing components from any package purchased through an online auction.

Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062, U.S.A.
Phone: 800/800.1020
FAX: 913/397.0836

Garmin (Europe) Ltd.
Unit 5, The Quadrangle
Abbey Park Industrial Estate
Romsey, SO51 9DL, U.K.
Phone: 44/0870.851241
Fax: 44/0870.851251

1.7.1 Garmin G900X Warranty Registration Instructions

In order to provide important information to the owner of the new G900X system at the very beginning of the aircraft project, it is required that the Avionics Distributor set up a link for the owner in the myGarmin network. The Avionics Distributor will need to create a unique myGarmin ID and obtain a temporary password for the owner. Once obtained, this information along with the G900X Installation Manual is then forwarded to the owner by the Avionics Distributor. In addition the Avionics Distributor will need to provide to Garmin within five (5) business days, the owner's ID and contact information and emailing the information to avionics@garmin.com.

This procedure is the first step of the registration process which will also include further steps to verify final Post Installation Checkout Procedures (PICP) at aircraft completion and a complete list of product serial numbers used in the final installation. Owners, please be sure to track all Garmin product serial numbers from the beginning of the installation process to finalize the warranty registration process when the installation is completed.

2 GDU 1040

2.1 Equipment Description

The GDU 1040 provides a central display and user interface for the G900X Integrated Cockpit System. The display is mounted flush to the aircraft instrument panel using four ¼ turn fasteners. A GDU 1040 can be configured as either a Multi Function Display (MFD) or Primary Flight Display (PFD). The GDU 1040 provides the following functions:

2.1.1 Flight Instrument Functions

- Display of attitude (pitch and roll), rate of turn, slip/skid, heading, airspeed, altitude, and vertical speed information (PFD or reversionary modes only)
- Display of engine and airframe instrumentation (MFD or reversionary modes only)

2.1.2 Navigation Instrument Functions

- Display of position and ground speed
- Display of stored navigation and map databases
- Control and display of the HSI, Selected Heading and Selected Course (PFD or reversionary modes only)
- Area navigation functions using the determined position/velocity and stored navigation data
- Approach navigation functions and associated databases

2.1.3 System Interface Functions

- Interfacing with the GIA 63W Integrated Avionics Unit (IAU) and other GDU 1040
- Control and display of dual communications transceivers operating in the 118.00 to 136.975 MHz range in 8.33 kHz or 25 kHz frequency spacing
- Control and display of dual VOR/ILS receivers tuning from 108.00 to 117.95 MHz in 50 kHz increments
- Control and display of transponder(s) GTX 33, GDU 1040, and GDL 69A data link, etc.

2.1.4 Interface Summary

The GDU 1040 is designed as an open architecture system that uses typical ARINC 429, RS-232, and Ethernet communications interfaces. The GDU 1040 communicates with the following LRUs:

- GRS 77 AHRS
- GDC 74A Digital Air Data Computer
- Other GDU 1040
- GMA 1347 Audio Panel
- GIA 63W IAU
- GDL 69A Data Link (optional)
- GCU 476 FMS Controller (optional)

2.2 Electrical Characteristics

Table 2-1. GDU 1040 Electrical Characteristics

Characteristics	Specifications
Power Requirements	14/28 VDC See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.

2.2.1 Power Consumption

Ambient temperature above -15°C:

	14V (Maximum)	14V (Typical)	28V (Maximum)	28V (Typical)
GDU 104X	2.71 Amps	2.36 Amps	1.25 Amps	1.07 Amps

Ambient temperature at or below -15°C:

	14V (Maximum)	14V (Typical)	28V (Maximum)	28V (Typical)
GDU 104X	3.36 Amps	3.00 Amps	2.50 Amps	2.32 Amps

2.3 Environmental Characteristics

The table below contains general specifications. For detailed environmental specifications, see the Environmental Qualification Form.

Table 2-2. GDU 1040 Environmental Characteristics

Characteristics	Specifications
Operating Temperature Range	-40°C to +55°C.
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 55,000 ft
Software Compliance	RTCA/DO-178B levels B, C, and D
Hardware Compliance	RTCA/DO-254 Level B
Environmental Compliance	RTCA/DO-160D

2.3.1 Environmental Qualification Form

Refer to the GDU 10XX Environmental Qualification Form, Garmin part number 005-00150-02, for a complete list of environmental characteristics.

2.4 TSO/ETSO

Table 2-3 contains a list of applicable TSO/ETSOs for the GDU 1040.

Table 2-3. GDU 1040 TSO/ETSO

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU Software Part Numbers	Applicable Custom Logic Device Part Numbers
Airborne Multipurpose Electronic Displays	TSO-C113 ETSO-C113 SAE AS8034	Type I, II, and III	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airspeed Instruments	TSO-C2d ETSO-C2d SAE AS8019A	Type C Range : 20 to 999 kts	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Turn and Slip Instrument	TSO-C3d ETSO-C3d SAE AS8004	Type II	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Bank and Pitch Instruments	TSO-C4c ETSO-C4c SAE AS8001	Turn Error, Category B	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Direction (Heading) Instrument, Magnetic	TSO-C6d ETSO-C6d SAE AS8013A		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Vertical Velocity Instruments (Rate-Of-Climb)	TSO-C8d ETSO-C8d SAE AS8016A	Type C Range : -9950 to 9950 ft/min	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Automatic Pilots	TSO-C9c SAE AS402B		All 006-B0319-() except 006-B0319-00 through 006-B0319-29	006-C0035-() 006-C0036-()
Altimeter, Pressure Actuated, Sensitive Type	TSO-C10b ETSO-C10b SAE AS8009A	Range : -1000 to 99,980 ft	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
ILS Glide Slope Receiving Equipment Operating Within The Radio Frequency Range of 328.6-335.4 Megahertz (MHz)	TSO-C34e ETSO-2C34f RTCA DO-192 EUROCAE ED-47B		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airborne Radio Marker Receiving Equipment	TSO-C35d ETSO-2C35d RTCA DO-143 EUROCAE 1/WG7	Category A	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airborne ILS Localizer Receiving Equipment Operating Within The Radio Frequency Range of 108-112 Megahertz	TSO-C36e ETSO-2C36f RTCA DO-195 EUROCAE ED-46B	Class A	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
VHF Radio Communications Transmitting Equipment Operating Within The Radio Frequency Range 117.975 to 137.000 Megahertz	TSO-C37d** ETSO-2C37e RTCA DO-186A EUROCAE ED-23B	Class 3 Class 5 200nm 25 kHz 8.33 kHz	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()

TSO Compliance, continued				
Function	**TSO/ETSO/SAE/ RTCA/EUROCAE**	**Category**	**Applicable LRU Software Part Numbers**	**Applicable Custom Logic Device Part Numbers**
VHF Radio Communications Receiving Equipment Operating Within The Radio Frequency Range 117.975 to 137.000 Megahertz	TSO-C38d** ETSO-2C38e RTCA DO-186A EUROCAE ED-23B	Class C Class E 200nm 25 kHz 8.33 kHz	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
VOR Receiving Equipment Operating Within The Radio Frequency Range Of 108-117.95 Megahertz (MHz)	TSO-C40c ETSO-2C40c RTCA DO-196 EUROCAE ED-22B		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airborne Automatic Direction Finding Equipment (ADF)	TSO-C41d ETSO-2C41d RTCA DO-179	Class A	All 006-B0319-() except 006-B0319-00 through 006-B0319-06	006-C0035-() 006-C0036-()
Temperature Instruments	TSO-C43c ETSO-C43c SAE AS8005A	Class IIIb	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Fuel Flowmeters	TSO-C44b ETSO-C44b SAE AS407C	Type I and II	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Manifold Pressure Instruments	TSO-C45a ETSO-C45a SAE AS8042	Type II Range : See Note Below	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Pressure Instruments – Fuel, Oil, and Hydraulic	TSO-C47 ETSO-C47 SAE AS408C	Type II Range : See Note Below	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Electric Tachometer: Magnetic Drag (Indicator and Generator)	TSO-C49b ETSO-C49b SAE AS404C	Range : See Note Below	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Flight Director Equipment	TSO-C52b SAE AS8008		All 006-B0319-() except 006-B0319-00 through 006-B0319-29	006-C0035-() 006-C0036-()
Fuel and Oil Quantity Instruments (Reciprocating Engine Aircraft)	TSO-C55 ETSO-C55 SAE AS405C	Range : See Note Below	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airborne Weather and Ground Mapping Pulsed Radars	TSO-C63c RTCA DO-173	Class 7	All 006-B0319-() except 006-B0319-00 through 006-B0319-39	006-C0035-() 006-C0036-()

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU Software Part Numbers	Applicable Custom Logic Device Part Numbers
Distance Measuring Equipment Operating Within the RF Range of 960-1215 MHz (DME)	TSO-C66c ETSO-2C66b RTCA DO-189 EUROCAE ED-54		All 006-B0319-() except 006-B0319-00 through 006-B0319-06	006-C0035-() 006-C0036-()
Airborne ATC Transponder Equipment	TSO-C74c ETSO-C74d		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Airborne Low-Range Radio Altimeter	TSO-C87†		All 006-B0319-() except 006-B0319-00 through 006-B0319-59	006-C0035-() 006-C0036-()
Airborne Passive Thunderstorm Equipment	TSO-C110a ETSO-C110a RTCA DO-191		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment	TSO-C112 ETSO-2C112a RTCA DO-181C EUROCAE ED-73A		006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Traffic Alert Collision Avoidance System (TCAS) Airborne Equipment, TCAS I	TSO-C118 RTCA DO-197A		All 006-B0319-() except 006-B0319-00 through 006-B0319-59	006-C0035-() 006-C0036-()
Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)	TSO-C129a** ETSO-C129a RTCA DO-208 EUROCAE ED-72A	Class A1	006-B0319-() 006-B0320-()	006-C0035-() 006-C0036-()
Stand-alone Airborne Navigation Equipment Using the Global Position System Augmented by the Wide Area Augmentation System	TSO-C146a*** RTCA DO-229C	Class 3	All 006-B0319-() except 006-B0319-00 through 006-B0319-49	006-C0035-() 006-C0036-()
Traffic Advisory System (TAS) Airborne Equipment	TSO-C147 ETSO-C147 RTCA DO-197A	Class A	All 006-B0319-() except 006-B0319-00 through 006-B0319-19	006-C0035-() 006-C0036-()
Terrain Awareness and Warning System	TSO-C151b*	Class B	All 006-B0319-() except 006-B0319-00 through 006-B0319-39	006-C0035-() 006-C0036-()
VHF Radio Communications – Transceiver Equipment	TSO-C169*** RTCA DO-186A	Class 3 Class 5 Class C Class E	All 006-B0319-() except 006-B0319-00 through 006-B0319-49	006-C0035-() 006-C0036-()

Note : The range for these engine gauges is configurable and will vary with aircraft type.

*TSO-C151b applies only when the system is configured to enable TAWS. A TERRAIN configuration only partially complies with TSO-C151b, excluding audio, excessive rate of descent alerting, negative climb rate alerting, altitude loss after takeoff alerting, the 500 foot voice callout, and the TAWS self test capability. Hence, TSO-C151b does not apply to units without the TAWS configuration.

**Applies only when installed with a GIA 63 (non-WAAS unit).

***Applies only when installed with a GIA 63W (WAAS unit).

†Applies only when installed with a Bendix/King KRA-405B.

2.4.1 TSO/ETSO Deviations

Table 2-4. GDU 1040 TSO/ETSO Deviations

TSO/ETSO	Deviation
TSO-C2d	1. Garmin was granted a deviation from TSO-C2d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C2d to use SAE AS 8019A instead of SAE AS 8019 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Garmin was granted a deviation from TSO-C2d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	4. Garmin was granted a deviation from TSO-C2d to eliminate the requirement 3.2.3 in SAE AS 8019A that requires “the instrument face to be marked with ‘Airspeed’ or ‘IAS’ and also with the applicable units of measure.”
	5. Garmin was granted a deviation from TSO-C2d to modify the requirement 3.2.5 in SAE AS 8019A that requires “The indicating means to be visible from all points on a surface defined as making an angle of 30 degrees with the perpendicular.”
ETSO-C2d	1. Garmin was granted a deviation from ETSO-C2d to use SAE AS 8019A instead of SAE AS 8019 as the Minimum Performance Standard.
	2. Garmin was granted a deviation from ETSO-C2d to eliminate the requirement 3.2.3 in SAE AS 8019A
	3. Garmin was granted a deviation from ETSO-C2d to modify the requirement 3.2.5 in SAE AS 8019A
	4. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C3d	1. Garmin was granted a deviation from TSO-C3d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C3d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	3. Garmin was granted a deviation from TSO-C3d to modify the requirement 3.7 in SAE AS 8004 that requires “The indicating means to be visible from all points on a surface defined as making an angle of 30 degrees with the perpendicular.”
ETSO-C3d	1. Garmin was granted a deviation from ETSO-C3d to modify the requirement 3.7 in SAE AS 8004
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C4c	1. Garmin was granted a deviation from TSO-C4c to use SAE AS 8001instead of SAE AS 396B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from SAE Aerospace Standard AS 8001 to use RTCA DO-160D instead of RTCA DO-138 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Neither TSO-C4c nor SAE Aerospace Standard AS 8001 specifies use of a standard for software development; Garmin intends to use RTCA DO-178B as the standard for Software Considerations in Airborne Systems and Equipment Certification.
ETSO-C4c	1. Garmin was granted a deviation from ETSO-C4c to use SAE AS 8001 instead of SAE AS 396B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from SAE Aerospace Standard AS 8001 to use RTCA DO-160D instead of RTCA DO-138 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Neither ETSO-C4c nor SAE Aerospace Standard AS 8001 specifies use of a standard for software development; Garmin intends to use RTCA DO-178B as the standard for Software Considerations in Airborne Systems and Equipment Certification.
	4. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C6d	1. Garmin was granted a deviation from TSO-C6d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C6d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	3. Garmin was granted a deviation from TSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.
	4. Garmin was granted a deviation from TSO-C6d to modify the requirement 3.10.2 in SAE AS 8013A that requires "The indicating means to be visible from all points on a surface defined as making an angle of 30 degrees with the perpendicular."
ETSO-C6d	1. Garmin was granted a deviation from ETSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.
	2. Garmin was granted a deviation from ETSO-C6d to modify the requirement 3.10.2 in SAE AS 8013A.
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C8d	1. Garmin was granted a deviation from TSO-C8d to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C8d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	3. Garmin was granted a deviation from TSO-C8d to use SAE AS 8016A instead of SAE AS 8016 as the Minimum Performance Standard
	4. Garmin was granted a deviation from TSO-C8d to modify the requirement 3.2.4 in SAE AS 8016A.
ETSO-C8d	1. Garmin was granted a deviation from ETSO-C8d to use SAE AS 8016A instead of SAE AS 8016 as the Minimum Performance Standard.
	2. Garmin was granted a deviation from ETSO-C8d to modify the requirement 3.2.4 in SAE AS 8016A.
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C9c	1. Garmin was granted a deviation from AS-402B paragraph 4.4.1 to limit autopilot engagement to attitudes considered safe for the certified aircraft.
	2. Garmin was granted a deviation from TSO-C9c to use SAE AS-402B instead of AS-402A.
	3. Garmin was granted a deviation from TSO-C9c to use DO-160D instead of specified environmental tests.
	4. Garmin was granted a deviation from TSO-C9c subpart A (c), which requires marking the weight of the unit on the unit.
	5. Garmin was granted a deviation from AS402B paragraph 4.3.2 to not provide servo effort indications when the automatic pilot is not engaged.

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C10b	1. Garmin was granted a deviation from TSO-C10b to use SAE AS 8009A instead of SAE AS 392c as the Minimum Performance Standard.
	2. Garmin was granted a deviation from TSO-C10b to use RTCA DO-160D instead of RTCA DO160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Garmin was granted a deviation from TSO-C10b to modify the requirement 3.7 in SAE AS 8009A that requires "Pointers and dial markings shall be visible from any point within the frustrum of a cone; the side of which makes an angle of 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture the instrument case."
	4. Garmin was granted a deviation from SAE AS 8009A Section 3.11 to not display ALTITUDE or ALT next to the tape indicating altitude.
ETSO-C10b	1. Garmin was granted a deviation from ETSO-C10b to use SAE AS 8009A instead of SAE AS 392C as the Minimum Performance Standard.
	2. Garmin was granted a deviation from ETSO-C10b to modify the requirement 3.7 in SAE AS 8009A
	3. Garmin was granted a deviation from SAE AS 8009A Section 3.11 to not display ALTITUDE or ALT next to the tape indicating altitude.
	4. Garmin was granted a deviation from ETSO-C10b to use RTCA DO-160D instead of SAE AS 8009A as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C34e	1. Garmin was granted a deviation from TSO-34e to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C34e to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
ETSO-2C34f	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C35d	1. Garmin was granted a deviation from TSO-C35d to use RTCA DO-160D instead of RTCA DO-138 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C35d to use FAR §21.607(d) instead of FAR §37.7 as the general rules governing holders of the TSO authorizations.
	3. Garmin was granted a deviation from TSO C-35d which calls out RTCA DO-143 Section 2.15 to allow the visual indication of the Standard
ETSO-C35d	1. Garmin was granted a deviation from ETSO-2C35d which calls out EUROCAE 1/WG7 Section 3.16 to allow the visual indication of the Standard
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C36e	1. Garmin was granted a deviation from TSO36e to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C36e to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
ETSO-2C36f	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C37d	1. Garmin was granted a deviation from TSO-C37d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C37d to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Garmin was granted a deviation from TSO-C37d paragraph (a)(1) to allow using RTCA document DO-186a instead of RTCA document DO-186 to specify minimum performance standards.
	4. Garmin was granted a deviation from TSO-C37d paragraph (a)(5) to allow 8.33 kHz spacing in addition to the 25 kHz spacing.
	5. Garmin was granted a deviation from TSO-C37d paragraph (b)(1) to allow the marking to call out 8.33 kHz spacing in addition to the 25 kHz spacing.
ETSO-2C37e	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C38d	1. Garmin was granted a deviation from TSO-C38d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C38d to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Garmin was granted to deviate from TSO-C38d paragraph (a)(1) to allow using RTCA document DO-186a instead of RTCA document DO-186 to specify minimum performance standards.
	4. Garmin was granted a deviation from TSO-C38d paragraph (a)(5) to allow 8.33 kHz spacing in addition to the 25 kHz spacing.
ETSO-2C38e	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C40c	1. Garmin was granted a deviation from TSO-C40c to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C40c to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-2C40c	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C41d	1. Garmin was granted a deviation from TSO-C41d to use RTCA DO-178B instead of RTCA DO-178 to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C41d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-2C41d	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C43c	1. Garmin was granted a deviation from TSO-C43c to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C43c to use SAE AS 8005A instead of SAE AS 8005 as the Minimum Performance Standard
ETSO-C43c	1. Garmin was granted a deviation from ETSO-C43c to use SAE AS 8005A instead of SAE AS 8005 as the Minimum Performance Standard.
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C44b	1. Garmin was granted a deviation from TSO-C44b section a.3 to use DO-160D for the Environmental Standard.
	2. Garmin was granted a deviation from TSO-C44b section b.1 to not display the software part number on the outside of the unit.
	3. Garmin was granted a deviation from TSO-C44b to use SAE AS 407C instead of SAE AS 407B to demonstrate compliance for Fuel Flowmeters.
	4. Garmin was granted a deviation from TSO-C44b to modify the requirement 4.2.5 in SAE AS 407C
	5. Garmin was granted a deviation from TSO-C44b to modify the requirement 4.1.1 in SAE AS 407C
ETSO-C44b	1. Garmin was granted a deviation from ETSO-C44b to use RTCA DO-160D instead of SAE AS 407B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from ETSO-C44b to use SAE AS 407C instead of SAE AS 407B to demonstrate compliance for Fuel Flowmeters.
	3. Garmin was granted a deviation from ETSO-C44b to modify the requirement 4.2.5 in SAE AS 407C
	4. Garmin was granted a deviation from ETSO-C44b to modify the requirement 4.1.1 in SAE AS 407C
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C45a	1. Garmin was granted a deviation from TSO-45a to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-45a SAE 8042 3.10.5 to use MAN as abbreviation instead of MANIFOLD PRESSURE or MANIF PRESS.
	3. Garmin was granted a deviation from TSO-C45a to modify the requirement 3.10.9 in SAE AS 8042
ETSO-C45a	1. Garmin was granted a deviation from ETSO-C45a to use RTCA DO-160D instead of SAE AS 411 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from ETSO-C45a to use SAE AS 8042 instead of SAE AS 411 for Minimum Performance Standards.
	3. Garmin was granted a deviation from ETSO-C45a SAE 8042 3.10.5 to use MAN as abbreviation instead of MANIFOLD PRESSURE or MANIF PRESS.
	4. Garmin was granted a deviation from ETSO-C45a to modify the requirement 3.10.9 in SAE AS 8042
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C47	1. Garmin was granted a deviation from TSO-C47 to use SAE AS 408C instead of SAE AS 408A for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from TSO-C47 to modify the requirement 4.1.5 in SAE AS 408C
	3. Garmin was granted a deviation from TSO-C47 to use RTCA DO-160D instead of AS 408C as the standard for Environmental Standards.
ETSO-C47	1. Garmin was granted a deviation from ETSO-C47 to use SAE AS 408C instead of SAE AS 408A for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from ETSO-C47 to modify the requirement 4.1.5 in SAE AS 408C
	3. Garmin was granted a deviation from ETSO-C47 to use RTCA DO-160D instead of AS 408C as the standard for Environmental Standards.
	4. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C49b	1. Garmin was granted a deviation from TSO-C49b to use SAE AS 404C instead of SAE AS 404B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from TSO-C49b to modify the requirement 4.1.2 in SAE AS 404C
	3. Garmin was granted a deviation from TSO-C49b, SAE AS 404C requirement 4.1.3.2
	4. Garmin was granted a deviation from TSO-C49b to use DO-160D instead of SAE AS 407B as the Environmental Standard.
ETSO-C49b	1. Garmin was granted a deviation from ETSO-C49b to use SAE AS 404C instead of SAE AS 404B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from ETSO-C49b to modify the requirement 4.1.2 in SAE AS 404C
	3. Garmin was granted a deviation from ETSO-C49b, SAE AS 404C requirement 4.1.3.2
	4. Garmin was granted a deviation from ETSO-C49b to use DO-160D instead of SAE AS 404B as the Environmental Standard.
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C52b	1. Garmin was granted a deviation from AS-8008 paragraph 3.6 to limit flight director operation to attitudes considered safe for the certified aircraft.
	2. Garmin was granted a deviation from TSO-52b to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
TSO-C55	1. Garmin was granted a deviation from TSO-C55 to use SAE AS 405C instead of SAE AS 405B to demonstrate compliance for Fuel and Oil Quantity Instruments.
	2. Garmin was granted a deviation from TSO-C55 to modify the requirement 4.2.5 in SAE AS 405C
	3. Garmin was granted a deviation from TSO-C55 to modify the requirement 4.2.4 in SAE AS 405C
ETSO-C55	1. Garmin was granted a deviation from ETSO-C55 to use SAE AS 405C instead of SAE AS 405B to demonstrate compliance for Fuel and Oil Quantity Instruments.
	2. Garmin was granted a deviation from ETSO-C55 to modify the requirement 4.2.5 in SAE AS 405C
	3. Garmin was granted a deviation from ETSO-C55 to modify the requirement 4.2.4 in SAE AS 405C to allow "FUEL QTY" to be used to abbreviate "Fuel Quantity".
	4. Garmin was granted a deviation from ETSO-C55 to use DO-160D instead of SAE AS 405B as the Environmental Standard.
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C63c	1. Garmin was granted a deviation from TSO-63c to use RTCA DO-160D instead of RTCA DO-160A as the standard Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-63c to use RTCA DO-178B instead of RTCA DO-178 to demonstrate compliance for the verification and validation of the computer software.
TSO-C66c	1. Garmin was granted a deviation from TSO-C66c to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C66c to use RTCA DO-160D instead of RTCA DO-160C as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-2C66b	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C74c	1. Garmin was granted a deviation from TSO-C74c section (c) Marking to allow the environmental categories to be left off of the S/N Tag.
ETSO-C74d	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C87	1. Garmin was granted a deviation from TSO-C87 to use RTCA/DO-160D instead of the FAA Document for “Environmental Test Procedures for Airborne Electronic Equipment,” dated August 31, 1962.
TSO-C110a	1. Garmin was granted a deviation from TSO-C110a to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C110a to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-C110a	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C112	1. Garmin was granted a deviation from TSO-C112 to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C112 to use Section 2 of RTCA DO-181B to meet the minimum performance standard instead of the revisions DO-181 revisions and changes listed. DO-181B contains all the revisions listed by the TSO.
	3. Garmin was granted a deviation from TSO-C112 to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-2C112a	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement “See Install Manual for Additional Appliance Approvals”.
TSO-C113	1. Garmin was granted a deviation from TSO-C113 to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	2. Garmin was granted a deviation from TSO-C113 to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
ETSO-C113	Garmin requires no deviation from ETSO-C113

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C129a	1. Garmin was granted a deviation from TSO-C129a to use DO-160D instead of DO-160C for the environmental standard.
	2. Garmin was granted a deviation from TSO-C129a to eliminate the annunciation for pending CDI scale change 3.0 NM from the FAF.
	3. Garmin was granted a deviation from TSO-C129a involving the use of GPS calibrated altitude in approach mode.
	4. Garmin was granted a deviation from TSO-C129a to extend automatic CDI sensitivity changes to non-approach mode navigation.
	5. Garmin was granted a deviation from TSO-C129a to eliminate the requirement in (a)(3)(xi)1.b.ii to "alert the pilot of the need to manually insert the barometric pressure".
	6. Garmin was granted a deviation from TSO-C129a to modify the requirement (a)(3)(xii)(3) to allow the approach mode to be deselected by performing a direct-to action on the unit.
	7. Garmin was granted a deviation from TSO-C129a to eliminate the requirement in (a)(3)(xv)4.b to provide a "means to manually identify a satellite that is expected to be unavailable at the destination (for scheduled maintenance as identified in FAA Notice to Airmen) shall be provided" for the RAIM prediction process.
	8. Garmin was granted a deviation from TSO-C129a to change the requirement in paragraph (a)(7)(ii) to match the WAAS TSO-C145a and DO-229 requirements for Power input testing.
ETSO-C129a	1. Garmin was granted a deviation from ETSO-C129a (ED-72A 3.2.2.1f(3) and 3.2.2.4j(4)) to eliminate the annunciation for pending CDI scale change 3.0 NM from the FAF.
	2. Garmin was granted a deviation from ETSO-C129a (ED-72A 3.2.2..1f(4), 3.2.2.3e(4), and 3.2.2.4j(2)) to eliminate the requirement to "alert the pilot of the need to manually insert the barometric pressure.
	3. Garmin was granted a deviation from ETSO-C129a (ED-72A 3.2.2.4j(8)) to modify the requirement to allow the approach mode to be deslected by performing a direct-to action on the unit.
	4. Garmin was granted a deviation from ETSO-C129a (ED-72A 3.2.2.3d(2))
	5. Garmin was granted a deviation from ETSO-C129a to change the requirement in ED-72A paragraph 4.16.2.
	6. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C146a	1. Garmin was granted a deviation from RTCA/DO-229C 2.2.1.1.4.3
	2. Garmin was granted a deviation from RTCA/DO-229C 2.2.1.4.9.c
	3. Garmin was granted a deviation from RTCA/DO-229C 2.2.4.2.3
	4. Garmin was granted a deviation from RTCA/DO-229C 2.2.4.6.4 and 2.2.5.6.4 pertaining to the low altitude alerting function.
	5. Garmin was granted a deviation to not furnish each person receiving a GDU 1XXX copies of the following data TSO-C146a 5.c(2) TSO-C146a 5.a(13) TSO-C146a 5.a(14)
	6. Garmin was granted a deviation from RTCA/DO-229C 2.2.1.1.6 to use the terms "ADVISORY" and "ALERTS" in addition to "MSG" depending upon the installation.

TSO/ETSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C147	Garmin requires no deviations from TSO-C147.
ETSO-C147	1. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C151b	1. Garmin was granted a deviation from TSO-C151b 5.c(2) TSO-C151b 5.a(11) states "An environmental qualification form as described in RTCA/DO-160D or the most current revision for each component of the TAWS equipment." TSO-C151b 5.a(12) primarily states "A list of all drawings and processes, including revision level, necessary to define the article's design." TSO-C151b 5.a(13) primarily states "If the article includes software: Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary." Garmin was granted a deviation to not furnish each person receiving a GDU 1XXX copies of the data in 5.a(12) and 5.a(13).

2.5 Installation Requirements

2.5.1 Required Accessories

Each of the following accessories is provided separately from the GDU 1040 unit and is required to install the unit.

Table 2-5. GDU 1040 Required Accessories

Item	Garmin P/N
GDU 1040 Connector Kit	011-00820-01
GDU 1040 Mounting Hardware	011-00821-00

2.5.2 Additional Items

Each of the following optional accessories are provided separately from the GDU 1040 unit.

Table 2-6. GDU 1040 Additional Items

Item	Garmin P/N
System Rack	115-00413-00 or 115-00635-00
Rack Nutplate Kit	011-01148-00 or 011-00915-00

2.6 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GDU 1040. Refer to Section 12 for Shield Block information and Appendix D for system interconnects.

2.7 Mounting Requirements

The GDU 1040 mounting hardware is designed to accommodate various sheet metal panel thickness (see the Table 2-7).

Table 2-7. GDU Mounting Hardware

GDU 104X Mounting Hardware P/N	Sheet Metal Panel Thickness
011-00821-00	0.080" ±0.005
011-00821-01	0.125" ±0.005
011-00821-02	0.090" ±0.005
011-00821-03	0.100" ±0.005

The locking socket (See Figure 2-1) can be attached by using a rivet or screw. If using rivets, the rivet should be a 1/8" flat head 100° countersunk solid rivet. If using screws, the screw should be #4-40 flat head 100° countersunk screws with standard hex nuts on the back. If screws are used, thread locking compound (Loctite or equivalent) or a self locking nut with a nylon locking feature should be used. The specified screws and rivets are designed to provide a flush front surface.

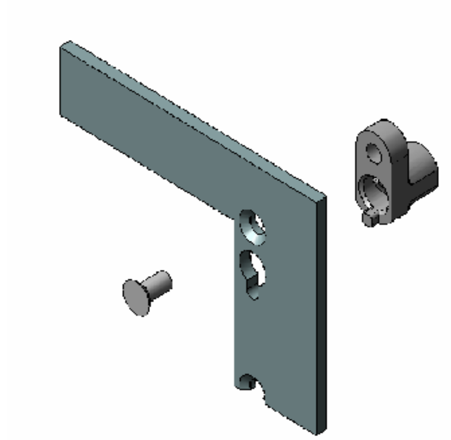


Figure 2-1. GDU 104X Locking Socket

NOTE

If using rivets to attach the locking socket to the panel, take care not to over-compress the rivet. Doing so can result in damage to the socket.

2.8 Unit Installation

The GDU 1040 is installed by holding the unit flush with the instrument panel. The locking studs should be oriented with the alignment marks in the vertical position for installation. A 3/32" hex drive tool is then used to turn each of the four locking sockets ¼ turn clockwise. When locked, the alignment marks are in the horizontal position.

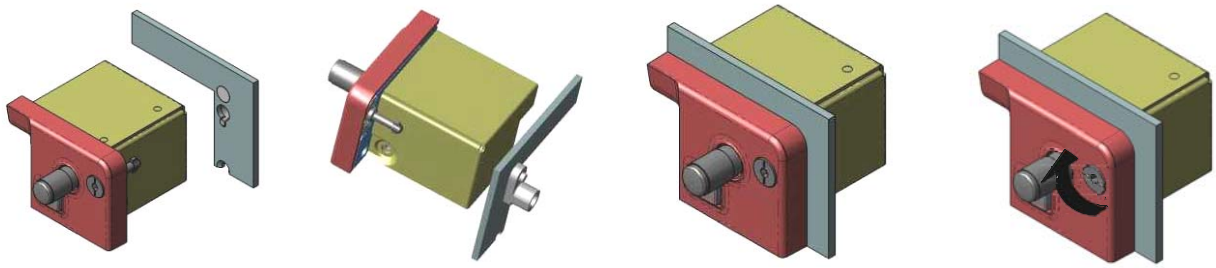


Figure 2-2. GDU 1040 ¼ Turn Fastener

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

2.9 Continued Airworthiness

Maintenance of the GDU 1040 is "on condition" only.

3 GMA 1347

3.1 Equipment Description

The Garmin GMA 1347 is a vertically oriented panel mounted audio control and marker beacon system. The system delivers reliability and versatility for all audio controlling functions. LED-illuminated push buttons and logical panel layout allow audio selection of NAV, COM and automatic warning audio in voice or tone annunciation. LED brightness is adjusted to a level appropriate for ambient cockpit light conditions automatically by the GDU or manually with radio lighting controls, depending upon installation connections. A failsafe circuit connects the pilot's headset and microphone directly to COM 1 in case power is interrupted or the unit is turned off.

The Garmin GMA 1347 Audio Panel incorporates a microcontroller for processing front panel key commands, annunciator control, input/output functions, and communication.

The GMA 1347 includes a six-position intercom system (ICS) with electronic cabin noise de-emphasis, two stereo music inputs, and combined pilot, copilot, and passenger volume controls. The intercom provides four selectable modes of isolation (All, Crew, Pilot, Copilot). A pilot-selectable cabin speaker output can be used to listen to the selected aircraft radios or to broadcast PA announcements. The PA function is pilot selectable.

The GMA 1347 provides digital audio input/output capability to external radios. The unit is capable of digitally interfacing with two transceivers and two receivers. For every channel except COM 3, the unit generates both digital and analog outputs, and combines both digital and analog inputs.

The installation ensures that only one channel is used. A programming pin indicates whether the digital or analog channels are used for COM 1, COM 2, NAV 1 and NAV 2. An additional digital input is used for Voice alerting and/or Pilot checklist.

The GMA 1347 provides a digital recorder with playback capability. Recording is automatic when a COM signal is received. Playback is controlled by pressing the PLAY button or a remote mounted switch.

The recorder can be disabled using an external switch. The digital clearance recorder can playback up to two and a half minutes of recording.

3.1.1 Features Summary

- Logical front panel layout
- LED annunciators indicate selected function
- Six position intercom: pilot, copilot, four passengers
- Three stereo headset amplifiers: one for pilot, one for copilot, and one for the passengers
- Two stereo music source inputs
- Four selectable intercom operational modes
- Independent pilot and copilot/passenger volume control
- VOX control for mic inputs
- Automatic selection of radio audio source when corresponding mic is selected
- MASQTM Processing
- COM swap function
- TX indication
- SmartMuteTM marker audio muting
- Speaker output for radios or PA function
- Power-off fail safe connection for Pilot PTT, mic and Pilot's Headset-Left to COM 1
- Digital audio interface
- Voice Recorder with playback

3.1.2 Interface Summary

The following is an interface summary for the GMA 1347:

- 3 Transceiver Inputs
- 5 Receiver Inputs
- 4 Unswitched Inputs
- 5 Digital Audio Inputs
- 2 Aircraft Power Inputs
- Discrete Inputs/Outputs
- PFD/MFD Reversionary Mode Outputs
- 2 RS-232 Inputs/Outputs
- Marker Beacon Antenna Input
- External Marker Beacon Lamp Driver Outputs

3.2 Electrical Specifications

Table 3-1. GMA 1347 Electrical Specifications

Characteristics	Specifications
Power Requirements	14/28 VDC See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.
Audio Panel	Transceiver inputs: 3 Receiver inputs: 5 Unswitched inputs: 4 Input impedance: 500 Ω Input isolation: 60 dB minimum Special functions: Failsafe operation ***MASQ***™ processing
Intercom	Positions: 6 (pilot, copilot, 4 passengers) Volume controls: 2 (pilot, copilot/passengers) VOX level controls: 2 (pilot, copilot/passengers) VOX circuits: 6 (one per mic input) Music inputs (stereo): 2 (one input mutable) Music input impedance: 5 kΩ Music input level: Less than 500 mVAC RMS for full output (typical). 1 VAC RMS MAX (3 V p-p) Microphone signal processing: 9 pole characteristic and special cabin noise band de-emphasis Intercom isolation modes: 4 (All, Pilot Isolate, Copilot Isolate, Crew Isolate) Special functions: Recorder with playback (automatic recording of selected COMs) up to 2.5 minutes of recording time. Automatic squelch: 6 (one per mic input) pilot selectable between auto and manual.
Headphone Outputs	Output amplifiers: 3, stereo (pilot, copilot, passengers) **Fidelity:** **Power into 150 Ω** **Distortion** 50 mW <0.5% 100 mW <5% Frequency response: music; 50 Hz to 20 kHz nominal Aircraft radio: 200 Hz to 6 kHz nominal ICS mic: (Special cabin noise band de-emphasis)
Speaker Outputs	Outputs selectable: 1, pilot selectable Output power: 10 watts into 4 Ω or 8 Ω, @ any normal supply voltage. Frequency response: 350 Hz to 6 kHz nominal Special functions: PA Mode, pilot selectable, including split operation
Marker Beacon Receiver	Frequency: Crystal controlled at 75 MHz Sensitivity: LO 1000 µV; HI 200 µV Selectivity: 6 dB @ ±10 kHz min, 40 dB @ ±200 kHz max. Input impedance: 50 Ω External lamp drive: 125 mA max each output Other outputs: Middle MKR sense Special functions: SmartMuteTM marker audio muting

3.3 Environmental Specifications

Table 3-2. GMA 1347 Environmental Specifications

Characteristics	Specifications
Regulatory Compliance	RTCA/DO-160D Environmental Conditions and EUROCAE/ED-14D
Unit Software	RTCA/DO-178B Level D (for software versions 006-B0203-00 through 006-B0203-29) RTCA/DO-178B Level C (for software versions 006-B0203-33 through 006-B0203-99)
Temperature Range	-45°C to +70°C
Altitude	55,000 Feet

3.3.1 Environmental Qualification Form

Refer to the GMA 1347 Environmental Qualification Form, Garmin part number 005-00155-79, for a complete list of environmental characteristics.

3.4 TSO/ETSO

Table 3-3. GMA 1347 TSO/ETSO

Function	TSO/ETSO	Category	Applicable LRU SW Part Numbers
Audio Selector Panels and Amplifiers	TSO-C50c ETSO-C50c		006-B0203-()
Airborne Radio Marker Receiving Equipment	TSO-C35d ETSO-2C35d	Class A	006-B0203-()

3.4.1 TSO/ETSO Deviations

Table 3-4. GMA 1347 TSO/ETSO Deviations

TSO	Deviation
TSO-C35d	Garmin was granted a deviation from TSO-C35d to use RTCA DO-160D instead of RTCA DO-138.
	Garmin was granted a deviation from TSO-C35d to use FAR §21.607(d) instead of FAR §37.7.
ETSO-C50c	Garmin requires no deviations from ETSO-C50c.
TSO-C50d	Garmin was granted a deviation from TSO-C50d to use RTCA DO-178B instead of RTCA DO-178A.
	Garmin was granted a deviation from TSO-C50c to use RTCA DO-178B instead of RTCA DO-178A.
ETSO-2C35d	Garmin requires no deviations from ETSO-2C35d.

3.5 Installation Requirements

3.5.1 Equipment Available

Each of the following accessories are provided separately for the GMA 1347:

Table 3-5. GMA 1347 Accessories

Item	Garmin P/N
Sub Assy, Connector Kit, GMA 1347	011-00813-01
SMP, Install Rack, GMA 1347	115-00427-00
Sub Assy, Bracket Kit, GMA 1347	011-01001-00
Sub Assy, Backplate, GMA 1347	011-00812-00
Sub Assy, Nut Plate Kit, GMA 1347	011-01019-00
Garmin Marker Beacon Antenna Kit**	010-10175-00

** **Note:** A marker beacon antenna approved to TSO-C35d that has been installed to meet the requirements of this manual may be approved for use with the GMA 1347.

3.5.2 Additional Equipment Required

- Antenna sealant (use manufacturer's instructions, install according to FAA AC 43.13-2A).
- Cables: The installer will fabricate and supply all system cables.
- Hardware: #6-32 x 100° Flat Head Screw (6 ea.) and #6-32 Self-Locking Nut (6 ea.). Screws and Nutplates supplied in nutplate kit 011-01019-00.
- Stereo headphone jacks (up to 6), microphone jacks (up to 6), 3.5mm stereo jacks (up to 2), and insulating washers for all.

3.6 Installation Considerations

The GMA 1347 interfaces with the GDU, GIA, and with various avionics equipment. Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GMA 1347.

3.7 Mounting Requirements

The GMA 1347 mounting surface must be capable of providing structural support and electrical bond to the aircraft to minimize radiated EMI and provide protection from High-Intensity Radiation Fields (HIRF).

The GMA 1347 is mounted using its own system rack. Figure 3-1 shows the GMA 1347 unit rack. The unit rack is fastened to the aircraft instrument panel using the nutplate kit and bracket kit listed in Section 3.4.2. Refer to Appendix C for nutplate placement locations. The installer must provide any additional remote mounting equipment.

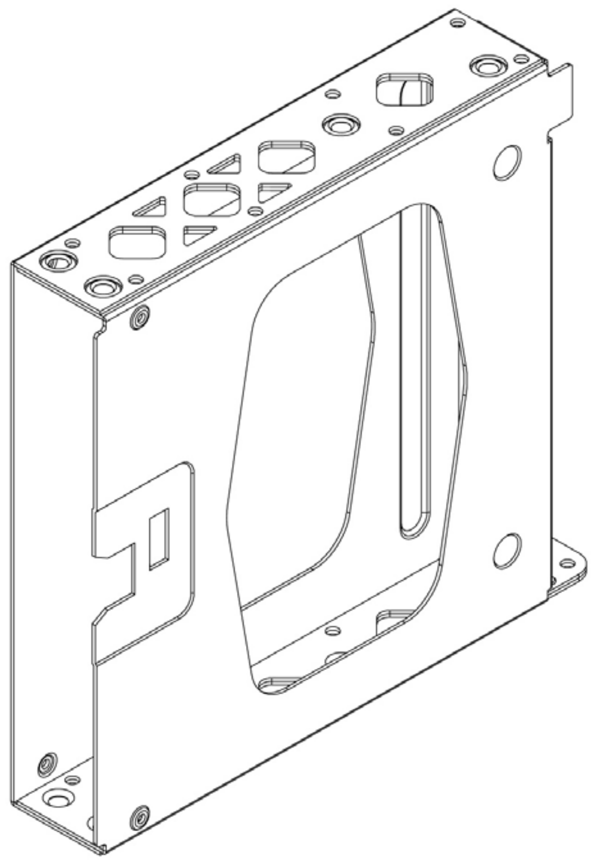


Figure 3-1. GMA 1347 Unit Rack

3.8 Unit Installation

CAUTION

> Do not use excessive force when inserting the GMA 1347 into the rack. This may damage the connectors, unit, and/or unit rack. If heavy resistance is felt during installation, stop! Remove the GMA 1347 and identify the source of resistance.

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the backshell.
2. Connect both backshells to the rear plate using the screws provided in the connector kit.
3. Mount the unit rack to a suitable mounting location on the panel using the provided nutplates.
4. Assemble the rear plate into the GMA 1347 unit rack.
5. Insert the GMA 1347 into the rack, noting proper orientation as shown on the installation drawing in Appendix A.
6. Lock the GMA 1347 in place using the appropriate size hex wrench.

3.9 Continued Airworthiness

Maintenance of the GMA 1347 is "on condition" only.

4 GIA 63W

4.1 Equipment Description

The GIA 63W is a microprocessor-based input/output Line Replaceable Unit (LRU) used in the G900X Integrated Flight Deck. The GIA 63W communicates with the GDU 1040 via Ethernet high-speed data bus (HSDB), and with other LRUs using RS-232, RS-485/422, and ARINC 429. All configuration is done through the GDU 1040. The GIA 63W contains the following sub-assemblies:

- A main processor that interfaces with all LRUs in the G900X sub-system.
- A fifteen channel parallel WAAS certified GPS receiver that simultaneously tracks and uses up to 15 satellites.
- A VHF COM transceiver that provides tuning from 118.00 to 136.975 MHz in 25 kHz or 8.33 kHz spacing for 760 or 3040 channel configuration respectively.
- A VOR/ILS localizer receiver that provides tuning from 108.00 to 117.95 MHz in 50 kHz increments.
- An ILS glideslope receiver that provides tuning from 328.6 to 335.4 MHz as paired with the frequency tuned on the VOR/ILS localizer receiver.

CAUTION

The operation of unapproved cellular telephones or other unapproved cellular devices aboard aircraft while airborne is prohibited by FCC rules. Due to the potential for interference with onboard systems, the operation of unapproved cellular communication devices while onboard an aircraft that is on the ground is subject to FAA regulations 14 CFR 91.21.

FCC regulation 47 CFR 22.925 prohibits airborne operation of unapproved cellular telephones installed in or carried aboard aircraft. Unapproved cellular telephones must not be operated aboard any aircraft while the aircraft is off the ground. When any aircraft leaves the ground, all unapproved cellular telephones on board that aircraft must be turned off.

Unapproved cellular telephones that are on, even in a monitoring state, can disrupt GPS performance.

4.1.1 Interface Summary

4.1.2 Primary Interfaces

The GIA 63W is designed as an open architecture system that provides the following interfaces:

- 1 Dedicated Ethernet High-Speed Data Bus (HSDB) input/output channel
- 2 Controller Area Network (CAN) I/O channels
- 8 Main ARINC 429 inputs
- 3 Main ARINC 429 outputs
- 1 VOR/ILS ARINC 429 input
- 1 VOR/ILS ARINC 429 output
- 5 RS-485 input/output channels (2 channels are configurable to RS-422)
- 11 RS-232 input/output channels
- 41 Discrete inputs
- 14 Discrete outputs

4.1.3 Additional Interfaces

The GIA 63W can provide interfaces for the following additional equipment:

- Altitude encoder/serializer
- Fuel management systems
- Lightning detection systems
- Traffic awareness systems
- Data link systems
- External annunciators
- DME (including King Serial)
- ADF

4.2 Electrical Specifications

4.2.1 WAAS GPS Specifications

Table 4-1. GIA 63W GPS Specifications

Characteristics	Specifications
Acquisition Time	a) Search-the-Sky (without almanac, without initial position or time): 5 minutes b) AutoLocate™ (with almanac, without initial position or time): 5 minutes c) Cold Start (position known to 300 nm, time known to 10 minutes, with valid almanac): 45 seconds d) Warm Start (position known to 10 nm, time known to 10 minutes, with valid almanac and ephemeris): 15 seconds
Max Velocity	1000 knots
Dynamics	6 g
Number of channels	15 (12 GPS and 3 GPS/WAAS/SBAS)
Frequency	1575.42 MHz L1, C/A code
Sensitivity (acquisition)	-116 dBm to -134.5 dBm GPS -116 dBm to -135.5 dBm WAAS
Sensitivity (drop lock)	-144 dBm
Dynamic range	>20dB
Lat/Long position frequency	<1 meter RMS typical with WAAS (horizontal/vertical)
Velocity	1000 knots maximum (above 60,000 ft)
TIFF (time to first fix)	1:45 min. typical with current almanac, position, and time
Reacquisition	10 seconds typical
Position update interval	0.2 sec (5 Hz)
1 pps (pulse per second)	±275 nsec of UTC second
Datum	WGS-84
SATCOM compatibility	Compatible on aircraft equipped with SATCOM
Antenna power supply	35 mA typical, 40 mA max at 4.7 VDC

4.2.2 COM Transceiver Specifications

Table 4-2. GIA 63W COM Transceiver Specifications

Characteristics	Specifications
Audio Output	100 mW minimum into a 500 Ω load.
Audio Response	Less than 6 dB of variation between 350 and 2500 Hz.
Audio Distortion	The distortion in the receiver audio output shall not exceed 25% at all levels up to 100 mW.
AGC Characteristics	The audio output shall not vary by more than 6 dB when the level of the RF input signal, modulated 30% at 1000 Hz, is varied from 5 μV to 100,000 μV (hard).
Sensitivity	(S+N)/N on all channels shall be greater than 6 dB when the RF level is 2 μV (hard) modulated 30% at 1000 Hz at rated audio.
Squelch	2 μv (hard) ±6 dB for 25 kHz channels. 3 μv (hard) ±6 dB for 8.33 kHz channels.
Selectivity	6 dB BW is greater than ±8 kHz for 25 kHz channeling. 60 dB BW is less than ±25 kHz for 25 kHz channeling. 6 dB BW is greater than ±2.778 kHz for 8.33 kHz channeling. 60 dB BW is less than ±7.37 kHz for 8.33 kHz channeling.
Spurious Response	Greater than 80 dB.
Transmitter Power	At Least 16 watts.
Transmitter Duty Cycle	Recommended 10% maximum.
Modulation Capability	The modulation shall not be less than 70% and not greater than 98% with a standard modulator signal applied to the transmitter.
Carrier Noise Level	Shall be at least 45 dB (S+N)/N.
Frequency Stability	0.0005%
Demodulated Audio Distortion	Less than 10% distortion when the transmitter is modulated at least 70%.
Sidetone	1.4 V_{RMS} into a 500 Ω load when the transmitter is modulated at least 70%.
Demodulated Audio Response	Shall be less than 6 dB when the audio input frequency is varied from 350 to 2500 Hz.

4.2.3 VOR Specifications

Table 4-3. GIA 63W VOR Specifications

Characteristics	Specifications
Receiver Audio Sensitivity	At -103.5 dBm (S+N)/N shall not be less than 6 dB.
Course Deviation Sensitivity	At –103.5 dBm deviation output shall not be less than 60% of standard deflection (90 mV) when a VOR deviation test signal is applied (10 degrees course difference).
Flag	The VLOC Course Deviation Flag must be flagged: a) in the absence of an RF signal. b) in the absence of the 9960 Hz modulation. c) in the absence of either one of the two 30 Hz modulations. d) When the level of a standard VOR deviation test signal produces less than a 50% of standard deflection.
AGC Characteristics	From -99 dBm to -13 dBm input of a Standard VOR Audio Test Signal, audio output levels shall not vary more than 3 dB.
Spurious Response	Greater than 60 dB.
VOR OBS Bearing Accuracy	The bearing information as presented to the pilot shall not have an error in excess of 2.7° as specified by RTCA DO-196 and EuroCAE ED-22B.
Audio Output	A minimum 100 mW into a 500 Ω load.
Audio Response	Less than 6 dB of variation between 350 and 2500 Hz. In voice mode, an ident tone of 1020 Hz shall be attenuated at least 20 dB.
Audio Distortion	The distortion in the receiver audio output shall not exceed 10% at all levels up to 100 mW.
Selectivity	6 dB BW is greater than 16.5 kHz.

4.2.4 LOC Specifications

Table 4-4. GIA 63W LOC Specifications

Characteristics	Specifications
Receiver Audio Sensitivity	At -103.5 dBm (S+N)/N shall not be less than 6 dB.
Course Deviation Sensitivity	At –103.5 dBm, deviation output shall not be less than 60% of standard deflection when a LOC deviation test signal is applied.
Flag	The VLOC Course Deviation Flag <u>must</u> be flagged: a) When the level of a standard deviation test signal produces 50% or less of standard deflection of the deviation indicator. b) In the absence of 150 Hz modulation. c) In the absence of 90 Hz modulation. d) In the absence of both 90 Hz and 150 Hz modulation. e) In the absence of RF.
AGC Characteristics	From –99 dBm and –13 dBm input of a Standard VOR Audio Test Signal, audio output levels shall not vary more than 3 dB.
Selectivity	6 dB BW is greater than 9 kHz. 69 dB BW is less than 36 kHz.
Standard Deflection	a) With a standard deflection 'FLY LEFT' condition (90 Hz dominant), the output shall be +90 mV ± 9 mV. b) With a standard deflection 'FLY RIGHT' condition (150 Hz dominant), the output shall be -90 mV ± 9 mV.
Spurious Response	Greater than 60 dB.
Centering Accuracy	Typical 0 ± 3 mV (Max error 9.9 mV per RTCA DO-195).
Audio Output	A minimum 100 mW into a 500 Ω load.
Audio Response	Less than 6 dB of Variation between 350 and 2500 Hz. In voice mode, an ident tone of 1020 Hz shall be attenuated at least 20 dB.
Audio Distortion	The distortion in the receiver audio output shall not exceed 10% at all levels up to 100 mW.

4.2.5 Glideslope Specifications

Table 4-5. GIA 63W Glideslope Specifications

Characteristics	Specifications
Sensitivity	At –93 dBm, deviation output shall not be less than 60% of standard deflection when glideslope deviation test signal is applied.
Centering Accuracy	0 ± .0091 ddm or 0 ± 7.8 mV.
Selectivity	6 dB BW is greater than 17 kHz. 69 dB BW is less than 132 kHz.
Standard deflection	a) With a standard deflection 'FLY DOWN' condition (90 Hz dominant), the output shall be -78 mV ± 7.8 mV. b) With a standard deflection 'FLY UP' condition (150 Hz dominant), the output shall be +78 mV ± 7.8 mV.
Flag	The GS Course Deviation Flag <u>must</u> be flagged: a) When the level of a standard deviation test signal produces 50% or less of standard deflection of the deviation indicator. b) In the absence of 150 Hz modulation. c) In the absence of 90 Hz modulation. d) In the absence of both 90 Hz and 150 Hz modulation. e) In the absence of RF.

4.2.6 Power Requirements

Table 4-6. GIA 63W Power Specifications

Characteristics	Specifications
Input Voltage Range	28 VDC for J601 14/28 VDC for J605 See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages.
Power Requirements for P601 (COM Connector)	0.3 A max @ 27.5 VDC (not transmitting); 4.3 A max @ 27.5 VDC (transmitting)
Superflag Power Requirements for P605 (Main 2 Connector)	Power depends upon loads present on Superflag output pins (see Sections 4.7.2.1 and 4.10.7)
Power Requirements for P605 (Main 2 Connector)	1.0 A @ 27.5 VDC (Without Superflags Active) 2.0 A @ 13.75 VDC (Without Superflags Active)

4.3 Environmental Specifications

Table 4-7. GIA 63W Environmental Specifications

Characteristics	Specifications
Operating Temperature Range	-40°C to +65°C. For more details see Environmental Qualification Form.
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 50,000 ft
Software Compliance	RTCA/DO-178B Level B, C, D
General Appliance Specifications	RTCA/DO-254 Level B and C

4.3.1 Environmental Qualification Form

Refer to the GIA 63W Environmental Qualification Form, Garmin part number 005-00235-00, for a complete list of environmental characteristics.

4.4 TSO/ETSO

The GIA 63W Class 3 WAAS GPS receiver is certified for IFR enroute, terminal, and precision approaches.

The GIA 63W has been qualified to RTCA/DO-160 Section 20 RF susceptibility and Section 22 lightning requirements. Special installation considerations are required, refer to the Environmental Qualification Form.

The GIA 63W meets the requirements for GPS as a Primary Means of Navigation for Oceanic/Remote Operations per FAA Notice N8110.60.

The GIA 63W is eligible for B-RNAV in accordance with AMJ20X2.

Eligible for PRNAV in accordance with PRNAV requirements: JAA Administrative & Guidance Material Section One: General Part 3: Temporary Guidance Leaflets, Leaflet No 10: Airworthiness and Operational Approval for Precession RNAV Operations in Designated European Airspace 7.1 Required Functions.

4.4.1 GIA 63W TSO/ETSO Compliance

Table 4-8. GIA 63W TSO/ETSO

<table>
<tr><th>Function</th><th>TSO/ETSO</th><th>Category</th><th>Applicable LRU Software Part Numbers</th><th>Applicable Custom Logic Device Part Numbers</th></tr>
<tr><td rowspan="5">Automatic Pilots</td><td rowspan="5">TSO-C9c
ETSO-C9c</td><td rowspan="5"></td><td rowspan="5">All
006-B0544-()
except
006-B0544-00
through
006-B0544-09</td><td>All
006-C0084-()
except
006-C0084-00</td></tr>
<tr><td>006-C0072-()</td></tr>
<tr><td>006-C0085-()</td></tr>
<tr><td>All
006-C0039-()
except
00C-C0039-00
through
00C-C0039-02</td></tr>
<tr><td>All
006-C0053-()
except
006-C0053-00</td></tr>
<tr><td rowspan="5">Glideslope Receiver</td><td rowspan="5">TSO-C34e
ETSO-2C34f</td><td rowspan="5"></td><td rowspan="5">All
006-B0544-()
except
006-B0544-00
through
006-B0544-09</td><td>All
006-C0084-()
except
006-C0084-00</td></tr>
<tr><td>006-C0072-()</td></tr>
<tr><td>006-C0085-()</td></tr>
<tr><td>All
006-C0039-()
except
00C-C0039-00
through
00C-C0039-02</td></tr>
<tr><td>All
006-C0053-()
except
006-C0053-00</td></tr>
<tr><td rowspan="5">Localizer Receiver</td><td rowspan="5">TSO-C36e
ETSO-2C36f</td><td rowspan="5">Class A</td><td rowspan="5">All
006-B0544-()
except
006-B0544-00
through
006-B0544-09</td><td>All
006-C0084-()
except
006-C0084-00</td></tr>
<tr><td>006-C0072-()</td></tr>
<tr><td>006-C0085-()</td></tr>
<tr><td>All
006-C0039-()
except
00C-C0039-00
through
00C-C0039-02</td></tr>
<tr><td>All
006-C0053-()
except
006-C0053-00</td></tr>
</table>

* GIA63W ARINC output labels 310 and 311 are not to be used as navigation data per RTCA/DO-229c.

GIA 63W TSO/ETSO Compliance, Continued				
Function	**TSO/ETSO**	**Category**	**Applicable LRU Software Part Numbers**	**Applicable Custom Logic Device Part Numbers**
VOR Receiver	TSO-C40c ETSO-2C40c		All 006-B0544-() except 006-B0544-00 through 006-B0544-09	All 006-C0084-() except 006-C0084-00
				006-C0072-()
				006-C0085-()
				All 006-C0039-() except 00C-C0039-00 through 00C-C0039-02
				All 006-C0053-() except 006-C0053-00
Flight Director Equipment	TSO-C52b ETSO-C52b		All 006-B0544-() except 006-B0544-00 through 006-B0544-09	All 006-C0084-() except 006-C0084-00
				006-C0072-()
				006-C0085-()
				All 006-C0039-() except 00C-C0039-00 through 00C-C0039-02
				All 006-C0053-() except 006-C0053-00
Airborne Navigation Sensors Using the Global Positioning System Augmented by the Wide Area Augmentation System*	TSO-C145a ETSO-C145	Class 3	All 006-B0544-() except 006-B0544-00 through 006-B0544-09	All 006-C0084-() except 006-C0084-00
				006-C0072-()
				006-C0085-()
				All 006-C0039-() except 00C-C0039-00 through 00C-C0039-02
				All 006-C0053-() except 006-C0053-00

* GIA63W ARINC output labels 310 and 311 are not to be used as navigation data per RTCA/DO-229c.

GIA 63W TSO/ETSO Compliance, Continued

Function	TSO/ETSO	Category	Applicable LRU Software Part Numbers	Applicable Custom Logic Device Part Numbers
TAWS	TSO-C151b ETSO-C151a	Class B	All 006-B0544-() except 006-B0544-00 through 006-B0544-09	All 006-C0084-() except 006-C0084-00
				006-C0072-()
				006-C0085-()
				All 006-C0039-() except 00C-C0039-00 through 00C-C0039-02
				All 006-C0053-() except 006-C0053-00
VHF Radio Communications – Transceiver Equipment	TSO-C169	Class 3 and 5 (transmitter) Class C and E (receiver)	All 006-B0544-() except 006-B0544-00 through 006-B0544-09	All 006-C0084-() except 006-C0084-00
				006-C0072-()
				006-C0085-()
				All 006-C0039-() except 00C-C0039-00 through 00C-C0039-02
				All 006-C0053-() except 006-C0053-00
				All 006-C0053-() except 006-C0053-00

* GIA63W ARINC output labels 310 and 311 are not to be used as navigation data per RTCA/DO-229c.

4.4.2 GIA 63W TSO/ETSO Deviations

Table 4-9. GIA 63W TSO/ETSO Deviations

TSO/ETSO	Deviation
TSO-C9c	1. Garmin was granted a deviation from TSO-C9c to use SAE AS 402B instead of AS-402A.
	2. Garmin was granted a deviation from TSO-C9c to use DO-160E instead of specified environmental tests.
	3. Garmin was granted a deviation from TSO-C9c subpart A (c), which requires marking the weight of the unit on the unit. Garmin will provide this information in the installation manual in lieu of marking on the serial tag. Garmin does not currently list the weight on other avionics units. This deviation has been previously requested and approved for various Garmin products.
	4. Garmin was granted a deviation from SAE AS 402B paragraph 4.4.1 to limit autopilot engagement to attitudes considered safe for the certified aircraft.
	5. Garmin was granted a deviation from SAE AS 402B paragraph 4.3.2 to not provide servo effort indications when the automatic pilot is not engaged.
ETSO-C9c	1. Garmin was granted a deviation from ETSO-C9c to use SAE AS-402B instead of AS-402A.
	2. Garmin was granted a deviation from ETSO-C9c to use DO-160E instead of the specified environmental tests.
	3. Garmin was granted a deviation from AS-402B paragraph 4.3.2 to not provide servo effort indications when the automatic pilot is not engaged.
	4. Garmin was granted a deviation from AS-402B paragraph 4.4.1 to limit autopilot engagement to attitudes considered safe for the certified aircraft.
	5. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C34e	1. Garmin was granted a deviation from TSO-C34e to use DO-160E instead of DO-160B, and DO-178B instead of DO-178A.
ETSO-2C34f	1. Garmin was granted a deviation from ETSO-2C34f to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C36e	1. Garmin was granted a deviation from TSO-C36e to use DO-160E instead of DO-160B, and DO-178B instead of DO-178A.
ETSO-2C36f	1. Garmin was granted a deviation from ETSO-2C36f to use DO-160E instead of DO-160D
	2. Garmin was granted a deviation from ETSO-2C36f to use ED-46B amendment 2 in addition to ED 46B
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals"
ETSO-2C37e	1. Garmin was granted a deviation from ETSO-2C37e to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from ETSO-2C37e to use ED-23B amendment 3 in addition to ED-23B.
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".

TSO Deviations, continued	
TSO/ETSO	**Deviation**
ETSO-2C38e	1. Garmin was granted a deviation from ETSO-2C38e to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from ETSO-2C38e to use ED-23B amendment 3 in addition to ED-23B.
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C40c	1. Garmin was granted a deviation from TSO-C40c to use DO-160E instead of DO-160B, and DO-178B instead of DO-178A.
ETSO-2C40c	1. Garmin was granted a deviation from ETSO-2C40c to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".
TSO-C52b	1. Garmin was granted a deviation from SAE AS 8008 paragraph 3.6 to limit flight director operation to attitudes considered safe for the certified aircraft.
	2. Garmin was granted a deviation from TSO-C52b to use DO-160E instead of DO-160C.
ETSO-C52b	1. Garmin was granted a deviation from ETSO-C52b to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from AS-8008 paragraph 3.6 to limit flight director operation to attitudes considered safe for the certified aircraft.
	3. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals".

TSO Deviations, continued	
TSO/ETSO	**Deviation**
TSO-C145a	1. Garmin was granted a deviation from TSO-C145a to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from RTCA/DO-229C paragraphs 2.1.1.10, 2.1.1.7, 2.1.1.8.1, 2.1.1.8.2, 2.1.1.9, 2.1.2.1, 2.1.3.1, 2.1.4.1.4, 2.1.4.1.5 and 2.1.5.1 in the form of an operational limitation to achieve an equivalent level of safety.
ETSO-C145	1. Garmin was granted a deviation from ETSO-C145 to use DO-160E instead of DO-160D
	2. Garmin was granted a deviation from ETSO-C145 to use DO-229C instead of DO-229A
	3. Garmin was granted a deviation from RTCA/DO-229C paragraphs 2.1.1.10, 2.1.1.7, 2.1.1.8.1, 2.1.1.8.2, 2.1.1.9, 2.1.2.1, 2.1.3.1, 2.1.4.1.4, 2.1.4.1.5 and 2.1.5.1 in the form of an operational limitation to achieve an equivalent level of safety.
	4. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approvals"
TSO-C151b	1. Garmin was granted a deviation from TSO-C151b to use DO-160E instead of DO-160D.
ETSO-C151a	1. Garmin was granted a deviation from ETSO-C151b to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation from EASA 21A.807 (a) 4 which requires all applicable ETSO numbers to be permanently and legibly marked on each article. The primary ETSO will be listed on the appliance tag along with the statement "See Install Manual for Additional Appliance Approval".
TSO-C169	1. Garmin was granted a deviation from TSO-C169 to use DO-160E instead of DO-160D.
	2. Garmin was granted a deviation to TSO-C169, paragraph 4.d requirement to mark the installation procedures drawing number on the equipment. Garmin will mark as follows, which Garmin believes meets the intent of the requirement. The Install Manual is part of the furnished data package. TSO-C145a See Install Manual for additional appliance approvals
	3. Garmin was granted a deviation to TSO-C169, paragraph 4.e requirement to mark (DEV) after the TSO number on the equipment. Garmin will mark as follows, as TSO-C169 is not the primary TSO and the Install Manual contains all of the TSO-C169 information including deviations. TSO-C145a See Install Manual for additional appliance approvals
	4. Garmin was granted to deviate from TSO-C169 by allowing a 6dB reduction of transmitter power during the Normal Operating Conditions – Emergency Operation Voltage as described in RTCA document DO-186a paragraph 2.5.13.1 and RTCA document DO-160E paragraph 16.6.1.1.

4.4.3 Pilot Operating Handbook Considerations

Due to the equipment's TSO qualified performance in tracking low-elevation-angle satellites, the following limitations are required to be included in the Aircraft Flight Manual or Aircraft Flight Manual for certified G1000 installations. Garmin also recommends this information be included in the builder specific pilot operating handbook on G900X installations.

Supplement:

This equipment does not comply with US 14 CFR Part 91, SFAR 97 requirements for TSO-C145a/TSO-146a equipment. Until complete compliance is demonstrated and approved by the FAA, authorization to conduct any GPS or WAAS operation under Instrument Flight Rules (IFR) requires that:

1. Aircraft using the GPS or WAAS capability of the GIA 63W navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight with the exception of oceanic and remote operations.

2. For flight planning purposes, if an alternate airport is required, it must have an approved instrument approach procedure other than GPS or RNAV that is anticipated to be operational and available at the estimated time of arrival. All equipment required for this procedure must be installed and operational.

3. For flight planning purposes, Garmin Prediction Program 006-A0154-01 with the <***insert installed antenna part number***> antenna selection should be used to confirm the availability of RAIM for the intended flight in accordance with the local aviation authority guidelines for TSO-C129a equipment. WAAS NOTAMs (or their absence) and generic prediction tools do not provide an acceptable indication of the availability for the GIA 63W equipment.

4. When flight planning an LNAV/VNAV or LPV approach, operators should use the Garmin Prediction Program 006-A0154-01 with the <***insert installed antenna part number***> antenna selection in addition to any NOTAMs issued for the approach.

4.5 Installation Requirements

4.5.1 Required Accessories

Each of the following accessories is provided separately from the GIA 63(W) and is required to install the unit.

Table 4-10. GIA 63W Required Accessories

Item	Garmin P/N
GIA 63 Unit Rack	115-00426-00
Rack Nutplate Kit	011-00915-01
GIA 63 Back Plate	011-00963-00
GIA 63 Connector Kit	011-01000-01

4.5.2 Additional Equipment Required

The following installation accessories are required but not provided:

COM Antenna:	Shall meet TSO-C37(), C38(), and C-169(). Broad band, 50 Ω, vertically polarized with coaxial cable
GPS Antenna:	Refer to Section 4.5.2.1.
VOR/LOC Antenna:	Shall meet TSO-C40(), C36(), and C-169(). Broad band, 50 Ω, horizontally polarized with coaxial cable
Glideslope Antenna:	Shall meet TSO-C34(). Broad band, 50 Ω, horizontally polarized with coaxial cable or low-loss splitter used with the VOR/LOC antenna
Headphones:	500 Ω nominal impedance Microphone: Low impedance, carbon or dynamic, with transistorized pre-amp

4.5.2.1 WAAS GPS Antennas

The following is a list of WAAS GPS antennas, currently supported by the G900X:

Table 4-11. GIA 63W Recommended WAAS Antennas

Model	Mount Style	Conn Type	SATCOM Compatible [3]	Mfr	Antenna Part Number	Garmin Order Number	Additional Requirements
GA 35 GPS WAAS Antenna [4,7]	Screw Mount, Teardrop Footprint [2]	TNC	Yes	Aero Antenna	AT575-93GW-TNCF-000-RG-27-NM	013-00235-00	The operational limitation described in Section 4.4.3 requires use of 006-A0154-01 as the Prediction Program in conjunction with these antennas.
				Garmin	013-00235-00		
A-34 GPS WAAS Antenna	Screw Mount, Teardrop Footprint [2]	TNC	Yes	Aero Antenna	AT575-93W-TNCF-000-05-26-NM	013-00113-00	
				Garmin AT	590-1112		
GA56A GPS WAAS Antenna*	Screw Mount, ARINC 743 Footprint	BNC	No	Garmin	011-01154-00	010-10599-00	
GA56W GPS WAAS Antenna (not yet approved)	Stud Mount, Teardrop Footprint [1]	BNC	No	Garmin	011-01111-00	010-10561-01	
GA57 GPS WAAS and FIS Antenna (not yet approved	Screw Mount, ARINC 743 Footprint	BNC TNC [5]	No	Garmin	011-01032-00	010-10604-00	
Comant 2580-200 WAAS and COM Antenna [4,7]	Screw Mount, Teardrop Footprint	BNC TNC [6]	Yes	Comant	CI 2580-200	N/A	
Comant 2580-410 FIS/WAAS /COM Antenna [4,7]					CI 2580-410		
Comant 428-200 WAAS Antenna [4,7]	Screw Mount, ARINC 743 Footprint	TNC	Yes	Comant	CI 428-200	N/A	
Comant 428-410 FIS/WAAS Antenna [4,7]					CI 428-410		

[1] Same footprint and mounting hole pattern as GA 56.

[2] Same mounting hole pattern as GA 56, but GA 35 and A34 antenna have a physically larger footprint.

[3] SATCOM compatibility requirements are as specified by RTCA/DO-229C Section 2.5.6.1, Section 2.5.8.2, Appendix C.2.1, and Appendix C.2.2.

[4] It is anticipated that there will be no operational limitations when using this antenna in conjunction with a future version of GPS software.

[5] The WAAS GPS antenna connector is a BNC type. The XM antenna connector is a TNC type.

[6] The WAAS GPS antenna connector (and XM antenna connector where applicable) is TNC type. The VHF COM antenna connector is BNC type.

[7] Not approved for use with the GIA 63 (non-WAAS) since max DC current specification exceeds 40 mA.

Other TSO-C144 antennas may meet the installation requirements of the GIA 63W. Contact Garmin to ensure compatibility and applicable operation limitations before beginning the installation.

4.6 Installation Considerations

The GIA 63W interfaces with the G900X system and with various avionics equipment. Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GIA 63W. Refer to Section 12 for Shield Block information and Appendix D for system interconnects.

4.6.1 GIA 63W Minimum Installation Requirements

Below is a list of required devices for TSO-C145a category Class Beta 3 certification.

Manual Course Device
This device delivers the manual course select to the GIA 63W, which is required for the VOR receiver, and optional for the GPS receiver. Course information can come from an analog resolver, or from the GDU PFD/MFD via Ethernet HSDB.

GDU PFD/MFD
This device displays Nav Flag, Left/Right, To/From, Glideslope Flag, and Up/Down as well as integrity messages. In addition it provides manual course selection to the GIA, which is required for the VOR receiver and optional for the GPS receiver.

Qualified GPS Antenna
This antenna must be one of those listed in Section 4.5.2.1, and meet the following requirements:

1. DO-160D Environmental Conditions
The antenna shall meet the environmental conditions listed below and shall conform to the test requirements of RTCA DO-160D.

Environmental Condition		Category	Description
Temperature	(operating)	F2	-55 to +70°C
	(ground survival)	F2	-55 to +85°C
Altitude		F2	55,000 feet
Temperature Variation		A	10°C per minute
Operational Shocks & Crash Safety		B	
Sustained Crash Safety			Aircraft type 5, Test type R
Humidity		B	95% at +55°C
Vibration		CLY	Turbo/Reciprocating/Helicopter
Waterproofness		S	Continuous Stream
Fluids		F	Deicing Fluid, SAE Type I, Spray Test Anti-Icing Fluid, SAE Type IV, Spray Test Av Gas, 100LL, Spray Test Jet A Fuel, Spray Test Isopropyl Alcohol, Immersion Test Denatured Alcohol, Immersion Test
Sand and Dust		D	
Salt Spray		S	
Magnetic Effect		Z	
Induced Signal Susceptibility		Z	
Radio Frequency Susceptibility		W	Radiated and Conducted
Emission of Radio Frequency Energy		H	
Lightning Induced Transients		A3E3	
Lightning Direct Effects		2A	Direct Effects, (Non functional following test)
Icing		C	0.5” thick

2. Electrical Characteristics

LNA Supply Voltage	4.5 - 5.5 VDC
LNA Supply Current	$25 \leq x \leq 50$mA
LNA Operating Frequency	1575.42 ± 10.00 MHz
LNA Gain	26.5 dB Minimum
LNA Noise Figure	4.0 dB Maximum
LNA Bandwidth	
(-3 dB)	20 MHz Minimum
(-50 dB)	-80 MHz, +50 MHz Maximum
Differential Group Delay	50 nS Maximum across 3 dB BW

3. Radiation Characteristics

Polarization	RHCP
Operating Frequency	1575.42 ±10.00 MHz
Gain >15 degrees elevation	-2.0 dBic Minimum
Axial Ratio	
(>10 degrees elevation)	3.0 dB Maximum
(5 ≤ 10 degrees elevation)	6.0 dB Maximum

4. Mounting Requirements

Cable connection	BNC Female
Mounting studs	Four 8-32 UNC-2A studs 0.50” long

4.7 Mounting Requirements

The GIA 63W is to be mounted using the G900X rack system. The unit may also be mounted remotely if desired. The kit builder must fabricate any additional mounting equipment needed, use outline and installation drawings in Appendix C for reference.

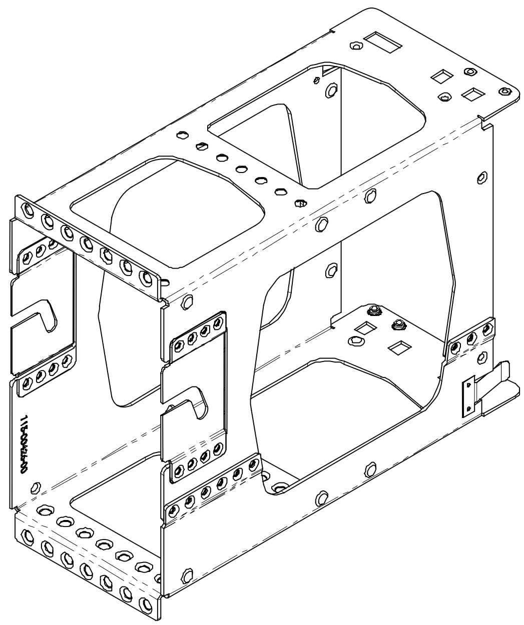


Figure 4-1 GIA 63W Unit Rack

4.8 Unit Installation

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the backshell connectors.

2. Connect backshell connectors to the rear plate using the provided screws.

3. Mount the unit rack to the main system rack or other suitable mounting location using the provided nutplates.

4. Assemble the NAV and Main rear plates into the GIA 63W unit rack.

5. Carefully slide the GIA 63W into the rack. Ensure that the orientation of the unit allows for the engagement of the locking stud in the channel on the rack. The unit can only be installed in one direction.

6. Push the GIA 63W lever down towards the bottom of the unit. This engages the locking stud with the dogleg slot and locks unit into the rack. If there is excessive resistance, do not force the unit.

7. Lock the handle into the GIA 63W body and tighten the Phillips screw.

CAUTION

Do not use excessive force when inserting the GIA 63W into the rack. This may cause damage to the connectors, unit and/or unit rack. If excessive resistance is felt during installation, stop! Remove the GIA 63W and identify the source of resistance. The rear plates are designed to float in the unit rack. Check to ensure the rear plates are not bound by the connectors or spring clip.

4.8.1 License Requirements

The Telecommunications Act of 1996, effective February 8, 1996, provides the FCC discretion to eliminate radio station license requirements for aircraft and ships. The GIA 63W installation must comply with current transmitter licensing requirements. To find out the specific details on whether a particular installation is exempt from licensing, please visit the FCC web site http://wireless.fcc.gov/aviation.

Transmitter Description:	Aviation-band VHF transceiver with 25 and 8.33 kHz channel spacing.
Antenna Characteristics:	Broad band, 50 ohm, vertically polarized.
Rated Power:	16 Watts
Emission Type:	6K00A3E
Frequency of Operation:	118.00 – 136.992 MHz

If an aircraft license is required, make application for a license on FCC form 404, application for Aircraft Radio Station License. The FCC also has a fax-on-demand service to provide forms by fax. The GIA 63W owner accepts all responsibility for obtaining the proper licensing before using the transmitter.

International transmitter license procedures vary by country. Contact the local spectrum agency for license requirements.

CAUTION

The VHF transmitter in this equipment is guaranteed to meet federal communications commission acceptance over the operating temperature range. Modifications not expressly approved by Garmin could invalidate the license and make it unlawful to operate the equipment.

4.9 Continued Airworthiness

Maintenance of the GIA 63W is “on condition” only.

5 GEA 71

5.1 Equipment Description

The GEA 71 is a micro-processor based input/output Line Replaceable Unit (LRU) used to monitor sensor inputs and drive annunciator outputs for aircraft airframe and engine systems. The GEA 71 interfaces with various sensors on the aircraft and communicates airframe and engine information via RS-485 digital interface to GIA 63W Integrated Avionics Units or IAUs. The GIA 63Ws then interface with the GDU 1040 Primary Flight Display (PFD) and Multi-Function Display (MFD). Typically, the MFD shows engine instrumentation while the PFD normally shows airframe alerts provided by the GEA 71. Engine/airframe instrumentation is also displayed on the PFD and/or MFD while the system is in reversionary mode. The PFD and MFD displays serve as the user interface for the GEA 71. All configuration settings are controlled via software settings accessed by the MFD and PFD displays.

The GEA 71 uses a configuration module temperature sensor and a thermocouple sensor housed in a backshell assembly to monitor backshell junction temperatures. This capability is only needed in the event thermocouple engine temperature sensors are used.

5.1.1 Interface Summary

The following list is an interface summary for the GEA 71 unit:

- 18 Analog Inputs (All differential inputs; 4 inputs are current monitor capable)
- 12 Engine Temperature Analog Inputs (differential Inputs)
- 23 Discrete Inputs
- 12 Digital Inputs*
- 18 Discrete Annunciate Outputs
- Two RS-485 channels that interface to GIA 63 IAUs
- Software & Configuration data input from G900X system
- Aircraft Power Input (Power-on controlled by aircraft avionics power bus)

  *Note that all digital inputs can also be configured as discrete inputs if desired.

5.2 Electrical Specifications

Table 5-1. GEA 71 Electrical Specifications

Characteristic	Specification
Input Voltage	14/28 VDC See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages.

Unit Status	Max Current @ 28 VDC	Max Current @ 14 VDC (Optional)
Off	0.01 A	0.01 A
On	0.15 A	0.30 A
On*	0.50 A	1.00 A

*Full Load On Transducer Power Outputs.

NOTE

During the first five seconds of unit power-up, current is slightly higher due to backup capacitors being charged. Estimate initial power-up current to be ~50 mA @ 28 VDC higher or ~100 mA @ 14 VDC higher than the above figures.

5.3 Environmental Specifications

Table 5-2 contains general environmental specifications. For detailed specifications, see the Environmental Qualification.

Table 5-2. GEA 71 Environmental Specifications

Characteristic	Specification
Operating Temperature Range	-55° C to +70° C
Software Compliance	RTCA DO-178B Level B
Environmental Compliance	RTCA DO-160D

5.3.1 Environmental Qualification Form

Refer to the GEA 71 Environmental Qualification Form, Garmin part number 005-00147-02, for a complete list of environmental characteristics.

5.4 TSO/ETSO

Table 5-3 contains a list of applicable TSO/ETSOs for the GEA 71.

Table 5-3. GEA 71 TSO/ETSO

Function	TSO/ETSO	Category	Applicable LRU SW Part Numbers
Fuel Flow Meters	TSO-C44b ETSO-C44b	Type I	006-B0193-()
Temperature Instruments	TSO-C43c ETSO-C43c	Class IIa	006-B0193-()
Manifold Pressure Instruments	TSO-C45a ETSO-C45a	Type II	006-B0193-()
Pressure Instruments-Fuel, Oil, and Hydraulic	TSO-C47 ETSO-C47	Type II	006-B0193-()
Electric Tachometer	TSO-C49b ETSO-C49b	N/A	006-B0193-()
Fuel and Oil Quantity Instruments	TSO-C55 ETSO-C55	Types I & II	006-B0193-()

5.4.1 TSO/ETSO Deviations

Table 5-4 contains a list of TSO/ETSO deviations granted to Garmin for the GEA 71:

Table 5-4. GEA 71 TSO/ETSO

TSO/ETSO	Deviation
TSO-C43c	1. Garmin was granted a deviation from TSO-C43c to use SAE AS 8005A in place of SAE AS 8005 to demonstrate compliance for Temperature Instruments.
	2. Garmin was granted a deviation from TSO-C43c section a.2 to use RTCA DO-160D in place of RTCA DO-160C for the Environmental Standard.
ETSO-C43c	1. Garmin was granted a deviation from ETSO-C43c to use SAE AS 8005A in place of SAE AS 8005 to demonstrate compliance for Temperature Instruments.
	2. Garmin was granted a deviation from ETSO-C43c section a.2 to use RTCA DO-160D in place of RTCA DO-160C for the Environmental Standard.
TSO-C44b	1. Garmin was granted a deviation from TSO-C44b section a.3 to use RTCA DO-160D in place of SAE AS 407B for the Environmental Standard.
	2. Garmin was granted a deviation from TSO-C44b section b.1 to not display the software part number on the outside of the unit. Notice 8110.49 paragraph 5-4.d states, "For airborne equipment having separate part numbers for hardware and software, the software part number need not be displayed on the outside of the unit, as long as it can be verified through some kind of electronic query."
	3. Garmin was granted a deviation from TSO-C44b to use SAE AS 407C in place of SAE AS 407B to demonstrate compliance for Fuel Flowmeters.
ETSO-C44b	1. Garmin was granted a deviation from ETSO-C44b section a.3 to use RTCA DO-160D in place of SAE AS 407B for the Environmental Standard.
	2. Garmin was granted a deviation from ETSO-C44b section b.1 to not display the software part number on the outside of the unit. Notice 8110.49 paragraph 5-4.d states, "For airborne equipment having separate part numbers for hardware and software, the software part number need not be displayed on the outside of the unit, as long as it can be verified through some kind of electronic query."
	3. Garmin was granted a deviation from ETSO-C44b to use SAE AS 407C in place of SAE AS 407B to demonstrate compliance for Fuel Flowmeters.
TSO-C45a	1. Garmin was granted a deviation from TSO-C45a section a.4 to use RTCA DO-160D in place of RTCA DO-160C for the Environmental Standard.
ETSO-C45a	1. Garmin was granted a deviation from ETSO-C45a section a.4 to use RTCA DO-160D in place of RTCA DO-160C for the Environmental Standard.
TSO-C47	1. Garmin was granted a deviation from TSO-C47 to use SAE AS 408C in place of SAE AS 408A to demonstrate compliance for Pressure Instruments, Fuel Oil and Hydraulic.
	2. Garmin was granted a deviation from TSO-C47 to use the environmental standards set forth in RTCA DO-160D in place of the environmental standards set forth in SAE AS 408C.
ETSO-C47	1. Garmin was granted a deviation from ETSO-C47 to use SAE AS 408C in place of SAE AS 408A to demonstrate compliance for Pressure Instruments, Fuel Oil and Hydraulic.
	2. Garmin was granted a deviation from ETSO-C47 to use the environmental standards set forth in RTCA DO-160D in place of the environmental standards set forth in SAE AS 408C.
TSO-C49b	1. Garmin was granted a deviation from TSO-C49b to use SAE AS 404C in place of SAE AS 404B to demonstrate compliance for Electric Tachometer Instruments.
	2. Garmin was granted a deviation from TSO-C49b section a.3 to use RTCA DO-160D in place of SAE AS 407B for the Environmental Standard.
ETSO-C49b	1. Garmin was granted a deviation from ETSO-C49b to use SAE AS 404C in place of SAE AS 404B to demonstrate compliance for Electric Tachometer Instruments.
	2. Garmin was granted a deviation from ETSO-C49b section a.3 to use RTCA DO-160D in place of SAE AS 407B for the Environmental Standard.

TSO/ETSO	Deviation
TSO-C55	1. Garmin was granted a deviation from TSO-C55 to use SAE AS 405C in place of SAE AS 405B to demonstrate compliance for Fuel and Oil Quantity Instruments for Reciprocating Engine Aircraft.
	2. Garmin was granted a deviation from TSO-C55 to use the environmental standards set forth in RTCA DO-160D in place of environmental standards set forth in SAE AS 405C.
ETSO-C55	1. Garmin was granted a deviation from ETSO-C55 to use SAE AS 405C in place of SAE AS 405B to demonstrate compliance for Fuel and Oil Quantity Instruments for Reciprocating Engine Aircraft.
	2. Garmin was granted a deviation from ETSO-C55 to use the environmental standards set forth in RTCA DO-160D in place of environmental standards set forth in SAE AS 405C.

5.5 Installation Requirements

5.5.1 Equipment Available

Each of the following accessories are provided separately for the GEA 71:

Table 5-5. GEA 71 Accessories

Item	Garmin Catalog Part Number
GEA 71 Unit Rack	115-00411-00
G900X Rack Nutplate Kit	011-00915-00
GEA 71 Back Plate (‘A’ Keyplate)	011-00796-00
GEA 71 Connector Kit	011-00797-03
Configuration Module Kit	011-00979-00
Thermocouple Kit	011-00981-00

5.6 Installation Considerations

The GEA 71 interfaces with the GIA 63W IAU and with various sensors on the aircraft. Fabrication of a wiring harness is required. Refer to Section 12 for Shield Block information and Appendix D for system interconnects.

5.6.1 G900X Supported Engines

The following is a list of engines, currently supported by the G900X software:

- Continental TSIO-550-E
- Continental IO-550-N
- Lycoming IO-540-D4A5, D4B5, N1A5, T4A5D, T4B5, T4B5D, T4C5D, V4A5D,
- Lycoming O-540-A*
- Lycoming IO-360-A*, C*, D*, J*, K*, AIO-360* (200 hp)
- Lycoming IO-360-M1A, M1B, B* (Except B1C, B1A), E*, F* (180 hp)
- Lycoming O-360-A* (Except A1C, A4FN), C* (Except C2B, C2D)
- Lycoming O-320- A*, B*, D*, E* (Except D2J)

Other engine configurations may be added as appropriate. Contact Garmin if your engine is not listed to ensure compatibility and applicable operating limitations before beginning the installation.

NOTE

The engine indicating system in the G900X is configured based on the "ENGINE" option that is selected during the software configuration process. Engine gauges, ranges, color bands, and caution and warning indications are established based on the engine manufacturer's recommended guidance. The installer does not have the ability to manually configure each parameter of the engine indicating system.

5.6.2 G900X Supported Sensors

Table 5-6 contains a list of G900X supported sensors.

CAUTION

Due to required software configuration necessary to interface with the G900X, only those sensors listed in Table 5-6 are acceptable to ensure proper system operation. Failure to use the sensors specified below may result in damage to the sensor or G900X system.

Table 5-6. G900X Supported Sensors

Sensor	Manufacturer	Sensor P/N	Sensor Type	GEA 71 Connection
EGT	Alcor	86255	K Thermocouple	ENGINE TEMP ANALOG IN 7 - 12
CHT	Alcor	86253 (one-piece) or 86252 with 28202 adapter (two-piece)	K Thermocouple	ENGINE TEMP ANALOG IN 1 - 6
TIT	Alcor	86245	K Thermocouple	ANALOG IN 6 - 7
RPM	UMA	Mechanical drive sender 1A3C-2	Tachometer Sending Unit	DIGITAL IN* 2
		Mag Bleed Port (T1A9-1 (Slick), or T1A9-2 (Bendix)	Tachometer Sending Unit	
Battery Ammeter	UMA	1C4	Shunt	ANALOG/CURRENT MON IN 1A
Alternator Ammeter	UMA	1C4	Shunt	ANALOG/CURRENT MON IN 2A
Auxiliary Ammeter	UMA	1C1	Shunt	ANALOG/CURRENT MON IN 3A
Position Sensor	Ray Allen	T2/T3 series servos and POS series position sensors	Slide Potentiometer	ANALOG IN 8 - 10
Fuel Pressure (carb)	UMA	T1EU35G-CS (TSO), or N1EU35G-CS (Non-TSO)	Pressure Transducer	ANALOG IN 2A
Fuel Pressure (injected)	UMA	T1EU70G-CS (TSO), or N1EU70G-CS (Non-TSO)	Pressure Transducer	ANALOG IN 2A
Manifold Pressure	UMA	T1EU70A-CS (TSO), or N1EU70A-CS (Non-TSO)	Pressure Transducer	ANALOG IN 3

G900X Supported Sensors, continued				
Sensor	**Manufacturer**	**Sensor P/N**	**Sensor Type**	**GEA 71 Connection**
Oil Pressure	UMA	T1EU150G-CS (TSO), or N1EU150G-CS (Non-TSO)	Pressure Transducer	ANALOG IN 2
Fuel Flow	Floscan	201-030-00 (Model 201B-6)	Turbine Flow Transducer	DIGITAL IN* 3A
Fuel Quantity	Electronics International	P-300C	Capacitive type fuel quantity sender	DIGITAL IN* 1A AND 2A
Fuel Quantity	~	~	Resititve type fuel quantity sender	ANALOG IN 3A AND 4A
Carb Temp	UMA	1B10R-C	Platinum RTD	ANALOG IN 1A
Oil Temp	UMA	1B3-2.5R-C	Platinum RTD	ANALOG IN 1

Table 5-7. Sensor Quantity by Engine Type

Measurement	Carbureted Engines		Fuel Injected Engines		Turbocharged Engines
	4 Cylinder	6 Cylinder	4 Cylinder	6 Cylinder	6 Cylinder
EGT	4	6	4	6	6
CHT	4	6	4	6	6
TIT	N/A	N/A	N/A	N/A	2
Carb Temp	1	1	N/A	N/A	N/A
RPM	1	1	1	1	1
Battery Ammeter	1	1	1	1	1
Alternator Ammeter	1	1	1	1	1
Auxiliary Ammeter	1 (Optional)	1 (Optional)	1 (Optional)	1 (Optional)	1 (Optional)
Position Sensor	Up to 3 (Optional)	Up to 3 (Optional)	Up to 3 (Optional)	Up to 3 (Optional)	Up to 3 (Optional)
Fuel Pressure	1	1	1	1	1
Manifold Pressure	1	1	1	1	1
Oil Pressure	1	1	1	1	1
Fuel Flow	1	1	1	1	1
Oil Temp	1	1	1	1	1

NOTE

The following sections contain general guidance on engine and airframe sensor installation. This information is provided for reference only. The installer should always follow any installation guidance and instructions provided by the applicable engine, sensor, or kitplane manufacturer. Additionally, all installation practices should be done in accordance with AC 43.13-1B.

5.6.2.1 EGT (Exhaust Gas Temperature) Sensor

Sensor Description:

Type K grounded thermocouple probe with integrated clamp for mounting in exhaust pipe.

General Installation Guidance:

To maintain G900X Engine Indicating System (EIS) measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs on the GEA. If the supplied sensor wires are not long enough to connect directly to the GEA, then Type K TC extension wire must be used. To minimize risk of breakage, it is recommended that a high-quality stranded (as opposed to solid) thermocouple wire be used. TT-K-22S Type K thermocouple wire from Omega Engineering is one such example of appropriate wire.

Alcor P/N 59180 EGT Installation Instructions should be referenced for complete installation details. Engine manufacturer's guidance should be consulted and followed for proper location of EGT probes.

1. EGT probes (Figure 5-1) should optimally be mounted between 2 and 4 inches from the cylinder head on a flat portion of the exhaust tube. To maintain consistent readings across cylinders, all probes should be mounted an equal distance from the exhaust flanges.
2. Carefully center punch the probe hole locations so that the external portion of the probe does not interfere with any other parts of the engine or cowling (Figure 5-2). It may be desirable to angle the probes towards the rear of the engine allow efficient wire routing back to the cockpit.
3. Carefully insert probe into the exhaust pipe and tighten clamp snugly with screwdriver.
4. Connect the EGT probes to the thermocouple extension wire. Provide strain relief for the assembly by either fastening the probe leads to the valve covers with a clamp, or by tying the extension wire to the intake tubes or other suitable location. A finger-sized loop should be provided to allow appropriate strain relief, and care should be taken to ensure that no chafing of the wires occurs. See Figure 5-3 for an example of an installed EGT probe.

Figure 5-1. EGT Package

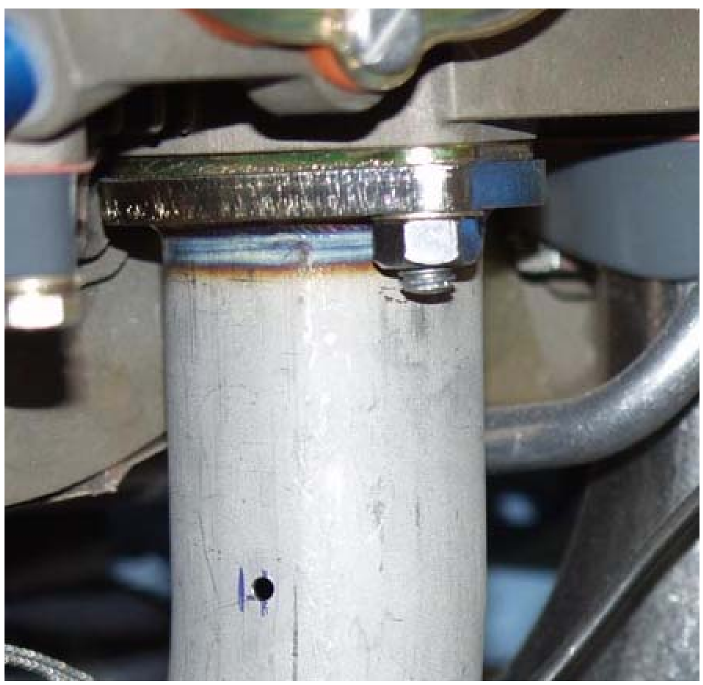


Figure 5-2. Exhaust Pipe Drilled

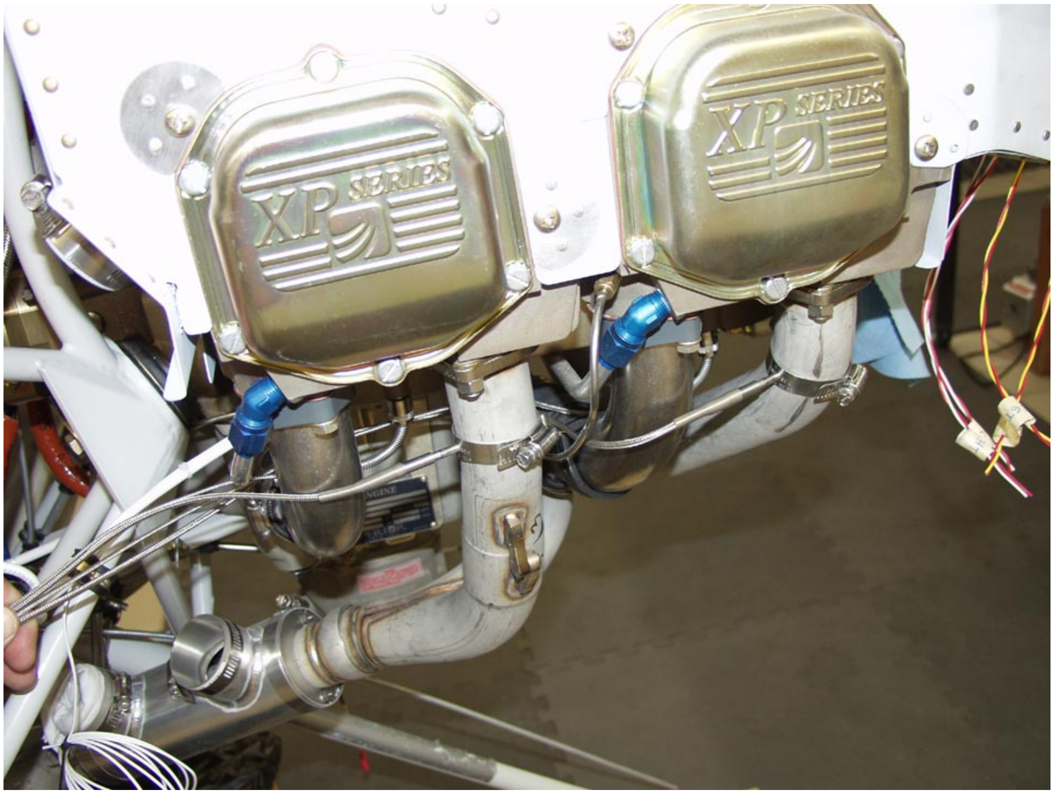


Figure 5-3. Installed EGT Probe Orientation

5.6.2.2 CHT (Cylinder Head Temperature) Sensor

Sensor Description:

Type K grounded thermocouple installed in CHT well. Two probe options exist:

1. Two piece bayonet probe with separate probe well adapter (Alcor P/N 86252 and 28202)
2. One piece probe with integrated well adapter (Alcor P/N 86253)

Both one piece and two piece probes are electrically equivalent. The one piece probe has the advantage of not requiring the external CHT well adapter (reduced cost), while the two piece probe may provide a more simplified installation and removal.

General Installation Guidance:

To maintain measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs on the GEA. If the supplied sensor wires are not long enough to connect directly to the GEA, then Type K TC extension wire must be used. To minimize risk of breakage, it is recommended that a high-quality stranded (as opposed to solid) thermocouple wire be used. One such example of appropriate wire would be TT-K-22S Type K thermocouple wire from Omega Engineering.

Alcor P/N 59188 CHT Installation Instructions should be referenced for complete installation details when using the two piece probe, while Alcor P/N 59167 CHT Installation Instructions should be referenced for complete installation details when using the one piece probe. Engine manufacturer's guidance should always be consulted for proper location of CHT probes. As with the EGT probe installation, a finger sized loop should be provided to allow sufficient strain relief of the probe assembly, and care should be taken to ensure that no chafing of the wires occurs.

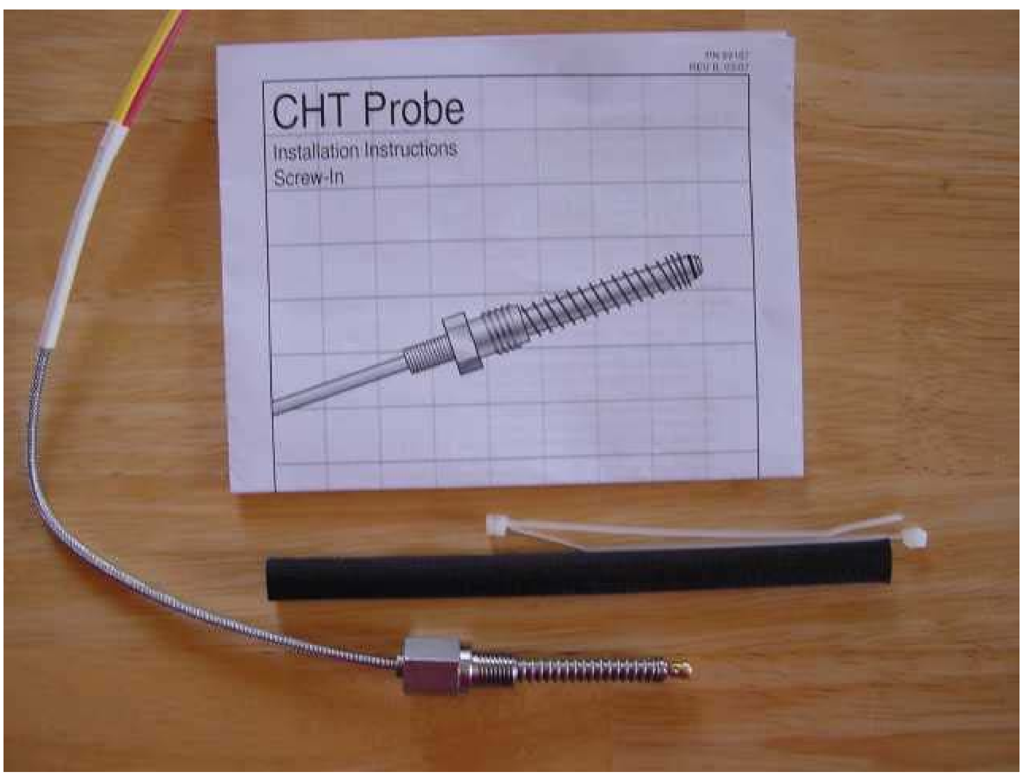


Figure 5-4. One Piece CHT Probe Package

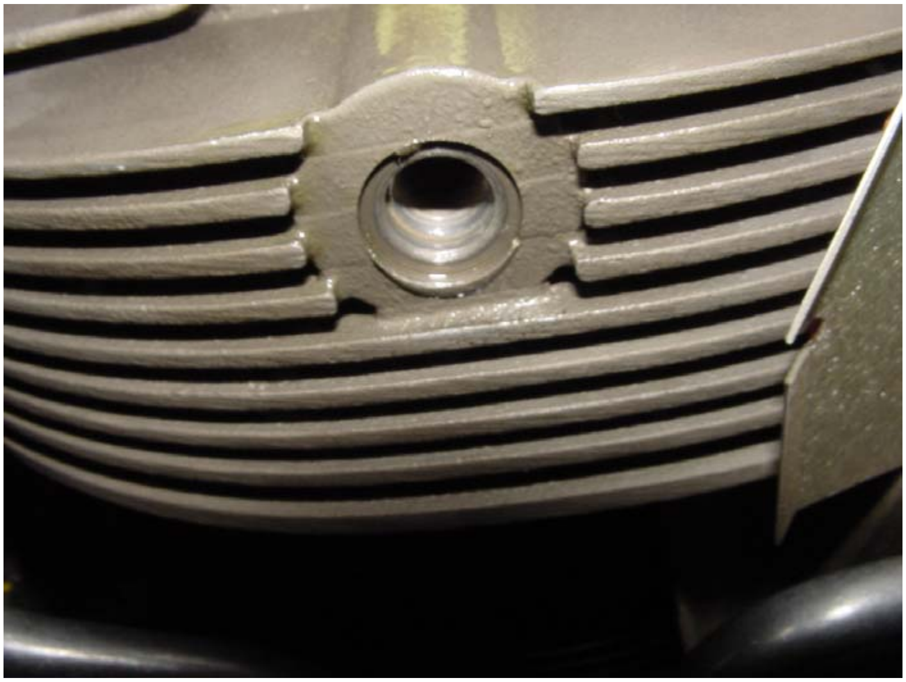


Figure 5-5. CHT Probe Well

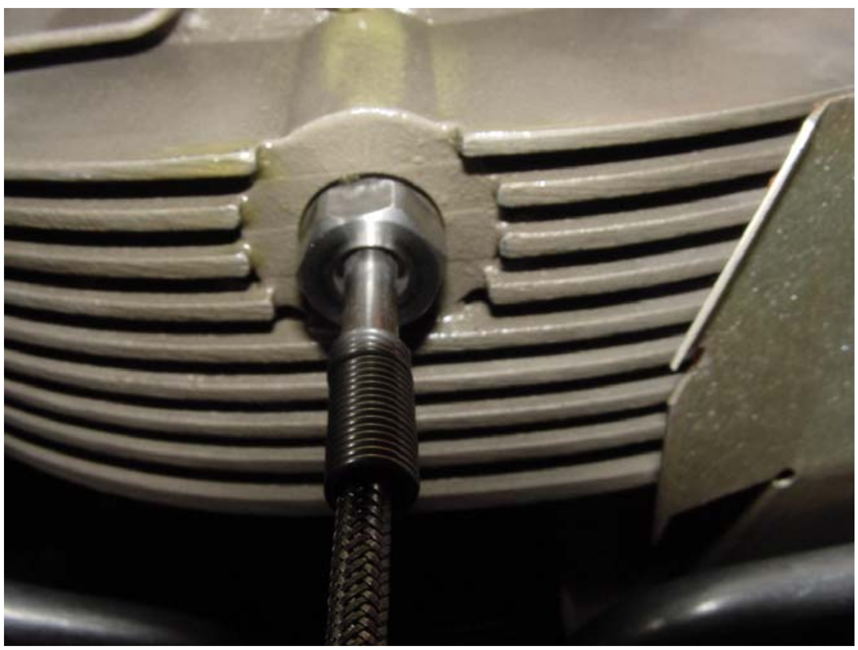


Figure 5-6. One Piece CHT Probe Installed

5.6.2.3 TIT (Turbine Inlet Temperature) Sensor

Sensor Description:

Type K grounded thermocouple probe with screw-in type adapter.

General Installation Guidance:

To maintain G900X Engine Indicating System (EIS) measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs on the GEA. If the supplied sensor wires are not long enough to connect directly to the GEA, then Type K TC extension wire must be used. To minimize risk of breakage, it is recommended that a high-quality stranded (as opposed to solid) thermocouple wire be used. One such example of appropriate wire would be TT-K-22S Type K thermocouple wire from Omega Engineering.

5.6.2.4 Carb Temp (Carburetor Temperature) Sensor

Sensor Description:

Threaded ¼-28 Platinum Resistance Temperature Detector (RTD) probe

General Installation Guidance:

1. Locate and remove the threaded ¼-28 brass plug (Figure 5-7 and Figure 5-8) on the side of the carburetor as shown in Figure 5-7 If a threaded plug is not present, as is the case with many very old carburetors, consult the engine and/or carburetor manufacturer for instructions on how to drill and tap the lead plug adjacent to the butterfly valve.
2. Install a very small amount of thread lubricant on the probe threads and insert into the carburetor (Figure 5-9).
3. Connect the supplied connector to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

Figure 5-7. Carb Temp Sensor Mounting Location

Figure 5-8. Carb Temp Sensor Mounting Location w/ Screw Removed

Figure 5-9. Carb Temp Sensor Installed

5.6.2.5 RPM (Revolutions Per Minute) Sensor

Sensor Description:

1A3C-2: Standard mechanical tach drive sender (0-5 volt square wave, 2 pulses per crankshaft rev)
N/T1A9-x-C: Magnetic pickup tach sender (installed on mag bleed port)

General Installation Guidance:

1A3C-2:

1. Remove the cap from the tachometer drive output (Figure 5-10) from the back of the engine.
2. Insert adapter tang into slotted keyway in sensor drive port.
3. Screw tach sensor onto threaded driver port, ensuring that the adapter tang on the sensor aligns with the slotted keyway in the drive port (Figure 5-11).
4. Connect the supplied connector to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D . Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

NOTE

The body of the sensor unit can be offset slightly to eliminate potential interference with other engine accessories. If the interference cannot be alleviated by offsetting the sensor directly, the builder may either install a magnetic pickup sensor or use a short tachometer drive extension cable to remote mount the sending unit to the engine mount (or other suitable location).

Figure 5-10. Tachometer Drive Output

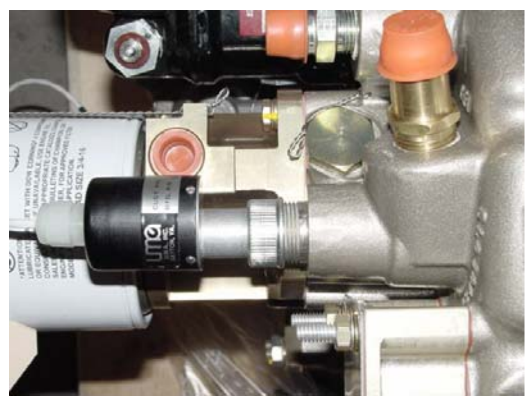


Figure 5-11. Installed Tachometer Sensor

N/T1A9-x:
The magnetic pickup tach sender is installed in the magneto bleed port. It is recommended that it be installed in the non-impulse magneto, but it can be installed in the impulse magneto if only one magneto exists (engines with single electronic ignition). The N/T1A9-x senders are suitable for non-pressurized magnetos only. Given that the bleed port size on Slick and Bendix magnetos differ, the installer should verify that the sender part number is appropriate for the magneto type.

1. Remove the existing vent plug from the magneto bleed port (Figure 5-12).
2. Lightly apply thread sealer such as Loctite 242 (or equivalent) to the threads of the sender. Be careful not to apply too much, and ensure sealer is applied only to the threads and not the pickup face itself.
3. Install the sensor into the port (Figure 5-13). The sensor should be installed finger tight plus 1/6 turn. Do not overtighten.
4. Connect the supplied connector to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

Figure 5-12. Magneto Bleed Port

Figure 5-13. Magnetic Tach Sensor Installed

5.6.2.6 Ammeter Sensor (Battery, Alternator, and Auxiliary)

<u>*General Installation Guidance:*</u>

Current sensing on the G900X is done via the use of a traditional ammeter shunt (Figure 5-14). The ammeter shunt has two holes in the base for mounting with #10 screws. The current-carrying wires are attached to the large 1/4" lugs, while the current sense wires are attached via the use of #8 ring terminals.

Figure 5-14. Ammeter Shunt

WARNING

It is important that no metal portion of the shunt touch any other portion of the aircraft or exposed wiring. Large voltages and current are present in the shunt, and an electrical short or fire could result from inadvertent contact.

The shunt should be installed in-line with the current being sensed. As noted below, the appropriate wire should be cut and attached to each of the large ¼" lugs. A one amp fuse or other form of circuit protection must be installed between the shunt and the applicable GEA inputs to prevent inadvertent damage to the G900X. Connect the two sense wires (attached to the #8 terminals) to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D. If the ammeter readings are shown with the opposite polarity, the sense wire connections on the shunt may need swapped.

5.6.2.6.1 Battery Ammeter Sensor

<u>*Sensor Description:*</u>

1C4: 100 Amp / 50 mv shunt

<u>*General Installation Guidance:*</u>

To minimize the potential reduction in ammeter accuracy introduced by a large common-mode voltage across the shunt, the main battery ammeter shunt should be installed inline between the negative battery terminal and airframe ground. As shown in Figure 5-15, wire is connected from the negative battery terminal to one end of the shunt. The other end of the shunt is connected to the airframe ground block via the use on 0.063" copper bus bar. If the shunt is not mounted in close proximity to the airframe ground, an appropriately sized wire can be used in lieu of the copper bus bar.

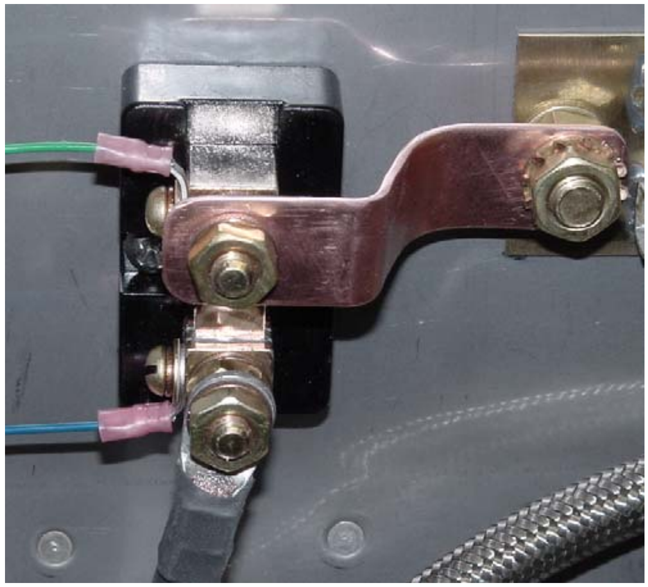


Figure 5-15. Ammeter Shunt Installed Next to Airframe Ground

5.6.2.6.2 Alternator Ammeter Sensor

<u>*Sensor Description:*</u>
1C4: 100 Amp / 50 mv shunt

<u>*General Installation Guidance:*</u>
Given most alternators are case grounded, the primary alternator ammeter shunt should be installed inline in the alternator output ("B" terminal). Depending on the location of the alternator relative to its supported electrical bus, it is typically desirable to install the shunt on the firewall near where the alternator output would normally penetrate the firewall.

5.6.2.6.3 Auxiliary Ammeter Sensor

<u>*Sensor Description:*</u>
1C1: 30 Amp / 50 mv shunt

<u>*General Installation Guidance:*</u>
Standby Battery: The standby battery ammeter shunt should be installed inline between the negative battery terminal and the airframe ground.
Standby Alternator: The standby alternator ammeter shunt should be installed inline in the alternator output ("B" terminal).

5.6.2.7 Position Sensor

<u>*Sensor Description:*</u>
Integrated trim servo with position sensor or standalone slide potentiometer (0 – 5 KOhm variable resistor)

<u>*General Installation Guidance:*</u>
Each position sensor installation will vary widely according to the aircraft, motion being sensed, and mechanical installation. For trim servos with integrated position sensing, no external position sensor is required. If mechanical trim is used or no trim servo is present on a particular system (i.e. flaps), then a standalone position sensor can be used. A standalone position sensor should ideally be mounted such that the full travel of the sensor corresponds with the full travel of the control surface.

Refer to the supplied servo or sensor installation manual and G900X interconnects in Appendix D for proper wiring connections. Section 14 provides calibration instructions.

5.6.2.8 Pressure Sensor (Fuel, Manifold, and Oil)

<u>*General Installation Guidance:*</u>

The specified pressure transducers (Figure 5-16) provide for a couple of different mounting options:

A. Sensor body secured to the engine mount or firewall via an appropriately sized Adel clamp (preferred), or
B. Mounted to a transducer mounting block located on the firewall via the use of a stainless steel AN911 fitting (union).

Figure 5-16. Pressure Transducer

WARNING

To minimize the possibility of cracking or breaking of the transducer due to vibration, the sensor should not be mounted directly to the engine. Mechanical failure of the transducer could result in loss of engine pressure for the sensed parameter (oil, fuel, manifold).

Once a suitable sensor mounting arrangement has been identified, the following installation procedures should be followed:

1. Mount the sensor using one of the two methods noted above.
2. Refer to the applicable engine manual to identify the appropriate connecting port on the engine for the parameter being sensed. Once identified, use appropriate aircraft-grade hoses and fittings to connect the corresponding port on the engine to the sensor. The female threads on the sensor are designed to accept a 1/8” NPT male thread.

NOTE

The fuel and oil pressure fittings on the engine port should have a restrictor hole where appropriate to minimize potential fluid loss in the event of breakage.

3. Connect the supplied connector to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

5.6.2.8.1 Fuel Pressure Sensor

Sensor Description:

T/N1EU35G-CS: 0 – 35 psiG pressure transducer for carbureted engines (TSO C47 on "T" model)

T/N1EU70G-CS: 0 – 70 psiG pressure transducer for fuel injected engines (TSO C47 on "T" model)

General Installation Guidance:

Lycoming fuel injected series engines have a maximum fuel pressure of 35 psi at the inlet to the fuel pump and 45 psi at the inlet to the fuel injector. Lycoming EIS display ranges are set to correspond with the pressure at the inlet to the fuel injector. Continental EIS display ranges are set to correspond to unmetered fuel pressure values.

5.6.2.8.2 Manifold Pressure Sensor

Sensor Description:

T1EU70A-CS: 5 – 70 in. HG pressure transducer (TSO C45a on "T" model)

5.6.2.8.3 Oil Pressure Sensor

Sensor Description:

T1EU150G-CS: 0 to 150 psiG pressure transducer

5.6.2.9 Fuel Flow Sensor

Sensor Description:

Floscan 201B-6 turbine fuel flow sensor. The sensor produces a current pulse signal from an opto-electronic pickup with a preamplifier.

General Installation Guidance:

The below is taken from the Floscan Series 200 Flow Transducer Application Notes:

1. The inlet and outlet ports in series 200 flow transducers have ¼" NPT threads. Use only ¼" NPT hose or pipe fittings to match. When assembling fittings into the inlet and outlet ports, DO NOT EXCEED a torque of 15 ft. lbs. (180 inch lbs.), or screw the fittings in more than 2 full turns past hand tight WHICHEVER HAPPENS FIRST. Floscan Instrument Co., Inc. will not be responsible for cracked castings caused by failure to use ¼" NPT fittings, over torquing the fittings, or assembling them beyond the specified depth.
2. A screen or filter should be installed upstream of the flow transducer to screen out debris which could affect rotor movement or settle in the V-bearings. As turbulence upstream of the transducer affects its performance, there should be a reasonable length of straight line between the transducer inlet and the first valve, elbow, or other turbulence producing device.
3. Install the flow transducer with wire leads pointed UP to vent bubbles and insure that the rotor is totally immersed in liquid. For maximum accuracy at low flow rates, the transducer should be mounted on a horizontal surface.

Some additional mounting considerations should be noted as follows:

1. When installing the NPT fittings into the transducer, use fuel lube such as EZ TURN © or an equivalent thread sealer. Teflon tape should NEVER by used in a fuel system.
2. To minimize inaccuracies caused by turbulence in the fuel flow, the sender should be mounted with approximately 5-6" of straight tubing before and after the sender. If special circumstances exist that prevent an extended length of straight tubing before and after the sender, then a gently curved hose may be acceptable. 45 degree or 90 degree elbow fittings should NOT be used immediately before or after the sensor.
3. Specific sender mounting location is left to the builder. Ideally, the sender should be placed prior to the fuel distribution device (carburetor or fuel injection distribution device). On a Continental fuel injected engine, the transducer must be located between the metering unit and the flow divider valve.
4. Sensor wires should be connected to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D.

When installing the sender, the builder should take note of the 16-XXXX number on the tag attached to the unit. The "XXXX" refers to the calibrated K factor of the sender, and it will be used in Section 14 to calibrate the G900X for the specific sender installed.

5.6.2.10 Oil Temperature Sensor

Sensor Description:
Threaded 5/8-18 Platinum Resistance Temperature Detector (RTD) probe

General Installation Guidance:
Refer to the applicable engine manual for proper location of the oil temperature sensor. The sensor is usually installed near the oil filter.

1. Cut the safety wire and remove the existing vent plug (Figure 5-17), if installed.
2. To prevent galling of the threads, apply a small amount of engine oil to the probe threads.
3. Ensure that an unused copper crush gasket is present on the probe, and install the probe into the engine (black side of crush gasket down).

NOTE

Crush gaskets can only be used once. A new gasket must be installed any time the probe is removed and installed.

4. Tighten the probe to the torque as specified by the engine manufacturer.
5. Safety-wire the probe to the engine case as appropriate.
6. Connect the supplied connector to the appropriate inputs on the GEA as referenced in the G900X interconnects in Appendix D. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

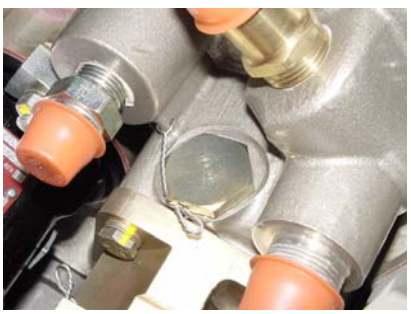


Figure 5-17. Vent Plug

Figure 5-18. Oil Temperature Probe

Figure 5-19. Oil Temperature Probe Installed (Crush Gasket Not Shown)

5.6.2.11 Resistive Type Fuel Quantity Senders

Resistive type fuel quantity senders with a 0 – 500 Ω range are currently supported. Please see the interconnect documentation for proper wiring considerations.

5.6.2.12 Capacitive Type Fuel Quantity Senders

Only Electronics International P-300C capacitive fuel probes are currently supported. The P-300C receives a +5V excitation input from the GEA 71 and outputs ±5V square wave from 600 Hz to 3.8 KHz. Please see the interconnect documentation for proper wiring considerations.

5.7 Mounting Requirements

The GEA 71 mounting surface should be capable of providing a sufficient electrical bond to the aircraft to minimize radiated EMI and provide protection from High-Intensity Radiation Fields (HIRF). The GEA 71 can be mounted using the G900X main system rack, or the unit may be mounted remotely if desired. Figure 5-20 shows the GEA 71 unit rack.

The unit rack is fastened to the main system rack using the nutplate kit listed in Section 5.5.1. Refer to the Appendix C for nutplate placement locations.

The installer must provide any additional remote mounting equipment.

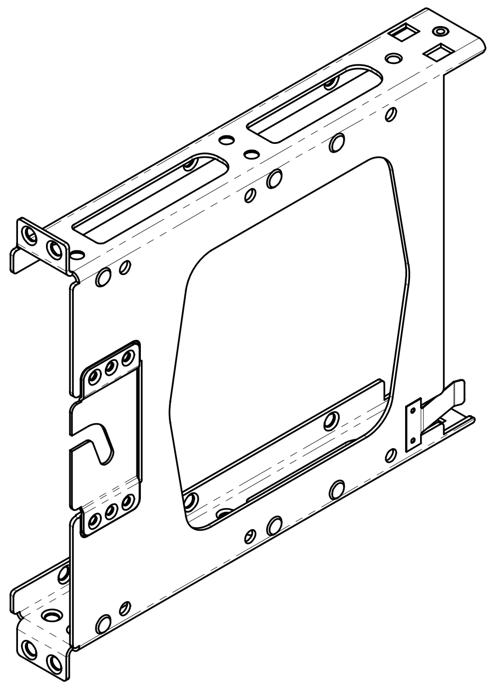


Figure 5-20. GEA 71 Unit Rack

5.7.1 Thermocouple Installation

The backshell assembly also houses a thermocouple reference junction (needed only if the GEA 71 is to monitor temperatures using thermocouple sensors). The thermocouple kit is available separately as Garmin part number 011-00981-00.

1. Crimp pins, item 2, onto each of the thermocouple wires, item 1. Ensure that pre-stripped wire length is 1/8” prior to crimping.
2. Insert newly crimped pins and wires into the appropriate connector housing location, item 4, as specified by the aircraft-specific interconnect diagram.
3. Place thermocouple body, item 1, onto the backshell boss, item 5. Place the thermocouple as shown in Figure 5-21 so that the wires exit towards the bottom of the backshell.
4. Fasten thermocouple tightly to backshell using the provided screw, item 3.
5. Fasten cover, item 6, to backshell using the provided screws, item 7.

Table 5-8. Thermocouple Kit (011-00981-00)

Item #	Description	Qty. Needed	Garmin Part Number
1	3” Thermocouple, K type	1	925-L0000-00
2	Pins #22 AWG	2	336-00021-00
3	Screw	1	211-60234-08

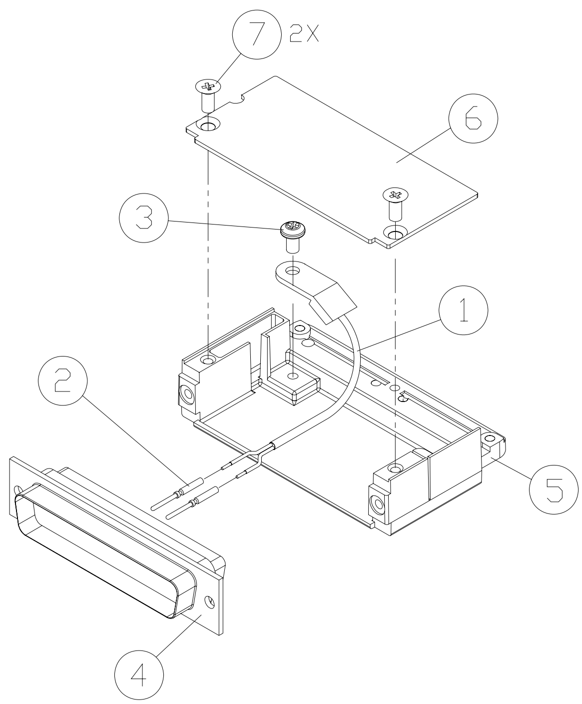


Figure 5-21. Thermocouple Installation

5.8 Unit Installation

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the connector backshells.
2. Connect both connectors to the rear plate using the screws provided in the connector kit.
3. Mount the unit rack to the main system rack or other suitable mounting location using the provided nutplates.
4. Assemble the rear plate into the GEA 71 unit rack.
5. Insert the GEA 71 into the rack, noting proper orientation as shown on the installation drawing in Appendix C.
6. Lock the GEA 71 in place using the lever-locking handle. Fasten the handle to the GEA 71 body using the provided Phillips screw.

CAUTION

Do not use excessive force when inserting the GEA 71 into the rack. This may cause damage to occur to the connectors, unit, and/or unit rack. If heavy resistance is felt during installation, stop! Remove the GEA 71 and identify the source of resistance. The rear plate is designed to float in the unit rack. Check to ensure the rear plate is not bound by the connector harness.

5.9 Continued Airworthiness

Maintenance of the GEA 71 is “on condition” only.

6 GDC 74A

6.1 Equipment Description

The Garmin GDC 74A Air Data Computer is a remote mounted device that provides air data for flight instrumentation. The system measures aircraft static and impact pressure information from pressure transducers and raw air temperature from an outside temperature probe. Using the raw data from the appropriate sensors, the unit computes pressure altitude, vertical speed, airspeed values, air temperature information and density altitude. Aircraft specific configuration parameters are stored in an external configuration module to make the GDC 74A a Line Replaceable Unit (LRU).

The system provides pitot-static and temperature derived air data to the GIA 63W Integrated Avionics Unit and the GDU 1040 Primary Flight Displays.

The GDC 74A provides the following information in ARINC 429 format:

- Air Temperature (total air temperature, outside/static air temperature)
- Corrected Static Pressure
- Density Altitude
- Impact Pressure Uncorrected
- Indicated Airspeed
- Mach Number
- Pressure altitude
- Total Pressure
- True Airspeed
- Vertical Speed

6.1.1 Interface Summary

The GDC 74A provides the following interface connections via the rear connector.

- ARINC 429 Output to GRS 77 AHRS
- 2 ARINC 429 Outputs to GDU 104X PFD/MFD and GIA 63W Integrated Avionics Units
- 4 ARINC 429 Inputs from external sensors (as applicable per installation)
- RS-232 Interface with GIA 63W Integrated Avionics Units
- 2 Aircraft Power Inputs
- Temperature Probe Interface for GTP 59

6.2 Electrical Specifications

Table 6-1 contains a list of electrical specifications for the GDC 74A.

Table 6-1. GDC 74A Electrical Specifications

Specification	Characteristic
Power Requirements	Supply Voltage: 14/28 VDC; See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.

6.3 Environmental Specifications

NOTE

The GDC 74A may require a warm-up period of 15 minutes to reach full accuracy (30 minutes if the environmental temperature is less than 0°C).

Table 6-2 contains a list of environmental specifications for the GDC 74A.

Table 6-2. GDC 74A Environmental Specifications

Specification	Characteristic
Regulatory Compliance	RTCA/DO-160D Environmental Conditions and EUROCAE/ED-14D
Unit Software	RTCA/DO-178B Level B
Aircraft Pressure Altitude Range	-1,400 feet to 50,000 Feet
Aircraft Vertical Speed Range	-20,000 feet per minute to +20,000 feet per minute
Aircraft Airspeed Range	450 Knots
Aircraft Mach Range	<1.00 Mach
Aircraft Total Air Temperature Range	-85°C to +85°C
Unit Operating Temperature Range	-55°C to +70°C

6.3.1 Environmental Qualification Form

Refer to the GDC 74A Environmental Qualification Form, Garmin part number 005-00191-77, for a complete list of environmental characteristic.

6.4 TSO/ETSO

Table 6-3 contains a list of applicable TSO/ETSOs for the GDC 74A.

Table 6-3. GDC 74A TSO/ETSO

Function	TSO/ETSO	Applicable LRU Software Part Numbers
Air Data Computer	TSO-C106 ETSO-C106	006-B0261-()

Table 6-4 contains a list of applicable TSO/ETSOs for the GTP 59.

Table 6-4. GTP 59 TSO/ETSO

Function	TSO/ETSO	Applicable LRU Software Part Numbers
Air Data Computer	TSO-C106 ETSO-C106	Not Applicable

6.4.1 TSO/ETSO Deviations for the GDC 74A

The following deviations have been requested and granted for the GDC 74A:

Table 6-5. GDC 74A TSO/ETSO Deviations

TSO/ETSO	Deviation
TSO-C106	1. Garmin was granted a deviation from TSO-C106 to use RTCA DO-160D.
	2. Garmin was granted a deviation from TSO-C106 to use RTCA DO-178B instead of RTCA DO-178A.
	3. Garmin was granted a deviation from TSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002.
ETSO-C106	1. Garmin was granted a deviation from ETSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002.

6.4.2 TSO/ETSO Deviations for the GTP 59

The following deviations have been requested and granted for the GTP 59:

Table 6-6. GTP 59 TSO/ETSO Deviations

TSO/ETSO	Deviation
TSO-C106	1. Garmin was granted a deviation from TSO-C106 to use RTCA DO-160D.
	2. Garmin was granted a deviation from TSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A.
ETSO-C106	3. Garmin was granted a deviation from ETSO-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002.

6.4.3 Continued Airworthiness

Maintenance of the GDC 74A and GTP 59 is "on condition" only.

6.5 Installation Requirements

6.5.1 Available Equipment

Table 6-7 contains a list of the available accessories for the GDC 74A.

Table 6-7. GDC 74A Accessories

Item	Garmin Part Number
GTP 59 OAT Probe Kit	011-00978-00
Sub-Assy, Conn Kit, SB, GDC 74A	011-01010-01
Remote Mounting Rack, GDC 74A	011-01011-00
Adapter Plate, GDC 74A	011-01014-00
Rack Nutplate Kit, 2 pos. GDC 74A	011-00915-00

Table 6-8 contains a list of items found in the GTP 59 Outside Air Temperature (OAT) Probe kit (011-00978-00). The GTP 59 probe has an attached pigtail.

Table 6-8. GTP Outside Air Temperature Kit

Item	Description	Garmin Part Number
Nut	Nut, 5/16", Hex, Skirt	210-00055-00
Screw, Qty. (2)	Screw, 4-40 x .250, PHP, SS/P, w/NYL	211-60234-08
Washer	Washer, Lock, Self-Sealing, 5/16	212-00026-00
Contact Pins, Qty. (5)	Contact, Pin, Mil Crimp, Size 22D	336-00021-00
GTP 59 OAT Probe	Outside Air Temperature Sensor	494-00022-xx

6.5.2 Additional Equipment Required

- Cables - The installer will supply all system cables including circuit breakers.
- Hardware - #6-32 x 100° SS Screw (6 ea.). Hardware required to mount the installation rack is not provided.
- Air hoses and fittings to connect pitot and static air to the GDC 74A. The GDC 74A has a female 1/8-27 ANPT fitting for each pitot and static port. Use appropriate aircraft fittings to connect to pitot and static system lines.

6.6 Installation Considerations

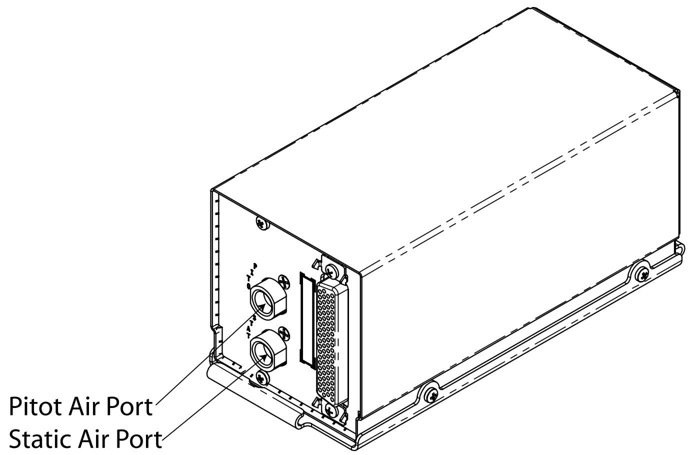
6.6.1 Cable Location Considerations

Use cable meeting the applicable aviation regulation for the interconnect wiring. Any cable meeting specifications is acceptable for the installation. When routing cables, observe the following precautions:

- All cable routing should be kept as short and as direct as possible.
- Avoid sharp bends.
- Avoid routing cables near power sources (e.g., 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting.

6.6.2 Pneumatic Plumbing

The GDC 74A has two ports that are connected to the aircraft's pitot pressure source and static pressure source. The two ports are labeled on the unit. Pressure ports have 1/8-27 ANPT female threads, all fittings should have 1/8-27 ANPT male threads.



GDC 74A (011-00882-10)

Figure 6-1. GDC 74A Air Hose Fitting Locations

Use appropriate air hoses and fittings to connect the pitot and static lines to the unit. Avoid sharp bends and routing near aircraft control cables. The GDC 74A should not be at the low point of the pitot or static plumbing lines, to avoid moisture or debris collecting at or near the unit. Ensure that no deformations of the airframe surface have been made that would affect the relationship between static air pressure and true ambient static air pressure for any flight condition. Refer to part 43, Appendix E for approved practices while installing hoses and connections.

6.6.3 GTP 59 Icing

The GTP 59 OAT probe has no icing protection. If ice accumulates on the GTP 59 OAT probe, its accuracy is unknown. Consequently, air temperature measurements may be incorrect if ice accumulates on the probe. Furthermore, computations dependent upon air temperature measurements may be affected (e.g. true airspeed and delta-ISA).

6.6.4 Pneumatic Connections

The installer is required to fabricate pneumatic hose connections and attach the aircraft pitot pressure source and aircraft static pressure source to the GDC 74A.

CAUTION

Check pneumatic connections for errors before operating the GDC 74A. Incorrect plumbing could cause internal component damage. Observe the following cautions when connecting pneumatic lines.

1. Make sure the aircraft static pressure port is plumbed directly to the unit static pressure input port and the aircraft pitot pressure port is plumbed directly to the unit pitot pressure input port.
2. Seal the threads of pneumatic fittings at the connector ports. Use caution to ensure there are no pneumatic leaks.
3. Use care to avoid getting fluids or particles anywhere within the pitot and static lines connected to the GDC 74A.

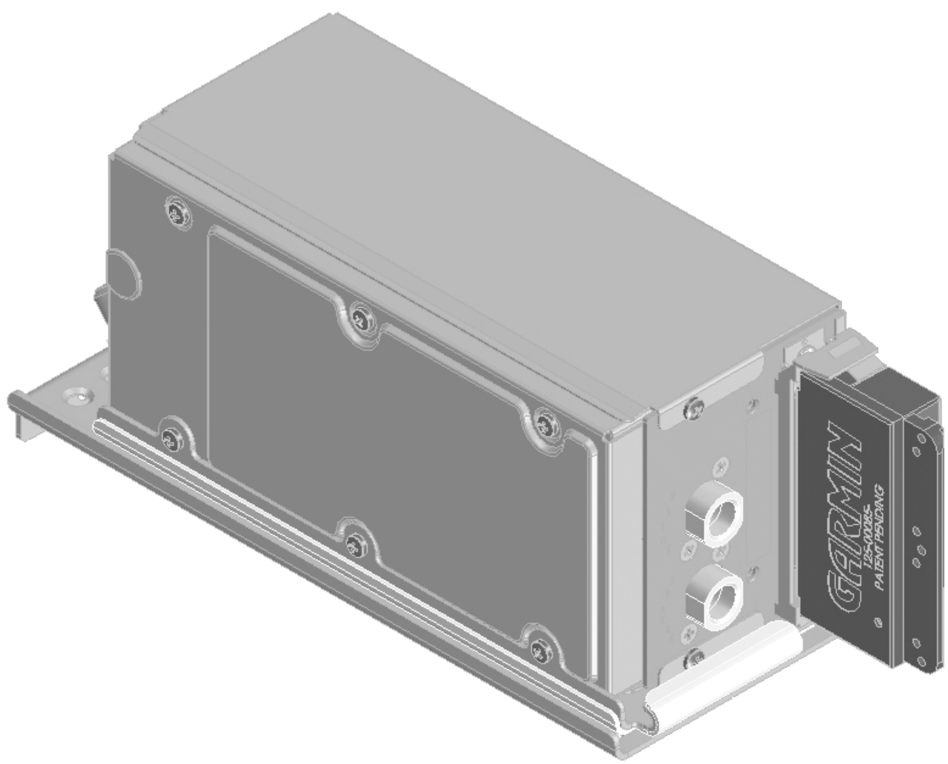


Figure 6-2. GDC 74A Unit on Rack, Pneumatic Ports and Connector View

6.7 Mounting Requirements

The GDC 74A mounting surface must be capable of providing structural support and electrical bond to the aircraft to minimize radiated EMI and provide protection from High-Intensity Radiation Fields (HIRF). The GDC 74A can be mounted using the main system rack, or may be mounted remotely if desired. The GDC 74A can be oriented in any position from horizontal to 45° past vertical. Appendix C shows the acceptable range of GDC 74A mounting orientation. The unit rack is fastened to the main system rack using the nutplate kit listed in Section 6.6.1. Refer to Appendix C for nutplate placement locations. The installer must provide any additional remote mounting equipment.

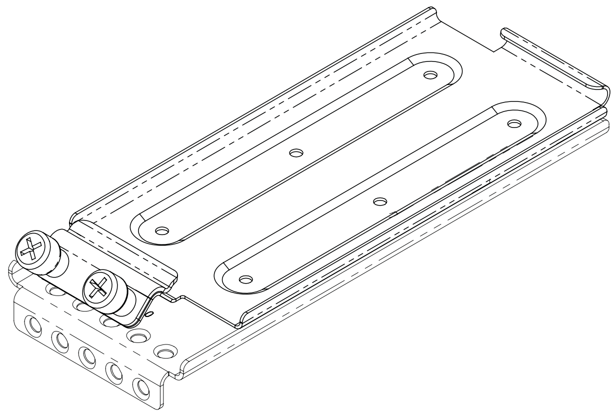


Figure 6-3. GDC 74A Unit Rack w/Adapter Plate

6.8 Unit Installation

There are three ways to install the GDC 74A. Refer to the preceding figure and the outline and installation drawings shown in Appendix A of this manual.

1. Remote Mounting Option I - Remote mounted rack with connector and fittings opposite the screw down mounting hardware. (Appendix C)
2. Remote Mounting Option II - Remote mounted rack with connector and fittings on the same end as the screw down mounting hardware. (Appendix C)
3. G900X Rack Mounting – Installation rack (Appendix C)

For remote mounted installations, attach the remote mounting kit (011-01011-00) to the airframe in a suitable location with suitable mounting hardware (not provided).

For the G900X rack installation, mount the remote adapter plate (011-01014-00) to the main system rack using the provided nutplate kit (011-00915-00). Then attach the remote mounting rack assembly to the G900X system rack using six screws provided.

Place the GDC 74A into its mounting plate and tighten the mounting screws firmly.

6.8.1 GTP 59 OAT Probe Installation

NOTE

The following instructions are general guidance.

Table 6-9 contains a list of parts needed for the GTP 59 installation and interconnect harness. Reference numbers in the table and instructions refer to item bubble numbers shown in Figure C-25.

Table 6-9. Parts Needed for GTP 59 Installation

Figure C-22	Description	Qty. Included	GPN or MIL Spec
2 Through 6, 11	OAT Probe Kit		011-00978-00
1	Shield Termination (method optional)	0	Parts used depend on method chosen
2	Ring Terminal	1	494-00022-xx
3	OAT Sensor		
4	3-Conductor Cable		
5	Nut	1	210-00055-00
6	Washer	1	212-00026-00
8	Pigtail Wire	0	M22759/16-16
9	Ring Terminal	0	MS25036-152
10	Pan Head Screw	1	211-60234-08
11	Pins, AWG #22	3	336-00021-00

1. Prepare the surface. The metal body of the OAT probe should be grounded to the aircraft. The installation requirements vary depending on the airframe material composition. Refer to the appropriate lightning certification document for zone requirements to determine an acceptable mounting location and bonding method for the OAT probe.

    a. Aluminum airframe: When a mounting location has been found, prepare the inside surface of the aircraft. Remove all paint from the contacting area and clean with a degreaser.

    b. Composite airframe: If possible, mount the OAT probe through a grounded metal strap or band. Otherwise, mount the OAT probe in an area of the airframe that has a significant amount of underlying metal foil or mesh. To ensure adequate conductivity, it may be necessary to mount the OAT probe through a metal doubler. Use fasteners that allow a conductive path to the airframe.

2. Mount the OAT probe on the prepared surface. Place the ring terminal (2) over the end of the OAT probe (4). Insert the probe and ring terminal into the hole in the skin of the aircraft. Place the washer (6) over the end of the OAT probe on the outside skin of the aircraft. Thread the nut (5) onto the OAT probe. Holding the OAT probe on the inside, tighten the nut (5) to 100 inch-lbs. ±20 inch-lbs.

3. Route the OAT probe cable (3) to the GDC 74A.

4. Cut the OAT Probe cable (3) to the required length. Strip back 2.0” to 3.5” of jacket while retaining the shield on the OAT Probe cable (3). Trim away enough to leave 0.5” of shield exposed.

5. Strip back 1/8” (0.125”) of insulation and crimp pins (11) to each of the conductors in the shielded cable.

6. Cut an AWG #16 (8) wire to 3” long. Strip back 0.5” of insulation from this cable. Connect the shield of the OAT Probe cable (3) to the AWG #16 wire (8).

7. Attach the ring terminal (9) to the backshell, using the screw provided in the OAT Probe Kit (10) and one of the tapped holes on the backshell termination area.

8. Insert newly crimped pins into the D-Sub connector and wires (3, 11) into the appropriate connector housing location (12, 7) as specified by the installation wiring diagrams.

9. Verify that all necessary pins for the GDC 74A have been attached to the cables and snapped into the proper slots of the 78 pin D-Sub connector.

10. Wrap the cable bundle with Silicone Fusion Tape (GPN: 249-00114-00 or a similar) at the point where the backshell strain relief and cast housing contact the cable bundle. The smooth side of the backshell strain relief should contact the tape.

6.9 Continued Airworthiness

Maintenance of the GDC 74A is “on condition” only.

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7. GRS 77 and GMU 44

7.1 Equipment Description

The Garmin GRS 77 AHRS (Attitude and Heading Reference System) and GMU 44 Magnetometer are remote mounted devices that provide flight attitude and heading data for flight instrumentation. With information available and valid from all sensors, or without the GPS, the GRS 77 AHRS provides valid attitude, angular rate and acceleration information to the GIA 63W Integrated Avionics and the GDU 1040 Primary Flight Display.

An Attitude and Heading Reference System combines the functions of a Vertical Gyro and a Directional Gyro to provide measurement of Roll, Pitch and Heading angles. The Garmin AHRS and magnetometer replace traditional rotating mass instruments.

Using long-life solid-state sensing technology, the GRS 77 AHRS and GMU 44 Magnetometer combine 3-axis angular rate, linear acceleration and magnetic field measurements to create an electronically stabilized AHRS.

The GRS 77 provides the following information in ARINC 429 format:

- Aircraft heading, pitch and roll
- Aircraft yaw, pitch and roll rates
- Aircraft body-axis accelerations
- Rates of change of heading, pitch and roll
- Aircraft accelerations expressed in a local level frame of reference

The GMU 44 magnetometer provides magnetic information to support the function of the GRS 77.

The GRS 77 provides operating voltage to the GMU 44 Magnetometer.

The GRS 77/GMU 44 is capable of maneuvers through a range of 360° in bank and pitch. The rotation rate capability is ±200° per second. However, ARINC 429 angular rate output messages are limited to ±128° per second.

Bank error and pitch error are within ±1.25° over the range of 30° bank, left and right, and 15° pitch nose up and nose down. Heading is accurate to within 2° in straight and level flight.

Operation is not authorized north of 70° North latitude nor south of 70° South latitude due to unsuitability of the magnetic fields near the Earth's poles. In addition, operation is not authorized in the following two regions:

1) North of 65° North latitude between longitude 75° W and 120° W. (Northern Canada)
2) South of 55° South latitude between longitude 120° E and 165° E. (Region south of Australia and New Zealand)

Interface Summary
The following is an interface summary for the GRS 77 and GMU 44.

- GMU 44 to GRS 77 Interface: Power, RS-232, RS-485 (19,200 baud)
- ARINC 429 Input From GDC 74A Air Data Computer (low-speed)
- 2 ARINC 429 Outputs to GDU 1040 PFD/MFD (high-speed)
- 2 ARINC 429 Outputs to GIA 63W Integrated Avionics Units (high-speed)
- 2 RS-232 Inputs From GIA 63W Integrated Avionics Units (19,200 baud)
- 2 Aircraft Power Inputs

7.2 Electrical Specifications

Table 7-1. GRS77/GMU 44 Electrical Specifications

Specification	Characteristic
Power Requirements Including GMU 44	Supply Voltage: 14/28 VDC. See the Environmental Qualification Form* for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.

*NOTE: As stated in Note 3 of the GRS 77 EQF (005-00165-31) the power inputs of the GRS 77 are rated to sustain A4 (waveform 4 level 4 and waveform 3 level 4) if both are connected to a power input. In the case of a single power source, where typically only one of the power pins would be used, both pins should be connected to this wire to get A4. The splice must be in the backshell of the GRS 77. Generally every installation should do this unless it is known that A3 on the power pins will suffice. Installations that input 2 different power sources to the two power input pins will need to be examined on a case by case basis.

7.3 Environmental Specifications

Table 7-2 lists general environmental specifications. For detailed specifications, see the Environmental Qualification Forms for the GRS 77 and the GMU 44.

Table 7-2. GRS77/GMU Environmental Specifications

Specification	Characteristic
Regulatory Compliance	RTCA/DO-160D Environmental Conditions and EUROCAE/ED-14D
Unit Software	RTCA/DO-178B Level B
Operating Temperature Range	-55° C to +70° C
Altitude	55,000 Feet

7.3.1 Environmental Qualification Form

Refer to the GRS 77 Environmental Qualification Form (Garmin part number 005-00165-31) and the GMU 44 Environmental Qualification Form (Garmin part number 005-00164-31) for a complete list of environmental characteristics.

7.4 TSO/ETSO

7.4.1 GMU 44 TSO/ETSO Compliance

Table 7-3. GMU 44 TSO/ETSO

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU Software Part Numbers
Direction Instrument, Magnetic (Gyroscopically Stabilized)	TSO-C6d ETSO-C6d AS8013A		006-B0224-()

7.4.2 GRS 77 TSO/ETSO Compliance

Table 7-4. GRS 77 TSO/ETSO

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU Software Part Numbers
Turn and Slip Instrument	TSO-C3d ETSO-C3d AS8004		006-B0223-()
Bank and Pitch Instruments	TSO-C4c ETSO-C4c AS8001	Category A	006-B0223-()
Direction Instrument, Magnetic (Gyroscopically Stabilized)	TSO-C6d ETSO-C6d AS8013A		006-B0223-()

7.4.3 TSO/ETSO Deviations

Table 7-5 contains a list of applicable TSO and SAE deviations for the GRS 77 and GMU 44.

Table 7-5. GRS 77/GMU 44 TSO/ETSO Deviations

TSO	Deviation
TSO-C3d (GRS 77)	1. Garmin was granted a deviation from TSO-C3d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C3d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
ETSO-C3d (GRS 77)	1. Garmin requires no deviation from ETSO-C3d.
TSO-C4c (GRS 77)	1. Garmin was granted a deviation from TSO-C4c to use SAE AS 8001 instead of SAE AS 396B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from SAE Aerospace Standard AS 8001 to use RTCA DO-160D instead of RTCA DO-138 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	Neither TSO-C4c nor SAE Aerospace Standard AS 8001 specifies use of a standard for software development; Garmin used RTCA DO-178B as the standard for Software Considerations in Airborne Systems and Equipment Certification.
ETSO-C4c (GRS 77)	1. Garmin was granted a deviation from ETSO-C4c to use SAE AS 8001 instead of SAE AS 396B for Minimum Performance Standards and Environmental Standards.
	2. Garmin was granted a deviation from SAE Aerospace Standard AS 8001 to use RTCA DO-160D instead of RTCA DO-138 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	3. Neither ETSO-C4c nor SAE Aerospace Standard AS 8001 specifies use of a standard for software development; Garmin used RTCA DO-178B as the standard for Software Considerations in Airborne Systems and Equipment Certification.
TSO-C6d (GRS 77 and GMU 44)	1. Garmin was granted a deviation from TSO-C6d to use RTCA DO-160D instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C6d to use RTCA DO-178B instead of RTCA DO-178A to demonstrate compliance for the verification and validation of the computer software.
	3. Garmin was granted a deviation from TSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.
ETSO-C6d (GRS 77 and GMU 44)	1. Garmin was granted a deviation from ETSO-C6d to use RTCA DO-160D instead of SAE AS 8013 as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from ETSO-C6d to use SAE AS 8013A instead of SAE AS 8013 as the Minimum Performance Standard.

7.5 Installation Requirements

7.5.1 Equipment Available

Table 7-6. GRS 77/GMU 44 Accessories

Item	Garmin P/N
Sub Assy, Connector Kit, GRS 77 w/Shield Block	011-00869-01
Installation Rack, GRS 77	115-00459-00
Sub Assy, Connector Kit, GMU 44	011-00871-00
Installation Rack, GMU 44	115-00481-00

7.6 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GRS 77 and GMU 44.

7.6.1 Consideration for Wing Grounded Lighting Fixtures

The following installation practices are recommended if the required GMU 44 mounting bracket is located in the wing.

1. The wing tip lights should not have a power ground referenced to the chassis of the light assembly that would then be referenced back to the airframe ground via the light assembly mounting.
2. A dedicated power ground should be used and returned as a twisted pair with the power source back into the fuselage for a wing mounted GMU 44.

These installation practices will prevent magnetically interfering currents from flowing in the wing skin that encloses the GMU 44. Electrically isolating the light assembly should not be used as an alternative to item 1 above, unless the isolated light assembly has been analyzed for adequate protection against direct attachment of lightning.

Refer to Appendix B for approved G900X airframe specific GMU 44 mounting locations.

7.7 Mounting Requirements

The following guidelines describe proper mechanical installation of the Garmin GRS 77 AHRS and GMU 44 Magnetometer. The guidelines include requirements for proper location selection in the aircraft, requirements for supporting structure and mechanical alignment and restriction on nearby equipment.

7.7.1 GRS 77 AHRS Mounting Guidelines

The GRS 77 includes an extremely sensitive strap-down inertial measurement unit. It must be mounted rigidly to the aircraft primary structure. Do not use shock mounting. Shock mounts used for other types of inertial systems are not acceptable for the GRS 77 AHRS. The mounting system must have no resonance with the unit installed that would cause DO–160D vibration levels to be exceeded. (See the GRS 77 Environmental Qualification Form). Vibration outside of these limits may result in degraded accuracy.

The supporting plate must be rigidly connected to the aircraft primary structure through strong structural members capable of supporting substantial loads. Avoid areas that are prone to severe vibration (e.g., areas close to engine mounts and landing gear).

The GRS 77 should be mounted within 13 feet (4.0 meters) longitudinally and 6.5 feet (2.0 meters) laterally of the aircraft center of gravity. The mounting location for the GRS 77 should be protected from rapid thermal transients, in particular, large heat loads from nearby high-power equipment.

The GRS 77 mounting rack should be leveled to within 3.0° of the aircraft level reference, and an aircraft leveling and offset setting procedure carried out prior to flight. (This procedure is described in Section 5.) Alternatively, if the mounting rack can be guaranteed level to within 0.25° of the aircraft level reference, the aircraft leveling and offset setting procedure is not required.

The GRS 77 mounting rack's forward direction must be aligned in heading to within 1.0° of the aircraft forward direction. (The arrow symbol on the rack points forward.)

Some metal structures of the GRS 77 may become magnetized if closely exposed to permanent magnets. While this will not affect the GRS 77 itself, it may slightly affect nearby magnetic instruments in the aircraft (whiskey compass). Ordinary use of magnetic screwdrivers to tighten the GRS 77 fasteners will not cause problems, but non-magnetic screwdrivers are preferred. Avoid placing the GRS 77 within 1 inch of magnetically mounted antennas, speaker magnets, or other strongly magnetic items.

Refer to Appendix B for approved G900X airframe specific GMU 44 mounting locations.

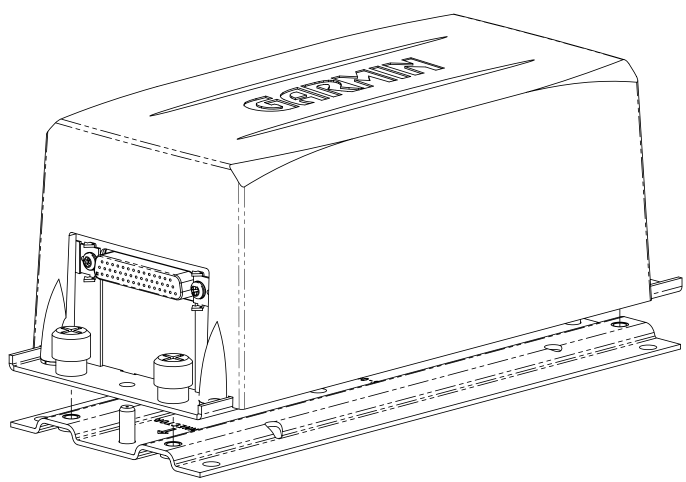


Figure 7-1. GRS 77 and Mounting Rack

7.7.2 GMU 44 Magnetometer Mounting Guidelines

The GMU 44 is an extremely sensitive three-axis magnetic sensor. It is more sensitive to nearby magnetic disturbances than a flux gate magnetometer. For this reason, observe the following distances from objects or devices that can disturb the magnetic field. Table 7-7 specifies required distances from magnetic disturbances for GMU 44 location.

Table 7-7. Required Distance from Magnetic Disturbances

Disturbance Source	Minimum Distance from GMU 44
Electric motors and relays, including servo motors	10 feet (3.0 meters)
Ferromagnetic structure greater than 1 kg total (iron, steel, or cobalt materials, especially landing gear structure)	8.2 feet (2.5 meters)
Ferromagnetic materials less than 1 kg total, such as control cables	3 feet (1.0 meter)
Any electrical device drawing more than 100 mA current	3 feet (1.0 meter)
Electrical conductors passing more than 100 mA current [(must be twisted shielded pair if within 10 feet (3.0 meters)]	3 feet (1.0 meter)
Electrical devices drawing less than 100 mA current	2 feet (0.6 meter)
Magnetic measuring device (e.g. installed flux gates, even if unpowered)	2 feet (0.6 meter)
Electrical conductors passing less than 100 mA current [(must be twisted shielded pair if within 10 feet (3.0 meters)]	1.3 feet (0.4 meter)

Ensure that any electrical conductor that comes within 10 feet (3.0 meters) of the GMU 44 is installed as a twisted shielded pair, not a single-wire conductor. (If possible, the shield should be grounded at both ends.)

Use nonmagnetic materials to mount the GMU 44, and replace any magnetic fasteners within 0.5 meter with nonmagnetic equivalents (e.g. replace zinc-plated steel screws used to mount wing covers or wingtips with nonmagnetic stainless steel screws.)

Mechanical mounting fixtures for the GMU 44 must be rigidly connected to the aircraft structure. Use of typical aircraft-grade materials and methods for rigid mounting of components is acceptable, so long as adequate measures are taken to ensure a stiffened mounting structure.

Align the GMU 44 mounting rack to within 3.0° of the aircraft level reference in pitch and roll.

Align the GMU 44 mounting rack's forward direction to within 0.5° in heading of the aircraft forward direction (longitudinal axis). If it is not possible to guarantee this accuracy, installation alignment to within 2.5° in heading is acceptable, in combination with a post-installation heading alignment of the aircraft to a precise heading to determine and set a heading offset.

It is strongly preferred that the GMU 44 alignment is within 0.5° of the aircraft longitudinal axis, rather than using the heading offset procedure.

Refer to Appendix B for approved G900X airframe specific GMU 44 mounting locations. The approved mounting locations have been evaluated for magnetic cleanliness and found to be acceptable on "typical" aircraft. Guidelines in Section 7-7 should be followed to ensure good performance.

7.7.3 GRS 77/GMU 44 Interconnect Harness Fabrication Instructions

Table 7-8 lists parts needed for the GMU 44 interconnect harness. Some of the parts for installation are included in the GMU 44 Connector Installation Kit. Other parts are provided by the installer. Reference numbers refer to item bubble numbers shown in Figure C-29.

Table 7-8. Parts Needed for GMU 44 Installation

Figure C-26 Ref	Description	Qty. Included	GPN or MIL Spec
1	Shield Termination (method optional)	0	Parts used depend on method chosen
2	Shield Extension Wire	0	M22759/16-22
3, 4, 9	GMU 44 Connector Kit	1	011-00871-00
5	3-Conductor Cable	0	M27500-22TE3T14
6	2-Conductor Cable	0	M27500-22TE2T14
7	Shield Block Kit	0	011-01169-00*
8	Cast Housing from GRS 77 Connector Kit	0	125-00083-00

Table 7-9 lists material in the GMU 44 connector kit. The GMU 44 magnetometer has an attached pigtail with male polarity. The harness connector for the GMU 44 has female polarity.

Table 7-9. GMU 44 Connector Kit, 011-00871-00 Contents

Figure C-26 Ref	Description	Garmin Part Number
4	Backshell, Circular, Kit	330-90005-00
4	Connector, Circular, Female, 9-Pin	330-00360-00
3	Standard-Density Sockets, Size 20	336-00022-00
9	Screw, 6-32 x .250, PHP, BR, w/Nylon Insert, Qty. (3)	211-60037-08

7.8 Unit Installation

NOTE

When mounting the GRS 77 rack to the airframe, and the unit to the rack, it is important to ensure that fastening hardware is tight for proper unit operation. Use a #2 Phillips screwdriver to tighten the GRS 77 to the rack, rather than hand tightening the knurled screws. The recommended torque is 22-25 inch pounds.

After ensuring that requirements are met, assemble the GRS 77 and GMU 44 mounting plate kits according to the dimensions given in Appendix C. Install the unit assemblies. While installing the GRS 77 on its rack, perform the flatness check described in Section 7.10.1. After completion, tighten the four mounting screws securing the GRS 77 unit to the rack.

Mount the GMU 44 to its mounting plate, taking care to tighten the mounting screws firmly.

The metal components in the GMU 44's connector may slightly affect the magnetic field sensed by the GMU 44. Place the connector at least 2 inches from the body of the GMU 44 to minimize this effect. After attaching the GMU 44's connector to its mate in the aircraft wiring, secure the connector in place using good installation practices. This will ensure that any remaining magnetic effect can be compensated for using Calibration Procedure B: Magnetometer Calibration.

If the GMU 44 is ever removed, the anti-rotation properties of the mounting screws must be restored. This may be done by replacing the screws with new Garmin PN 211-60037-08. If original screws must be re-used, coat screw threads with Loctite 242 (blue) thread-locking compound, Garmin PN 291-00023-02, or equivalent. Important: Mounting screws must be brass.

7.8.1 GRS 77 Rack to Unit Flatness Check

While installing the GRS 77 unit on its rack, a flatness check is required to ensure that the unit's base is properly preloaded after installation.

Place the unit on its rack, and tighten the screw fasteners on one end of the unit to the rack (recommended torque is 22-25 inch pounds), but leave the screw fasteners on the other end of the unit unfastened.

At the unfastened end of the unit, there should now be a gap between the unit baseplate and the rails of the mounting rack. Measure the gap to determine if it is within tolerances. See Figure 7-2. Using feeler gauges, check to ensure that the gap between the unit and each rack rail is at least 0.010 inch, but less than 0.070 inch.

If the gaps between the unit and each rack rail are within tolerance (0.010 inch, but less than 0.070 inch) tighten the remaining two screw fasteners to hold the GRS 77 unit firmly to its rack (recommended torque is 22-25 inch pounds).

If the gap is less than 0.010 inch, or greater than 0.070 inch, then the proper amount of preload will not be exerted on the unit baseplate when the unit is fastened down, and the installation is not acceptable. Possible causes for a failure of this check include the following:

a) The rack is fastened down to a surface that is not sufficiently flat
b) The rack is warped or damaged
c) The GRS 77 has a center baseplate external shim that is damaged or has been removed
d) The GRS 77 baseplate has been warped or damaged

In the event of a failed test (gap on unfastened end of unit not within the range of 0.010 inch to 0.070 inch), these possibilities must be examined, and any deficiencies corrected to pass this check before the installation is acceptable.

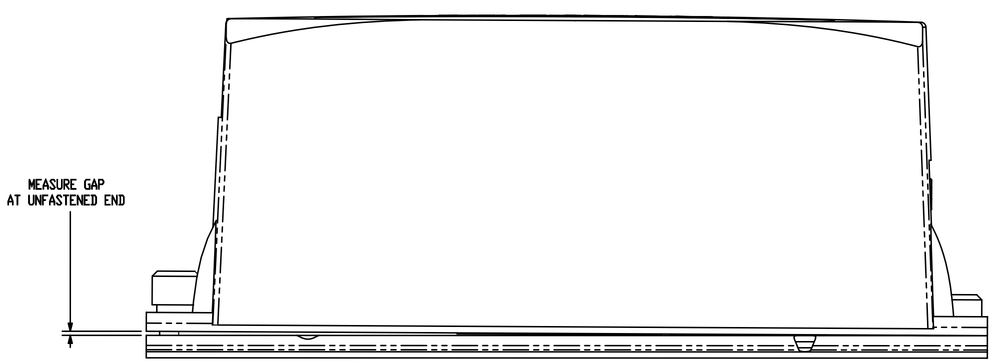


Figure 7-2. Measuring GRS 77 to Mounting Rack with Feeler Gauge

7.9 Continued Airworthiness

The GRS 77 utilizes an Earth magnetic field model which is updated once every five years. The update is expected to be available from Garmin by July 1 of each of the following years: 2010, 2015, and every five years thereafter, so long as the GRS 77 remains a Garmin-supported product. Otherwise maintenance of the GRS 77 is 'on condition' only.

Maintenance of the GMU 44 is 'on condition' only.

8 GTX 33

8.1 Equipment Description

The Garmin GTX 33 rack mounted Mode S Transponder is a radio transmitter and receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. The GTX 33 is equipped with IDENT capability that activates the Special Position Identification (SPI) pulse for 18 seconds.

The GTX 33 replies to Mode A, Mode C and Mode S interrogation. Mode A replies consist of framing pulses and any one of 4,096 codes, which differ in the position and number of pulses transmitted. Mode C replies include framing pulses and encoded altitude.

Ground stations can interrogate Mode S Transponders individually using a 24-bit ICAO Mode S address, which is unique to the particular aircraft. In addition, ground stations may interrogate a GTX 33 for its Transponder data capability and the aircraft's Flight ID, which is the registration number or other call sign. The GTX 33 makes the maximum airspeed capability (set during configuration setup) available to TCAS systems on-board nearby aircraft to aid in the determination of TCAS advisories.

The unit features an altitude monitor and TIS traffic advisories. A voice or tone audio output announces altitude and traffic alerts. The GDU 1040 Primary Flight Display screen displays the code, reply symbol and mode of operation, depending on equipment connections and configuration selection.

The GTX 33 features multiple transmit/receive ARINC 429 and RS-232 data ports. The unit concentrates data from three ARINC 429 inputs, gray code, RS-232 input data and discrete inputs to the high-speed RS-232 data ports for display on the GDU 1040. Although multiple output capability is available, the unit is designed to feed all outgoing data via RS-232 data ports. Two RS-232 data ports send and receive data to/from the GIA 63W Integrated Avionics Units.

The GTX 33 with software version 4.01 meets Mode S Enhanced Surveillance requirements. Mode S Enhanced Surveillance is used predominantly in European airspace. It provides information consisting of additional aircraft parameters (see JAA NPA 20-12a) to ground radar systems. Compliance with Enhanced Surveillance may require additional interface between aircraft systems and the GTX 33.

8.1.1 Mutual Suppression Pulses

Other equipment on board the aircraft may transmit in the same frequency band as the transponder, such as DME or another transponder. Mutual suppression is a synchronous pulse that is sent to the other equipment to suppress transmission of a competing transmitter for the duration of the pulse train transmission. The transponder transmission is suppressed by an external source and other equipment on board is suppressed by the GTX 33 transponder. This feature is designed to limit mutual interference.

8.1.2 TIS System Capabilities

Traffic Information Service (TIS) provides a graphic display of traffic advisory information in the cockpit for non-TCAS equipped aircraft.

TIS is a ground-based service providing relative location of all ATCRBS Mode A and Mode C transponder equipped aircraft within a specified service volume. The TIS ground sensor uses real time track reports to generate traffic notification.

Traffic display is available to aircraft equipped with a Mode S data link such as the Garmin GTX 33 transponder. Traffic can then be displayed on the GDU 1040 Primary Flight Display.

Surveillance data includes all transponder equipped aircraft within the coverage volume. Aircraft without an operating transponder are invisible to TIS. TIS displays traffic within seven nautical miles from 3000 feet below to 3500 feet above the requesting aircraft.

8.1.3 Interface Summary

The GTX 33 provides the following interface connections via the rear connector.

- Ten (10) encoding altimeter inputs
- External IDENT input
- External STBY input (useful for dual transponder installations)
- External suppression pulse input
- Switched power output of up to 1.5 amps (for digital altitude encoder power)
- Aircraft power input (14/28 VDC)
- Remote power turn on
- Serial airdata or GPS groundspeed input
- Serial altitude input (Reduces wire count vs. parallel wire gray code altimeter interface)
- Software update input
- Supports Comm-A and Comm-B protocol
- Temperature, Altitude Hold and Density Altitude
- Digitally recorded voice and discrete warning annunciator activated by Altitude Hold when limits are exceeded

The GTX 33 P/N 010-00267-( ) and 010-00294-( ) support the following list of Binary Data Selector (BDS) registers:

- BDS (0,0) Air Initiated Comm-B (AICB)
- BDS (1,0) Data Link Capability Report
- BDS (1,7) Common Usage Ground Initiated Comm-B (GICB) Capability Report
- BDS (1,8) Mode S Specific Services GICB Capability Report
- BDS (1,9) Mode S Specific Services GICB Capability Report
- BDS (1,D) Mode S Specific Services Protocols (MSP) Capability Report
- BDS (2,0) Aircraft Identification

8.2 Electrical Specifications

Table 8-1. GTX 33 Electrical Specifications

Characteristic	Specification
Transmitter Frequency	1090 MHz ±1 MHz
Transmitter Power	125 Watts minimum, 250 Watts nominal
Receiver Frequency	1030 MHz
Receiver Sensitivity	-74 dBm nominal for 90% replies
Mode A Capability	4096 Identification Codes
Mode C Capability	100 Foot Increments from -1000 to 62,700 feet. 25 Foot Increments from -1000 to 50,175 feet with suitable serial data altitude.
Mode S Capability	4096 Identification Codes, Altitude
External Suppression Input	Low ≤ 0.5 V; High ≥ 8 V
Audio Output	4.04 Vrms to 7.85 Vrms into a 500 Ω load
Input Voltage	14/28 VDC See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages.
Power Input	22 Watts Typical, 45 Watts Maximum
Maximum Full TSO Reply Rate; 1200 PRF, Code7777	1.6 A @ 27.5 VDC, 3.1 A @13.75 VDC
Maximum Quiescent	0.85 A @ 27.5 VDC, 1.1A @ 13.75 VDC

8.3 Environmental Characteristics

Table 8-2. GTX 33 Environmental Specifications

Characteristic	Specification
Regulatory Compliance; GTX 33	RTCA DO-160D, DO-181C Environmental Conditions and EUROCAE/ED-73A
Unit Software	RTCA/DO-178B Level D
FCC Authorization	Emission Designator 12M0M1D
Temperature Range	-45°C to +70°C (continuous operation)
Altitude	55,000 Feet

8.3.1 Environmental Qualification Form

Refer to the GTX 33 Environmental Qualification Form, Garmin part number 005-00131-03, for a complete list of environmental characteristics.

8.4 TSO/ETSO

Table 8-3 contains a list of applicable TSO/ETSOs for the GTX 33.

Table 8-3. GTX 33 TSO/ETSO

Function	TSO/ETSO	Category	Applicable LRU Software Part Numbers
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment	TSO-C112 ETSO-2C112a		006-B0328-00 and later 006-B0328-()

8.4.1 TSO/ETSO Deviations

None.

8.5 Installation Requirements

8.5.1 Available Equipment

Table 8-4. GTX 33 Accessories

Item	Garmin Catalog Part Number
Modular Install Rack, GTX 33/GTX 33D	115-00438-00
Nutplate Kit	011-00915-01
Or	
GTX 33/GTX 33D Stand-Alone Install Rack (Alternate Configuration)	115-00629-00
Connector Kit, GTX 33	011-01012-01
Backplate Assembly, GTX 33	011-00582-00
Garmin Transponder Antenna kit	010-10160-00

8.5.2 Additional Equipment Required

The following installation accessories are required but not provided:

- Cables – The installer will supply all system cables including circuit breakers. Cable requirements and fabrication is detailed in Section 3 of this manual.
- Hardware – #6-32 x 100° Flathead SS Screw [(MS24693, AN507R or other approved fastener) (4 ea.)] for horizontal mounting.
- Hardware – #8-32 x 100° Panhead Machine Screw [(MS35206, AN526 or other approved fastener) (4 ea.)] for vertical mounting of the remote stand-alone rack.

8.6 Installation Considerations

The GTX 33 interfaces with both GIA 63W units. Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GTX 33.

8.6.1 Cable Routing Considerations

When routing cables, observe the following precautions:

- All cable routing should be kept as short and as direct as practical.
- Avoid sharp bends.
- Avoid routing cables near power sources (e.g., 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting.
- Avoid routing antenna cables near ADF antenna cable (allow at least a 12-inch separation).

8.7 Mounting Requirements

The GTX 33 mounting surface must be capable of providing structural support and electrical bond to the aircraft to minimize radiated EMI and provide protection from High-Intensity Radiation Fields (HIRF). The GTX 33 can be mounted using the G900X main system rack, or may be mounted remotely if desired. Figures 8-1 and 8-2 show the GTX 33 unit racks. The unit rack is fastened to the main system rack using the nutplate kit listed in Section 8.5.1. The installer must provide any additional remote mounting equipment.

8.7.1 Remote Mounted Stand-Alone Rack Considerations

The remote rack can be installed in a variety of locations, such as the electronics bay, under a seat or on an avionics shelf behind the rear baggage area. Refer to Figure 2-4 for suggested location. Leave sufficient clearance between the GTX 33 and any obstruction. Install the rack in accordance with AC 43.13-2A Chapter 2 “Radio Installations”. The rack should be mounted to a surface known to have sufficient structural integrity to withstand additional inertia forces imposed by a 4.3-pound (1.95 kg) unit. If it is necessary to build a shelf or bracket to mount the GTX 33 stand-alone rack or it is not certain that the chosen location is of sufficient structural integrity, refer to Appendix A for validation of rack mounting structures and determining static load capability.

Figures C-33 and C-34 give the GTX 33 stand-alone rack dimensions. The rack can be mounted vertically using four 8-32 pan head screws (MS35206, AN526 or other approved fastener). It can also be mounted horizontally using four 6-32 100° counter-sunk flathead screws (MS24693, AN507R or other approved fastener). Ensure that the GTX 33 chassis has a ground path to the airframe by having at least one mounting screw in contact with the airframe. If more water-resistance is desired, the rack should be installed in the upright vertical orientation only, otherwise, the rack may be mounted in either vertical or horizontal orientation.

After the cable assemblies are made and wiring installed to the rack back plate, route wiring bundle as appropriate. Use cable ties to secure the cable assemblies and coax to provide strain relief for the cable assemblies.

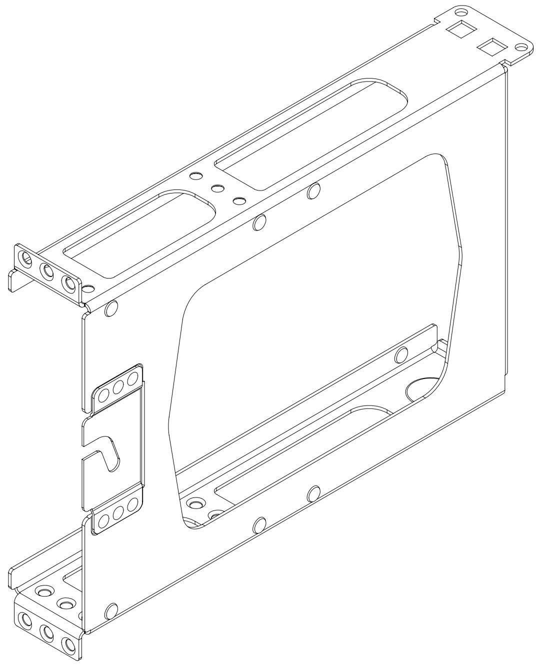


Figure 8-1. GTX 33 Modular Rack (115-00438-00)

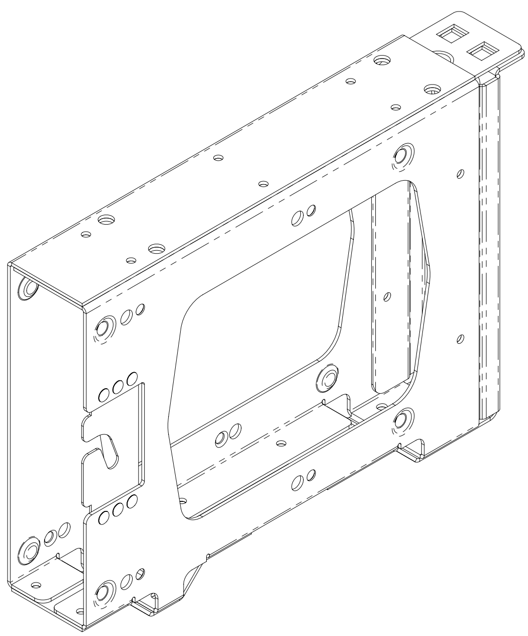


Figure 8-2. GTX 33 Stand-Alone Rack (115-00629-00)

8.8 Unit Installation

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the backshell connector.
2. Connect backshell connector to the rear plate using the provided screws.
3. Mount the unit rack to the main system rack or other suitable mounting location using the provided nutplates.
4. Carefully slide the GTX 33 into the rack. Ensure that the orientation of the unit allows for the engagement of the locking stud in the channel on the rack. The unit can only be installed in one direction.
5. Push the GTX 33 lever down towards the bottom of the unit. This engages the locking stud with the dogleg slot and locks unit into the rack. If there is excessive resistance, do not force the unit.
6. Lock the handle into the GTX 33 body and tighten the Phillips screw.

CAUTION

Do not use excessive force when inserting the GTX 33 into the rack. This may cause damage to the connectors, unit and/or unit rack. If excessive resistance is felt during installation, stop! Remove the GTX 33 and identify the source of resistance. The rear plate is designed to float in the unit rack. Check to ensure the rear plates are not bound by the connectors or spring clip.

8.9 Continued Airworthiness

Maintenance of the GTX 33 is “on condition” only.

9 GCU 476 (Optional)

9.1 Equipment Description

The GCU 476 refers to the Garmin Flight Management System (FMS) Controller used in the G900X Integrated Cockpit System. The GCU 476 provides alphanumeric, softkey, and flight planning function keys used to interface with the G900X. In addition to alphanumeric, softkey, and flight planning function keys the GCU 476 provides COM/NAV tuning capabilities. The GCU 476 mounts flush to the aircraft instrument panel using a jackscrew.

9.1.1 Interface Summary

The GCU 476 interfaces with the GDU 1040 PFD/MFD via RS-232 digital interface.

9.2 Electrical Specifications

Table 9-1. GCU 476 Electrical Specifications

Characteristics	Specifications
Power Requirements	14/28 VDC. See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.

9.3 Environmental Specifications

Table 9-2. GCU 476 Environmental Specifications

Characteristics	Specifications
Operating Temperature Range	-45°C to +70°C. For more details see Environmental Qualification Form.
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 55,000 ft

9.3.1 Environmental Qualification Form

Refer to the GCU 476 Environmental Qualification Form, Garmin part number 005-00219-01, for a complete list of environmental characteristics.

9.4 TSO/ETSO

Table 9-3 contains a list of applicable TSO/ETSOs for the GCU 476.

Table 9-3. GCU 476 TSO/ETSO

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU Software Part Numbers
Airborne Multipurpose Electronic Displays	TSO-C113 ETSO-C113	Type I,II, and III	006-B0472-()

9.4.1 TSO/ETSO Deviations

Table 9-4. GCU 476 TSO/ETSO Deviations

TSO	Deviation
TSO-C113	1. Garmin was granted a deviation from TSO-C113 to use RTCA DO-160E, instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C113 to use RTCA DO-178B instead of RTCA DO-178A as the standard for Software Considerations in Airborne Systems and Equipment Certification.
ETSO-C113	1. Garmin was granted a deviation from RTCA DO-160E, instead of RTCA DO-160D as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.

9.5 Installation Requirements

9.5.1 Required Accessories

Table 9-5. GCU 476 Accessories

Item	Garmin P/N
GCU 476 Installation Rack	115-00736-00
GMC 710 Connector Kit	011-01040-01

9.6 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GCU 476.

9.7 Mounting Requirements

The GCU 476 is to be mounted using the GCU 476 Unit Rack, see Figure 9-1. Installer must fabricate any additional mounting equipment needed, use outline and installation drawings for reference.

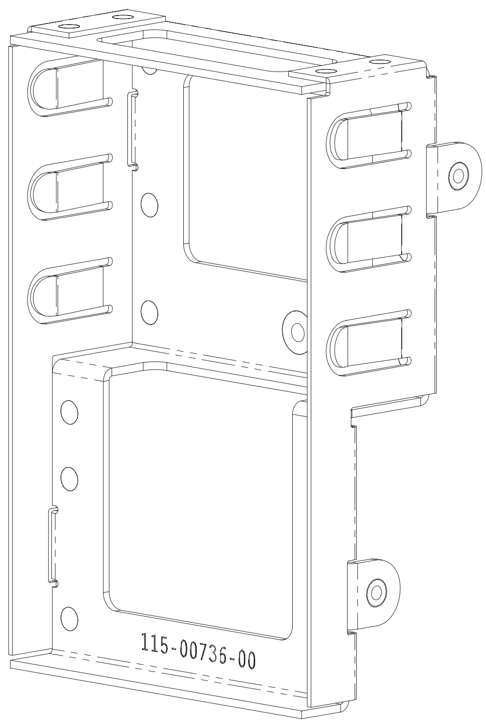


Figure 9-1. GCU 476 Unit Rack

9.8 Unit Installation

The GCU 476 is installed by gently pushing the unit into the rack. A 3/32" hex drive tool is then used to turn the jack screw clockwise until it is firmly seated into the rack, ensuring jack screw is not over-tightened.

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

9.9 Continued Airworthiness

Maintenance of the GCU 476 is “on condition” only.

10 GDL 69A (Optional)

10.1 Equipment Description

The GDL 69A is an XM Satellite Radio data link receiver that receives both XM Satellite Radio and weather data. The GDL 69A interfaces with the GDU 1040 via an Ethernet link, and to the GMA 1347 for distribution of the audio signal. Optional remote mounted switches can be installed in the cabin for audio volume and channel adjusting.

10.1.1 Interface Summary

The following list is an interface summary for the GDL 69A unit.

- 3 RS-232 Inputs/Outputs
- 4 Ethernet Inputs/Outputs
- 5 Audio Discrete Control Inputs (Volume Up, Volume Down, Channel Up, Channel Down, Mute)
- 6 Audio Suppression Inputs (3 Active High, 3 Active Low)
- 1 Stereo Audio Output (Left Audio, Right Audio with internal volume control)
- 1 Remote Power On/Off Discrete Input
- 2 Other Discrete Inputs (Reserved for Future Use)
- Configuration Module (for storing aircraft configuration data)
- Aircraft Power Input (Power-on controlled by aircraft avionics power bus)

10.2 Electrical Specifications

Table 10-1. GDL 69A Electrical Specifications

Characteristics	Specifications
Power Requirements	14/28 VDC. See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages. See Table 1-2 for current specifications.

10.3 Environmental Characteristics

Table 10-2. GDL 69A Environmental Specifications

Characteristics	Specifications
Operating Temperature Range	-55° C to +70° C
Software Compliance	RTCA DO-178B Level D
Environmental Compliance	RTCA DO-160D

10.3.1 Environmental Qualification Form

Refer to the GDL 69A Environmental Qualification Form, Garmin part number 005-00217-33, for a complete list of environmental characteristics.

10.4 TSO/ETSO

None

10.4.1 TSO/ETSO Deviations

None

10.5 Installation Requirements

10.5.1 Required Accessories

Table 10-3. GDL 69A Accessories

Item	Garmin P/N
Back Plate Assembly	011-00796-35
Remote Mount Rack GDL 69	115-00658-00
Connector Kit Assembly	011-00997-01
Rack Nut Plate, 2 POS	011-00915-00
Modular Rack	115-00411-00

10.5.2 Equipment Required But Not Supplied

- Wire: MIL-W-22759/16 or equivalent
- Shielded Wire: MIL-C-27500 or equivalent
- Hardware: #6-32 x 100 Flat Head Screw (MS24693, AN507R or equivalent) (4 ea) or #6-32 Phillips slotted pan head screw (MS35207, AN526 or equivalent) (4 ea)
- Circuit Breaker: Appropriate for selected wire size

10.6 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GDL 69A.

10.6.1 Auxiliary Equipment

Although not required, optional remote switches can be used for channel up/down and volume up/down control. An optional auxiliary music jack can also be installed to allow other music sources to be played through the audio panel. See interconnects for further details.

10.6.2 Antennas

Refer to Section 4.5.2.1 for a list of approved GPS/XM antennas.

10.7 Mounting Requirements

10.7.1 Remote Mount Rack

The remote mount rack can be installed in a variety of locations, such as the electronics bay, behind the instrument panel, under the seat or behind the rear baggage area. Leave sufficient clearance between the GDL 69A and any obstruction. Install the rack in accordance with AC43.13-2A Chapter 2 Radio Installations. The remote mount rack should be mounted to a surface known to have sufficient structural integrity to withstand additional inertial forces imposed by a 1.86 pound unit (1.72 lbs. for GDL 69). If it is necessary to build a shelf or bracket to mount the GDL 69A rack or if is not certain that the chosen location is of sufficient structural integrity, refer to Appendix C. The rack can be mounted vertically using four 8-32 pan head screws (MS35206, AN526 or equivalent.) It can also be mounted horizontally using four 6-32 100° counter-sunk flathead screws (MS24693, AN507R or equivalent.) Ensure that the rack has a ground path to the airframe by having at least one mounting screw in contact with the airframe to minimize radiated electromagnetic interference (EMI).

10.7.2 Modular Rack

The modular rack is used to install the GDL 69A in the G900X integrated avionics system rack. This modular rack may be mounted behind the instrument panel or in the avionics bay.

10.8 Unit Installation

For final installation and assembly, refer to the outline and installation drawings shown in Appendix C of this manual.

1. Assemble the backshell connector.

2. Connect backshell connectors to the rear plate using the provided screws.

3. Mount the unit rack to the main system rack or other suitable mounting location using the provided nutplates.

4. Carefully slide the GDL 69A into the rack. Ensure that the orientation of the unit allows for the engagement of the locking stud in the channel on the rack. The unit can only be installed in one direction.

5. Push the GDL 69A lever down towards the bottom of the unit. This engages the locking stud with the dogleg slot and locks unit into the rack. If there is excessive resistance, do not force the unit.

6. Lock the handle into the GDL 69A body and tighten the Phillips screw.

CAUTION

Do not use excessive force when inserting the GDL 69A into the rack. This may cause damage to the connectors, unit and/or unit rack. If excessive resistance is felt during installation, stop! Remove the GDL 69A and identify the source of resistance. The rear plates are designed to float in the unit rack. Check to ensure the rear plates are not bound by the connectors or spring clip.

10.9 Continued Airworthiness

Maintenance of the GDL 69A is “on condition” only.

11 Garmin GPS WAAS Antennas (Optional)

11.1 Description

This section provides mechanical and electrical installation requirements for installing the following Garmin GPS WAAS Antennas:

- GA 35 GPS WAAS Antenna
- A-34 GPS WAAS Antenna
- GA 56A GPS WAAS Antenna
- GA 56W GPS WAAS Antenna (not yet approved)
- GA 57 GPS WAAS and FIS Antenna (not yet approved)

Refer to Table 4-11 for additional information regarding these antennas.

11.2 GA 35 GPS WAAS Antenna

11.2.1 Specifications

Table 11-1. GA 35 Specifications

Characteristics	Specifications	
Frequency Range	1575 MHz +/- 10 MHz	
Polarization	Right Hand Circular	
Axial Ratio	3 dB Max at bore site	
Radiation Coverage	Elevation Angle	Minimum Gain
	>15°	-2.0 dBic
	10°	-3.0 dBic
	5°	-3.5 dBic
	0°	-7.5 dBic
Weight	0.47 lbs. (0.21 kg)	
Finish	Polyurethane Enamel	
Operating Temperature	-55°C to +85°C	
Operating Altitude	55,000 feet (16,764m) max	
Noise Figure	1.9 dB max @ 25°C, 2.5 dB max	
Impedance	50 ohms	
VSWR (Dry)	≤ 1.5:1	
VSWR (Rain)	≤ 2.0:1	
Power Handling	1 Watt	
Voltage	5-18 VDC	
Current	40 mA nominal, 60 mA max	
TSO	TSO-C144 and TSO-C129a	

11.3 A-34 GPS WAAS Antenna

11.3.1 Specifications

Table 11-2. A-34 Specifications

Characteristics	Specifications	
Frequency Range	1575 MHz +/- 10 MHz	
Polarization	Right Hand Circular	
Axial Ratio	3 dB Max at bore site	
Radiation Coverage	Elevation Angle	Minimum Gain
	>15°	-2.0 dBic
	10°	-3.0 dBic
	5°	-4.5 dBic
	0°	-7.5 dBic
Weight	0.38 lbs. (0.17 kg)	
Height	0.66 inches (1.76 cm)	
Finish	Polyurethane Enamel	
Operating Temperature	-55°C to +85°C	
Operating Altitude	55,000 feet (16,764m) max	
Noise Figure	2.5 dB max	
Impedance	50 ohms	
VSWR (Dry)	≤ 1.5:1	
VSWR (Rain)	≤ 2.0:1	
Band Rejection	35 dB	
Power Handling	1 Watt	
Voltage	5 VDC +/-10%	
Current	35 mA nominal, 40 mA max	
TSO	TSO-C144	

11.4 GA 56A and GA 57 GPS WAAS Antenna

11.4.1 Specifications

Table 11-3. GA 56A and GA 57 WAAS Specifications

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Weight	GA 56A 0.43 lbs. (0.20 kg)
	GA 57 0.47 lbs. (0.21 kg)
Operating Temperature	-55°C to +85°C
Noise Figure	<4.00 dB
Impedance	50 ohms
Voltage	4.5 to 5.5 VDC
Current	30 to 50 mA

Table 11-4. Antenna Pattern

(measured with a 3 wavelength radius ground plane)

Frequency	Elevation angle (90=zenith)	RHCP Isotropic Gain (min/max)	Axial Ratio
1575MHz	90°	(-2.0/+7) dBic	3 dB max
1575MHz	15°	(-2.0/+7) dBic	N/A
1575MHz	10°	(-3.0/+7) dBic	N/A
1575MHz	5°	(-4.5/+7) dBic	N/A
1575MHz	0°	(-7.5/-2) dBic	N/A

Table 11-5. XM Antenna Specifications (GA 57 only)

Characteristics	Specifications
Frequency Range	2332.5 to 2345 MHz
Gain	23.75 ± 2 dB
Noise Figure	<1.1 dB
Nominal Output Impedance	50 ohms
Supply Voltage	3.6 to 5.5 VDC
Supply Current	15 to 45 mA

11.5 GA 56W GPS WAAS Antenna

11.5.1 Specifications

Table 11-6. GA 56W Antenna Specifications

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Gain	26.5 dB to 28.5 dB
Noise Figure	≤4.00 dB
Nominal Output Impedance	50 ohms
Supply Voltage	4.5 to 5.5 VDC
Supply Current	50 mA max
TSO	TSO-C144

Table 11-7. Antenna Pattern

(measured with a 3 wavelength radius ground plane)

Frequency	Elevation angle (0=up)	RHCP Isotropic Gain (min)	Axial Ratio
1575MHz	0°	3.0 dBic	3 dB max
1575MHz	75°	-0.5 dBic	3 dB max
1575MHz	80°	-2.0 dBic	6 dB max
1575MHz	85°	-3.4 dBic	6 dB max
1575MHz	90°	-5.7 dBic	6 dB max

11.6 Installation Considerations and Mounting Requirements

11.6.1 Teardrop Footprint Antennas: GA 35, GA 56W, A-34

11.6.1.1 Stud Mount Antennas: GA 56W

Materials required:

- Neoprene Gasket, Garmin P/N: 253-00002-00
- Doubler Plate, Garmin P/N: 115-00846-10
- 8-32 Self-locking nuts, Garmin P/N: 210-10004-09 (AN365C832 or MS21044C08), Quantity - 4
- Rivets for mounting doubler plate MS20426AD4-( ), length and quantity determined at installation.

Figure 11-1. Stud Mount Teardrop Footprint Antenna

11.6.1.2 Through Mount Antennas: GA 35, A-34

Materials required:

- Nitrile O-ring
  - 26.64mm ID x 2.62mm W, size 2-121 (A-34)
  - MS28775-116 (GA 35)
- Doubler Plate, Garmin P/N: 115-00846-10
- 8-32 Self-locking nuts, AN365C832, MS21044C08 or equivalent, Quantity - 4
- Rivets for mounting doubler plate MS20426AD4-( ), length and quantity determined at installation.

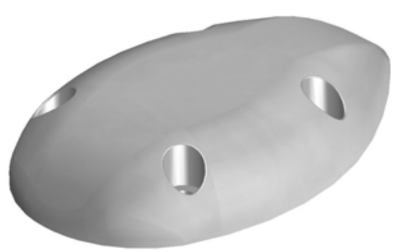


Figure 11-2. Through Mount Teardrop Footprint Antenna

11.6.2 ARINC 743 Footprint Antennas: GA 56A and GA 57

Materials required:

- Neoprene Gasket, Garmin P/N: 253-00138-00
- Doubler Plate, Garmin P/N: 115-00846-00
- 10-32 x 1" mounting screws, Garmin P/N: 211-60212-20 (MS51958-67), Quantity – 4
- Rivets for mounting doubler plate MS20426AD4-( ), length and quantity determined at installation.

Figure 11-3. Garmin ARINC 743 Footprint Antenna

11.6.3 Antenna Mounting Location

Refer to Section 1.6

11.6.4 Antenna Doubler/Backing Plate

The antenna installation must provide adequate support for the antenna considering a maximum drag load of 5 lbs. (at subsonic speed). A doubler plate is required when the antenna is mounted on any unsupported skin area. Never weaken the aircraft structure when choosing a mounting area. Make use of any available reinforcements where appropriate. Antenna performance is improved by having an appropriate grounding plane. When designing the doubler, the installation should evaluate the ground plane requirements and make decisions to accomplish both functions with the doubler.

11.6.5 Antenna Grounding Plane

The antenna should be attached to a metal ground plane (aircraft skin). The ground plane should be a conductive surface as large as practical, with a minimum diameter of 8 inches. To use an antenna in aircraft with fabric or composite skin, a ground plane is recommended. It is usually installed under the skin of the aircraft, below the antenna, and is made of either aluminum sheet or of wire mesh.

11.6.6 Antenna Grounding

The antenna is grounded through the mounting hardware. The mounting hardware (washers and nuts) and doubler plate should make contact with an unpainted surface ensuring proper antenna grounding.

It is very important to have good conductivity between the coaxial shield and the ground plane. This is ensured when all fasteners properly ground the antenna base to the skin of the aircraft.

11.7 Teardrop Footprint Antenna Installation (GA 35, A-34, and GA 56W)

This section describes the structural mounting of the teardrop footprint antenna installation. One acceptable method is to use Garmin P/N: 115-00846-10 doubler plate. Another acceptable method is to fabricate and install one of three doublers, Figure 11-4, Figure 11-5, and Figure 11-6, depending on the thickness of the skin. The three doubler designs vary only by number of rivets and hole preparation for installation with flush rivets. Figure 11-14 shows installation of the stud mount teardrop footprint antenna. Figure A-15 shows installation of the through mount teardrop footprint antenna.

Table 11-8 provides a summary of design and installation details for the antenna doubler. Figure 11-7 shows an example of the doubler installed between stringers on the top fuselage skin, just off centerline. The location should be flat, with no gaps between the skin and doubler, to keep from deforming the skin during installation.

Table 11-8. Teardrop Footprint Antenna Doubler Design and Installation

Skin Thickness	0.032” to 0.049”	0.049” to 0.051”	0.051” to 0.063”
Doubler Design (Figure)	Figure 11-4	Figure 11-5	Figure 11-6
Number of Rivets Required	12	16	16
Type of Rivets Required[1]	MS20426AD4-x	MS20426AD4-x	MS20426AD4-x
Skin Preparation for Rivets	Dimple	Dimple	Countersink
Doubler Preparation for Rivets	Countersink	Countersink	None
Skin Cutout Detail (Figure)	Figure 11-8	Figure 11-9	Figure 11-10
Doubler Installation (Figure)	Figure 11-11	Figure 11-12	Figure 11-13

Notes:

1. Rivet length determined at installation, dependent on thickness of material (rivet length = grip length + 1.5*rivet diameter)

11.7.1 Preparation of Doubler

a. Use Garmin P/N: 115-00846-10, or refer to Table A-1 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063" sheet thickness.

b. For installation in aircraft skins of thickness less than 0.051", countersink the rivet holes in the doubler for use with flush head rivets (MS20426AD4-x).

c. When using Garmin P/N: 115-00846-10 doubler, sixteen rivet holes exist in the part. For installation of Garmin P/N: 115-00846-10 in skins of thickness between 0.032" and 0.049", only those identified for use through the skin cutout detail (Figure 11-8) and doubler installation (Figure 11-11) are required.

11.7.2 Antenna Installation Instructions

a. Refer to Table 11-8 for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).

b. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 11.7.1 for doubler preparation and Table 11-8 for additional guidance on the doubler installation. Dimple aircraft skin when the skin thickness is less than 0.051" for installation of flush head rivets. Countersink aircraft skin when the skin thickness is between 0.051" and 0.063" for installation of flush head rivets.

c. For the stud mount teardrop footprint antenna, place install gasket on top of aircraft skin using the four screw holes to align the gasket. For the through mount teardrop footprint antenna, secure o-ring in the o-ring groove on the underside of the antenna.

d. Washers and locking nuts are required to secure the antenna. Torque the four #8-32 stainless steel locking nuts 12-15 in-lbs. Torque should be applied evenly across all mounting studs or screws to avoid deformation of the mounting area.

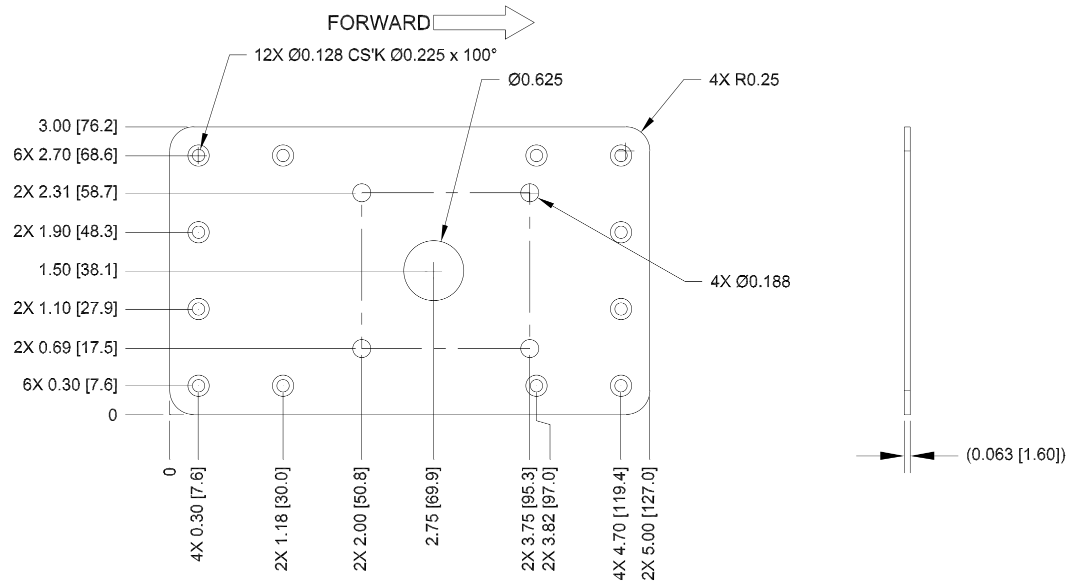
e. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket or o-ring, as appropriate to the antenna model.

f. Seal the antenna and gasket to the fuselage using Dow Corning 738 Electrical Sealant or equivalent. Run a bead of the sealant along the edge of the antenna where it meets the exterior aircraft skin. Use caution to ensure that the antenna connectors are not contaminated with sealant.

CAUTION

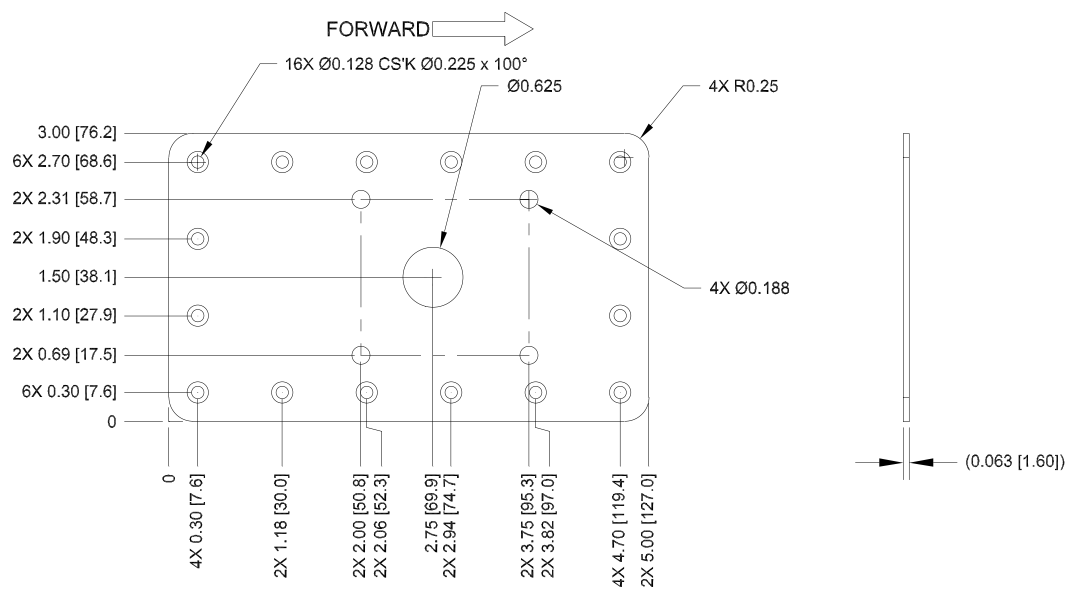
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

11.7.3 Reference Figures



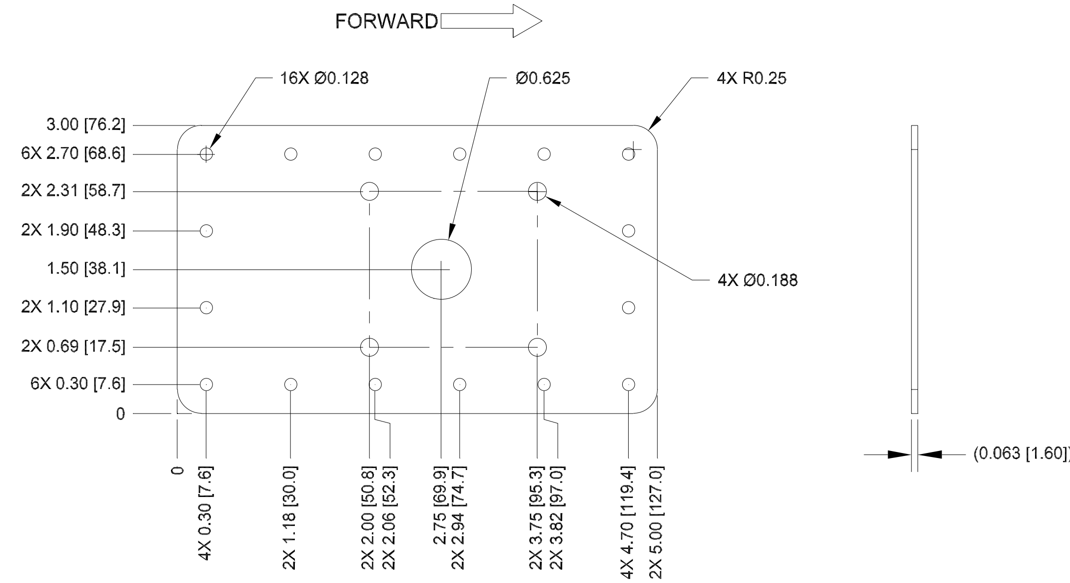
NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 11-4. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 11-5. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM
(AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 11-6. Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

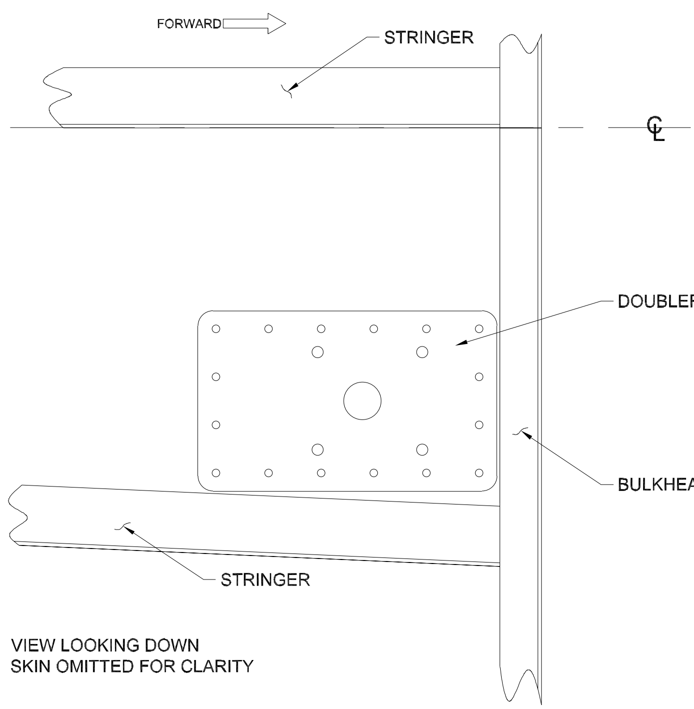


Figure 11-7. Sample Doubler Location, Teardrop Footprint Antenna, Metal Skin Aircraft

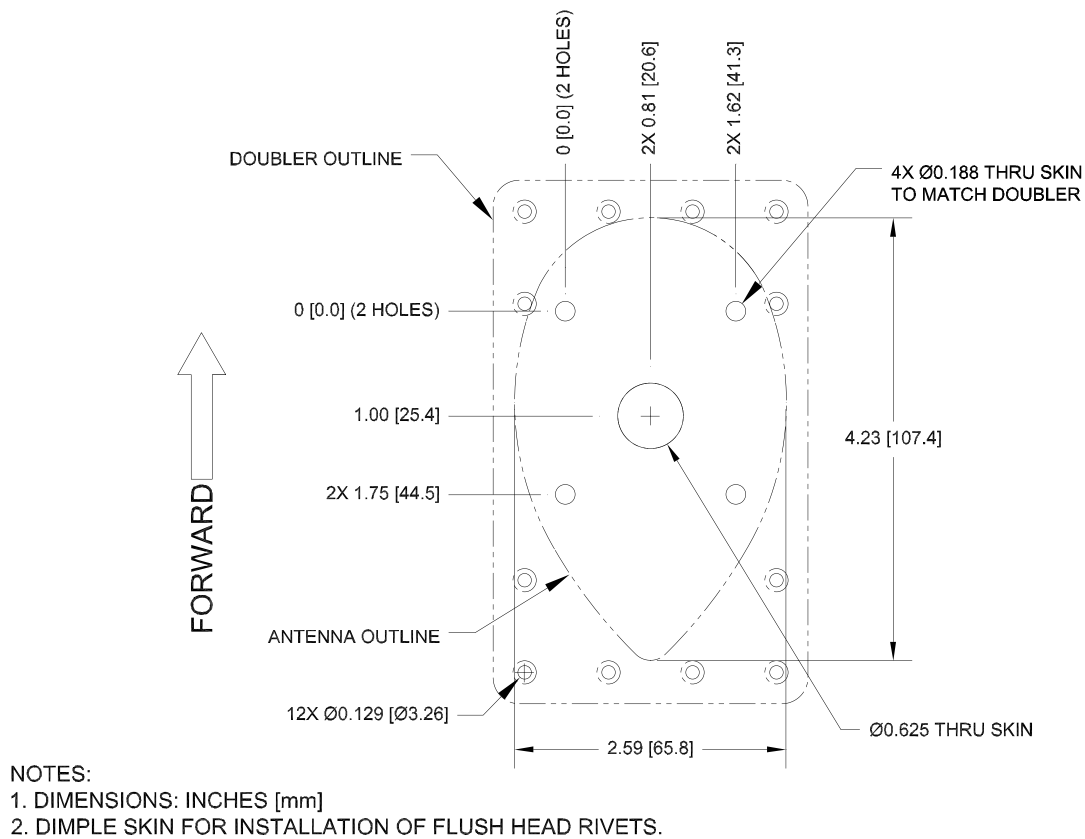


Figure 11-8. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"

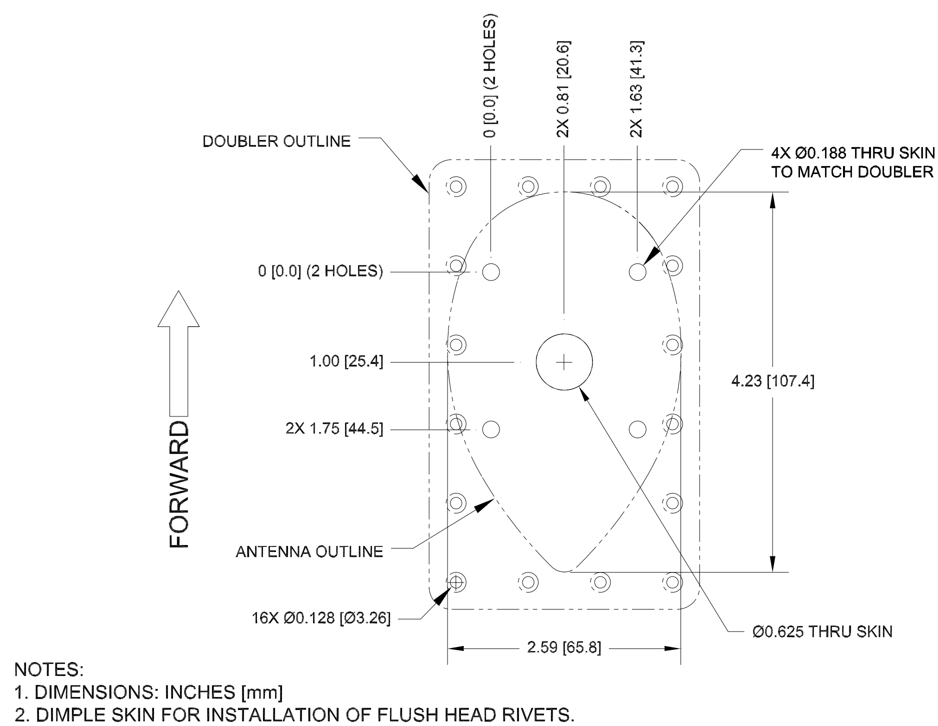
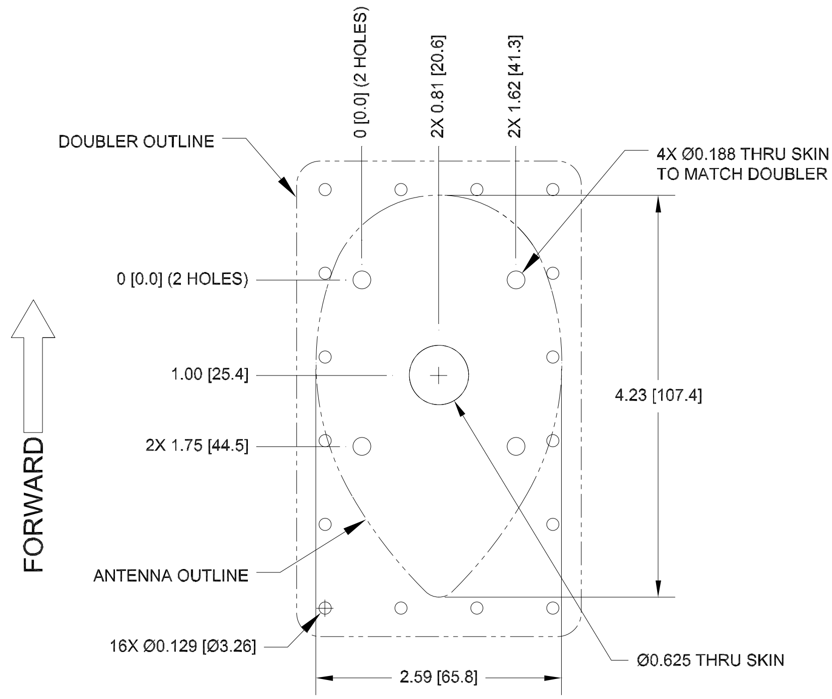
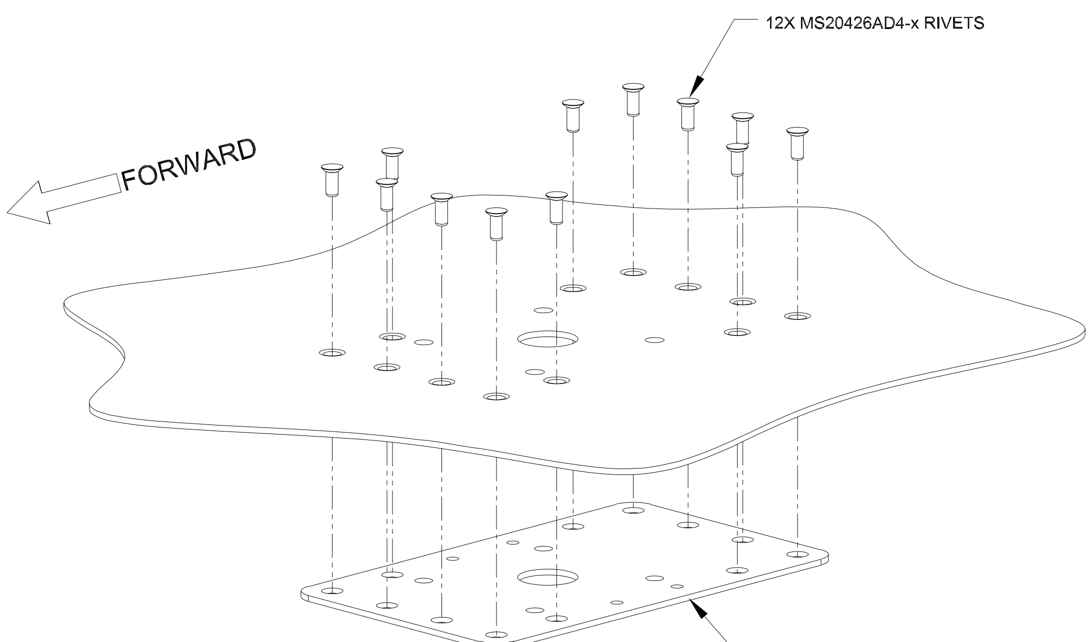


Figure 11-9. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



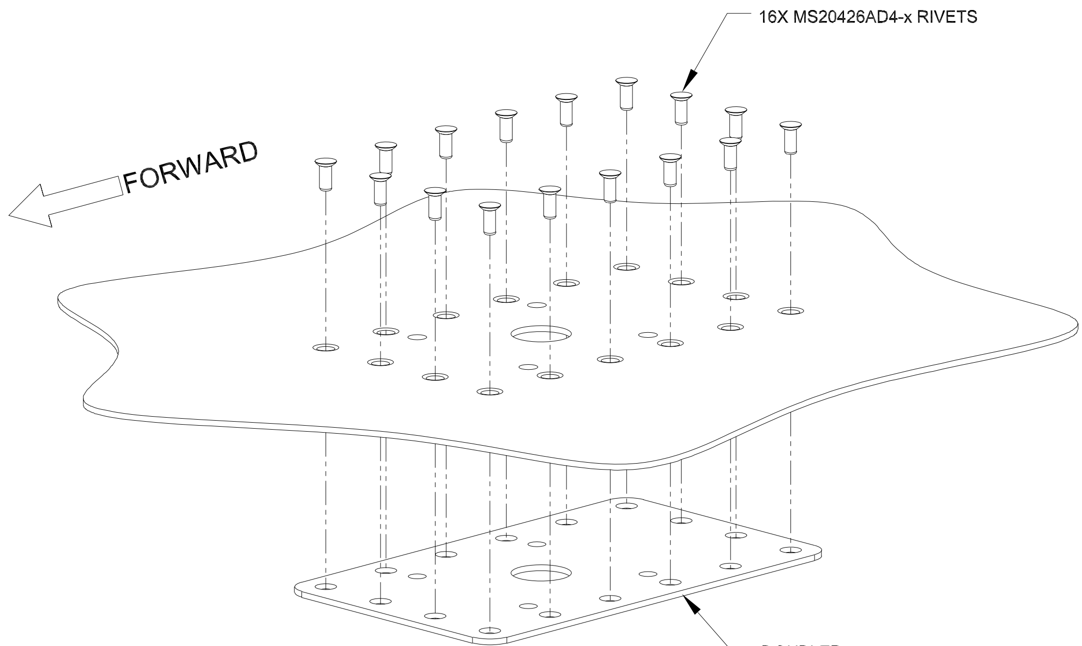
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 11-10. Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"



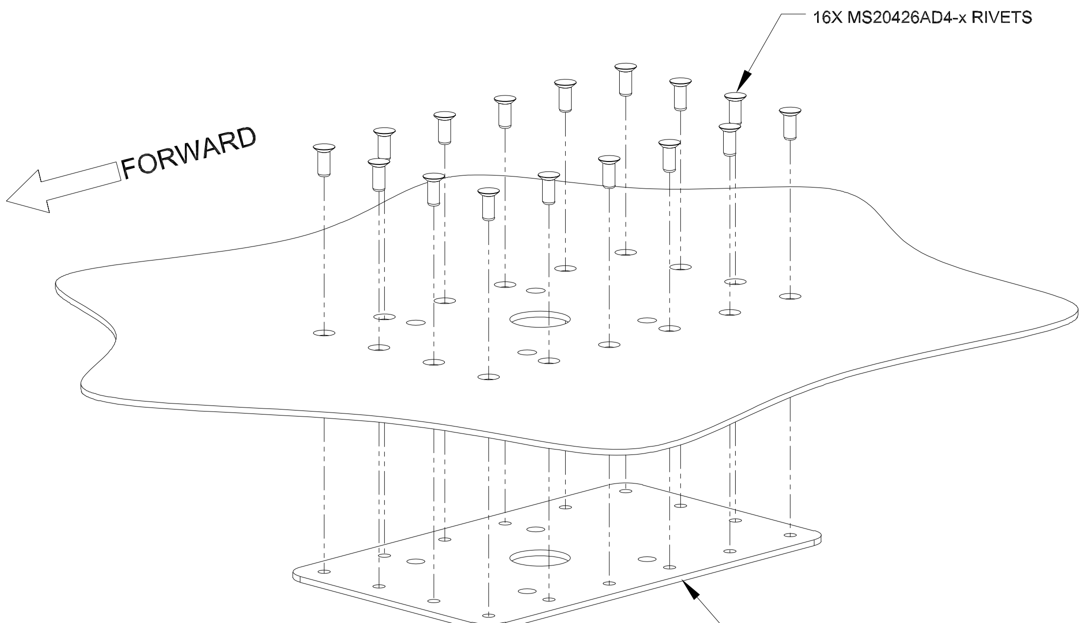
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 11-11. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 11-12. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 11-13. Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

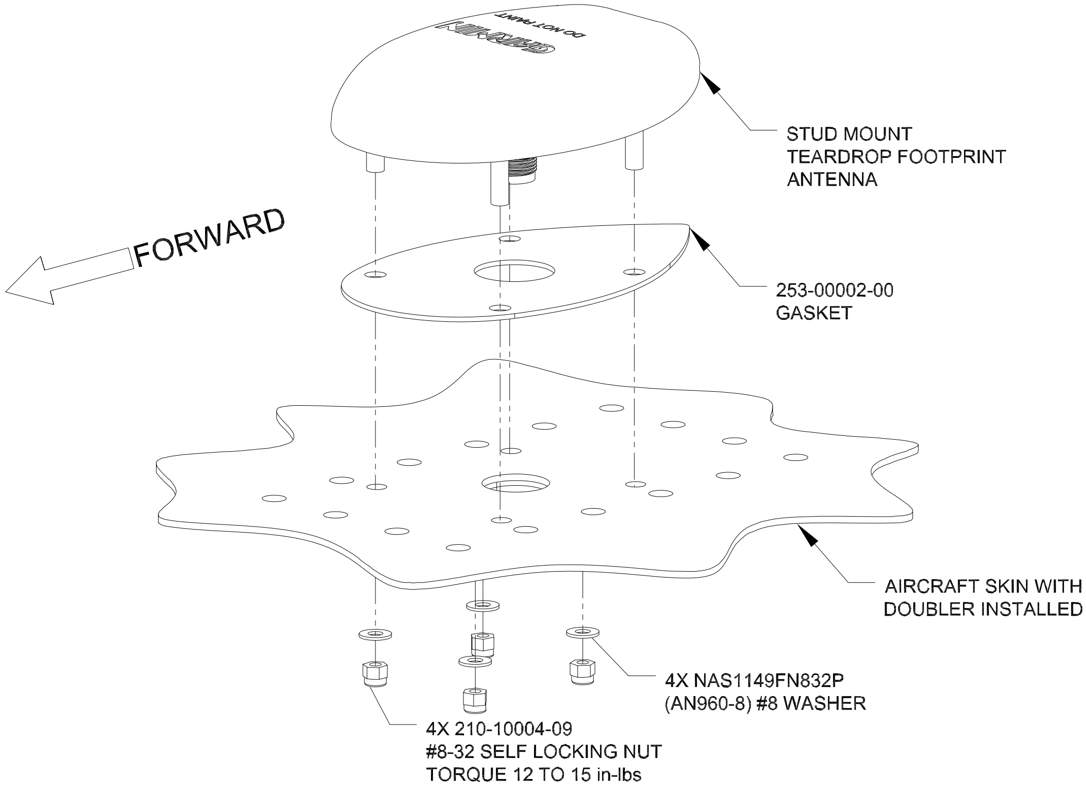


Figure 11-14. Stud Mount Teardrop Footprint Antenna Installation

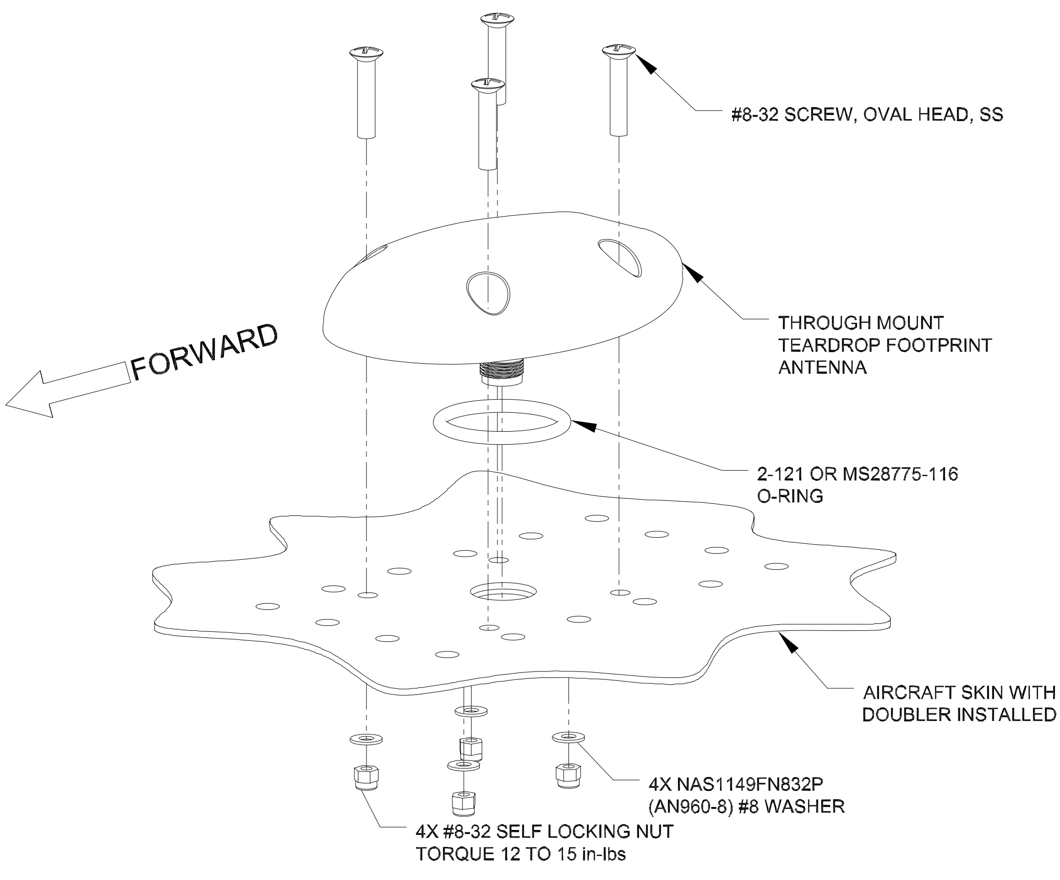


Figure 11-15. Through Mount Teardrop Footprint Antenna Installation

11.8 ARINC 743 Footprint Antenna Installation (GA 56A and GA 57)

This section describes the structural mounting of the ARINC 743 footprint antenna installation. One acceptable method is to use Garmin P/N: 115-00846-00 doubler plate. Another acceptable method is to fabricate and install one of three doublers, Figure 11-16, Figure 11-17, or Figure 11-18, depending on the thickness of the skin. The three doubler designs vary only by number of rivets and hole preparation for installation with flush rivets. Figure 11-29 shows installation of the ARINC 743 footprint antenna. Table 11-9 provides a summary of design and installation details for the antenna doubler. Figure 11-19 shows an example of the doubler installed between stringers on the top fuselage skin, just off centerline. The location should be flat, with no gaps between the skin and doubler, to keep from deforming the skin during installation.

Table 11-9. ARINC 743 Footprint Antenna Doubler Design and Installation

Skin Thickness	0.032” to 0.049”	0.049” to 0.051”	0.051” to 0.063”
Doubler Design (Figure)	Figure 11-16	Figure 11-17	Figure 11-18
Number of Rivets Required	12	16	16
Type of Rivets Required[1]	MS20426AD4-x	MS20426AD4-x	MS20426AD4-x
Skin Preparation for Rivets	Dimple	Dimple	Countersink
Doubler Preparation for Rivets	Countersink	Countersink	None
Skin Cutout Detail (GA 56A)	Figure 11-20	Figure 11-21	Figure 11-22
Skin Cutout Detail (GA 57)	Figure 11-23	Figure 11-24	Figure 11-25
Doubler Installation (Figure)[2]	Figure 11-26	Figure 11-27	Figure 11-28

Notes:

1. Rivet length determined at installation, dependent on thickness of material (rivet length = grip length + 1.5*rivet diameter)
2. Doubler installation figures show skin cutouts for GA 57 antenna as an example; use only the skin cutouts required for the antenna being installed.

11.8.1 Preparation of Doubler

a. Use Garmin P/N: 115-00846-00, or refer to Table 11-9 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063" sheet thickness.

b. For installation in aircraft skins of thickness less than 0.051", countersink the rivet holes in the doubler for use with flush head rivets (MS20426AD4-x).

c. When using Garmin P/N: 115-00846-00 doubler, sixteen rivet holes exist in the part. For installation of Garmin P/N: 115-00846-10 in skins of thickness between 0.032" and 0.049", only those identified for use through the skin cutout detail (Figure 11-20 for GA 56A, Figure 11-23 for GA 57) and doubler installation (Figure 11-26) are required.

11.8.2 Antenna Installation Instructions

a. Refer to Table 11-9 for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).

b. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 11.8.1 for doubler preparation and Table 11-9 for additional guidance on the doubler installation. Dimple aircraft skin when the skin thickness is less than 0.051" for installation of flush head rivets. Countersink aircraft skin when the skin thickness is between 0.051" and 0.063" for installation of flush head rivets.

c. Place install gasket, Garmin P/N: 253-00138-00, on top of aircraft skin using the four screw holes to align the gasket.

d. Locking nuts are required to secure the antenna (locking nutplates installed on doubler). Torque the four supplied #10-32 stainless steel screws (Garmin P/N: 211-60212-20, MS51958-67, or equivalent) 20-25 in-lbs. Torque should be applied evenly across all mounting studs to avoid deformation of the mounting area.

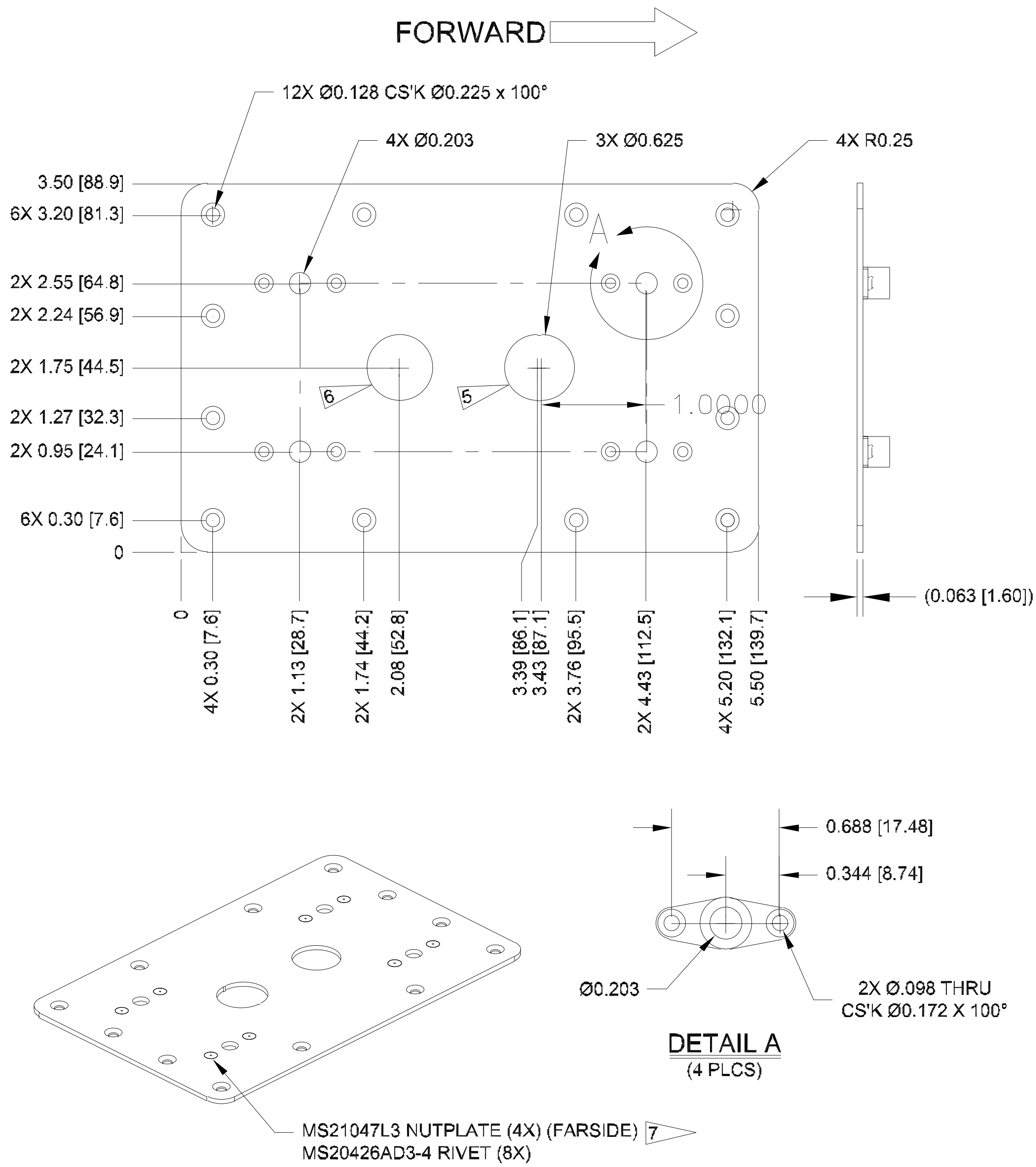
e. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket.

f. Seal the antenna and gasket to the fuselage using Dow Corning 738 Electrical Sealant or equivalent. Run a bead of the sealant along the edge of the antenna where it meets the exterior aircraft skin. Use caution to ensure that the antenna connectors are not contaminated with sealant.

CAUTION

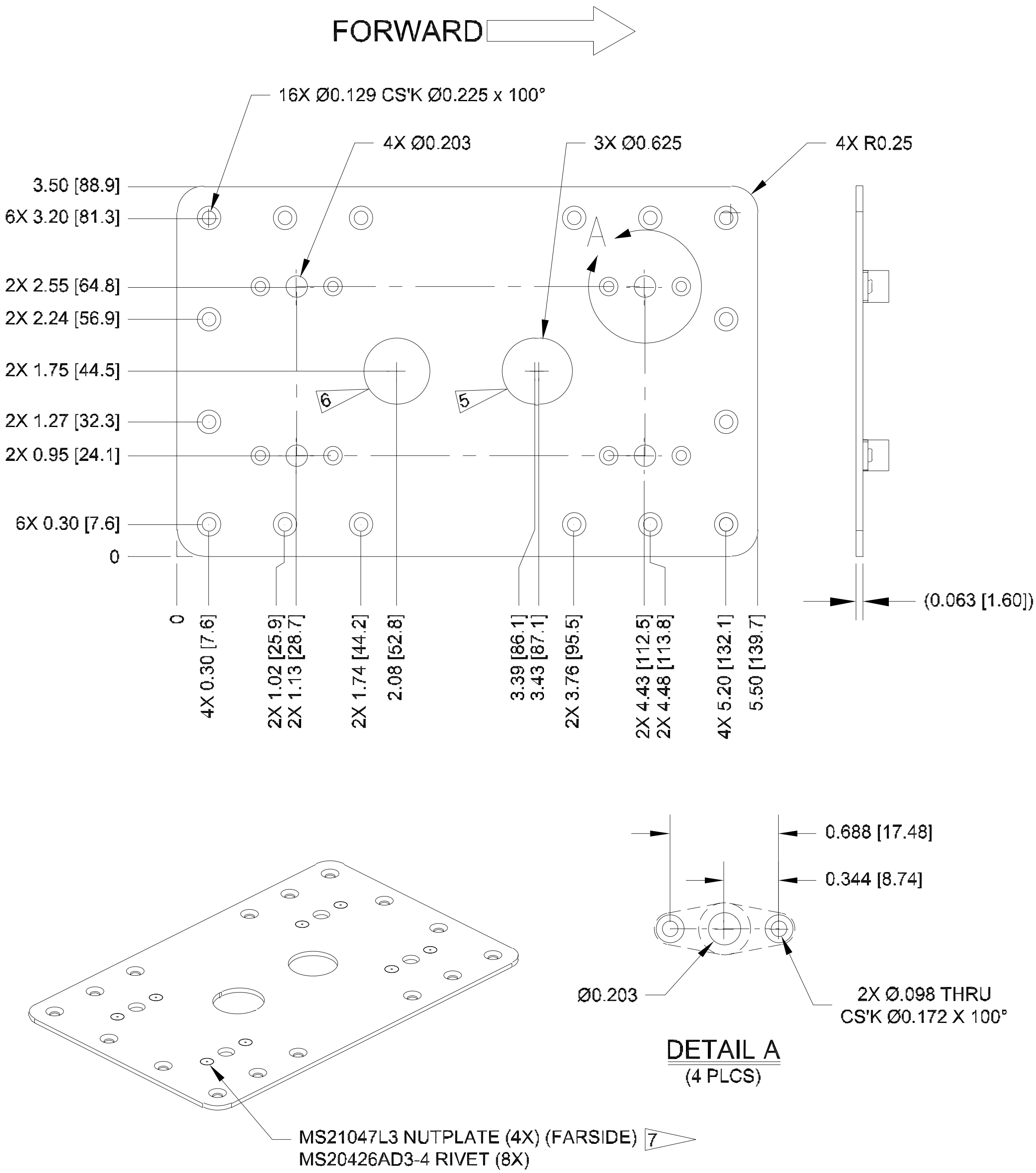
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

11.8.3 Reference Figures



NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. HOLE OPTIONAL, GA 36 AND GA56A ANTENNA INSTALLATION
7. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

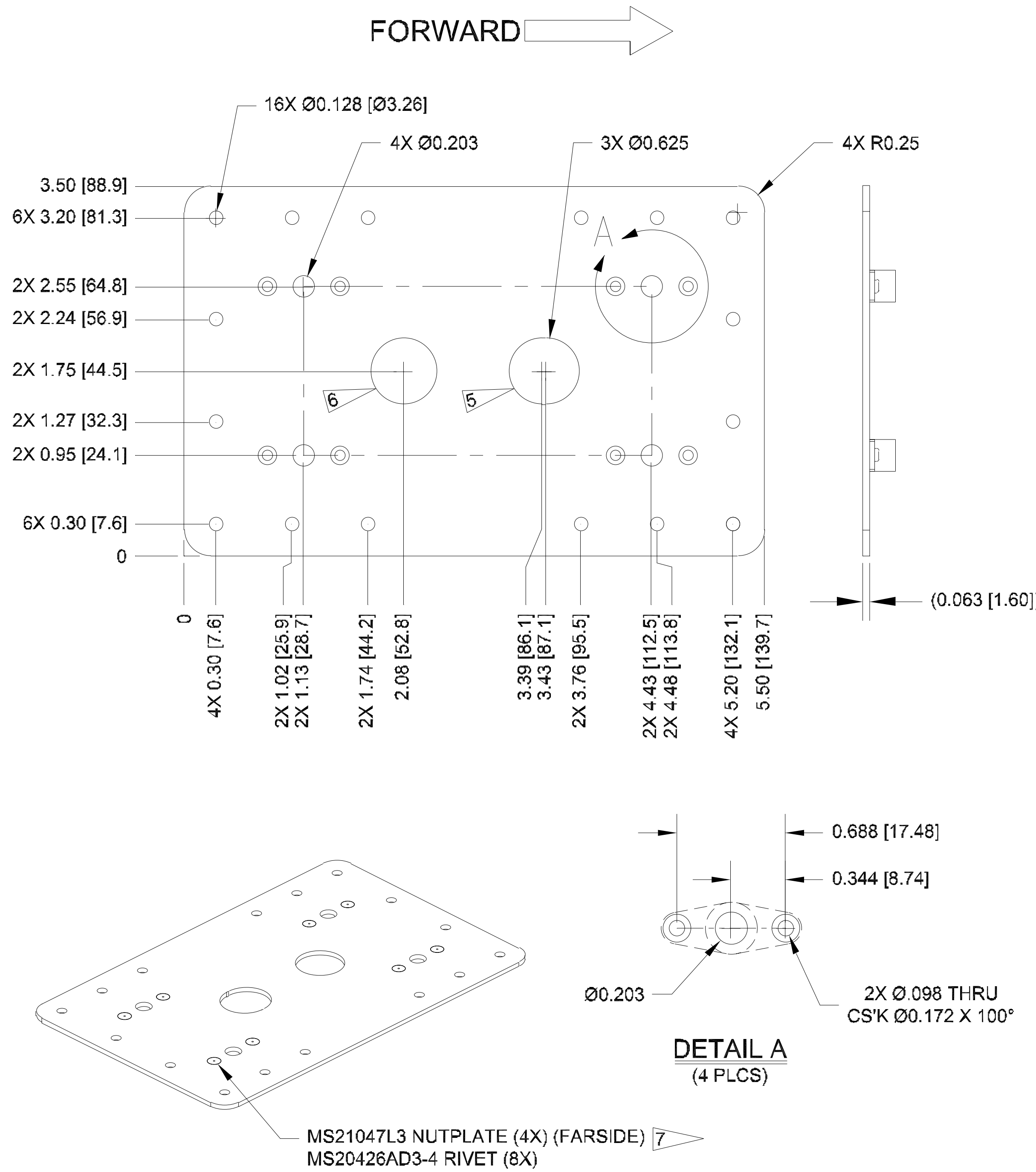
Figure 11-16. Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:

1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. HOLE OPTIONAL, GA 36 AND GA56A ANTENNA INSTALLATION
7. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 11-17. Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:

1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. HOLE OPTIONAL, GA 36 AND GA56A ANTENNA INSTALLATION
7. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 11-18. Doubler Design, ARINC 743 Footprint, Skin Thickness 0.051" to 0.063"

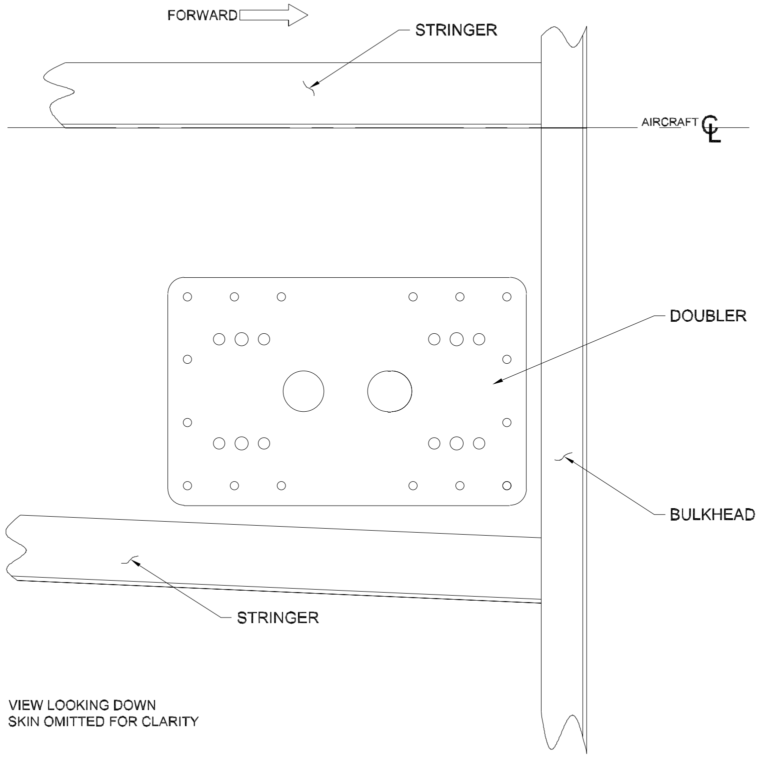
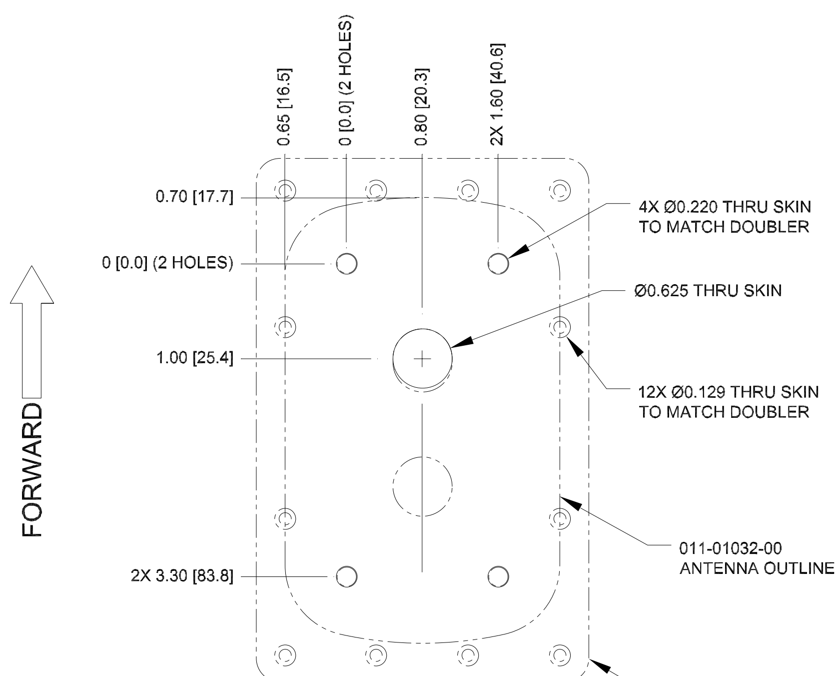
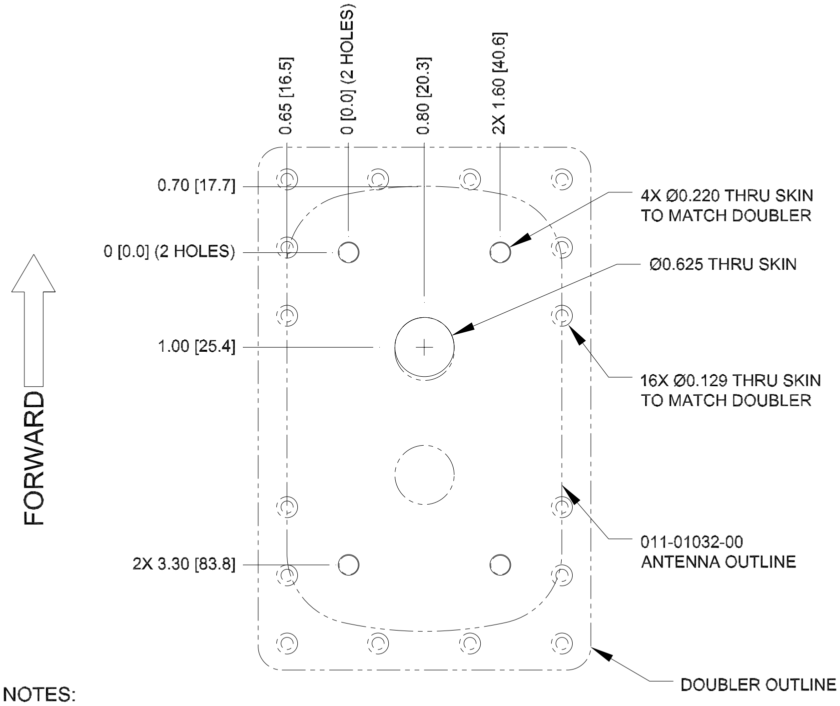


Figure 11-19. Sample Doubler Location, ARINC 743 Footprint Antenna, Metal Skin Aircraft



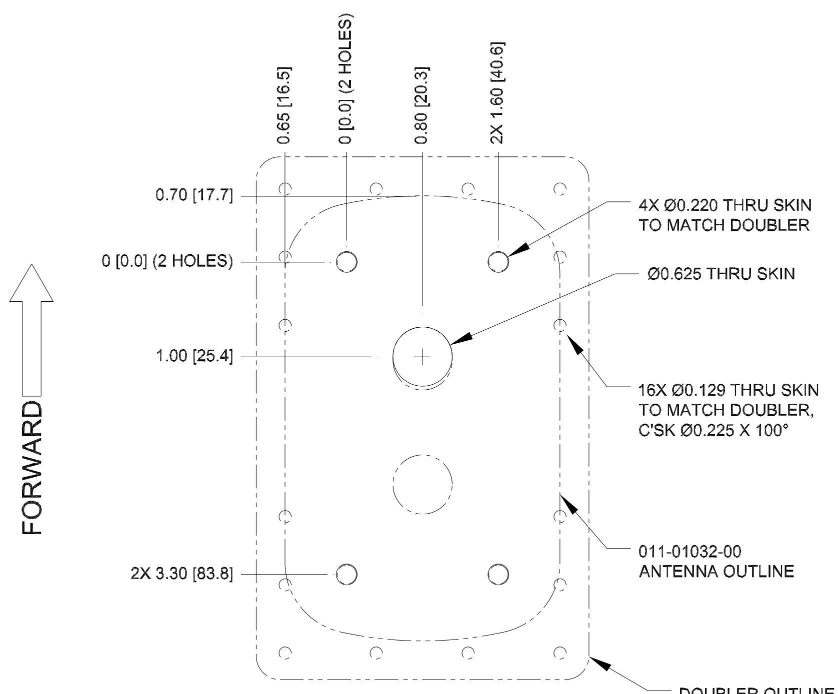
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 11-20. Skin Cutout Detail, GA 56A Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 11-21. Skin Cutout Detail, GA 56A Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH RIVETS.

Figure 11-22. Skin Cutout Detail, GA 56A Antenna, Skin Thickness 0.051" to 0.063"

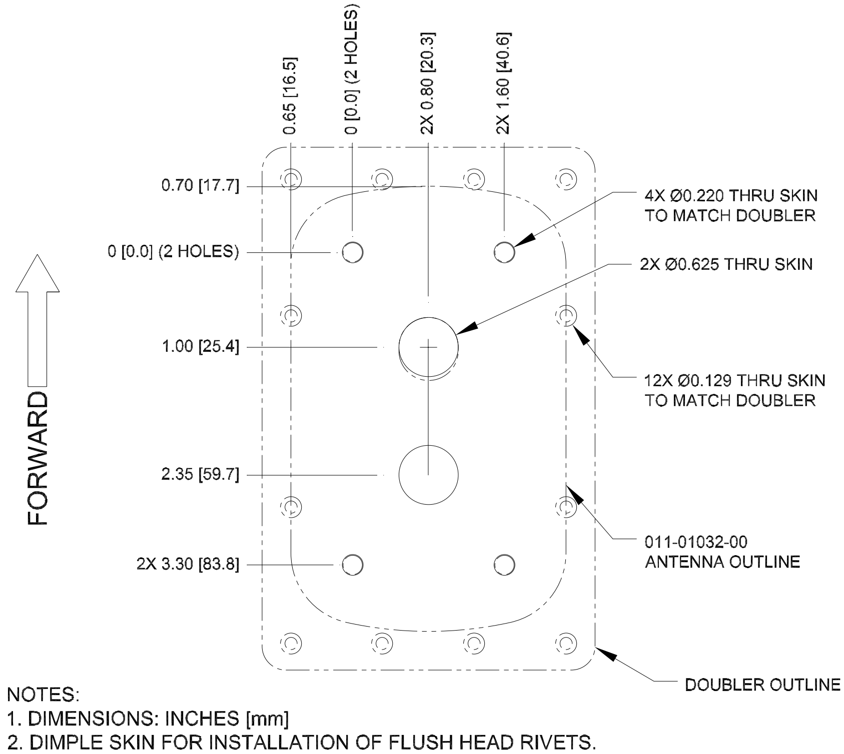


Figure 11-23. Skin Cutout Detail, GA 57 Antenna, Skin Thickness 0.032" to 0.049"

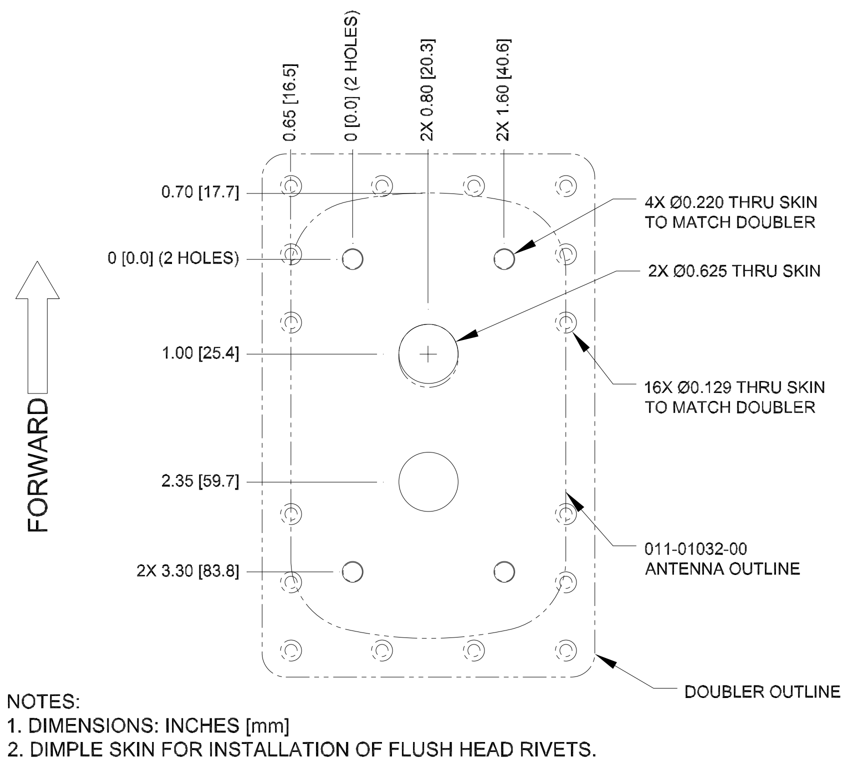


Figure 11-24. Skin Cutout Detail, GA 57 Antenna, Skin Thickness 0.049" to 0.051"

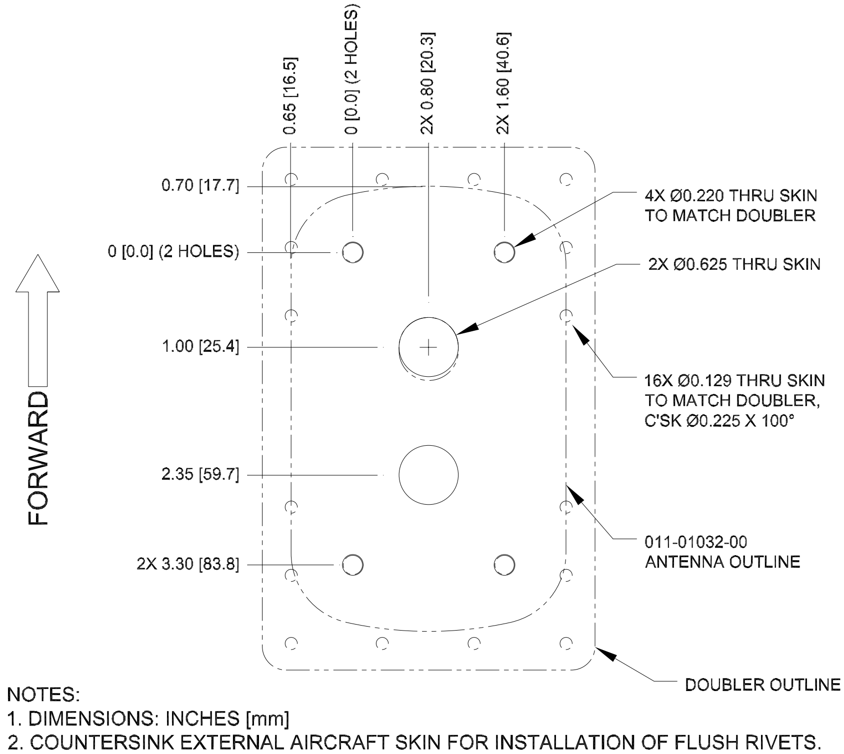


Figure 11-25. Skin Cutout Detail, GA 57 Antenna, Skin Thickness 0.051" to 0.063"

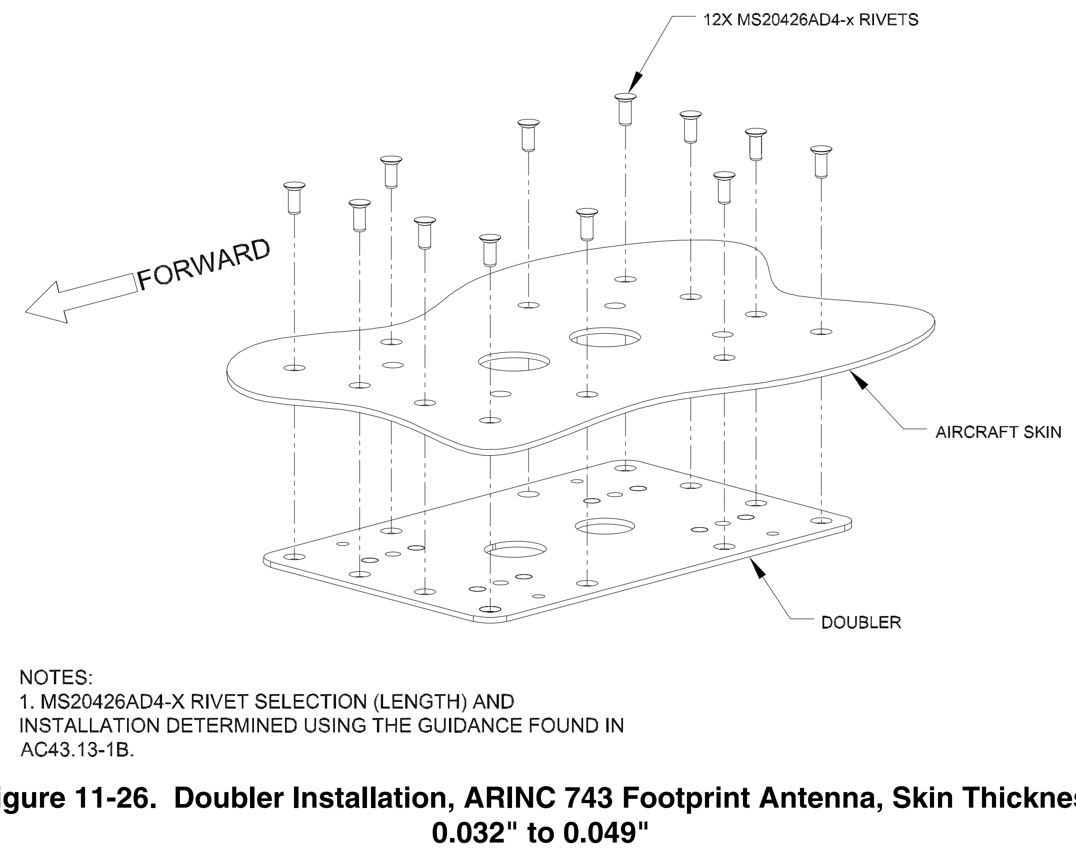
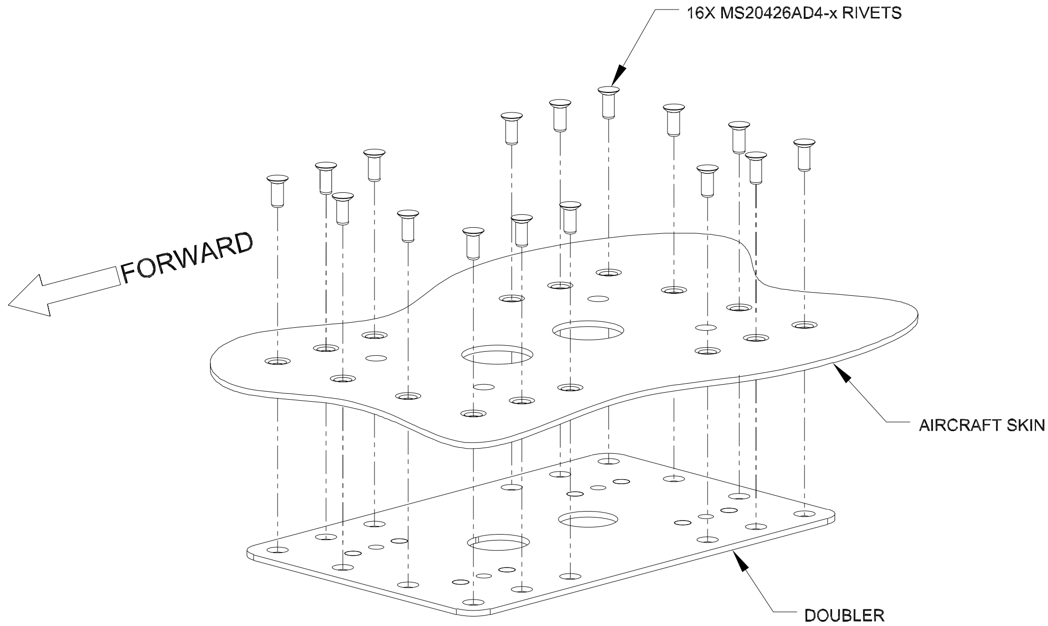
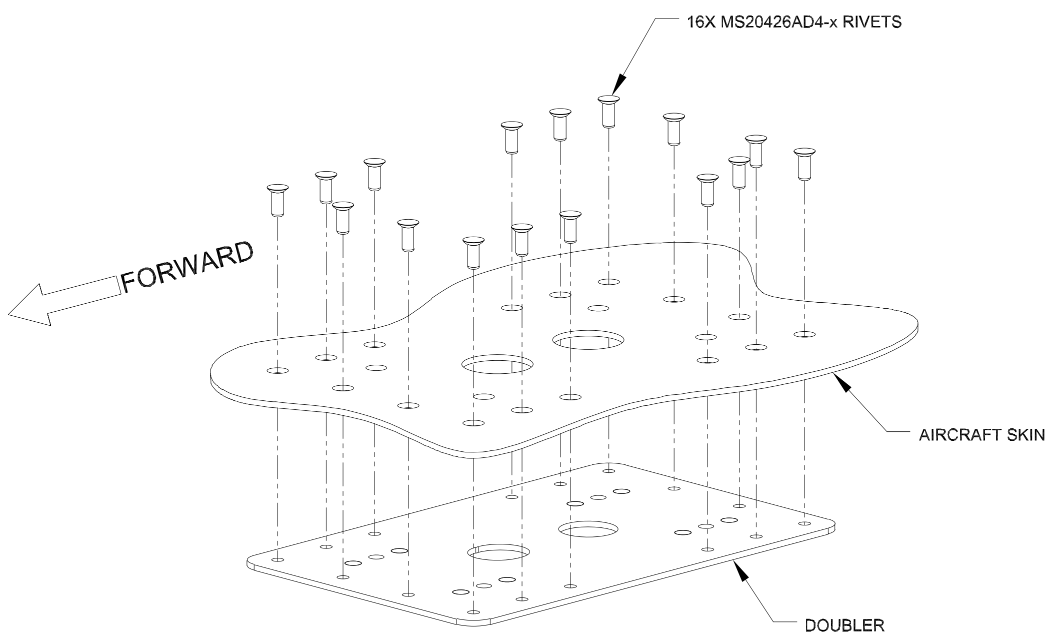


Figure 11-26. Doubler Installation, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 11-27. Doubler Installation, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 11-28. Doubler Installation, ARINC 743 Footprint, Skin Thickness 0.051" to 0.063"

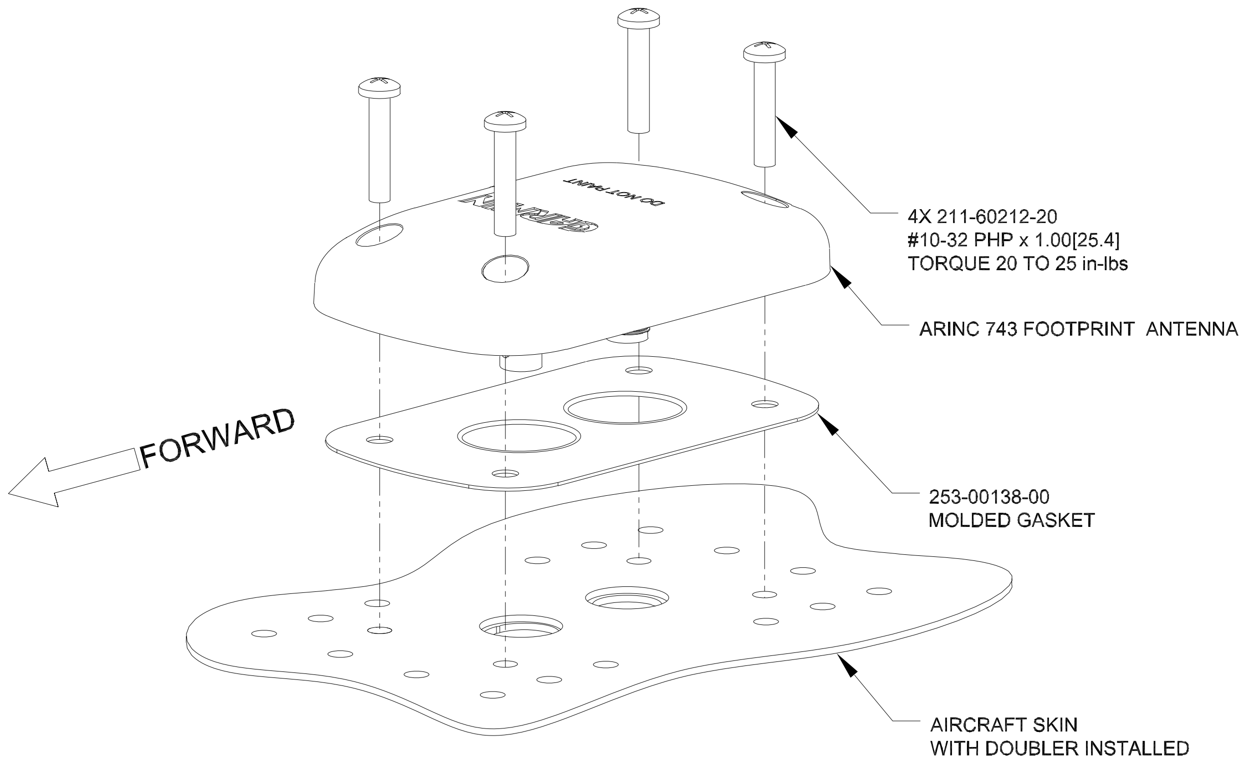


Figure 11-29. Installation of ARINC 743 Footprint Antenna

11.9 Non-Structural Mount Installation

This section provides installation examples and considerations for non-structural mounting of teardrop and ARINC 743 footprint antennas. Typical installations may be below a non-metallic glareshield, under the composite or fabric skin, or on an external, non-structural surface. Other non-structural installations may exist, but are not presented in this manual.

11.9.1 Generic Teardrop Footprint Antenna

Figure 11-30 shows the generic non-structural installation for the stud mount teardrop format antenna. A doubler plate similar to Figure 11-4, or Garmin P/N: 115-00846-10 can be used with the mounting surface to support the antenna. Rivets used to secure the doubler plate to the mounting surface are optional in a non-structural installation. Washers and locking nuts are required to secure the antenna to the mounting surface. Torque the four supplied #8-32 stainless steel nylon locking nuts (Garmin P/N: 210-10004-09, AN365C832, MS21044C08, or equivalent) 12-15 in-lbs. Apply torque evenly across all mounting studs.

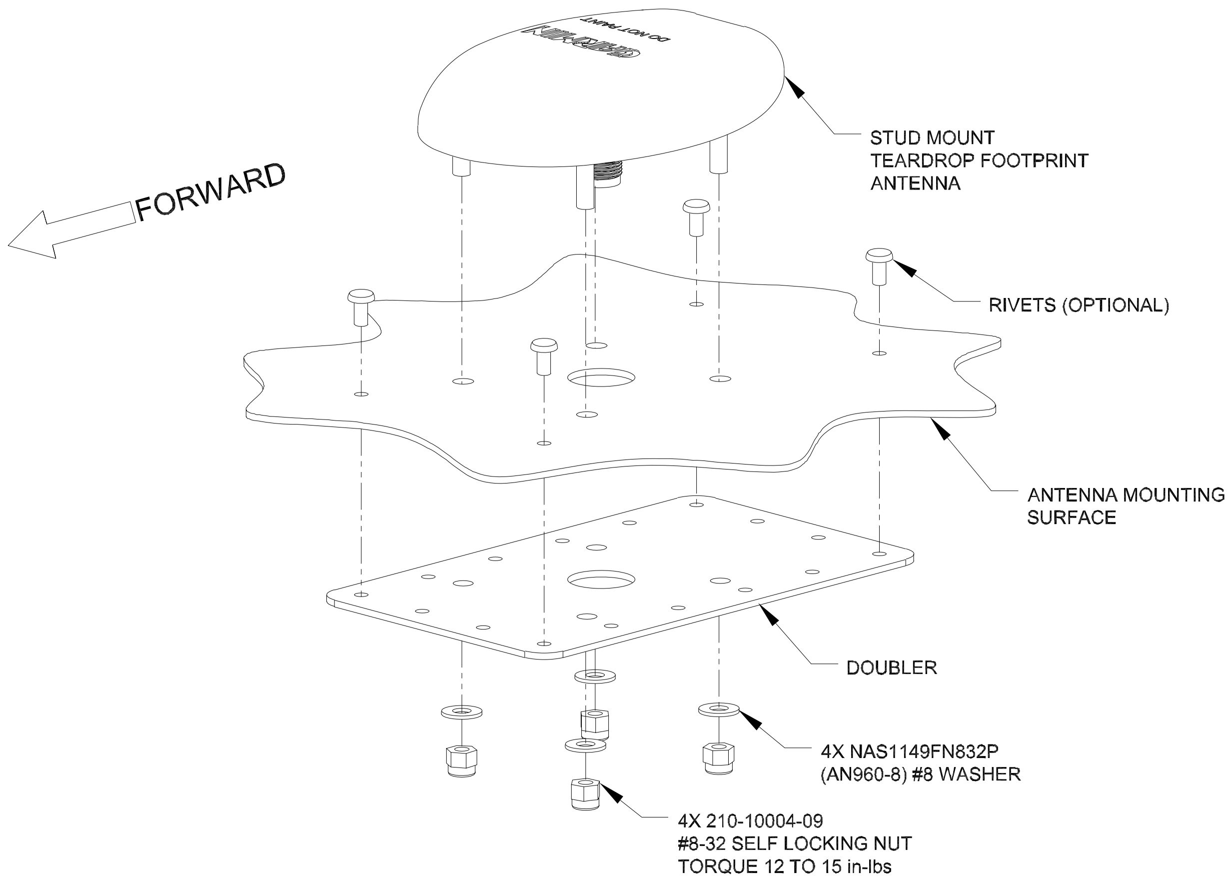


Figure 11-30. Generic Non-structural Stud Mount Teardrop Footprint Antenna Installation

Figure 11-31 shows the generic non-structural installation for the through mount teardrop footprint antenna. A doubler plate similar to Figure 11-4, or Garmin P/N: 115-00846-10 can be used with the mounting surface to support the antenna. Rivets used to secure the doubler plate to the mounting surface are optional in a non-structural installation. Screws, washers and locking nuts are required to secure the antenna to the mounting surface. Torque the four #8-32 stainless steel locking nuts (AN365C832, MS21044C08, or equivalent) evenly across all mounting screws.

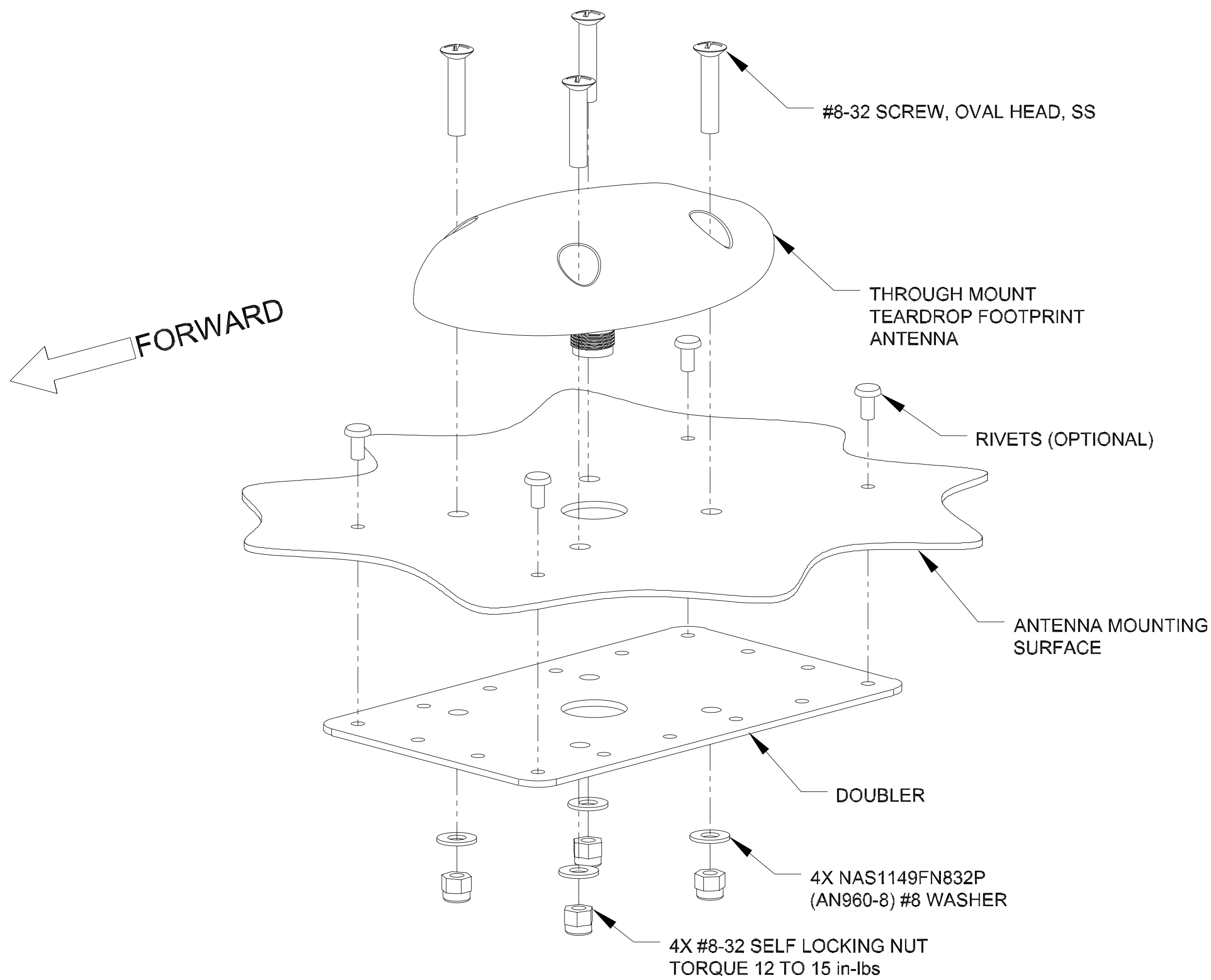


Figure 11-31. Generic Non-structural Through Mount Teardrop Footprint Antenna Installation

11.9.2 Generic Non-structural Installation of ARINC 743 Footprint Antenna

Figure 11-32 shows the generic non-structural installation for the ARINC 743 footprint antenna. A doubler plate similar to Figure 11-16, or Garmin P/N: 115-00846-00 can be used with the mounting surface. Locking nuts are required to secure the antenna (locking nutplates installed on doubler). Torque the four supplied #10-32 stainless steel screws (Garmin P/N: 211-60212-20, MS51958-67, or equivalent) evenly across all mounting screws.

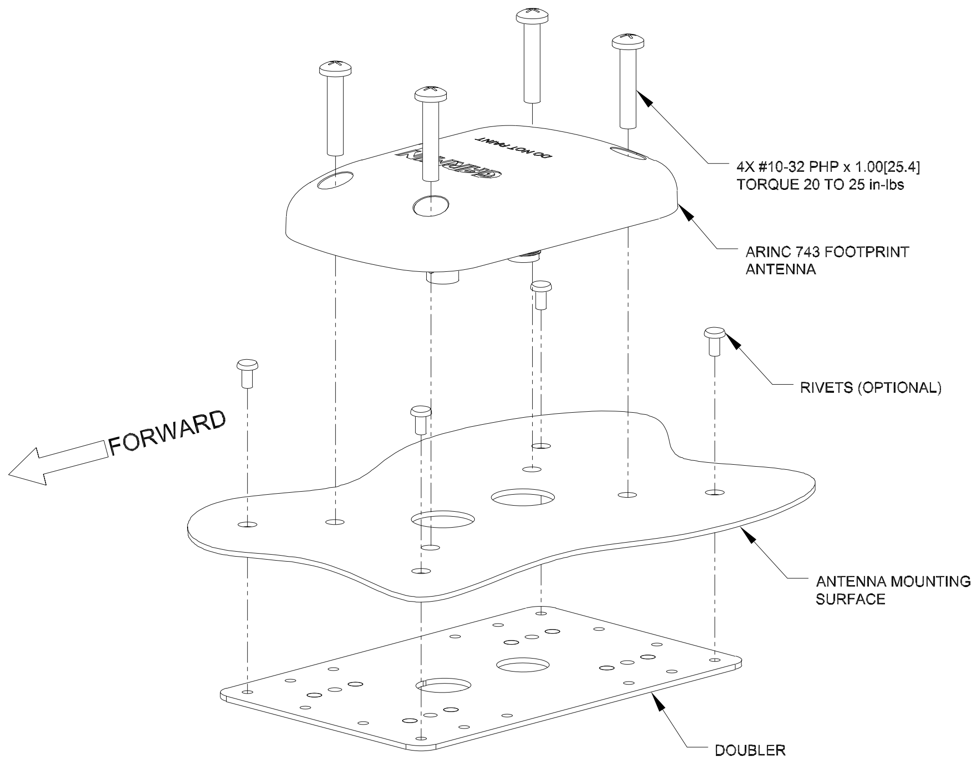


Figure 11-32. Generic Non-structural ARINC 743 footprint Antenna Installation

11.9.3 Considerations for Non-Structural Mounting

External mounting of the antenna is preferred, although the antenna can be mounted inside the aircraft. When mounted internally, the antenna does not have to be aligned with the aircraft forward direction, but should be within 15º of the pitch and roll axes of the aircraft.

There should be a solid mechanical base in the mounting area for the antenna, and existing surfaces or brackets may be used with the doubler plate. Alternately, non-structural brackets may be fabricated in the field as necessary to mount the antenna. Brackets should be made of minimum 0.032" thickness aluminum and should span as short a distance as possible.

Some fabric aircraft include aluminum paste in the fabric finishing process, often referred to as "silver coats". Presence of thick fabric and / or heavy "silver coats" may degrade the signal strength of the antenna.

11.9.4 Non-structural Installation to Glareshield

Figure 11-33 shows an example of a bracket created to support an antenna mounted on the underside of the glare shield. Figure 11-34 shows the non-structural mounting of the antenna under the glareshield, with the bracket assembly shown in Figure 11-33.

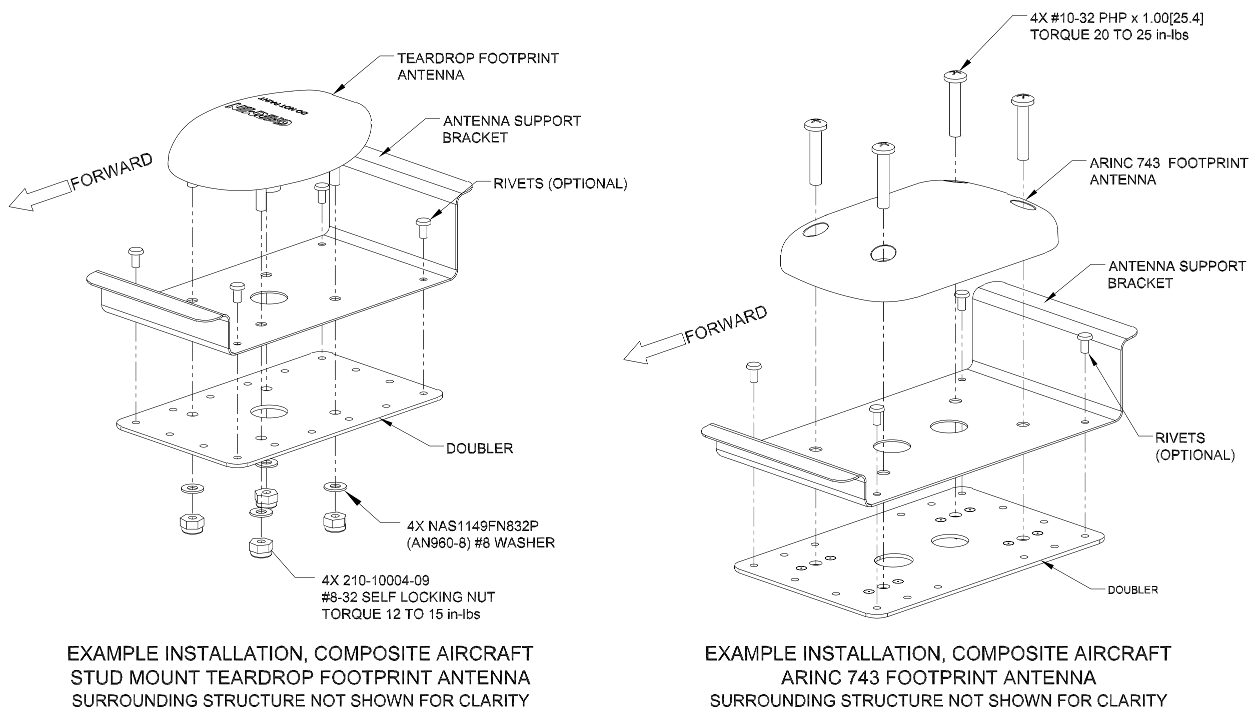


Figure 11-33. Example Bracket Antenna Mounting under Glareshield

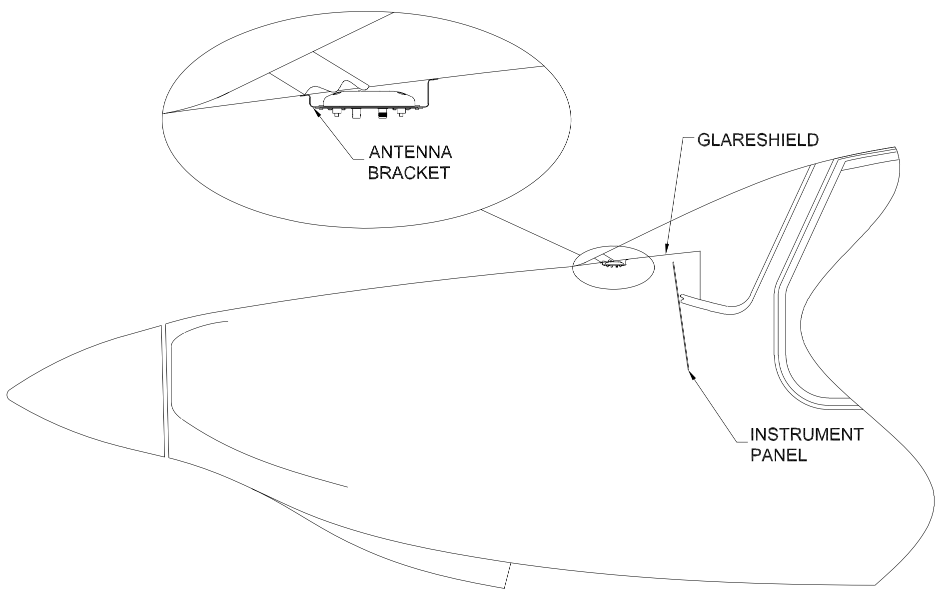


Figure 11-34. Example Non-structural Antenna Mounting under Glareshield

11.9.5 Non-structural Installation to Airframe

Figure 11-35, Figure 11-36, and Figure 11-38 show examples of non-structural mounting of the antenna to the airframe of a tube-and-fabric aircraft. Figure 11-37 shows minimum distance from metal tube structure requirements for internal, non-structural mounting of the antenna.

In Figure 11-35, a bracket is made to attach to the airframe, just under the fabric. The doubler plate and mounting hardware shown in the generic installations of Figure 11-30 or Figure 11-31 are used with the bracket as the antenna mounting surface. In Figure 11-36, a similar case is shown using the generic installation of the ARINC 743 footprint antenna (Figure 11-32). The doubler plate is optional.

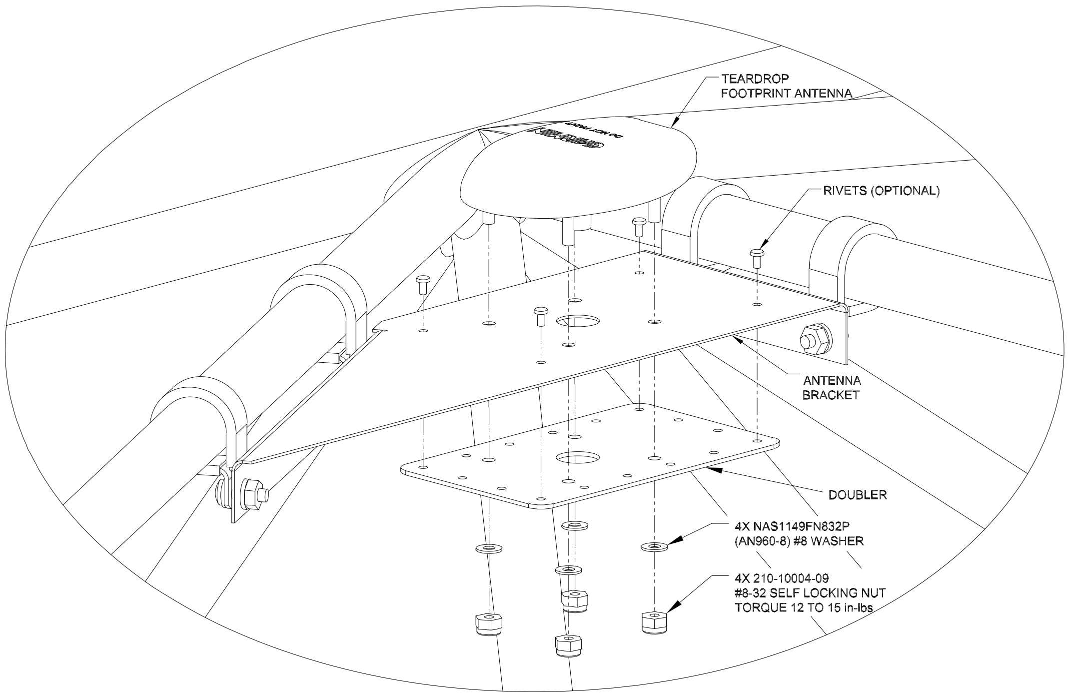


Figure 11-35. Example Teardrop Antenna Installation in Airframe under Fabric Skin

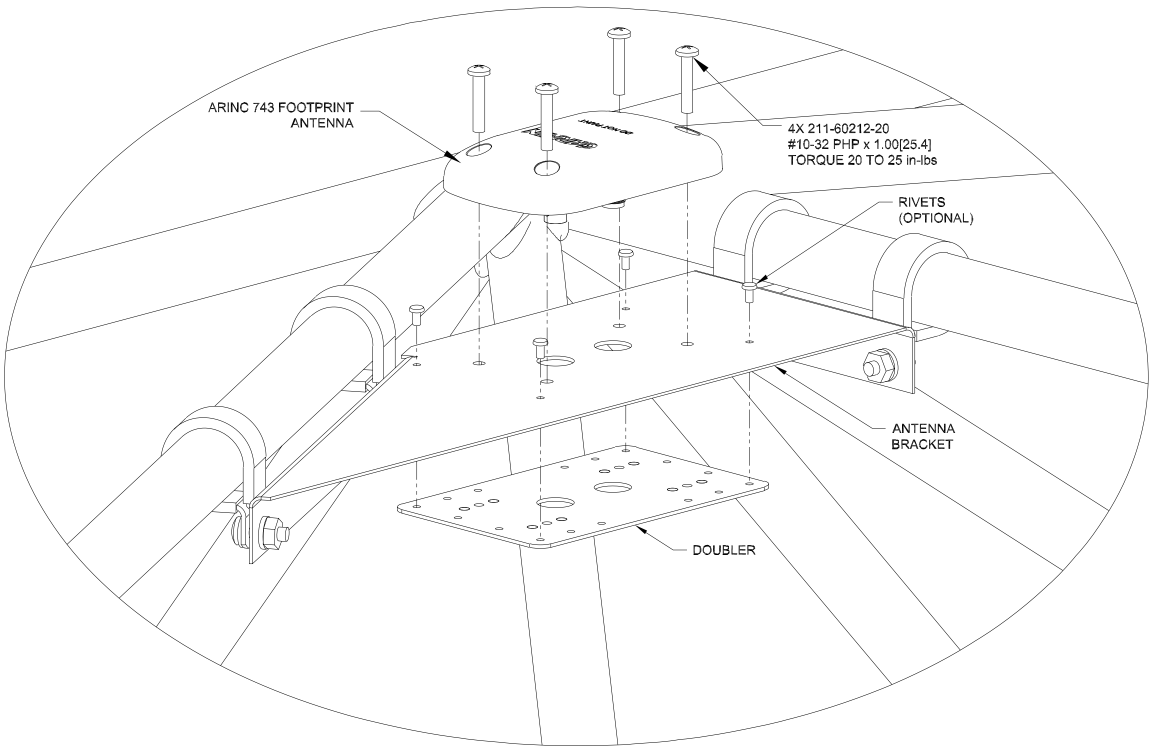


Figure 11-36. Example ARINC 743 Footprint in Airframe under Fabric Skin

Table 11-10 presents minimum distance requirements between the tube structure and the antenna for cases where the antenna sits underneath the fabric in a metal-tube structure aircraft. Figure 11-37 illustrates the tube diameter (d) and minimum distance (l) references in the table.

Table 11-10. Minimum Distance Required Between Tube Structure and Antenna

Illustrated Case	Tube Diameter d (in)	Minimum Distance l (in)
Top of antenna at or above the center of the tube structure (Figure 11-37, top)	0.625	3.6
	0.75	4.3
	1.00	5.7
	1.25	7.2
Top of antenna between the center and bottom of the tube structure (Figure 11-37, bottom)	0.625	7.2
	0.75	8.6
	1.00	11.5
	1.25	14.3

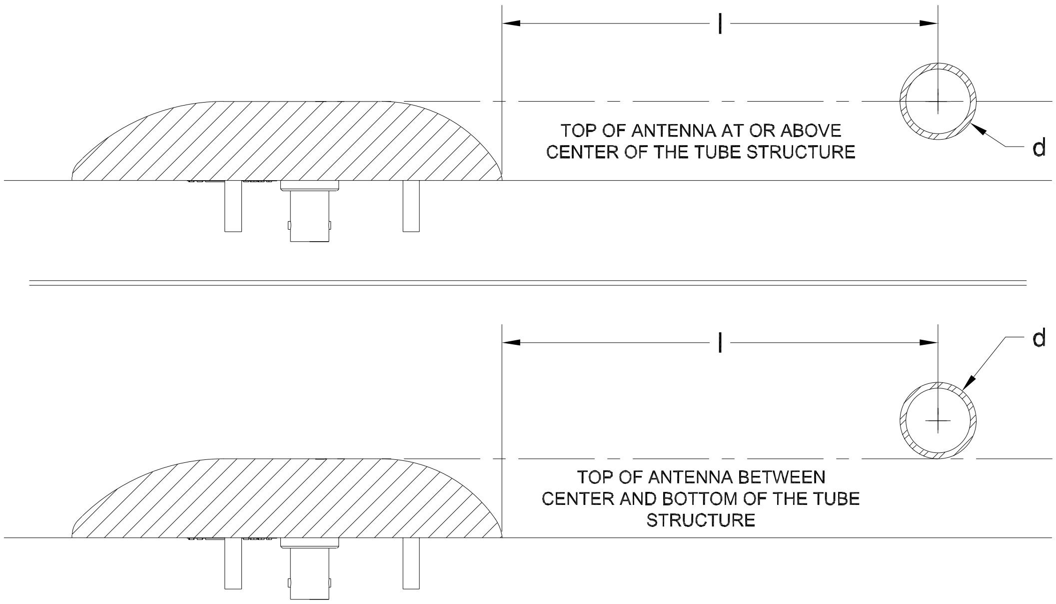


Figure 11-37. Example Teardrop Footprint Antenna Mounting Under Fabric Skin

Figure 11-38 is an example of an external, non-structural mounting of the antenna in a tube-and-fabric aircraft. The antenna support bracket shown should be made of 2024-T3 Aluminum with a minimum material thickness 0.032" and maximum distance between airframe tubes of 36". The bracket is installed to the airframe under the fabric, and the antenna is mounted externally to the bracket. The generic installations of the teardrop footprint (Figure 11-30 and Figure 11-31) and ARINC 743 footprint (Figure 11-32) antennas are used, with the antenna support bracket as the mounting surface.

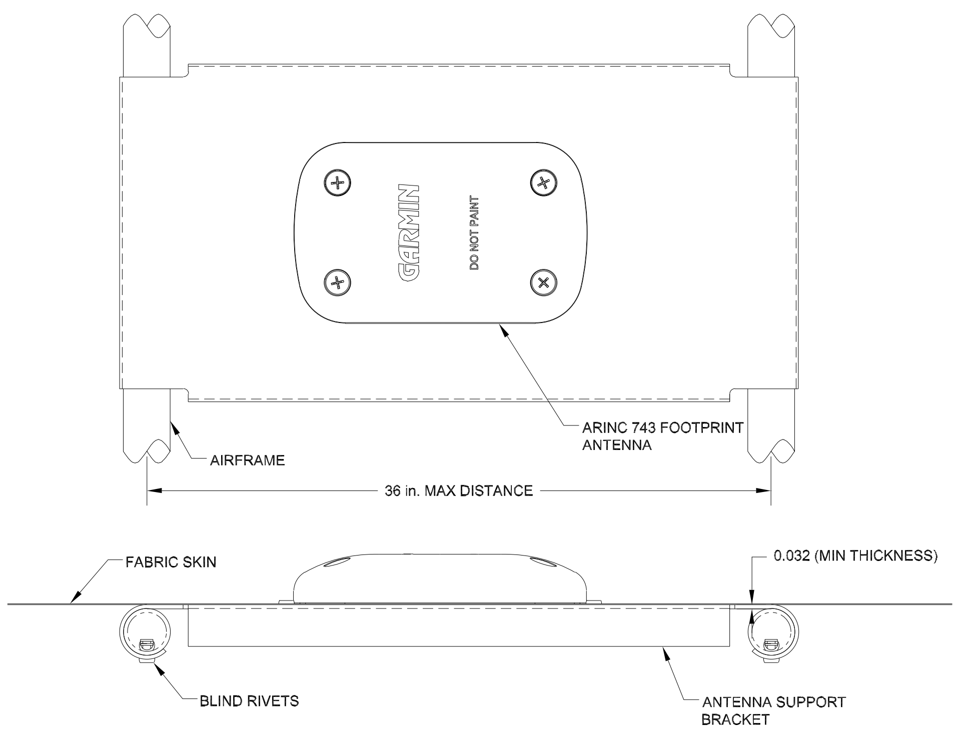


Figure 11-38. Example Non-Structural Antenna Mounting on Airframe

12 Non LRU Specific Installation Information

12.1 Shield Block Installation Instructions

12.1.1 Shield Block Installation Parts

List of Parts: Tables 12-1, 12-2, and 12-3 provide a list of parts needed to install a Shield Block. Parts for this installation are included in the Shield Block installation kits along with other Garmin installation kits, and some are to be provided by the installer.

Table 12-1. Parts needed for a Shield Block Installation (see Figure 12-1)

Figure Ref	Description	GPN or MIL spec
1	Cast Housing (from Garmin Backshell Kit)	125-0008x-00
2	Shield Block(s)	117-00147-00 117-00147-01
3	Screw,4-40x.250,FLHP 100,SS/P,Nylon (from Garmin Shield Block Kit)	211-63234-08
4	Multiple Conductor Shielded Cable *(2 –conductor demonstrated here)*	Reference Installation Wiring Diagrams
5	Drain Wire Shield Termination (method optional)	Parts used depend on method chosen
6	Braid, Flat *(19-20 AWG equivalent, tinned plated copper strands 36 AWG, Circular Mil Area 1000 -1300)*	Parts used depend on method chosen
7	Floating Shield Termination (method optional)	Parts used depend on method chosen
8	Pins	336-00021-00
9	Ring terminal, #8, insulated, 18-22 AWG	MS25036-149
	Ring terminal, #8, insulated, 14-16 AWG	MS25036-153
	Ring terminal, #8, insulated, 10-12 AWG	MS25036-156
10	Screw, PHP, 8-32x.312", Stainless	MS51957-42
	Screw, PHP, 8-32x.312", Cad Plated Steel	MS35206-242
11	Split Washer, #8, (.045" compressed thickness) Stainless	MS35338-137
	Split Washer, #8, (.045" compressed thickness) Cad-plated steel	MS35338-42
12	Flat Washer, Stainless, #8, .032" thick, .174"ID, .375" OD	NAS1149CN832R
	Flat washer, Cad-plated Steel, #8, .032" thick, .174"ID, .375" OD	NAS1149FN832P
13	Silicon Fusion Tape	249-00114-00
14	Strain Relief (from Garmin Backshell Kit)	115-00499-xx
15	Screw,4-40x.375,PHP,SS/P,w/Nylon (from Garmin Backshell Kit)	211-60234-10
16	Lid from Garmin Backshell Kit	115-00500-xx
17	Screw,4-40x.187,FLHP100,SS/P,w/Nylon (from Garmin Backshell Kit)	211-63234-06

Table 12-2. GPN: 011-01169-00 – Sub-Assy,Grnd Adaptr,Shell 1-3

Figure Ref	Description	Qty. Included	GPN or MIL spec
Not Shown	Adapter,Ring Term,Shell SZ 1,2,3	1	117-00147-00
3	Screw,4-40x.250,FLHP 100,SS/P,	2	211-63234-08

Table 12-3. GPN: 011-01169-01 – Sub-Assy,Grnd Adaptr,Shell 4&5

Figure Ref	Description	Qty. Included	GPN or MIL spec
2	Adapter,Ring Term,Shell SZ 4&5	1	117-00147-01
3	Screw,4-40x.250,FLHP 100,SS/P,w/ Nyl	2	211-63234-08

NOTE

For the following steps please refer to the drawings showing the installation of a Shield Block onto a Garmin backshell.

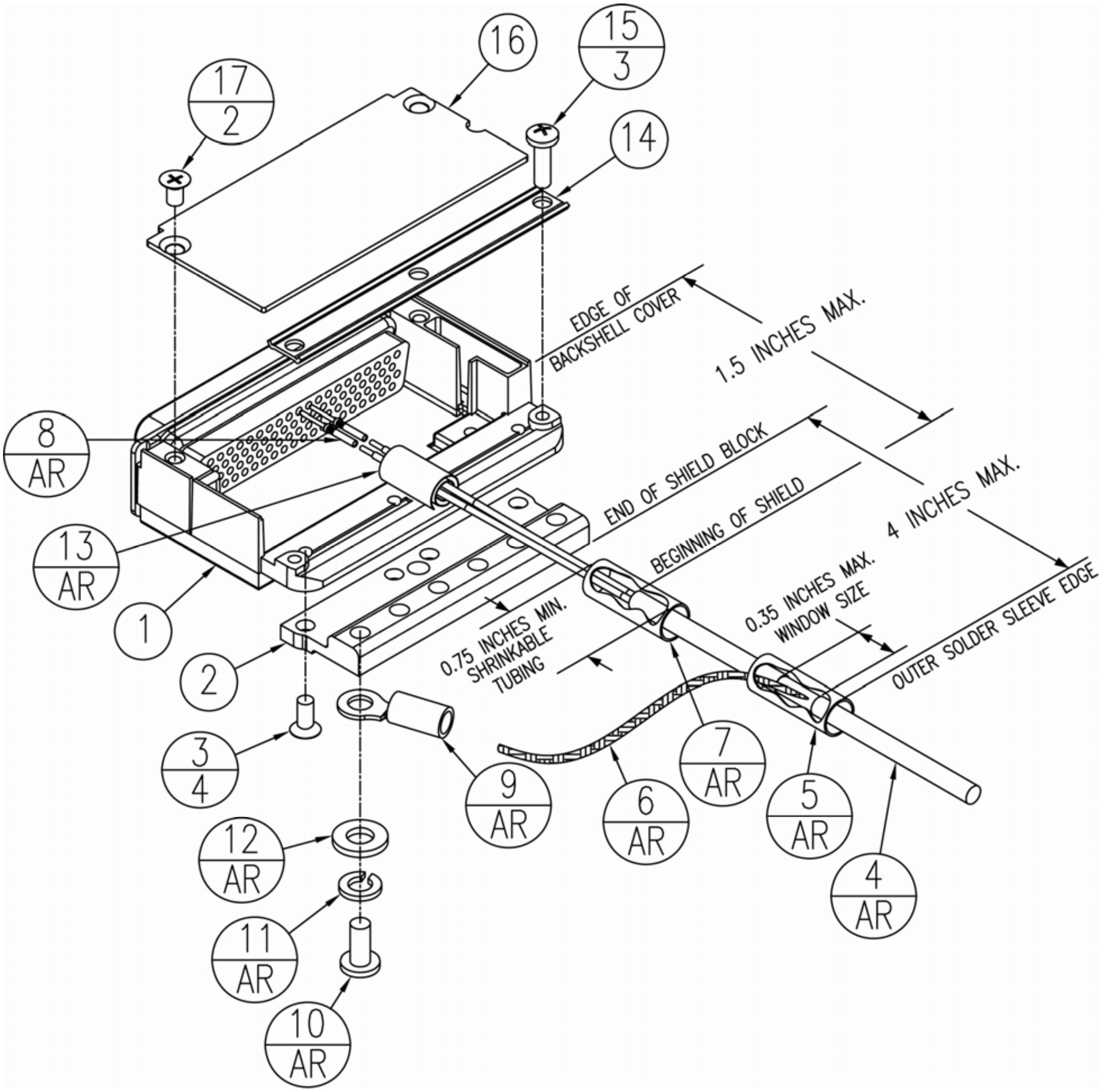


Figure 12-1. Shield Block Install onto a Backshell (78 pin example)

Note: "AR" denotes quantity "As Required" for the particular installation

12.2.1 Shield Termination Technique – Method A.1 (Standard)

1. Attach the Shield Block(s) (item 2) to the backshell (item 1) by inserting the flathead screws (item 3) through the holes on the Shield Block and threading into the tapped holes on the backshell (item 1) (see Figure 12-1). The appropriate number of Shield Block kits will be included in the particular LRU connector kit, but Table 12-4 lists possible configurations.

Table 12-4. Possible Shield Block Arrangements

Backshell Assembly		Shield Block	
Pin Count (Std./High)	**GPN**	**GPN**	**Arrangement**
(9/15)	011-00950-00	011-01169-00	One
(15/26)	011-00950-01	011-01169-00	One
(25/44)	011-00950-02	011-01169-00	One
			Two (if needed)
(37/62)	011-00950-03	011-01169-01	One
(50/78)	011-00950-04	011-01169-01	One

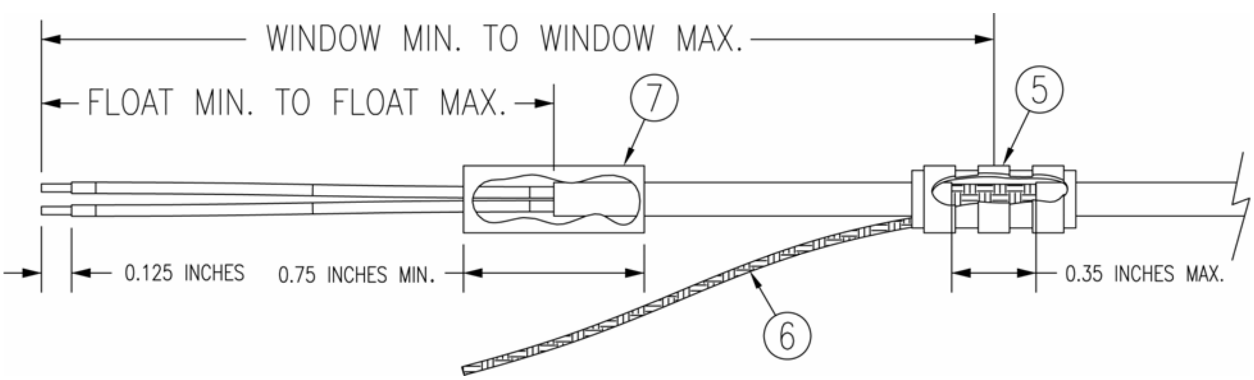


Figure 12-2. Method A.1 for Shield Termination

Table 12-5. Shielded Cable Preparations for Garmin Connectors

Backshell Size	Number of Pins Std/HD	Float Min (inches)	Float Max (inches)	Ideal Float (inches)	Window Min (inches)	Window Max (inches)	Ideal Window (inches)
1	9/15	1.25	2.25	1.75	2.75	5.25	4.25
2	15/26	1.5	2.5	2.0	3.0	5.5	4.5
3	25/44	1.5	2.5	2.0	3.0	5.5	4.5
4	37/62	1.5	2.5	2.0	3.0	5.5	4.5
5	50/78	1.5	2.5	2.0	3.0	5.5	4.5

2. At one end of a shielded cable (item 4) measure a distance between “Window Min” to “Window Max” (Table 12-5) and cut a window (max size 0.35”) in the jacket to expose the shield (see Figure 12-2). Use caution when cutting the jacket to avoid damaging the individual braids of the shield. When dealing with a densely populated connector with many cables, it may prove beneficial to stagger the windows throughout the “Window Min” to “Window Max” range. If staggering is not needed the “Ideal Window” length is recommended.

   12.3.1 <u>Suggested tools to accomplish the window cut:</u>

   - Coaxial Cable Stripper
   - Thermal Stripper
   - Sharp Razor Blade

3. Connect a Flat Braid (item 6) to the shield exposed through the window of the prepared cable assembly (item 4) from step 2. The Flat Braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector (see Figure 12-2). Make this connection using an approved shield termination technique.

NOTE

FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

<u>Preferred Method:</u>

Slide a solder sleeve (item 5) onto the prepared cable assembly (item 4) and connect the Flat Braid (item 6) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed Flat Braid versus having to cut a length of Flat Braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the Flat Braid (item 6) to be attached.

Solder Sleeves with pre-installed Flat Braid

A preferred solder sleeve would be the Raychem S03 Series with the thermochromic temperature indicator (S03-02-R-9035-100, S03-03-R-9035-100, S03-04-R-9035-100). These solder sleeves come with a pre-installed braid and effectively take the place of items 5 and 6. For detailed instructions on product use, reference Raychem installation procedure RCPS 100-70.

Raychem recommended heating tools:

- HL1802E
- AA-400 Super Heater
- CV-1981
- MiniRay
- IR-1759

Individual solder sleeves and Flat Braid

Solder Sleeves:

Reference the following MIL-Specs for solder sleeves.
(M83519/1-1, M83519/1-2, M83519/1-3, M83519/1-4, M83519/1-5)

Flat Braid:

If the preferred Raychem sleeves are not being used, the individual flat braid selected should conform to ASTMB33 for tinned copper and be made up of 36 AWG strands to form an approximately 19-20 AWG equivalent flat braid. A circular mil area range of 1000 to 1300 is required. The number of individual strands in each braid bundle is not specified. (e.g. QQB575F36T062)

NOTE

Flat Braid as opposed to insulated wire is specified in order to allow continuing air worthiness by allowing for visual inspection of the conductor.

<u>Secondary Method:</u>

Solder a Flat Braid (item 6) to the shield exposed through the window of the prepared cable assembly (item 4). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum 0.75 inches of Teflon heat shrinkable tubing (item 5) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable and the Flat Braid (item 6) to be attached.

Teflon Heat Shrinkable Tubing:

Reference the following MIL-Spec for Teflon heat shrinkable tubing (M23053/5-X-Y).

4. At the same end of the shielded cable (item 4) and ahead of the previous shield termination, strip back “Float Min” to “Float Max” (Table 12-5) length of jacket and shield to expose the insulated center conductors (see Figure 12-2). The “Ideal Float” length may be best to build optimally.

   Preferred Method:

   The jacket and shield should be cut off at the same point so no shield is exposed. Slide 0.75 inches minimum of Teflon heat shrinkable tubing (item 7) onto the cable and use a heat gun to shrink the tubing. The chosen size of heat shrinkage tubing must accommodate the number of conductors present in the cable.

   Secondary Method:

   Leave a max 0.35 inches of shield extending past the jacket. Fold this 0.35 inches of shield back over the jacket. Slide a solder sleeve (item 7) over the end of the cable and use a heat gun approved for solder sleeves to secure the connection. The chosen size of solder sleeve must accommodate the number of conductors present in the cable.

5. Strip back 0.125 inches of insulation and crimp a pin (item 8) to each of the conductors in the shielded cable.

6. Insert newly crimped pins and wires into the appropriate connector housing location as specified by the installation wiring diagrams.

7. Cut the Flat Braid (item 6) to a length that, with the addition of a ring terminal, will reach one of the tapped holes of the Shield Block (item 2) (see Figure 12-1). An appropriate amount of excess length without looping should be given to the Flat Braid (Item 6) to allow it to freely move with the wire bundle.

NOTE

Position the window splice to accommodate a Flat Braid (item 6) length of no more than 4 inches.

8. Guidelines for terminating the newly cutoff Flat Braid(s) (item 6) with insulated ring terminals (item 9):

   - Each tapped hole on the Shield Block (item 2) may accommodate only two ring terminals (item 9).

   - It is preferred that only two Flat Braid(s) (item 6) be terminated per ring terminal. Two Flat Braids per ring terminal will necessitate the use of a Ring terminal, #8, insulated, 14-16 AWG (MS25036-153).

   - If only a single Flat Braid is left or if only a single Flat Braid is needed for this connector a Ring terminal, #8, insulated, 18-22 AWG (MS25036-149) can accommodate this single Flat Braid.

   - If more braids exist for this connector than two per ring terminal, it is permissible to terminate three braids per ring terminal. This will necessitate the use of a Ring terminal, #8, insulated, 10-12 AWG (MS25036-156).

9. Repeat steps 2 through 8 as needed for the remaining shielded cables.

10. Terminate the ring terminals to the Shield Block (item 2) by placing items on the Pan Head Screw (item 10) in the following order: Split Washer (item 11), Flat Washer (item 12) first Ring Terminal, second Ring Terminal (if needed) before finally inserting the screw into the tapped holes on the Shield Block. Do not violate the guidelines presented in Step 8 regarding ring terminals.

11. It is recommended to wrap the cable bundle with Silicone Fusion Tape (item 13) (GPN: 249-00114-00 or a similar version) at the point where the backshell strain relief and cast housing will contact the cable bundle.

NOTE

Choosing to use this tape is the discretion of the installer.

12. Place the smooth side of the backshell strain relief (item 14) across the cable bundle and secure using the three screws (item 15). Warning: Placing the grooved side of the strain relief across the cable bundle may risk damage to wires.

13. Attach the cover (item 16) to the backshell (item 1) using the two screws (item 17).

12.4.1 Shield Termination Technique - Method A.2 (Daisy Chain)

In rare situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (see Figure 12-3). All other restrictions and instructions for the shield termination technique set forth for Method A.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

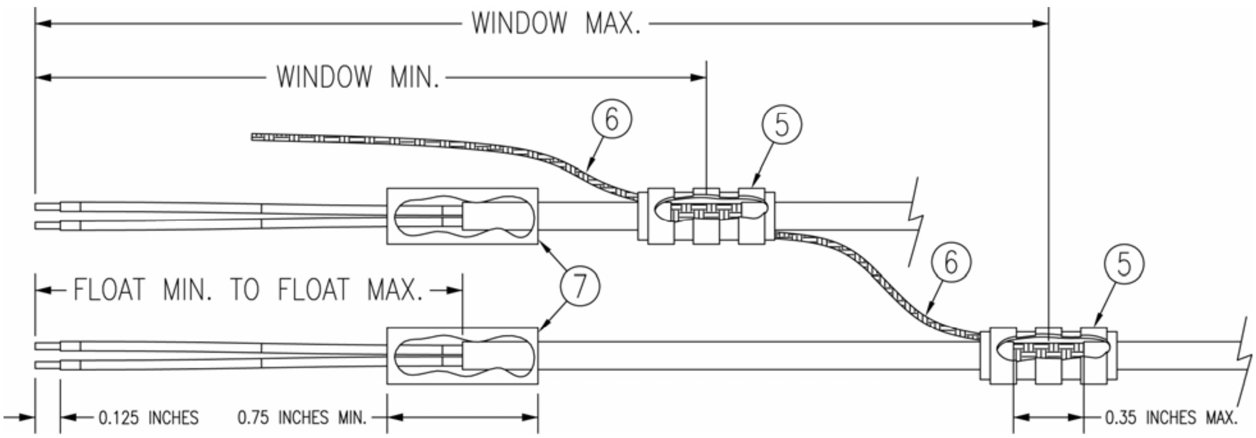


Figure 12-3. Method A.2 (Daisy Chain) for Shield Termination

12.5.1 Shield Termination – Method B.1 (Quick Term)

If desired, the drain wire termination (Item 5) and the floating shield termination (Item 7) can be effectively combined into a “Quick Term”. This method eliminates the float in the cable insulation and moves the placement of the window which was described by the dimensions “Window Min” and “Window Max” from Method A. This technique is depicted in Figure 12-7.

NOTE

The original purpose for separating the shield drain termination (Item 5) from the float termination (Item 7) in Method A was to allow for a variety of lengths for the drain wires so that the shield drain terminations (Item 5) would not all “bunch up” in the harness and to eliminate loops in the drain wires. If Method B is chosen, as described in this section, care must be taken to insure that all drain shield terminations can still be inspected. With connectors which require a large number of shield terminations it may be best to use Method A. This will allow the drain shield terminations (Item 5) a larger area to be dispersed across.

Instructions for Method B (Quick Term)

Using this method, the instructions from Method A are followed except that:

1) Step 2 is eliminated

2) Steps 3 and 4 are replaced by the following:

At the end of the shielded cable (item 4), strip “Quick Term Min” to “Quick Term Max” (Table 4-1) length of the jacket to expose the shield. Next trim the shield so that at most 0.35 inches remains extending beyond the insulating jacket. Fold this remaining shield back over the jacket.

Connect a Flat Braid (Item 6) to the folded back shield of the prepared cable assembly. The flat braid should go out the front of the termination towards the connector. It is not permitted to exit the rear of the termination and loop back towards the connector. (See Figure 4-1). Make this connection using an approved shield termination technique.

NOTE

FAA AC 43.13-1B Chapter 11, Section 8 (Wiring Installation Inspection Requirements) may be a helpful reference for termination techniques.

<u>Preferred Method:</u>

Slide a solder sleeve (item 5) onto the prepared cable assembly (item 4) and connect the Flat Braid (Item 6) to the shield using a heat gun approved for use with solder sleeves. It may prove beneficial to use a solder sleeve with a pre-installed Flat Braid versus having to cut a length of Flat Braid to be used. The chosen size of solder sleeve must accommodate both the number of conductors present in the cable and the Flat Braid (item 6) to be attached.

NOTE

Reference Section 12.1.2 for recommended solder sleeves and flat braid. The same recommendations are applicable to this technique.

<u>Secondary Method:</u>

Solder a Flat Braid (Item 6) to the folded back shield on the prepared cable assembly (Item 4). Ensure a solid electrical connection through the use of acceptable soldering practices. Use care to avoid applying excessive heat that burns through the insulation of the center conductors and shorts the shield to the signal wire. Slide a minimum of 0.75 inches of Teflon heat shrinkable tubing (Item 5) onto the prepared wire assembly and shrink using a heat gun. The chose size of heat shrinkage tubing must accommodate both the number of conductors present in the cable as well as the Flat Braid (Item 6) to be attached.

Teflon Heat Shrinkable Tubing:
Reference the following MIL-Spec for general Teflon heat shrinkable tubing (M23053/5-X-Y)

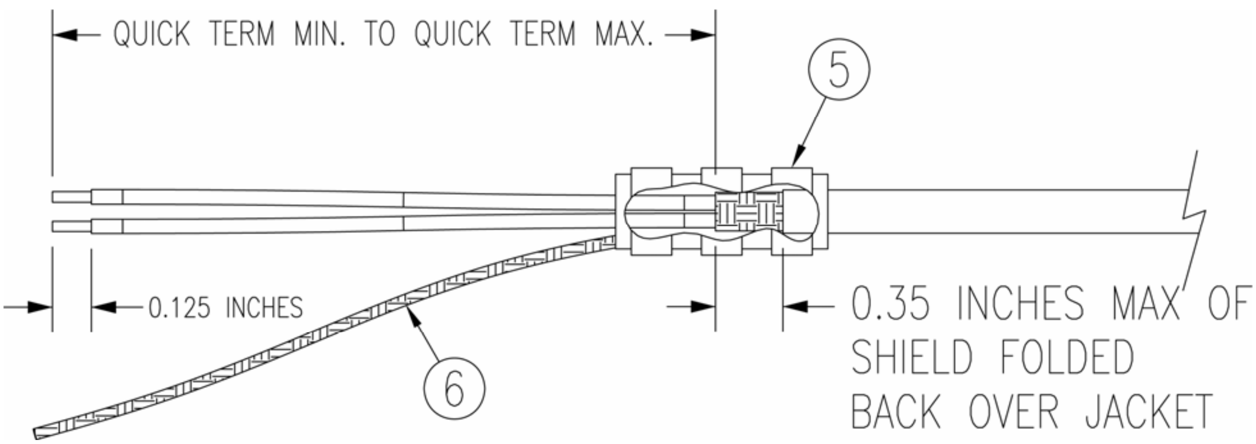


Figure 12-4. Method B.1 (Quick Term) for Shield Termination

Table 12-6. Shielded Cable Preparations – (Quick Term)

Backshell Size	Number of Pins Std/HD	Quick Term Min (inches)	Quick Term Max (inches)	Quick Term Float (inches)
1	9/15	1.25	2.25	1.75
2	15/26	1.5	2.5	2.0
3	25/44	1.5	2.5	2.0
4	37/62	1.5	2.5	2.0
5	50/78	1.5	2.5	2.0

12.6.1 Shield Termination-Method B.2 (Daisy Chain-Quick Term)

In rare situations where more braids need to be terminated for a connector than three per ring terminal it is allowable to daisy chain a maximum of two shields together before coming to the ring terminal (see Figure 12-5). All other restrictions and instructions for the shield termination technique set forth for Method B.1 are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

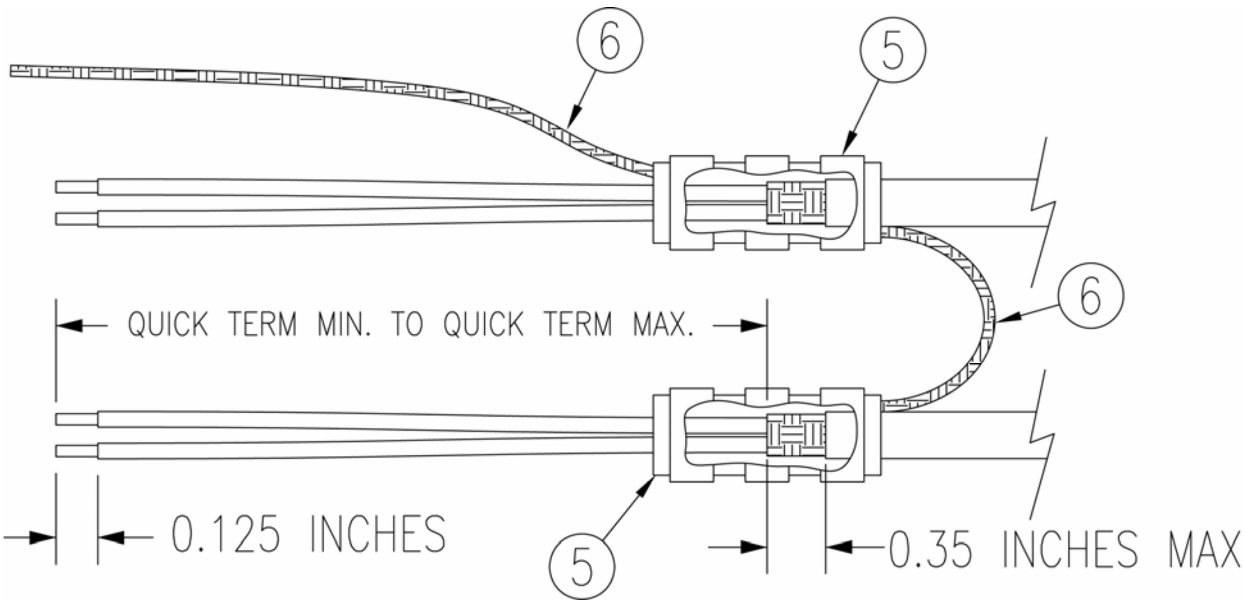


Figure 12-5. Method B.2 (Daisy Chain-Quick Term) for Shield Termination

12.7.1 Daisy Chain between Methods A and B

In rare situations where more braids need to be terminated for a connector than three per ring terminal and a mixture of Methods A and B have been used, it is allowable to daisy chain a maximum of two shields together from a Method A termination to a Method B (see Figure 12-6). All other restrictions and instructions for the shield termination technique set forth for Method A and B are still applicable.

NOTE

The maximum length of the combined braids should be approximately 4 inches.

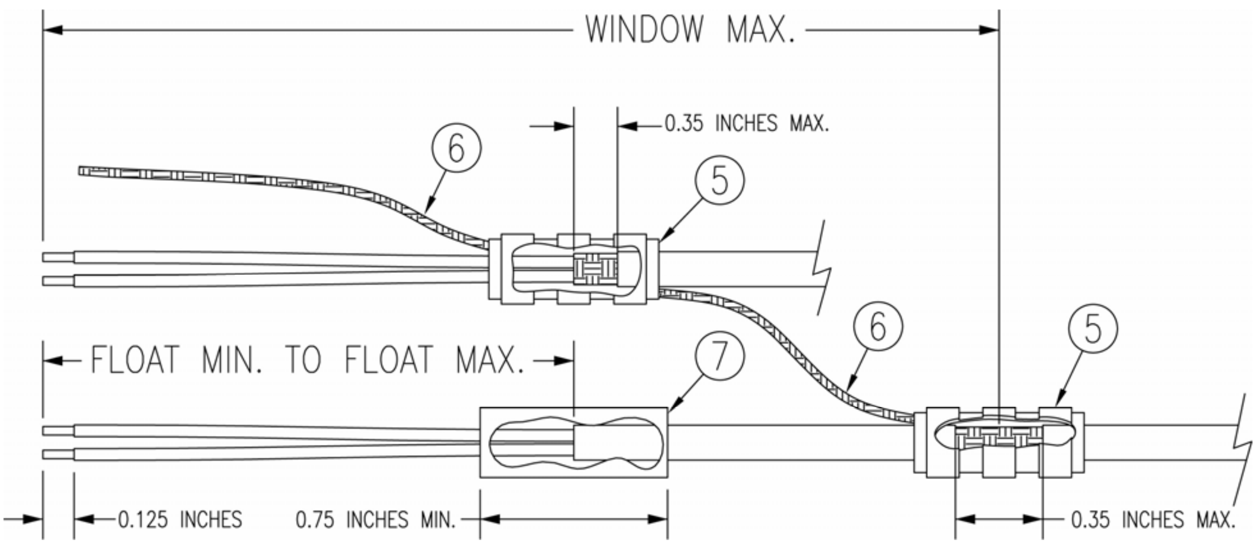


Figure 12-6. Daisy Chain between Methods A and B

12.8.1 Double-Shield Termination Technique - Method C.1

In rare situations where double shielding may be necessary, the outer shield should be grounded at both ends, while the inner shield should be grounded only at one end. All other restrictions set forth for in Table 12-7 are applicable.

NOTE

The maximum length of the braids should be approximately 4 inches.

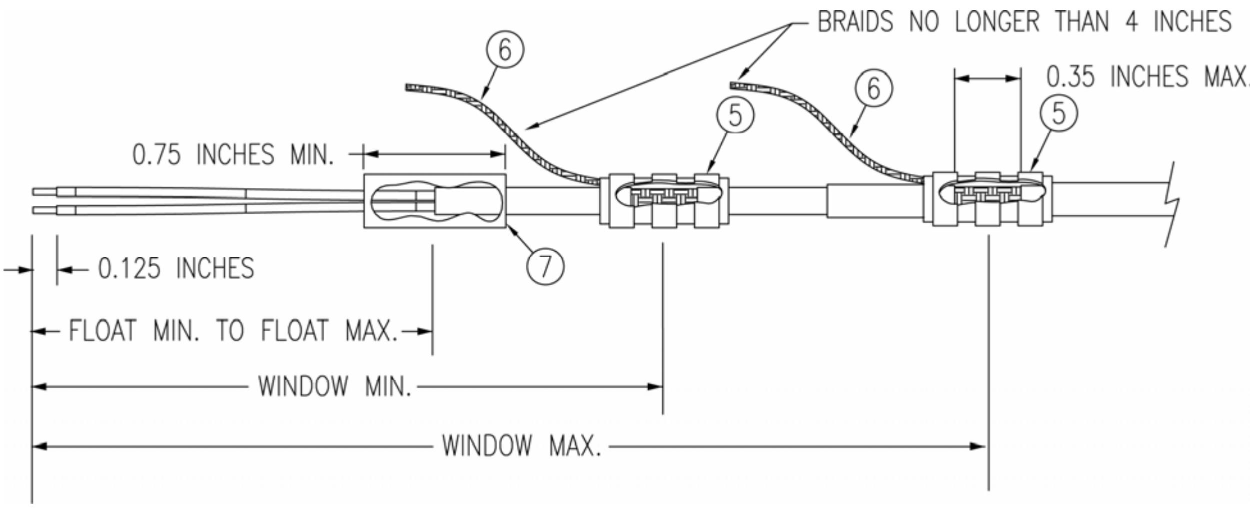


Figure 12-7. Method C.1 Double-Shield Termination

Table 12-7. Shielded Cable Preparations for Garmin Connectors

Backshell Size	Number of Pins Std/HD	Float Min (inches)	Float Max (inches)	Ideal Float (inches)	Window Min (inches)	Window Max (inches)
1	9/15	1.25	2.25	1.75	2.75	5.25
2	15/26	1.5	2.5	2.0	3.0	5.5
3	25/44	1.5	2.5	2.0	3.0	5.5
4	37/62	1.5	2.5	2.0	3.0	5.5
5	50/78	1.5	2.5	2.0	3.0	5.5

12.9.1 Double-Shield Termination Technique (Quick Term) - Method C.2

In addition to method C.1, described previously, another suitable method for double-shielding wires is presented in Figure 12-8. All restrictions set forth for Method C.1 (Table 12-7) are still applicable.

NOTE

The maximum length of the braids should be approximately 4 inches.

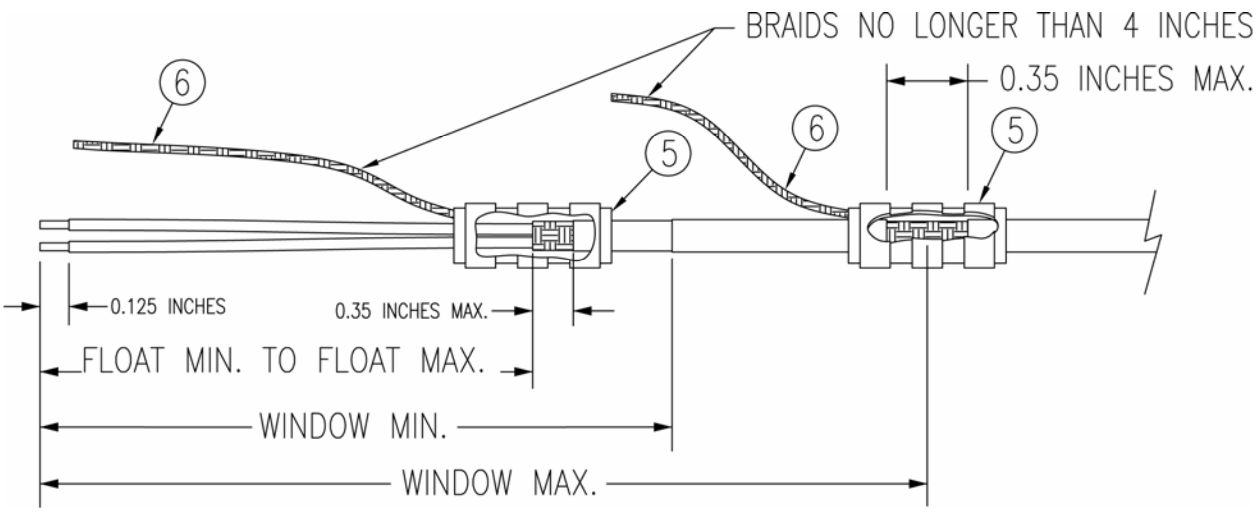


Figure 12-8. Method C.2 Double-Shield Termination

12.10.1 ID Program Pins (Strapping)

ID Program Pins provide a ground reference used by the hardware as a means of configuration for system identification. The following instructions will illustrate how this ground strapping should be accomplished with the Shield Blocks:

A1. Cut a 4 inch length of 22 AWG insulated wire.

WARNING

Flat Braid is not permitted for this purpose. Use only insulated wire to avoid inadvertent ground issues that could occur from exposed conductors.

A2. Strip back 0.125 inches of insulation and crimp a pin (item 8) to the 4” length of 22 AWG insulated wire.

A3. Insert newly crimped pins and wires into the appropriate connector housing location as specified by the installation wiring diagrams.

A4. At the end opposite the pin on the 22 AWG insulated wire strip back 0.2 inches of insulation.

A5. Terminate this end via the ring terminals with the other Flat Braid per Steps 8 and 11 pertaining to shield termination. If this ground strap is only wire to terminate, attach a Ring terminal, #8, insulated, 18-22 AWG (MS25036-149).

12.11.1 Splicing Signal Wires

NOTES

C1. Figure 12-9 illustrates that a splice must be made within a 3 inch window from outside the edge of strain relief to the end of the 3 inch max mark.

WARNING

1) Keep splice out of backshell for pin extraction.
2) Keep splice outside of strain relief to avoid preloading.

C2. Figure 12-9 shows a two wire splice, but a maximum of three wires can be spliced. If a third wire is spliced, it is located out front of splice along with signal wire going to pin.

C3. Splice part numbers:
Raychem D-436-36/37/38
MIL Spec MIL-S-81824/1

C4. This technique may be used with shield termination methods: A.1, A.2, B.1, B.2, C.1 and C.2.

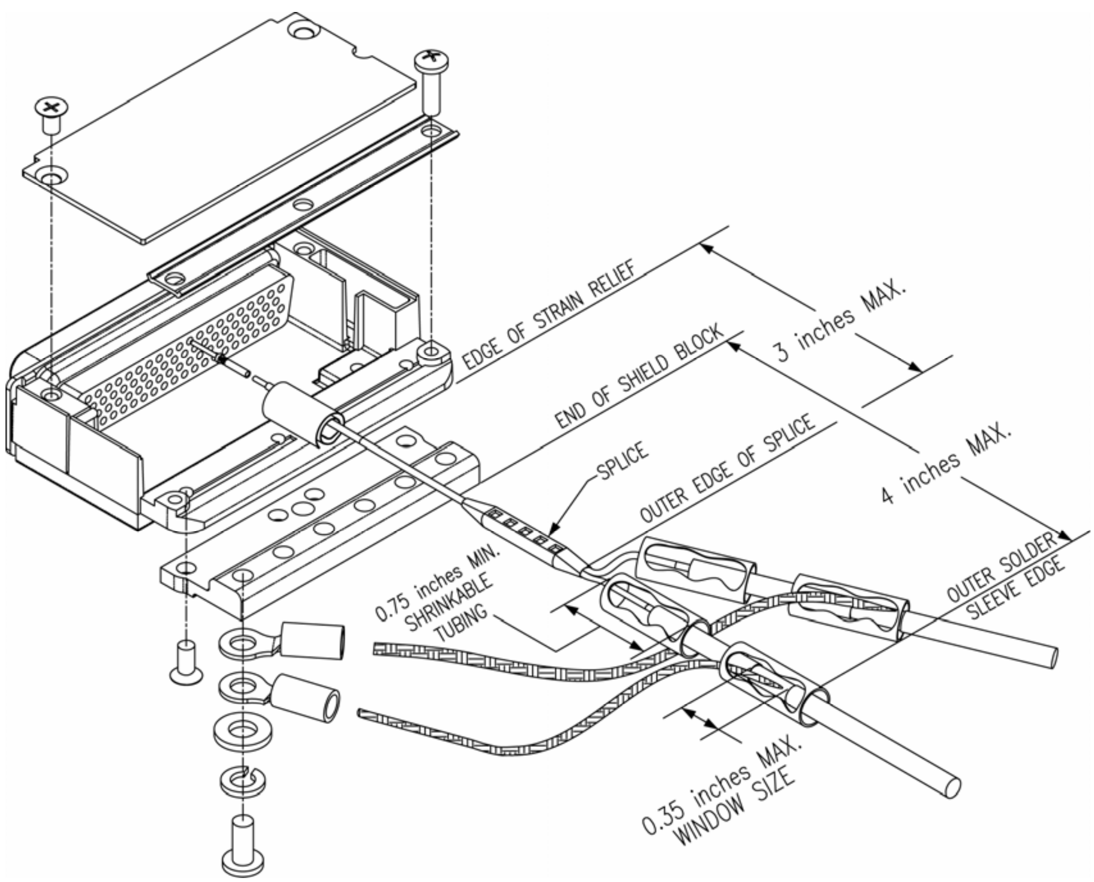


Figure 12-9. D-Sub Spliced Signal Wire Illustration

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13 3rd Party Interfaces

13.1 Discretes

Discrete switches are only needed if associated annunciations are desired. Refer to Table 13-1 for a list of optional discretes.

Table 13-1. G900X Optional Discretes

Annunciation	Description	Triggered by	Annunciation Level	Interface Type	Standard/ Optional
FUEL IMBALANCE	Fuel imbalance is greater than 10 gallons	Fuel imbalance is greater than 10 gallons and the lower of the two tanks is selected	MESSAGE ADVISORY	Fuel quantity is measured as an analog input and the calculation is performed internally to the system. This annunciation does require the installation of a discrete microswitch to indicate which tank is selected (see Fuel selector)	Optional
DR/CANOPY OPEN ALERT**	Door or canopy not secured	The door or canopy is not properly latched and the tachometer reads less than 1770 RPM	WARNING	Requires a normally open switch to be installed. See interconnect documentation for details	Optional
DR/CANOPY OPEN AUDIO**	Door or canopy not secured	The door or canopy is not properly latched and the tachometer reads above 1800	WARNING	Requires a normally open switch to be installed. See interconnect documentation for details position	Optional
L FUEL LOW	Left fuel tank is low	Left tank fuel quantity reads below 8 gallons for 1 minute (5 gallons for RV 7/9)	CAUTION	Should be wired to an analog input according to the interconnect documentation	Standard
R FUEL LOW	Right fuel tank is low	Right tank fuel quantity reads below 8 gallons for 1 minute (5 gallons for RV 7/9)	CAUTION	Should be wired to an analog input according to the interconnect documentation	Standard

Continued					
Annunciation	**Description**	**Triggered by**	**Annunciation Level**	**Interface Type**	**Standard/ Optional**
FUEL SELECTOR POSITION	There is no descriptive text. Fuel selector position is indicated by a cyan marker on the engine strip and the full-page EIS	Shows an indicator light on the engine strip and the full page EIS for the currently selected fuel tank	DISPLAY INDICATOR LIGHT	Requires the installation of a discrete micoswitch on the fuel selector to indicate which tank is selected. See interconnect documentation for details	Optional
SPEED BRAKES	Speed brakes are active	Either the right or the left speed brake is deployed	ANNUNCIATION ADVISORY	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when either speed brake is activated. See interconnect documentation for details.	Optional
PITOT HEAT ON	Pitot heat on	Pitot heat switch is on	SAFE ANNUNCIATION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when pitot heat is activated. See interconnect documentation for details.	Optional
FUEL PUMP ON	Auxiliary fuel boost pump on	Fuel pump switch is on	SAFE ANNUNCIATION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when the fuel pump is activated. See interconnect documentation for details.	Optional

Continued					
Annunciation	**Description**	**Triggered by**	**Annunciation Level**	**Interface Type**	**Standard/ Optional**
LDG LIGHT ON	Landing light on	Landing light switch is turned on	SAFE ANNUNCIATION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when the landing light is activated. See interconnect documentation for details.	Optional
TAXI LIGHT ON	Taxi light on	Taxi light switch is on	SAFE ANNUNCIATION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when the taxi light is activated. See interconnect documentation for details.	Optional
LANDING GEAR*	Verify position of landing gear	Postponed	WARNING	for future release	Optional
STARTER ENGAGED	Starter relay has power applied	The starter is engaged and the tachometer reads greater than 600 RPM	CAUTION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when the starter is engaged. See interconnect documentation for details.	Optional

Continued					
Annunciation	**Description**	**Triggered by**	**Annunciation Level**	**Interface Type**	**Standard/ Optional**
LOW OIL PRESS	Low engine oil pressure	Oil pressure is low and the tachometer reads above 600 RPM	WARNING	Should be wired to an analog input according to the interconnect documentation	Standard
FUEL PRESS LOW	Low fuel pressure	Fuel pressure is low	WARNING	Should be wired to an analog input according to the interconnect documentation	Standard
AUX ALT ON* **	Auxiliary alternator on	Auxiliary alternator is switched on and the tachometer reads above 1000 RPM for at least 2 seconds	CAUTION	Active low annunciation input from the standby alternator voltage regulator. See interconnect documentation for details.	Optional
LOW VOLTS	Low voltage on the main bus	Main bus voltage is low	CAUTION	Should be wired to an analog input according to the interconnect documentation	Standard
ESS BUS ALT PWR	Essential bus alternate power is active	Essential bus is using the alternate power source	CAUTION	Should be wired to the appropriate positive circuit such that it senses the reference voltage only when the essential bus is activated. See interconnect documentation for details.	Optional

Continued					
Annunciation	**Description**	**Triggered by**	**Annunciation Level**	**Interface Type**	**Standard/ Optional**
CO LVL HIGH	Carbon Monoxide level is too high	Carbon Monoxide level is too high	CAUTION	RS-232 interface to CO Guardian unit. See interconnect documentation for details.	Optional
HYD PUMP ON	Hydraulic pump on	The hydraulic pump has been activated	ANNUNCIATION ADVISORY	Should be wired to the appropriate bus voltage such that it sees the reference voltage when the essential bus is activated. See interconnect documentation for details.	Optional
ALT AIR DOOR	Intake system alternate air door is open	The intake system alternate air door is open	ANNUNCIATION ADVISORY	Requires a normally open switch to be installed. See interconnect documentation for details	Optional

* For retractable landing gear aircraft without landing gear discrete switches installed, pins 9, 17, and 18 on 1P604 of GIA 63W should be grounded.
** This switch should be normally open so that it will not annunciate unless it is grounded (door open).
*** The following standby alternator regulators are recommended (do not use optional current monitor):

- SB1B-14 for 14V systems.
- SB1B-28 for 28V systems.

13.2 LRU’s

13.2.1 Avidyne TAS 600

The Avidyne TAS 600 is an active traffic system that interfaces with the following G900X LRUs.

- GIA 63W via two ARINC 429 channels and remote mute lines.
- GMA 1347 via unswitched audio input
- GTX 33 via suppression line

If the Avidyne TAS 600 is installed, TAS information will be available on the traffic map page instead of the standard GTX 33 TIS information. Please see the manufacturer’s documentation for additional details on the Avidyne TAS 600 system.

13.2.2 Artex ELT 406-N

The Artex ELT model 406-N interfaces with the GIA 63W via an ARINC 429 channel. The Artex ELT receives latitude/longitude information from the GIA 63W. The ELT automatically activates during a crash and transmits the standard swept tone on 121.5 and 243.0 MHz. Every 50 seconds the 406.028 MHz transmitter turns on for 520 milliseconds broadcasting latitude/longitude position information received from the GIA 63W for search and rescue operations. Please see the manufacturer’s documentation for additional details.

13.2.3 CO Guardian

The CO Guardian Aero 353 and 452 remote models interface with the GIA 63W via a RS-232 channel. The CO Guardian unit will annunciate if carbon monoxide contamination reaches a concentration between 0.005 and 0.007 percent by volume. This annunciation should occur within a maximum of 5 minutes and will be displayed on the PFD. An alert will also be displayed on the PFD if the CO Guardian encounters a problem which requires service or if there is a loss of communication with the unit. Please see the manufacturer’s documentation and the G900X Pilot’s Guide for additional details.

14 Software, Configuration, and Calibration

Software for the G900X should be downloaded from my.Garmin.com. If you have not received a user ID and password, please contact the certified Garmin distributor which you purchased the system through to have your account set up.

14.1 Configuration Mode

Configuration mode exists to provide the installer or technician with a means of configuring, checking, and calibrating various G900X sub-systems. Troubleshooting/diagnostics information can also be derived from this mode. To complete this aircraft checkout, a basic understanding of the G900X configuration mode is required.

To start the system in Configuration mode:

1. Press and hold the ENT key on the PFD while applying power to PFD.
2. Release the ENT key after 'INITIALIZING SYSTEM' appears in the upper left corner of PFD.
3. Repeat steps 1 and 2 for the MFD.
4. It is required to have all displays in the same mode.

NOTE

Except where specifically noted, configuration settings for each LRU must be adjusted on the PFD.

The following list shows the order and organization of various typical page groups and pages shown in the G900X configuration mode. Some pages listed are read-only and require security codes. These are provided in this document where necessary.

System Page Group

1. System Status
2. Date/Time Setup
3. Main Lighting
4. Audio Alert Configuration
5. System Upload
6. File Manager
7. Maintenance Log
8. OEM Diagnostics
9. System Configuration
10. System Setup
11. Manifest Configuration

GDU Page Group

1. RS-232 / ARINC 429 Configuration
2. GDU Status
3. GDU Test
4. Diagnostics
5. Serial/Ethernet I/O
6. Alert Configuration
7. Airframe Configuration

GIA Page Group

1. RS-232 / ARINC 429 Configuration
2. CAN / RS-485 Configuration
3. GIA I/O Configuration
4. COM Setup
5. GIA Status

GEA Page Group

1. Engine Data
2. GEA Status
3. GEA Configuration

GTX Page Group

1. RS-232 / ARINC 429 Configuration
2. Transponder Configuration

GRS Page Group

1. AHRS / Air Data Input
2. GRS / GMU Calibration

GDC Page Group

1. GDC Configuration

GMA Page Group

1. GMA Configuration

GDL Page Group

1. GDL 69 Configuration

CAL Page Group

1. Fuel Tank Calibration
2. Flaps and Trim Calibration
3. HSCM Calibration

14.2 Software and Configuration Loading Procedures

The G900X is not airworthy unless software and configuration procedures are accomplished successfully as described in these procedures. It is extremely important that each LRU software load be completed successfully.

14.2.1 MFD & PFD Software Load

1. Pull the MFD and PFD circuit breakers.
2. Insert the correct G900X Loader Card into the MFD top card slot.
3. While holding the ENT key on the MFD, restore power by closing the MFD circuit breaker.
4. When the words INITIALIZING SYSTEM appear in the upper left corner of the MFD, release the ENT key.
5. The system first automatically compares the existing GDU 1040 boot block with the version on the loader card. If a difference exists, the GDU prompts to load new boot block:

```
INITIALIZING SYSTEM.
DO YOU WANT TO UPDATE THE BOOT BLOCK FROM 2.00 TO 2.03?
NO WILL BE ASSUMED IN 30 SECONDS.
```

6. ENSURE that power will remain applied to the system. Press the ENT key and new boot block will be loaded:

```
INITIALIZING SYSTEM.
DO YOU WANT TO UPDATE THE BOOT BLOCK FROM 2.00 TO 2.03?
NO WILL BE ASSUMED IN 30 SECONDS.

UPDATING BOOT BLOCK.  DO NOT TURN OFF POWER!!!
```

7. Press the ENT key to acknowledge the “Do you want to update system files?” prompt to load new software (NOTE: A softkey labeled ‘YES’ appears in the lower right corner and may be used in lieu of the ENT key):
8. New software is loaded to the MFD. When complete, the MFD starts in configuration mode.
9. Remove the G900X Loader Card from the MFD and insert it into the top card slot on the PFD. Repeat Steps 3 through 7 for the PFD.
10. When the PFD load is complete, it starts in the configuration mode. Do not remove power.

IMPORTANT

For the rest of the software/configuration procedure, do not operate the MFD while loading software or configuration files unless specifically instructed to do so. A failed or cancelled load may result.

14.2.2 G900X System Software Upload

14.2.2.1 Airframe

Selection Order	1st
Required?	Yes
Multiple Selections Allowed?	Yes, only if No-EIS is desired
Purpose	The "Airframe" parameter sets all appropriate airframe variables including such things as V-speeds, fuel qty, etc. If No-EIS is selected, an engine selection should not be necessary.

The following selections will be available for configuration of the selected G900X airframe (1 required):

- Lancair IV
- Lancair IV-P
- Lancair ES
- Lancair ES-P
- Lancair Legacy
- Van's RV - 7/7A
- Van's RV - 10
- Van's RV - 9/9A
- Epic LT
- No-EIS

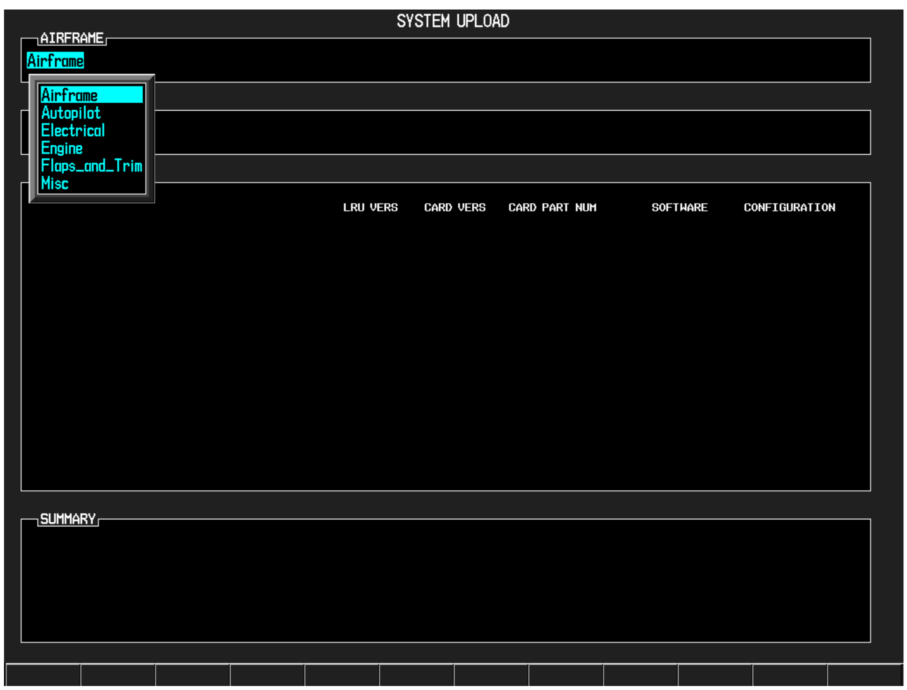


Figure 14-1. Example Airframe – System Upload Page

1. On the PFD, go to the System Upload page using the FMS knob.
2. Activate the cursor and use the FMS knob to highlight "Airframe" in the AIRFRAME field.
3. Press the ENT key.

4. Using the FMS knob, select the appropriate airframe in the FILE field.

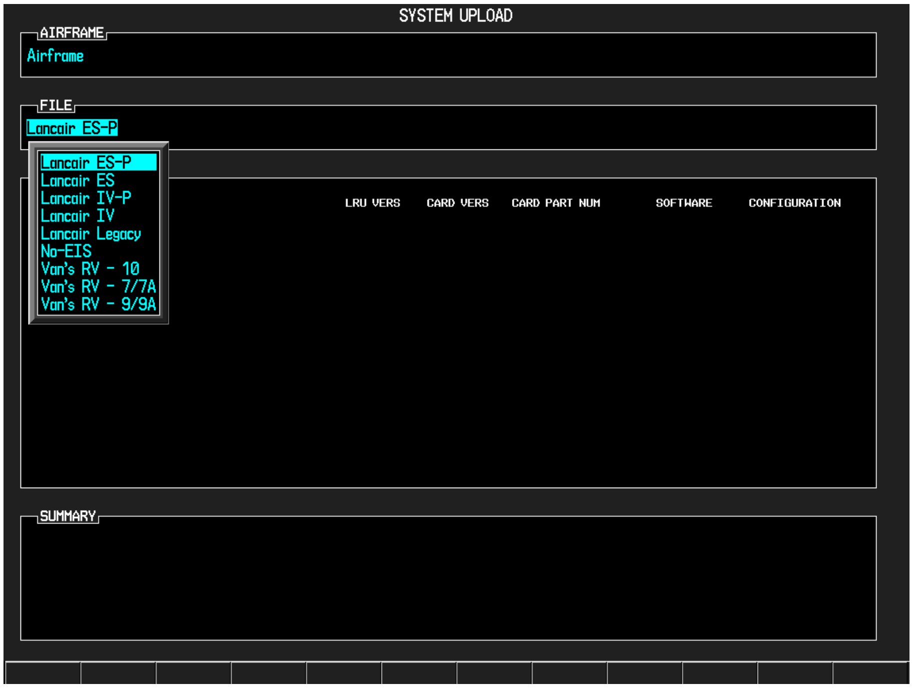


Figure 14-2. Example Airframe – System Upload Page

IMPORTANT

Ensure that the correct airframe type is selected before proceeding; otherwise, incorrect configuration information will be loaded.

5. Press the ENT key.

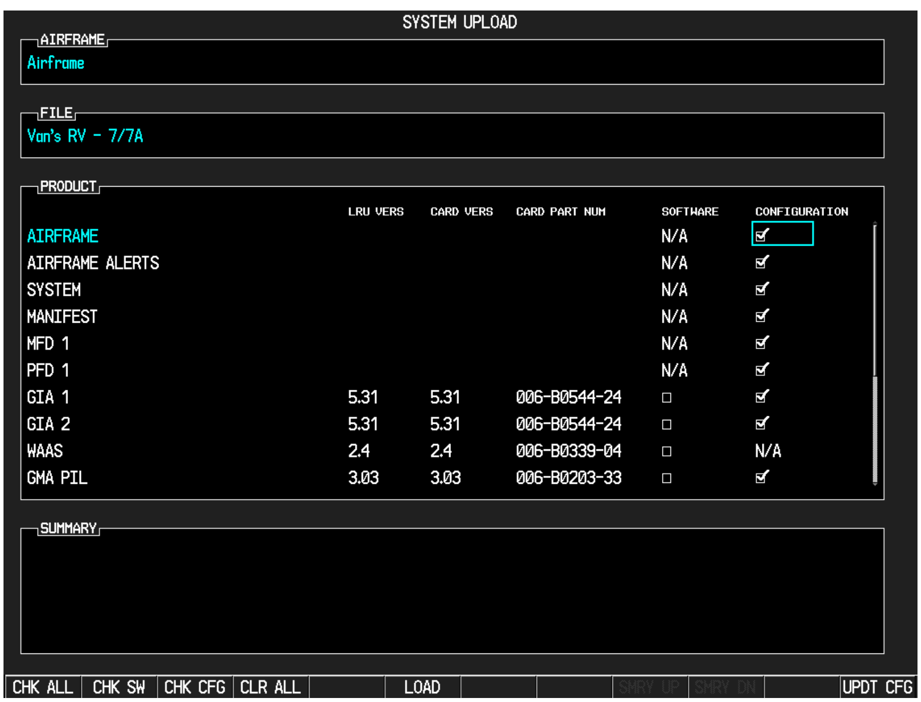


Figure 14-3. Example Airframe – System Upload Page

6. Press the LOAD softkey. The system automatically determines what software needs to be loaded.

14.2.2.2 Engine

Selection Order	2nd
Required?	Yes, except for No-EIS installations.
Multiple Selections Allowed?	No
Purpose	The “Engine” parameter sets all appropriate EIS display ranges and operating characteristics specific to the selected engine.

The following selections will be available for configuration of the selected G900X engine (1 required):

- TSIO-550-E
- IO-550-N
- IO-540-D4A5, D4B5, N1A5, T4A5D, T4B5, T4B5D, T4C5D, V4A5D,
- O-540-A*
- IO-360-A*, C*, D*, J*, K*, AIO-360* (200 hp)
- IO-360-M1A, M1B, B* (Except B1C, B1A), E*, F* (180 hp)
- O-360-A* (Except A1C, A4FN), C* (Except C2B, C2D)
- O-320- A*, B*, D*, E* (Except D2J)

1. Activate the cursor and use the FMS knob to highlight “Engine” in the AIRFRAME field.
2. Press the ENT key.
3. Using the FMS knob, select the appropriate engine in the FILE field.

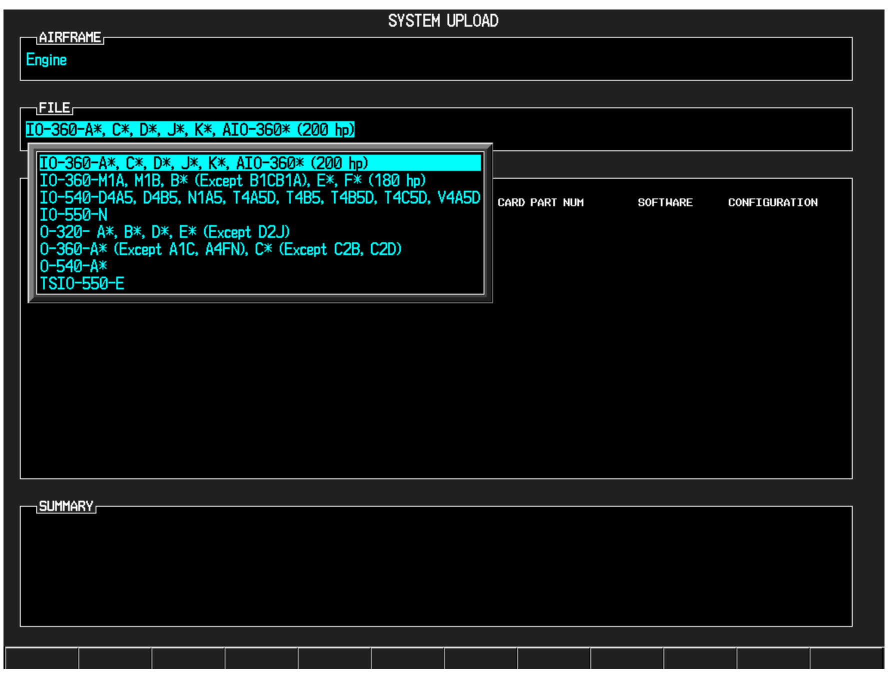


Figure 14-4. Example Engine – System Upload Page

4. Press the ENT key.

Figure 14-5. Example Engine – System Upload Page

5. Press the LOAD softkey. The system automatically determines what software needs to be loaded.

14.2.2.3 Electrical

Selection Order	3rd
Required?	Yes, except for No-EIS installations. Bus voltage and primary alternator required. Standby battery or standby alternator optional.
Multiple Selections Allowed?	Yes – see above
Purpose	The "Electrical" configuration parameters set the appropriate voltage and ammeter display ranges as well as enables an optional auxiliary ammeter display if installed.

The following selections will be available for configuration of the selected G900X electrical system:
Main and essential bus voltage (1 required):

- 14 Volt System
- 28 Volt System

Primary alternator capacity (1 required):

- 60 Amp Alternator
- 70 Amp Alternator
- 80 Amp Alternator

Auxiliary ammeter display (1 optional):

- Standby Battery
- Standby Alternator

1. Activate the cursor and use the FMS knob to highlight "Electrical" in the AIRFRAME field.
2. Press the ENT key.
3. Using the FMS knob, select the appropriate electrical system (14 or 28 Volt System) in the FILE field.

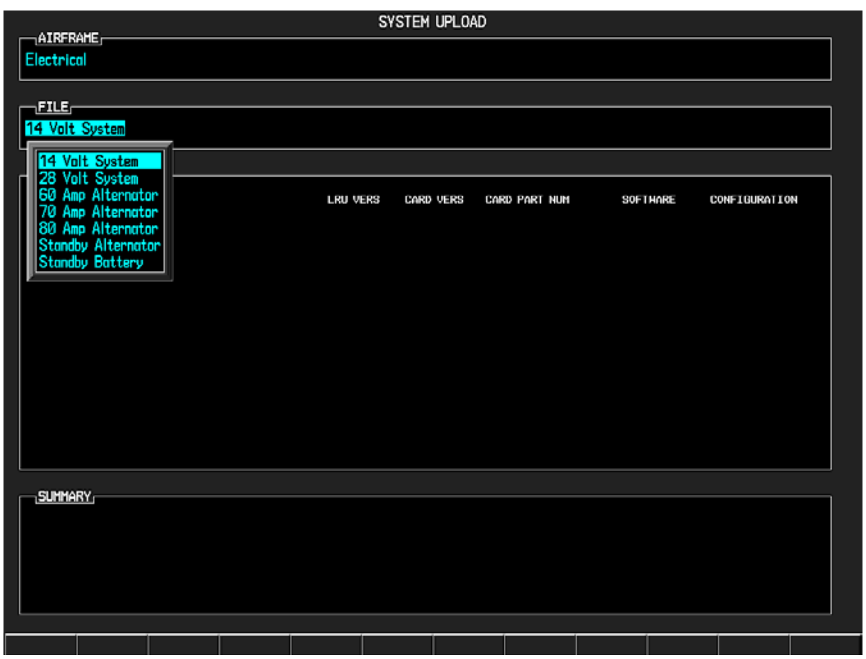


Figure 14-6. Example Electrical – System Upload Page

4. Press the ENT key.

Figure 14-7. Example Electrical – System Upload Page

5. Press the LOAD softkey. The system automatically determines what software needs to be loaded.
6. Repeat previous steps to select alternator size (60, 70, or 80 Amp) and Standby Battery/Standby Alternator (if installed).

14.2.2.4 Flaps and Trim

Selection Order	4th
Required?	No
Multiple Selections Allowed?	Yes
Purpose	The "Flaps/Trim" parameter enables the display of optional trim indicators for flaps, elevator, aileron, or rudder trim.

The following selections will be available for configuration of the selected G900X flaps and trim indications (0-3 optional):

- Flaps
- Elevator Trim
- Aileron Trim (not available if rudder trim installed)
- Rudder Trim (not available if aileron trim installed)

1. Activate the cursor and use the FMS knob to highlight "Flaps_and_Trim" in the AIRFRAME field.
2. Press the ENT key.
3. Using the FMS knob, select the appropriate flaps and trim in the FILE field.

Figure 14-8. Example Flaps and Trim – System Upload Page

4. Press the ENT key.

Figure 14-9. Example Flaps and Trim – System Upload Page

5. Press the LOAD softkey. The system automatically determines what software needs to be loaded.

14.2.2.5 Autopilot

Selection Order	5th
Required?	No
Multiple Selections Allowed?	No
Purpose	The "Autopilot" configuration parameter sets up the appropriate data interface for the G900X to communicate with an optional 3rd party autopilot.

The following selections will be available for configuration of the selected G900X autopilot (1 optional):

- STEC 55X
- Tru Trak Sorecerer / DFC Series
- Tru Trak Digiflight II Series
- Tru Trak Digitrak / Pictorial Pilot
- Tru Trak ADI
- Trio Avionics EZ Pilot

1. Activate the cursor and use the FMS knob to highlight "Autopilot" in the AIRFRAME field.
2. Press the ENT key.
3. Using the FMS knob, select the appropriate autopilot in the FILE field.

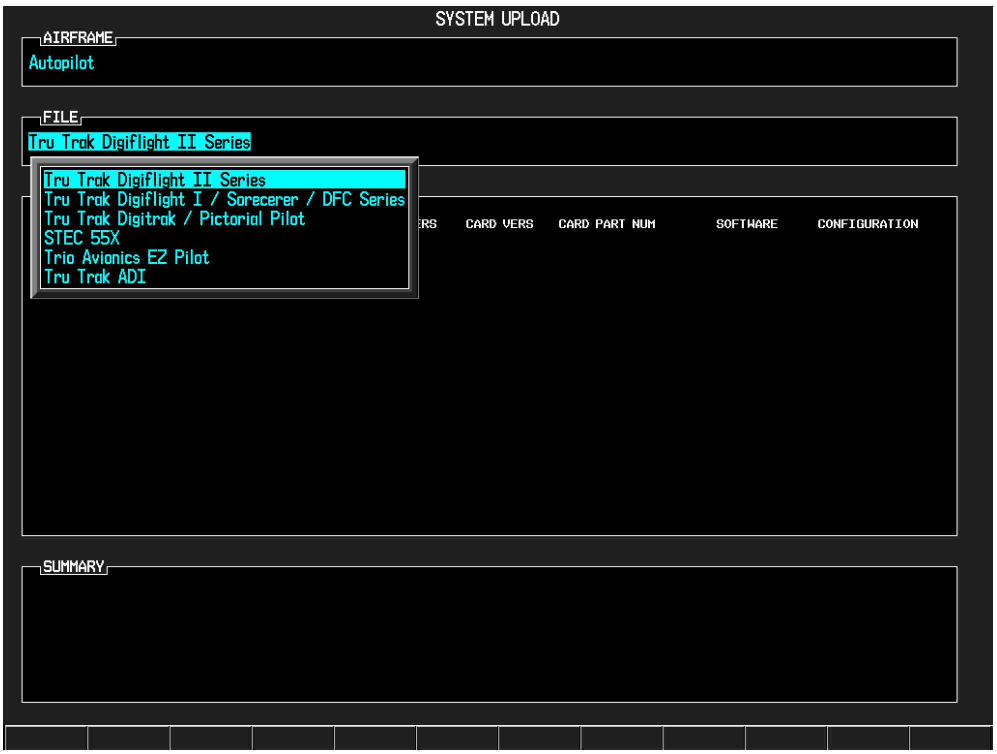


Figure 14-10. Example Autopilot – System Upload Page

4. Press the ENT key.

Figure 14-11. Example Autopilot – System Upload Page

5. Press the LOAD softkey. The system automatically determines what software needs to be loaded.

14.2.2.6 Miscellaneous

Selection Order	6th
Required?	No
Multiple Selections Allowed?	Yes
Purpose	The "Options" configuration parameter sets up the appropriate interfaces for the G900X to communicate with optional Garmin or 3rd party equipment.

The following selections will be available for configuration of the selected G900X optional interfaces (if installed):

- CO Guardian (AERO 353/452)
- GDL 69A
- GCU 476
- Avidyne TAS 600
- Artex 406N ELT
- P-300C Fuel Quantity Sender
- Tach Sensor – 4 Cylinder Mag Bleed Port
- Tach Sensor – 6 Cylinder Mag Bleed Port

1. Activate the cursor and use the FMS knob to highlight the appropriate item in the AIRFRAME field.
2. Press the ENT key.
3. Using the FMS knob, select the appropriate item in the FILE field.

Figure 14-12. Example Misc – System Upload Page

4. Press the ENT key.
5. Press the LOAD softkey. The system automatically determines what software needs to be loaded.
6. Repeat for additional installed options.

14.3 Additional Configuration

14.3.1 GDL 69A Configuration

1. Measure the length of RG-400 coaxial cable from the GDL to the antenna.
2. Use the following formula to determine cable loss:

NOTE

RG-400 coaxial cable loss is 0.261 db/feet.

Loss in dB = (Length x Loss) + (0.5 x # of connectors)

Length = cable length in feet
Loss = specified cable loss per foot at 2332-2345 MHz
Connectors = number of connectors on cable

Example, an RG-400 coaxial cable is 10 feet long with 2 TNC connectors, the cable would be figured as:

(10 x 0.261) + (0.5 x 2) = ***3.61 dB***

3. Pull the MFD and PFD circuit breakers.
4. While holding the ENT key on the MFD, restore power by closing the MFD circuit breaker.
5. When the words INITIALIZING SYSTEM appear in the upper left corner of the MFD, release the ENT key.
6. Repeat steps 2 – 3 for the PFD.
7. Using the PFD, go to the GDL Configuration Page.

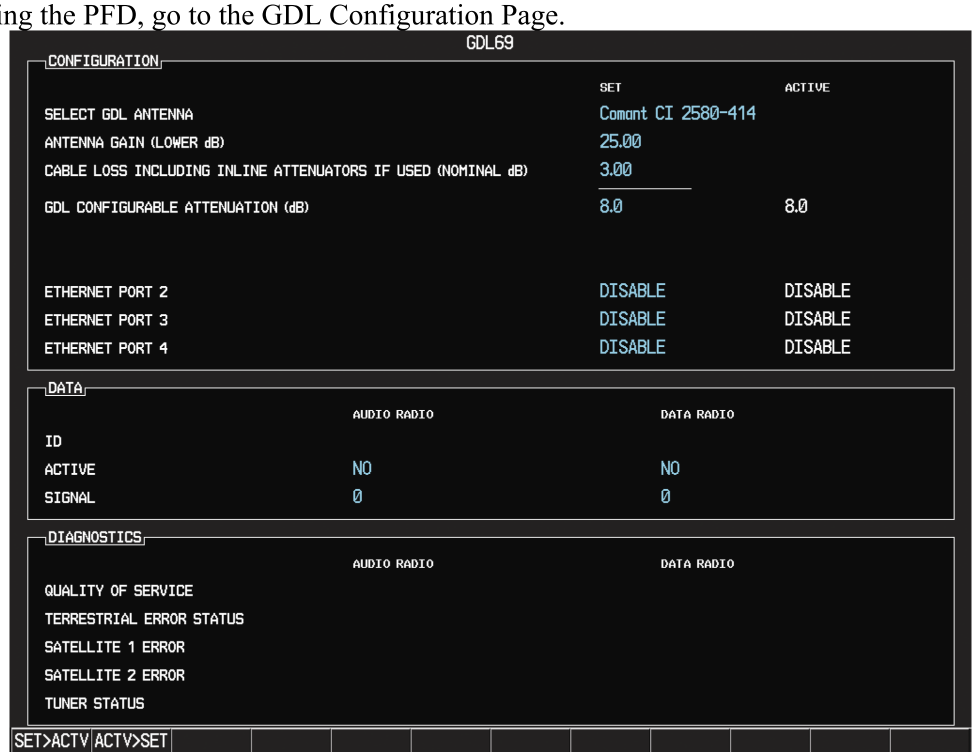


Figure 14-13. GDL 69 Configuration Page

8. Press softkeys 12, 9, 6, and 3 in order to unlock this page.
9. Using the FMS knob go to the SELECT GDL ANTENNA field.

NOTE

Default configuration is set to GA 37 or GA 57 XM antennas. If another antenna is being used proceed to Step 10. If a GA 37 or GA 57 XM antenna is installed proceed to Step 12.

10. Using the FMS knob select the installed antenna.
11. Press the ENT key.
12. Using the FMS knob go to the CABLE LOSS INCLUDING INLINE ATTENUATORS IF USED (NOMINAL DB) field.
13. Enter value calculated above.
14. Press the ENT key.

14.3.2 Cabin Speaker (if installed)

For installations with a cabin speaker installed the cabin speaker is enabled in Configuration mode.

1. Place the G900X system in Configuration mode.
2. On the PFD, go to the GMA CONFIGURATION page using the FMS knob.
3. Activate the cursor and highlight the 'Disable Speaker' option and press the ENT key. A black "SET" and "ACTIVE" check box indicates the cabin speaker is enabled.

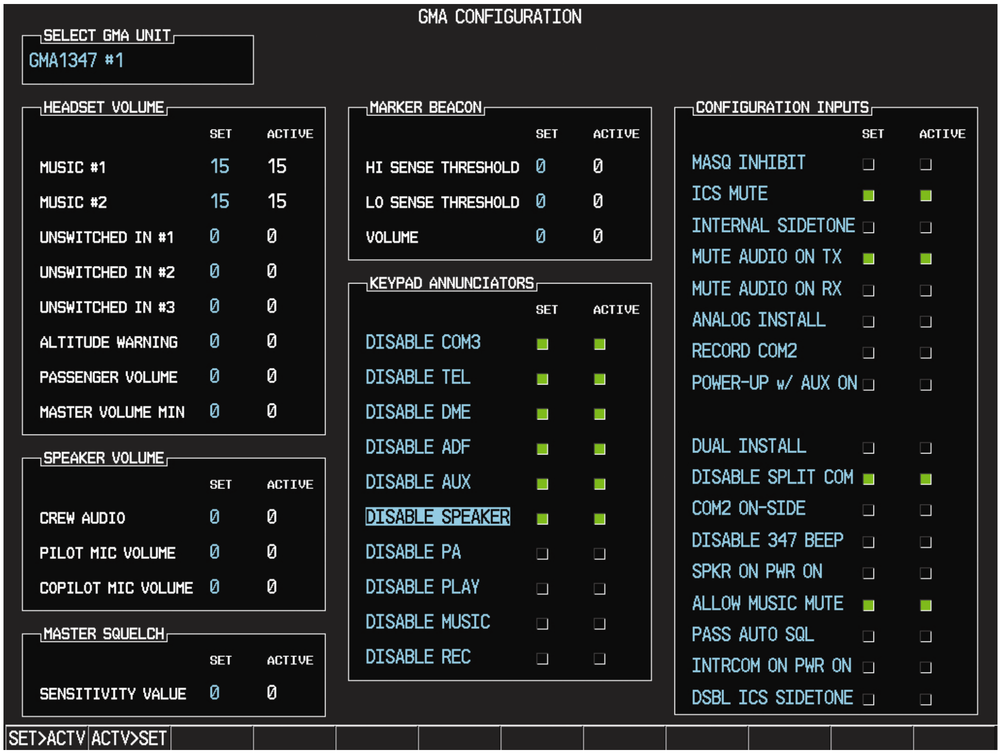


Figure 14-14. GMA Configuration Page

14.3.3 TAWS (if installed)

1. Remove power from the PFD and MFD by opening the PFD and MFD circuit breakers.
2. A special TAWS Unlock card is required to enable TAWS. Refer to the appropriate G900X option list for the correct part number. Insert this card in the upper slot of the PFD.
3. While holding the ENT key on the PFD, restore power by closing the PFD circuit breaker.
4. When the words INITIALIZING SYSTEM appear in the upper left corner of the PFD, release the ENT key.
5. Repeat steps 3 and 4 for the MFD.
6. On the PFD, go to the System Upload page using the FMS knob.
7. Activate the cursor and use the small FMS knob to select the Enable TAWS in the FILE field.
8. Press the ENT key to select the Enable TAWS option. Once the option is selected the configuration files in the SECTION field will be displayed. All files should be checked. If not, press the CHK ALL softkey.
9. Press the LOAD softkey.
10. Monitor the status of the upload. When the upload is finished, press the ENT key to acknowledge the upload complete confirmation.
11. View the SUMMARY field and ensure that the item is 'COMPLETE'.
12. De-activate the cursor.
13. Power down the system and remove the TAWS Enable card from the PFD.

14.3.4 ChartView (if installed)

1. Remove power from the PFD and MFD by opening the PFD and MFD circuit breakers.
2. A special ChartView Unlock card is required to enable ChartView. Refer to the appropriate G900X option list for the correct part number. Insert this card in the upper slot of the PFD.
3. While holding the ENT key on the PFD, restore power by closing the PFD circuit breaker.
4. When the words INITIALIZING SYSTEM appear in the upper left corner of the PFD, release the ENT key.
5. Repeat steps 3 and 4 for the MFD.
6. On the PFD, go to the System Upload page using the FMS knob.
7. Activate the cursor and use the small FMS knob to select the Enable ChartView in the FILE field.
8. Press the ENT key to select the Enable ChartView option. Once the option is selected the configuration files in the SECTION field will be displayed. All files should be checked. If not, press the CHK ALL softkey.
9. Press the LOAD softkey.
10. Monitor the status of the upload. When the upload is finished, press the ENT key to acknowledge the upload complete confirmation.
11. View the SUMMARY field and ensure that the item is 'COMPLETE'.
12. De-activate the cursor.
13. Power down the system and remove the ChartView Enable card from the PFD.

14.3.5 G900X Splash Screen (if applicable)

The G900X software loader card comes with the following airframe specific splash screens.

- Epic LT
- Van's Aircraft RV-7/7A
- Van's Aircraft RV-9/9A
- Van's Aircraft RV-10

An airframes splash screen will be become available after the associated airframe configuration is performed.

To view an aircraft specific splash screen image perform the following after all other software configuration is complete.

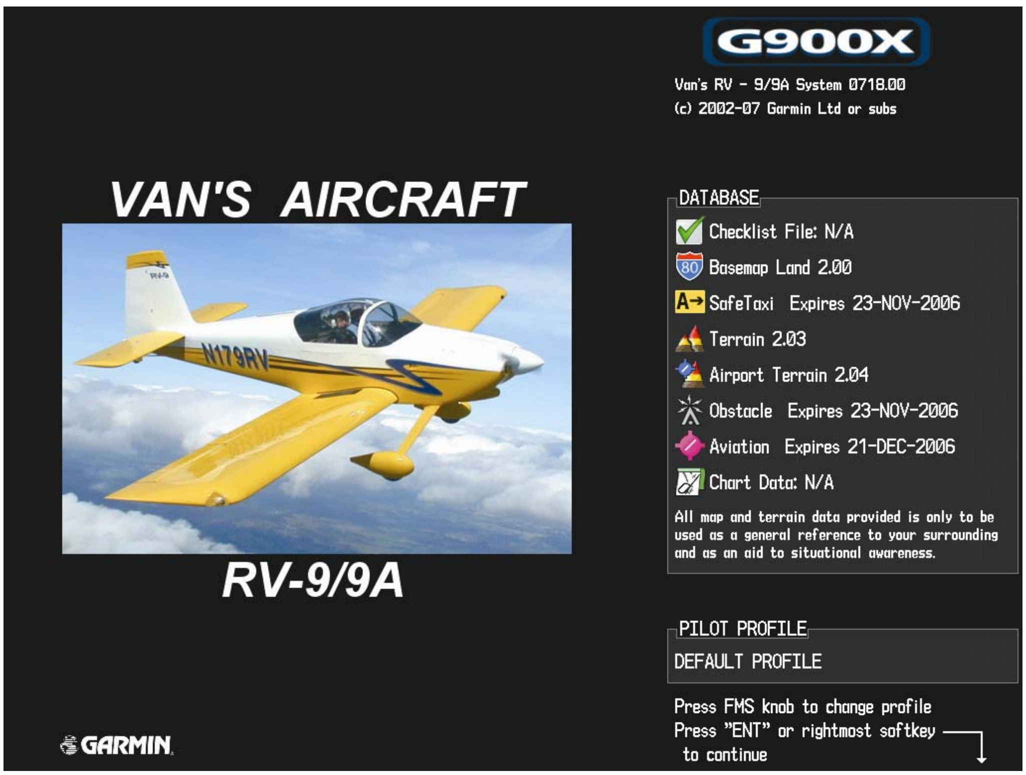


Figure 14-15. Example Splash Screen

1. After loading all G900X software, remove power from the PFD.
2. Place the software loader card containing the standard aircraft specific image in the upper slot of the PFD.
3. Apply power to the PFD.
4. Press the 'YES' softkey to acknowledge the following prompt:

```
DO YOU WANT TO UPDATE THE SPLASH SCREEN?
NO WILL BE ASSUMED IN 28 SECONDS.
UPDATING SPLASH SCREEN.
.
UPDATED 1 FILES SUCCESSFULLY!
PRESS ANY KEY TO CONTINUE.
CONTINUING IN 9 SECONDS.
```

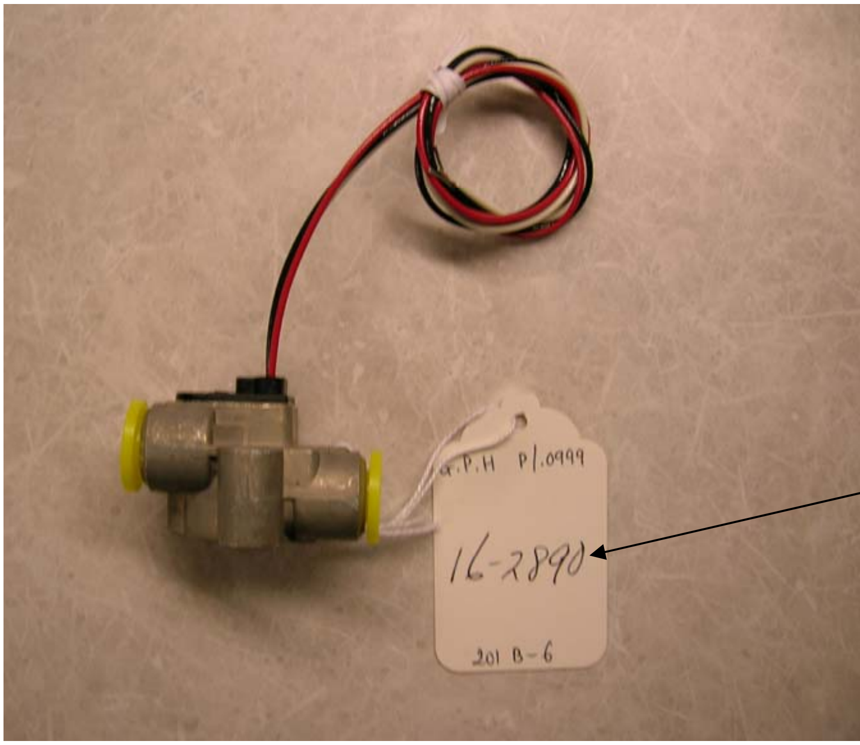
5. Repeat steps 2 through 4 for the MFD.

14.4 Calibration

14.4.1 Fuel Flow Calibration

The Floscan 201B-6 (201-030-000) fuel flow sensor ranges from 28,000 to 31,000 pulses/gallon.

The G900X default fuel flow setting is set to 29,500 pulses/gallon. This corresponds to a K factor setting of 2,947 (29,500 x 0.0999 = 2,947). The Floscan fuel flow sensor comes with an actual K factor number measured during unit calibration (see Figure 14-16).



Actual K Factor measured at 16 GPH

Figure 14-16. Example Fuel Flow Sensor

To adjust the G900X for the actual K factor of the fuel flow sensor received, perform the following procedure:

1. Pull the MFD and PFD circuit breakers.
2. While holding the ENT key on the MFD, restore power by closing the MFD circuit breaker.
3. When the words INITIALIZING SYSTEM appear in the upper left corner of the MFD, release the ENT key.
4. Repeat steps 2 – 3 for the PFD.
5. Using the PFD, go to the Fuel Tank Calibration page (see Figure 14-17).

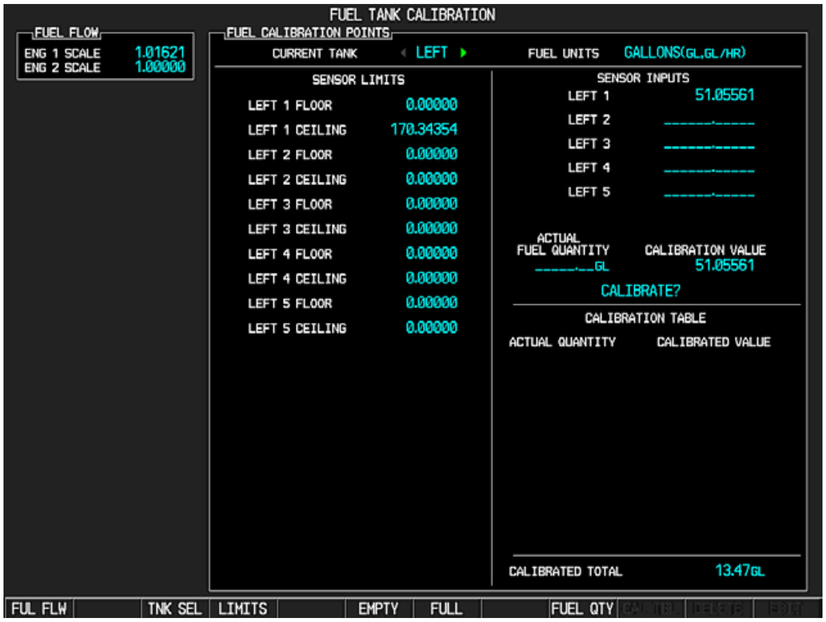


Figure 14-17. Fuel Tank Calibration Page

6. Press softkeys 12, 11, 10, and 9 in order to unlock this page.
7. Using the FMS knob adjust ENG 1 SCALE using the formula below.

   $ENG\ 1\ SCALE = K_{default} / K_{actual}$

   For example, if K_{actual} is equal to 2,890 (tag reads 16-2,890), the value entered for ENG 1 SCALE should be:

   2,947/2,890 = 1.01972

   ENG 1 SCALE = 1.01972

14.4.1.1 Fuel Tank Calibration

Calibration Setup:

1. Level the aircraft.
2. Drain all fuel from each fuel tank, and set the fuel selector switch to the 'OFF' position.

NOTE

To achieve the required fuel quantity precision, it is recommended that the fuel quantities be weighed with a calibrated scale. Fuel density of 6 lbs/gallon is acceptable for purposes of this procedure.

3. Fill each fuel tank with unusable fuel amount (consult airplane kit manufacturer for instructions on determining this number). Use proper precautions when handling fuel. Ensure that the aircraft is grounded correctly and that there is adequate ventilation.
4. Pull the MFD and PFD circuit breakers.
5. While holding the ENT key on the PFD, restore power by closing the PFD circuit breaker.
6. When the words INITIALIZING SYSTEM appear in the upper left corner of the PFD, release the ENT key.
7. Restore power to the MFD. (The PFD should now be in Configuration mode, and the MFD should be in Normal mode).
8. Using the PFD, go to the FUEL TANK CALIBRATION page (see Figure 14-18).
9. On the MFD, press the ENGINE softkey to display the full page engine instrumentation.

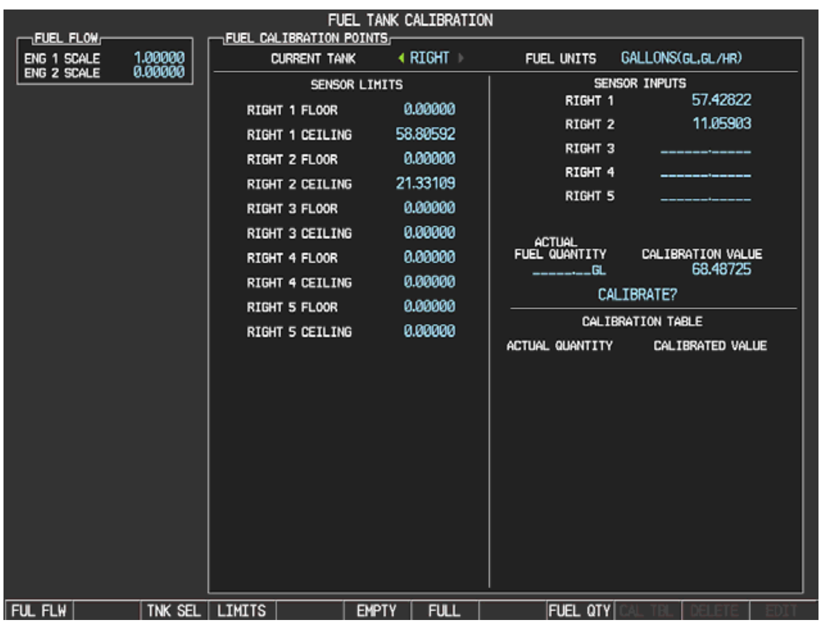


Figure 14-18. Fuel Tank Calibration Page

10. Press softkeys 12, 11, 10, and 9 in order to unlock this page:
11. Press the TNK SEL softkey to activate the cursor in the CURRENT TANK field. Rotate the FMS knob as necessary throughout this procedure to select the RIGHT or LEFT tanks.

Empty Calibration:

1. Verify that unusable fuel has been added to both tanks. Allow both fuel probes to stabilize for at least 2 minutes.
2. Select the LEFT tank on the PFD.
3. Press the EMPTY softkey. The cursor will automatically activate and select the CALIBRATE? option. The calibrated value setting will default to 00.00.
4. Press the ENT key. A prompt appears requesting overwrite acknowledgement. Select YES and press the ENT key. The G900X system will 'zero' the actual fuel quantity value to be displayed.
5. Select the RIGHT tank.
6. Press the EMPTY softkey. The cursor will automatically activate and select the CALIBRATE? option. The calibrated value setting will default to 00.00.
7. Press the ENT key. A prompt appears requesting overwrite acknowledgement. Select YES and press the ENT key. The G900X system will 'zero' the actual fuel quantity value to be displayed.
8. Observe the CALIBRATED TOTAL indication for the RIGHT tank. Verify that it remains at 0.00.
9. Select the LEFT tank. Observe the CALIBRATED TOTAL indication for the LEFT tank. Verify that it remains at 0.00.
10. On the MFD, verify the fuel quantity indicators correctly point to '0'.

Calibration Check:

1. Fill the fuel tank with a measurable amount of usable fuel (e.g. one gallon).
2. Allow the fuel probe to stabilize at least 2 minutes before continuing.
3. Enter the amount of fuel currently in the tank into the ACTUAL FUEL QUANTITY field and press the ENT key. The cursor automatically selects the CALIBRATE? Option.
4. Press the ENT key again to calibrate.
5. Verify a corresponding point appears in the CALIBRATION TABLE.
6. Verify that the CALIBRATED TOTAL value equals the amount of fuel put into the tank.

NOTE

Up to 44 separate entries can be used to generate the calibration table. The more entries made the more accurate the calibration table will be. It is recommended that a minimum of 10 equally spaced entries be made.

7. Continue procedure until all required data points are entered. Points must be entered for empty and full fuel quantities.
8. Repeat procedure for other fuel tank.

14.4.2 Flaps and Trim Calibration

With the appropriate trim sensors or trim servos installed, perform the following procedure:

1. Pull the MFD and PFD circuit breakers.
2. While holding the ENT key on the PFD, restore power by closing the PFD circuit breaker.
3. When the words INITIALIZING SYSTEM appear in the upper left corner of the PFD, release the ENT key.
4. Restore power to the MFD. (The PFD should now be in Configuration mode, and the MFD should be in Normal mode).
5. Using the PFD, go to the FLAPS AND TRIM CALIBRATION page (see Figure 14-19).

Figure 14-19. Flaps and Trim Calibration Page

6. Press softkeys 1, 2, 3, and 4 in order to unlock this page.

Flaps Position:

7. Place the flaps in the full up position, and wait for the sensor to stabilize.
8. Verify desired position on the MFD.
9. Press the corresponding UP softkey.
10. Place the flaps in the full down position, and wait for the sensor to stabilize.
11. Verify desired position on the MFD.
12. Press the corresponding DN softkey.

Elevator Trim:

13. Place the elevator trim in the full up position, and wait for the sensor to stabilize.
14. Verify the desired position on the MFD.

15. Press the corresponding UP softkey.
16. Place the elevator trim in the full down position, and wait for the sensor to stabilize.
17. Verify the desired position on the MFD.
18. Press the corresponding DN softkey.

Rudder Trim/Aileron Trim:

19. Place the rudder/aileron in the full left position, and wait for the sensor to stabilize.
20. Press the corresponding LEFT softkey.
21. Verify the desired position on the MFD.
22. Place the rudder/aileron in the full right position, and wait for the sensor to stabilize.
23. Verify the desired position on the MFD.
24. Press the corresponding RIGHT softkey.

14.4.3 GRS77/GMU 44

The GRS 77 AHRS unit and the GMU 44 magnetometer unit require calibration before first flight. There are three procedures to be carried out (Sections 14.4.3.1, 14.4.3.4, 14.4.3.5). The aircraft engine must be started after the first procedure is complete. When ready to perform the procedures, shut the PFD and MFD off by pulling the PFD and MFD circuit breakers. Restart both displays in configuration mode.

14.4.3.1 Procedure A: GRS 77 Pitch/Roll Offset Calibration

Figure 14-20. GRS/GMU Calibration Page

This procedure must be carried out with the engine off. Go to the GRS page group on the PFD. Select the GRS/GMU Calibration page on the PFD.

To perform the following procedures press the following softkeys:

a) 9

b) 10

c) 11

d) 12 (Far Right softkey)

1. Level the aircraft to within ±0.25° of zero pitch and zero roll.

2. Initiate the AHRS Ground Pitch/Roll Aircraft Level compensation mode by performing the following steps:
    a) Ensure that the No. 1 GRS 77 is selected.
    b) Select PITCH/ROLL OFFSET, then press the ENT key.
    c) Follow the checklist items displayed on the PFD and press the ENT key as each one is completed or confirmed. When the CALIBRATE field is blinking, press the ENT key to begin the procedure.
    d) After several seconds, a new checklist appears in the lower half of the PFD. Press the ENT key as each item is confirmed. When the CONFIRM AIRCRAFT IS LEVEL field is blinking, press the ENT key to continue.
3. The result of the pitch/roll offset compensation is displayed on the PFD. If successful, the AHRS records the required pitch and roll offsets, informs the operator of a successful conclusion and returns to normal operation.
4. Press the ENT key on the PFD to conclude this procedure.
5. Restart both displays in normal mode.

14.4.3.2 Final GRS 77/GMU 44 Calibration Procedures

The Magnetometer Calibration Procedure (Calibration Procedure B) must be carried out at a site that is determined to be free of magnetic disturbances. If it is unsure whether the site is 'clean' the technician should verify that the site is 'clean' by following the guidance provided in Section 14.4.3.3. The technician may skip Section 14.4.3.3 if the site condition is acceptable.

14.4.3.3 Site Evaluation of Magnetic Disturbances for Magnetometer Calibration Procedure (Optional)

NOTE

Typically, a compass rose is an acceptable location to perform the magnetometer calibration procedure. However, because not all compass roses are well maintained, even an existing compass rose should be regularly evaluated using the method described here to determine if it is free of magnetic disturbances. If evaluation of an existing compass rose indicates that magnetic disturbances are present, then an alternative location must be found to perform the Magnetometer Calibration Procedure.

A G900X-equipped airplane can be used to evaluate a candidate site for magnetic disturbances and determine whether it is a suitable location to perform the magnetometer calibration procedure. The magnetometer calibration procedure itself contains the logic to simultaneously survey the location for magnetic cleanliness while it is computing the magnetometer calibration parameters.

The airplane used to evaluate the site must have already completed the pitch/roll offset compensation procedure (Procedure A). However, prior completion of the Magnetometer Calibration Procedure (Procedure B) is not required.

In order to evaluate a candidate site, the Magnetometer Calibration Procedure must be performed twice: once turning clockwise around the site, and once turning counter-clockwise. Both times, the procedure should be conducted as described in Section 14.4.3.4 of this document, with the exception of the direction of turns around the site.

NOTE

Although Section 14.4.3.4 indicates that the Magnetometer Calibration Procedure should be performed by making a series of clockwise turns around the site, the procedure can also be performed by making counter-clockwise turns for the purpose of evaluating the site for magnetic disturbances.

If, upon completion of the Magnetometer Calibration Procedure in each clockwise and counter-clockwise direction, the PFD displays the "CALIBRATION SUCCESSFUL / SITE IS CLEAN" message, then the candidate site is sufficiently free of magnetic disturbances and is acceptable for performing the Magnetometer Calibration Procedure. It is important to obtain successful result in both the clockwise and counter-clockwise directions to ensure that the magnetometer sweeps over a large enough area at the candidate site.

If, upon completion of the Magnetometer Calibration Procedure in either of the two directions, the PFD displays either the "MAG FIELD AT SITE NOT UNIFORM", or "MAG FIELD AT SITE DIFFERS FROM IGRF MODEL" message, then the site contains magnetic disturbances that are too large.

14.4.3.4 Procedure B: GRS 77/GMU 44 Magnetic Calibration

Calibration Procedure B must be carried out on a compass rose in order to guarantee measurements free of environmental magnetic disturbances. Attempting to carry out this maneuver on a typical ramp area may not yield a successful calibration. The accuracy of the AHRS cannot be guaranteed if this calibration is not performed on a magnetically clean compass rose. If the compass rose condition is not known, it is recommended that the technician follow the guidance in Section 14.4.3.3.

1. Start the aircraft engine.
2. After aircraft engine startup, taxi the aircraft to a properly calibrated compass rose.
3. At the compass rose, align the aircraft to a heading of magnetic north (±5°).

CAUTION

CALIBRATION PROCEDURE B MUST BE CARRIED OUT ON A COMPASS ROSE IN ORDER TO GUARANTEE MEASUREMENTS FREE OF ENVIRONMENTAL MAGNETIC DISTURBANCES. ATTEMPTING TO CARRY OUT THIS MANEUVER ON A TYPICAL RAMP AREA MAY NOT YIELD A SUCCESSFUL CALIBRATION. THE ACCURACY OF THE AHRS CANNOT BE GUARANTEED IF THIS CALIBRATION IS NOT PERFORMED ON A MAGNETICALLY CLEAN COMPASS ROSE OR EQUIVALENT.

4. Restart the PFD and MFD in configuration mode.
5. Go to the GRS Page Group on the PFD.

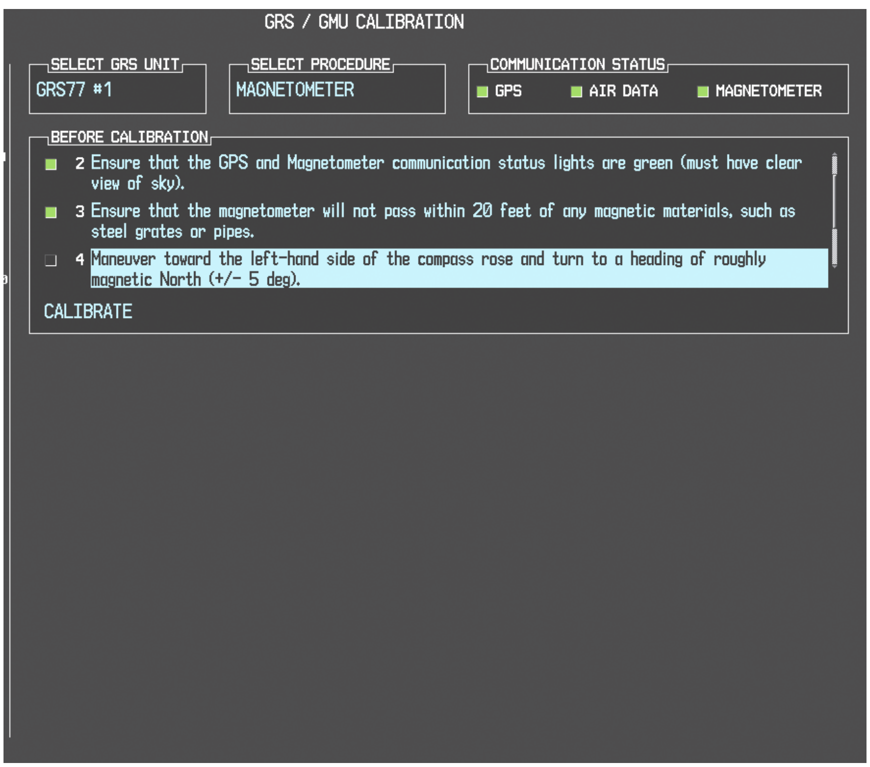


Figure 14-21. GRS/GMU Calibration

6. Select the GRS/GMU Calibration page and enter the following softkey password:
   a) 9
   b) 10
   c) 11
   d) 12 (Far Right softkey)

   Note that engine instruments may be monitored at this page.
7. Activate the cursor and highlight the SELECT PROCEDURE window and select MAGNETOMETER.
8. Press the ENT keu.
9. Use the cursor to highlight the BEFORE CALIBRATION window.
10. Follow the checklist items displayed on the PFD and press the ENT key as each one is completed or confirmed. When the CALIBRATE field is blinking, press the ENT key to begin the procedure.
11. The PFD display advises the operator when to turn the aircraft, when to stop, and when to turn again.
12. Upon instruction to turn, taxi the aircraft in a right turn. After approximately 25° to 30° of turn from the last heading, the PFD display advises the operator to stop the aircraft.

NOTE

Due to the difficulties in executing smooth, accurate turns the PFD may incorrectly interpret a station and instruct to "HOLD POSITION" prior to full completion of a 30° turn. If this scenario is encountered, it is best for the operator to ignore the "HOLD POSITION" command and instead use outside references to complete the approximate 30° turn. Instead of using the PFD instruction to turn as a real-time indication of when to turn, simply judge the 30° (±5°) turn increments of the aircraft by using the compass rose radials. Dwelling at these 30° increments for the time recommended by the PFD should result in successful calibration.

13. The PFD guides the operator to dwell at multiple headings around a complete circle.

NOTE

Due to high winds or excessive airframe vibration, the operator may encounter a condition where the PFD restarts the 18-second countdown without full completion of the previous countdown. If this is encountered more than once for a given station, the operator should begin turning to the next station (approximately 30°). A minimum of 2 successful stations per quadrant is required, where a successful station is a full 18-second countdown followed by instruction to move. Ensure that at least 2 stations per quadrant are completed. Thus, it may sometimes be required to dwell at a station after a countdown restart. A maximum of 30 stations is allowed for the entire calibration procedure. If too many countdown restarts are encountered, the calibration will fail with the message, "TOO MANY STATIONS."

14. Repeat the turn-and-stop process until the PFD advises that a successful calibration is complete. The GRS 77 AHRS then enters its normal operational mode. Press the ENT button on the PFD to conclude this procedure.
15. Repeat the turn-and-stop process until the PFD advises that a successful calibration is complete. The GRS 77 AHRS then enters its normal operational mode. Press the ENT button on the PFD to conclude this procedure.
16. Proceed to Section 14.4.3.5 for the engine run-up procedure.

14.4.3.5 Procedure C: Engine Run-Up

Calibration Procedure C must be performed in order to guarantee that the AHRS mounting is sufficiently rigid and insensitive to vibration.

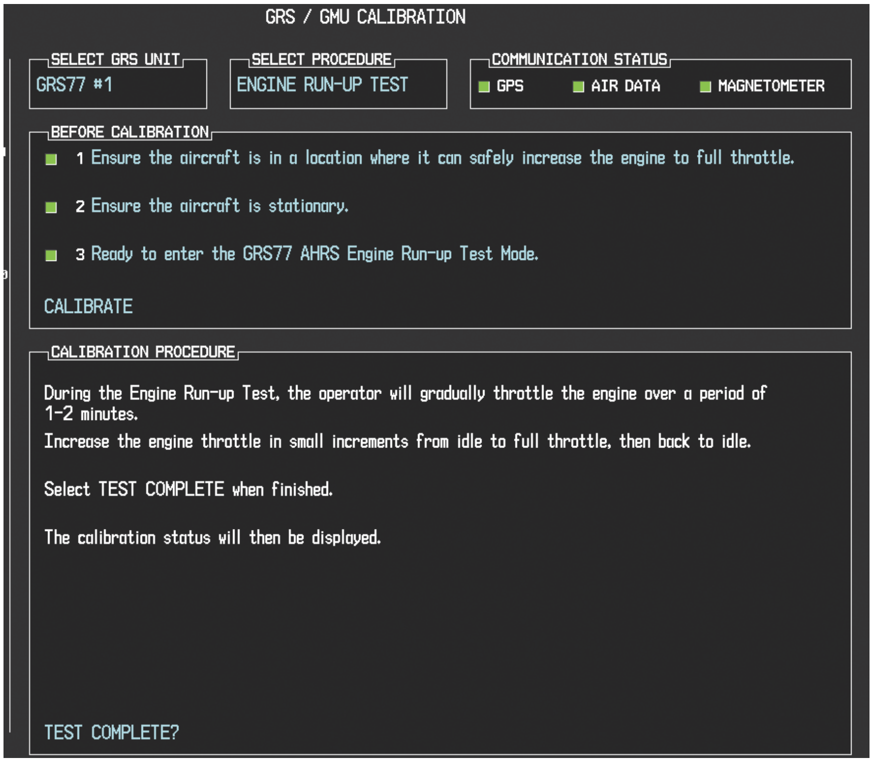


Figure 14-22. Engine Run-Up

1. Initiate the AHRS engine run-up vibration test procedure by performing the following steps:
   a) Select the ENGINE RUN-UP TEST procedure and press the ENT key.
   b) Follow the checklist items displayed on the PFD, and press the ENT key as each one is completed or confirmed. When the CALIBRATE field is blinking, press the ENT key to begin the procedure.
2. The PFD display instructs the operator to gradually increase power from idle to full throttle and back to idle over a period of 1-2 minutes.
3. When the operator has completed the engine run-up and the engine is back to an idle setting, press the ENT key to indicate that the process is complete. When this is done, the TEST COMPLETE field stops blinking.
4. The PFD informs the operator if the installation has passed or failed the vibration test. If the test fails, the specific measurements causing the failure are identified and associated numeric values are displayed on the PFD.

NOTE

Should a failure occur, the technician may perform the Engine Run-up test up to 3 times successively before corrective action must be taken. If the test does not pass after three attempts, then the installation should not be considered reliable until the source of the vibration problem is identified and remedied. In the event of repeated failure of the engine run-up test, record the values that are reported to be out of range for future reference.

The following are potential causes for failure of the engine run-up test:

a) Vibration motion of GRS77 and/or GMU44 caused by neighboring equipment and/or supports.
b) Mounting screws and other hardware for GRS77 and/or GMU44 not firmly attached.
c) GRS77 connector not firmly attached to unit.
d) Cabling leading to GRS77 or GMU44 not firmly secured to supporting structure.
e) An engine / propeller that is significantly out of balance.

5. Press the ENT key on the PFD to conclude this procedure.

14.4.4 GDU Lighting Setup

14.4.4.1 Main Lighting Page

Figure 14-23. Main Lighting Page

Through configuration settings on this main lighting page, G900X lighting can be setup and adjusted to suit each installation/cockpit environment. Each GDU must be configured for individual performance. The GMA 1347 and GCU 476 lighting is also controlled from this page. Audio panel lighting is directly tied to display configuration, normally to the PFD (if the PFD fails, the MFD supplies lighting information to the GMA). A default lighting configuration is included in the standard G900X configuration. The following guidance can be used to adjust the lighting performance.

14.4.4.2 Display/Key Parameters

The following parameters apply to both display lighting and key/bezel lighting. The two are divided into separate windows on screen as shown in Figure 14-23.

INPUT: Input level is provided from two photocells on the display (ambient light) or an external avionics dimmer bus voltage. Range is between 0 and 99.99. The higher number indicates a corresponding demand for a brighter display. Input level is shown on the graph as the 'x' (horizontal) axis, with a vertical magenta line showing the current input value. The input value is only adjustable by varying the amount of light reaching the photocell or by manipulating the appropriate aircraft dimmer bus, if equipped.

BRIGHTNESS: Depicts actual brightness level of the display, shown on the graph as the 'y' (vertical) axis with a horizontal yellow line. For any given condition, the brightness is determined by the intersection of the input level and the lighting curve. Range is between 0.0 and 99.99.

SOURCE:

Selection	Description
PHOTO	Allows the input level to be controlled by ambient lighting sensed from the display's photocells.
14V DC	Input level is controlled by 14 VDC dimmer bus.
28V DC	Input level is controlled by 28 VDC dimmer bus.
5V DC	Input level is controlled by 5 VDC dimmer bus.
5V AC	Input level is controlled by 5 VAC dimmer bus.

RESPONSE TIME: Adjusts the speed, in seconds, that the brightness level responds to input level (bus voltage or ambient light) changes. Adjustable range is between 0 to 9 seconds. A higher number yields a greater delay in response. For testing purposes it might prove beneficial to set the response time to 0, or a low value, to see immediate reaction to an input stimulus.

MINIMUM: Sets the minimum display brightness. Adjustable range is between 0.14 to 99.99. The higher the number, the greater the minimum brightness. Display brightness will not decrease below the set minimum, regardless of input value or slope. The minimum needs to be set to avoid the input from going too low and experiencing display flicker caused by difficulties of lighting bulbs at low inputs.

EDIT CURVE VERTEX: Selects which point (vertex) on the lighting curve to adjust. See Figure 14-24. By adjusting the vertices, the lighting curve slope(s) can be adjusted as functions of a single curve. This sets the brightness level for any given input level. When a point is selected for adjustment, the map-panning joystick on the PFD/MFD is used to manipulate the point.

Selection	Description
NONE	No vertex point is selected.
1	The #1 vertex (bottom endpoint of curve) is selected for adjustment. This point cannot be moved in the vertical (y) direction. It is only adjustable in the horizontal (right/left) direction.
2	The #2 vertex is selected for adjustment.
3	The #3 vertex is selected for adjustment.
4	The #4 vertex (top endpoint of curve) is selected for adjustment. This point cannot be moved in the vertical (y) direction. It is only adjustable in the horizontal (right/left) direction.
ALL	All vertex points are selected for adjustment. Movement is only allowed within each respective bound of a vertex (vertex #1 and #2, the curve endpoints, can not move vertically). The most pronounced resultant movements would be a step or trough shaped curve.

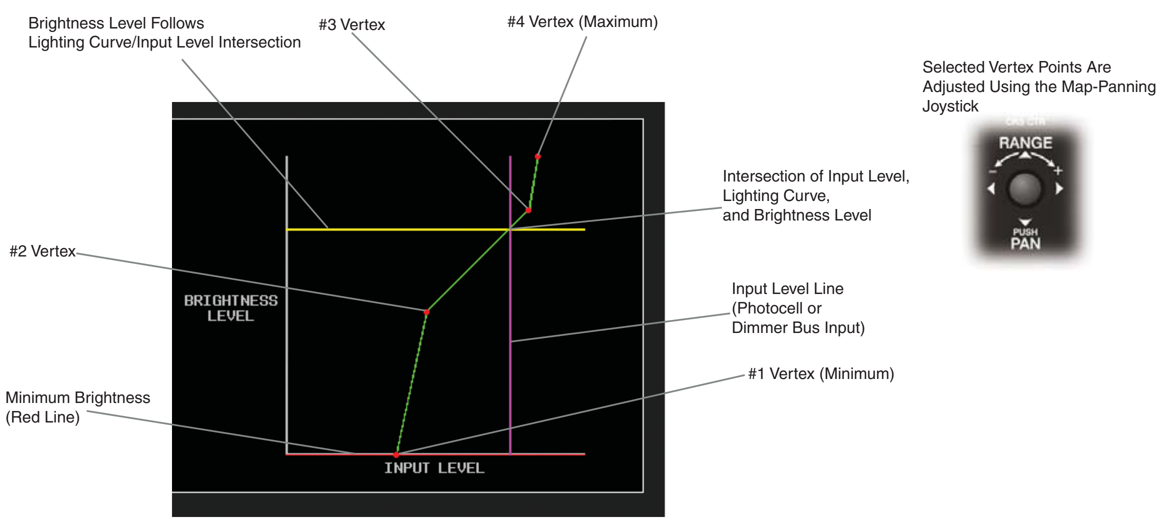


Figure 14-24. Lighting Curve Vertices

14.4.4.3 GMA Annunciator Parameters (arrow light beneath keys)

BRIGHTNESS: Depicts actual brightness level of the arrow lights beneath the keys on the GMA. Range is between 0.0 and 99.99.

GAIN: Controls the brightness level of the arrow lights beneath the keys on the GMA. Range is between 0 and 2. Gain is a brightness multiplier and is best suited for small adjustments.

OFFSET: Allows an offset control of the brightness level for the arrow lights beneath the keys on the GMA. Range is between -100 and 100. Offset allows for the largest change in brightness in efforts to match other cockpit lighting.

14.4.4.4 GMA Key Parameters

BRIGHTNESS: Depicts actual brightness level of the keys on the GMA. Range is between 0.0 and 99.99.

GAIN: Controls the brightness level of the keys on the GMA. Range is between 0 and 2. The gain is a multiplier that lends itself best to small adjustments, mainly used for tweaking the brightness.

OFFSET: Allows an offset control of the brightness level for the keys on the GMA. Range is between -100 and 100. Offset allows for the largest change in brightness in efforts to match other cockpit lighting.

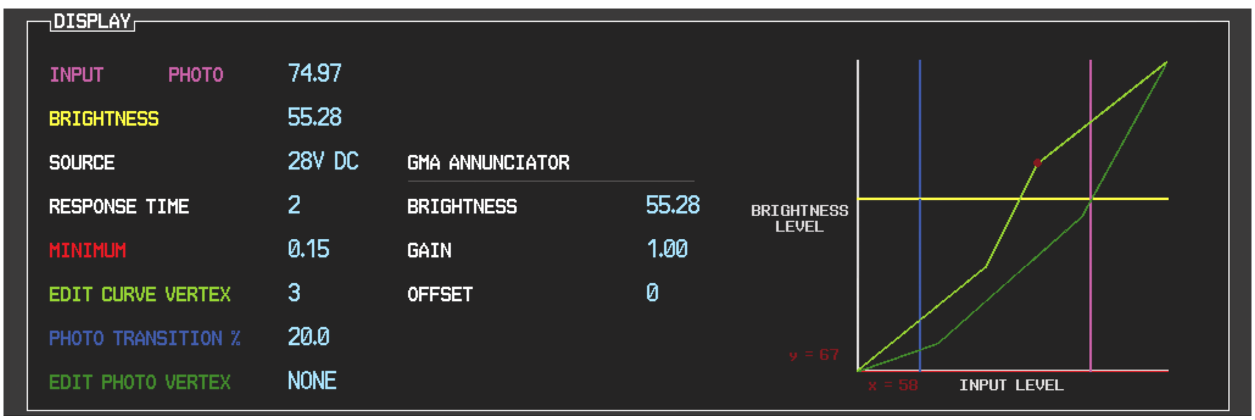


Figure 14-25. Dimmer Bus Lighting

When the lighting input source is set to use dimmer bus voltage (14 VDC, 28 VDC, 5 VDC, 5 V AC), installers can set a transition point where the display switches from using dimmer bus voltage to using the photocell. The light green curve represents the selected input. If something other than photo input is used, the light-green curve will represent that input, while the dark-green input will represent the photo input.

PHOTO TRANSITION %: Sets the input level point at which the display transitions from using the photocell to dimmer bus. At input levels greater than the transition point, the display uses the dimmer bus. At input levels less than the transition point, the display uses the photocell. Should the installer desire to completely operate the display entirely on dimmer bus voltage, the transition point should be set to 0.0. This allows the brightness to track the full range of the dimmer bus voltage from the maximum input value to the minimum value.

EDIT PHOTO CURVE VERTEX: Controls the slopes of the lighting curve used by the photocell when the dimmer bus input level falls below the set transition point. Operation is identical to that of the normal vertex adjustment described above.

14.4.5 Cockpit Lighting Setup

The following guidance is recommended to help the technician determine a suitable setup. A test flight is recommended upon completion of the setup.

NOTE

To accurately configure the lighting, the ability to adjust ambient light conditions is required. The technician should be prepared to simulate complete darkness in the cockpit. Simply covering the photocells may not allow the technician's eyes to properly judge whether the display brightness is too bright, or too dim, for night use.

Photocell Configuration:

1. It is recommended to start configuration with a linear lighting curve slope (45° Straight Line).
2. Minimize photocell input levels by simulating night conditions in the cockpit. Any other instrument panel or cockpit lighting should be turned on for this adjustment. Seek uniform consistency between display lighting, bezel/key lighting, and any other illuminated objects.
    a) If a display/keypad is too bright, lower the minimum setting and/or adjust the lighting curve to achieve the desired brightness.
    b) If the display is not bright enough, raise the minimum setting to the desired brightness.
    c) In the case of the GMA, adjust gain and offset settings to achieve the desired brightness relative to other lighting.
3. Simulate direct maximum sunlight in the cockpit (best if done outside).
    a) Verify that the display produces maximum brightness on the graph.
4. Simulate average sunlight conditions in the cockpit (between ~50-75% input level).
    a) If the display is too bright or too dim, use a combination of lighting curve changes to achieve desired brightness at mid-range lighting input levels.
    b) Ensure that the lighting curve and minimum setting still maintain the low-light configuration achieved in Step 2. Repeat Step 2 if necessary to re-adjust night lighting settings.
    c) Adjust the response time to smooth changes to brightness as required.

Dimmer Bus Configuration:

1. Select the appropriate source voltage for the dimmer bus. Set the Photo Transition point to 0.0 for initial dimmer knob calibration.
2. Simulate night conditions in the cockpit. Turn the dimmer bus knob to its minimum setting and observe the graph for corresponding change to the input level. Attempt to seek uniform consistency between display lighting, bezel key lighting, and any other cockpit illuminated information.
    a) If a display/keypad is too bright, lower the minimum setting and/or adjust the lighting curve to achieve the desired brightness.
    b) If the display is too dim, increase the minimum setting to achieve desired levels.
    c) In the case of the GMA, adjust gain and offset settings to achieve the desired brightness relative to other lighting.

3. Simulate direct sunlight conditions in the cockpit. Turn the dimmer bus knob to its maximum setting and observe the graph for a corresponding change to the input level.
    a) If the brightness is below maximum on the graph, adjust the lighting curve settings to achieve maximum brightness.
    b) Check for smoothness in the transition from dark to light and adjust the lighting curve and response time settings to achieve desired results.

If desired, set the photocell transition point and associated photo lighting curve to achieve desired display performance over a variety of lighting conditions.

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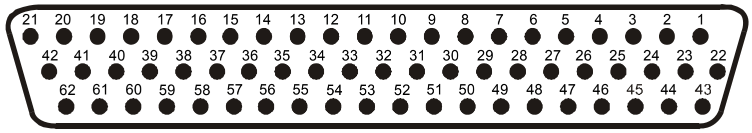
APPENDIX A G900X Pinouts

A G900X PINOUTS

A.1 GDU 1040

A.1.1 P10001 Connector

View of J10001 connector from back of unit



Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	Out
2	ETHERNET OUT 1 A	Out
3	ETHERNET OUT 1 B	Out
4	ETHERNET IN 1 A	In
5	ETHERNET IN 1 B	In
6	ETHERNET OUT 2 A	Out
7	ETHERNET OUT 2 B	Out
8	ETHERNET IN 2 A	In
9	ETHERNET IN 2 B	In
10	ETHERNET OUT 3 A	Out
11	ETHERNET OUT 3 B	Out
12	ETHERNET IN 3 A	In
13	ETHERNET IN 3 B	In
14	FAN MONITOR VALID*	In
15	REVERSIONARY MODE SELECT 2	In
16	ARINC 429 IN 2 A	In
17	ARINC 429 IN 2 B	In
18	ARINC 429 IN 1 A	In
19	ARINC 429 IN 1 B	In
20	SIGNAL GROUND	--
21	SIGNAL GROUND	--
22	CONFIG MODULE DATA	I/O
23	CONFIG MODULE POWER OUT	Out
24	RESERVED	--
25	RESERVED	--
26	SIGNAL GROUND	--
27	POWER GROUND	--
28	RESERVED	--
29	POWER GROUND	--
30	SIGNAL GROUND	--
31	POWER GROUND	--
32	SIGNAL GROUND	--
33	POWER GROUND	--
34	SIGNAL GROUND	--

Connector P10001, continued		
Pin	**Pin Name**	**I/O**
35	AIRCRAFT POWER 1	In
36	SIGNAL GROUND	--
37	AIRCRAFT POWER 1	In
38	SIGNAL GROUND	--
39	AIRCRAFT POWER 2	In
40	SIGNAL GROUND	--
41	AIRCRAFT POWER 2	In
42	SIGNAL GROUND	--
43	CONFIG MODULE CLOCK	Out
44	RS-232 OUT 1	Out
45	RS-232 IN 1	In
46	RS-232 OUT 2	Out
47	RS-232 IN 2	In
48	UNIT 5 REMOTE POWER OFF	Out
49	UNIT 4 REMOTE POWER OFF	Out
50	UNIT 3 REMOTE POWER OFF	Out
51	UNIT 2 REMOTE POWER OFF	Out
52	UNIT 1 REMOTE POWER OFF	Out
53	RESERVED	--
54	DEMO MODE SELECT*	In
55	CDU SYSTEM ID PROGRAM* 1	In
56	CDU SYSTEM ID PROGRAM* 2	In
57	CDU SYSTEM ID PROGRAM* 3	In
58	REVERSIONARY MODE SELECT 1	In
59	LIGHTING BUS HI	In
60	LIGHTING BUS LO	In
61	RESERVED	--
62	RESERVED	--

* Indicates Active Low

Power

This section covers the power input requirements.

A.1.1.1 Aircraft Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P10001	35	In
AIRCRAFT POWER 1	P10001	37	In
AIRCRAFT POWER 2	P10001	39	In
AIRCRAFT POWER 2	P10001	41	In
POWER GROUND	P10001	27	--
POWER GROUND	P10001	29	--
POWER GROUND	P10001	31	--
POWER GROUND	P10001	33	--

Pins 35 and 37 are internally connected to form AIRCRAFT POWER 1. Pins 39 and 41 are internally connected to form AIRCRAFT POWER 2. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode ORed" to provide aircraft power redundancy.

A.1.1.2 Remote Power

Pin Name	Connector	Pin	I/O
UNIT 5 REMOTE POWER OFF	P10001	48	Out
UNIT 4 REMOTE POWER OFF	P10001	49	Out
UNIT 3 REMOTE POWER OFF	P10001	50	Out
UNIT 2 REMOTE POWER OFF	P10001	51	Out
UNIT 1 REMOTE POWER OFF	P10001	52	Out

Used to control power of a remote sub-system. 28 Volts DC turns the remote unit off. Ground/Open turns the remote unit on.

A.1.2 Configuration

A.1.2.1 CDU System ID Program

CDU SYSTEM ID PROGRAM 1 (P10001, Pin 55)	CDU SYSTEM ID PROGRAM 2 (P10001, Pin 56)	CDU SYSTEM ID PROGRAM 3 (P10001, Pin 57)	DISPLAY
Open	Open	Ground	MFD
Open	Open	Open	PFD1
Ground	Open	Open	PFD2

These inputs determine if the GDU 1040 is a MFD or PFD.

A.1.2.2 Configuration Module

Pin Name	Connector	Pin	I/O
CONFIG MODULE GROUND	P10001	1	Out
CONFIG MODULE DATA	P10001	22	I/O
CONFIG MODULE POWER OUT	P10001	23	Out
CONFIG MODULE CLOCK	P10001	43	Out

A.1.2.3 Reversionary Mode

Pin Name	Connector	Pin	I/O
REVERSIONARY MODE SELECT 1	P10001	58	In
REVERSIONARY MODE SELECT 2	P10001	15	In

These inputs determine whether to place the system in reversionary mode.

A.1.2.4 Demo Mode

Pin Name	Connector	Pin	I/O
DEMO MODE SELECT	P10001	54	In

This is an active low input that places the unit in demo mode. This input is not to be used in aircraft installations.

A.1.3 Serial Data

A.1.3.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	P10001	44	Out
RS-232 IN 1	P10001	45	In
RS-232 OUT 2	P10001	46	Out
RS-232 IN 2	P10001	47	In

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5V when driving a standard RS-232 load.

A.1.3.2 ARINC 429

Pin Name	Connector	Pin	I/O
ARINC 429 IN 2 A	P10001	16	In
ARINC 429 IN 2 B	P10001	17	In
ARINC 429 IN 1 A	P10001	18	In
ARINC 429 IN 1 B	P10001	19	In

The ARINC 429 inputs conform to ARINC 429 electrical specifications when loaded with up to 2 standard ARINC 429 transmitters.

A.1.3.3 Ethernet

Pin Name	Connector	Pin	I/O
ETHERNET OUT 1 A	P10001	2	Out
ETHERNET OUT 1 B	P10001	3	Out
EHTERNET IN 1 A	P10001	4	In
ETHERNET IN 1 B	P10001	5	In
ETHERNET OUT 2 A	P10001	6	Out
ETHERNET OUT 2 B	P10001	7	Out
EHTERNET IN 2 A	P10001	8	In
ETHERNET IN 2 B	P10001	9	In
ETHERNET OUT 3 A	P10001	10	Out
ETHERNET OUT 3 B	P10001	11	Out
EHTERNET IN 3 A	P10001	12	In
ETHERNET IN 3 B	P10001	13	In

This Ethernet based HSDB (High Speed Data Bus) meets the hardware aspects of IEEE standard 802.3 for 10 base T Ethernet communications.

A.1.3.4 Lighting

Pin Name	Connector	Pin	I/O
LIGHTING BUS HI	P10001	59	In
LIGHTING BUS LO	P10001	60	In

The GDU 1040 display and keys can be configured to track 28 VDC, 14 VDC, 5 VDC, or 5 VAC lighting busses using these inputs. Alternatively, the GDU 1040 can be configured to automatically adjust for ambient lighting conditions based on the photocell.

A.1.3.5 Fan Monitor

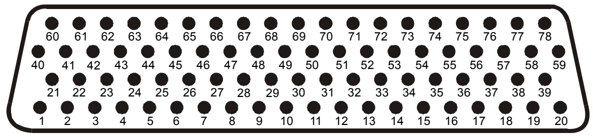
Pin Name	Connector	Pin	I/O
FAN MONITOR VALID*	P10001	14	In

An active low input that monitors the status of the cooling fan.

A.2 GMA 1347

A.2.1 P3471

View of J3471 connector from back of unit



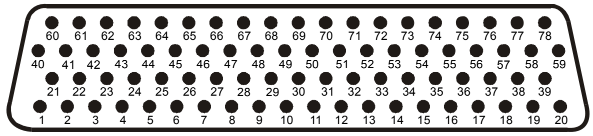
Pin	Pin Name	I/O
1	FAIL SAFE WARN AUDIO IN	In
2	RESERVED	--
3	TEL RINGER AUDIO IN HI	In
4	TEL RINGER AUDIO IN LO	In
5	REMOTE PASS ICS OUT HI	Out
6	ON-SIDE NAV AUDIO IN HI	In
7	ON-SIDE COM AUDIO IN HI	In
8	ON-SIDE COM AUDIO LO	I/O
9	PILOT HEADSET AUDIO OUT LEFT	Out
10	PILOT HEADSET AUDIO OUT RIGHT	Out
11	PILOT HEADSET AUDIO OUT LO	Out
12	CROSS-SIDE COM AUDIO IN HI	In
13	CROSS-SIDE COM AUDIO LO	I/O
14	CROSS-SIDE NAV AUDIO IN HI	In
15	DME AUDIO IN HI	In
16	DME AUDIO IN LO	In
17	MUSIC IN 1 LEFT	In
18	MUSIC IN 1 RIGHT	In
19	UNSWITCHED AUDIO IN 1 HI	In
20	UNSWITCHED AUDIO IN 2 HI	In
21	REMOTE CREW ICS AUDIO IN HI	In
22	REMOTE CREW ICS AUDIO IN LO	In
23	TEL MIC AUDIO OUT HI	Out
24	PASS ICS KEY*	In
25	ON-SIDE NAV AUDIO IN LO	In
26	ON-SIDE COM MIC AUDIO OUT HI	Out
27	ON-SIDE COM MIC KEY*	Out
28	PILOT MIC AUDIO IN HI	In
29	PILOT MIC KEY* IN	In
30	PILOT MIC IN LO	In
31	PILOT ICS KEY*	In
32	CROSS-SIDE COM MIC AUDIO OUT HI	Out
33	CROSS-SIDE COM MIC KEY*	Out
34	CROSS-SIDE NAV AUDIO IN LO	In
35	ADF AUDIO IN HI	In
36	ADF AUDIO IN LO	In
37	MUSIC IN 1 LO	In

Connector P3471, continued		
Pin	**Pin Name**	**I/O**
38	UNSWITCHED AUDIO IN 3 HI	In
39	UNSWITCHED AUDIO IN LO	In
40	REMOTE PASS ICS AUDIO IN HI	In
41	REMOTE PASS ICS AUDIO IN LO	In
42	TEL AUDIO IN HI	In
43	TEL AUDIO IN LO	In
44	PASS 3 MIC AUDIO IN HI	In
45	PASS 3 MIC AUDIO IN LO	In
46	PASS 1 MIC AUDIO IN HI	In
47	PASS 1 MIC AUDIO IN LO	In
48	PASS HEADSET AUDIO OUT LO	Out
49	COPILOT MIC AUDIO IN HI	In
50	COPILOT MIC KEY* IN	In
51	COPILOT MIC IN LO	In
52	COPILOT ICS KEY*	In
53	RESERVED	--
54	ALTITUDE WARN AUDIO IN HI	In
55	ALTITUDE WARN AUDIO IN LO	In
56	MUSIC IN 2 LEFT	In
57	MUSIC IN 2 RIGHT	In
58	COM 3 AUDIO IN HI	In
59	COM 3 AUDIO LO	I/O
60	REMOTE CREW ICS OUT HI	Out
61	REMOTE CREW ICS OUT LO	Out
62	TEL MIC AUDIO OUT LO	Out
63	PASS 4 MIC AUDIO IN HI	In
64	PASS 4 MIC AUDIO IN LO	In
65	PASS 2 MIC AUDIO IN HI	In
66	PASS 2 MIC AUDIO IN LO	In
67	PASS HEADSET AUDIO OUT LEFT	Out
68	PASS HEADSET AUDIO OUT RIGHT	Out
69	COPILOT HEADSET AUDIO OUT LEFT	Out
70	COPILOT HEADSET AUDIO OUT RIGHT	Out
71	COPILOT HEADSET AUDIO OUT LO	Out
72	RESERVED	--
73	RESERVED	--
74	AUX AUDIO IN HI	In
75	AUX AUDIO IN LO	In
76	MUSIC IN 2 LO	In
77	COM 3 MIC AUDIO OUT HI	Out
78	COM 3 MIC KEY*	Out

* Indicates Active Low

A.2.2 P3472

View of J3472 connector from back of unit



Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	RESERVED	--
3	PROGRAM GROUND	--
4	RECORDER PLAY*	In
5	PROGRAM GROUND	--
6	RS-232 OUT 1	Out
7	RS-232 IN 1	In
8	ON-SIDE COM MIC DIGITAL AUDIO OUT	Out
9	ON-SIDE COM DIGITAL AUDIO IN	In
10	RESERVED	--
11	PROGRAM GROUND	--
12	RESERVED	--
13	RESERVED	--
14	POWER GROUND	--
15	RESERVED	--
16	POWER GROUND	--
17	COM SWAP*	In
18	PROGRAM GROUND	--
19	RESERVED	--
20	RESERVED	--
21	CONFIG MODULE POWER OUT	Out
22	RESERVED	--
23	PROGRAM GROUND	--
24	RECORDER OFF SELECT*	In
25	PROGRAM GROUND	--
26	RESERVED	--
27	GMA REMOTE POWER OFF	In
28	ON-SIDE NAV DIGITAL AUDIO IN	In
29	VOICE ALERT DIGITAL AUDIO IN	In
30	AIRCRAFT POWER 2	In
31	RESERVED	--
32	AIRCRAFT POWER 2	In
33	RESERVED	--
34	MIDDLE MARKER SENSE	Out
35	RESERVED	--
36	REVERSIONARY MODE 1	Out
37	REVERSIONARY MODE COMMON 1	Out

Connector P3472, continued		
Pin	**Pin Name**	**I/O**
38	RS-232 OUT 2	Out
39	RS-232 IN 2	In
40	CONFIG MODULE DATA	I/O
41	SPEAKER AUDIO OUT LO	Out
42	SPEAKER AUDIO OUT HI	Out
43	RESERVED	--
44	PROGRAM GROUND	--
45	RESERVED	--
46	PROGRAM GROUND	--
47	CROSS-SIDE COM MIC DIGITAL AUDIO OUT	Out
48	CROSS-SIDE COM DIGITAL AUDIO IN	In
49	SECONDARY DIGITAL AUDIO CLOCK OUT	Out
50	SECONDARY DIGITAL AUDIO CLOCK IN	In
51	14 V LIGHTING HI	In
52	28 V LIGHTING HI	In
53	AIRCRAFT POWER 1	In
54	RESERVED	--
55	AIRCRAFT POWER 1	In
56	REVERSIONARY MODE 2	Out
57	REVERSIONARY MODE COMMON 2	Out
58	RESERVED	--
59	MARKER ANTENNA LO	In
60	CONFIG MODULE CLOCK	Out
61	RESERVED	--
62	RESERVED	--
63	RESERVED	--
64	PA MUTE* OUT	Out
65	RESERVED	--
66	RESERVED	--
67	PROGRAM GROUND	--
68	CROSS-SIDE NAV DIGITAL AUDIO IN	In
69	POWER GROUND	--
70	RESERVED	--
71	POWER GROUND	--
72	RESERVED	--
73	RESERVED	--
74	AIRWAY/INNER MARKER EXT LAMP OUT	Out
75	MIDDLE MARKER EXT LAMP OUT	Out
76	OUTER MARKER EXT LAMP OUT	Out
77	RESERVED	--
78	MARKER ANTENNA HI	In

* Indicates Active Low

A.2.3 J3471 Connector Pin Assignments

A.2.3.1 Mic Audio Inputs and Mic Keys

Pin Name	Connector	Pin	I/O
PILOT MIC KEY* IN	P3471	29	In
COPILOT MIC KEY* IN	P3471	50	In
PILOT MIC AUDIO IN HI	P3471	28	In
PILOT MIC IN LO	P3471	30	--
COPILOT MIC AUDIO IN HI	P3471	49	In
COPILOT MIC IN LO	P3471	51	--
PASS 1 MIC AUDIO IN HI	P3471	46	In
PASS 1 MIC AUDIO IN LO	P3471	47	--
PASS 2 MIC AUDIO IN HI	P3471	65	In
PASS 2 MIC AUDIO IN LO	P3471	66	--
PASS 3 MIC AUDIO IN HI	P3471	44	In
PASS 3 MIC AUDIO IN LO	P3471	45	--
PASS 4 MIC AUDIO IN HI	P3471	63	In
PASS 4 MIC AUDIO IN LO	P3471	64	--

A.2.3.2 Remote ICS Audio and ICS Keys

Pin Name	Connector	Pin	I/O
PILOT MIC KEY* IN	P3471	31	In
COPILOT MIC KEY* IN	P3471	52	In
PASS 2 MIC AUDIO IN LO	P3471	24	In
PASS 3 MIC AUDIO IN HI	P3471	21	In
PASS 3 MIC AUDIO IN LO	P3471	22	--
PASS 4 MIC AUDIO IN HI	P3471	40	In
PASS 4 MIC AUDIO IN LO	P3471	41	--
REMOTE CREW ICS OUT HI	P3471	60	Out
REMOTE PASS ICS AUDIO OUT HI	P3471	5	Out
REMOTE CREW ICS OUT LO	P3471	61	--

A.2.3.3 COM Audio and Mic Keys

Pin Name	Connector	Pin	I/O
ON-SIDE COM MIC KEY*	P3471	27	Out
CROSS-SIDE COM MIC KEY*	P3471	33	Out
COM 3 MIC KEY*	P3471	78	Out
ON-SIDE COM AUDIO IN HI	P3471	7	In
ON-SIDE COM MIC AUDIO OUT HI	P3471	26	Out
ON-SIDE COM AUDIO LO	P3471	8	--
CROSS-SIDE COM AUDIO IN HI	P3471	12	In
CROSS-SIDE COM MIC AUDIO OUT HI	P3471	32	Out
CROSS-SIDE COM AUDIO LO	P3471	13	--
COM 3 AUDIO HI	P3471	58	In
COM 3 MIC AUDIO OUT HI	P3471	77	Out
COM 3 AUDIO LO	P3471	59	--

A.2.3.4 Nav Audio

Pin Name	Connector	Pin	I/O
ON-SIDE NAV AUDIO IN HI	P3471	6	In
ON-SIDE NAV AUDIO IN LO	P3471	25	--
CROSS-SIDE NAV AUDIO IN HI	P3471	14	In
CROSS-SIDE NAV AUDIO IN LO	P3471	34	--

A.2.3.5 Headset Outputs

Pin Name	Connector	Pin	I/O
PILOT HEADSET AUDIO OUT LEFT	P3471	9	Out
PILOT HEADSET AUDIO OUT RIGHT	P3471	10	Out
PILOT HEADSET AUDIO OUT LO	P3471	11	--
COPILOT HEADSET AUDIO OUT LEFT	P3471	69	Out
COPILOT HEADSET AUDIO OUT RIGHT	P3471	70	Out
COPILOT HEADSET AUDIO OUT LO	P3471	71	--
PASS HEADSET AUDIO OUT LEFT	P3471	67	Out
PASS HEADSET AUDIO OUT RIGHT	P3471	68	Out
PASS HEADSET AUDIO OUT LO	P3471	48	--

A.2.3.6 Music Inputs

Pin Name	Connector	Pin	I/O
MUSIC IN 1 LEFT	P3471	17	In
MUSIC IN 1 RIGHT	P3471	18	In
MUSIC IN 1 LO	P3471	37	--
MUSIC IN 2 LEFT	P3471	56	In
MUSIC IN 2 RIGHT	P3471	57	In
MUSIC IN 2 LO	P3471	76	--

A.2.3.7 Unswitched Audio Inputs

Pin Name	Connector	Pin	I/O
UNSWITCHED AUDIO IN 1 HI	P3471	19	In
UNSWITCHED AUDIO IN 2 HI	P3471	20	In
UNSWITCHED AUDIO IN 3 HI	P3471	38	In
UNSWITCHED AUDIO IN LO	P3471	39	--
ALTITUDE WARN AUDIO IN HI	P3471	54	In
ALTITUDE WARN AUDIO IN LO	P3471	55	--

A.2.3.8 Telephone I/O

Pin Name	Connector	Pin	I/O
TEL RINGER AUDIO IN HI	P3471	3	In
TEL RINGER AUDIO IN LO	P3471	4	In
TEL MIC AUDIO OUT HI	P3471	23	Out
TEL MIC AUDIO OUT LO	P3471	62	--
TEL AUDIO IN HI	P3471	42	In
TEL AUDIO IN LO	P3471	43	--

A.2.3.9 AUX, DME, and ADF Audio

Pin Name	Connector	Pin	I/O
AUX AUDIO IN HI	P3471	74	In
AUX AUDIO IN LO	P3471	75	--
DME AUDIO IN HI	P3471	15	In
DME AUDIO IN LO	P3471	16	--
ADF AUDIO IN HI	P3471	35	In
ADF AUDIO IN LO	P3471	36	--

A.2.3.10 Failsafe Audio

Pin Name	Connector	Pin	I/O
FAIL SAFE WARN AUDIO IN	P3471	1	In

A.2.4 J3472 Connector Pin Assignments

A.2.4.1 Aircraft Power and Lighting

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P3472	53	In
AIRCRAFT POWER 1	P3472	55	In
AIRCRAFT POWER 2	P3472	30	In
AIRCRAFT POWER 2	P3472	32	In
POWER GROUND	P3472	69	--
POWER GROUND	P3472	71	--
POWER GROUND	P3472	14	--
POWER GROUND	P3472	16	--
GMA REMOTE POWER OFF	P3472	27	In

The power-input pins accept 14/28 VDC. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

Pins 53 and 55 of J3472 are internally connected to form AIRCRAFT POWER 1. Pins 30 and 32 of J3472 are internally connected to form AIRCRAFT POWER 2. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

A.2.4.2 Lighting Bus

Pin Name	Connector	Pin	I/O
14 V LIGHTING HI	P3472	51	In
28 V LIGHTING HI	P3472	52	In

The GMA 1347 can be configured to track a 28 VDC or 14 VDC lighting bus using these inputs. The GMA 1347 can also automatically adjust for ambient lighting conditions based on photocell input on the PFD/MFD by digital means.

A.2.4.3 RS-232 Serial Input/Output

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	P3472	6	Out
RS-232 IN 1	P3472	7	In
RS-232 OUT 2	P3472	38	Out
RS-232 IN 2	P3472	39	In

The RS-232 outputs conform to EIA/TIA-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load.

A.2.4.4 Marker Beacon Functions

Pin Name	Connector	Pin	I/O
MIDDLE MARKER SENSE	P3472	34	Out
AIRWAY/INNER MARKER EXT LAMP OUT	P3472	74	Out
MIDDLE MARKER EXT LAMP OUT	P3472	75	Out
OUTER MARKER EXT LAMP OUT	P3472	76	Out
MARKER ANTENNA HI	P3472	78	In
MARKER ANTENNA LO	P3472	59	--

Marker Beacon connections are listed in the following table. The antenna input is connected to pins 78 (HI or Center Conductor) and 59 (LO or Shield).

A.2.4.5 External Configuration Module

Pin Name	Connector	Pin	I/O
Configuration Module Ground	P3472	1	--
Configuration Module Power	P3472	21	In
Configuration Module Data	P3472	40	In/Out
Configuration Module Clock	P3472	60	In/Out

The configuration module contains an I2C temp sensor and EEPROM. The configuration module, if required, is located in the connector backshell. Most installations will not require a configuration module in the 1347 backshell, as the data will be stored with the GDU 1040.

A.2.4.6 Reversionary Mode

Pin Name	Connector	Pin	I/O
REVERSIONARY MODE 1	P3472	36	Out
REVERSIONARY MODE COMMON 1	P3472	37	--
REVERSIONARY MODE 2	P3472	56	Out
REVERSIONARY MODE COMMON 2	P3472	57	--

The reversionary mode pins are used in installations having more than one GDU 1040 that have a GMA 1347. The GMA 1347 contains a display backup button. This button is used to switch the PFD and MFD display data.

A.2.4.7 Speaker

Pin Name	Connector	Pin	I/O
SPEAKER AUDIO OUT LO	P3472	41	--
SPEAKER AUDIO OUT HI	P3472	42	Out

The speaker output is capable of driving up to 10 Watts into a 4 Ω or 8 Ω speaker.

A.2.4.8 Digital Audio

Pin Name	Connector	Pin	I/O
ON-SIDE COM MIC DIGITAL AUDIO OUT	P3472	8	Out
ON-SIDE COM DIGITAL AUDIO IN	P3472	9	In
CROSS-SIDE COM MIC DIGITAL AUDIO OUT	P3472	47	Out
CROSS-SIDE COM DIGITAL AUDIO IN	P3472	48	In
ON-SIDE NAV DIGITAL AUDIO IN	P3472	28	In
CROSS-SIDE NAV DIGITAL AUDIO IN	P3472	68	In
CROSS-SIDE DIGITAL AUDIO CLOCK OUT	P3472	49	Out
CROSS-SIDE DIGITAL AUDIO CLOCK IN	P3472	50	In
VOICE ALERT DIGITAL AUDIO IN	P3472	29	In
COM SWAP*	P3472	17	In
PROGRAM GROUND	P3472	18	--
RECORDER PLAY*	P3472	4	In
PROGRAM GROUND	P3472	5	--
RECORDER OFF SELECT*	P3472	24	In
PROGRAM GROUND	P3472	25	--

A.2.4.9 PA MUTE

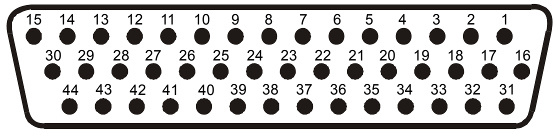
Pin Name	Connector	Pin	I/O
PA MUTE* OUT	P3472	64	Out

PA MUTE is an output that when pulled low is active. It is used to trigger the mute function on an external PA system.

A.3 GIA 63W

A.3.1 P601 (COM)

View of J601 connector from back of unit



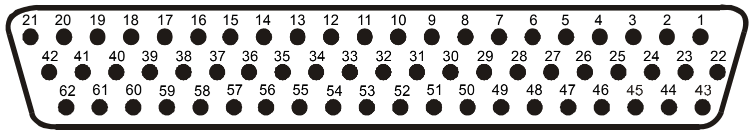
Pin	Pin Name	I/O
1	RESERVED (UNSQUELCHED AUDIO TEST)	--
2	RESERVED	--
3	RESERVED	--
4	COM MIC KEY*	In
5	INTERCOM MIC IN HI	In
6	INTERCOM MIC IN LO (GROUND)	--
7	COM MIC AUDIO IN HI	In
8	COM MIC AUDIO IN LO (GROUND)	--
9	COM 500Ω AUDIO OUT HI	Out
10	COM 500Ω AUDIO OUT LO (GROUND)	--
11	TRANSMIT INTERLOCK*	In
12	COM REMOTE TRANSFER*	In
13	COM DIGITAL AUDIO OUT	Out
14	COM MIC DIGITAL AUDIO IN	In
15	SIGNAL GROUND	--
16	COM REMOTE POWER OFF	In
17	AIRCRAFT POWER 1	In
18	SPARE	--
19	AIRCRAFT POWER 1	In
20	SPARE	--
21	AIRCRAFT POWER 1	In
22	SPARE	--
23	AIRCRAFT POWER 2	In
24	SPARE	--
25	AIRCRAFT POWER 2	In
26	SPARE	--
27	AIRCRAFT POWER 2	In
28	RESERVED	--
29	RESERVED	--
30	POWER GROUND	--
31	POWER GROUND	--
32	RESERVED	--
33	RESERVED	--
34	RESERVED	--

Connector P601, continued		
Pin	**Pin Name**	**I/O**
35	RESERVED	--
36	RESERVED	--
37	RESERVED	--
38	RESERVED	--
39	RESERVED	--
40	RESERVED	--
41	RESERVED	--
42	RESERVED	--
43	POWER GROUND	--
44	POWER GROUND	--

* Indicates Active Low

A.3.2 P602 (VOR/ILS)

View of J602 connector from back of unit



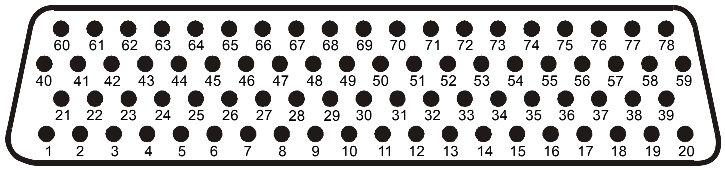
Pin	Pin Name	I/O
1	VOR/LOC +TO	Out
2	VOR/LOC +FROM (VOR/LOC COMMON)	--
3	VOR/LOC +FLAG	Out
4	VOR/LOC -FLAG (VOR/LOC COMMON)	--
5	VOR/LOC +LEFT	Out
6	VOR/LOC +RIGHT (VOR/LOC COMMON)	--
7	RESERVED (VOR/LOC IF AGC)	--
8	VOR/LOC COMPOSITE OUT	Out
9	VOR OBS ROTOR C	Out
10	VOR OBS ROTOR H (GROUND)	--
11	VOR OBS STATOR E (VOR/LOC COMMON)	--
12	VOR OBS STATOR F	In
13	VOR OBS STATOR D	In
14	VOR OBS STATOR G (VOR/LOC COMMON)	--
15	VOR/LOC SUPERFLAG	Out
16	VOR/LOC 500Ω AUDIO OUT HI	Out
17	VOR/LOC 500Ω AUDIO OUT LO	--
18	KING SERIAL DME CLOCK	Out
19	KING SERIAL DME DATA	Out
20	KING SERIAL RNAV REQUEST	In
21	KING SERIAL RNAV* MODE	In
22	SIGNAL GROUND	--
23	VOR/ILS ARINC 429 OUT B	Out
24	VOR/ILS ARINC 429 OUT A	Out
25	VOR OBI CLOCK	Out
26	VOR OBI SYNC	Out
27	VOR OBI DATA	Out
28	VOR/ILS REMOTE TRANSFER*	In
29	ILS ENERGIZE*	Out
30	RESERVED	--
31	RESERVED	--
32	GLIDESLOPE +FLAG	Out
33	PARALLEL DME 1 MHZ-D	Out
34	GLIDESLOPE +UP	Out
35	VOR/ILS ARINC 429 IN B	In
36	VOR/ILS ARINC 429 IN A	In
37	PARALLEL DME 100 KHZ-A	Out

Connector P602, continued		
Pin	**Pin Name**	**I/O**
38	GLIDESLOPE SUPERFLAG	Out
39	PARALLEL DME 100 KHZ-B	Out
40	PARALLEL DME 100 KHZ-C	Out
41	DME COMMON	In
42	PARALLEL DME 100 KHZ-D	Out
43	PARALLEL DME 50 KHZ	Out
44	SPARE	--
45	PARALLEL DME 1 MHZ-A	Out
46	PARALLEL DME 1 MHZ-B	Out
47	PARALLEL DME 1 MHZ-C	Out
48	RESERVED	--
49	SIGNAL GROUND	--
50	RESERVED	--
51	SPARE	--
52	SPARE	--
53	GLIDESLOPE –FLAG (GLIDESLOPE COMMON)	--
54	PARALLEL DME 100KHZ-E	Out
55	GLIDESLOPE +DOWN (GLIDESLOPE COMMON)	--
56	PARALLEL DME 1MHZ-E	Out
57	RESERVED	--
58	SPARE	--
59	VOR/LOC DIGITAL AUDIO OUT	Out
60	SIGNAL GROUND	--
61	POWER GROUND	--
62	POWER GROUND	--

* Indicates Active Low

A.3.3 P603 (Main Serial)

View of J603 connector from back of unit



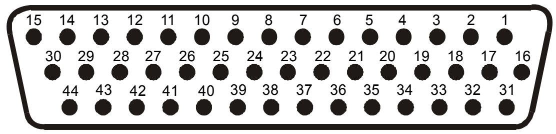
Pin	Pin Name	I/O
1	RESERVED	--
2	ETHERNET OUT A	Out
3	ETHERNET OUT B	Out
4	RS-485 4 A (SERVO)	I/O
5	RS-485 4 A (SERVO)	I/O
6	RS-485 4 B (SERVO)	I/O
7	RS-485 4 B (SERVO)	I/O
8	MAIN ARINC 429 IN 3 A	In
9	MAIN ARINC 429 IN 3 B	In
10	MAIN ARINC 429 IN 4 A	In
11	MAIN ARINC 429 IN 4 B	In
12	MAIN ARINC 429 IN 5 A	In
13	MAIN ARINC 429 IN 5 B	In
14	MAIN ARINC 429 IN 6 A	In
15	MAIN ARINC 429 IN 6 B	In
16	MAIN ARINC 429 IN 7 A	In
17	MAIN ARINC 429 IN 7 B	In
18	MAIN ARINC 429 IN 8 A	In
19	MAIN ARINC 429 IN 8 B	In
20	CAN BUS 1 HI	I/O
21	RESERVED	--
22	CAN BUS 1 LO	I/O
23	RS-485 1 A	I/O
24	RS-485 1 B	I/O
25	RS-485 2 A	I/O
26	RS-485 2 B	I/O
27	RS-485 3 A/RS-422 IN A	I/O
28	RS-485 3 B/RS-422 IN B	I/O
29	MAIN ARINC 429 IN 1 A	In
30	CAN BUS 2 LO	I/O
31	MAIN ARINC 429 IN 1 B	In
32	CAN BUS 2 HI	I/O
33	MAIN ARINC 429 IN 2 A	In
34	CAN BUS 1 TERMINATION	--
35	MAIN ARINC 429 IN 2 B	In
36	RS-485 5 A/RS-422 OUT A	I/O

Connector P603, continued		
Pin	**Pin Name**	**I/O**
37	RS-485 5 B/RS-422 OUT B	I/O
38	RESERVED	--
39	CAN BUS 2 TERMINATION	--
40	RESERVED	--
41	MAIN RS-232 IN 1	In
42	SIGNAL GROUND	--
43	MAIN RS-232 OUT 1	Out
44	MAIN RS-232 IN 2	In
45	SIGNAL GROUND	--
46	MAIN RS-232 OUT 2	Out
47	MAIN RS-232 IN 3	In
48	SIGNAL GROUND	--
49	MAIN RS-232 OUT 3	Out
50	MAIN RS-232 IN 4	In
51	SIGNAL GROUND	--
52	MAIN RS-232 OUT 4	Out
53	MAIN RS-232 IN 5	In
54	SIGNAL GROUND	--
55	MAIN RS-232 OUT 5	Out
56	MAIN RS-232 IN 6	In
57	SIGNAL GROUND	--
58	MAIN RS-232 OUT 6	Out
59	MAIN RS-232 IN 7	In
60	RESERVED	--
61	SIGNAL GROUND	--
62	MAIN RS-232 OUT 7	Out
63	MAIN RS-232 IN 8	In
64	SIGNAL GROUND	--
65	MAIN RS-232 OUT 8	Out
66	RESERVED	--
67	GPS PPS OUT	Out
68	RESERVED	--
69	VOICE ALERT DIGITAL AUDIO OUT	Out
70	MAIN ARINC 429 OUT 1 B	Out
71	MAIN ARINC 429 OUT 1 A	Out
72	MAIN ARINC 429 OUT 2 B	Out
73	MAIN ARINC 429 OUT 2 A	Out
74	MAIN ARINC 429 OUT 3 B	Out
75	MAIN ARINC 429 OUT 3 A	Out
76	ETHERNET IN A	In
77	ETHERNET IN B	In
78	RESERVED	--

* Indicates Active Low

A.3.4 P604 (Main Discrete)

View of J604 connector from back of unit



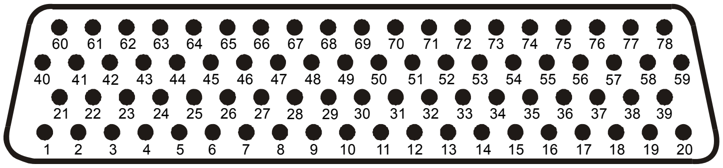
Pin	Pin Name	I/O
1	ANNUNCIATE* 22	Out
2	VOICE ALERT 500Ω AUDIO OUT HI	Out
3	VOICE ALERT 500Ω AUDIO OUT LO (GROUND)	--
4	DISCRETE IN 13	In
5	DISCRETE IN 14	In
6	ANNUNCIATE* 1	Out
7	DISCRETE IN* 1	In
8	DISCRETE IN* 2	In
9	DISCRETE IN* 3	In
10	DISCRETE IN 15	In
11	AUTOPILOT DISCONNECT IN	In
12	DISCRETE IN* 4	In
13	DISCRETE IN* 5	In
14	DISCRETE IN* 6	In
15	DISCRETE IN 16	In
16	DISCRETE IN 17	In
17	DISCRETE IN* 7	In
18	DISCRETE IN* 8	In
19	DISCRETE IN* 9	In
20	DISCRETE IN* 10	In
21	DISCRETE IN* 11	In
22	GIA SYSTEM ID PROGRAM* 1	In
23	GIA SYSTEM ID PROGRAM* 2	In
24	DISCRETE IN* 12	In
25	ANNUNCIATE* 2	Out
26	ANNUNCIATE* 3	Out
27	ANNUNCIATE* 4	Out
28	ANNUNCIATE* 5	Out
29	ANNUNCIATE* 6	Out
30	ANNUNCIATE* 7	Out
31	ANNUNCIATE* 8	Out
32	ANNUNCIATE* 9	Out
33	ANNUNCIATE* 10	Out
34	ANNUNCIATE* 11	Out
35	ANNUNCIATE* 12	Out
36	ANNUNCIATE* 13	Out
37	ANNUNCIATE* 14	Out
38	ANNUNCIATE* 15	Out
39	ANNUNCIATE* 16	Out

Connector P604, continued		
Pin	**Pin Name**	**I/O**
40	ANNUNCIATE* 17	Out
41	ANNUNCIATE* 18	Out
42	ANNUNCIATE* 19	Out
43	ANNUNCIATE* 20	Out
44	ANNUNCIATE* 21	Out

* Indicates Active Low

A.3.5 P605 (I/O 1)

View of J605 connector from back of unit



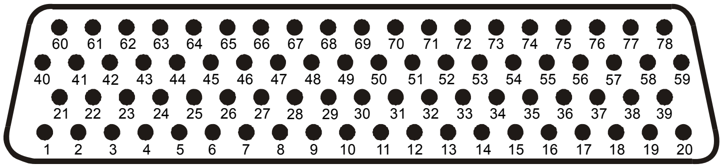
Pin	Pin Name	I/O
1	RADAR ALTIMETER DC HI	In
2	RADAR ALTIMETER DC LO	In
3	DISCRETE IN 18A	In
4	SPARE	--
5	SPARE	--
6	SPARE	--
7	SPARE	--
8	FLIGHT DIRECTOR PITCH +UP	In
9	FLIGHT DIRECTOR PITCH +DOWN	In
10	FLIGHT DIRECTOR ROLL +RIGHT	In
11	FLIGHT DIRECTOR ROLL +LEFT	In
12	DISCRETE IN 19A	In
13	POTENTIOMETER SIGNAL IN	In
14	POTENTIOMETER REF IN HI	In
15	POTENTIOMETER REF IN LO	In
16	DISCRETE IN 20A	In
17	MAIN LATERAL DEVIATION +LEFT	Out
18	MAIN LATERAL DEVIATION +RIGHT (MAIN COMMON)	Out
19	MAIN LATERAL +FLAG	Out
20	MAIN LATERAL –FLAG (MAIN COMMON)	Out
21	SPARE	--
22	SPARE	--
23	MAIN VERTICAL DEVIATION +UP	Out
24	MAIN VERTICAL DEVIATION +DOWN (MAIN COMMON)	Out
25	MAIN VERTICAL +FLAG	Out
26	MAIN VERTICAL –FLAG (MAIN COMMON)	Out
27	SPARE	--
28	SPARE	--
29	AIRCRAFT POWER 1	In
30	POTENTIOMETER SIGNAL OUT	Out
31	AIRCRAFT POWER 1	In
32	POTENTIOMETER REF OUT HI	Out
33	AIRCRAFT POWER 2	In
34	POTENTIOMETER REF OUT LO (GROUND)	Out
35	AIRCRAFT POWER 2	In
36	GIA REMOTE POWER OFF	In

Connector P605, continued		
Pin	**Pin Name**	**I/O**
37	DISCRETE IN* 1A	In
38	DISCRETE IN* 2A	In
39	DISCRETE IN* 3A	In
40	DISCRETE IN* 4A	In
41	DISCRETE IN* 5A	In
42	DISCRETE IN* 6A	In
43	DISCRETE IN* 7A	In
44	DISCRETE IN* 8A	In
45	DISCRETE IN* 9A	In
46	DISCRETE IN* 10A	In
47	DISCRETE OUT* 1A	Out
48	SIGNAL GROUND	--
49	DISCRETE IN* 11A	In
50	DISCRETE IN 21A	In
51	DISCRETE IN 22A	In
52	DISCRETE IN* 12A	In
53	DISCRETE IN* 13A	In
54	DISCRETE IN* 14A	In
55	DISCRETE IN* 15A	In
56	OUTER MARKER LAMP IN	In
57	MIDDLE MARKER LAMP IN	In
58	AIRWAY/INNER MARKER LAMP IN	In
59	DISCRETE IN* 16A	In
60	DISCRETE IN 23A	In
61	SIGNAL GROUND	--
62	MAIN LATERAL SUPERFLAG	Out
63	MAIN VERTICAL SUPERFLAG	Out
64	SUPERFLAG 4A	Out
65	SPARE	--
66	SPARE	--
67	SUPERFLAG 1A	Out
68	DISCRETE OUT* 2A	Out
69	DISCRETE OUT* 3A	Out
70	DISCRETE OUT* 4A	Out
71	ANNUNCIATE* 1A	Out
72	ANNUNCIATE* 2A	Out
73	DISCRETE IN* 17A	In
74	DISCRETE IN 24A	In
75	SUPERFLAG 2A	Out
76	POWER GROUND	--
77	SUPERFLAG 3A	Out
78	POWER GROUND	--

* Indicates Active Low

A.3.6 P606 (I/O 2)

View of J606 connector from back of unit



Pin	Pin Name	I/O
1	26 VAC VERTICAL GYRO REF HI	In
2	26 VAC VERTICAL GYRO REF LO	In
3	26 VAC ADF REF HI	In
4	26 VAC ADF REF LO	In
5	26 VAC AFCS REF HI	In
6	26 VAC AFCS REF LO	In
7	DIRECTIONAL GYRO MOTOR A	In
8	DIRECTIONAL GYRO MOTOR B	In
9	SIGNAL GROUND	--
10	ADF X/COS	In
11	ADF Y/SIN	In
12	ADF Z (GROUND)	In
13	SIGNAL GROUND	--
14	HEADING X	In
15	HEADING Y	In
16	HEADING Z (GROUND)	In
17	SIGNAL GROUND	--
18	PITCH ATTITUDE X	In
19	PITCH ATTITUDE Y	In
20	PITCH ATTITUDE Z (GROUND)	In
21	ROLL ATTITUDE X	In
22	ROLL ATTITUDE Y	In
23	ROLL ATTITUDE Z (GROUND)	In
24	SIGNAL GROUND	--
25	SPARE	--
26	SPARE	--
27	SPARE	--
28	SPARE	--
29	RESERVED	--
30	SIGNAL GROUND	--
31	RESERVED	--
32	ADF DC REF IN	In
33	RESERVED	--
34	ANALOG ROLL STEERING HI	Out
35	RESERVED	--
36	ANALOG ROLL STEERING LO (GROUND)	Out

Connector P606, continued		
Pin	**Pin Name**	**I/O**
37	HEADING BOOTSTRAP OUT X	Out
38	HEADING BOOTSTRAP OUT Y	Out
39	HEADING BOOTSTRAP OUT Z (GROUND)	Out
40	AC ROLL ATTITUDE OUT HI	Out
41	AC ROLL ATTITUDE OUT LO (GROUND)	Out
42	AC PITCH ATTITUDE OUT HI	Out
43	AC PITCH ATTITUDE OUT LO (GROUND)	Out
44	YAW RATE +RIGHT	Out
45	YAW RATE +LEFT (GROUND)	Out
46	HEADING DATUM HI	Out
47	HEADING DATUM LO (GROUND)	Out
48	COURSE DATUM HI	Out
49	COURSE DATUM LO (GROUND)	Out
50	SIGNAL GROUND	--
51	26 VAC DIRECTIONAL GYRO REF HI	In
52	26 VAC DIRECTIONAL GYRO REF LO	In
53	REMOTE ANNUNCIATE CLOCK	In
54	REMOTE ANNUNCIATE DATA	In
55	REMOTE ANNUNCIATE SYNC	In
56	MAIN OBI CLOCK	Out
57	MAIN OBI DATA	Out
58	MAIN OBI SYNC	Out
59	MAIN KING SERIAL DME DATA	I/O
60	MAIN KING SERIAL DME CLOCK	I/O
61	MAIN KING SERIAL DME HOLD* OUT	Out
62	MAIN KING SERIAL DME REQUEST	I/O
63	MAIN KING SERIAL DME ON* OUT	Out
64	MAIN KING SERIAL RNAV REQUEST	In
65	RESERVED	--
66	RESERVED	--
67	DISCRETE OUT* 1B	Out
68	DISCRETE OUT* 2B	Out
69	DISCRETE OUT* 3B	Out
70	DISCRETE OUT* 4B	Out
71	DISCRETE OUT* 5B	Out
72	DISCRETE OUT* 6B	Out
73	DISCRETE OUT* 7B	Out
74	DISCRETE OUT* 8B	Out
75	DISCRETE OUT* 9B	Out
76	RESERVED	--
77	DISCRETE OUT* 10B	Out
78	RESERVED	--

* Indicates Active Low

A.3.7 Power and Antennas

A.3.7.1 Aircraft Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P601	17	In
AIRCRAFT POWER 1	P601	19	In
AIRCRAFT POWER 1	P601	21	In
AIRCRAFT POWER 2	P601	23	In
AIRCRAFT POWER 2	P601	25	In
AIRCRAFT POWER 2	P601	27	In
AIRCRAFT POWER 1	P605	29	In
AIRCRAFT POWER 1	P605	31	In
AIRCRAFT POWER 2	P605	33	In
AIRCRAFT POWER 2	P605	35	In
POWER GROUND	P601	30	--
POWER GROUND	P601	31	--
POWER GROUND	P601	43	--
POWER GROUND	P601	44	--
POWER GROUND	P602	61	--
POWER GROUND	P602	62	--
POWER GROUND	P605	76	--
POWER GROUND	P605	78	--

Pins 17, 19, and 21 of P601 are internally connected to form AIRCRAFT POWER 1. Pins 23, 25, and 27 of P601 are internally connected to form AIRCRAFT POWER 2. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode ORed" to provide power redundancy. The same applies to pins 29/31 and pins 33/35 of P605. Use of more than one AIRCRAFT POWER and POWER GROUND pins is required for installations where current through a single connector pin will exceed 5A.

A.3.7.2 Remote On/Off

Pin Name	Connector	Pin	I/O
GIA REMOTE POWER OFF	P605	36	In
COM REMOTE POWER OFF	P601	16	In

INACTIVE: Vin ≤ 3.5VDC
ACTIVE: 10 ≤ Vin ≤ 33VDC with ≥ 75 uA source current
Source current is internally limited to 1.5 mA max for a 10-33VDC input

A.3.7.3 Antennas

Pin Name	Connector	I/O
GPS ANTENNA	P611	In
COM ANTENNA	P612	I/O
VOR/LOC ANTENNA	P613	In
GLIDESLOPE ANTENNA	P614	In

A.3.8 GIA System ID Program

The GIA 63W utilizes a hard strapping method to assign a unit ID to a unit. Unit ID's identify a unit as a #1, #2, #3, or #4 GIA.

GIA SYSTEM ID PROGRAM 1 (P604, Pin 22)	GIA SYSTEM ID PROGRAM 2 (P604, Pin 23)	UNIT NUMBER
Open	Open	#1
Ground	Open	#2
Open	Ground	#3
Ground	Ground	#4

A.3.9 Serial Data

A.3.9.1 RS-232

Pin Name	Connector	Pin	I/O
MAIN RS-232 IN 1	P603	41	In
MAIN RS-232 OUT 1	P603	43	Out
MAIN RS-232 IN 2	P603	44	In
MAIN RS-232 OUT 2	P603	46	Out
MAIN RS-232 IN 3	P603	47	In
MAIN RS-232 OUT 3	P603	49	Out
MAIN RS-232 IN 4	P603	50	In
MAIN RS-232 OUT 4	P603	52	Out
MAIN RS-232 IN 5	P603	53	In
MAIN RS-232 OUT 5	P603	55	Out
MAIN RS-232 IN 6	P603	56	In
MAIN RS-232 OUT 6	P603	58	Out
MAIN RS-232 IN 7	P603	59	In
MAIN RS-232 OUT 7	P603	62	Out
MAIN RS-232 IN 8	P603	63	In
MAIN RS-232 OUT 8	P603	65	Out

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ± 5V when driving a standard RS-232 load.

A.3.9.2 RS-485/422

Pin Name	Connector	Pin	I/O
RS-485/422 IN A	P603	27	In
RS-485/422 IN B	P603	28	In
RS-485/422 OUT A	P603	36	Out
RS-485/422 OUT B	P603	37	Out
GEA RS-485 1 A	P603	23	I/O
GEA RS-485 1 B	P603	24	I/O
GEA RS-485 2 A	P603	25	I/O
GEA RS-485 2 B	P603	26	I/O
SERVO RS-485 A	P603	4	I/O
SERVO RS-485 A	P603	5	I/O
SERVO RS-485 B	P603	6	I/O
SERVO RS-485 B	P603	7	I/O

The GIA 63W contains a total of 5 channels of RS-485 serial data communications. Two of these channels can also be configured as RS-422 mode channels to allow for system flexibility. These data busses conform to EIA standard RS-485, or RS-422, depending on which mode they are currently operating in.

A.3.9.3 ARINC 429

Pin Name	Connector	Pin	I/O
MAIN ARINC 429 IN 1 A	P603	29	In
MAIN ARINC 429 IN 1 B	P603	31	In
MAIN ARINC 429 IN 2 A	P603	33	In
MAIN ARINC 429 IN 2 B	P603	35	In
MAIN ARINC 429 IN 3 A	P603	8	In
MAIN ARINC 429 IN 3 B	P603	9	In
MAIN ARINC 429 IN 4 A	P603	10	In
MAIN ARINC 429 IN 4 B	P603	11	In
MAIN ARINC 429 IN 5 A	P603	12	In
MAIN ARINC 429 IN 5 B	P603	13	In
MAIN ARINC 429 IN 6 A	P603	14	In
MAIN ARINC 429 IN 6 B	P603	15	In
MAIN ARINC 429 IN 7 A	P603	16	In
MAIN ARINC 429 IN 7 B	P603	17	In
MAIN ARINC 429 IN 8 A	P603	18	In
MAIN ARINC 429 IN 8 B	P603	19	In
MAIN ARINC 429 OUT 1 B	P603	70	Out
MAIN ARINC 429 OUT 1 A	P603	71	Out
MAIN ARINC 429 OUT 2 B	P603	72	Out
MAIN ARINC 429 OUT 2 A	P603	73	Out
MAIN ARINC 429 OUT 3 B	P603	74	Out
MAIN ARINC 429 OUT 3 A	P603	75	Out
VOR/ILS ARINC 429 OUT B	P602	23	Out
VOR/ILS ARINC 429 OUT A	P602	24	Out
VOR/ILS ARINC 429 IN B	P602	35	In
VOR/ILS ARINC 429 IN A	P602	36	In

The MAIN and VOR/ILS ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers.

A.3.9.4 Can Bus

Pin Name	Connector	Pin	I/O
CAN BUS 1 HI	P603	20	I/O
CAN BUS 1 LO	P603	22	I/O
CAN BUS 1 TERMINATION	P603	34	--
CAN BUS 2 HI	P603	32	I/O
CAN BUS 2 LO	P603	30	I/O
CAN BUS 2 TERMINATION	P603	39	--

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. CAN BUS TERMINATION should be connected to CAN BUS LO if GIA is located at the end of the bus.

A.3.9.5 Ethernet HSDB

Pin Name	Connector	Pin	I/O
ETHERNET OUT A	P603	2	Out
ETHERNET OUT B	P603	3	Out
ETHERNET IN A	P603	76	In
ETHERNET IN B	P603	77	In

This Ethernet based high speed data bus (HSDB) provides communications capability with the GDU. HSDB meets the hardware aspects of IEEE standard 802.3 for 10 base T Ethernet communications.

A.3.10 Discrete I/O

Pin Name	Connector	Pin	I/O
DISCRETE IN	P604	4, 5, 10, 15, 16	In
	P605	3, 12, 16, 50-51, 60, 74	In
DISCRETE IN*	P604	7-9, 12-14, 17-21, 24	In
	P605	37-46, 49, 52-55, 59, 73	In
DISCRETE OUT*	P605	47, 68-70	Out
	P606	67-75, 77	Out
ANNUNCIATE	P605	71, 72	Out
ANNUNCIATE	P604	6, 25-44	Out

DISCRETE IN* pins:
INACTIVE: 10 ≤ Vin ≤ 33VDC or Rin ≥ 100kΩ
ACTIVE: Vin ≤ 1.9VDC with ≥ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

DISCRETE IN pins:
INACTIVE: Vin ≤ 3.5VDC
ACTIVE: 10 ≤ Vin ≤ 33VDC with ≥ 75 uA source current
Source current is internally limited to 1.5 mA max for a 10-33VDC input

DISCRETE OUT pins:
INACTIVE: Floating (can be pulled up to externally sourced Vout in the range 0 ≤ Vout ≤ 33VDC)
Leakage current in the INACTIVE state is typically ≤ 10 uA to ground
ACTIVE: Vout ≤ 0.5VDC with ≤ 20 mA sink current
Sink current must be externally limited to 20 mA max

ANNUNCIATE pins:
INACTIVE: Floating (can be pulled up to externally sourced Vout in the range 0 ≤ Vout ≤ 33VDC)
Leakage current in the INACTIVE state is typically ≤ 250 uA to ground
ACTIVE: Vout ≤ 0.5VDC with ≤ 500 mA sink current
Sink current must be externally limited to 500 mA max

A.3.11 COM/VOR/ILS/Digital Audio

A.3.11.1 COM/VOR/ILS/Digital Audio Function and Emergency Mode

Activation of COM MIC KEY enables COM MIC AUDIO and causes the transceiver to transmit.

500Ω COM AUDIO and 500Ω VOR/ILS AUDIO are 100 mW audio outputs that are intended to drive a headset or an audio panel. Digital audio outputs from the GMA 1347 are 3.87 Vrms into 150 ohms.

Momentarily depressing the COM REMOTE TRANSFER button toggles the active and standby COM frequencies. Momentarily depressing the VLOC REMOTE TRANSFER button toggles the active and standby VLOC frequencies.

The COM REMOTE TRANSFER input may be used for EMERGENCY operation of the COM transmitter. If the remote transfer switch is depressed for two seconds, the active COM frequency changes to 121.50 MHz. Once the emergency frequency is activated through COM REMOTE TRANSFER, the GIA 63W ignores inputs from the front panel controls for COM selections only. The pilot may exit this independent mode—restoring COM selection control to the front panel knobs and buttons—by momentarily depressing the COM REMOTE TRANSFER switch.

When TRANSMIT INTERLOCK is active, the GIA 63W COM receiver sensitivity is decreased. This input is intended to reduce interference from other transmitters in the aircraft. The TRANSMIT INTERLOCK input should be connected to the PTT input of other transmitters in the aircraft. If connected to multiple PTT inputs, these connections must include diode isolation or multiple radios transmit simultaneously.

For digital audio installations, all of this information is transferred in the digital audio data stream.

A.3.12 Com/VOR/ILS/DIGITAL Audio Electrical Characteristics

A.3.12.1 Com Mic Key

Pin Name	Connector	Pin	I/O
COM MIC KEY	P601	4	In

INACTIVE: $10 \lesssim Vin \lesssim 33VDC$ or $Rin \geq 100k\Omega$
ACTIVE: $Vin \leq 1.9VDC$ with $\gtrsim 75$ uA sink current, or $Rin \leq 375\Omega$
Sink current is internally limited to 200 uA max for a grounded input

A.3.12.2 Com Mic Audio, Intercom Mic Audio

Pin Name	Connector	Pin	I/O
INTERCOM MIC IN HI	P601	5	In
INTERCOM MIC IN LO (GROUND)	P601	6	--
COM MIC AUDIO IN HI	P601	7	In
COM MIC AUDIO IN LO (GROUND)	P601	8	--

COM MIC AUDIO and INTERCOM MIC each have a 520 Ω AC input impedance and supply the microphone with a 9 V bias through 620 Ω.

COM MIC AUDIO is set in the factory for 275 mV_{RMS} to modulate the transmitter at 80% nominally. The microphone gain adjustment is accessible through the top cover.

When a 125 mV_{RMS} signal at 1000 Hz is applied to the INTERCOM MIC input, the level on the COM AUDIO output is not less than 7.07 V_{RMS}.

A.3.12.3 Com/VOR/ILS Audio

Pin Name	Connector	Pin	I/O
COM 500Ω AUDIO OUT HI	P601	9	Out
COM 500Ω AUDIO OUT LO (GROUND)	P601	10	--
VOR/LOC 500Ω AUDIO OUT HI	P602	16	Out
VOR/LOC 500Ω AUDIO OUT LO (GROUND)	P602	17	--
VOICE ALERT 500Ω AUDIO OUT HI	P604	2	Out
VOICE ALERT 500Ω AUDIO OUT LO (GROUND)	P604	3	--

500Ω COM AUDIO and 500Ω VOR/ILS AUDIO each supply 100 Mw into a 500 Ω load. These are balanced outputs and the LO output must be connected.

500Ω COM AUDIO is the summation of the COM receiver audio, COM sidetone audio, and INTERCOM MIC audio.

A.3.12.4 Digital Audio

Pin Name	Connector	Pin	I/O
COM DIGITAL AUDIO OUT	P601	13	Out
COM MIC DIGITAL AUDIO IN	P601	14	In
VOICE ALERT DIGITAL AUDIO OUT	P603	69	Out
VOR/LOC DIGITAL AUDIO OUT	P602	59	Out

When interfaced to a GMA 1347 audio panel, these can be used in place of analog audio lines.

A.3.12.5 Discrete Inputs

Pin Name	Connector	Pin	I/O
TRANSMIT INTERLOCK	P601	11	In
COMM REMOTE TRANSFER	P601	12	In
VLOC/ILS REMOTE TRANSFER	P602	28	In

INACTIVE: $10 \lesssim Vin \lesssim 33VDC$ or $Rin \geq 100k\Omega$
ACTIVE: $Vin \leq 1.9VDC$ with $\gtrsim 75$ uA sink current, or $Rin \leq 375\Omega$
Sink current is internally limited to 200 uA max for a grounded input

COM REMOTE TRANSFER and VLOC REMOTE TRANSFER are momentary inputs.

A.3.12.6 Marker Beacon

Pin Name	Connector	Pin	I/O
OUTER MARKER LAMP IN	P605	56	In
MIDDLE MARKER LAMP IN	P605	57	In
AIRWAY/INNER MARKER LAMP IN	P605	58	In

Active high inputs used for outer/middle/inner marker lamp inputs.

A.3.13 VOR/ILS Indicator

A.3.14 VOR/ILS Indicator Function

The VOR/ILS indicator displays both lateral and vertical, To/From indications, lateral flags, vertical flags, and superflags.

VOR/LOC COMPOSITE OUT is a standard VOR/Localizer Composite signal which may be used to drive the Left/Right, TO/FROM, and Flag indications of certain navigational indicators that contain an internal converter.

The ILS ENERGIZE output goes low when the VLOC frequency is channeled to a localizer channel.

A.3.15 VOR/ILS Indicator Electrical Characteristics

A.3.15.1 Superflags

Pin Name	Connector	Pin	I/O
VOR/LOC SUPERFLAG	P602	15	Out
GLIDESLOPE SUPERFLAG	P602	38	Out

The output supplies not less than 500 mA on a 28 volt system with the output voltage not less than (AIRCRAFT POWER – 1.5 VDC) when the flag is to be OUT OF VIEW. The output voltage with respect to ground is less than 0.25 VDC when the flag is to be IN VIEW.

A.3.15.2 Deviation

Pin Name	Connector	Pin	I/O
VOR/LOC +LEFT	P602	5	Out
VOR/LOC +RIGHT (VOR/LOC COMMON)	P602	6	--
GLIDESLOPE +UP	P602	34	Out
GLIDESLOPE +DOWN (GLIDESLOPE COMMON)	P602	55	--

The deviation outputs are each capable of driving up to three 1000 Ω meter loads with ±150 mVDC ±10% with respect to 2.5V Common for full-scale deflection. The drive circuit provides for more than full-scale deflection with a maximum course deviation output voltage of ±300 mVDC ±10%.

A.3.15.3 To/From

Pin Name	Connector	Pin	I/O
VOR/LOC +TO	P602	1	Out
VOR/LOC +FROM (VOR/LOC COMMON)	P602	2	--

The output is capable of driving up to three 200 Ω meter loads. When indicating TO, the output is +225 ±75 mVDC. When indicating FROM, output is -225 ±75 mVDC. When invalid information is present (Flag IN VIEW) the TO/FROM output is 0 ±10 mVDC.

A.3.15.4 Flag

Pin Name	Connector	Pin	I/O
VOR/LOC +FLAG	P602	3	Out
VOR/LOC -FLAG (VOR/LOC COMMON)	P602	4	--
GLIDESLOPE +FLAG	P602	32	Out
GLIDESLOPE -FLAG (GLIDESLOPE COMMON)	P602	53	--

The Flag output is capable of driving up to three 1000 Ω meter loads. When valid information is present (Flag OUT OF VIEW) the Flag output is 375 ±80 mVDC. When invalid information is present (Flag IN VIEW) the Flag output is 0 ±25 mVDC.

A.3.15.5 OBS

Pin Name	Connector	Pin	I/O
VOR OBS ROTOR C	P602	9	Out
VOR OBS ROTOR H (GROUND)	P602	10	--
VOR OBS STATOR E (VOR/LOC COMMON)	P602	11	--
VOR OBS STATOR F	P602	12	In
VOR OBS STATOR D	P602	13	In
VOR OBS STATOR G (VOR/LOC COMMON)	P602	14	--

VOR OBS ROTOR C and H are a buffered 500 Hz output that is intended to drive the OBS rotors. VOR OBS STATOR D and VOR OBS STATOR F are each phase and amplitude shifted version of the VOR ROTOR C output. Each pair is intended to read one of the two windings of the indicator's OBS stator.

A.3.15.6 VOR/LOC Composite

Pin Name	Connector	Pin	I/O
VOR/LOC COMPOSITE OUT	P602	8	Out

With a Standard VOR Test Signal applied, VOR/LOC COMPOSITE OUT is 0.5 ±0.1 V_{RMS} into a 10 kΩ load. With a Standard Localizer Centering Test Signal applied, VOR/LOC COMPOSITE OUT is 0.350 ±0.05 V_{RMS} into a 10 kΩ load.

A.3.15.7 ILS Energize

Pin Name	Connector	Pin	I/O
ILS ENERGIZE	P602	29	Out

INACTIVE: Floating (can be pulled up to externally sourced Vout in the range 0 ≤ Vout ≤ 33VDC)
Leakage current in the INACTIVE state is typically ≤ 10 uA to ground
ACTIVE: Vout ≤ 0.5VDC with ≤ 20 mA sink current
Sink current must be externally limited to 20 mA max

A.3.16 RMI/OBI

A.3.16.1 RMI/OBI Function

The MAIN OBI output provides bearing information from the active waypoint based upon GPS navigation information. The MAIN OBI output may be configured so that it sends VOR/ILS bearing information when VLOC is selected.

The VOR OBI output provides bearing information from the active waypoint based upon the VOR receiver.

When a localizer channel is tuned on the VLOC window, there is a bit in the data stream set to indicate that a localizer frequency is tuned which stows the needle or drives it to the 3 o'clock position.

A.3.16.2 RMI/OBI Electrical Characteristics

Pin Name	Connector	Pin	I/O
MAIN OBI CLOCK	P606	56	Out
MAIN OBI SYNC	P606	57	Out
MAIN OBI DATA	P606	58	Out

Pin Name	Connector	Pin	I/O
VOR OBI CLOCK	P602	25	Out
VOR OBI SYNC	P602	26	Out
VOR OBI DATA	P602	27	Out

INACTIVE: Floating (can be pulled up to externally sourced Vout in the range $0 \leq$ Vout $\leq$ 33VDC)
Leakage current in the INACTIVE state is typically $\leq$ 10 uA to ground
ACTIVE: Vout $\leq$ 0.5VDC with $\leq$ 20 mA sink current
Sink current must be externally limited to 20 mA max

A.3.17 DME Tuning and ADF

A.3.17.1 DME Tuning Function

The GIA 63W can channel a DME based on the tuned VLOC frequency. The GIA 63W outputs 2 of 5, BCD or Slip parallel DME and King Serial DME channeling format. When DME COMMON is held low, the GIA 63W actively tunes the DME.

A.3.18 DME Interface and ADF Electrical Characteristics

A.3.18.1 Parallel DME Tuning

Pin Name	Connector	Pin	I/O
PARALLEL DME 1 MHZ-D	P602	33	Out
PARALLEL DME 100 KHZ-A	P602	37	Out
PARALLEL DME 100 KHZ-B	P602	39	Out
PARALLEL DME 100 KHZ-C	P602	40	Out
PARALLEL DME 100 KHZ-D	P602	42	Out
PARALLEL DME 50 KHZ	P602	43	Out
PARALLEL DME 1 MHZ-A	P602	45	Out
PARALLEL DME 1 MHZ-B	P602	46	Out
PARALLEL DME 1 MHZ-C	P602	47	Out
PARALLEL DME 100KHZ-E	P602	54	Out
PARALLEL DME 1MHZ-E	P602	56	Out
NAV DME COMMON	P602	41	In

For each of the parallel DME tuning discrete outputs:

INACTIVE: Floating (can be pulled up to externally sourced Vout in the range $0 \lesssim \text{Vout} \lesssim 33\text{VDC}$)
Leakage current in the INACTIVE state is typically ≤ 10 uA to ground
ACTIVE: Vout ≤ 0.5VDC with ≲ 20 mA sink current
Sink current must be externally limited to 20 mA max

NAV DME COMMON must be pulled low to indicate to the NAV module that it is the device channeling the DME.

INACTIVE: $10 \lesssim \text{Vin} \lesssim 33\text{VDC}$ or Rin ≥ 100kΩ
ACTIVE: Vin ≤ 1.9VDC with ≳ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

A.3.18.2 King Serial DME Interface

Pin Name	Connector	Pin	I/O
KING SERIAL DME CLOCK	P602	18	Out
KING SERIAL DME DATA	P602	19	Out
KING SERIAL RNAV REQUEST	P602	20	In
KING SERIAL RNAV MODE	P602	21	In
MAIN KING SERIAL DME DATA	P606	59	I/O
MAIN KING SERIAL DME CLOCK	P606	60	I/O
MAIN KING SERIAL DME HOLD OUT	P606	61	Out
MAIN KING SERIAL DME REQUEST	P606	62	I/O
MAIN KING SERIAL DME ON OUT	P606	63	Out
MAIN KING SERIAL RNAV REQUEST	P606	64	In

These pins are used when the GIA 63W is configured for King Serial DME tuning.
Input logic levels are:
High 6.5 VDC or greater
Low 3.5 VDC or less

A.3.18.3 Automatic Direction Finder Inputs

Pin Name	Connector	Pin	I/O
ADF X/COS	P606	10	In
ADF Y/SIN	P606	11	In
ADF Z (GROUND)	P606	12	--
ADF DC REF IN	P606	32	In

ADF (Automatic Direction Finder) inputs which is configurable as either XYZ (AC) or SIN/COS (DC).

	AC	DC
Frequency:	400 Hz ±10%	--
Amplitude:	0 to 11.8 Vrms max	-8 V to +8 V
Input Impedance:	> 80 kΩ	> 80 kΩ
Range:	0 to 360 degrees	0 to 360 degrees
Resolution:	±0.1 degree or better	±0.1 degree or better
Accuracy:	±3.0 degrees	±3.0 degrees
DC Reference Input:	--	0 to 5 VDC maximum (>40 kΩ)

A.3.19 Auto Pilot

A.3.19.1 Radar Altimeter

Pin Name	Connector	Pin	I/O
RADAR ALTIMETER DC HI	P605	1	In
RADAR ALTIMETER DC LO	P605	2	In

Provides altitude information during approach.

A.3.19.2 Flight Instruments

Pin Name	Connector	Pin	I/O
FLIGHT DIRECTOR PITCH +UP	P605	8	In
FLIGHT DIRECTOR PITCH +DOWN	P605	9	In
FLIGHT DIRECTOR PITCH +RIGHT	P605	10	In
FLIGHT DIRECTOR PITCH +LEFT	P605	11	In

Inputs from AFCS that direct the pilot through the PFD.

Pin Name	Connector	Pin	I/O
HEADING BOOTSTRAP OUT X	P606	37	Out
HEADING BOOTSTRAP OUT Y	P606	38	Out
HEADING BOOTSTRAP OUT Z (GROUND)	P606	39	--

Outputs to backup VOR/ILS/GPS indicator.

Pin Name	Connector	Pin	I/O
AC ROLL ATTITUDE OUT HI	P606	40	Out
AC ROLL ATTITUDE OUT LO (GROUND)	P606	41	--
AC PITCH ATTITUDE OUT HI	P606	42	Out
AC PITCH ATTITUDE OUT LO (GROUND)	P606	43	--

Outputs roll and pitch attitude information to AFCS or weather radar.

A.3.19.3 Barometric Setting/Altitude

Pin Name	Connector	Pin	I/O
POTENTIOMETER SIGNAL IN	P605	13	In
POTENTIOMETER REF IN HI	P605	14	In
POTENTIOMETER REF IN LO	P605	15	In
POTENTIOMETER SIGNAL OUT	P605	30	Out
POTENTIOMETER REF OUT HI	P605	32	Out
POTENTIOMETER REF OUT LO (GROUND)	P605	34	Out

Inputs and outputs for barometric pressure correction.

A.3.19.4 26 Volt AC References

Pin Name	Connector	Pin	I/O
26 VAC VERTICAL GYRO REF HI	P606	1	In
26 VAC VERTICAL GYRO REF LO	P606	2	In
26 VAC ADF REF HI	P606	3	In
26 VAC ADF REF LO	P606	4	In
26 VAC AFCS REF HI	P606	5	In
26 VAC AFCS REF LO	P606	6	In
26VAC DIRECTIONAL GYRO REF HI	P606	51	In
26VAC DIRECTIONAL GYRO REF LO	P606	52	In

Used to sample AC inputs and provides reference for AC outputs. A vertical gyro gives pitch and roll information and a directional gyro gives heading information.

This signal must be the same phase and frequency as the indicator being driven.

Frequency: 400 Hz ± 10%
Voltage: 22.6 Vrms to 28.6 Vrms
Input Impedance: 50 kΩ

A.3.19.5 Inputs From Gyros

Pin Name	Connector	Pin	I/O
HEADING X	P606	14	In
HEADING Y	P606	15	In
HEADING Z (GROUND)	P606	16	--

Inputs heading information from a directional gyro.
3-wire synchro magnetic heading input, with HEADING Z grounded. Index reference is 0° as specified by ARINC 407.

Frequency: 400Hz ± 10%
Voltage: 11.8 Vrms nominal, 13.0 Vrms maximum
Input Impedance: 80 kΩ
Resolution: ± 0.1° or better
Accuracy: ± 3°

Pin Name	Connector	Pin	I/O
PITCH ATTITUDE X	P606	18	In
PITCH ATTITUDE Y	P606	19	In
PITCH ATTITUDE Z	P606	20	--

Inputs pitch attitude information from a vertical gyro.

Pin Name	Connector	Pin	I/O
ROLL ATTITUDE X	P606	21	In
ROLL ATTITUDE Y	P606	22	In
ROLL ATTITUDE Z	P606	23	--

Inputs roll attitude information from a vertical gyro.

A.3.19.6 Automatic Flight Control System Outputs

Pin Name	Connector	Pin	I/O
ANALOG ROLL STEERING HI	P606	34	Out
ANALOG ROLL STEERING LO (GROUND)	P606	36	--

Variable-amplitude output, which is proportional to the aircraft roll command from the GPS navigation system.

	AC	DC
Frequency:	400 Hz ±10%	--
Amplitude:	0 to 11.8 Vrms max	-15 to +15 VDC
Load Impedance:	$\geq$ 5 kΩ	$\geq$ 5 kΩ
Scaling:	393 mVrms per degree of roll command	2.0 VDC per degree of roll command
Range:	0 ± 30 degrees of roll	0 ± 7.5 degrees of roll
Resolution:	± 0.05° or better	± 0.05° or better
Accuracy:	± 0.5°	± 0.3°

Pin Name	Connector	Pin	I/O
YAW RATE +RIGHT	P606	44	Out
YAW RATE +LEFT (GROUND)	P606	45	--

Outputs yaw rate (DC) information to AFCS.

Pin Name	Connector	Pin	I/O
HEADING DATUM HI	P606	46	Out
HEADING DATUM LO (GROUND)	P606	47	--

Outputs heading datum (AC or DC) information to AFCS.

	AC	DC
Frequency:	400 Hz ±10%	--
Amplitude:	0 to 11.8 Vrms max	-15 to +15 VDC
Load Impedance:	$\geq$ 5 kΩ	$\geq$ 5 kΩ
Scaling:	TBD	0.55 VDC per degree of heading error
Range:	TBD	0 ± 27 degrees
Resolution:	± 0.02°	± 0.15° or better
Accuracy:	± 1°	± 1°

Pin Name	Connector	Pin	I/O
COURSE DATUM HI	P606	48	Out
COURSE DATUM LO (GROUND)	P606	49	--

Outputs course datum (AC or DC) information to AFCS.

	AC	DC
Frequency:	400 Hz ±10%	--
Amplitude:	0 to 11.8 Vrms max	-15 to +15 VDC
Load Impedance:	$\geq$ 5 kΩ	$\geq$ 5 kΩ
Scaling:	TBD	0.21 VDC per degree of course error
Range:	TBD	0 ± 71 degrees
Resolution:	± 0.02°	± 0.15° or better
Accuracy:	± 1°	± 1°

A.3.19.7 Main Deviation Outputs

Pin Name	Connector	Pin	I/O
MAIN LATERAL DEVIATION +LEFT	P605	17	Out
MAIN LATERAL DEVIATION +RIGHT (MAIN COMMON)	P605	18	Out
MAIN VERTICAL DEVIATION +UP	P605	23	Out
MAIN VERTICAL DEVIATION +DOWN (MAIN COMMON)	P605	24	Out

The deviation output is capable of driving up to three 1000 Ω loads with ±150 mVDC ±5% for full-scale deflection. The drive circuit provides for more than full-scale deflection with a maximum course deviation output voltage of ±300 mVDC ±5%.

Pin Name	Connector	Pin	I/O
MAIN LATERAL +FLAG	P605	19	Out
MAIN LATERAL -FLAG (MAIN COMMON)	P605	20	Out
MAIN VERTICAL +FLAG	P605	25	Out
MAIN VERTICAL –FLAG (MAIN COMMON)	P605	26	Out

The Flag output is capable of driving up to three 1000 Ω loads. When valid information is present (Flag OUT OF VIEW) the Flag output is 375 ±80 mVDC. When invalid information is present (Flag IN VIEW) the Flag output is 0 ±25 mVDC.

Pin Name	Connector	Pin	I/O
MAIN LATERAL SUPERFLAG	P605	62	Out
MAIN VERTICAL SUPERFLAG	P605	63	Out
SUPERFLAG 1A	P605	67	Out
SUPERFLAG 2A	P605	75	Out
SUPERFLAG 3A	P605	77	Out
SUPERFLAG 4A	P605	64	Out

The output supplies not less than 500 mA on a 28 volt system with the output voltage not less than (AIRCRAFT POWER –2.0 VDC) when the flag is to be OUT OF VIEW. The output voltage with respect to ground is less than 0.25 VDC when the flag is to be IN VIEW.

A.3.19.8 Digital Inputs

Pin Name	Connector	Pin	I/O
DIRECTIONAL GYRO MOTOR A	P606	7	In
DIRECTIONAL GYRO MOTOR B	P606	8	In

Inputs from a pulsed directional gyro, which gives heading.

A.3.19.9 Remote Annunciate Data Bus

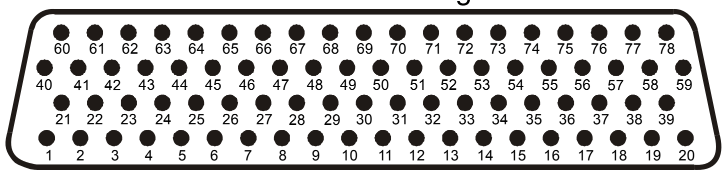
Pin Name	Connector	Pin	I/O
REMOTE ANNUNCIATE CLOCK	P606	53	In
REMOTE ANNUNCIATE DATA	P606	54	In
REMOTE ANNUNCIATE SYNC	P606	55	In

These inputs read the remote annunciate data bus that the autopilot uses to tell its remote annunciator panel what mode it is operating in.

A.4 GEA 71

A.4.1 P701 Connector

View of J701 connector looking at rear of unit.



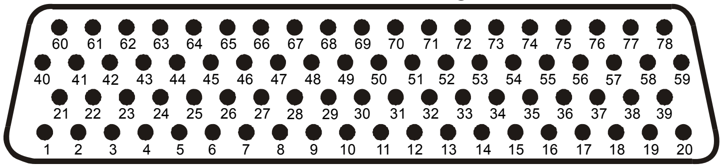
Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	DIGITAL IN* 1	In
3	DIGITAL IN* 2	In
4	SIGNAL GROUND	--
5	RS 485 1 A	I/O
6	RS 485 1 B	I/O
7	RS 485 2 A	I/O
8	RS 485 2 B	I/O
9	GEA SYSTEM ID PROGRAM* 1	In
10	GEA SYSTEM ID PROGRAM* 2	In
11	TRANSDUCER POWER OUT LO (GROUND)	--
12	TRANSDUCER POWER OUT LO (GROUND)	--
13	TRANSDUCER POWER OUT LO (GROUND)	--
14	+10 VDC TRANSDUCER POWER OUT	Out
15	+5 VDC TRANSDUCER POWER OUT	Out
16	+12 VDC TRANSDUCER POWER OUT	Out
17	ENGINE TEMP ANALOG IN 6 HI	In
18	ENGINE TEMP ANALOG IN 6 LO	In
19	SIGNAL GROUND	--
20	POWER GROUND	--
21	CONFIG MODULE POWER	Out
22	ANALOG IN 1 HI	In
23	ANALOG IN 1 LO	In
24	ANALOG IN 2 HI	In
25	ANALOG IN 2 LO	In
26	ENGINE TEMP ANALOG IN 1 HI	In
27	ENGINE TEMP ANALOG IN 1 LO	In
28	ENGINE TEMP ANALOG IN 2 HI	In
29	ENGINE TEMP ANALOG IN 2 LO	In
30	ENGINE TEMP ANALOG IN 3 HI	In
31	ENGINE TEMP ANALOG IN 3 LO	In
32	SIGNAL GROUND	--
33	ENGINE TEMP ANALOG IN 4 HI	In
34	ENGINE TEMP ANALOG IN 4 LO	In
35	AIRCRAFT POWER 1	In
36	ENGINE TEMP ANALOG IN 5 HI	In
37	AIRCRAFT POWER 2	In
38	ENGINE TEMP ANALOG IN 5 LO	In

Connector P701, continued		
Pin	**Pin Name**	**I/O**
39	SIGNAL GROUND	--
40	CONFIG MODULE DATA	I/O
41	DIGITAL IN* 3	In
42	ANALOG IN 3 HI	In
43	ANALOG IN 3 LO	In
44	ANALOG IN 4 HI	In
45	ANALOG IN 4 LO	In
46	ANALOG IN 5 HI	In
47	ANALOG IN 5 LO	In
48	ENGINE TEMP ANALOG IN 7 HI	In
49	ENGINE TEMP ANALOG IN 7 LO	In
50	ENGINE TEMP ANALOG IN 8 HI	In
51	ENGINE TEMP ANALOG IN 8 LO	In
52	ENGINE TEMP ANALOG IN 9 HI	In
53	ENGINE TEMP ANALOG IN 9 LO	In
54	ENGINE TEMP ANALOG IN 10 HI	In
55	ENGINE TEMP ANALOG IN 10 LO	In
56	ENGINE TEMP ANALOG IN 11 HI	In
57	ENGINE TEMP ANALOG IN 11 LO	In
58	ENGINE TEMP ANALOG IN 12 HI	In
59	ENGINE TEMP ANALOG IN 12 LO	In
60	CONFIG MODULE CLOCK	Out
61	DIGITAL IN* 4	In
62	ANALOG IN 6 HI	In
63	ANALOG IN 6 LO	In
64	ANALOG IN 7 HI	In
65	ANALOG IN 7 LO	In
66	ANALOG IN 8 HI	In
67	ANALOG IN 8 LO	In
68	THERMOCOUPLE REF IN HI	In
69	THERMOCOUPLE REF IN LO	In
70	DISCRETE IN* 1	In
71	DISCRETE IN* 2	In
72	ANALOG IN 9 HI	In
73	ANALOG IN 9 LO	In
74	ANALOG IN 10 HI	In
75	ANALOG IN 10 LO	In
76	DISCRETE IN* 3	In
77	GEA REMOTE POWER OFF	In
78	POWER GROUND	--

* Indicates Active Low

A.4.2 P702 Connector

View of J702 connector looking at rear of unit.



Pin	Pin Name	I/O
1	ANNUNCIATE* 1A	Out
2	ANNUNCIATE* 2A	Out
3	ANNUNCIATE* 3A	Out
4	ANNUNCIATE* 4A	Out
5	ANNUNCIATE* 5A	Out
6	ANNUNCIATE* 6A	Out
7	ANNUNCIATE* 7A	Out
8	ANNUNCIATE* 8A	Out
9	ANNUNCIATE* 9A	Out
10	ANNUNCIATE* 10A	Out
11	TRANSDUCER POWER OUT LO (GROUND)	--
12	TRANSDUCER POWER OUT LO (GROUND)	--
13	TRANSDUCER POWER OUT LO (GROUND)	--
14	+10 VDC TRANSDUCER POWER OUT A	Out
15	+5 VDC TRANSDUCER POWER OUT A	Out
16	+12 VDC TRANSDUCER POWER OUT A	Out
17	ANNUNCIATE* 11A	Out
18	ANNUNCIATE* 12A	Out
19	ANNUNCIATE* 13A	Out
20	ANNUNCIATE* 14A	Out
21	ANNUNCIATE* 15A	Out
22	ANNUNCIATE* 16A	Out
23	ANNUNCIATE* 17A	Out
24	ANNUNCIATE* 18A	Out
25	DISCRETE IN* 11A	In
26	DISCRETE IN* 12A	In
27	DISCRETE IN* 13A	In
28	DISCRETE IN* 14A	In
29	DISCRETE IN* 15A	In
30	DISCRETE IN* 16A	In
31	SIGNAL GROUND	--
32	SIGNAL GROUND	--
33	SIGNAL GROUND	--
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	SIGNAL GROUND	--
39	SIGNAL GROUND	--

* Indicates Active Low

Connector P702, continued		
Pin	**Pin Name**	**I/O**
40	DISCRETE IN* 17A	In
41	DISCRETE IN* 18A	In
42	DISCRETE IN* 19A	In
43	DISCRETE IN* 20A	In
44	ANALOG/CURRENT MONITOR IN 1A HI	In
45	ANALOG/CURRENT MONITOR IN 1A LO	In
46	ANALOG/CURRENT MONITOR IN 2A HI	In
47	ANALOG/CURRENT MONITOR IN 2A LO	In
48	ANALOG/CURRENT MONITOR IN 3A HI	In
49	ANALOG/CURRENT MONITOR IN 3A LO	In
50	ANALOG/CURRENT MONITOR IN 4A HI	In
51	ANALOG/CURRENT MONITOR IN 4A LO	In
52	ANALOG IN 1A HI	In
53	ANALOG IN 1A LO	In
54	ANALOG IN 2A HI	In
55	ANALOG IN 2A LO	In
56	ANALOG IN 3A HI	In
57	ANALOG IN 3A LO	In
58	ANALOG IN 4A HI	In
59	ANALOG IN 4A LO	In
60	DISCRETE IN* 1A	In
61	DISCRETE IN* 2A	In
62	DISCRETE IN* 3A	In
63	DISCRETE IN* 4A	In
64	DISCRETE IN* 5A	In
65	DISCRETE IN* 6A	In
66	DISCRETE IN* 7A	In
67	DIGITAL IN* 5A	In
68	DIGITAL IN* 6A	In
69	DIGITAL IN* 7A	In
70	DIGITAL IN* 8A	In
71	DISCRETE IN* 8A	In
72	DISCRETE IN* 9A	In
73	DISCRETE IN* 10A	In
74	DIGITAL IN* 1A	In
75	DIGITAL IN* 2A	In
76	DIGITAL IN* 3A	In
77	DIGITAL IN* 4A	In
78	SIGNAL GROUND	--

* Indicates Active Low

A.4.3 Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P701	35	In
AIRCRAFT POWER 2	P701	37	In
POWER GROUND	P701	20	--
POWER GROUND	P701	78	--

A.4.4 Analog Inputs

These inputs are multi-purpose and have several configuration options. See Table A-1 for a summarization of configuration options.

Pin Name	Connector	Pin	I/O
ANALOG IN 1 HI	P701	22	In
ANALOG IN 1 LO	P701	23	In
ANALOG IN 2 HI	P701	24	In
ANALOG IN 2 LO	P701	25	In
ANALOG IN 3 HI	P701	42	In
ANALOG IN 3 LO	P701	43	In
ANALOG IN 4 HI	P701	44	In
ANALOG IN 4 LO	P701	45	In
ANALOG IN 5 HI	P701	46	In
ANALOG IN 5 LO	P701	47	In
ANALOG IN 6 HI	P701	62	In
ANALOG IN 6 LO	P701	63	In
ANALOG IN 7 HI	P701	64	In
ANALOG IN 7 LO	P701	65	In
ANALOG IN 8 HI	P701	66	In
ANALOG IN 8 LO	P701	67	In
ANALOG IN 9 HI	P701	72	In
ANALOG IN 9 LO	P701	73	In
ANALOG IN 10 HI	P701	74	In
ANALOG IN 10 LO	P701	75	In
ANALOG/CURRENT MONITOR IN 1A HI	P702	44	In
ANALOG/CURRENT MONITOR IN 1A LO	P702	45	In
ANALOG/CURRENT MONITOR IN 2A HI	P702	46	In
ANALOG/CURRENT MONITOR IN 2A LO	P702	47	In
ANALOG/CURRENT MONITOR IN 3A HI	P702	48	In
ANALOG/CURRENT MONITOR IN 3A LO	P702	49	In
ANALOG/CURRENT MONITOR IN 4A HI	P702	50	In
ANALOG/CURRENT MONITOR IN 4A LO	P702	51	In
ANALOG IN 1A HI	P702	52	In
ANALOG IN 1A LO	P702	53	In
ANALOG IN 2A HI	P702	54	In
ANALOG IN 2A LO	P702	55	In
ANALOG IN 3A HI	P702	56	In
ANALOG IN 3A LO	P702	57	In
ANALOG IN 4A HI	P702	58	In
ANALOG IN 4A LO	P702	59	In

Table A-1. Analog Input Configuration Summary

Configurable Parameter	Description/Characteristic
Resistive Divider	Resistive Divider can be enabled or disabled for each analog input. Enabling & Disabling is achieved via software configuration. See Section 3.6. *When Disabled*: Hardware scaling is 1:1 and input impedance is greater than 10 MΩ. *When Enabled*: Hardware scaling is 50:1 and input impedance is approximately 100 kΩ.
Voltage Measurement Ranges	There are six voltage measurement ranges for analog inputs: • 25 mV, 55 mV, 100 mV, 1 VDC, 2.5 VDC, and 5.0 VDC (Applies to both 1:1 and 50:1 scaling). Effective voltage range in 50:1 mode: • 1.25 VDC, 2.75 VDC, 5.0 VDC, and 50 VDC.
Bipolar/Unipolar	Each analog input can be configured to measure Bi-Polar (positive and negative) or Uni-Polar (positive only) voltages. All analog inputs are differential.
Constant Current Source	Each analog input can be configured to supply a 250 μA constant current source (CCS) from the positive differential input used to measure resistive sensors.
Miscellaneous Sensor Configuration Parameters	• Update Rate • High Side Current Monitor Feature Enabled/Disabled • Voltage Translation Equations • Minimum/Maximum Values for Sensors • Hysteresis Value • Digital Filtering Value

A.4.4.1 Engine Temperature Analog In

Pin Name	Connector	Pin	I/O
ENGINE TEMP ANALOG IN 1 HI	P701	26	In
ENGINE TEMP ANALOG IN 1 LO	P701	27	In
ENGINE TEMP ANALOG IN 2 HI	P701	28	In
ENGINE TEMP ANALOG IN 2 LO	P701	29	In
ENGINE TEMP ANALOG IN 3 HI	P701	30	In
ENGINE TEMP ANALOG IN 3 LO	P701	31	In
ENGINE TEMP ANALOG IN 4 HI	P701	33	In
ENGINE TEMP ANALOG IN 4 LO	P701	34	In
ENGINE TEMP ANALOG IN 5 HI	P701	36	In
ENGINE TEMP ANALOG IN 5 LO	P701	38	In
ENGINE TEMP ANALOG IN 6 HI	P701	17	In
ENGINE TEMP ANALOG IN 6 LO	P701	18	In
ENGINE TEMP ANALOG IN 7 HI	P701	48	In
ENGINE TEMP ANALOG IN 7 LO	P701	49	In
ENGINE TEMP ANALOG IN 8 HI	P701	50	In
ENGINE TEMP ANALOG IN 8 LO	P701	51	In
ENGINE TEMP ANALOG IN 9 HI	P701	52	In
ENGINE TEMP ANALOG IN 9 LO	P701	53	In
ENGINE TEMP ANALOG IN 10 HI	P701	54	In
ENGINE TEMP ANALOG IN 10 LO	P701	55	In
ENGINE TEMP ANALOG IN 11 HI	P701	56	In
ENGINE TEMP ANALOG IN 11 LO	P701	57	In
ENGINE TEMP ANALOG IN 12 HI	P701	58	In
ENGINE TEMP ANALOG IN 12 LO	P701	59	In

Aircraft engine temperature sensors are usually one of two types: Thermocouple or Resistive Temperature Detector (RTD). The GEA 71 is designed to utilize either sensor for EGT and CHT temperature measurements. Engine Temp Analog inputs are only available with the resistive divider disabled (1:1 scaling). The maximum differential voltage and the maximum voltage with respect to ground that can be measured on any Engine Temp Analog Input is 2.5 VDC.

The GEA 71 uses an additional backshell thermocouple to determine the reference junction temperature at the thermocouple wire-to-copper crimp pin junction.

A.4.4.2 High Side Current Monitor

Pin Name	Connector	Pin	I/O
ANALOG/CURRENT MONITOR IN 1A HI	P702	44	In
ANALOG/CURRENT MONITOR IN 1A LO	P702	45	In
ANALOG/CURRENT MONITOR IN 2A HI	P702	46	In
ANALOG/CURRENT MONITOR IN 2A LO	P702	47	In
ANALOG/CURRENT MONITOR IN 3A HI	P702	48	In
ANALOG/CURRENT MONITOR IN 3A LO	P702	49	In
ANALOG/CURRENT MONITOR IN 4A HI	P702	50	In
ANALOG/CURRENT MONITOR IN 4A LO	P702	51	In

The GEA 71 offers high side current monitor capability (HSCM) in 4 analog inputs. This allows aircraft bus power to be monitored.

A.4.5 Discrete Signals

Pin Name	Connector	Pin	I/O
DISCRETE IN* 1	P701	70	In
DISCRETE IN* 2	P701	71	In
DISCRETE IN* 3	P701	76	In
DISCRETE IN* 1A	P702	60	In
DISCRETE IN* 2A	P702	61	In
DISCRETE IN* 3A	P702	62	In
DISCRETE IN* 4A	P702	63	In
DISCRETE IN* 5A	P702	64	In
DISCRETE IN* 6A	P702	65	In
DISCRETE IN* 7A	P702	66	In
DISCRETE IN* 8A	P702	71	In
DISCRETE IN* 9A	P702	72	In
DISCRETE IN* 10A	P702	73	In
DISCRETE IN* 11A	P702	25	In
DISCRETE IN* 12A	P702	26	In
DISCRETE IN* 13A	P702	27	In
DISCRETE IN* 14A	P702	28	In
DISCRETE IN* 15A	P702	29	In
DISCRETE IN* 16A	P702	30	In
DISCRETE IN* 17A	P702	40	In
DISCRETE IN* 18A	P702	41	In
DISCRETE IN* 19A	P702	42	In
DISCRETE IN* 20A	P702	43	In

Discrete In signals are active low by design. However, software configuration allows the active low state to be interpreted as active high or active low. Discrete data is updated two times per second (2 Hz) and outputs discrete data in RS-485 serial format to the GIA 63W. Discrete inputs are low when the signal is ≤ 1.9 VDC or the resistance to ground is ≤ 375 Ω, and are otherwise high.

A.4.6 Digital Input Signals

Pin Name	Connector	Pin	I/O
DIGITAL IN* 1	P701	2	In
DIGITAL IN* 2	P701	3	In
DIGITAL IN* 3	P701	41	In
DIGITAL IN* 4	P701	61	In
DIGITAL IN* 1A	P702	74	In
DIGITAL IN* 2A	P702	75	In
DIGITAL IN* 3A	P702	76	In
DIGITAL IN* 4A	P702	77	In
DIGITAL IN* 5A	P702	67	In
DIGITAL IN* 6A	P702	68	In
DIGITAL IN* 7A	P702	69	In
DIGITAL IN* 8A	P702	70	In

Digital input minimum frequency is 1 Hz and maximum frequency is 100 kHz. Digital signals are updated 10 times per second (10 Hz). Digital inputs are low when the signal is ≤ 1.9 VDC or the resistance to ground is ≤ 375 Ω, and are otherwise high. Maximum output high/low and low/high transition period is 5.0 µS. Digital inputs can also be configured as discrete inputs.

A.4.7 GEA System ID Program

The GEA SYSTEM ID PROGRAM 1 (P701, Pin 9) and GEA SYSTEM ID PROGRAM 2 (P701, Pin 10) should be left open.

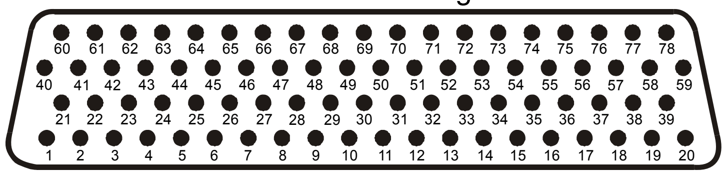
A.4.8 Remote Power Off

The GEA 71 powers down upon receiving the remote power-off signal. Power-off action is triggered by voltages ≥10.0 VDC. Remote power-off input is connector P701, pin 77.

A.5 GDC 74A

A.5.1 P741 Connector

View of J741 connector looking at rear of unit.



Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	OAT PROBE POWER OUT	Out
3	OAT PROBE IN HI	In
4	OAT PROBE IN LO	In
5	SIGNAL GROUND	--
6	ADC SYSTEM ID PROGRAM* 1	In
7	SIGNAL GROUND	--
8	DISCRETE IN* 6	In
9	SIGNAL GROUND	--
10	RS-232 IN 1	In
11	RS-232 OUT 1	Out
12	SIGNAL GROUND	--
13	RS-232 IN 2	In
14	RS-232 OUT 2	Out
15	SIGNAL GROUND	--
16	RESERVED	--
17	POWER GROUND	--
18	POWER GROUND	--
19	POWER GROUND	--
20	POWER GROUND	--
21	CONFIG MODULE POWER OUT	Out
22	SPARE	--
23	ARINC 429 IN 1 A	In
24	ARINC 429 IN 1 B	In
25	SIGNAL GROUND	--
26	ARINC 429 OUT 1 A	Out
27	ARINC 429 OUT 1 B	Out
28	SIGNAL GROUND	--
29	ARINC 429 OUT 2 A	Out
30	ARINC 429 OUT 2 B	Out
31	SIGNAL GROUND	--
32	ARINC 429 OUT 3 A	Out
33	ARINC 429 OUT 3 B	Out
34	SIGNAL GROUND	--
35	ARINC 429 IN 2 A	In
36	ARINC 429 IN 2 B	In
37	SIGNAL GROUND	--

* Indicates Active Low

Connector P741, continued		
Pin	**Pin Name**	**I/O**
38	SPARE	--
39	SPARE	--
40	CONFIG MODULE DATA	I/O
41	ARINC 429 OUT 1 A	Out
42	ARINC 429 OUT 1 B	Out
43	SIGNAL GROUND	--
44	ARINC 429 OUT 2 A	Out
45	ARINC 429 OUT 2 B	Out
46	SIGNAL GROUND	--
47	ARINC 429 OUT 3 A	Out
48	ARINC 429 OUT 3 B	Out
49	SIGNAL GROUND	--
50	DISCRETE IN 7	In
51	SIGNAL GROUND	--
52	DISCRETE IN 8	In
53	SIGNAL GROUND	--
54	SPARE	--
55	AIRCRAFT POWER 1	In
56	SPARE	--
57	SPARE	--
58	AIRCRAFT POWER 2	In
59	SPARE	--
60	CONFIG MODULE CLOCK	Out
61	DISCRETE IN* 1	In
62	SIGNAL GROUND	--
63	DISCRETE IN* 2	In
64	SIGNAL GROUND	--
65	DISCRETE IN* 3	In
66	SIGNAL GROUND	--
67	DISCRETE IN* 4	In
68	SIGNAL GROUND	--
69	DISCRETE IN* 5	In
70	SIGNAL GROUND	--
71	ADC SYSTEM ID PROGRAM* 2	In
72	SIGNAL GROUND	--
73	ARINC 429 IN 3 A	In
74	ARINC 429 IN 3 B	In
75	SIGNAL GROUND	--
76	ARINC 429 IN 4 A	In
77	ARINC 429 IN 4 B	In
78	SIGNAL GROUND	--

* Indicates Active Low

A.5.2 Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P741	55	In
AIRCRAFT POWER 2	P741	58	In
OAT PROBE POWER OUT	P741	2	Out
POWER GROUND	P741	17	--
POWER GROUND	P741	18	--
POWER GROUND	P741	19	--
POWER GROUND	P741	20	--
CONFIG MODULE POWER OUT	P741	21	Out

The power-input pins accept 14/28 VDC. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses. AIRCRAFT POWER 1 (Pin 55) and AIRCRAFT POWER 2 (Pin 58) are internally "diode ORed" to provide power redundancy.

A.5.3 Serial Data

A.5.3.1 RS-232 input/Output

Pin Name	Connector	Pin	I/O
RS-232 IN1	P741	10	In
RS-232 OUT 1	P741	11	Out
RS-232 IN 2	P741	13	In
RS-232 OUT 2	P741	14	Out
SIGNAL GROUND	P741	12	--
SIGNAL GROUND	P741	15	--

The RS-232 outputs conform to EIA/TIA-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load.

A.5.3.2 ARINC 429 Input/Output

Pin Name	Connector	Pin	I/O
ARINC 429 OUT 1 A	P741	26,41	Out
ARINC 429 OUT 1 B	P741	27,42	Out
SIGNAL GROUND	P741	28	--
SIGNAL GROUND	P741	43	--
ARINC 429 OUT 2 A	P741	29,44	Out
ARINC 429 OUT 2 B	P741	30,45	Out
SIGNAL GROUND	P741	31	--
SIGNAL GROUND	P741	46	--
ARINC 429 OUT 3 A	P741	32,47	Out
ARINC 429 OUT 3 B	P741	33,48	Out
SIGNAL GROUND	P741	34	--
SIGNAL GROUND	P741	49	--
ARINC 429 IN 1 A	P741	23	In
ARINC 429 IN 1 B	P741	24	In
SIGNAL GROUND	P741	25	--
ARINC 429 IN 2 A	P741	35	In
ARINC 429 IN 2 B	P741	36	In
SIGNAL GROUND	P741	37	
ARINC 429 IN 3 A	P741	73	In
ARINC 429 IN 3 B	P741	74	In
SIGNAL GROUND	P741	75	--
ARINC 429 IN 4 A	P741	76	In
ARINC 429 IN 4 B	P741	77	In
SIGNAL GROUND	P741	78	--

The ARINC 429 transmitters currently operate at low speed. The receivers are capable of accepting either high-speed or low-speed data. Unless high-speed transmission is necessary, low-speed transmission is preferred.

A.5.4 Temperature Inputs

Temperature input is used for Outside Air Temperature (OAT) computations. The temperature input is a three-wire temperature probe interface. OAT Power Out and OAT High are connected internally at the OAT probe. A GTP 59 or other supported temperature probe is required for the GDC 74(X) ADC (Air Data Computer) installation. The GTP 59 is a Resistive Temperature Device (RTD).

Pin Name	Connector	Pin	I/O
OAT PROBE POWER OUT	P741	2	Out
OAT PROBE IN HI	P741	3	In
OAT PROBE IN LO	P741	4	In

A.5.5 Discrete Signal Inputs

Pin Name	Connector	Pin	I/O
DISCRETE IN* 1	P741	61	In
DISCRETE IN* 2	P741	63	In
DISCRETE IN* 3	P741	65	In
DISCRETE IN* 4	P741	67	In
DISCRETE IN* 5	P741	69	In
DISCRETE IN* 6	P741	8	In
DISCRETE IN* 7	P741	50	In
DISCRETE IN* 8	P741	52	In

DISCRETE IN* pins:
INACTIVE: $10 \leq Vin \leq 33VDC$ or $Rin \geq 100k\Omega$
ACTIVE: $Vin \leq 1.9VDC$ with ≥ 75 uA sink current, or $Rin \leq 375\Omega$
Sink current is internally limited to 200 uA max for a grounded input

DISCRETE IN pins:
INACTIVE: $Vin \leq 3.5VDC$
ACTIVE: $10 \leq Vin \leq 33VDC$ with ≥ 75 uA source current
Source current is internally limited to 1.5 mA max for a 10-33VDC input

A.5.6 Configuration Module Connections

Pin Name	Connector	Pin	I/O
CONFIG MODULE GROUND	P741	1	--
CONFIG MODULE DATA	P741	40	I/O
CONFIG MODULE POWER OUT	P741	21	Out
CONFIG MODULE CLOCK	P741	60	Out

The configuration module, mounted in the unit connector backshell, contains an EEPROM.

A.5.7 ADC ARINC 429 System ID Connections

Pin Name	Connector	Pin	I/O
ADC SYSTEM ID PROGRAM* 1	P741	6	In
ADC SYSTEM ID PROGRAM* 2	P741	71	In

The GDC 74(X) has an associated Source/Destination Identifier (SDI or System ID) that is coded into its ARINC 429 output messages/labels. The System ID may be used to uniquely distinguish the source of the GDC 74(X) ARINC 429 labels in a system with more than one GDC 74(X). The GDC 74(X) System ID can be set to All Call, #1, #2, or #3 for such purposes.

By hard strapping the program pins to ground or open, the GDC 74(X) ADC (Air Data Computer) is assigned a System ID. The System ID is included in each transmitted ARINC 429 word. The System ID indicates that there is only a single ADC installed (All Call) or, if multiple units are installed, which ADC the data originates from (#1, #2 or #3). When a single GDC 74(X) is installed in the system, then the pins are left open (All Call). Table A-2 shows strapping connections to achieve the desired system ID.

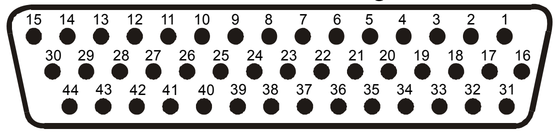
Table A-2. P741 Strapping to Achieve Desired System ID

System ID Number	ARINC System ID 1 Pin 6	ARINC System ID 2 Pin 71
All Call	Open	Open
#1	Ground	Open
#2	Open	Ground
#3	Ground	Ground

A.6 GRS 77/GMU 44

A.6.1 P771 Connector

View of J771 connector looking at rear of unit.



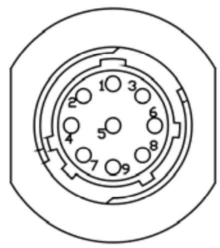
Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	AHRS SYSTEM ID PROGRAM* 1	In
3	AHRS SYSTEM ID PROGRAM* 2	In
4	RESERVED	--
5	SPARE	--
6	GPS 2 RS-232 IN	In
7	RESERVED	--
8	SPARE RS-232 IN 1	In
9	MAGNETOMETER POWER OUT	Out
10	MAGNETOMETER RS-232 OUT	Out
11	GPS 1 RS-232 IN	In
12	ARINC 429 OUT 3 A (CDU 1, high-speed)	Out
13	ARINC 429 OUT 2 A (GIA 2, high-speed)	Out
14	ARINC 429 OUT 1 A (GIA 1, high-speed)	Out
15	ARINC 429 IN 1 A (AIR DATA, low speed)	In
16	CONFIG MODULE DATA	I/O
17	CONFIG MODULE POWER OUT	Out
18	AIRCRAFT POWER 1	In
19	ARINC 429 OUT 3 B (CDU 2, high-speed)	Out
20	AIRCRAFT POWER 2	In
21	GPS 2 RS-232 OUT	Out
22	POWER GROUND	--
23	SPARE RS-232 OUT 1	Out
24	POWER GROUND	--
25	MAGNETOMETER RS-485 IN A	In
26	GPS 1 RS-232 OUT	Out
27	ARINC 429 OUT 3 B (CDU 1, high-speed)	Out
28	ARINC 429 OUT 2 B (GIA 2, high-speed)	Out
29	ARINC 429 OUT 1 B (GIA 1, high-speed)	Out
30	ARINC 429 IN 1 B (AIR DATA, low-speed)	In
31	CONFIG MODULE CLOCK	Out
32	SPARE	--
33	ARINC 429 OUT 3 A (CDU 2, high-speed)	Out
34	SPARE	--
35	SIGNAL GROUND (GPS 2)	--
36	SPARE	--
37	SIGNAL GROUND	--
38	SIGNAL GROUND (MAGNETOMETER)	--
39	MAGNETOMETER RS-485 IN B	In

Connector P771, continued		
Pin	Pin Name	I/O
40	MAGNETOMETER GROUND	--
41	SIGNAL GROUND (GPS 1)	--
42	SIGNAL GROUND (CDU 1)	--
43	SIGNAL GROUND (AFCS)	--
44	SIGNAL GROUND (AIR DATA)	--

* Indicates Active Low

A.6.2 J441 Connector

View of J441 connector looking at rear of unit.



Pin	Pin Name	I/O
1	SIGNAL GROUND	--
2	RS-485 OUT B	Out
3	SIGNAL GROUND	--
4	RS-485 OUT A	Out
5	SPARE	--
6	POWER GROUND	--
7	SPARE	--
8	RS-232 IN	In
9	+12 VDC POWER	In

A.6.3 Power Function

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1, GRS 77	P771	18	In
AIRCRAFT POWER 2, GRS 77	P771	20	In
MAGNETOMETER POWER OUT	P771	9	Out
MAGNETOMETER GROUND	P771	40	--
POWER GROUND, GRS 77	P771	22	--
POWER GROUND, GRS 77	P771	24	--
+12 VDC POWER, GMU 44	P441	9	In
POWER GROUND, GMU 44	P441	6	--

Power-input pins accept 14/28 VDC. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

A.6.4 Serial Data

A.6.4.1 RS-232

Pin Name	Connector	Pin	I/O
GPS 1 RS-232 IN	P771	11	In
GPS 2 RS-232 IN	P771	6	In
SPARE RS-232 IN 1	P771	8	In
GPS 1 RS-232 OUT	P771	26	Out
GPS 2 RS-232 OUT	P771	21	Out
SPARE RS-232 OUT 1	P771	23	Out
MAGNETOMETER RS-232 OUT	P771	10	Out
GPS 1 RS-232 IN	P441	8	In

The RS-232 outputs conform to EIA/TIA-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load.

A.6.4.2 RS-485

Pin Name	Connector	Pin	I/O
MAGNETOMETER RS-485 IN B	P771	39	In
MAGNETOMETER RS-485 IN A	P771	25	In
MAGNETOMETER GROUND	P771	40	--
RS-485 OUT A	P441	4	Out
RS-485 OUT B	P441	2	Out

A.6.4.3 ARINC 429

Pin Name	Connector	Pin	I/O
ARINC 429 OUT 3 A (CDU 1, high-speed)	P771	12	Out
ARINC 429 OUT 3 A (CDU 2, high-speed)	P771	33	Out
ARINC 429 OUT 3 B (CDU 1, high-speed)	P771	27	Out
ARINC 429 OUT 3 B (CDU 2, high-speed)	P771	19	Out
SIGNAL GROUND (CDU 1)	P771	42	--
ARINC 429 OUT 1 A (GIA 1, high-speed)	P771	14	Out
ARINC 429 OUT 2 A (GIA 2, high-speed)	P771	13	Out
ARINC 429 OUT 1 B (GIA 1, high-speed)	P771	29	Out
ARINC 429 OUT 2 B (GIA 2, high-speed)	P771	28	Out
SIGNAL GROUND (AFCS)	P771	43	--
ARINC 429 IN 1 A (AIR DATA, low-speed)	P771	15	In
ARINC 429 IN 1 B (AIR DATA, low-speed)	P771	30	In
SIGNAL GROUND (AIR DATA)	P771	44	--
SIGNAL GROUND (GPS 1)	P771	41	--
SIGNAL GROUND (GPS 2)	P771	35	--
SIGNAL GROUND	P771	37	--

A.6.5 Configuration Module Connections

Pin Name	Connector	Pin	I/O
CONFIG MODULE GROUND	P771	1	--
CONFIG MODULE DATA	P771	16	I/O
CONFIG MODULE POWER OUT	P771	17	Out
CONFIG MODULE CLOCK	P771	31	Out

A.6.6 AHRS System ID Strapping

Pin Name	Connector	Pin	I/O
AHRS SYSTEM ID PROGRAM* 1	P771	2	In
AHRS SYSTEM ID PROGRAM* 2	P771	3	In

By hard strapping the program pins to ground, the GRS 77 is assigned a System ID identified within the transmitted ARINC 429 words. ID's identify a GRS 77 as an All Call, #1, #2, or #3. For a single system, the pins are left open (All Call).

The GRS 77 has an associated Source/Destination Identifier (SDI or System ID) that is coded into its ARINC 429 output messages/labels. The System ID may be used to uniquely distinguish the source of the GDC 74A ARINC 429 labels in a system with more than one GRS 77. The GRS 77 System ID can be set to All Call, #1, #2, or #3 for such purposes.

A.6.7 GRS 77 System ID Strapping

By hard strapping the program pins listed in Section A.6.6 to ground or open, the GRS 77 is assigned a System ID. The System ID is included in each transmitted ARINC 429 word. The System ID indicates that there is only a single AHRS installed (All Call) or, if multiple units are installed, which AHRS the data originates from (#1, #2 or #3). When a single GRS 77 is installed in the system, then the pins are left open (All Call). Table A-3 shows strapping connections to achieve the desired system ID.

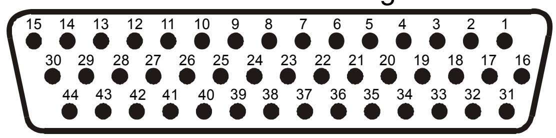
Table A-3. P771 Strapping to Achieve Desired System ID

System ID Number	ARINC System ID 1 Pin 2	ARINC System ID 2 Pin 3
All Call	Open	Open
#1	Ground	Open
#2	Open	Ground
#3	Ground	Ground

A.7 GTX 33

A.7.1 P3301 Connector

View of J3301 connector looking at rear of unit.



Pin	Pin Name	I/O
1	RESERVED	In
2	ALTITUDE A1	In
3	ALTITUDE C2	In
4	ALTITUDE A2	In
5	ALTITUDE A4	In
6	ALTITUDE C4	In
7	ALTITUDE B1	In
8	ALTITUDE C1	In
9	ALTITUDE B2	In
10	ALTITUDE B4	In
11	ALTITUDE D4	In
12	EXTERNAL IDENT SELECT*	In
13	EXTERNAL STANDBY SELECT*	In
14	NOT USED	In
15	AUDIO OUT HI	Out
16	AUDIO OUT LO	Out
17	SQUAT SWITCH IN	In
18	RESERVED	--
19	ALTITUDE ALERT ANNUNCIATE*	Out
20	RESERVED	--
21	AIRCRAFT POWER 1	In
22	RS-232 IN 1	In
23	RS-232 OUT 1	Out
24	RS-232 IN 2	In
25	RS-232 OUT 2	Out
26	ARINC 429 IN 3 A	In
27	POWER GROUND	--
28	ARINC 429 OUT 2 B	Out
29	ARINC 429 IN 3 B	In
30	ARINC 429 OUT 2 A	Out
31	EXTERNAL SUPPRESSION I/O	I/O

* Indicates Active Low

Connector P3301, continued		
Pin	**Pin Name**	**I/O**
32	ARINC 429 IN 1 A	In
33	ARINC 429 IN 2 A	In
34	ARINC 429 OUT 1 B	Out
35	ARINC 429 IN 1 B	In
36	ARINC 429 IN 2 B	In
37	ARINC 429 OUT 1 A	Out
38	RESERVED	--
39	RESERVED	--
40	SPARE	--
41	CURRENT TEMPERATURE PROBE OUT	Out
42	AIRCRAFT POWER 1	In
43	POWER GROUND	--
44	CURRENT TEMPERATURE PROBE IN	In
45	NOT USED	In
46	TIS CONNECT SELECT*	In
47	AUDIO MUTE SELECT*	In
48	ARINC 429 IN 4 A	In
49	ARINC 429 IN 4 B	In
50	ALTITUDE COMMON (GROUND)	In
51	SIGNAL GROUND	--
52	RESERVED	--
53	RESERVED	--
54	XPDR REMOTE POWER OFF	In
55	NOT USED	--
56	AIRCRAFT POWER 2	In
57	NOT USED	--
58	SIGNAL GROUND	--
59	NOT USED	--
60	AIRCRAFT POWER 2	In
61	NOT USED	--
62	SWITCHED POWER OUT	Out

* Indicates Active Low

A.7.2 Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P3301	21	In
AIRCRAFT POWER 1	P3301	42	In
AIRCRAFT POWER 2	P3301	56	In
AIRCRAFT POWER 2	P3301	60	In
SWITCHED POWER OUT	P3301	62	Out
XPDR REMOTE POWER OFF	P3301	54	In
POWER GROUND	P3301	27	--
POWER GROUND	P3301	43	--
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--

Power Input requirements are listed in the following tables. The power-input pins accept 14/28 VDC. Switched Power Out is a power source available for devices such as a remote digital altitude encoder.

A.7.3 Temperature Inputs

Pin Name	Connector	Pin	I/O
CURRENT TEMPERATURE PROBE OUT	P3301	41	Out
CURRENT TEMPERATURE PROBE IN	P3301	44	In

Temperature function is provided for the external display system via input to the GTX 33 transponder. The temperature input is used for Outside Air Temperature (OAT) display and Density Altitude computations. The type of temperature probe required is a current sensor type, such as a Garmin GTP 59 or an AD590-KH or AD592 made by Analog Devices. The GTX 33 is not configurable for different types of temperature sensors. The temperature-input specification is 1 micro amp per degree Kelvin (1 uA/°K).

A.7.4 Altitude Functions

Altitude functions with pin assignments are shown for reference since the altitude function is available in the GTX 33. In the G900X system, altitude data is received from the GIA 63W in RS-232 format.

Parallel gray code altitude inputs are considered active if either the voltage to ground is < 1.9 V or the resistance to ground is < 375 Ω. These inputs are considered inactive if the voltage to ground is 11-33 VDC.

NOTES

The GTX 33 contains internal altitude code line isolation diodes to prevent the unit from pulling the encoder lines to ground when the transponder is turned off.

If two separate altitude encoders are connected to the GTX 33, one providing parallel gray code and the other, serial data, the unit selects only one for use at a time, with serial data input receiving the highest priority.

For altitude encoders that can be connected in both serial data and parallel gray code format, such as the Garmin GAE 43 (Garmin P/N 013-00066-00), select one or the other but not both wiring connections.

Among the surveillance items the Mode S transponder will transmit to the ground stations and other aircraft are altitude reporting in 25' increments with the proper encoder. In order to report altitude in 25-foot increments the GTX 33 must receive altitude from suitable altitude reporting devices through serial input connections. Altitude input to the GTX 33 received from parallel wire gray code encoders is supplied to the unit in 100-foot increments and thus reported in 100-foot increments.

A.7.4.1 Altimeter Inputs

Pin Name	Connector	Pin	I/O
ALTITUDE D4	P3301	11	In
ALTITUDE A1	P3301	2	In
ALTITUDE A2	P3301	4	In
ALTITUDE A4	P3301	5	In
ALTITUDE B1	P3301	7	In
ALTITUDE B2	P3301	9	In
ALTITUDE B4	P3301	10	In
ALTITUDE C1	P3301	8	In
ALTITUDE C2	P3301	3	In
ALTITUDE C4	P3301	6	In
ALTITUDE COMMON	P3301	50	--

A.7.5 Discrete Function

Discrete functions with pin assignments are shown for reference since the functions are available in the GTX 33. External suppression should be connected if another transponder or DME is installed in the aircraft avionics system. Depending on system configuration, the G900X system may not use these inputs, as many functions are received from the GIA 63W in RS-232 format.

A.7.5.1 Discrete Outputs

External suppression should be connected if a DME is installed in the aircraft avionics system. The GTX 33 suppression I/O pulses may not be compatible with all models of DME. Known incompatible units include the Bendix/King KN 62, KN 64 and KNS 80. These models have an output-only suppression port and can be damaged by the GTX 33 mutual suppression output. In this case, leave the suppression pin open.

Pin Name	Connector	Pin	I/O
ALTITUDE ALERT ANNUNCIATE*	P3301	19	Out
EXTERNAL SUPPRESSION I/O (TXP/DME)	P3301	31	I/O
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--

* INACTIVE: 10 ≤ Vin ≤ 33VDC or Rin ≥100kΩ
ACTIVE: Vin ≤ 1.9VDC with ≥ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

A.7.5.2 Discrete Inputs

Pin Name	Connector	Pin	I/O
EXTERNAL IDENT SELECT*	P3301	12	In
EXTERNAL STANDBY SELECT*	P3301	13	In
SQUAT SWITCH IN	P3301	17	In
TIS CONNECT SELECT*	P3301	46	In
AUDIO MUTE SELECT*	P3301	47	In

* INACTIVE: 10 ≤ Vin ≤ 33VDC or Rin ≥100kΩ
ACTIVE: Vin ≤ 1.9VDC with ≥ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

EXTERNAL IDENT SELECT (remote IDENT) is a momentary input.

EXTERNAL STANDBY SELECT (remote STANDBY) is a momentary input used when two GTX 33 systems are installed in an aircraft. When EXTERNAL STANDBY SELECT is grounded, ARINC 429 OUT PORT 1 remains active, while PORT 2 is inactive.

When TIS is inactive, the GTX 33 logs onto TIS service when a momentary ground is applied to P3301-46. When TIS is active, a momentary ground logs off of TIS service.

An AUDIO MUTE SELECT mute switch may be used to control TIS audio alerts. TIS (Traffic) Mute must be clearly marked with MUTE ON/MUTE OFF or TIS Audio ON/Audio OFF labels. The muting feature may be enabled through a Multi-Function display. In order to prevent inadvertent muting, the status of muting must default to "Mute off" upon each power cycle.

A.7.6 Serial Data

The GTX 33 manages support for several equipment interfaces. The GTX 33 can be configured to include GPS, Airdata, AHRS, EFIS/Airdata, and ADLP 429 inputs, functioning as an ARINC 429 data concentrator.

The GTX 33 has four ARINC 429 input ports, making it capable of taking altitude, air data, heading, EFIS selected course and possible future features, and then concentrating it on the ARINC 429 OUT 2 ports for possible data link applications.

The GTX 33 is designed to feed all outgoing data to the external display via RS-232 data ports.

A.7.6.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	P3301	23	Out
RS-232 IN 1	P3301	22	In
RS-232 OUT 2	P3301	25	Out
RS-232 IN 2	P3301	24	In
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load.

When connecting two GTX 33 transponders to a GPS, the unit can only receive RS-232 serial data from one unit at a time. Use a DPDT switch for connecting both serial data and External Standby Select.

A.7.6.2 ARINC 429

Pin Name	Connector	Pin	I/O
ARINC 429 OUT 1A	P3301	37	Out
ARINC 429 OUT 1B	P3301	34	Out
ARINC 429 IN 1A	P3301	32	In
ARINC 429 IN 1B	P3301	35	In
ARINC 429 IN 2A	P3301	33	In
ARINC 429 IN 2B	P3301	36	In
ARINC 429 OUT 2A	P3301	30	Out
ARINC 429 OUT 2B	P3301	28	Out
ARINC 429 IN 3A	P3301	26	In
ARINC 429 IN 3B	P3301	29	In
ARINC 429 IN 4A	P3301	48	In
ARINC 429 IN 4B	P3301	49	In
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to five standard ARINC 429 receivers.

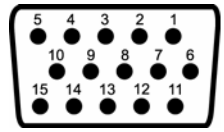
The following data is sent out at specified intervals using high speed ARINC 429 (100 kHz). The transmit data labels and their rates are as follows:

LABEL	DATA	RATE
100	Selected Course (degrees)	200 ms
203	Pressure Altitude [in feet set to 29.92" Hg (1013.25 mb)]	100 ms
204	Barometric Corrected Altitude (feet)	100 ms
206	Indicated Air Speed (knots)	100 ms
210	True Air Speed (knots)	100 ms
211	Total Air Temperature (degrees)	100 ms
213	Static Air Temperature (degrees)	100 ms
306	Joystick Lat	500 ms
307	Joystick Lon	500 ms
314	True Heading	100 ms
320	Magnetic Heading (Degrees)	100 ms
371	GA Equipment Identifier	500 ms
377	Equipment Identifier	500 ms

A.8 GCU 476 (optional)

A.8.1 P4751 Connector

View of J4751 connector from back of unit



Pin	Pin Name	I/O
1	RS-232 OUT 1	Out
2	RS-232 IN 1	In
3	RS-232 OUT 2	Out
4	RS-232 IN 2	In
5	POWER GROUND	--
6	SIGNAL GROUND	--
7	AIRCRAFT POWER 1	In
8	SIGNAL GROUND	--
9	AIRCRAFT POWER 2	In
10	CONTROL UNIT REMOTE POWER OFF	In
11	LIGHTING BUS HI	In
12	LIGHTING BUS LO	In
13	RESERVED	--
14	RESERVED	--
15	POWER GROUND	--

A.8.2 Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P4751	7	In
AIRCRAFT POWER 2	P4751	9	In
POWER GROUND	P4751	5	--
POWER GROUND	P4751	15	--
SIGNAL GROUND	P4751	6	--
SIGNAL GROUND	P4751	8	--

AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

A.8.2.1 Remote Power Off

Pin Name	Connector	Pin	I/O
CONTROL UNIT REMOTE POWER OFF	P4751	10	In

This input is used to power down the GCU 476, by a remote source. An input voltage between 6.5 VDC and 33 VDC will power-off the GCU 476. An input voltage of 3.5 VDC or less will allow the GCU 476 to power on.

A.8.3 Serial Data

A.8.3.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	P4751	1	Out
RS-232 IN 1	P4751	2	In
RS-232 OUT 2	P4751	3	Out
RS-232 IN 2	P4751	4	In

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5V when driving a standard RS-232 load.

A.8.4 Lighting

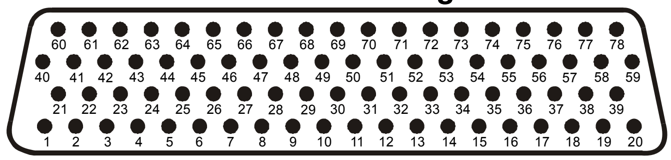
Pin Name	Connector	Pin	I/O
LIGHTING BUS HI	P4751	11	In
LIGHTING BUS LO	P4751	12	In

The GCU 476 can be configured to track a 28 VDC, 14 VDC, 5 VDC, or 5 VAC lighting bus using these inputs. The GCU 476 can also automatically adjust for ambient lighting conditions based on photocell input.

A.9 GDL 69A (optional)

A.9.1 P691 Connector

View of J691 connector looking at rear of unit.



Pin	Pin Name	I/O
1	Config Module Ground	Out
2	RS-232 Out 2	Out
3	RS-232 Out 3	Out
4	Signal Ground	--
5	RS-232 In 2	In
6	RS-232 In 3	In
7	RS-232 In 1	In
8	RS-232 Out 1	Out
9	Data Link System ID Program 1	In
10	Data Link System ID Program 2	In
11	Signal Ground	--
12	Spare	--
13	Signal Ground	--
14	Spare	--
15	Spare	--
16	Spare	--
17	Audio Out Low	--
18	Audio Out Right	Out
19	Audio Out Left	Out
20	Power Ground	--
21	Config Module Power Out	Out
22	Ethernet In 1 B	In
23	Ethernet In 1 A	In
24	Ethernet Out 1 B	Out
25	Ethernet Out 1 A	Out
26	Ethernet In 2 B	In
27	Ethernet In 2 A	In
28	Ethernet Out 2 B	Out
29	Ethernet Out 2 A	Out
30	Ethernet In 3 B	In
31	Ethernet In 3 A	In
32	Ethernet Out 3 B	Out
33	Ethernet Out 3 A	Out
34	Spare	--
35	Aircraft Power 1	In
36	Spare	--
37	Aircraft Power 2	In

Connector P741, continued		
Pin	**Pin Name**	**I/O**
38	Spare	--
39	Signal Ground	--
40	Config Module Data	I/O
41	Spare	--
42	Spare	--
43	Spare	--
44	Spare	--
45	Spare	--
46	Spare	--
47	Spare	--
48	Spare	--
49	Spare	--
50	Spare	--
51	Spare	--
52	Line Out Low	--
53	Line Out Right	Out
54	Line Out Left	Out
55	Spare	--
56	Ethernet In 4 B	In
57	Ethernet In 4 A	In
58	Ethernet Out 4 B	Out
59	Ethernet Out 4 A	Out
60	Config Module Clock	Out
61	Audio Suppression Hi 1	--
62	Audio Suppression Hi 2	--
63	Audio Suppression Hi 3	--
64	Audio Suppression Lo 1*	--
65	Audio Suppression Lo 2*	--
66	Audio Suppression Lo 3*	--
67	Discrete In 2	In
68	Discrete In 1	In
69	Test Enable	In
70	Audio Mute*	In
71	Channel Up (+)*	In
72	Channel Down (-)*	In
73	Volume Up (+)*	In
74	Volume Down (-)*	In
75	Signal Ground	--
76	Spare	--
77	Data Link Remote Power Off	In
78	Power Ground	In

* Indicates Active Low

A.9.2 Power

Pin Name	Connector	Pin	I/O
Aircraft Power 1	P691	35	In
Aircraft Power 2	P691	37	In
Power Ground	P691	20	--
Power Ground	P691	78	--
Data Link Remote Power Off	P691	77	In

The GDL 69A will accept input power from 14/28 VDC. The two aircraft power inputs (Aircraft Power 1, Aircraft Power 2) are intended to allow power to be provided by two different power busses. Typically, both power input pins are connected on a single bus through a single circuit breaker. If power is obtained from two different power busses, each leg should have its own circuit breaker.

The unit will turn off if this input is pulled above 3 volts. The unit will turn ON if the input is left floating or grounded. The input presents a load of greater than 100 kΩ.

A.9.3 RS-232

Pin Name	Connector	Pin	I/O
RS-232 Out 2	P691	2	Out
RS-232 Out 3	P691	3	Out
Signal Ground	P691	4	--
RS-232 In 2	P691	5	In
RS-232 In 3	P691	6	In
RS-232 In 1	P691	7	In
RS-232 Out 1	P691	8	Out
Signal Ground	P691	11	--

A.9.4 Ethernet

Pin Name	Connector	Pin	I/O
Ethernet In 1 B	P691	22	In
Ethernet In 1 A	P691	23	In
Ethernet Out 1 B	P691	24	Out
Ethernet Out 1 A	P691	25	Out
Ethernet In 2 B	P691	26	In
Ethernet In 2 A	P691	27	In
Ethernet Out 2 B	P691	28	Out
Ethernet Out 2 A	P691	29	Out
Ethernet In 3 B	P691	30	In
Ethernet In 3 A	P691	31	In
Ethernet Out 3 B	P691	32	Out
Ethernet Out 3 A	P691	33	Out
Ethernet In 4 B	P691	56	In
Ethernet In 4 A	P691	57	In
Ethernet Out 4 B	P691	58	Out
Ethernet Out 4 A	P691	59	Out

All four ports are set up to a connection speed of 10 Mb/s.

A.9.5 Discrete Inputs

Pin Name	Connector	Pin	I/O
Volume Increment	P691	73	In
Volume Decrement	P691	74	In
Audio Mute	P691	70	In
Channel Increment	P691	71	In
Channel Decrement	P691	72	In
Audio Suppression Hi 1	P691	61	In
Audio Suppression Hi 2	P691	62	In
Audio Suppression Hi 3	P691	63	In
Audio Suppression Lo 1*	P691	64	In
Audio Suppression Lo 2*	P691	65	In
Audio Suppression Lo 3*	P691	66	In

The Volume Increment, Volume Decrement, and Mute discrete provides audio volume control of the audio output. (Note: The volume and mute controls have no affect on the Line Out output volume.)

There are six discrete inputs for audio suppression. There are three active low and three active high inputs. The Audio Suppression inputs suppress the Audio Out output by activating any one of multiple inputs. The threshold voltages are as follows:

Active HIGH discrete inputs: Input will go active with input voltages above 8.5V
Active LOW discrete inputs: Input will go active with input voltages below 5.0V

A.9.6 Audio Out

Pin Name	Connector	Pin	I/O
Audio Out Low	P691	17	--
Audio Out Right	P691	18	Out
Audio Out Left	P691	19	Out

A.9.7 Line Out

Pin Name	Connector	Pin	I/O
Line Out Low	P691	52	--
Line Out Right	P691	53	Out
Line Out Left	P691	54	Out

The Line Out output is always at a fixed output. The Line Out is not affected by the volume controls, mute function, and suppression inputs.

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APPENDIX B AIRFRAME SPECIFIC INSTALLATION INSTRUCTIONS

Airframe specific installation instructions are to be provided in a subsequent revision of this manual. These instructions will include required mounting locations for the GRS 77 and GMU 44 for each supported airframe.

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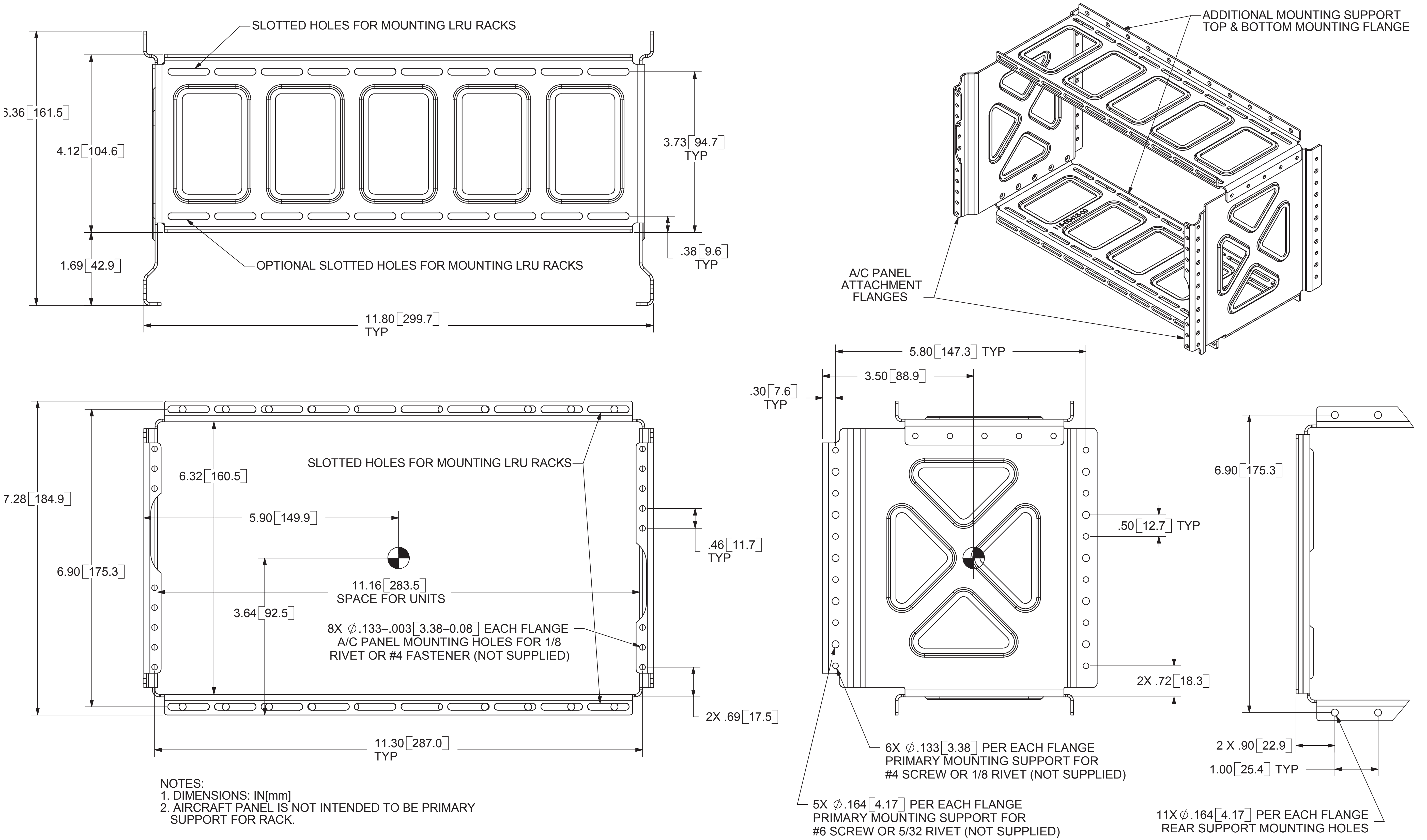


NOTES:
1. DIMENSIONS: IN[mm]
2. AIRCRAFT PANEL IS NOT INTENDED TO BE PRIMARY SUPPORT FOR RACK.

Figure C-1. 10 Inch Main System Rack (Garmin P/N 115-00413-00) Drawing

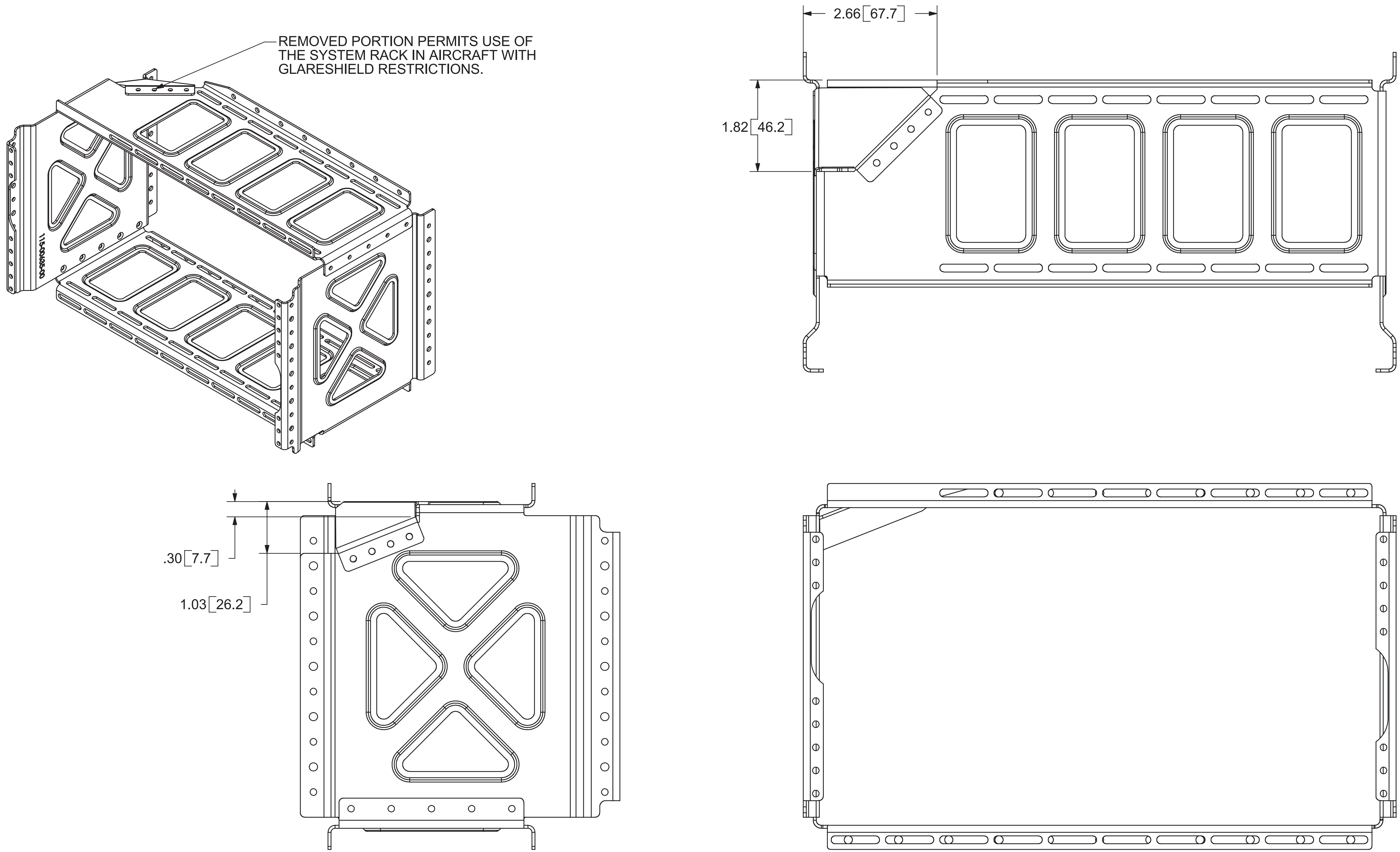


Figure C-2. Truncated Main System Rack (Garmin P/N 115-00635-00) Drawing

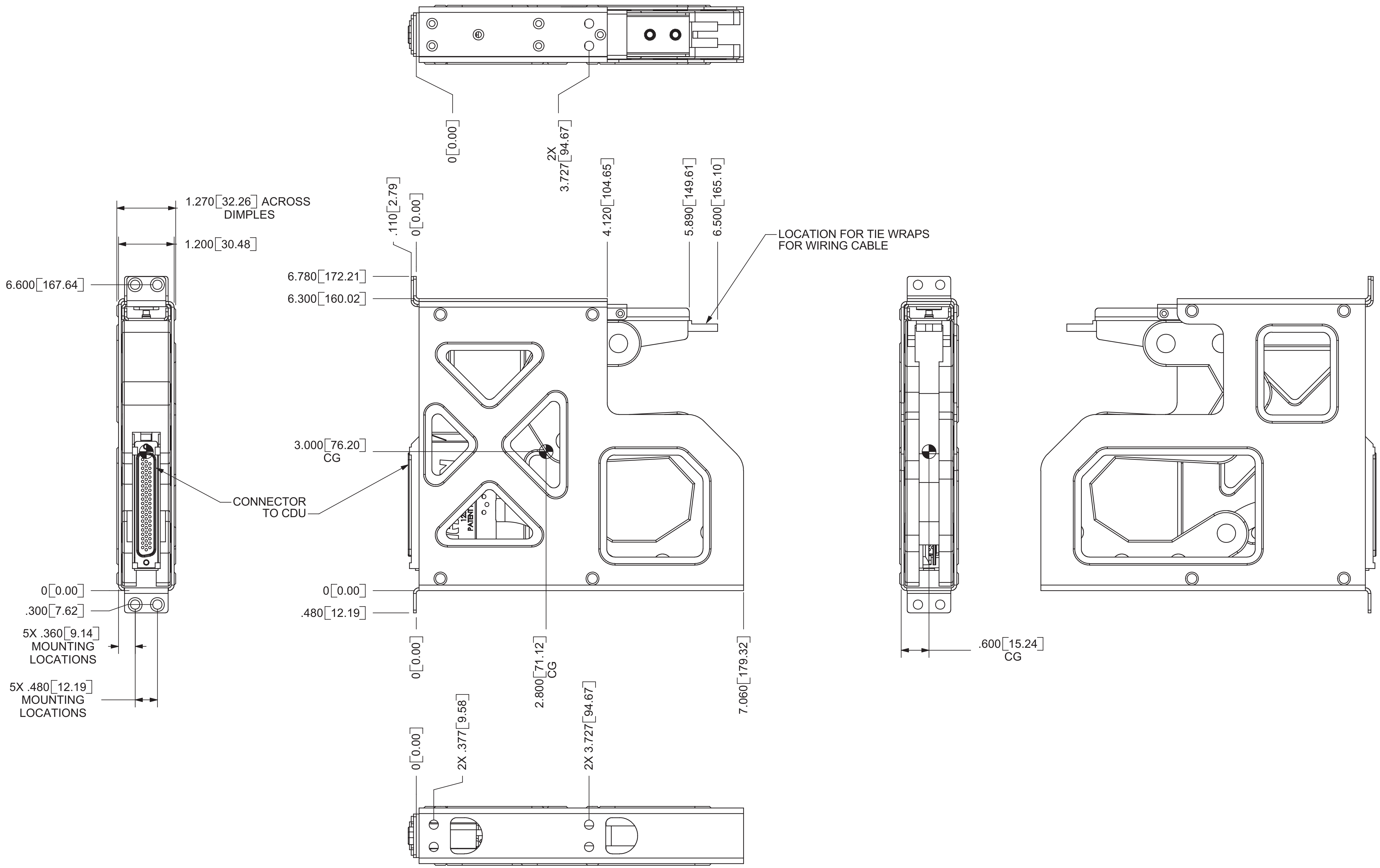


Figure C-3. CHiPS Outline Drawing (optional)

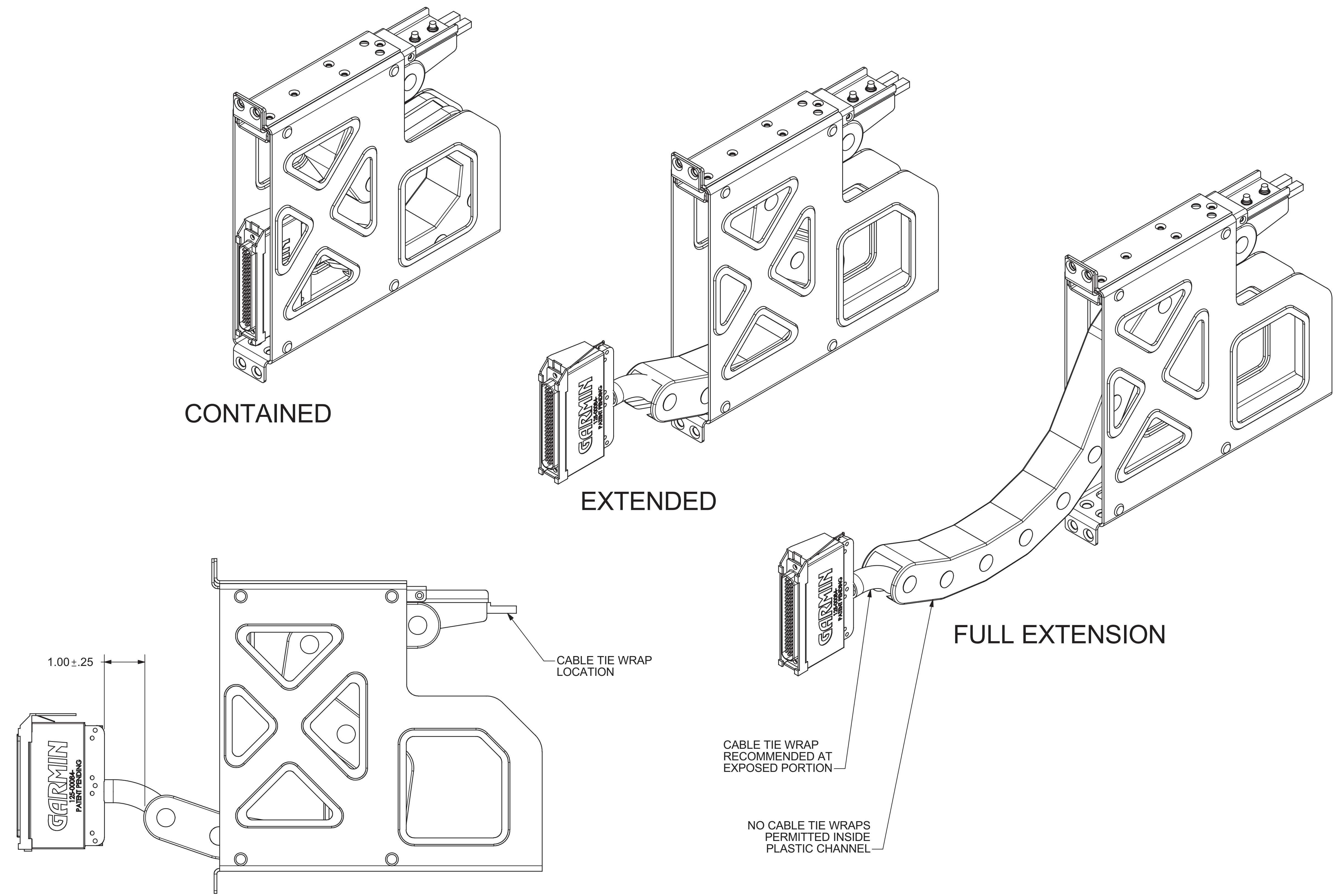


Figure C-4. CHiPS Installation Drawing (optional)

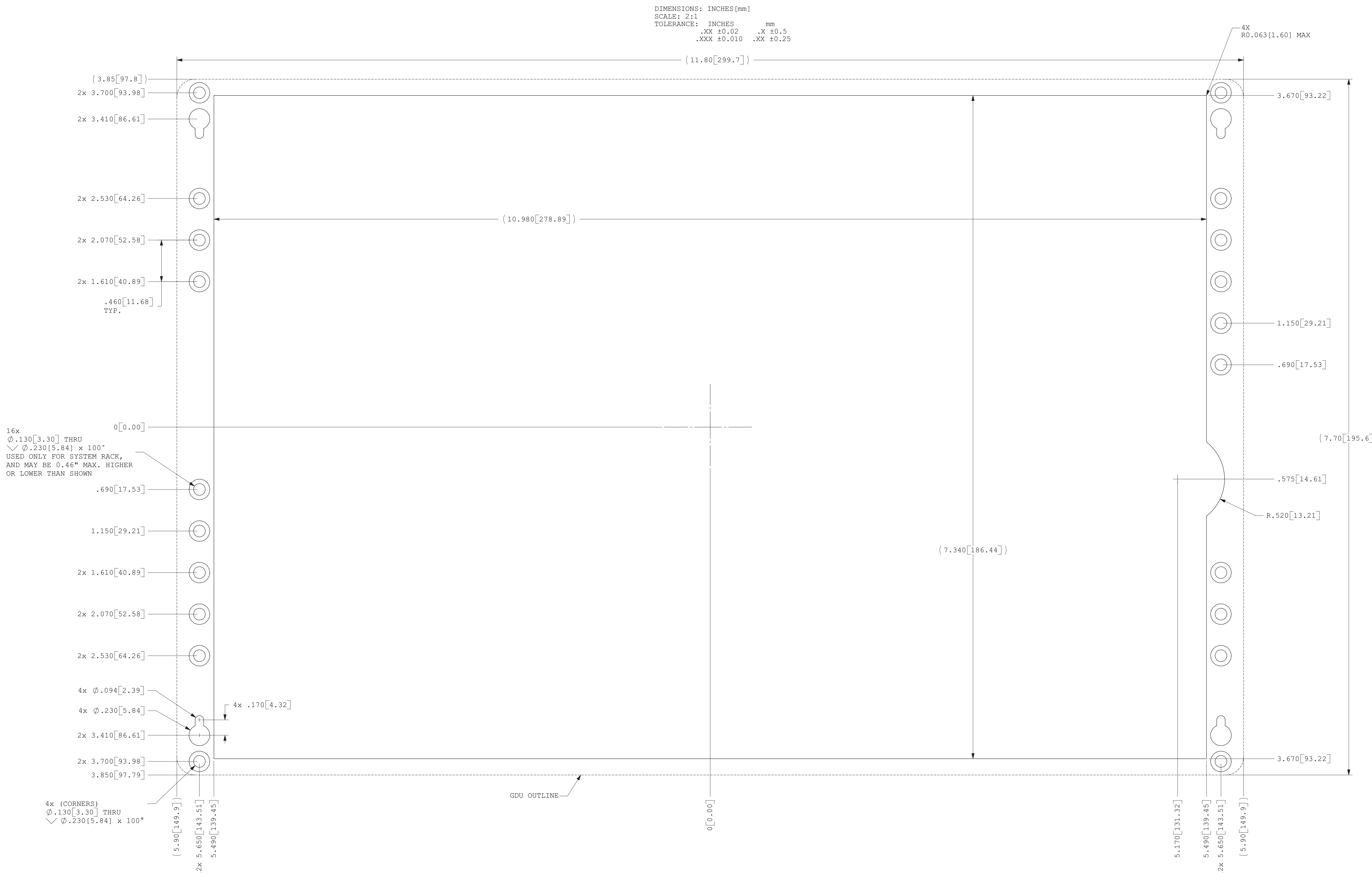
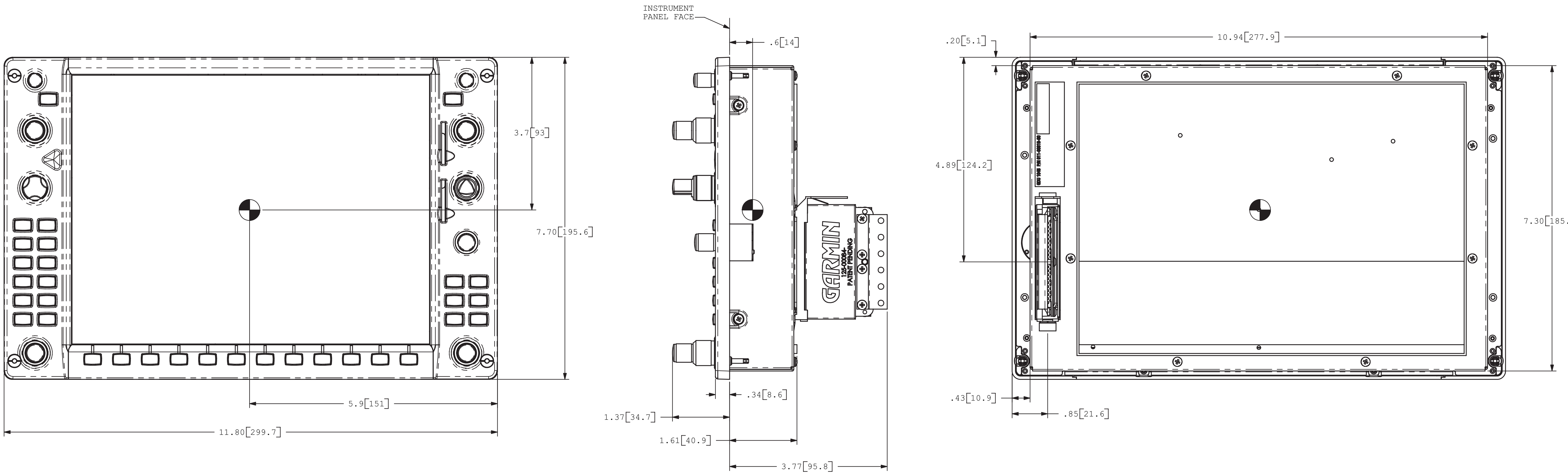


Figure C-5. GDU 1040 Cutout Drawing (Not To Scale)



NOTES:
1. DIMENSIONS: INCHES[mm].
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.

Figure C-6. GDU 1040 Outline Drawing

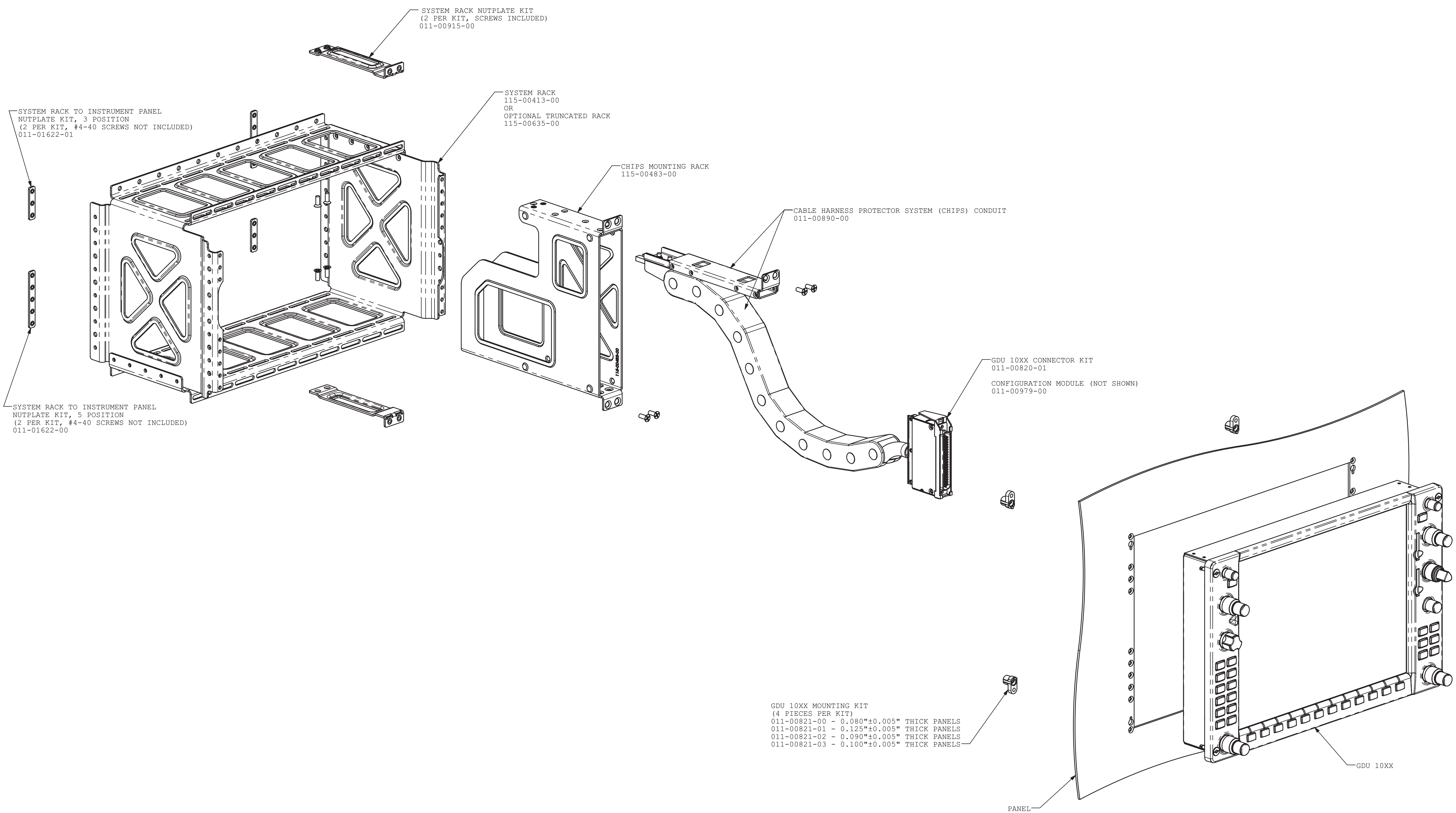
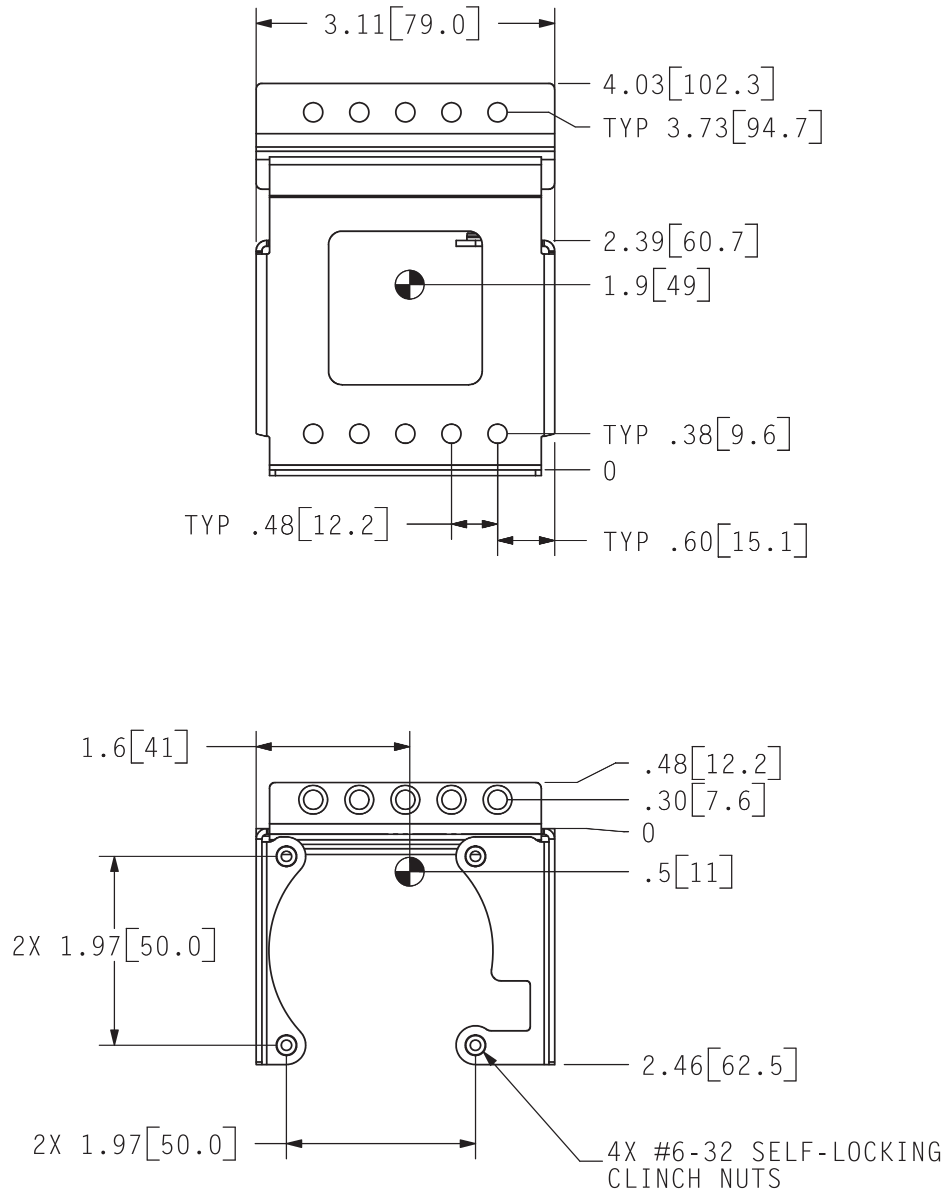
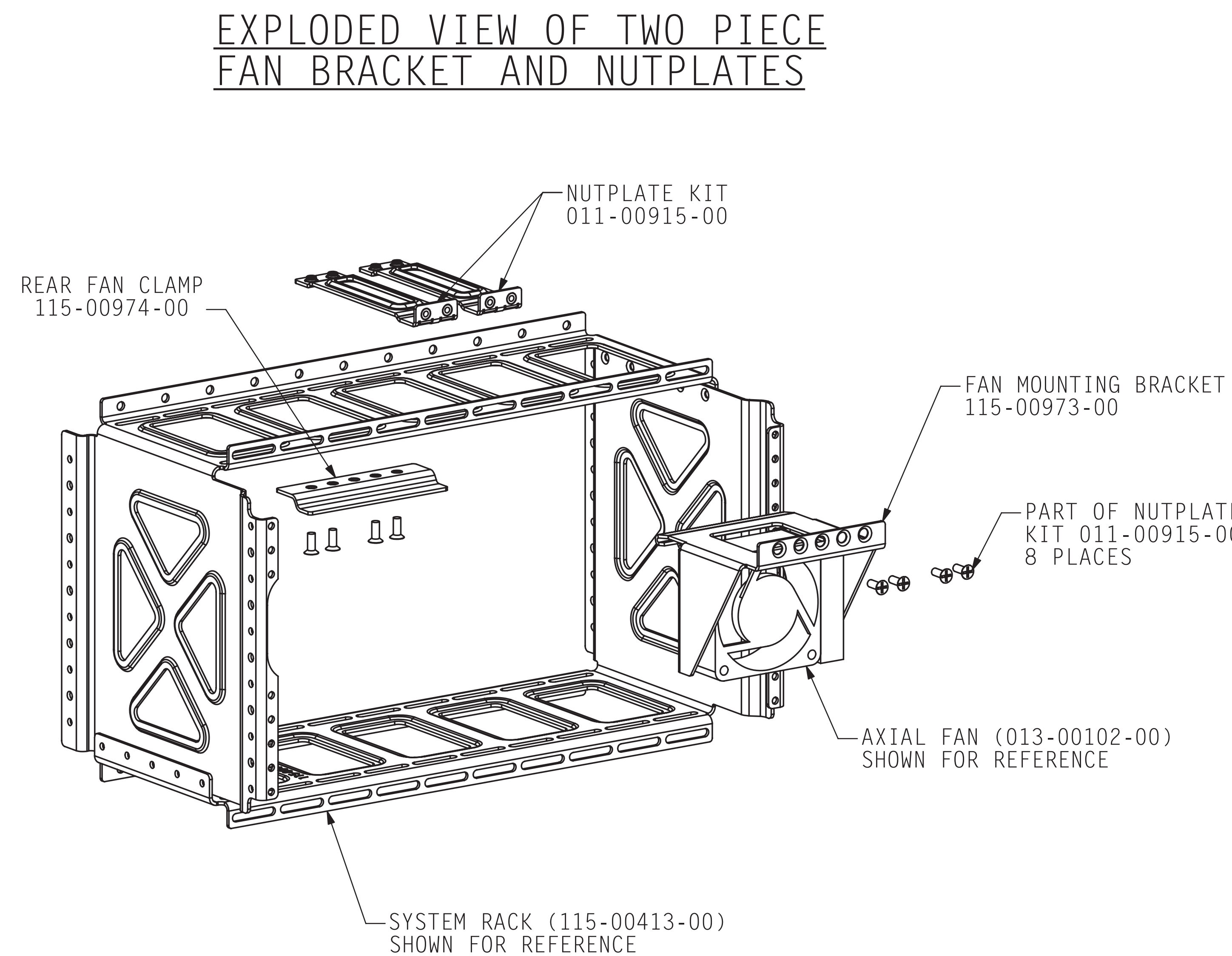


Figure C-7. GDU 1040 Installation Drawing





NOTES:
1. 115-00973-00 AND 115-00974-00 ARE DESIGNED TO SECURE A 2.36[60.0] AXIAL FAN WITH A WEIGHT OF .25 LBS INTO A SYSTEM RACK.
2. SECURE 115-00973-00 AND 115-00974-00 INTO A SYSTEM RACK WITH 011-00915-00 NUTPLATE KIT.
3. DIMENSIONS: INCHES[mm]
4. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.

Figure C-8. Fan Bracket Drawing (Sheet 1 of 2)

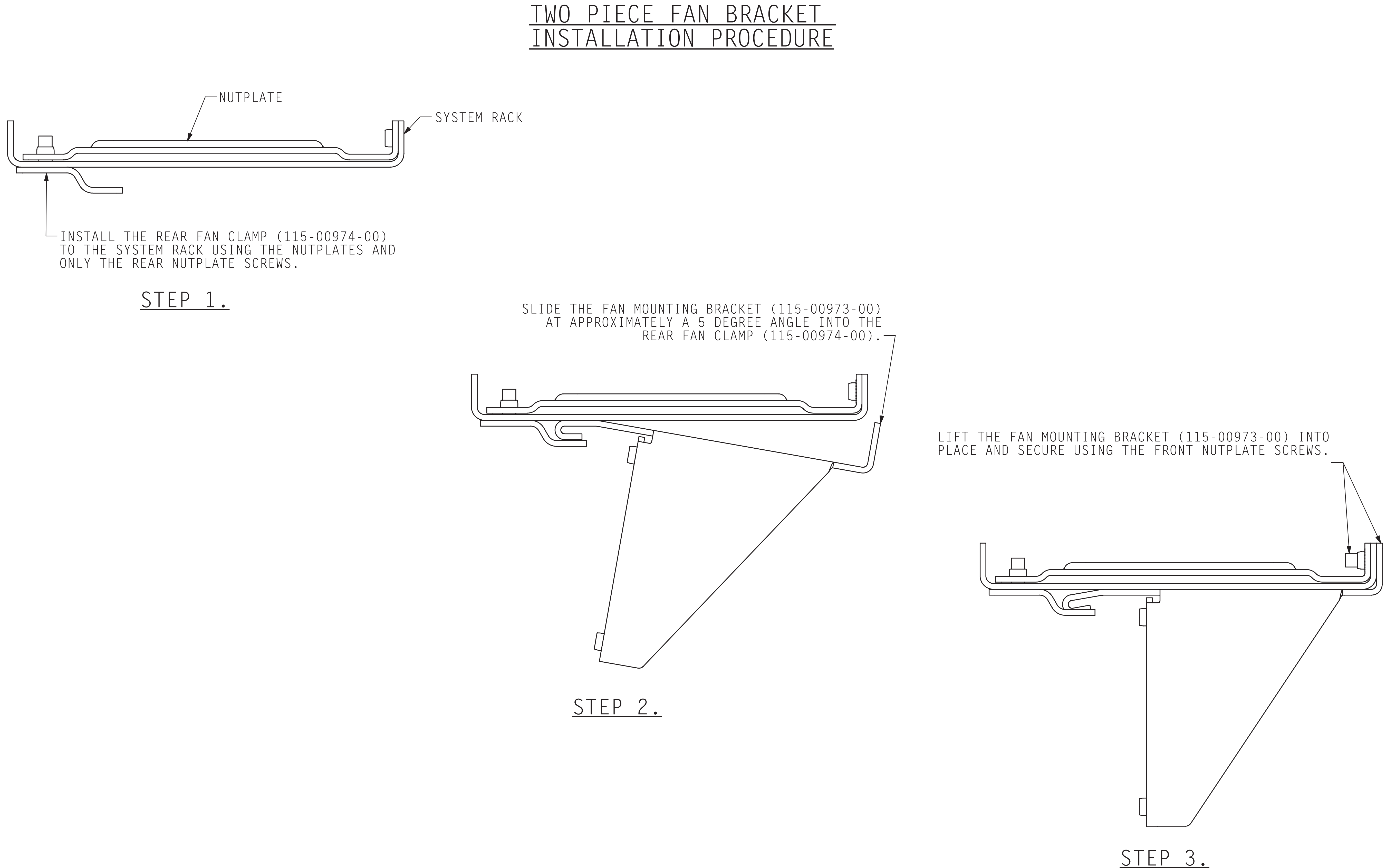


Figure C-9. Fan Bracket Drawing (Sheet 2 of 2)

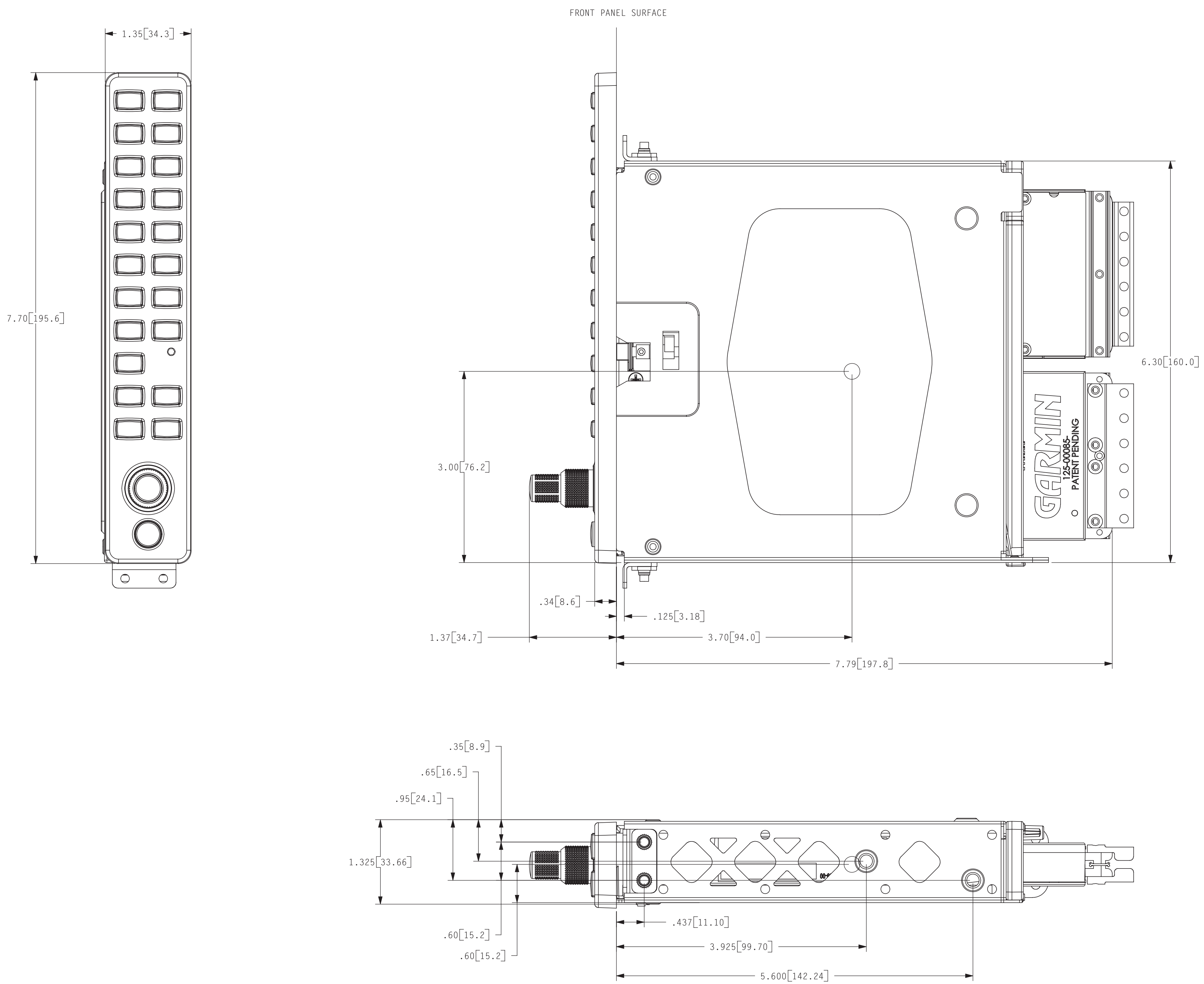


Figure C-10. GMA 1347 Outline Drawing

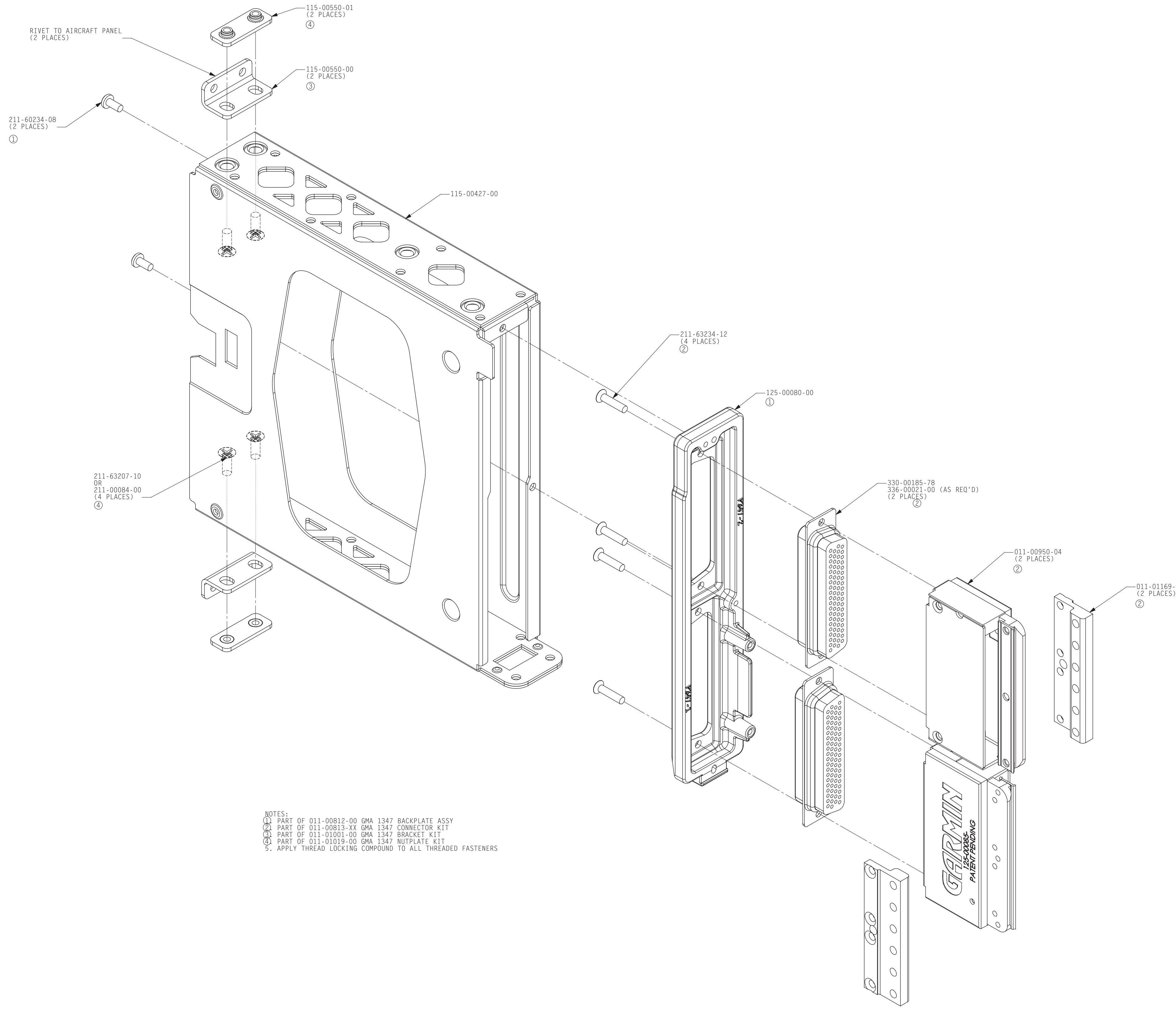
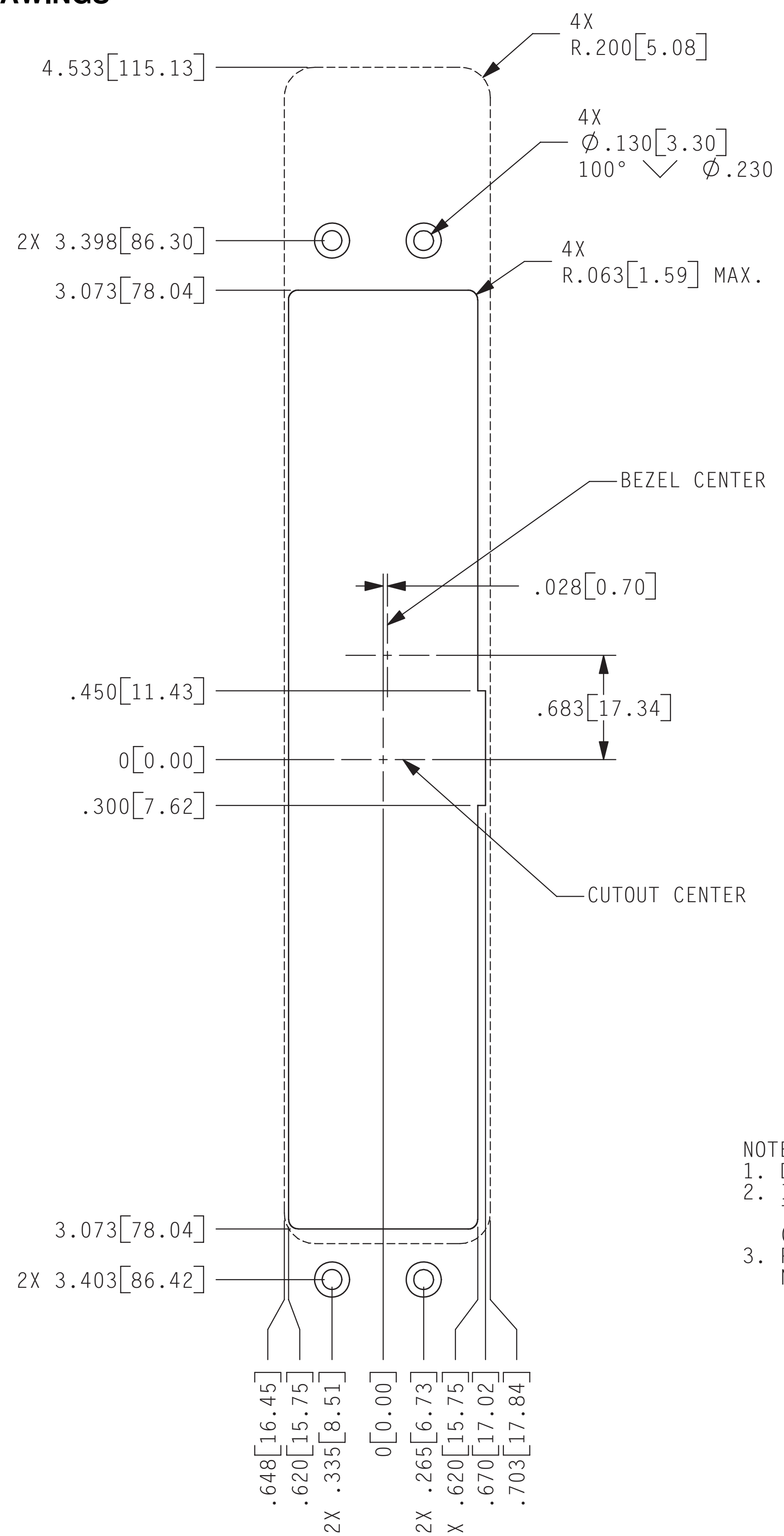
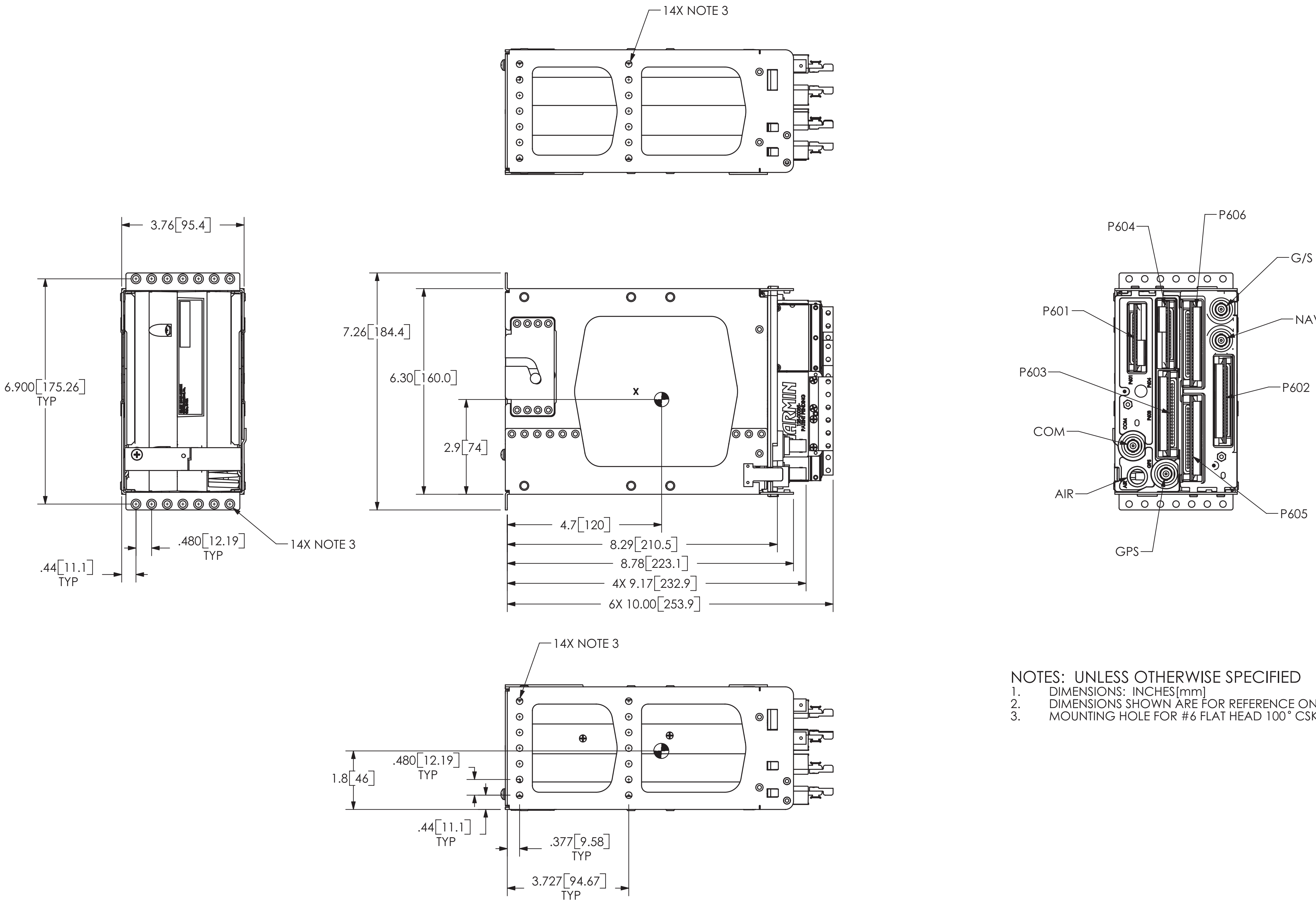


Figure C-11. GMA 1347 Connector/Rack Assembly Drawing



NOTES:
1. DIMENSIONS: INCHES [mm]
2. IF THE FRONT LIP OF THE MOUNTING RACK IS BEHIND THE SURFACE OF THE AIRCRAFT PANEL, THE UNIT CONNECTORS MAY NOT FULLY ENGAGE.
3. RACK MUST BE INSTALLED FROM BACK OF AIRCRAFT PANEL ONLY. MAXIMUM AIRCRAFT PANEL THICKNESS IS .125 [3.2].

Figure C-12. GMA 1347 Recommended Panel Cutout Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED
1. DIMENSIONS: INCHES[mm]
2. DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
3. MOUNTING HOLE FOR #6 FLAT HEAD 100° CSK SCREW (42 PLCS).

Figure C-13. GIA 63W Outline Drawing

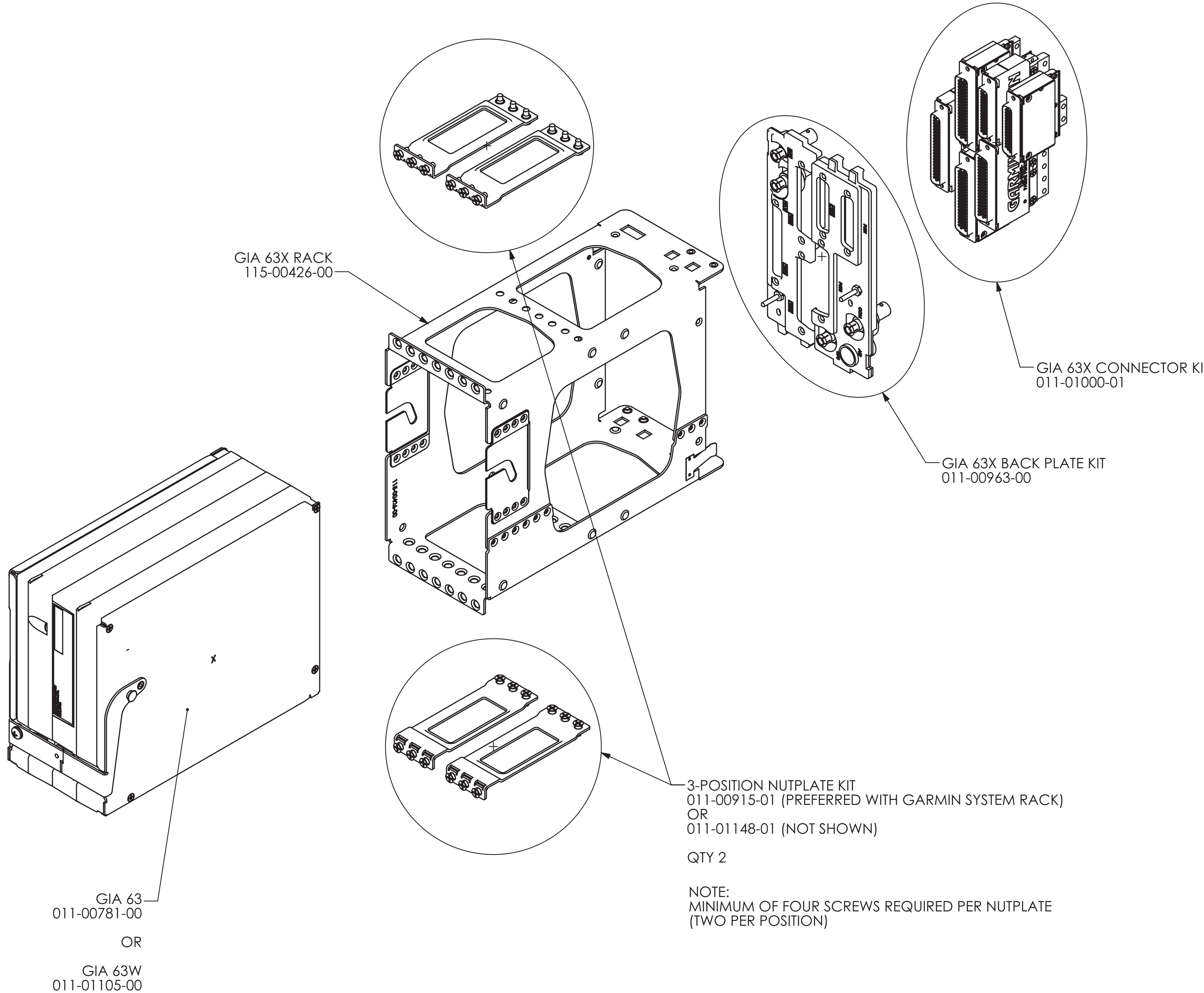


Figure C-14. GIA 63W Installation Drawing

Note: Dimensions in inches [mm].

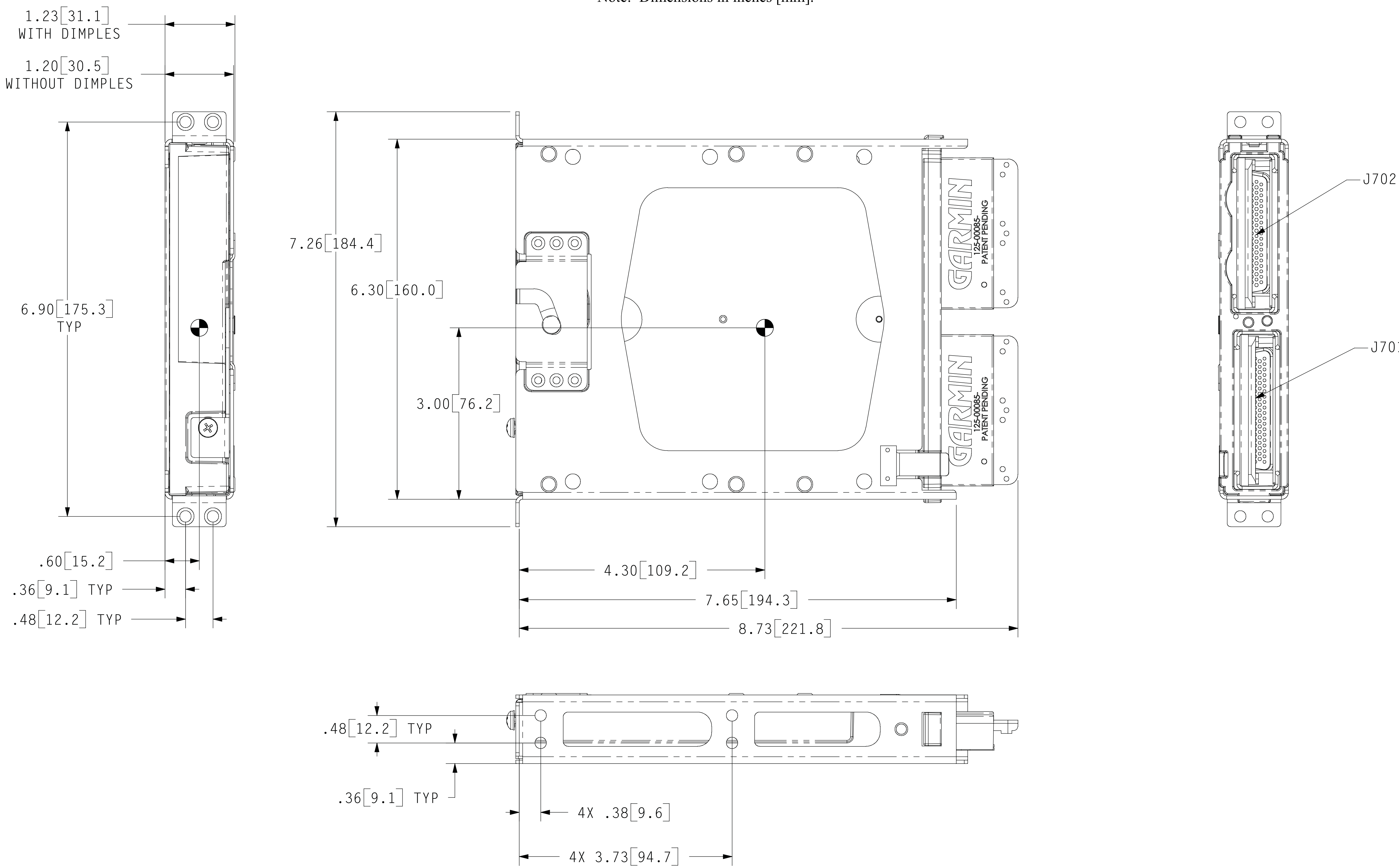


Figure C-15. GEA 71 Outline Drawing

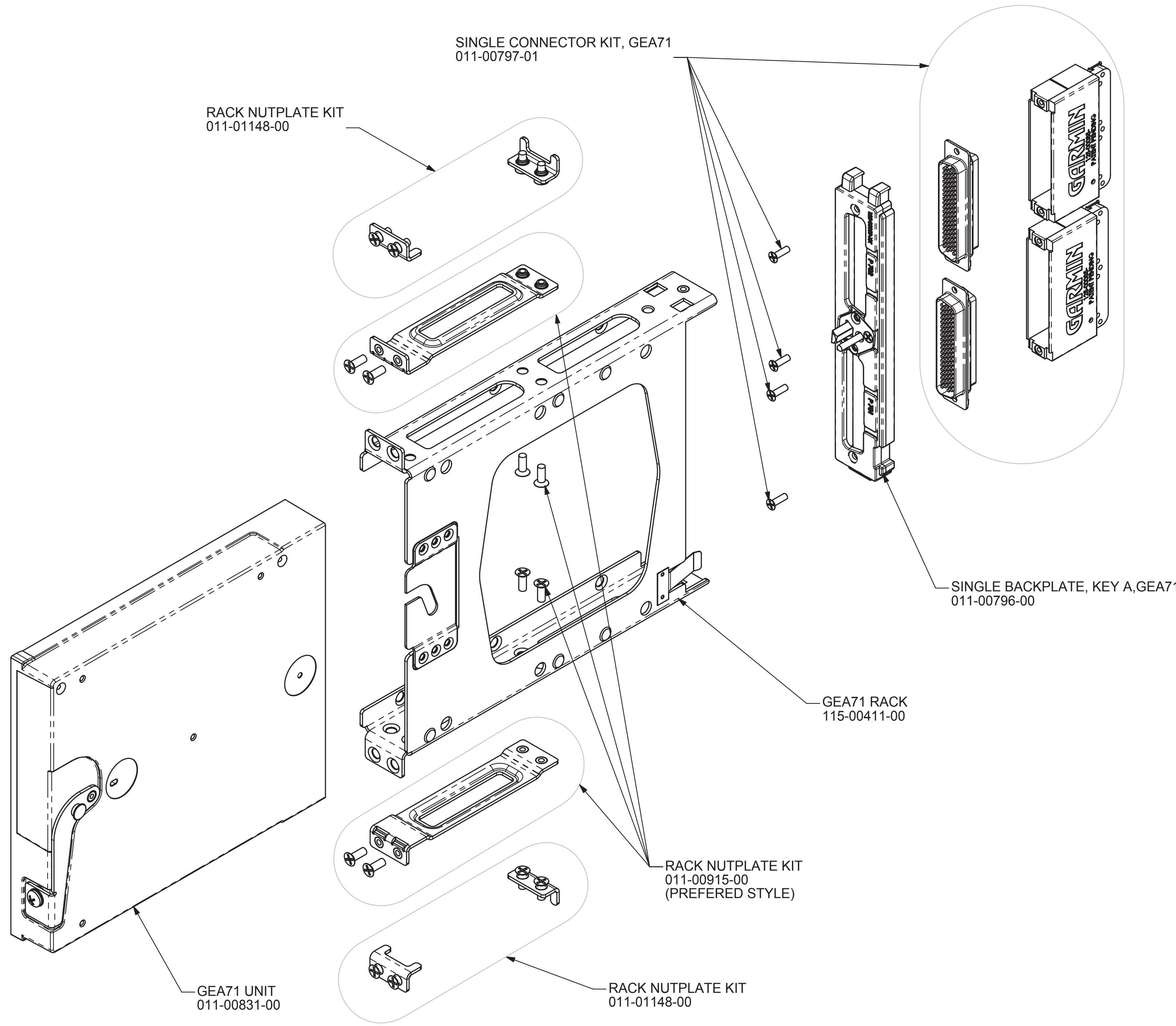


Figure C-16. GEA 71 Installation Drawing

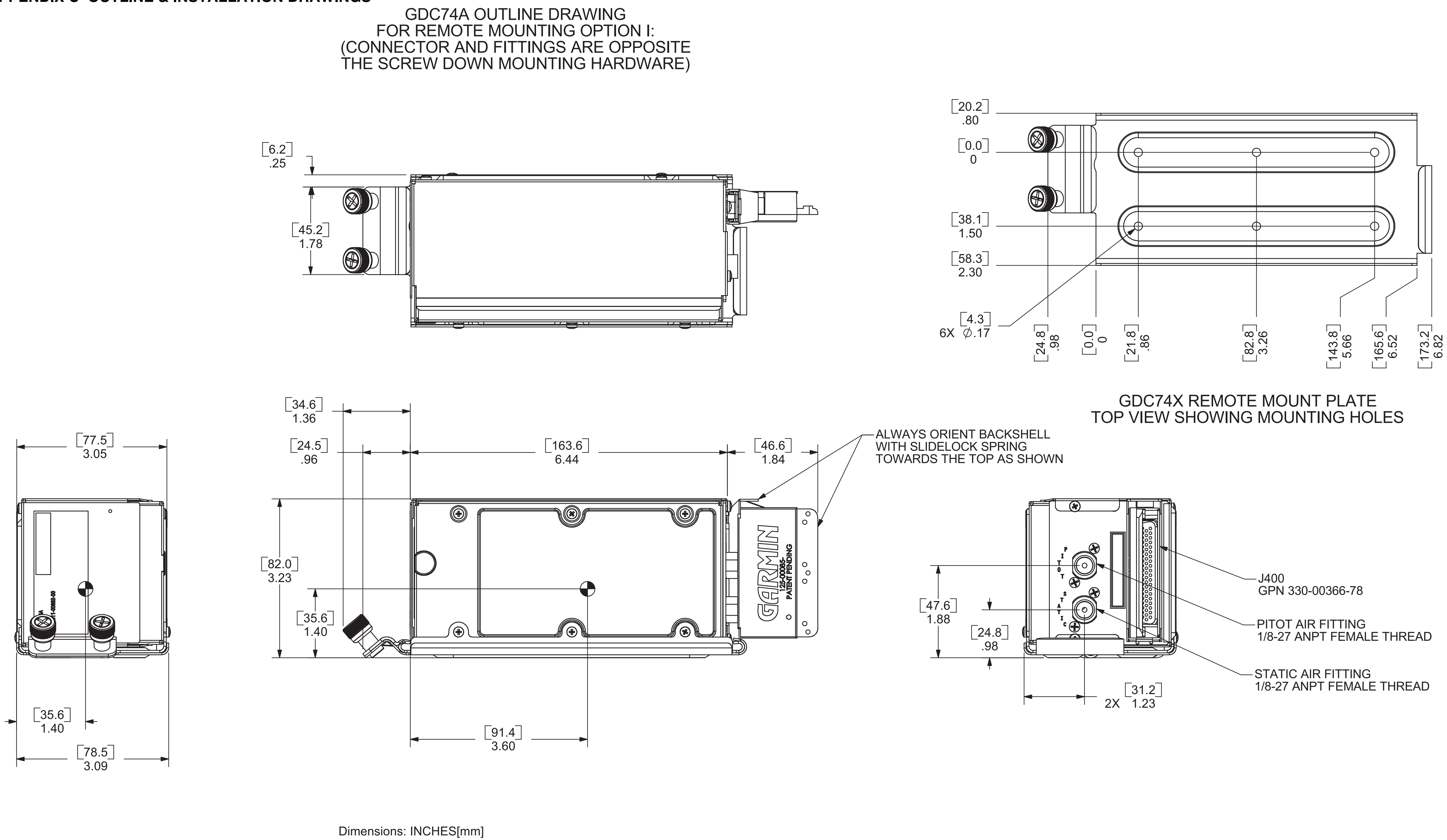
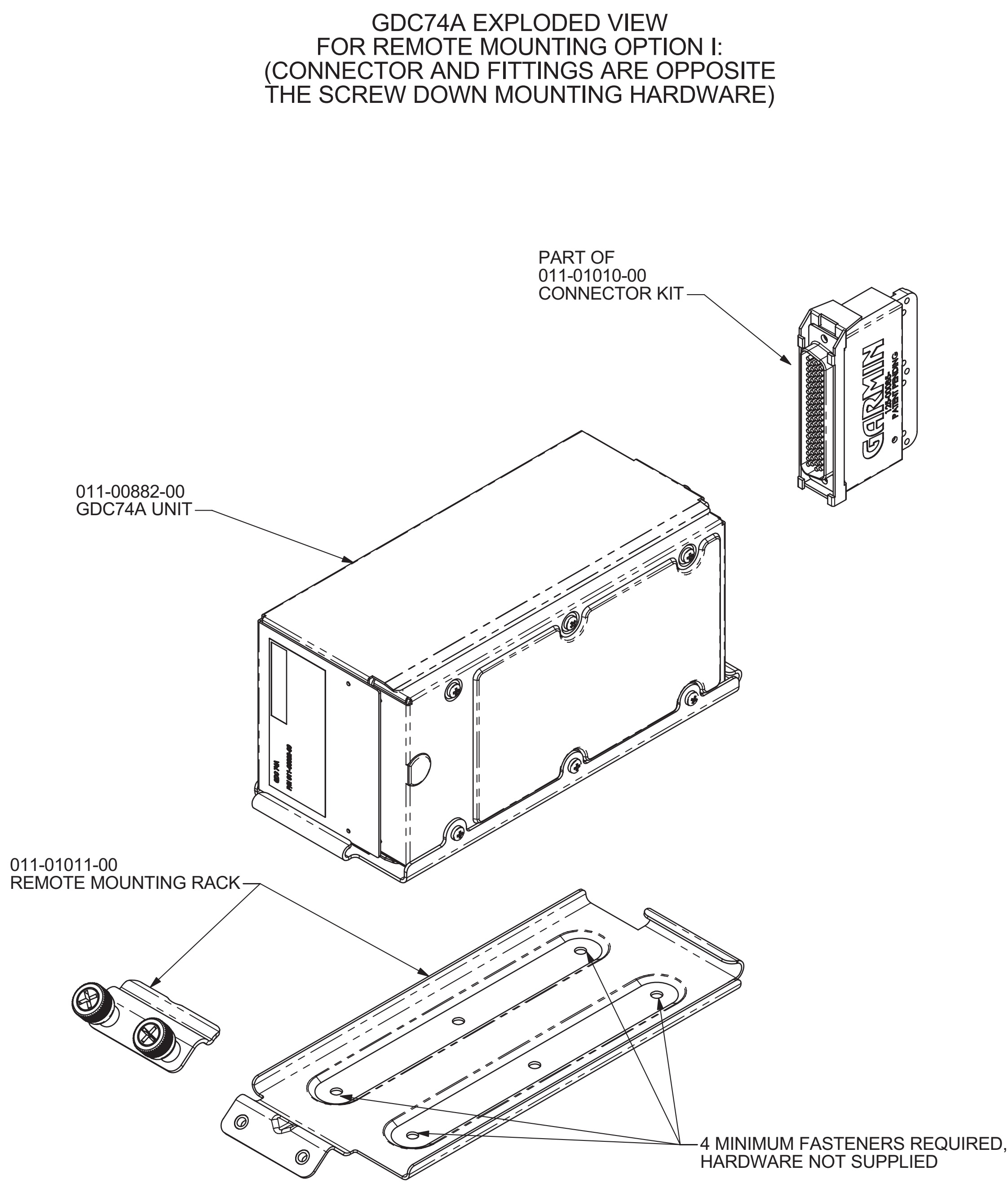


Figure C-17. GDC 74A Outline Drawing for Remote Mounting Option I (Sheet 1 of 2)



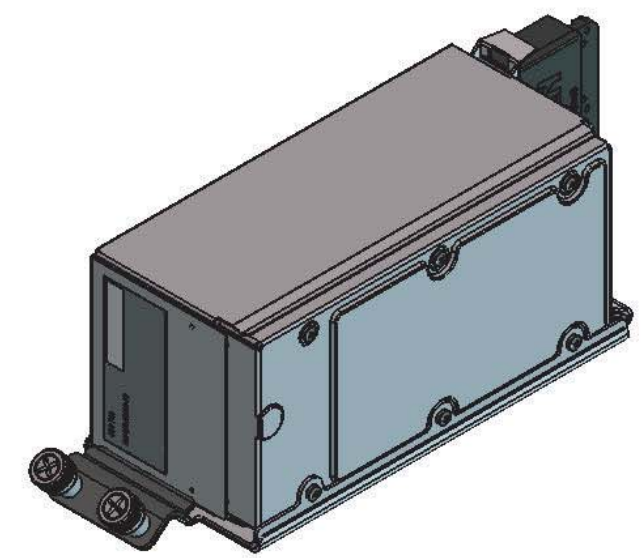


Figure C-18. GDC 74A Outline Drawing for Remote Mounting Option I (Sheet 2)

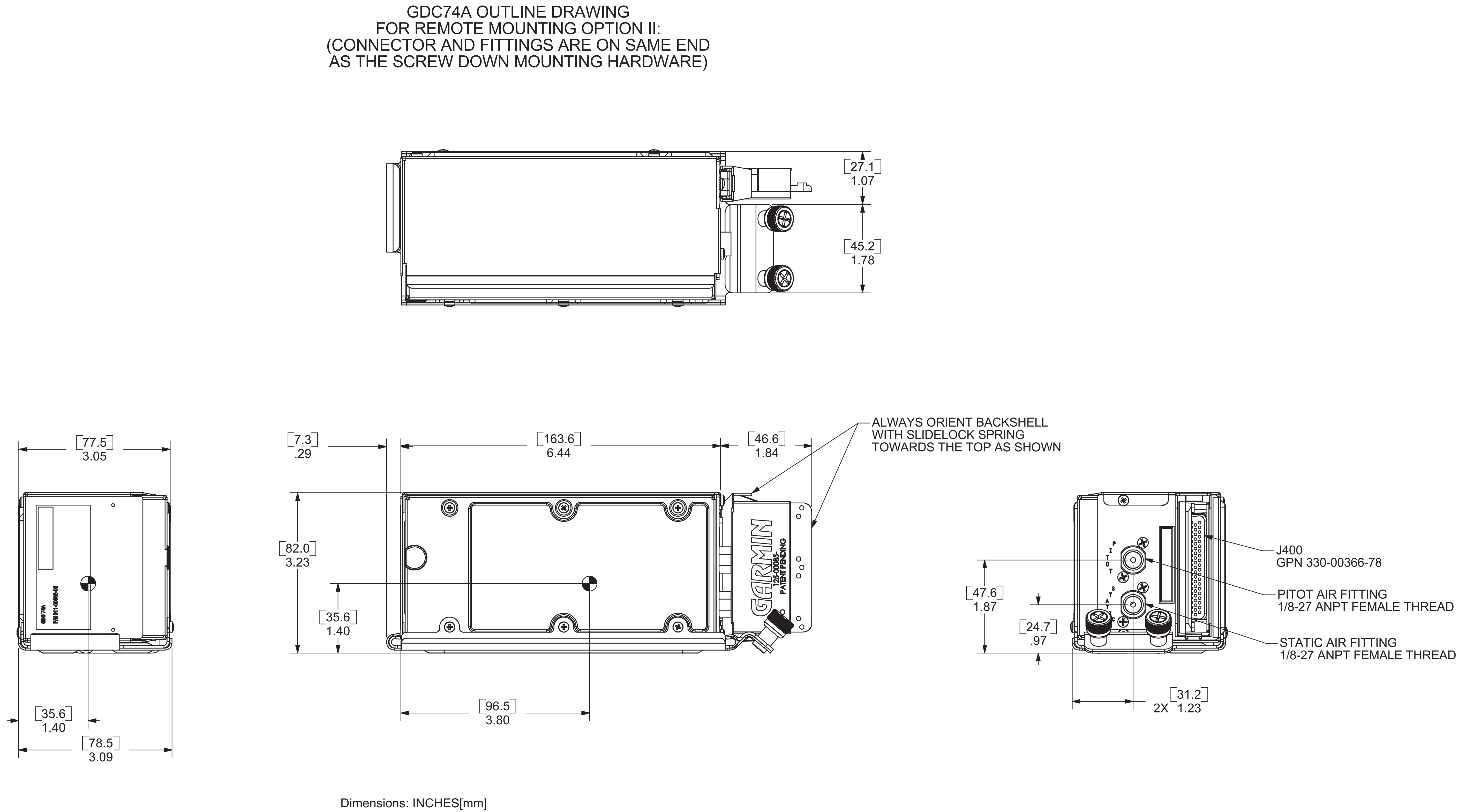
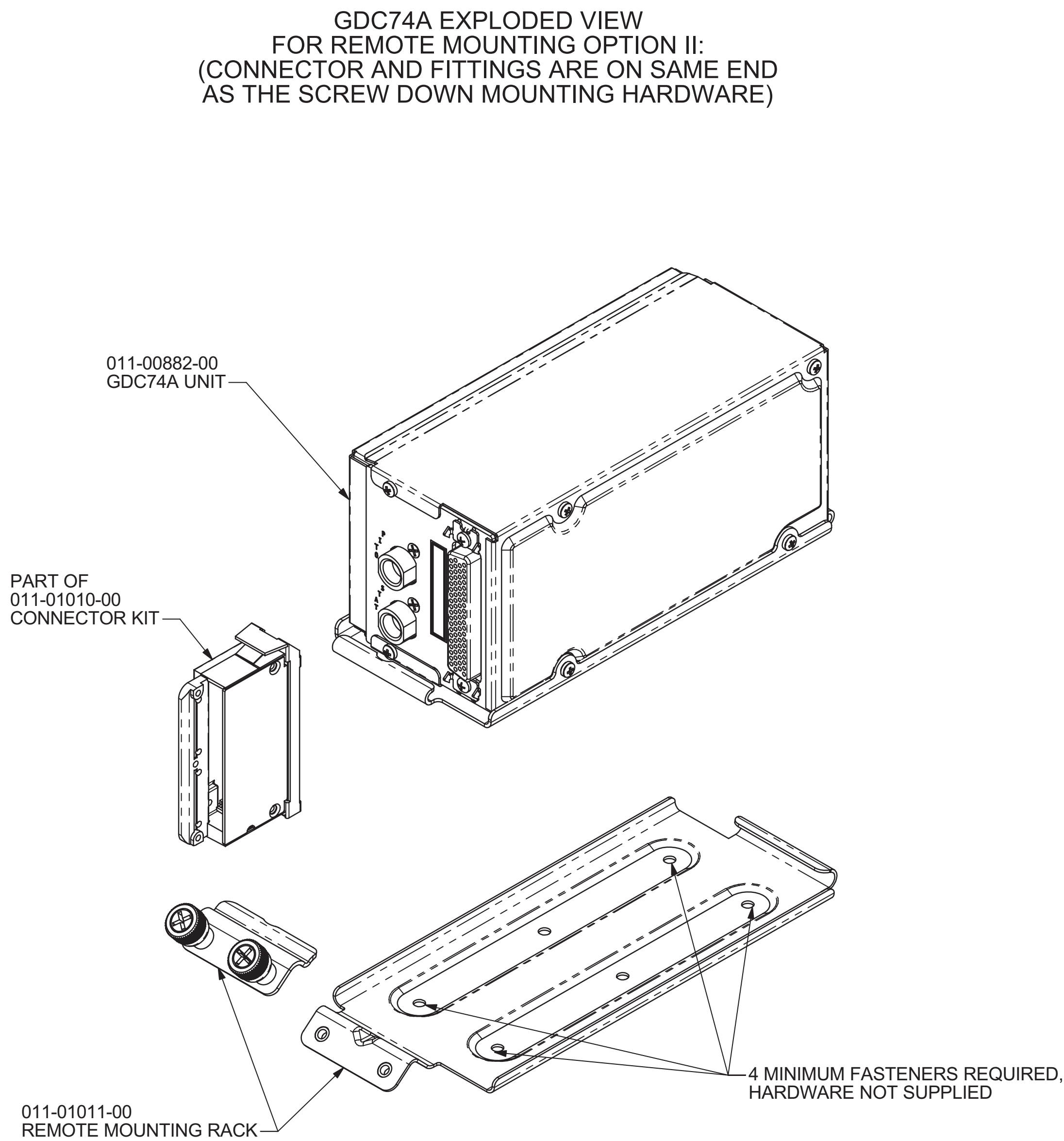


Figure C-19. GDC 74A Outline Drawing for Remote Mounting Option II (Sheet 1 of 2)



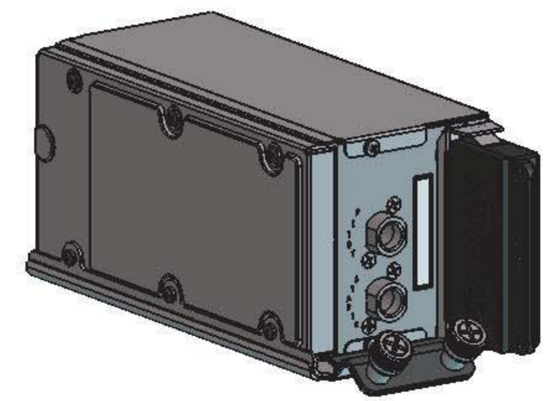


Figure C-20. GDC 74A Outline Drawing for Remote Mounting Option II (Sheet 2)

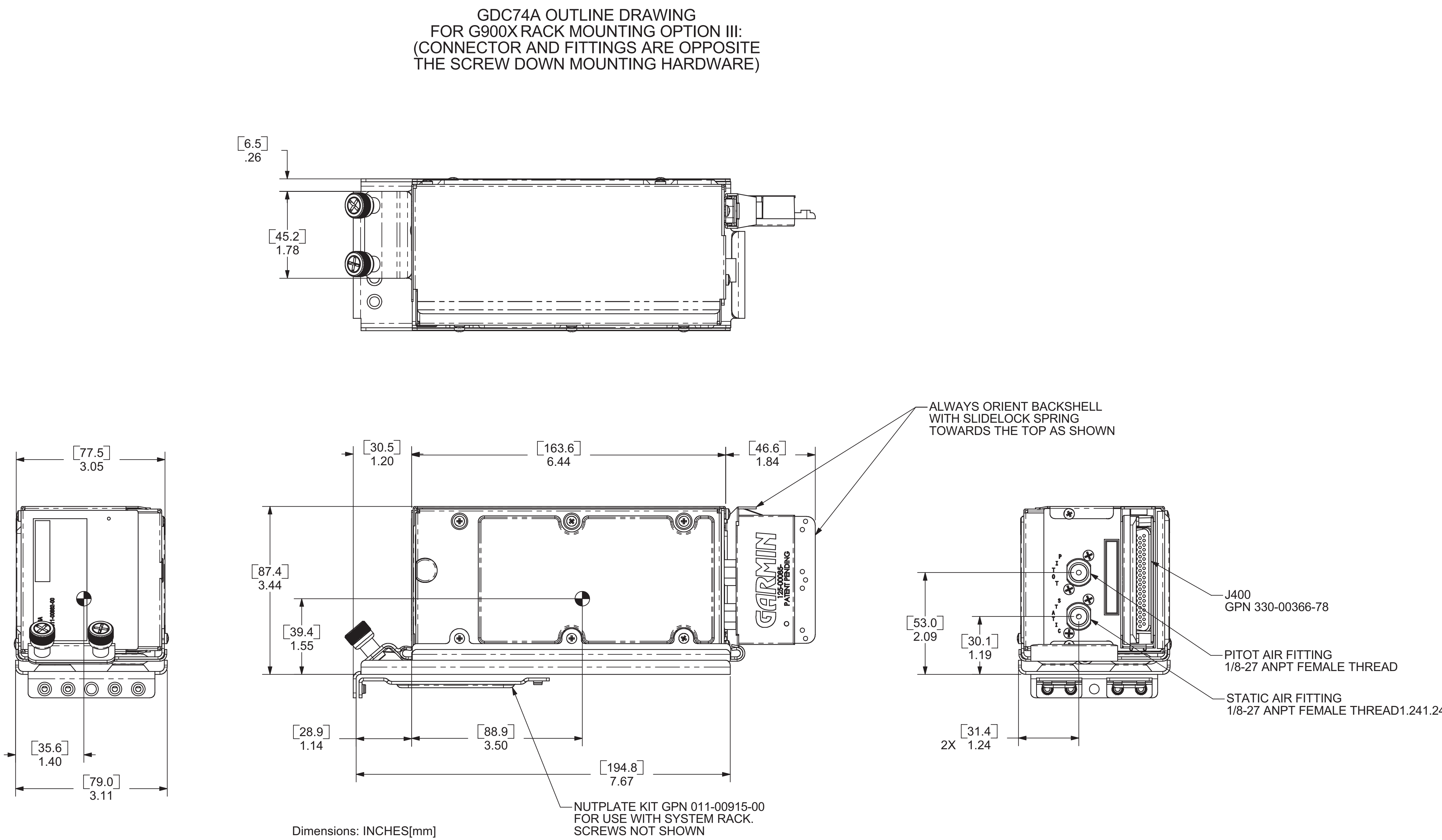
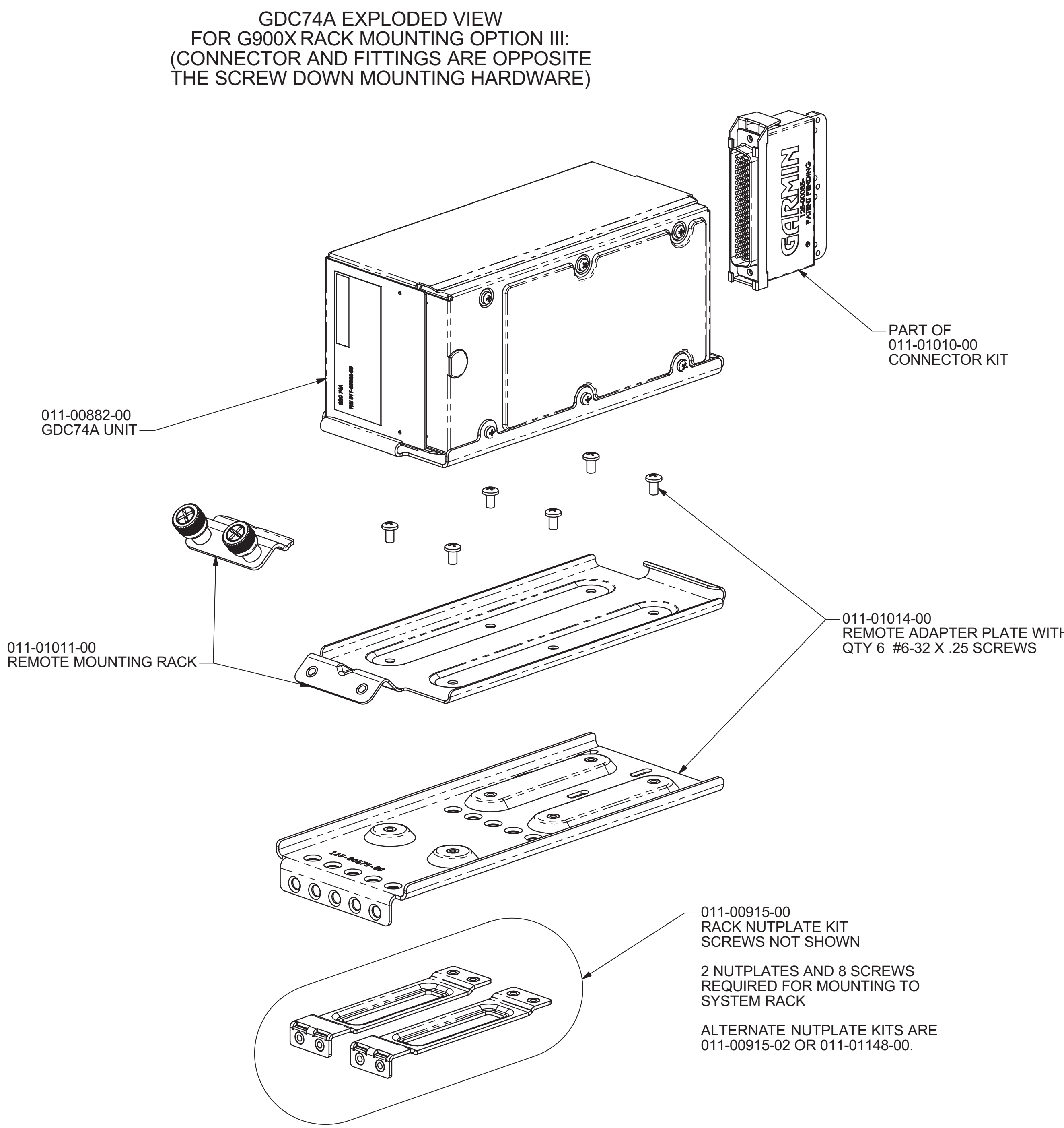


Figure C-21. GDC 74A Outline Drawing for Rack Mounting (Sheet 1 of 2)



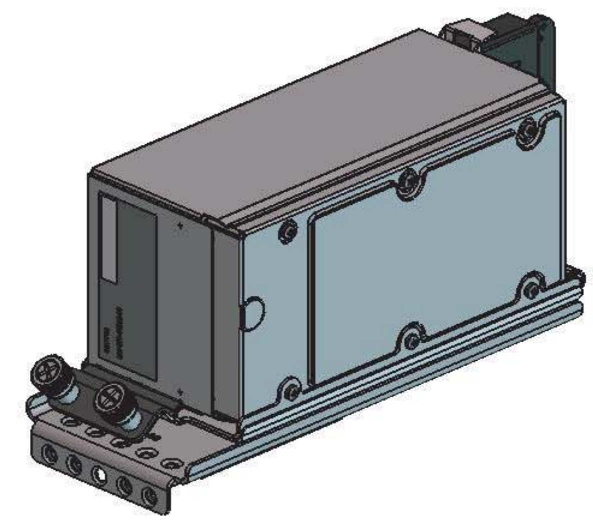
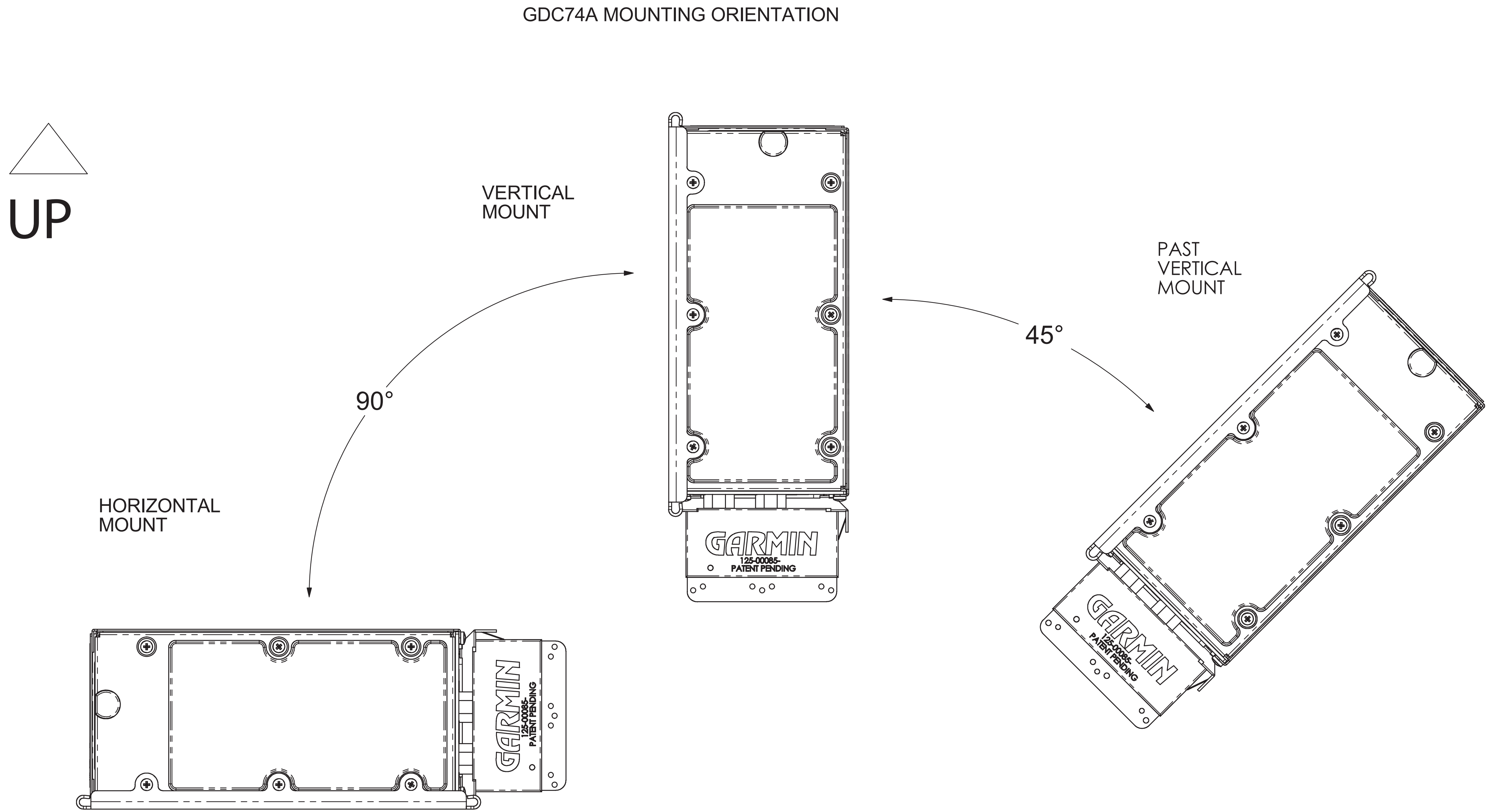


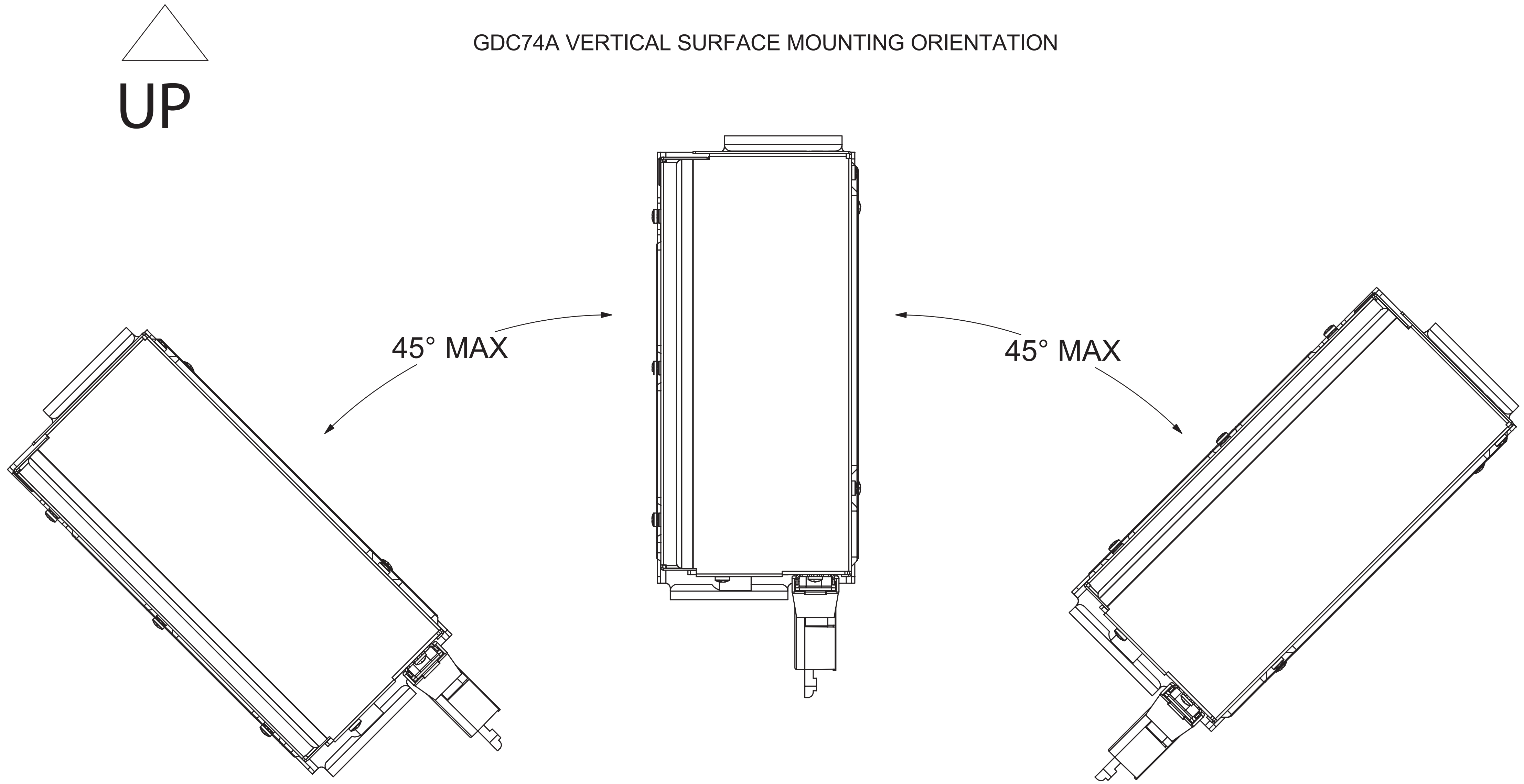
Figure C-22. GDC 74A Outline Drawing for Rack Mounting (Sheet 2)



NOTES:
1. ORIENTATION MUST BE LIMITED TO RANGE SHOWN TO AVOID FLUID ACCUMULATION INSIDE UNIT.

UNIT MAY BE ORIENTED AS SHOWN IN ANY POSITION FROM HORIZONTAL TO 45 DEGREES PAST VERTICAL.

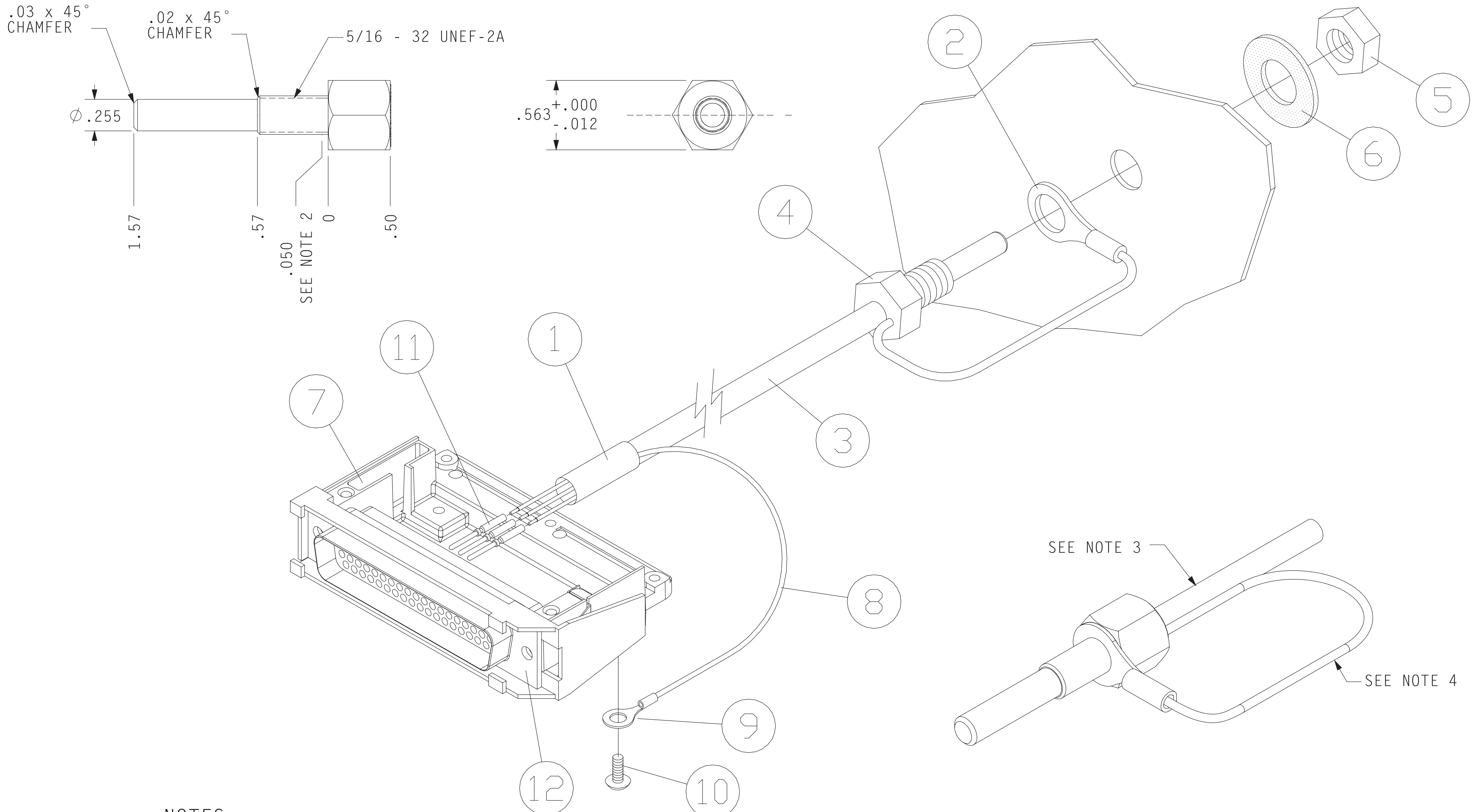
Figure C-23. GDC 74A Mounting Orientation (Sheet 1 of 2)



NOTES:
1. ORIENTATION MUST BE LIMITED TO RANGE SHOWN
TO AVOID FLUID ACCUMULATION INSIDE UNIT.

UNIT MAY BE ORIENTED ON VERTICAL SURFACE AS SHOWN.
MOUNTING ORIENTATION MUST BE WITHIN 45 DEGREES OF
VERTICAL.

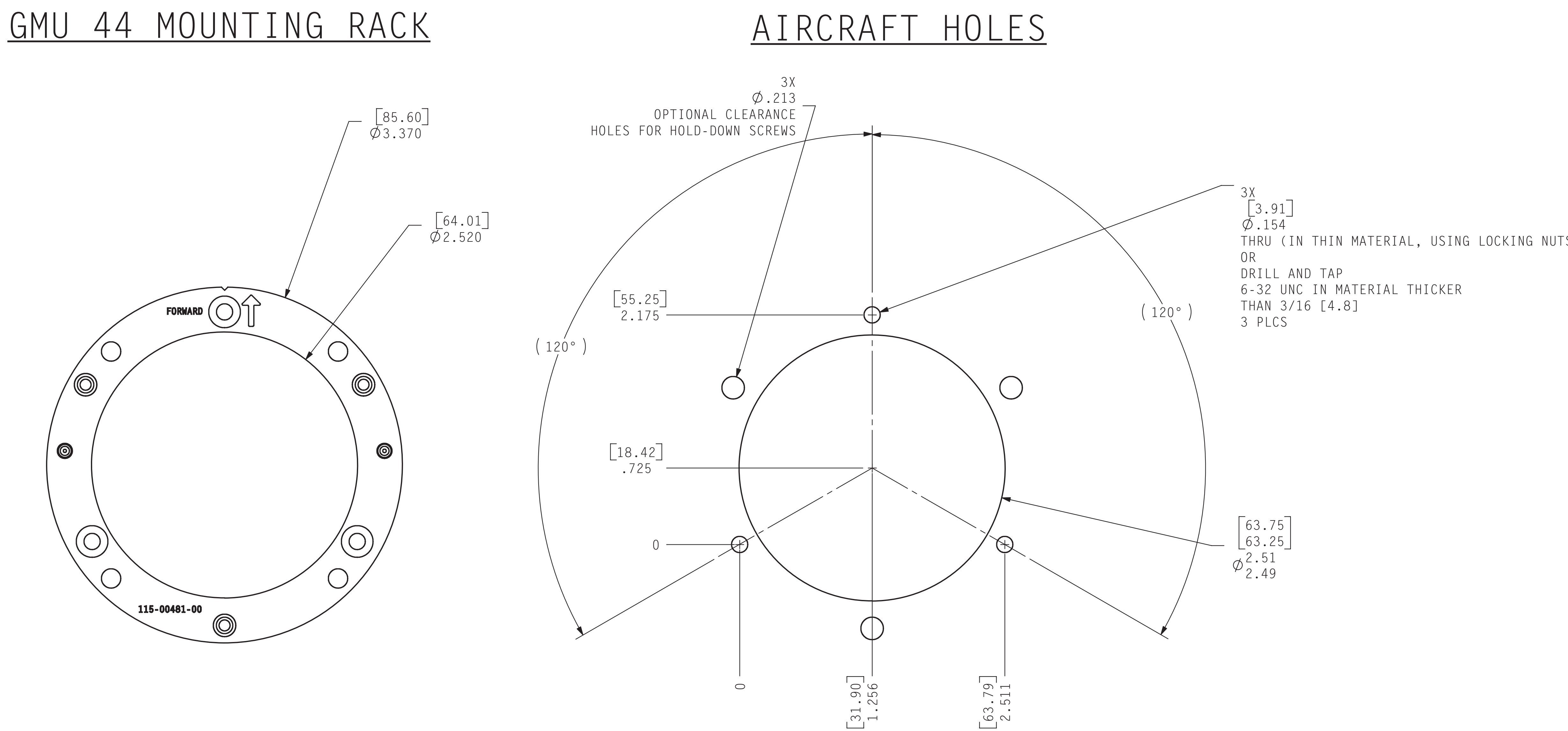
Figure C-24. GDC 74A Mounting Orientation (Sheet 2)



NOTES:

1. DIMENSIONS: INCHES
2. MAX HEIGHT OF INCOMPLETE THREAD: 0.050
3. CABLE: M27500-22TE3V14. CABLE LENGTH TO BE 10 FEET ± 6 INCHES
4. 16 AWG WIRE: M22759/16-16. LENGTH OF WIRE OUTSIDE OF CASE TO BE 3.5 INCHES +0.25, -0.
5. SOLDER TERMINAL: MS25036-109
6. SHIELD OF CABLE ELECTRICALLY CONNECTED TO 16 AWG WIRE.
7. BUBBLE NUMBERS IN THIS DRAWING REFER TO REFERENCE NUMBERS LISTED IN TABLE 6-9.

Figure C-25. GTP 59 O.A.T. Probe Wiring Detail



NOTE:
1. DIMENSIONS IN INCHES [mm].
2. REFER TO APPENDIX B FOR APPROVED AIRFRAME SPECIFIC MOUNTING BRACKETS AND LOCATIONS.
3. FOLLOW "FORWARD" AND "TOP" INDICATIONS ON UNIT AND RACK.

Figure C-26. GMU 44 Mounting Rack

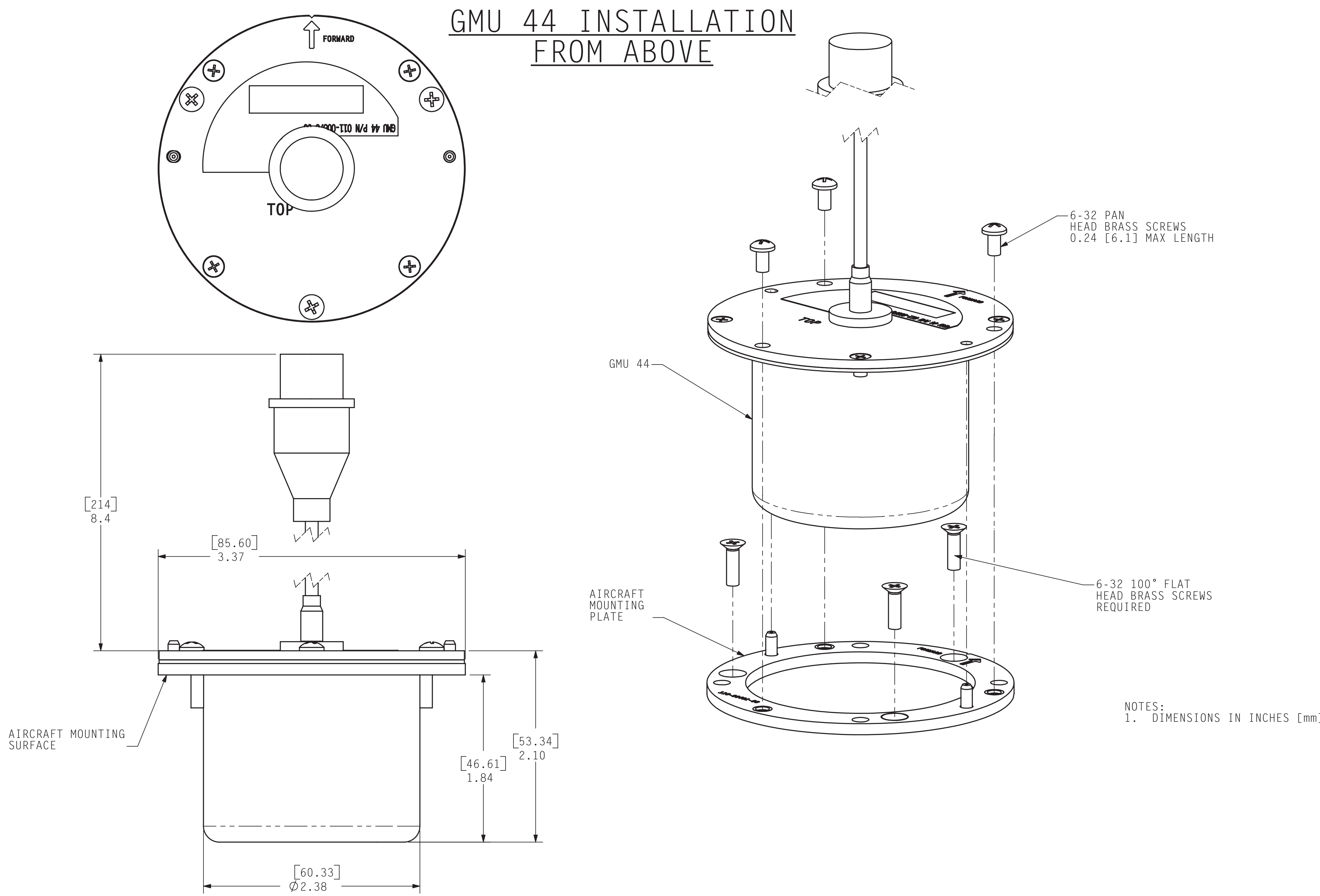


Figure C-27. GMU 44 Top Mounted Installation

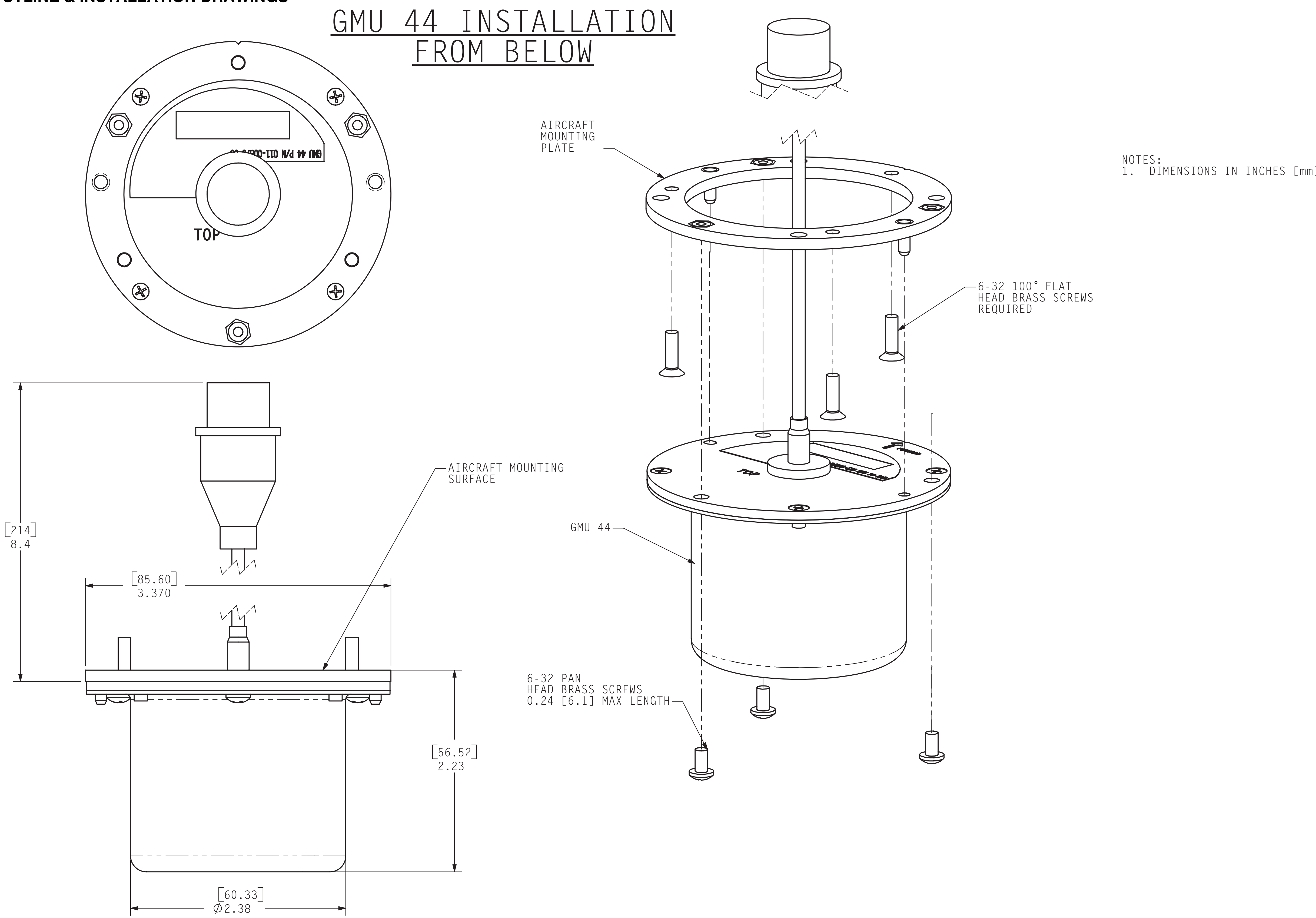


Figure C-28. GMU 44 Bottom Mounted Installation

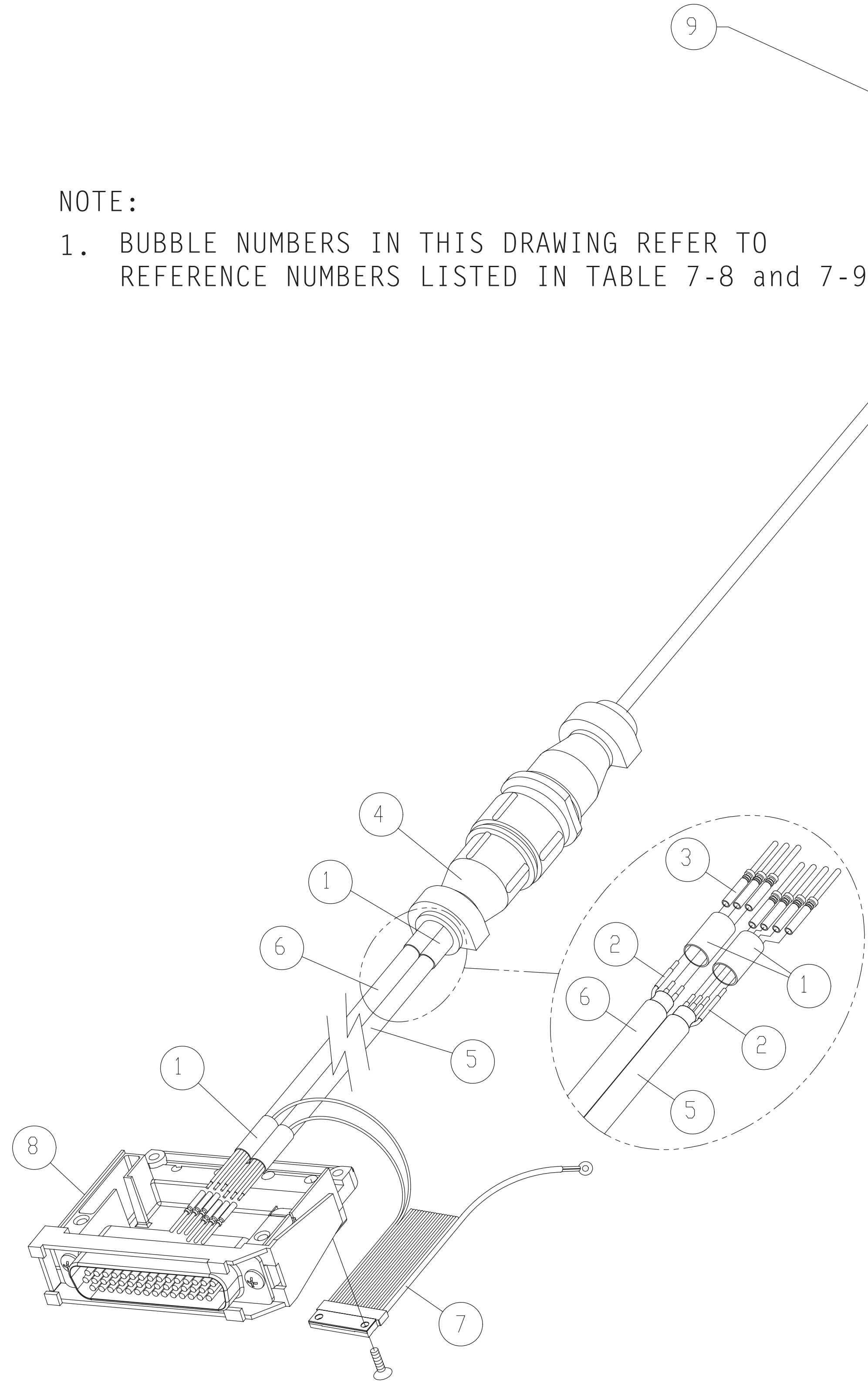


Figure C-29. GMU 44 Wiring Detail

NOTE:
1. DIMENSIONS IN INCHES [mm].
2. MOUNTING RACK IS NOT SYMMETRIC. GRS 77 UNIT MUST BE MOUNTED WITH CONNECTOR FORWARD.
3. SECURE MOUNTING PLATE TO RIGID LOCATION ON AIRFRAME USING FIVE (5) #10 PAN HEAD OR BUTTON HEAD SCREWS.

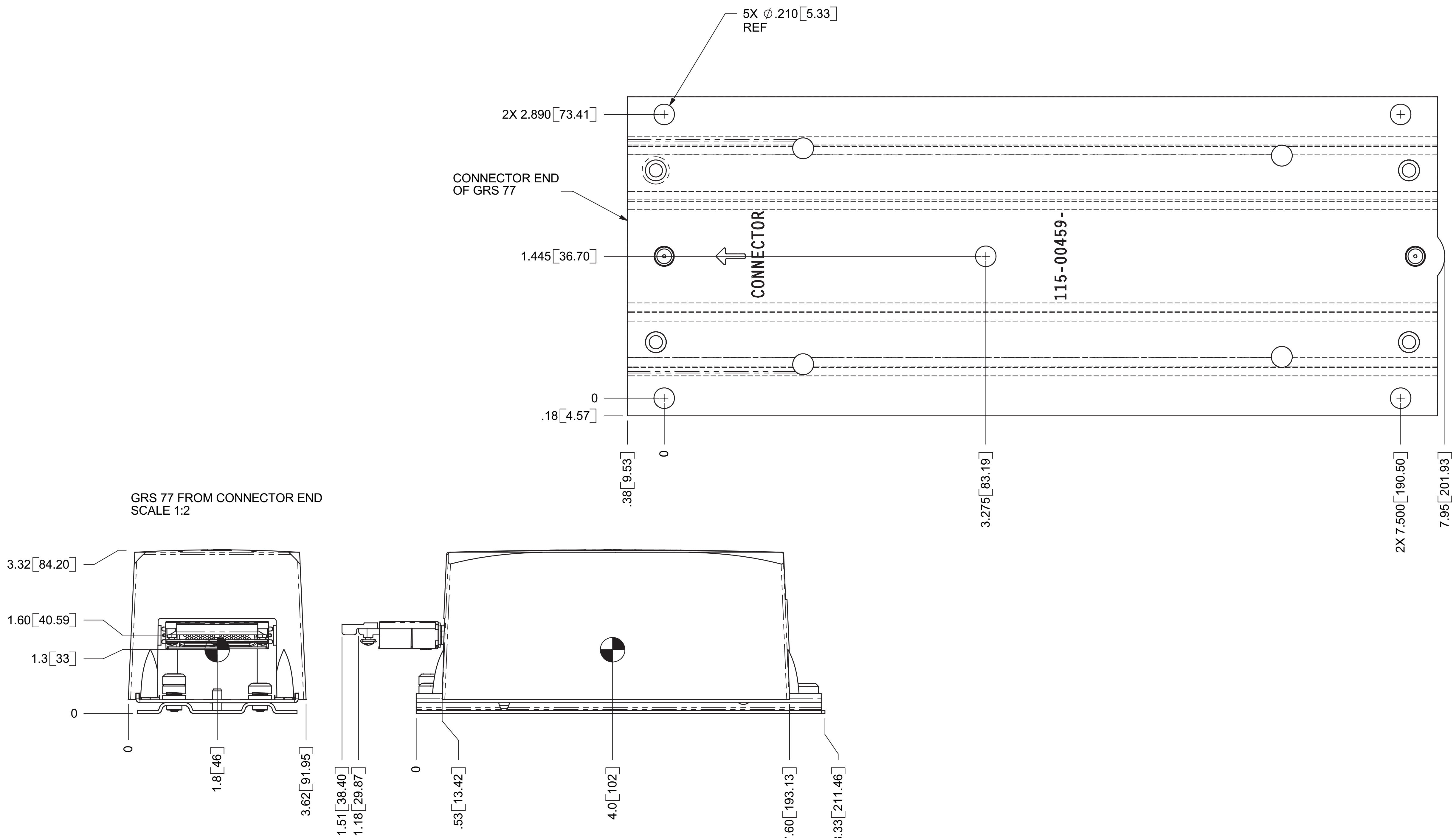


Figure C-30. GRS 77 Outline Drawing with Mounting Rack

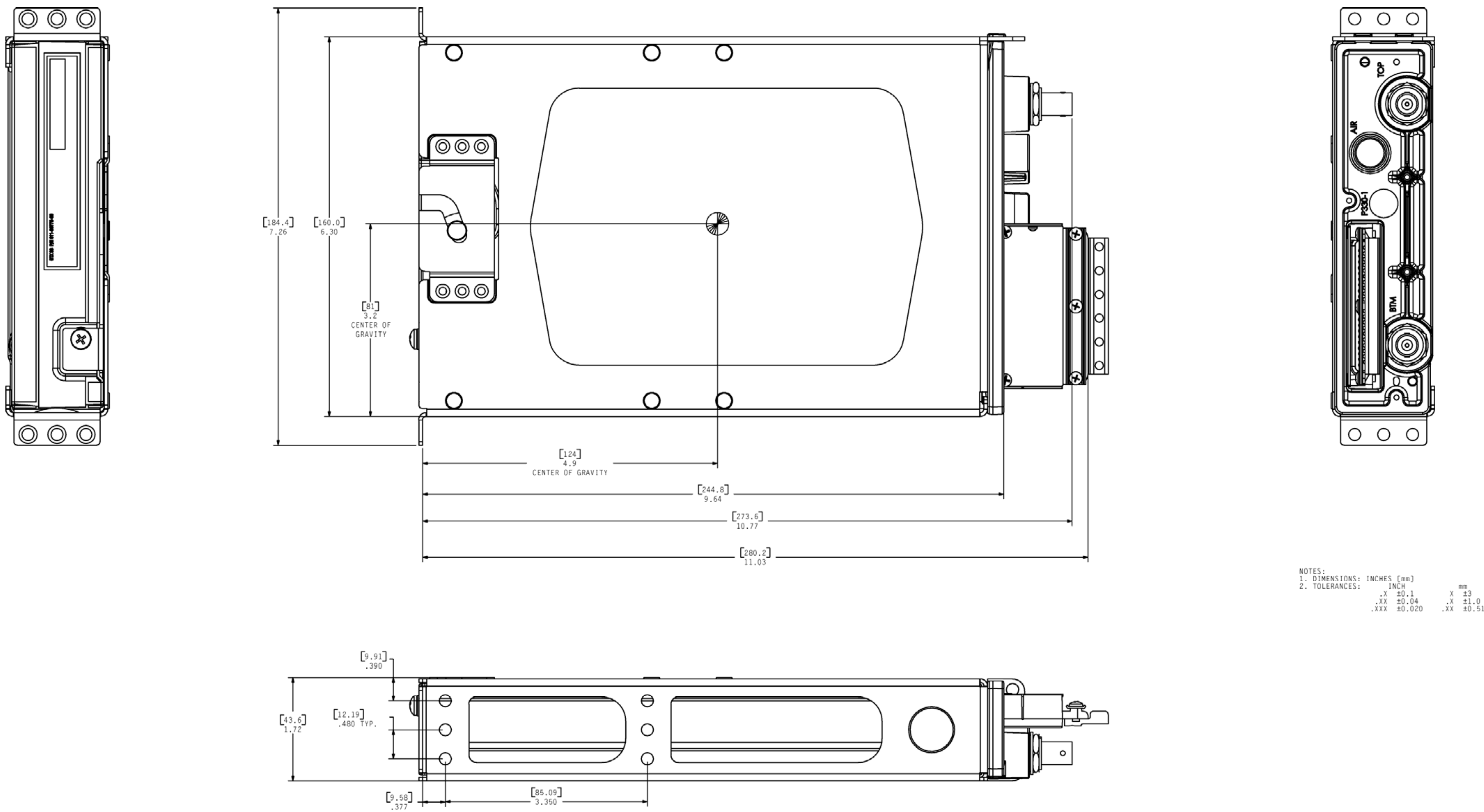


Figure C-31. GTX 33 in Modular Rack, Outline Drawing

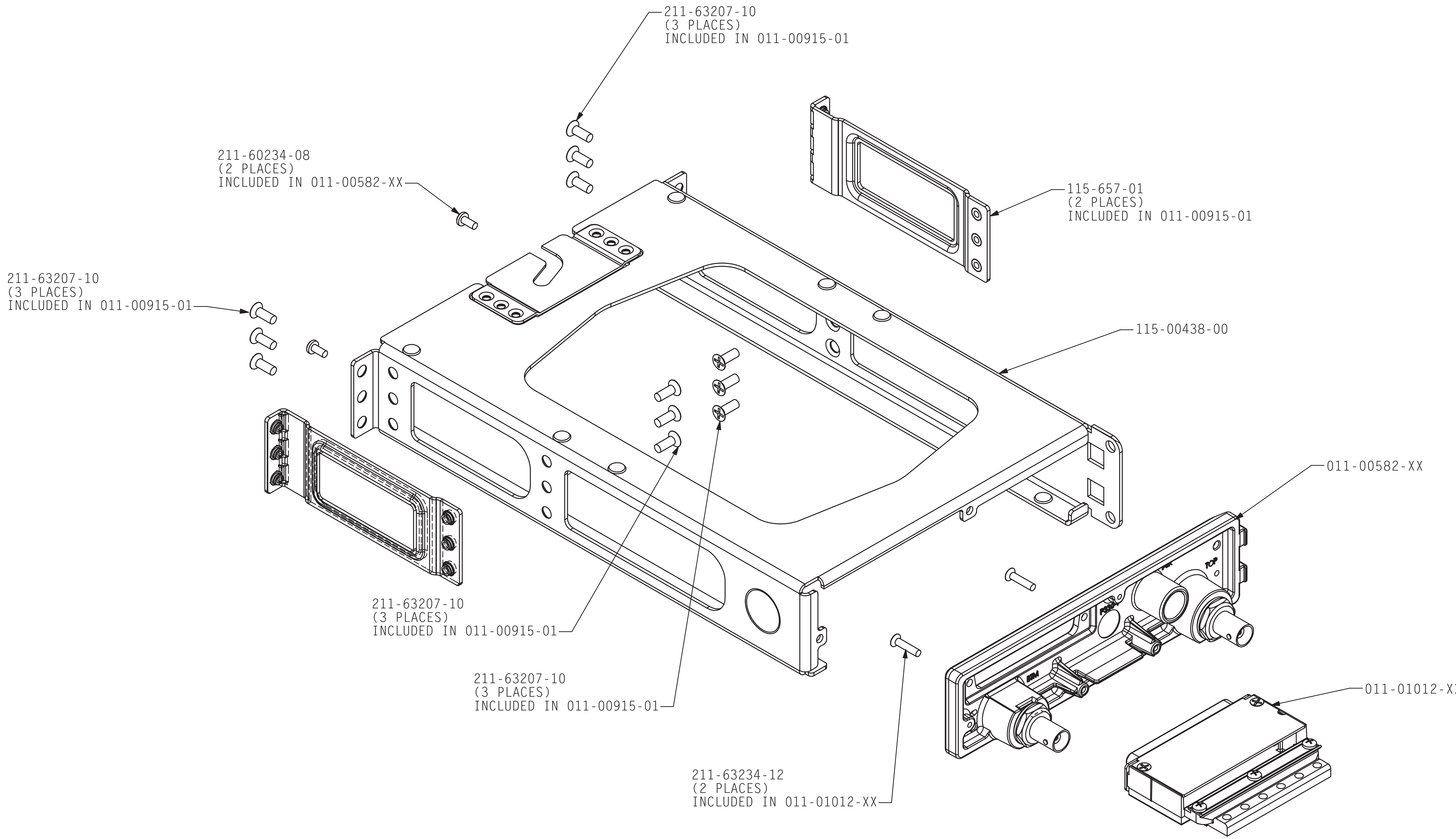
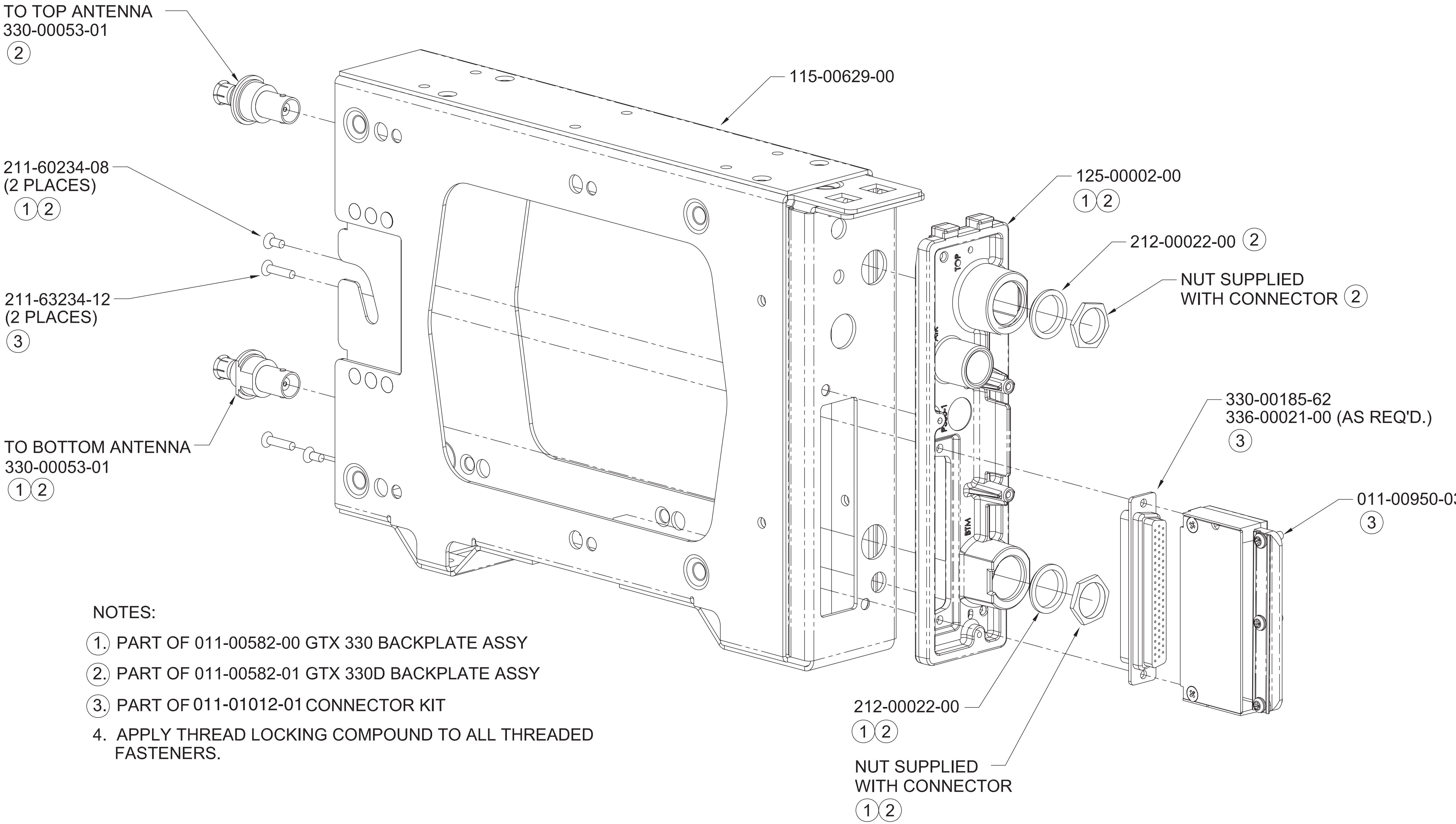


Figure C-32. GTX 33 Connector/Rack Assembly Drawing



NOTES:

1. PART OF 011-00582-00 GTX 330 BACKPLATE ASSY
2. PART OF 011-00582-01 GTX 330D BACKPLATE ASSY
3. PART OF 011-01012-01 CONNECTOR KIT
4. APPLY THREAD LOCKING COMPOUND TO ALL THREADED FASTENERS.

Figure C-33. GTX 33 Remote Stand-Alone Rack/Connector Assembly

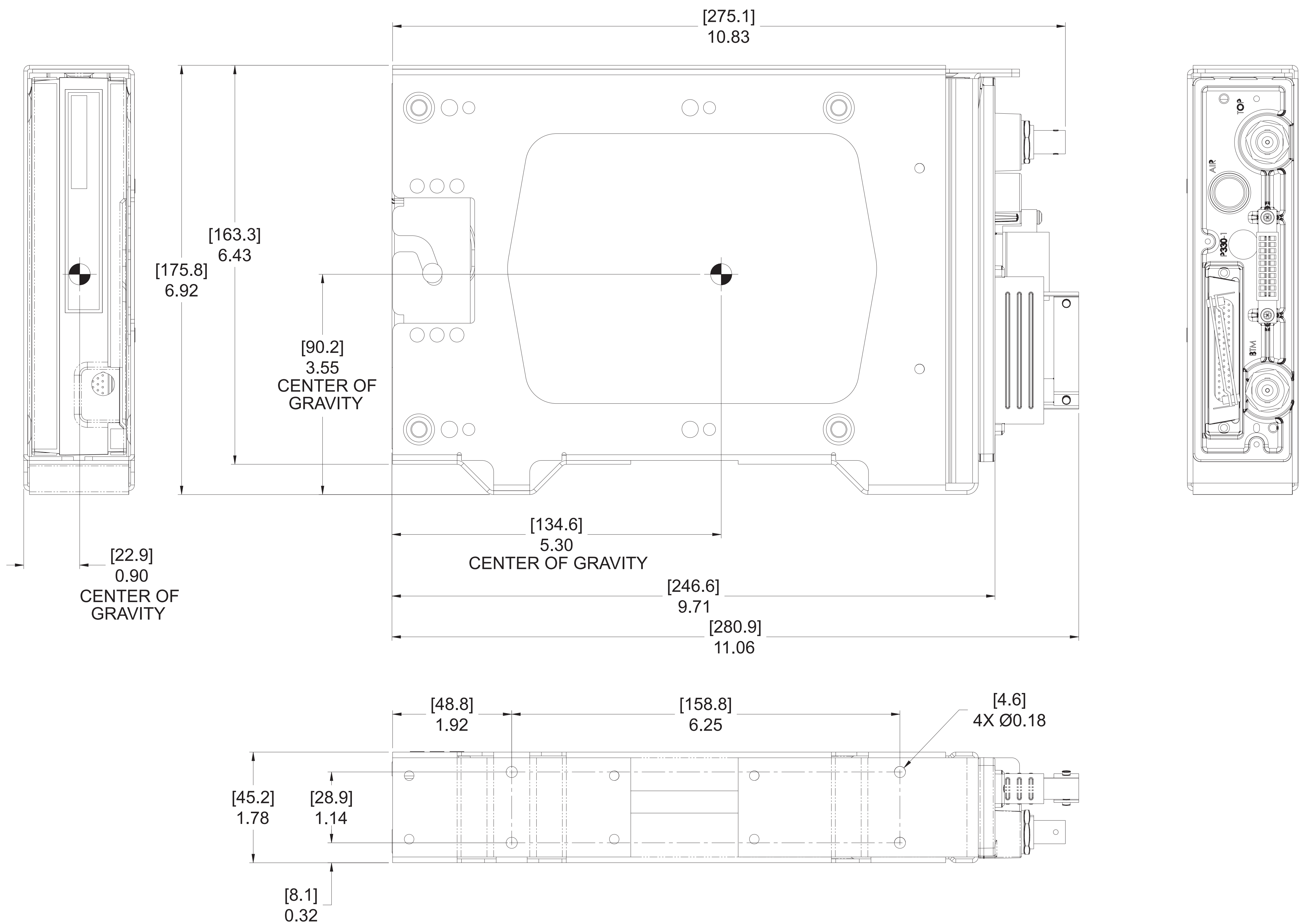


Figure C-34. GTX 33 Stand-Alone Rack/Connector Assembly

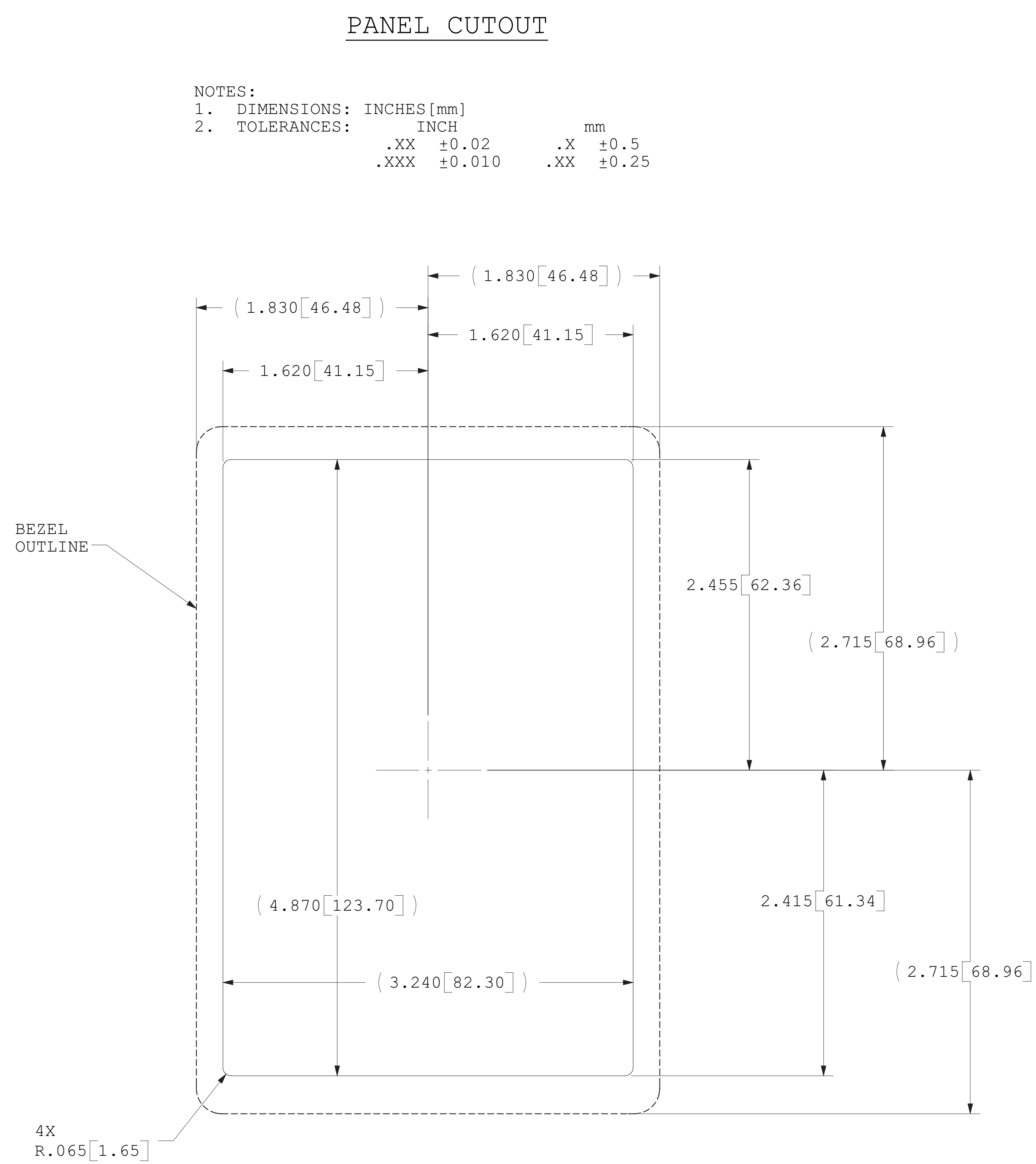
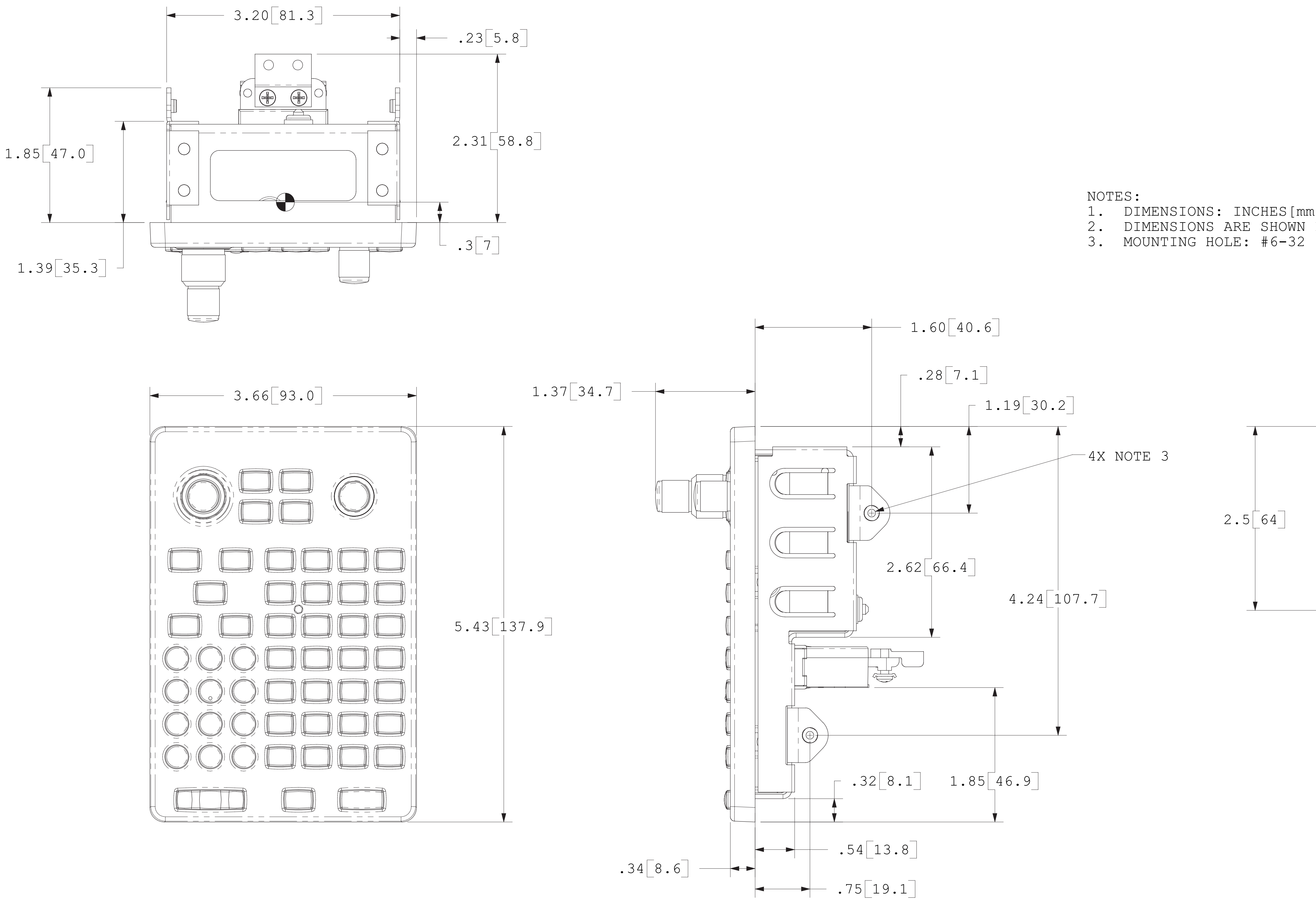


Figure C-35. GCU 476 Cutout Drawing (optional) (Not To Scale)



NOTES:
1. DIMENSIONS: INCHES[mm]
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. MOUNTING HOLE: #6-32 SELF-LOCKING CLINCH NUT (4 PLCS)

Figure C-36. GCU 476 Outline Drawing (optional)

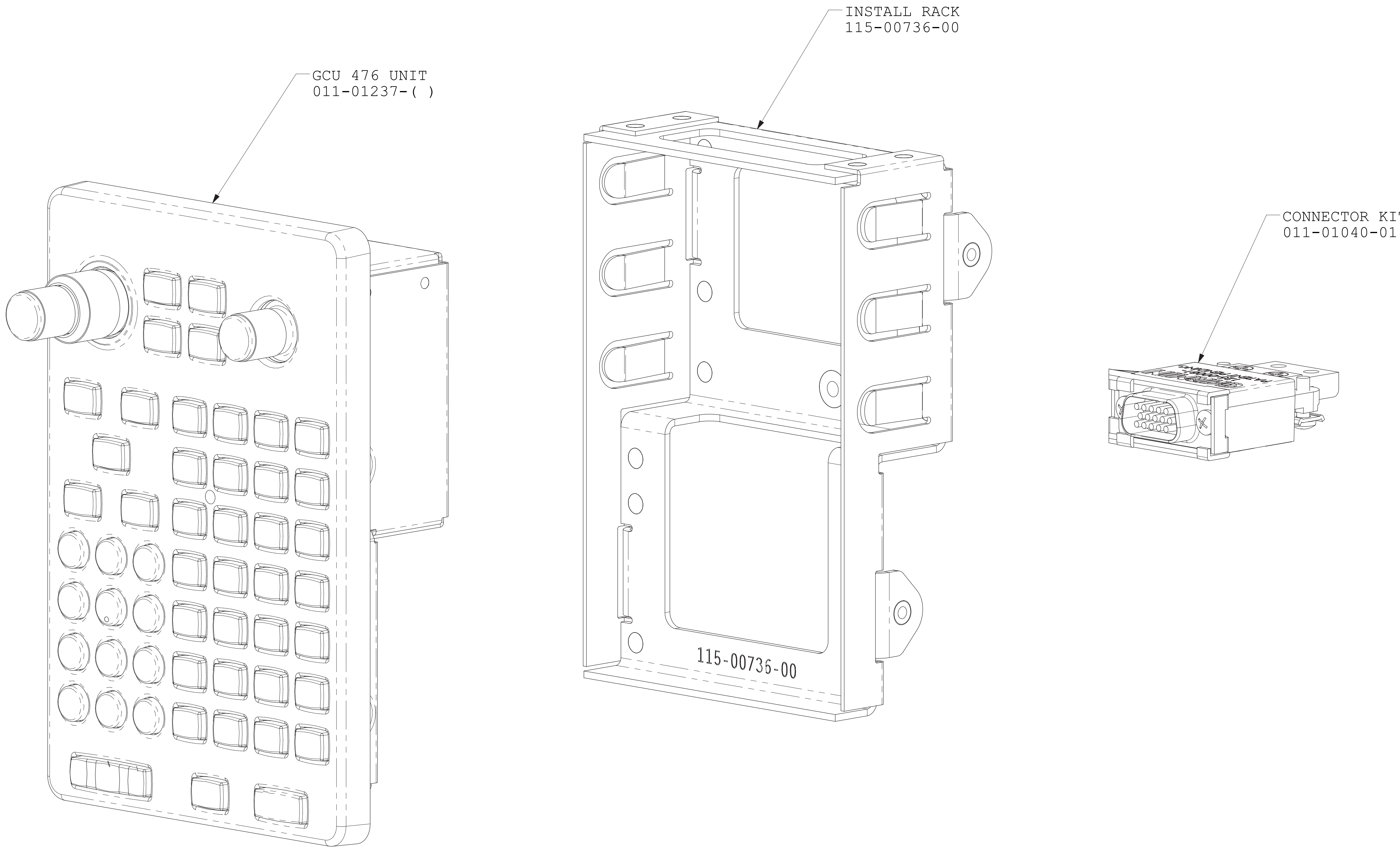


Figure C-37. GCU 476 Installation Drawing (optional)

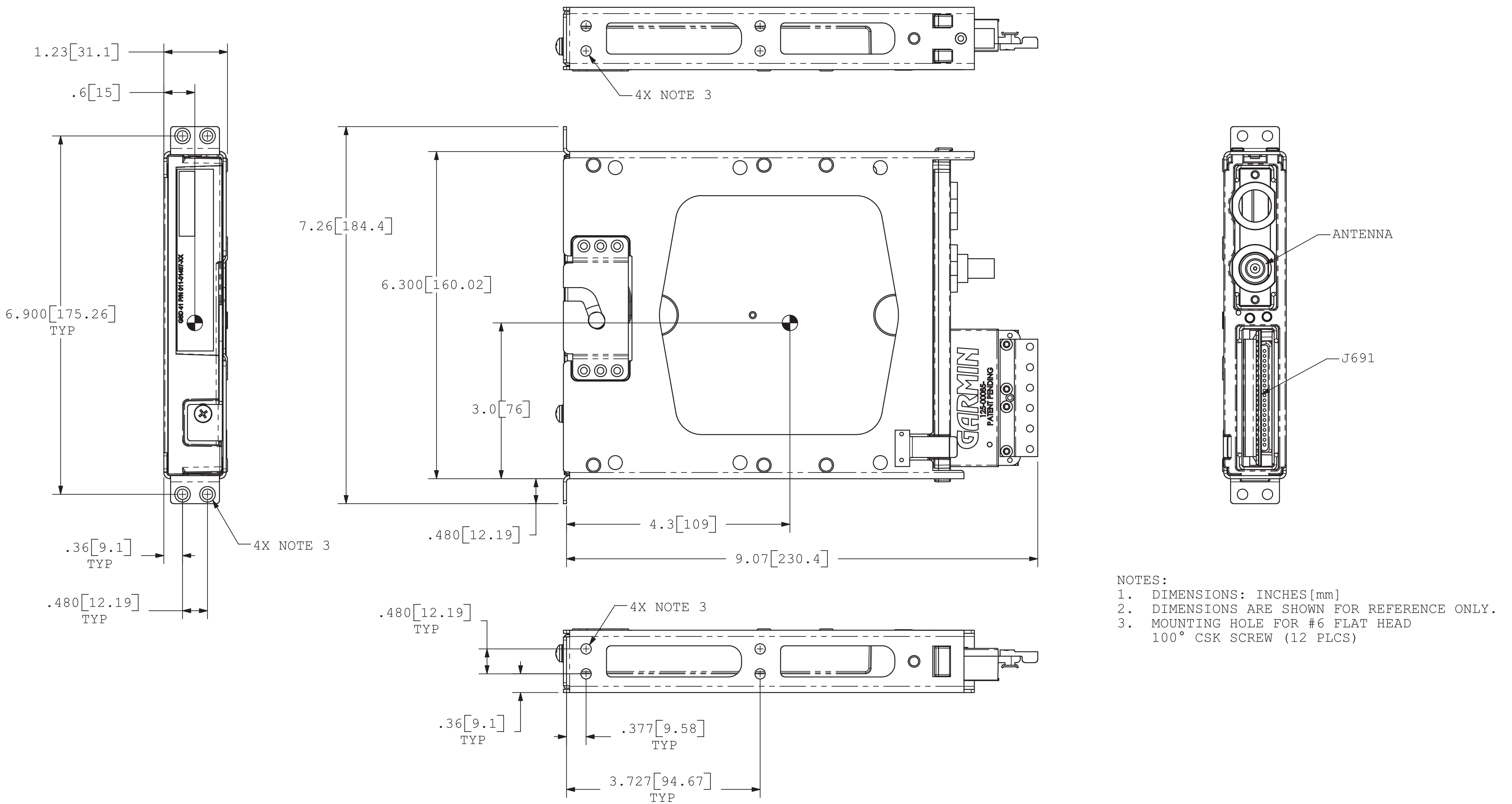


Figure C-38. GDL 69A w/Modular Rack Outline Drawing (optional)

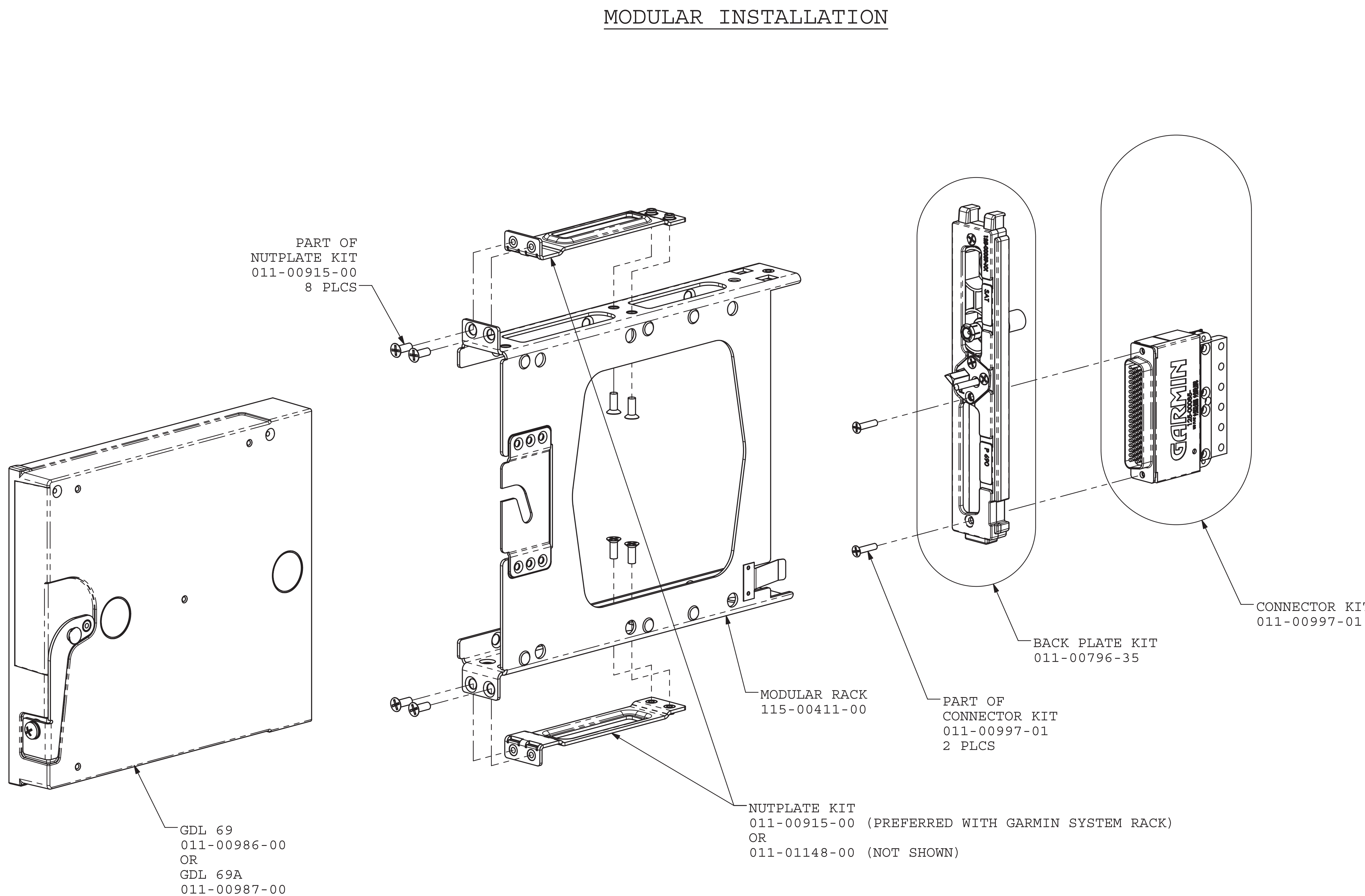


Figure C-39. GDL 69A w/Modular Rack Installation Drawing (optional)

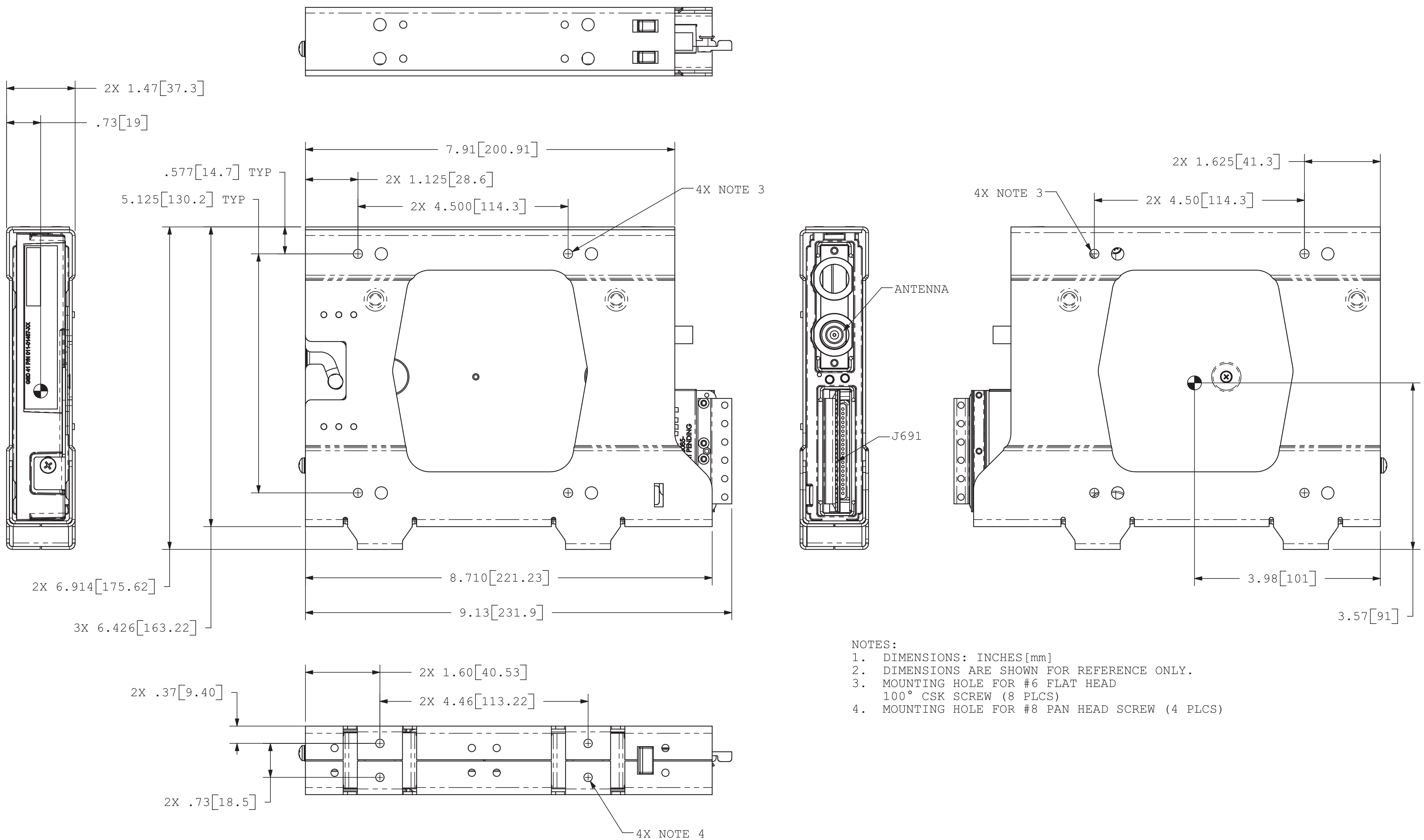


Figure C-40. GDL 69A w/Remote Rack Outline Drawing (optional)

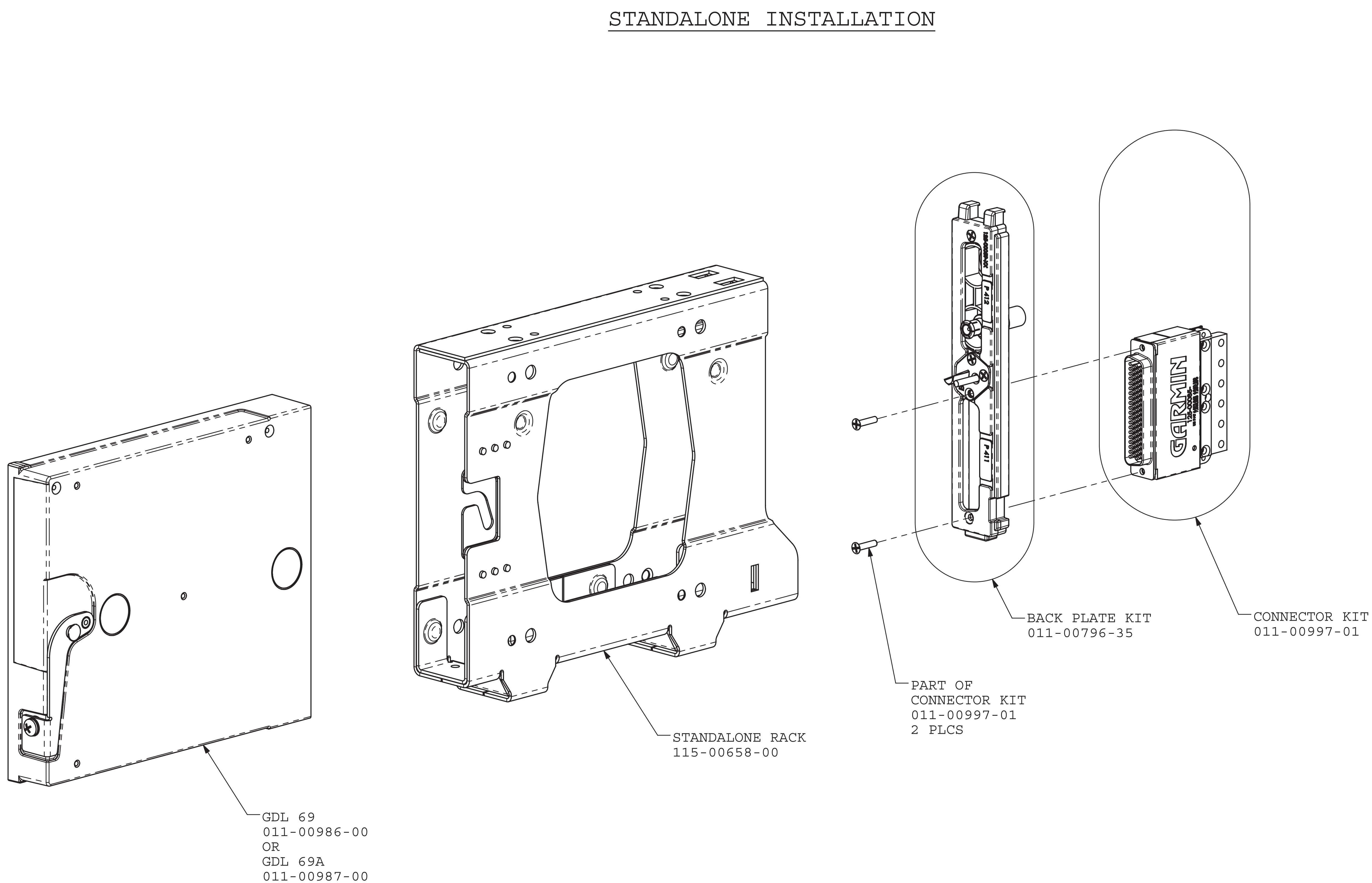
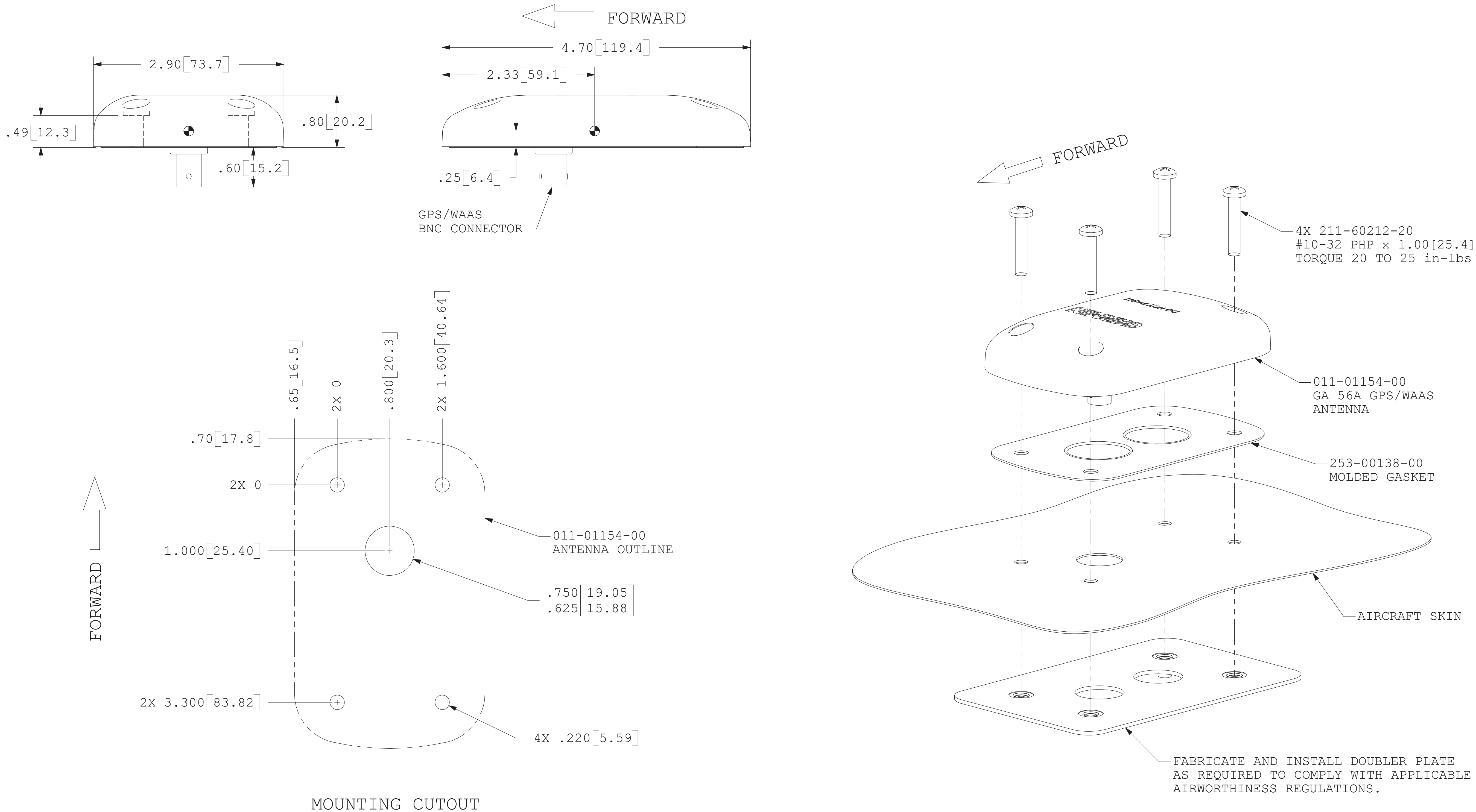
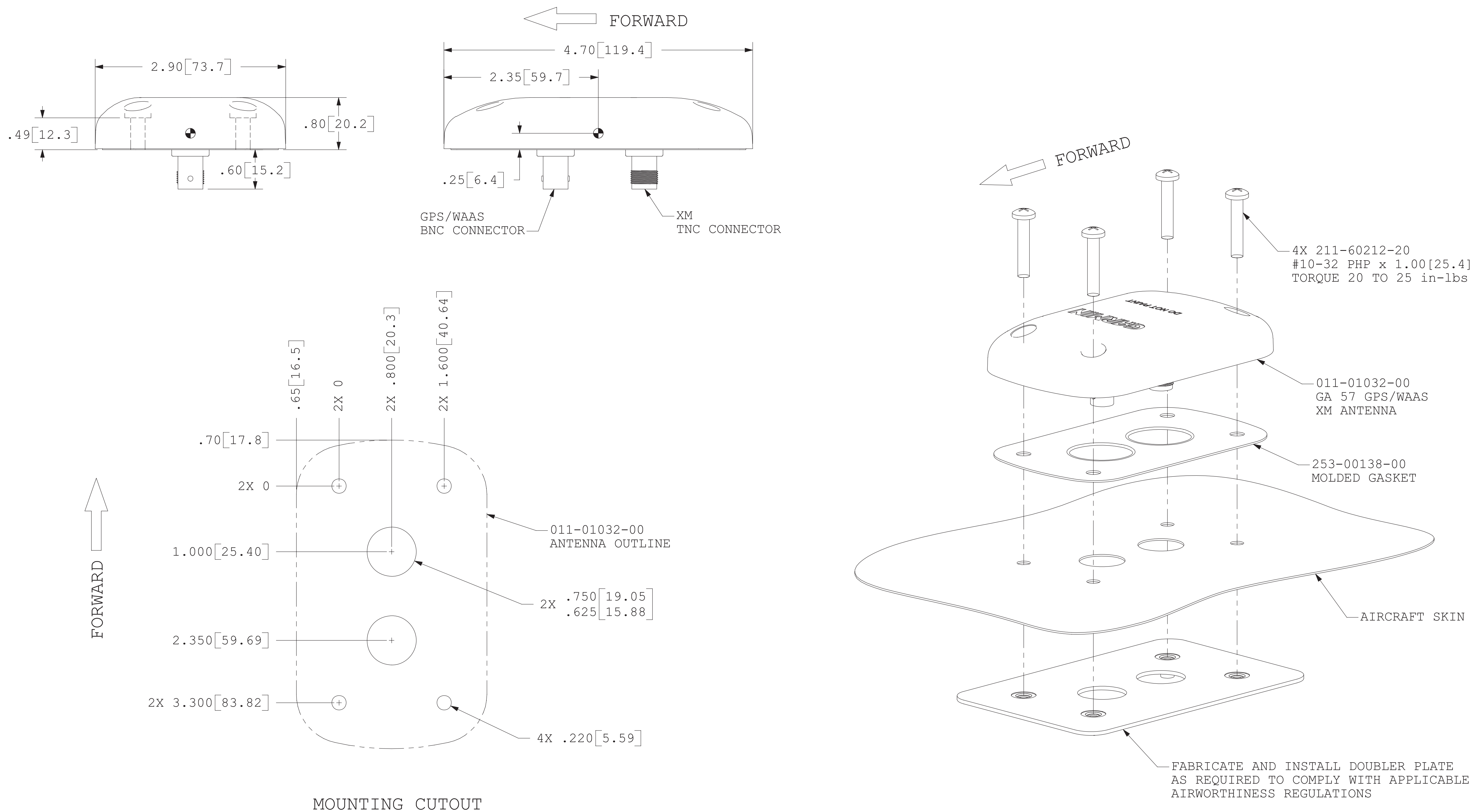


Figure C-41. GDL 69A w/Remote Rack Installation Drawing (optional)



NOTES:
1. DIMENSIONS: INCHES[mm]

Figure C-42. GA 56A Antenna Installation Drawing



NOTES:
1. DIMENSIONS: INCHES[mm]

Figure C-43. GA 57 Antenna Installation Drawing

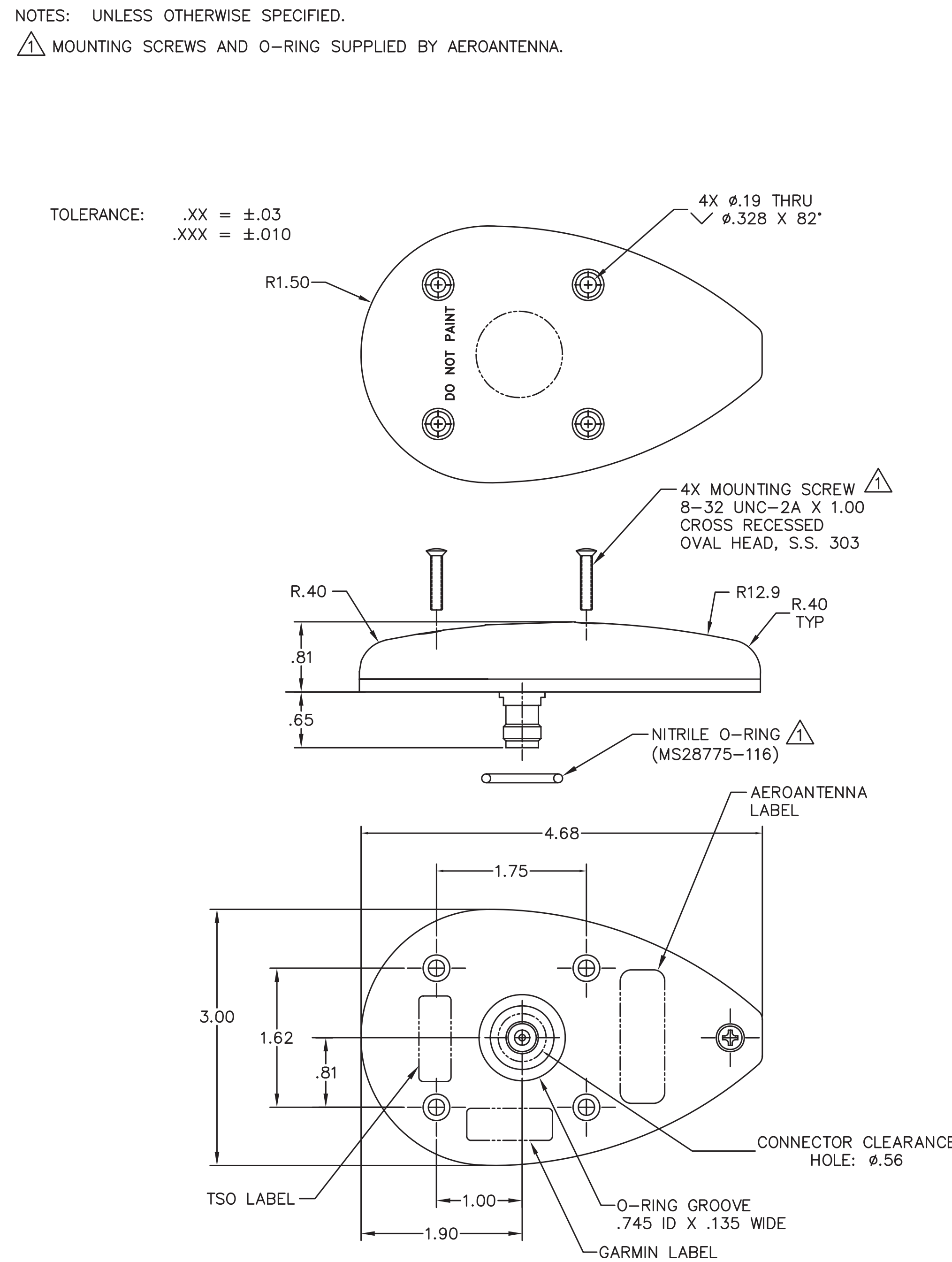


Figure C-44. GA 35 Antenna Installation Drawing

NOTES:

1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS
   - TWISTED SHIELDED SINGLE CONDUCTOR SHIELD TERMINATED TO GROUND
   - TWISTED SHIELDED SINGLE CONDUCTOR SHIELD FLOATS
   - TWISTED SHIELDED PAIR SHIELD TERMINATED TO GROUND
   - TWISTED SHIELDED PAIR SHIELD FLOATS
   - TWISTED SHIELDED 3 CONDUCTOR SHIELD TERMINATED TO GROUND
   - TWISTED SHIELDED 3 CONDUCTOR SHIELD FLOATS
   - TWISTED SHIELDED 4 CONDUCTOR SHIELD TERMINATED TO GROUND
   - TWISTED SHIELDED 4 CONDUCTOR SHIELD FLOATS
   - GARMIN SHIELD BLOCK GROUND PLEASE REFER TO 190-00313-09
   - AIRCRAFT GROUND
   - WIRE SPLICE CONNECTION
   - COAXIAL CABLE
   - N/C = NO CONNECTION
5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE UNIT BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. WIRE COLORS ARE NOTED FOR ADVISORY PURPOSES ONLY, EXCEPT FOR THE CONFIG MODULE AND GTP 59.
7. USE AIRCRAFT GRADE CATEGORY 5 ETHERNET CABLE.

MANUFACTURER	P/N
PIC WIRE AND CABLE	E10422 (22 GAUGE)
PIC WIRE AND CABLE	E10424 (24 GAUGE)
ELECTRONIC CABLE SPECIALIST	922204 (22 GAUGE)
ELECTRONIC CABLE SPECIALIST	922404 (24 GAUGE)

8. INSTALLATION INSTRUCTIONS FOR OAT PROBE, GMU 44, GND HARNESS, CONFIGURATION MODULES AND THERMOCOUPLES.

DESCRIPTION	DRAWING NUMBER
INSTR SHEET, OAT PROBE	190-00313-00
INSTR SHEET, GMU44	190-00313-04
INSTR SHEET, CONFIG MODULE	190-00313-02
INSTR SHEET, THERMOCOUPLE	190-00313-01
INSTR SHEET, SHIELD BLOCK	190-00313-09

THE ABOVE INSTRUCTIONS ARE ALSO INCLUDED IN THE G900X INSTALLATION MANUAL.

9. OPTIONAL BUILDER INSTALLATION.
10. ALL GDU 1XXX's, GIA 63W's, & GTX 3X'S SHOULD HAVE COOLING AIR PROVIDED.
11. FOR A COMPLETE LIST OF ALL PINS USED ON EACH CONNECTOR SEE THE SHEET(S) WITH THAT UNIT'S MODEL NUMBER ABOVE THE TITLE BLOCK. CONNECTORS TO UNITS WHOSE COMPLETE LIST IS ON LOWER NUMBERED PAGES ARE SHOWN AS "REF SHEET X". CONNECTORS TO UNITS WHOSE COMPLETE LIST IS ON HIGHER NUMBERED SHEETS ARE EXPLICITLY SHOWN. THE ONLY EXCEPTIONS TO THIS RULE ARE POWER, GARMIN CONFIGURATION PINS AND ANTENNA CONNECTORS WHICH ARE SPECIFIED ON "POWER/ANTENNA" SHEETS AND REFERENCED FROM LOWER PAGE NUMBERED SHEETS.
12. CONNECTORS THAT SHOW "SEE XXX" MAY NOT HAVE ALL CONNECTIONS SHOWN. ONLY THOSE CONNECTIONS THAT ARE DIFFERENT FROM THE REFERENCED XXX DRAWING NUMBER ARE SHOWN. THE REFERENCED XXX DRAWING CAN BE REFERRED TO FOR OTHER CONNECTIONS.
13. THIS CONNECTION IS NOT CURRENTLY SUPPORTED. IT IS SHOWN HERE FOR POSSIBLE FUTURE EXPANSION. LOW SIDE PIN 47 MUST BE CONNECTED TO THE AUTOPILOT GROUND AS SHOWN.
14. BREAKERS SPECIFIED WITH (MIN) NEAR THEIR RESPECTIVE RATING CAN NOT BE REDUCED IN SIZE.
15. EITHER AILERON OR RUDDER TRIM INDICATIONS (NOT BOTH) CAN BE CONNECTED DEPENDING ON KIT AND TRIM SYSTEM TYPE.
17. RESERVED
18. APPLICABLE ONLY ON SIX CYLINDER ENGINES.
19. APPLICABLE ONLY ON TURBOCHARGED ENGINES.
20. OPTIONAL GARMIN LRU.
21. OPTIONAL THIRD PARTY LRU.
22. IN THIS DOCUMENT, AN ASTERISK (*) IS USED FOR SIGNALS THAT ARE ACTIVE LOW (GROUND TO ACTIVATE). ON INSTALLATION WIRING DIAGRAMS, THE MORE TRADITIONAL $\overline{\text{OVERLINE}}$ SYMBOLOGY IS USED.
23. PULL-UP RESISTORS ARE ONLY REQUIRED IF USING THE STEC 55X WITH THE GIA63 (NON-WAAS) UNIT. WHEN CONNECTED TO A 14V ELECTRICAL SYSTEM, 2.2 KOHM PULL-UP RESISTORS SHOULD BE USED. WHEN CONNECTED TO A 28V ELECTRICAL SYSTEM, 4.7 KOHM PULL-UP RESISTORS SHOULD BE USED.
24. WHEN THE ALTRAK SYSTEM IS SPLICED INTO PIN 7 OF THE DIGITRAK/PICTORIAL PILOT SYSTEM, THE ALTRAK WILL ONLY ENGAGE IF THE DIGITRAK IS ENGAGED. DISENGAGING THE DIGITRAK SYSTEM WILL DISENGAGE THE ALTRAK BUT WILL NOT ENGAGE THE ALTRAK. PRESSING AND HOLDING THE CWS WILL DISENGAGE THE DIGITRAK, BUT NOT THE ALTRAK. THIS CONNECTION SHOULD NOT BE USED IF THE TWO SYSTEMS ARE TO BE USED INDEPENDENTLY.
25. APPLICABLE ONLY ON CARBURETED ENGINES.
26. WHEN BOTH THE TRIO AVIONICS EZ PILOT AND TRIO AVIONICS AFCS EZ ALTITUDE CONTROL UNITS ARE INSTALLED, BOTH CAN BE POWERED FROM A SINGLE 5 AMP BREAKER WITH #22 AWG WIRE.
27. FOR AIRCRAFT WITH RETRACTABLE LANDING GEAR THAT DO NOT PLAN TO HAVE THE OPTIONAL SWITCHES INSTALLED, PINS 9, 17 AND 18 MUST GROUNDED.
28. THE OPTIONAL DOOR/CANOPY OPEN SWITCH MUST BE SET SO THAT IT IS A NORMALLY OPEN CIRCUIT WHEN THE DOOR/CANOPY IS PHYSICALLY CLOSED. IF IT IS DESIRED TO MONITOR MULTIPLE DOORS, ADDITIONAL SWITCHES MAY BE WIRED IN PARALLEL.
29. ONLY P-300C CAPACITIVE TYPE FUEL QUANTITY SENDERS SHOULD BE USED FOR THIS ALTERNATE SENDER INSTALLATION. SEE INSTALLATION MANUAL FOR ADDITIONAL DETAILS.
30. THE BATTERY AMMETER SHUNT SHOULD BE WIRED IN SERIES BETWEEN THE NEGATIVE BATTERY TERMINAL AND THE AIRFRAME GROUND.
31. THE ALTERNATOR AMMETER SHUNT SHOULD BE WIRED IN SERIES ON THE OUTPUT ("B" LEAD) OF THE ALTERNATOR.
32. IF THE AUXILIARY AMMETER IS TO BE USED FOR A BATTERY, IT SHOULD BE WIRED IN SERIES BETWEEN THE NEGATIVE BATTERY TERMINAL AND THE AIRFRAME GROUND. IF THE AUXILIARY AMMETER IS TO BE USED FOR AN ALTERNATOR, IT SHOULD BE WIRED IN SERIES ON THE OUTPUT ("B" LEAD) OF THE ALTERNATOR.
33. THE DISPLAY BRIGHTNESS WILL BE CONTROLLED BY A PHOTOCELL ON THE UNIT BY DEFAULT. THE INDICATED PIN CAN BE WIRED TO AN APPROPRIATE DIMMER BUS TO ALLOW MANUAL ADJUSTMENT OF THE DISPLAY AS AN OPTION. REFER TO THE INSTALLATION MANUAL FOR APPROPRIATE DIMMER BUS VOLTAGES AND CONFIGURATION.

Figure D-1. Notes

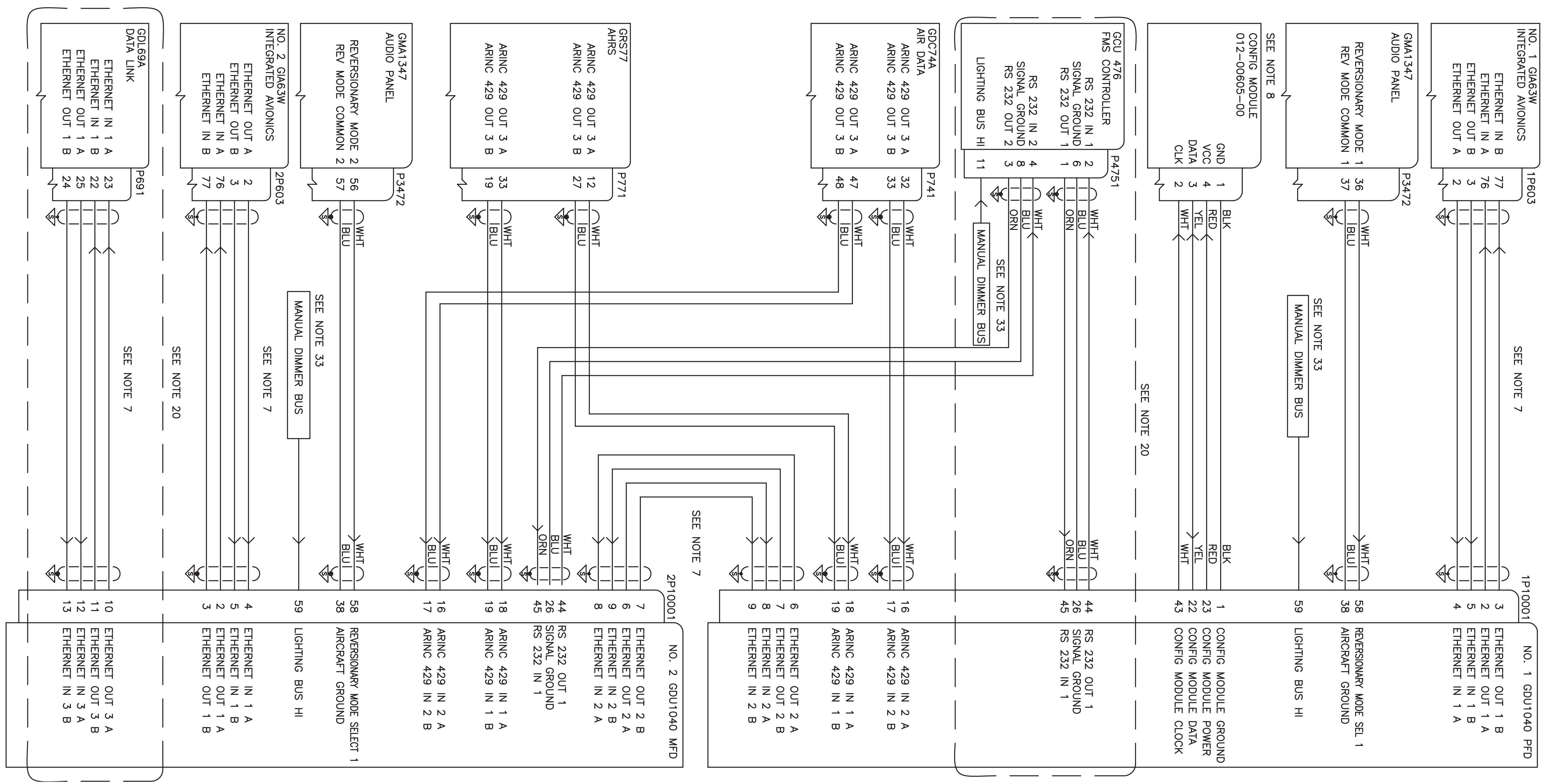


Figure D-2. CDU

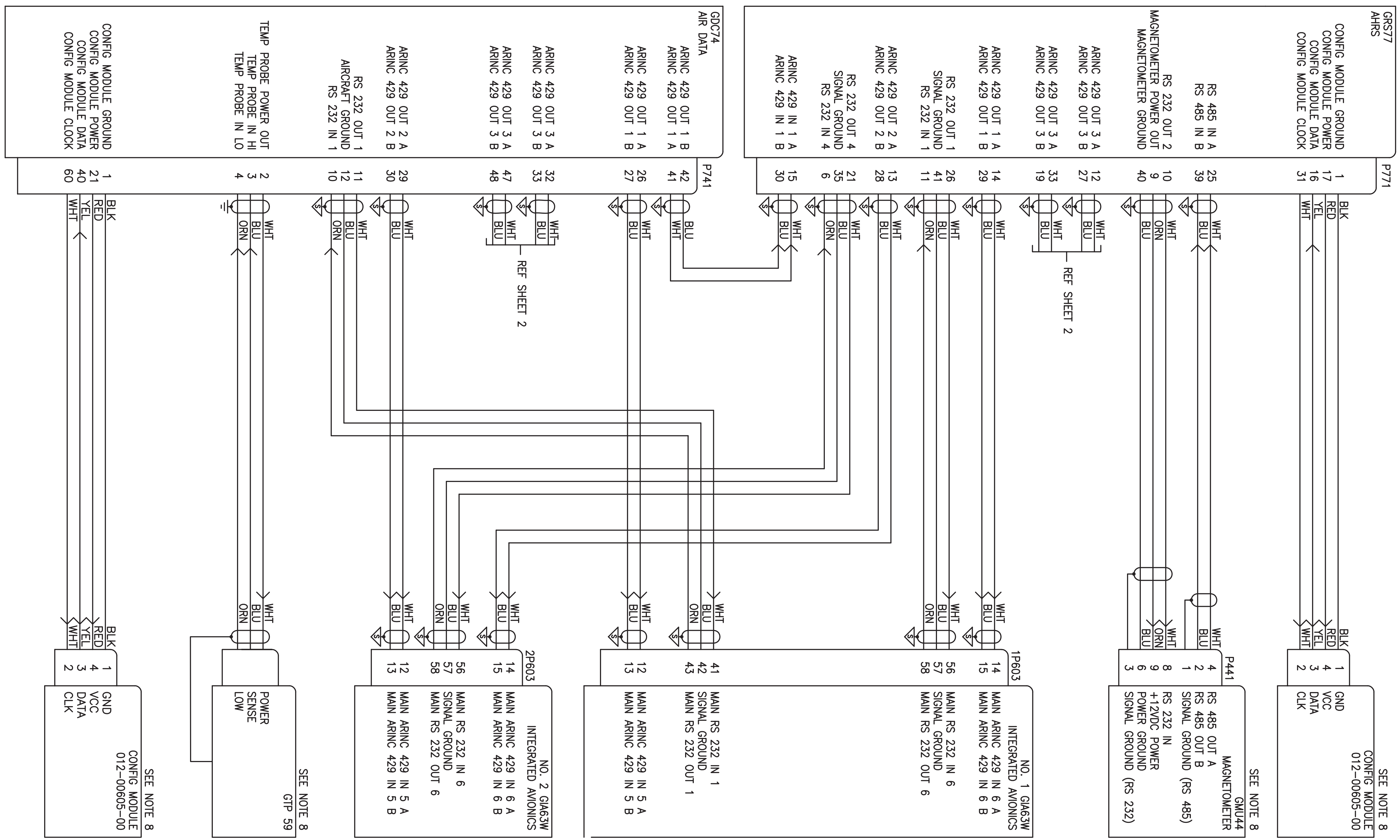


Figure D-3. GRS 77/GDC 74

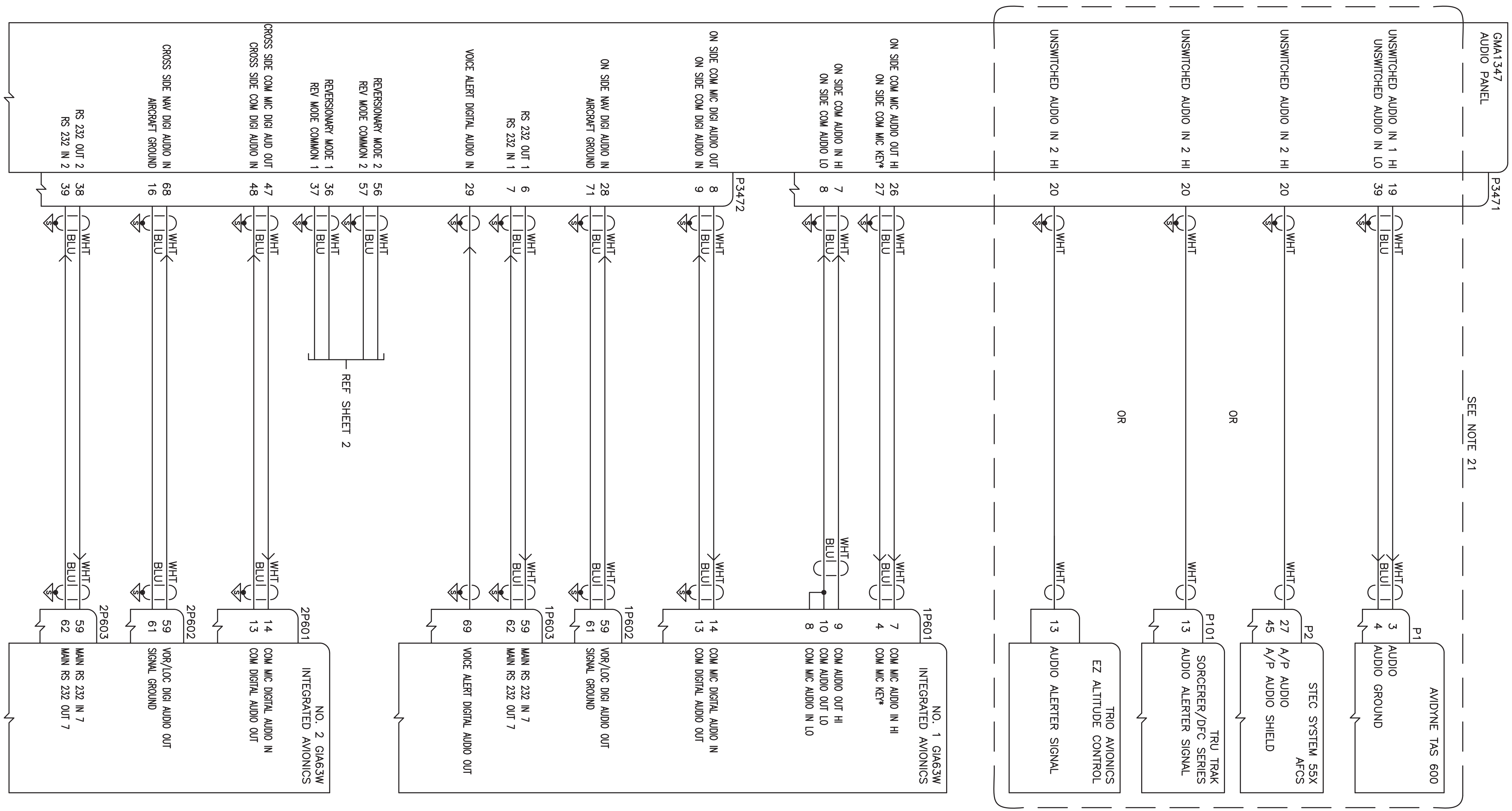


Figure D-4. GMA 1347

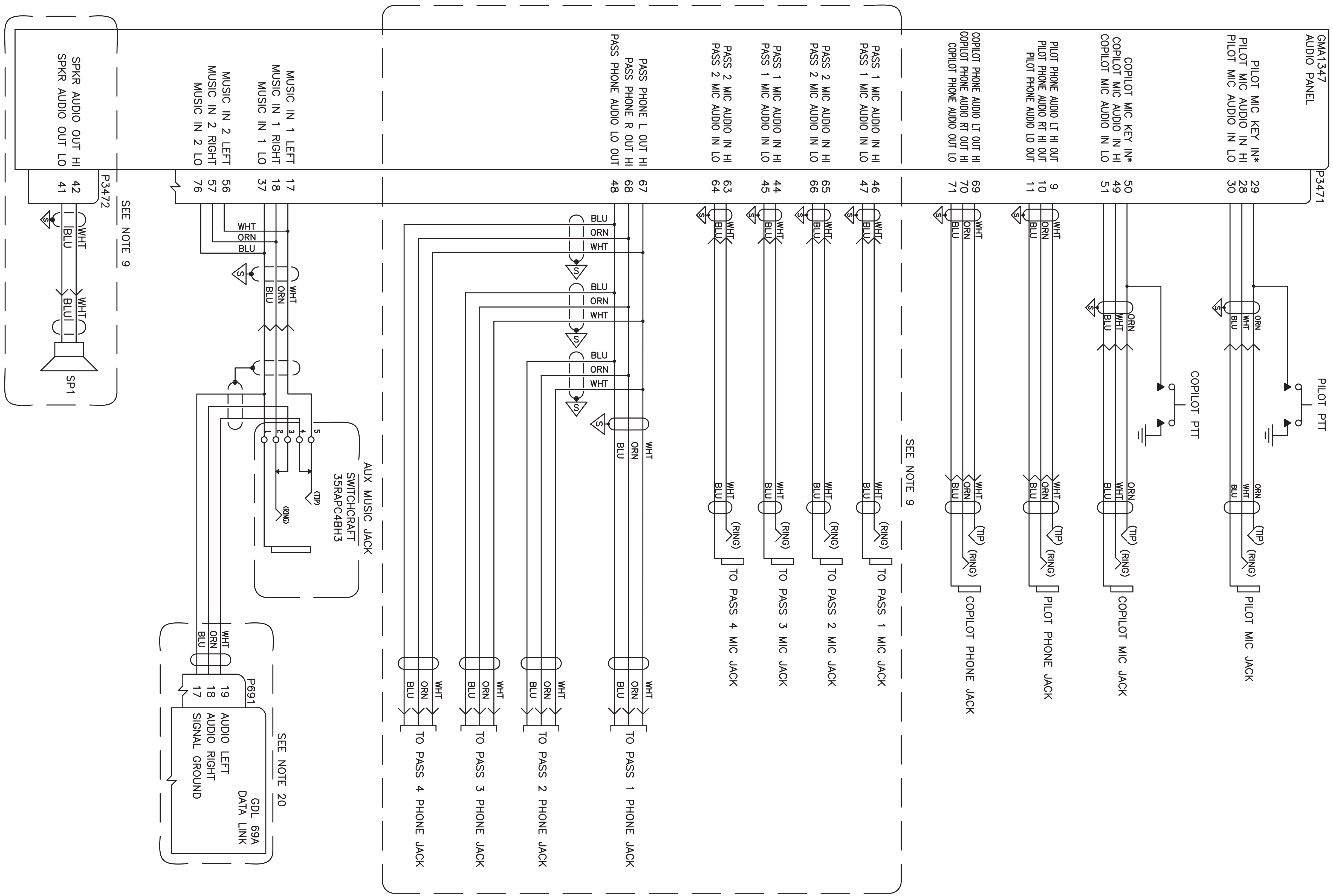


Figure D-5. GMA 1347

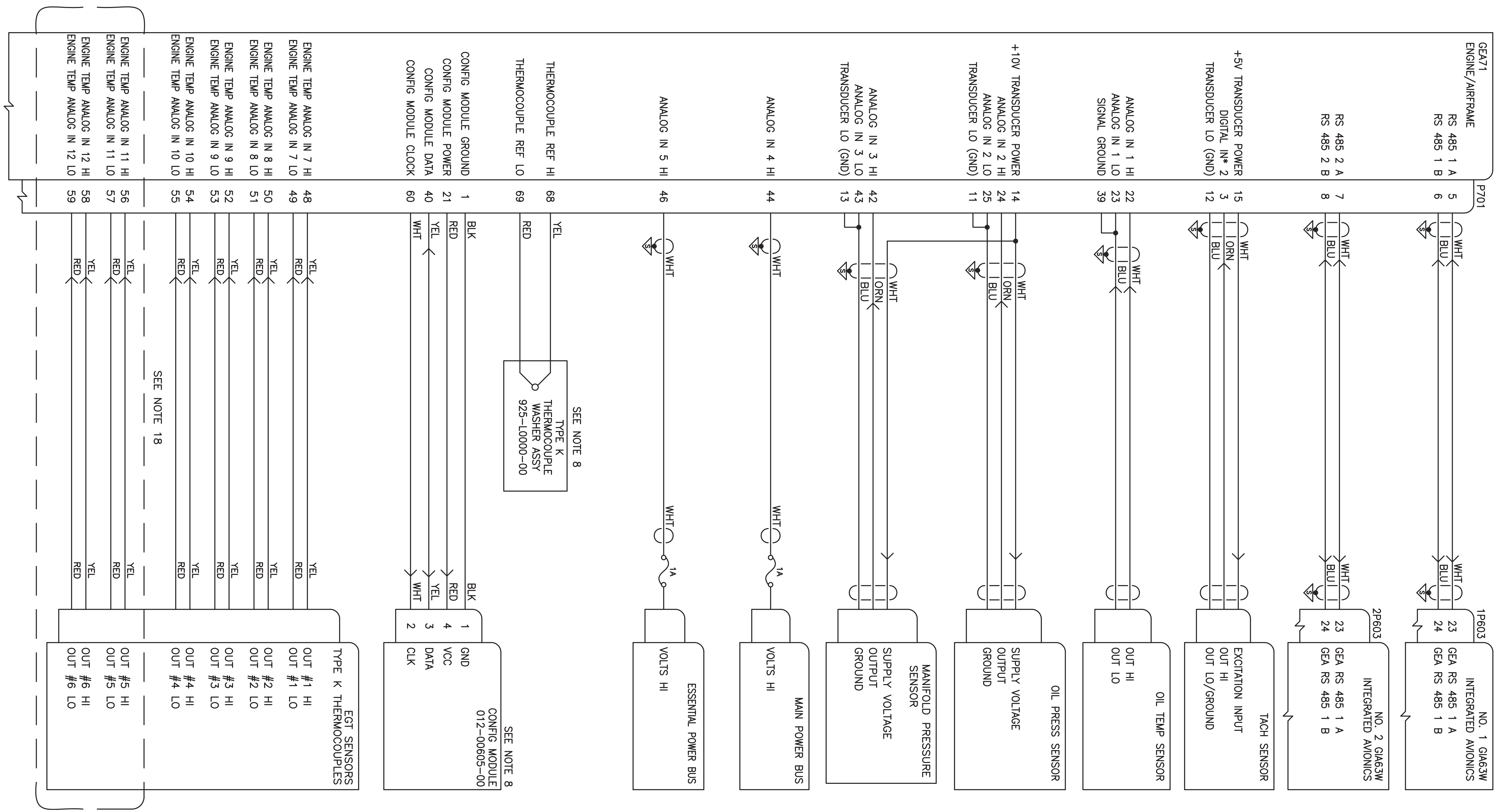


Figure D-6. GEA 71

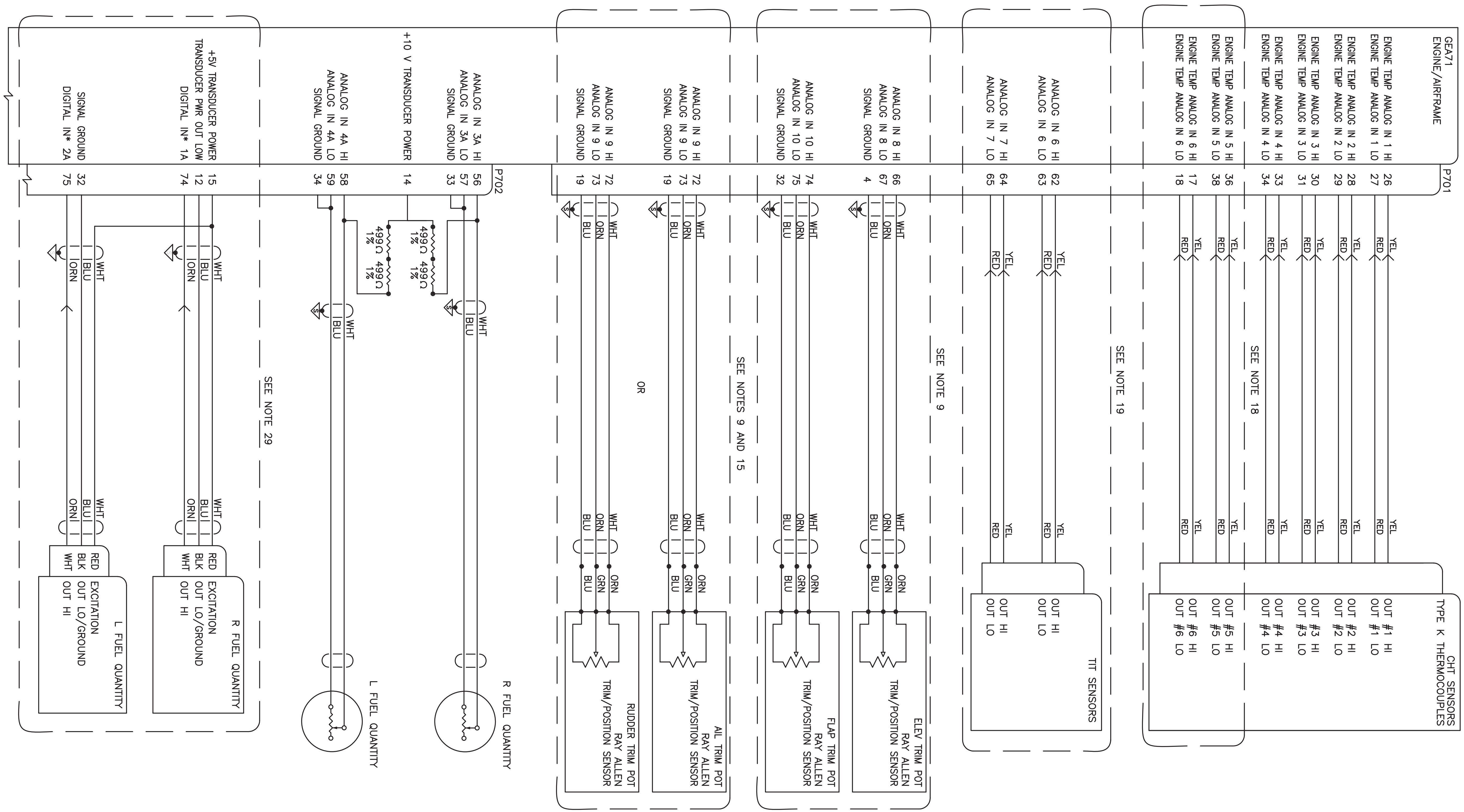


Figure D-7. GEA 71

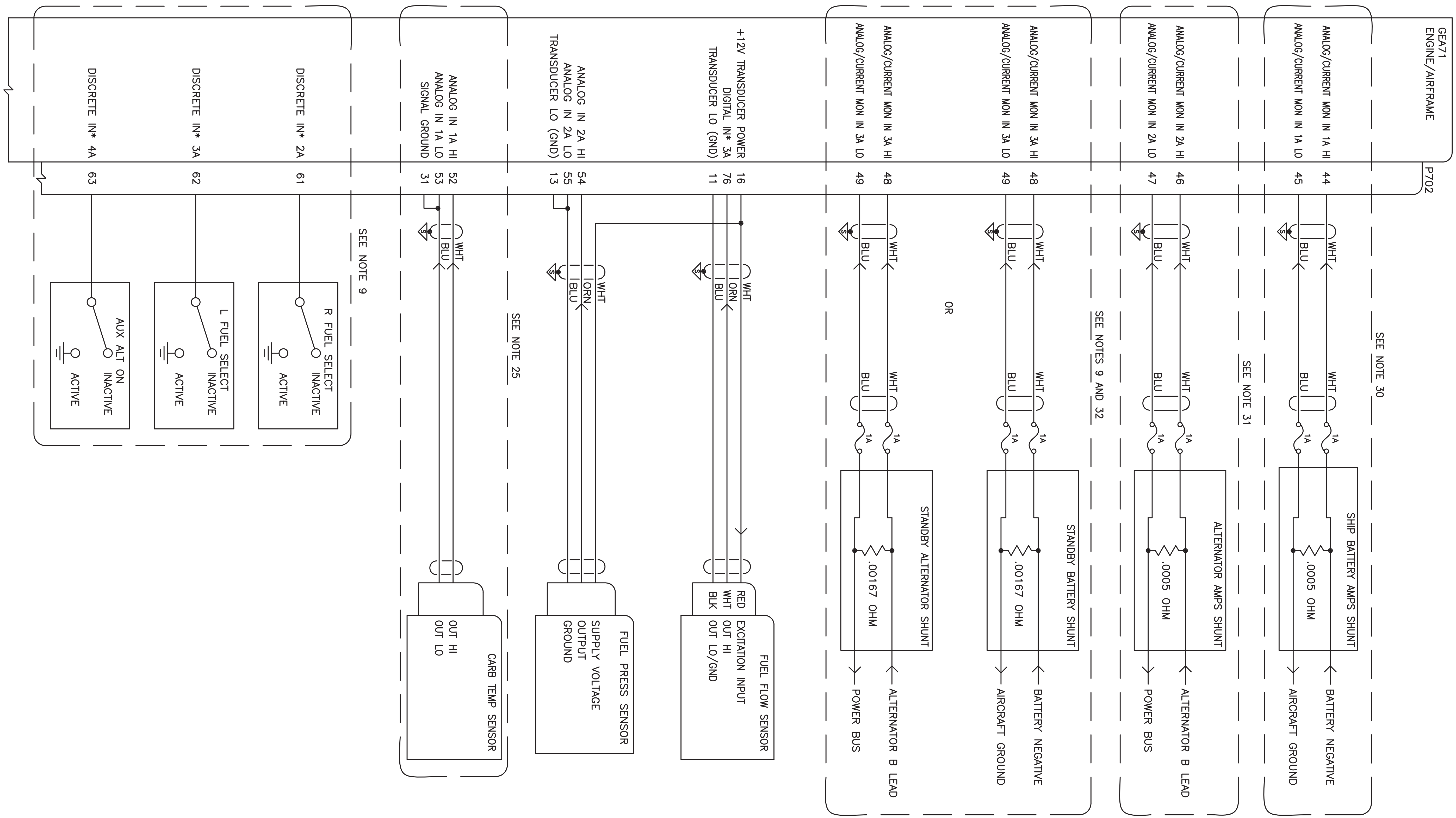


Figure D-8. GEA 71

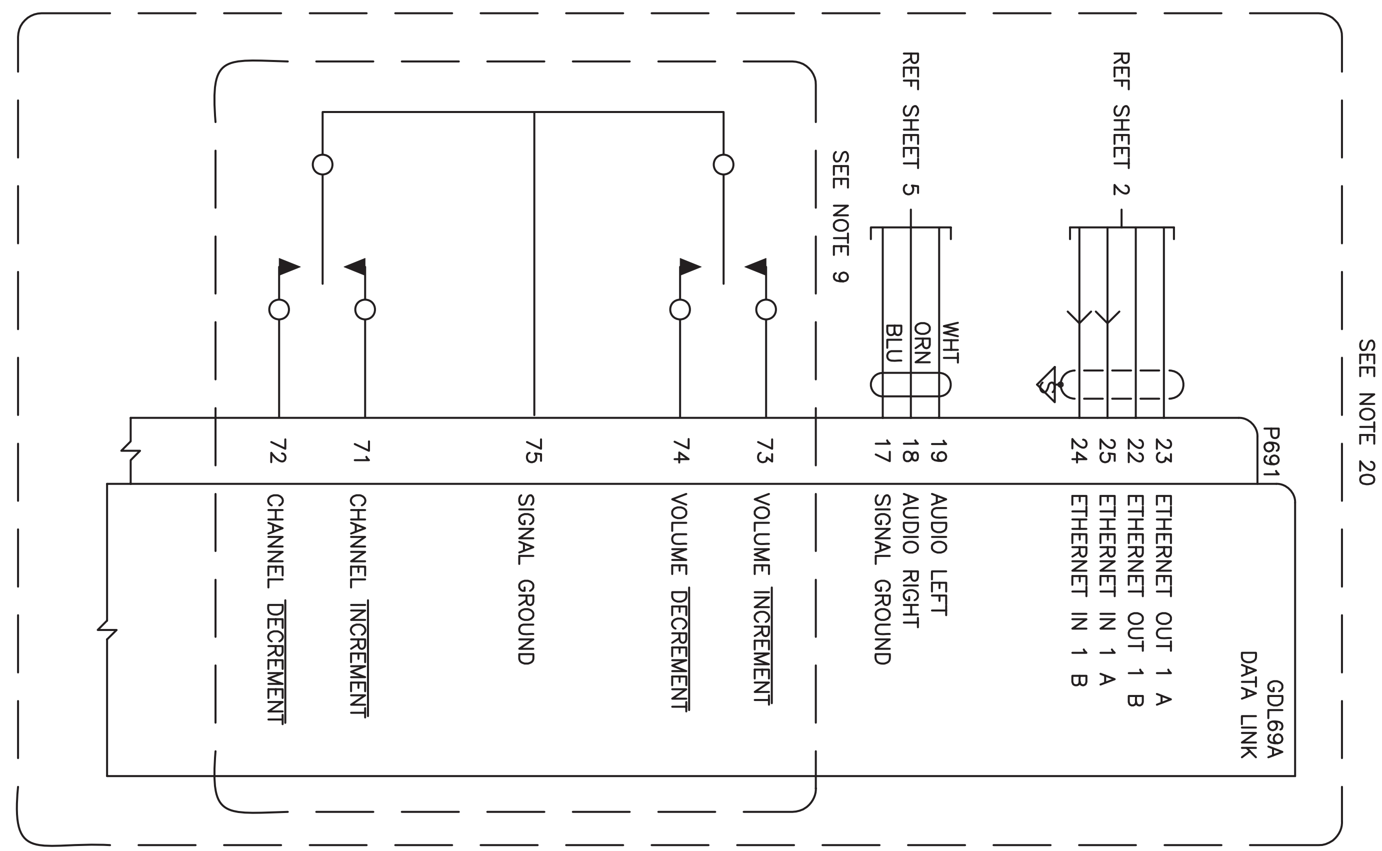


Figure D-9. GDL 69A

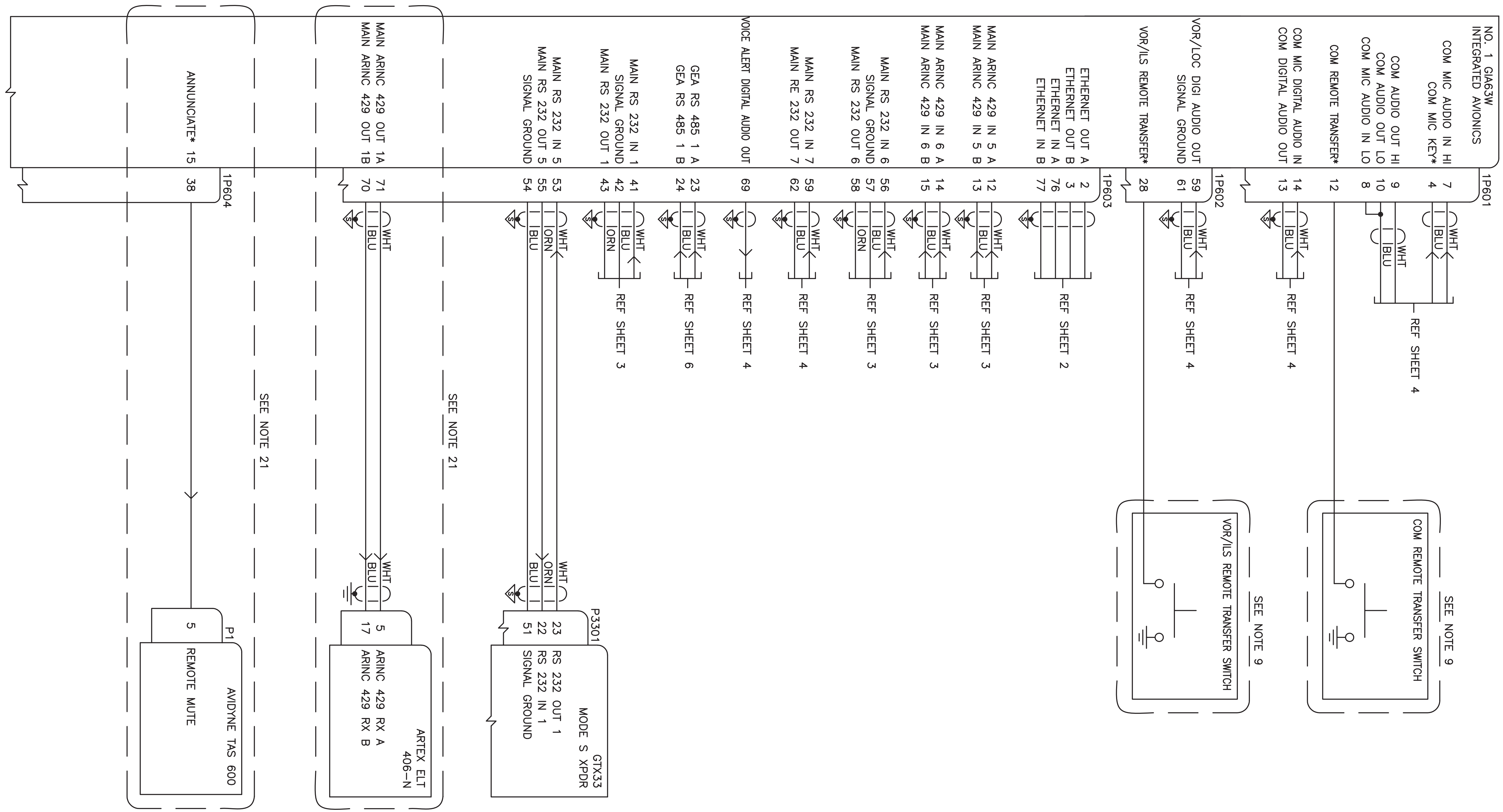


Figure D-10. No. 1 GIA 63W

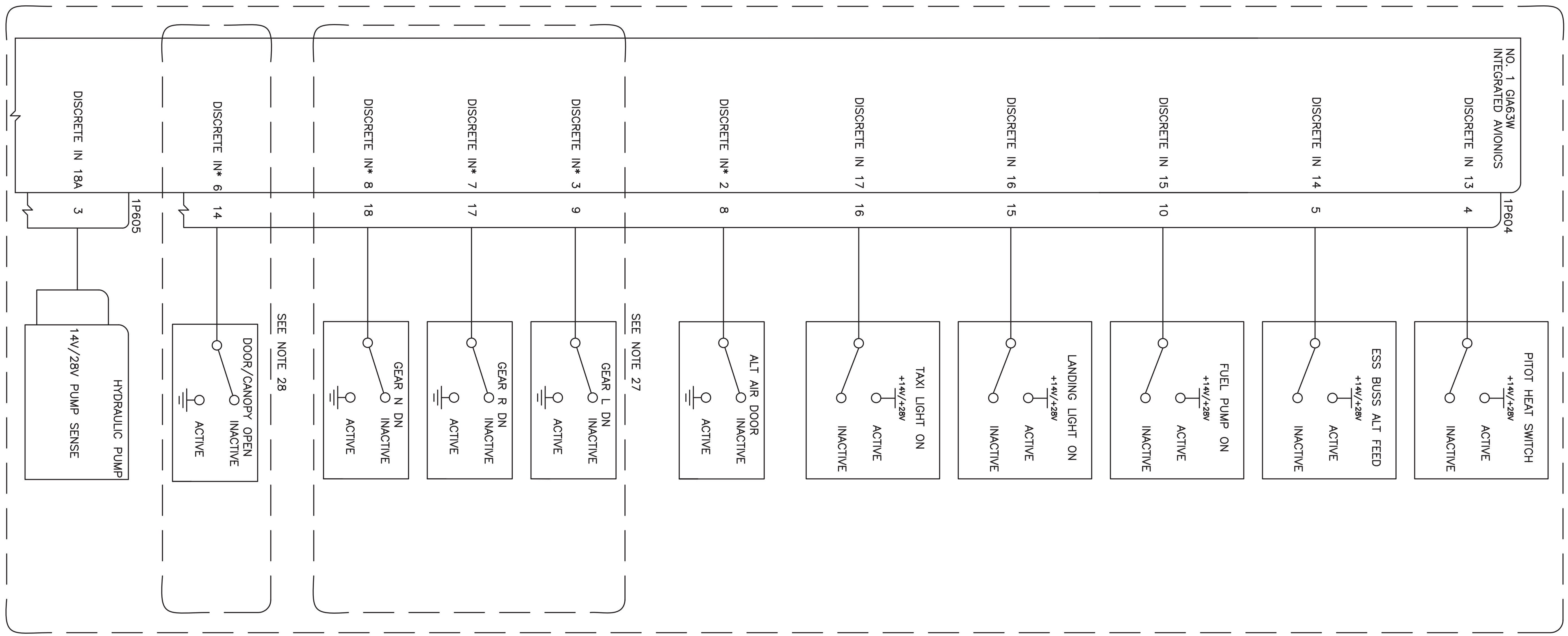


Figure D-11. No. 1 GIA 63W

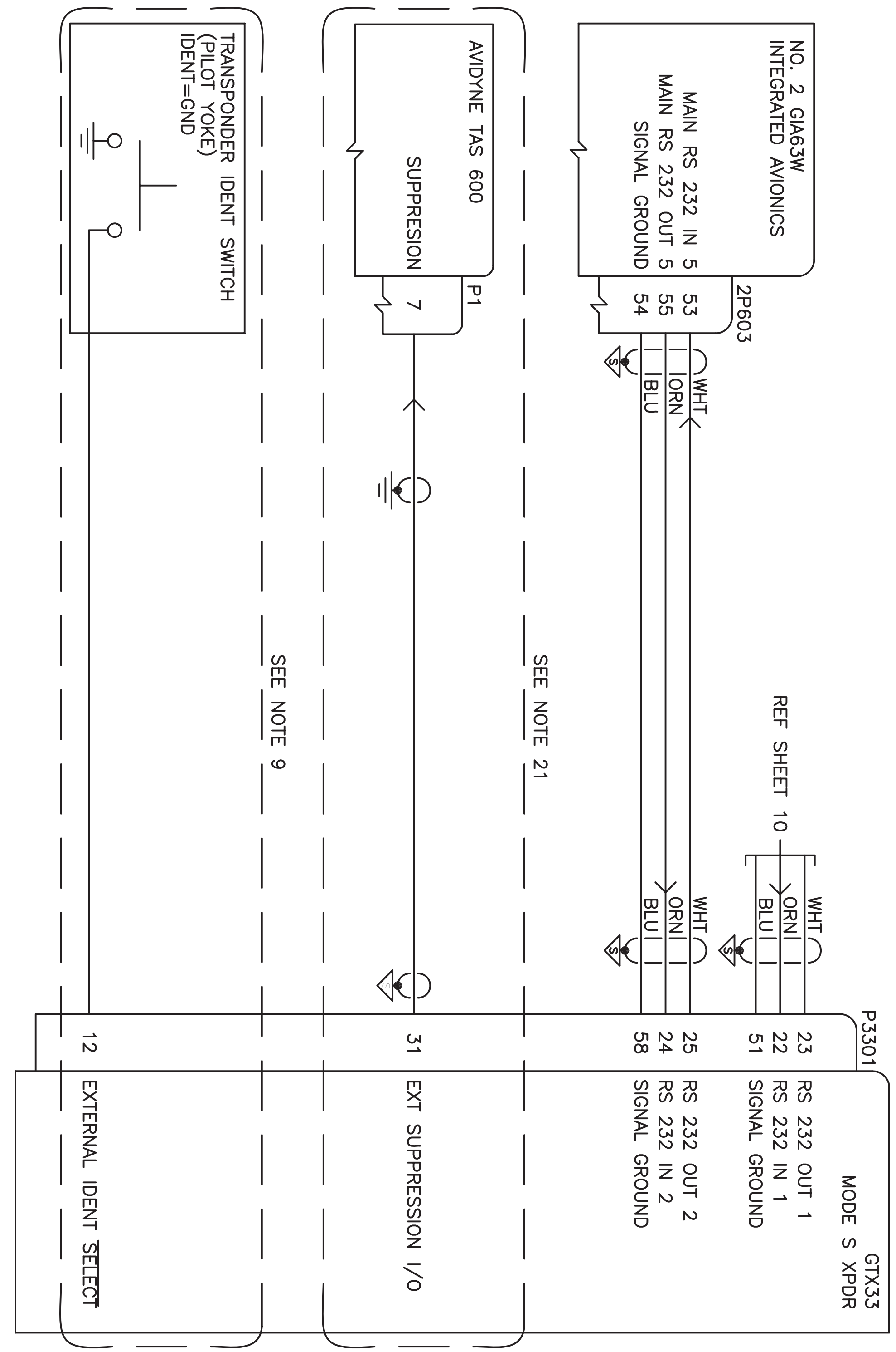


Figure D-12. GTX 33

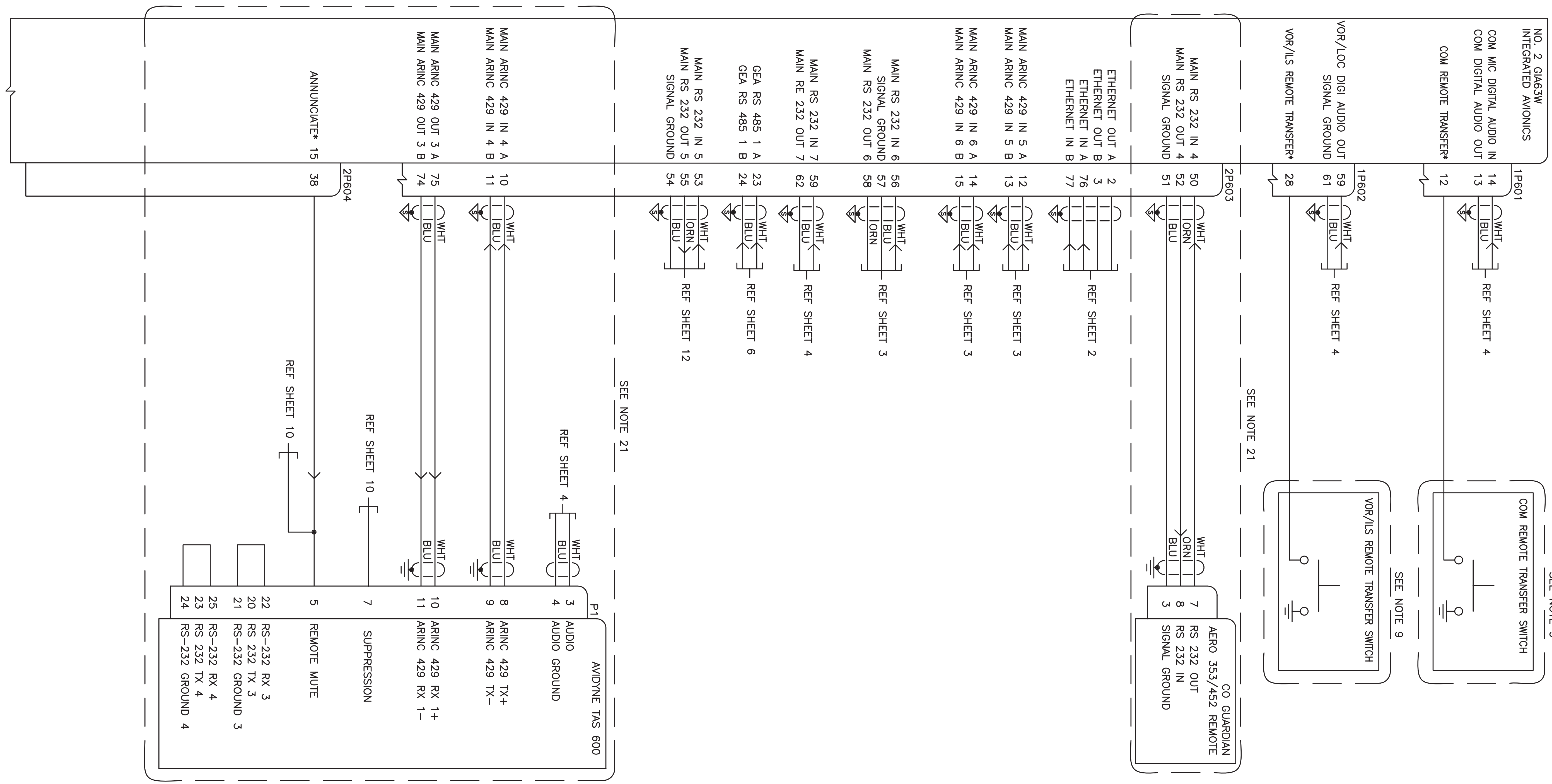


Figure D-13. No. 2 GIA 63W

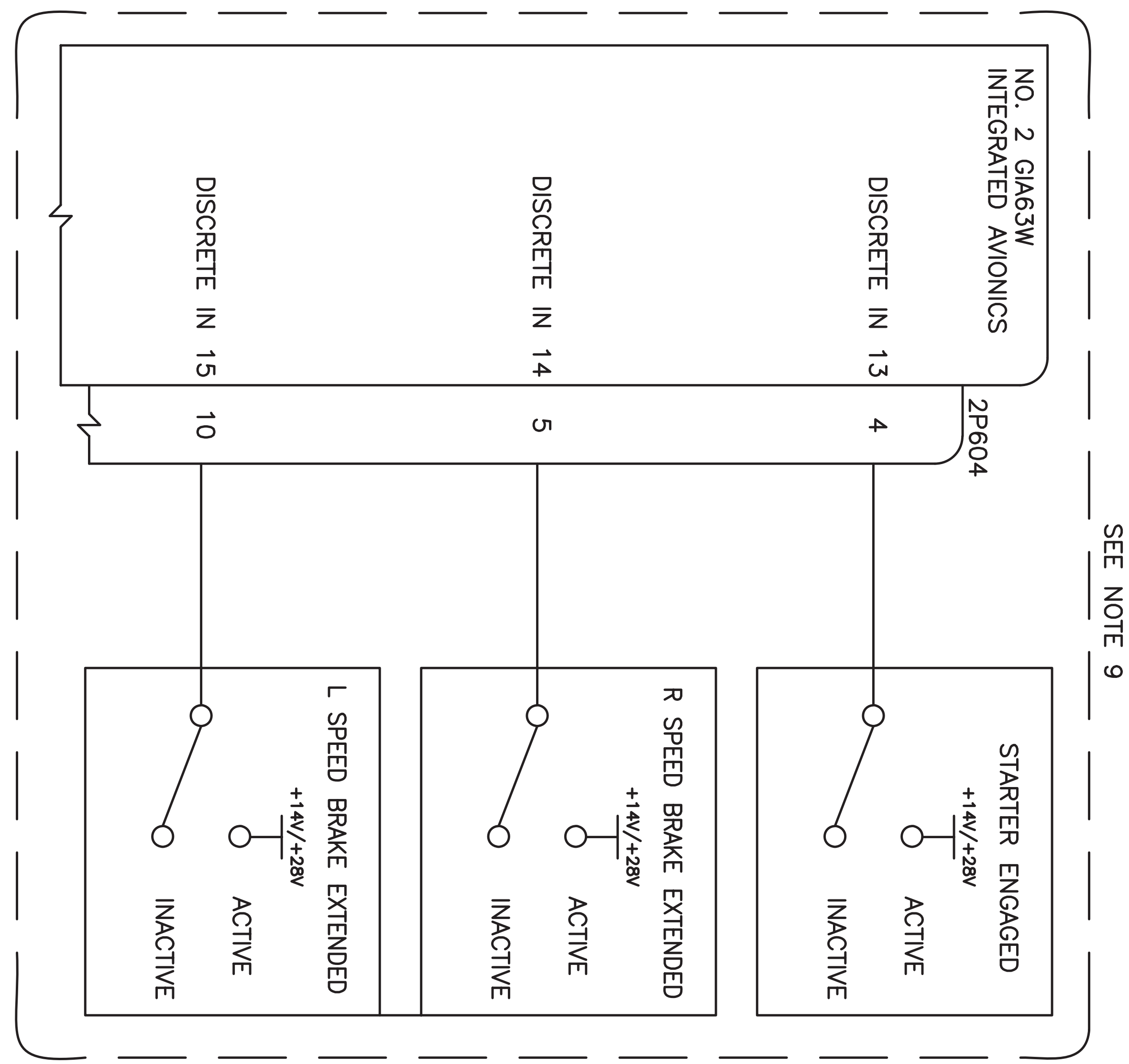


Figure D-14. No. 2 GIA 63W

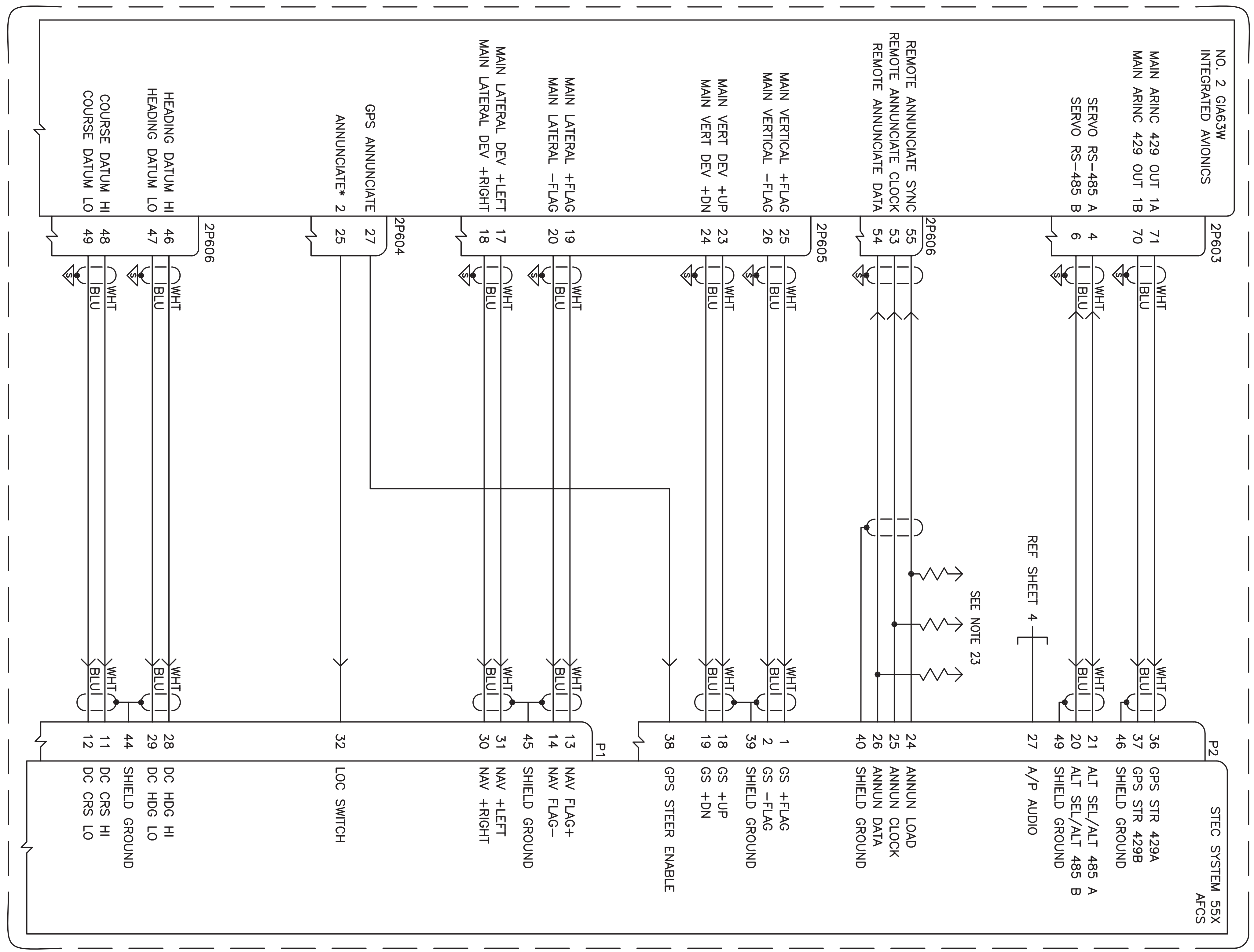


Figure D-15. No. 2 GIA 63W, STEC System 55x

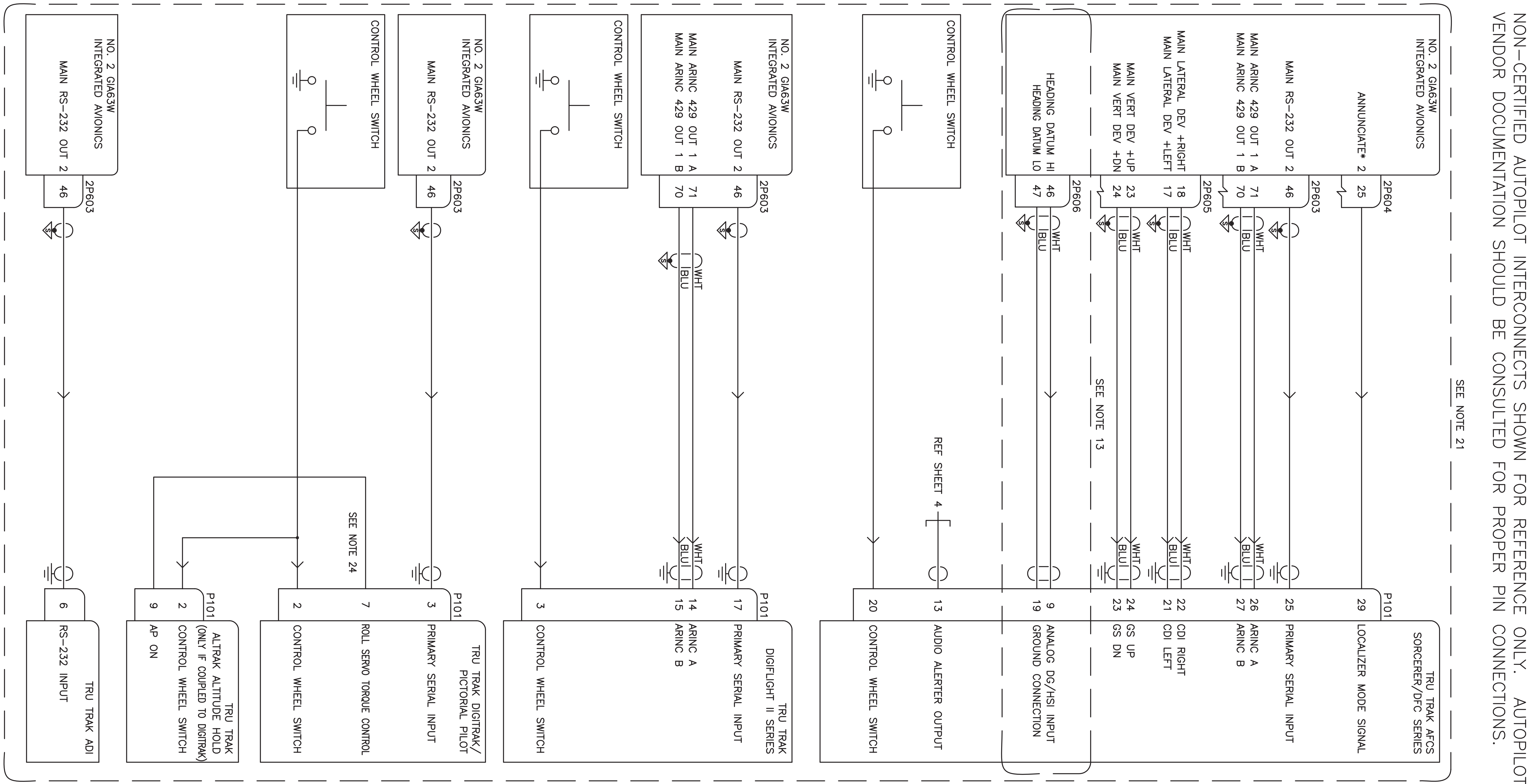


Figure D-16. No. 2 GIA 63W, TRU TRAK AFCS

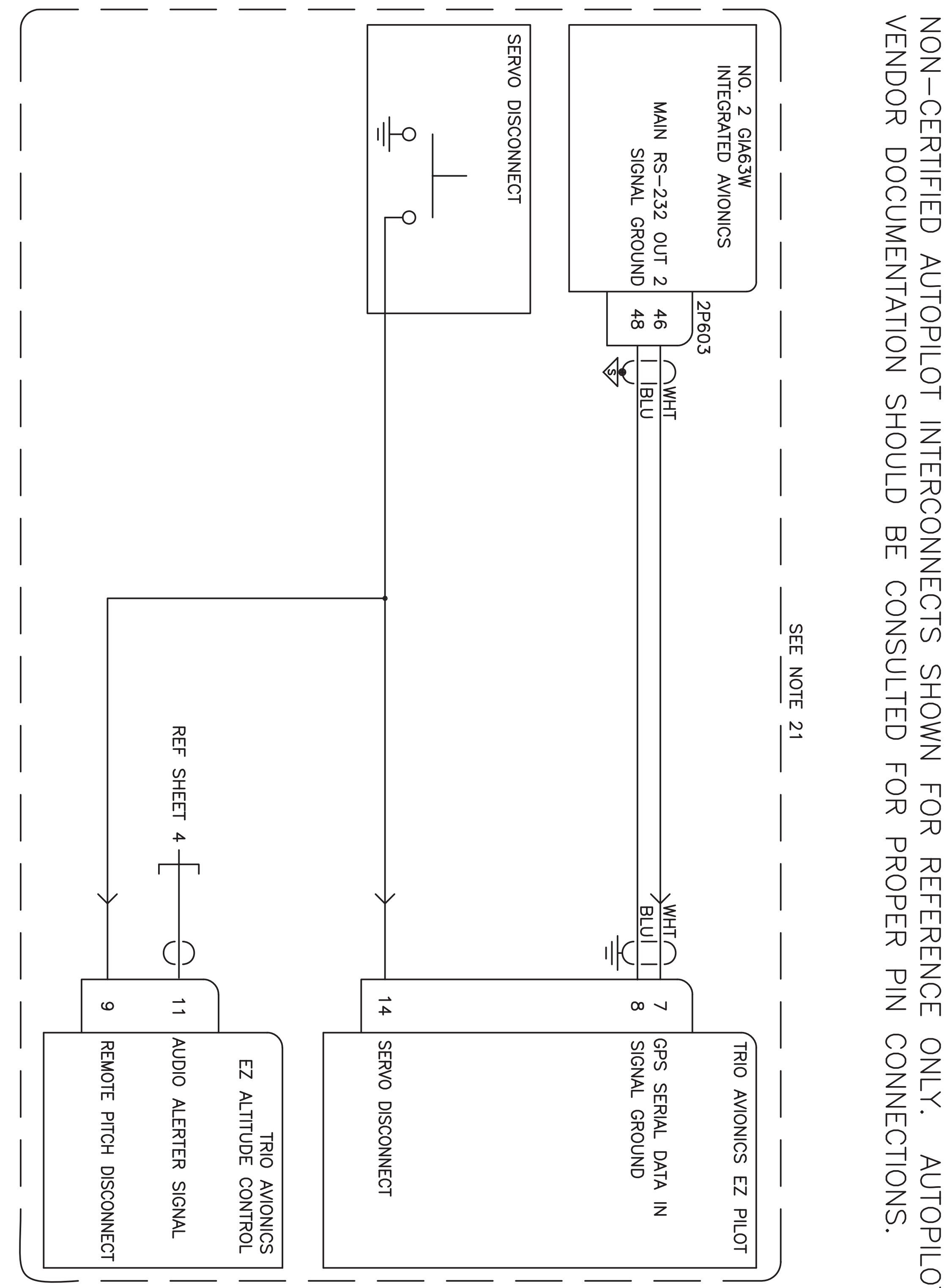


Figure D-17. No. 2 GIA 63W, TRIO Avionics AFCS

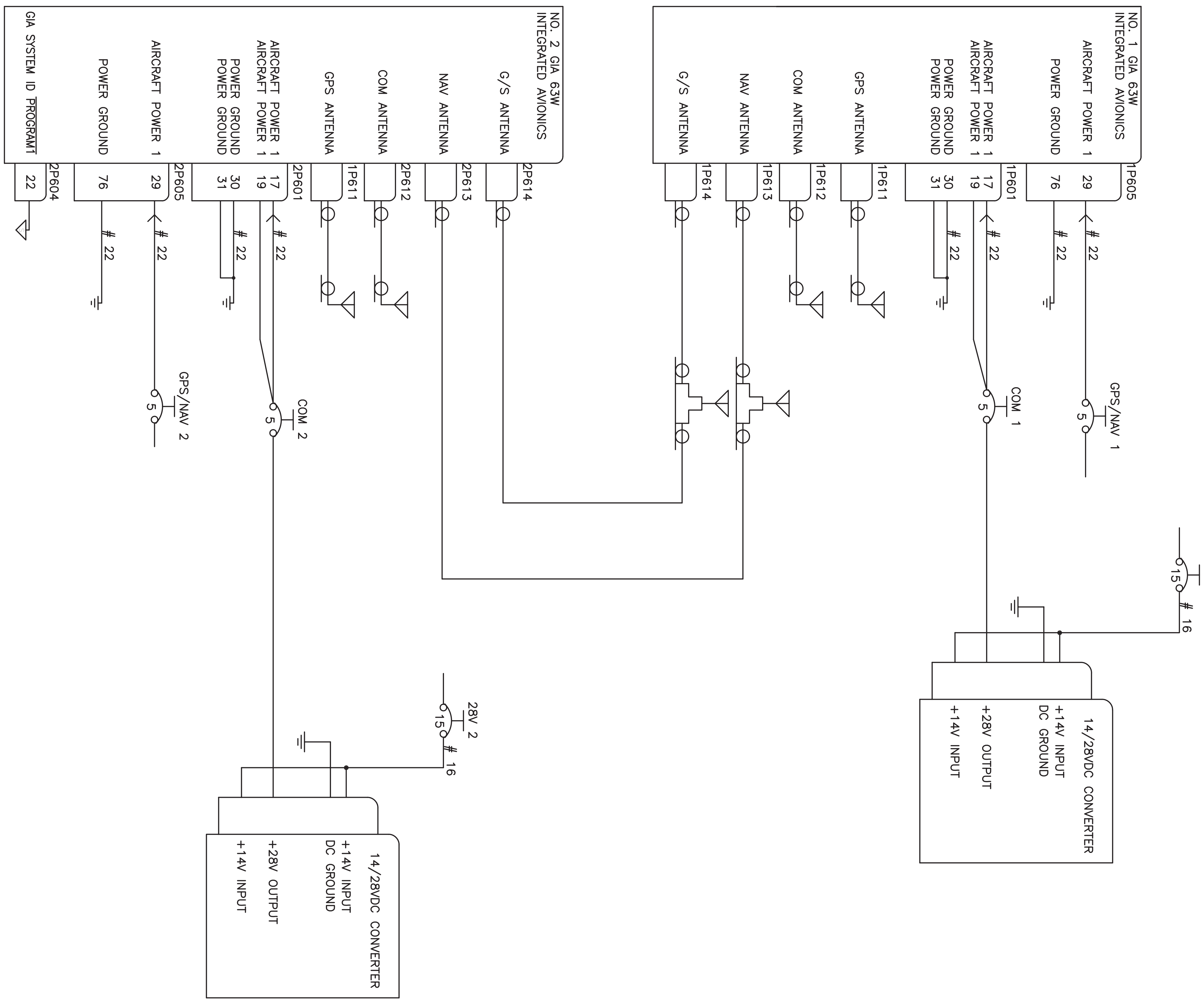


Figure D-18. 14V to 28V Conversion/Antenna

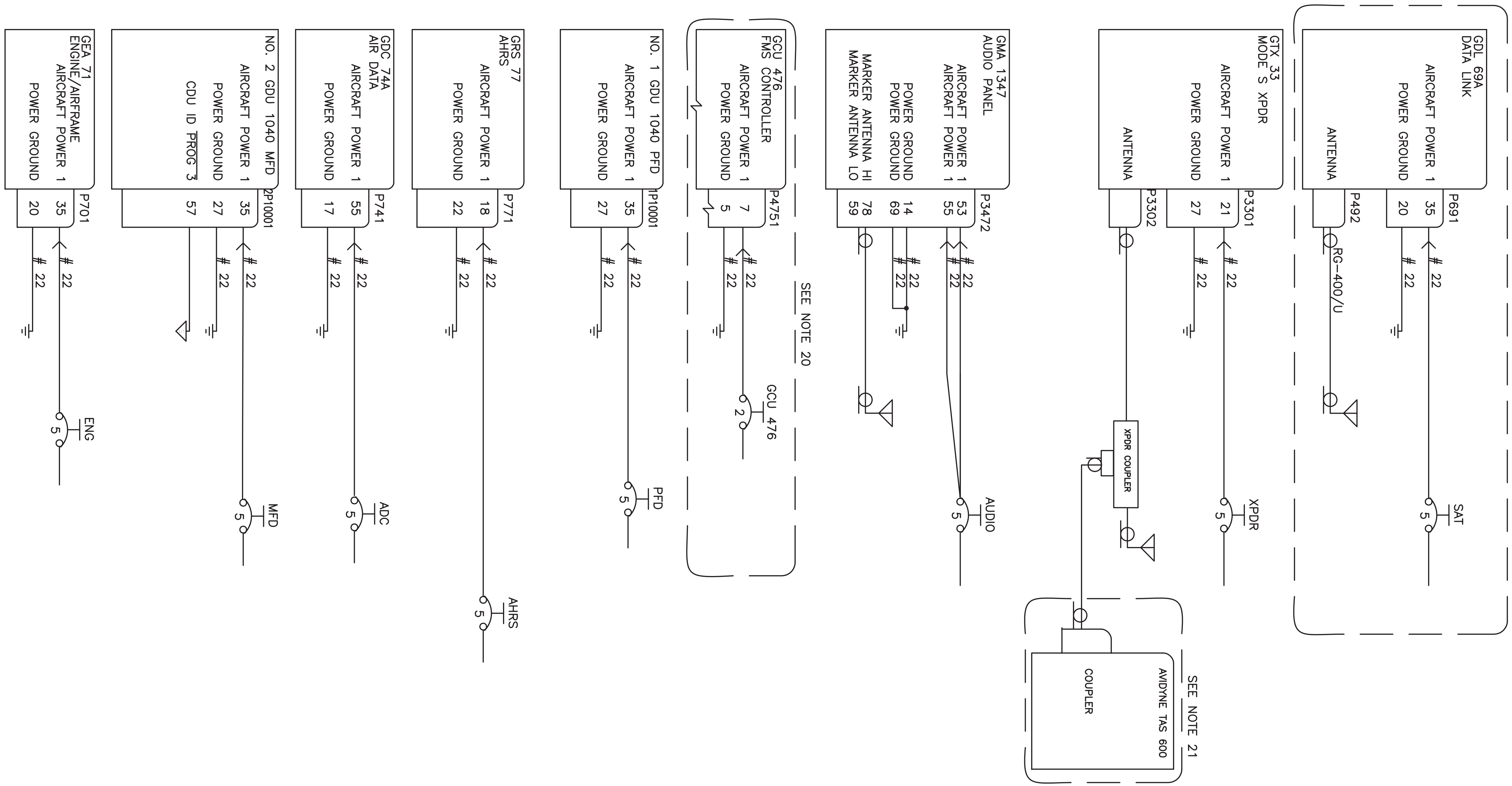


Figure D-19. 14V Power/Antenna

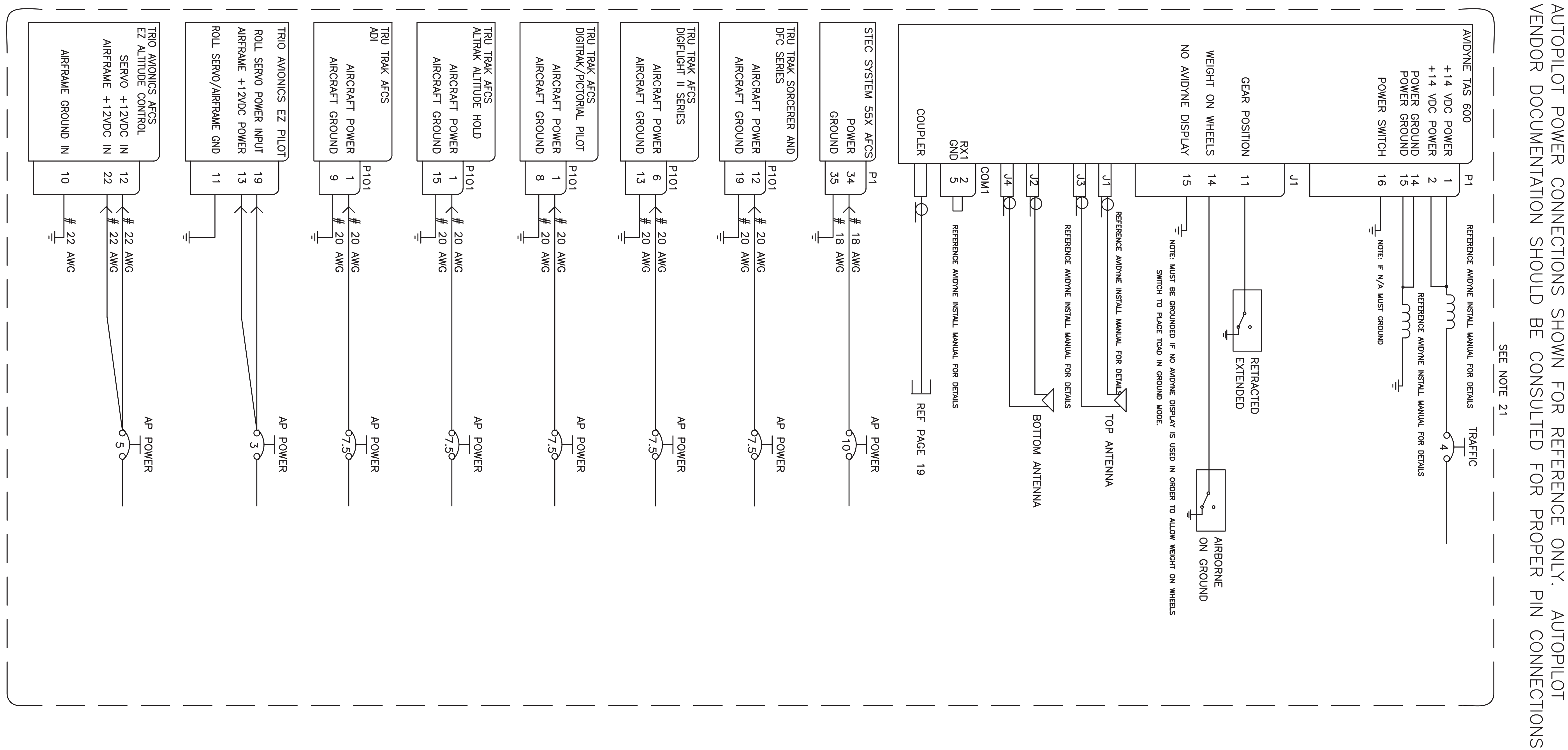


Figure D-20. 14V Power/Antenna

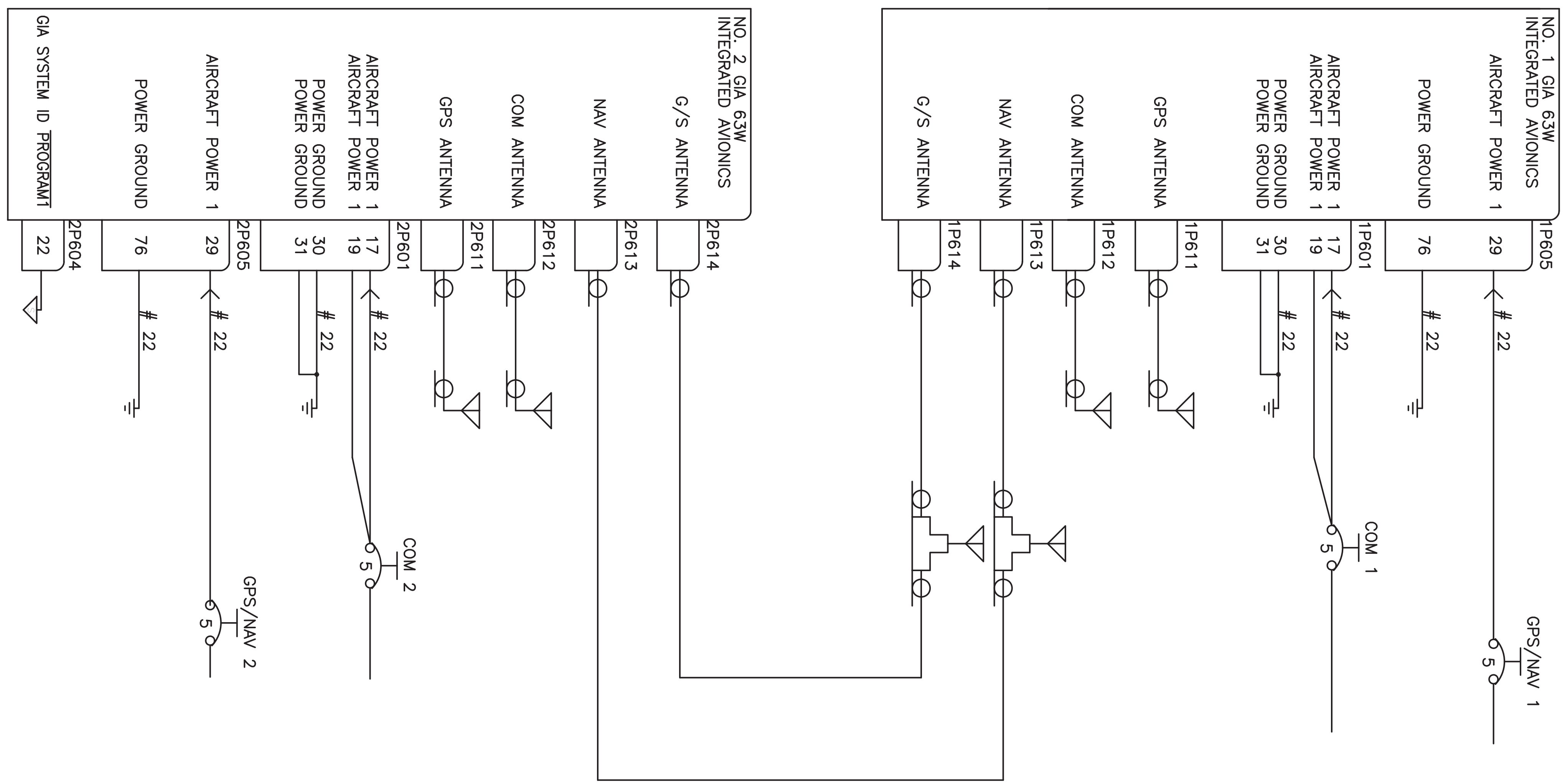


Figure D-21. 28V Power/Antenna

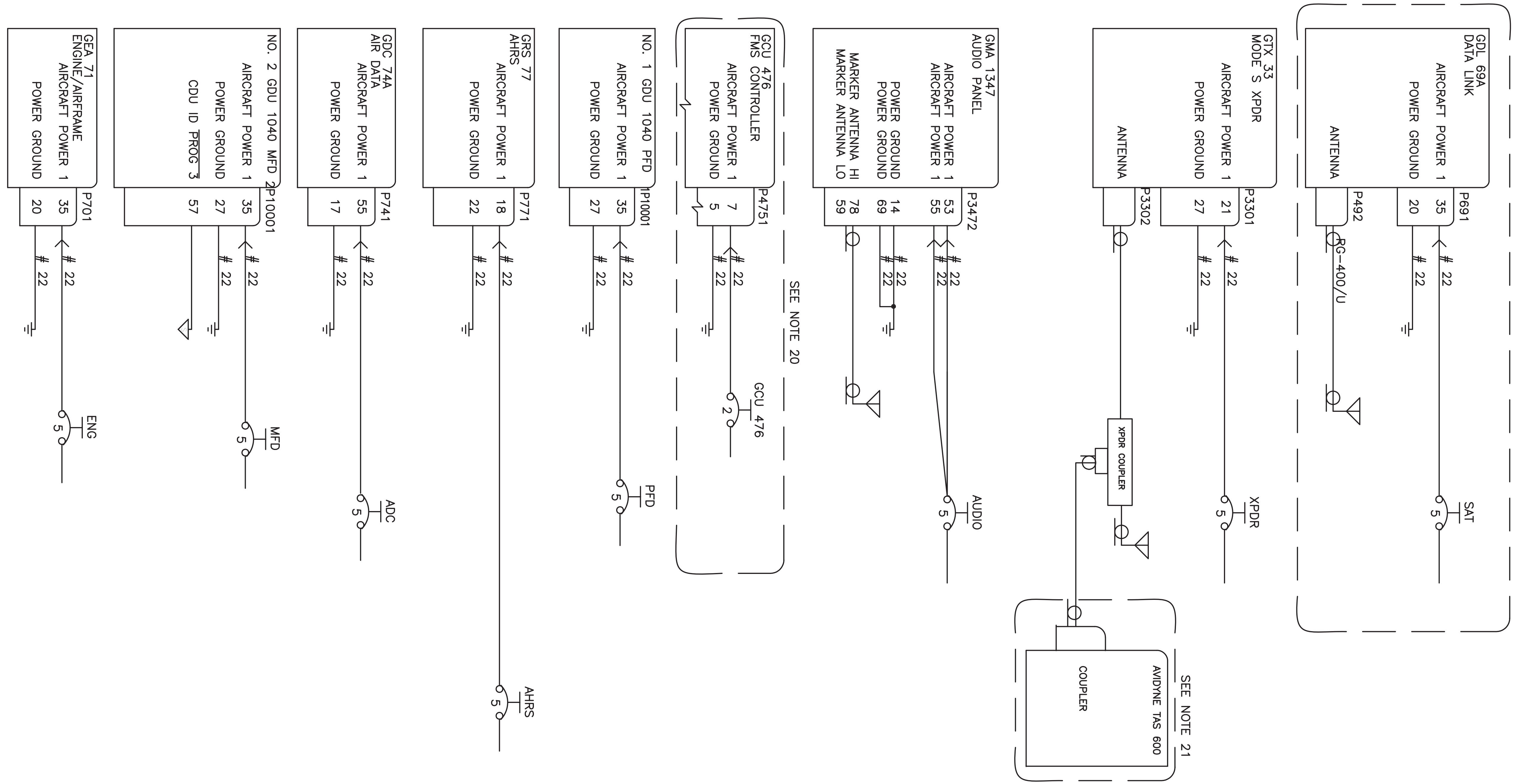


Figure D-22. 28V Power/Antenna

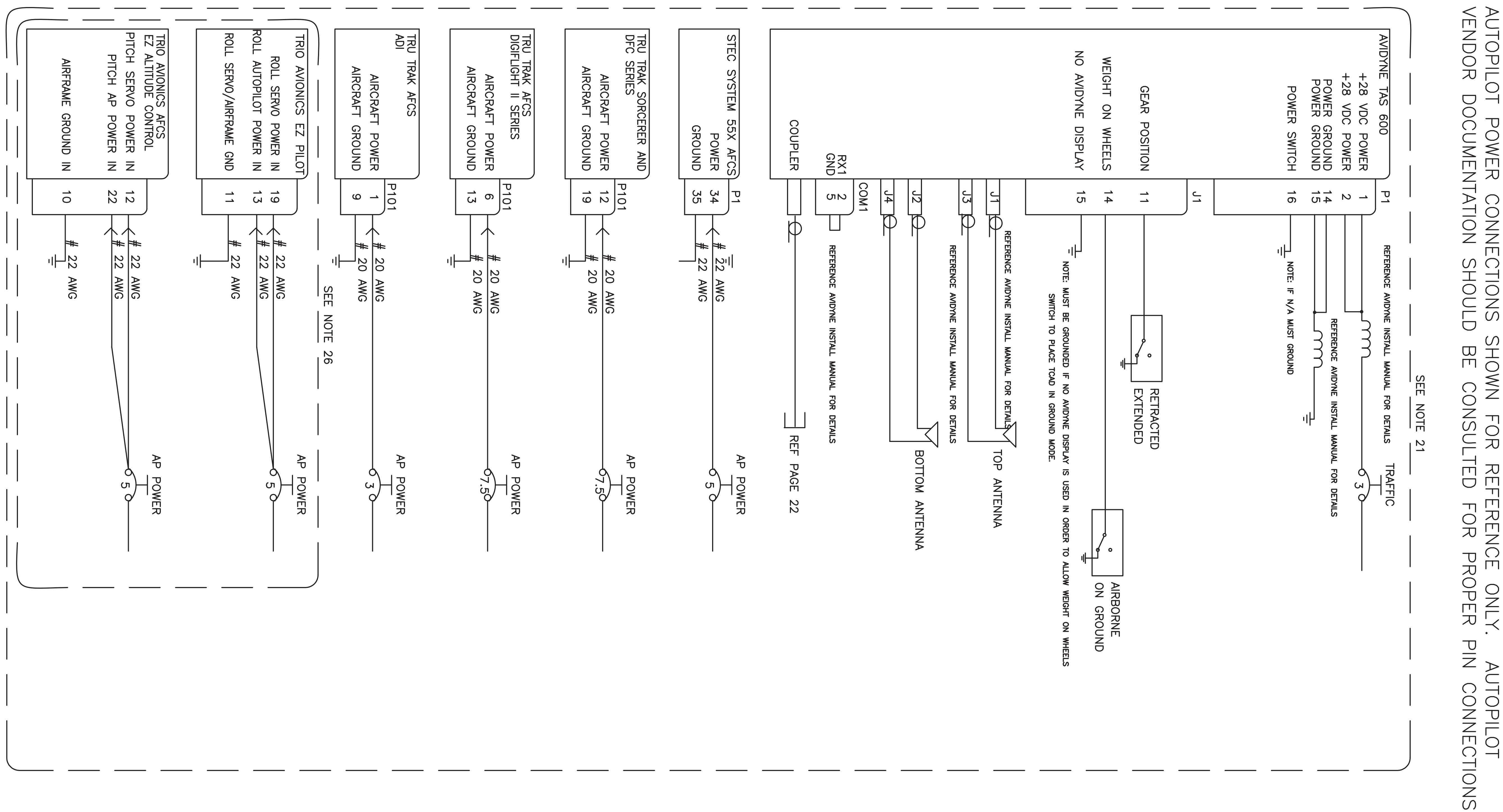


Figure D-23. 28V Power/Antenna