GARMIN

G3X

Installation Manual

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RECORD OF REVISIONS

Revision	Revision Date	Description
A	08/26/09	Initial Release
B	01/05/10	Added Appdx C and made various changes/corrections
C	02/25/10	Added Section 8 and Appendices G, H, and I
D	04/07/10	Updated Section 7 and Appendices E, G, H, & I
E	10/11/10	Added GSU 73 Datalogging info, various updates
F	09/09/11	Added GTX 23, GTN 6XX/7XX, and airborne determination information

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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CURRENT REVISION DESCRIPTION

Revision	Page Number(s)	Section Number	Description of Change
F	1-2	1.3.1	Updated Figure 1-1
	1-4	1.3.3	Updated external navigator info
	1-9	1.7.3	Removed Garmin supplied BNC connector info
	2-2	2.1.2	Updated list of applicable LRU's
	6-1	6	Removed Garmin from section title
	6-2	6.2	Consolidated table info
	6-24	6.6	Moved non-structural mount info from another section
	7-1	7.1	Updated paragraph
	7-3	7.2.2	Updated procedure and screenshot
	7-5	7.3	Added XPDR configuration page info
	7-6	7.3.1	Updated screenshot
	7-7–7-9	7.3.3	Added Vne info and updated screenshot
	7-10	7.3.4	Updated step 3 of the procedure
	7-11	7.3.5	Updated screenshot
	7-11–7-13	7.3.6	Updated display options info and screenshots
	7-15	7.3.7	Updated sound configuration info
	7-17–7-19	7.3.8	Updated procedure, added screenshots and GTN units
	7-21–7-22	7.3.10	Added XPDR Config Page info
	8-25–8-30	8.4.2	Updated configuration info
	8-33–8-34	8.4.3	Added ground/taxi attitude calibration curve info
	9-4–9-26	9.3	Updated GSU/GMU cal procedure
	9-30–9-31	9.4.3	Added GTN configuration info
	F-1–F-10	Appdx F	Updated dwgs in Appdx F
	G-1–G-6	Appdx G	Updated dwgs in Appdx G
	H-1–H-4	Appdx H	Updated dwgs in Appdx H
	K-1–K-6	Appdx K	Added Appendix K, RS-232 Text Output Format

WARNING

This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This Notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.

NOTE

The Garmin G3X system includes products like the GDU 37X and the GSU 73 that are not TSO-certified products and have received no FAA approval or endorsement. Consequently the G3X system is not type-certificated and is not suitable for installation in type-certificated aircraft.

NOTE

Unless otherwise noted all installation guidance, requirements, and instructions apply to one-display, two-display, and three-display G3X systems.

NOTE

References to the GDU 37X throughout this manual apply equally to the GDU 370 and GDU 375 except where specifically noted.

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Limited Warranty for Garmin GMU 44 and GTP 59 Products

The Garmin products GMU 44 and GTP 59 are warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within the applicable 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 apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Garmin; or (v) damage to a product that has been modified or altered without the written permission of Garmin. In addition, Garmin reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

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GSU 73 HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GSU 73 LRU. Mod Levels are listed with the associated service bulletin number, service bulletin date, and the purpose of the modification. The table is current at the time of publication of this manual (see date on front cover) and is subject to change without notice.

MOD LEVEL	SERVICE BULLETIN NUMBER	SERVICE BULLETIN DATE	PURPOSE OF MODIFICATION
1	N/A	N/A	Improved HSCM accuracy when using +28V supply
2	N/A	N/A	Improved backup capacitor circuit to increase backup time in certain under-voltage conditions

1 Installation Overview

1.1 Unpacking Unit

Carefully unpack the equipment and make a visual inspection of the unit for evidence of damage incurred during shipment. If any component of the G3X is damaged, notify the carrier and file a claim. To justify a claim, save the original shipping container and all packing materials. Do not return any equipment to Garmin until the carrier has authorized the claim.

Retain the original shipping containers for storage. If the original containers are not available, a separate cardboard container should be prepared that is large enough to accommodate sufficient packing material to prevent movement.

1.2 Introduction

This manual provides all of the mechanical and electrical information required for the installation of the G3X system..

NOTE

The Garmin G3X system includes products like the GDU 37X and the GSU 73 that are not TSO-certified products and have received no FAA approval or endorsement. Consequently the G3X system is not suitable for installation in type-certificated aircraft.

The following table lists the section of this manual:

Section Name	Description
Section 1	This section contains a basic overview of the G3X system and interface. A Block diagram is given to aid in the understanding of the system. This section also contains generic information that pertains to all components of the G3X system, such as mounting, wiring, and antenna location.
Section 2	This section describes the mechanical, electrical, and installation aspects of the GDU 37X.
Section 3	This section describes the mechanical, electrical, and installation aspects of the GMU 44.
Section 4	This section describes the mechanical, electrical, and installation aspects of the GSU 73.
Section 5	This section describes the mechanical, electrical, and installation aspects of the GTP 59.
Section 6	This section describes the mechanical, electrical, and installation aspects for the GPS and XM antennas.
Section 7	This section contains software, configuration, database, and XM activation information.
Section 8	This section contains installation, configuration, and calibration information for Engine/ Airframe sensors.
Section 9	This section contains post-installation checkout and calibration procedures for the G3X.
Section 10	This section contains G3X troubleshooting information.
Section 11	This section contains information for ensuring the unit is suitable to be returned to service.
Appendix A	This section contains pinout information for all G3X LRU's.
Appendix B	This section contains connector installation instructions.
Appendix C	This section contains airframe specific installation guidance.
Appendix D	This section contains G3X Outline and Installation Drawings.
Appendix E	This section contains G3X Interconnect Drawings.
Appendix F	This section contains G3X External Interface Drawings.
Appendix G	This section contains Sensor Wiring Examples.
Appendix H	This section contains Lycoming/Continental Engine Sensor Wiring Examples.
Appendix I	This section contains Rotax Engine Sensor Wiring Examples.
Appendix J	This section contains Jabiru Engine Sensor Wiring Examples.
Appendix K	This section contains details of the RS-232 Text Output Format

1.3 System Overview

The G3X 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 one, two, or three color screens. The G3X 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 G3X 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.

1.3.1 System Architecture

Figure 1-1 illustrates an example block diagram of a G3X installation. The flexibility of the system allows the installer to determine the architecture that best fits each installation.

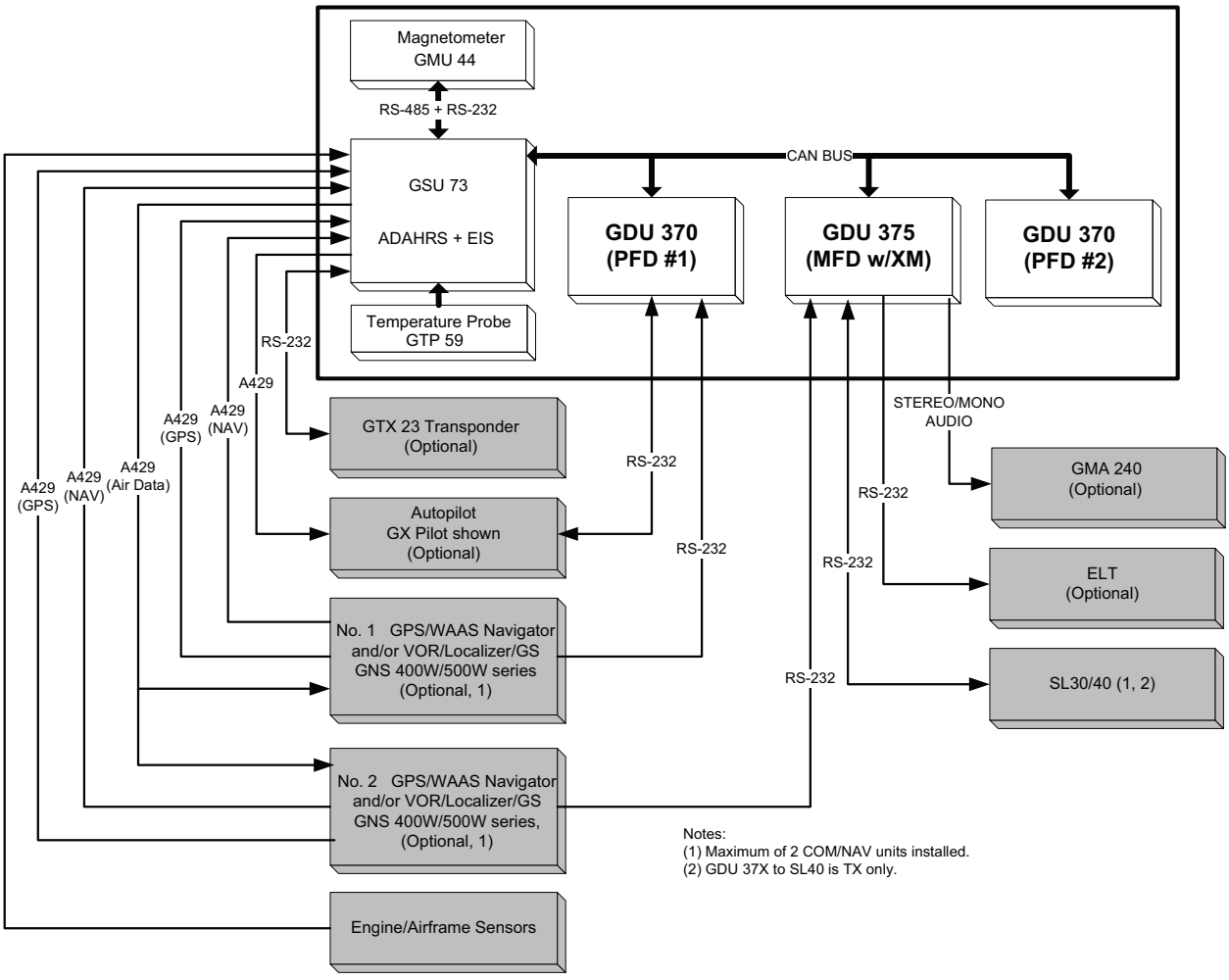

Figure 1-1 G3X Interconnect Example

1.3.2 Configuration Module

The G3X system is designed to store configuration and calibration data in multiple locations to retain the configuration of the system during maintenance. Figure 1-2 shows the configuration module that installs on both the GDU 37X (PFD) and the GSU 73 connector backshell.

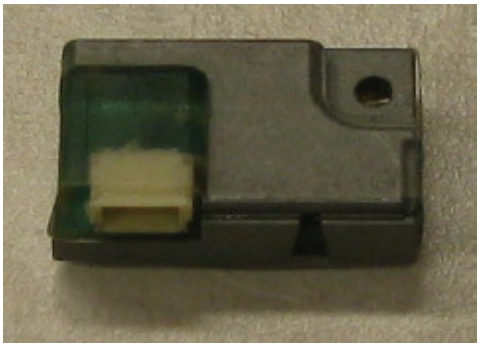

Figure 1-2 Configuration Module

1.3.2.1 GDU 37X PFD Configuration Module

The GDU 37X PFD uses a configuration module designated as the master system configuration module. The master system configuration module stores configuration data identical to the PFD configuration data stored in the PFD memory. The PFD cross-checks the configuration module data against internal PFD memory and self-configures to match the master system configuration module. The PFD also maintains control of the GSU 73 configuration and calibration settings except for GSU AHRS calibration settings which are stored in the GSU configuration module.

1.3.2.2 GSU 73 Configuration Module

The GSU configuration module stores a duplicate copy of the AHRS/Magnetometer calibration values which are recorded upon completion of post-installation calibration procedures. The GSU configuration module also provides a reference temperature measurement which is used for calculating thermocouple temperatures. All thermocouple temperature readouts will be red-x'd if the GSU configuration module is not present.

1.3.3 External Navigators (Optional)

The G3X can interface with the SL30 Nav/Comm Transceiver, GTN 600/700 series, and the GNS 400/500 series units (Table 1-1) for use as external navigators.

In a configuration which includes one or more external GPS navigators (i.e., GNS 400/500 or GTN 600/700 series units), the G3X can display the selected external GPS Navigator's flight plan and guidance information. This may include information from the external navigator such as arrivals, departures, holding patterns, procedure turns, and other data which is not part of the G3X database (the G3X database contains only FAF and MAP approach info).

WARNING

Do not use the approach information provided by the VFR navigation database residing within the G3X as a means of navigating any instrument approach. The G3X VFR navigation database is limited to providing only the waypoints for the final approach leg of a published procedure. These waypoints and associated course line are made available for monitoring purposes only.

When an external navigator that supports both GPS and VOR/ILS capabilities (i.e. GNS 430/530 or GTN 600/700 series units) is selected, the external navigator's CDI button is used to switch the G3X HSI between GPS and VOR/ILS navigation.

When the G3X is using flight plan data from an external GPS navigator, changes to the active flight plan are entered on the external GPS unit, and the ability to navigate using the G3X controls is disabled. When the G3X internal VFR GPS navigation source is selected, changes to the active flight plan are entered using the G3X controls, and external GPS flight plan data is ignored. Use of the internal VFR GPS navigation source can be manually selected by the user at any time, and it will be selected automatically in the event that communication from all configured external GPS sources is lost.

1.4 General LRU Specifications

1.4.1 Garmin LRU Part Number

Table 1-1 lists the available G3X LRUs. The GDU 37X Assembly Part Numbers (010-00667-XX) include the GDU and all items listed in Table 1-2. Other LRUs listed in Table 1-1 are included in the G3X LRU Kit (Table 1-6) and their Connector Kits are listed in Table 1-5.

Table 1-1 GDU 37X LRU Part Numbers

LRU	Unit Only Part Number	Assembly Part Number
GDU 370 Americas DB	011-01747-15	010-00667-15
GDU 370 Atlantic DB	011-01747-20	010-00667-20
GDU 370 Pacific DB	011-01747-35	010-00667-35
GDU 375 Americas DB	011-01747-30	010-00667-25
GMU 44	011-00870-10	010-00296-10*
GSU 73	011-01817-00	010-00691-00
GTP 59	011-00978-00*	NA

Table 1-2 Contents of GDU 37X Assembly (010-00667-XX)

Item	Garmin P/N	Quantity
GDU 37X	011-01747-XX	1
GDU 37X Connector Kit	011-01921-00	1
GDU 37X Nutplate	115-01054-00	1
SD Card, Dummy	145-00561-00	1
Important Safety and Product Information	190-00720-50	1
GDU 37X Quick Reference Guide	190-01055-00	1
Jeppesen Free Single Update	190-10003-03	1

1.4.2 Power Specifications

All LRUs are capable of operating at either 14 or 28 VDC. See Table 1-3 for current draw specifications.

Table 1-3 GDU 37X LRU Power Requirements

LRU	Supply Voltage	Current Draw
GDU 37X	10-29Vdc	1.10 Amp @ 14Vdc 0.55 Amp @ 28Vdc
GMU 44	12Vdc (from GSU 73)	Inc. in GSU Current Draw
GSU 73*	10-29Vdc	1.75 Amp @ 14Vdc (Max) 0.80 Amp @ 28Vdc (Max)

*Garmin recommends using Mod 1 level GSU 73 in aircraft that use a +28V supply voltage and intend to monitor current on high voltage devices such as the aircraft alternator.

1.4.3 Physical Specifications

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

Table 1-4 GDU 37X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Unit Weight w/Nutplate & Connector Weight
GDU 370	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.7 mm)	1.6 lbs (0.713 kg)	1.8 lbs (0.803 kg)
GDU 375	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.7 mm)	1.7 lbs (0.753 kg)	1.9 lbs (0.843 kg)
GMU 44	N/A	2.10 inches (5.33 cm)	*3.35 inches (85.1 mm)	0.35 lbs. (0.16 kg)	0.50 lbs. (0.23 kg)
GSU 73	5.50 inches (139.8 mm)	3.96 inches (100.6 mm)	7.33 inches (186.2 mm)	3.1 lbs (1.41 kg)	3.5 lbs (1.59 kg)

1.4.4 Cooling Requirements

While no forced cooling air is required for the G3X system, it is highly recommended that the air behind the panel be kept moving (by ventilation or a fan).

- No cooling air is required for the GDU 37X
- No cooling air is required for the GMU 44
- No cooling air is required for the GSU 73, however the GSU 73 should be mounted in a location that provides adequate airflow to comply with the maximum outer case temperature listed in Section 4.

NOTE

Avoid installing the G3X LRUs near heat sources. If this is not possible, ensure that additional cooling is provided. Allow adequate space for installation of cables and connectors. The installer will supply and fabricate all of the cables. All wiring should be in accordance with FAA AC 43.13-1B and AC 43.13-2B.

1.5 Installation Requirements

One GDU 37X assembly (listed in Table 1-1) is required, dependent upon customer's desired database region. Each GDU 37X (010-00667-XX) comes with all equipment needed for installation.

1.5.1 Required Accessories

The following kits are required for the installation of the G3X. The GDU 37X is not included in either the G3X Installation Kit or the G3X LRU Kit. The available GDU 37X units are listed in Table 1-1.

Table 1-5 Contents of G3X Installation Kit (K10-00017-00)

Item	Garmin P/N	Quantity
GMU 44, Connector Kit	011-00871-00	1
Config Module w/EEPROM, Jackscrew (for GSU)	011-00979-20	1
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1
Thermocouple Kit	011-00981-00	1
GSU 73, Connector Kit, P9731	011-01818-00	1
GSU 73, Connector Kit, P9732	011-01818-01	1
G3X, Supplemental Parts	011-02347-00	1
GMU 44, Install Rack, Modified	115-00481-10	1

Table 1-6 Contents of G3X LRU Kit (K10-00016-00)

Item	Garmin P/N	Quantity
GMU 44, Unit Only	010-00296-10	1
GSU 73, Unit Only	010-00691-00	1
GTP 59, Unit Only	011-00978-00	1

1.6 Mounting

Refer to Section 2 through Section 6 for specific mounting instructions for each component of the G3X, and to Appendix D for Outline & Installation Drawings.

1.7 Wiring/Cabling Considerations

Use MIL-W-22759/16 (or other approved wire) AWG #22 or larger wire for all connections unless otherwise specified. The supplied standard pin contacts 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. Do not attempt to combine more than one unit on the same circuit breaker.

RG400 or RG142 coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation.

1.7.1 Wiring Harness Installation

Allow adequate space for installation of cables and connectors. Ensure that routing of the wiring does not come in contact with sources of heat, RF or EMI interference. Analog Input wires routed too close to spark plugs, plug wires, or magnetos may result in erratic readings.

The installer shall supply and fabricate all of the cables. Required connectors, etc. are provided with the G3X Installation Kit (K10-00017-00). Electrical connections are made through D subminiature connectors for the GDU 37X and GSU 73 units, and through a round 9-pin connector for the GMU 44. Appendix A defines the electrical characteristics of all input and output signals. Required connectors and associated hardware are supplied with the connector kit.

Contacts for the connectors must be crimped onto the individual wires of the aircraft wiring harness. Table 1-7 lists contact part numbers (for reference) and recommended crimp tools.

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CAUTION

Check wiring connections for errors before connecting any wiring harnesses. Incorrect wiring could cause internal component damage.

Table 1-7 Pin Contact and Crimp Tools Part Numbers

LRU	Contact Type	Garmin Contact Part Number	Recommended Positioner	Recommended Insertion/ Extraction Tool	Recommended Hand Crimping Tool
GDU 37X	Socket, Mil Crimp, Size 20	336-00094-00	M22520/2-08, Daniels K13-1	M81969/1-04 for size 22D pins and M81969/1-02 for size 20 pins	M22520/2-01
GSU 73	Pin, Mil Crimp, Size 22D	336-00021-00	Positronic P/N 9502-4, ITT P/N M22520/2-09, Daniels P/N K42		
GTP 59					
011-00979-20 (Config module w/ EEPROM kit)					
011-00981-00 (thermocouple kit)					
GMU 44	Socket, Mil Crimp, Size 20	336-00022-00	M22520/2-08, Daniels K13-1		
011-00979-22 (Config module w/ Sockets & Jackscrew kit)	Socket, Mil Crimp, Size 20, 26-30 AWG	336-00022-01	Positronic P/N 9502-5		

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NOTES

1. Insertion/Extraction tools from ITT Cannon are all plastic; others are plastic with metal tip.
2. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.
3. Standard Density pins can accept up to 20 AWG, High Density pins can accept up to 22 AWG.
4. Garmin recommends using 22 AWG or larger wires unless otherwise specified.

1.7.2 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.
- Check that there is ample space for the cabling and mating connectors.
- Avoid sharp bends in cabling.
- Avoid routing near aircraft control cables.
- Avoid routing cables near heat sources, power sources (e.g., 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting.
- Route the GPS antenna cable as far as possible away from all COM transceivers and antenna cables.

1.7.3 Cable Connector Installation

1. Route the coaxial cable to the unit location. Secure the cable in accordance with good aviation practices.
2. Trim the coaxial cable to the desired length and install the BNC or TNC (per Figure 1-3) connector. If, provided, follow the connector manufacturer's instructions for cable preparation.

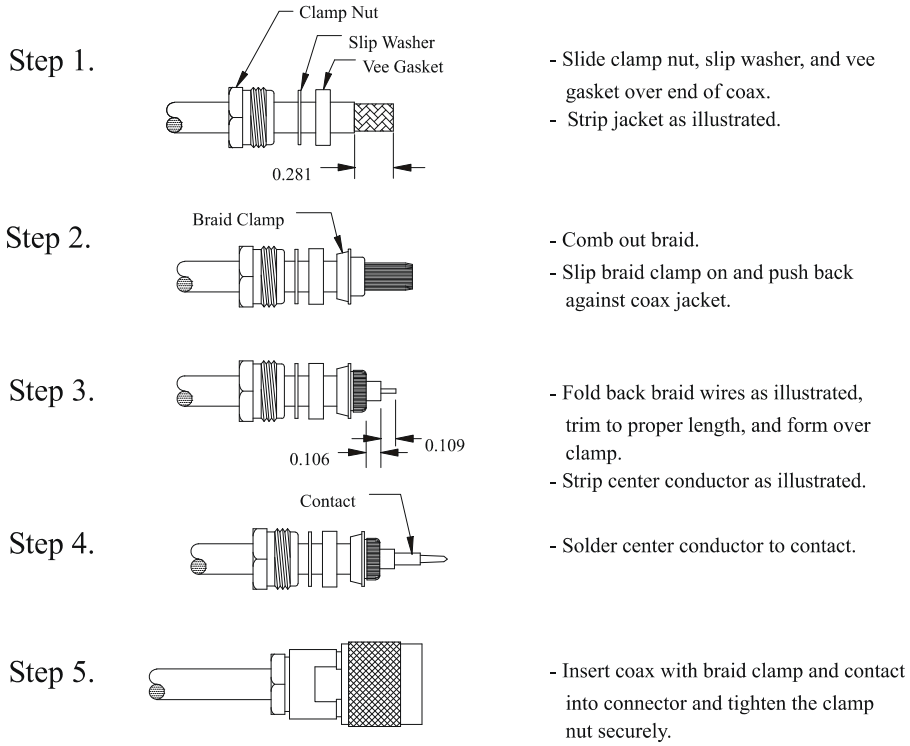

Figure 1-3 TNC Connector Installation

1.7.4 Backshell Assemblies

Connector kits include backshell assemblies. The backshell assembly houses the configuration module and a thermocouple reference junction (if applicable, see Appendix D). Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds at the backshell housing. The instructions needed to install the Jackscrew Backshell, Configuration Module, and Thermocouple are located in Appendix B.

NOTE

The GDU 37X rear connector (J3701) is electrically isolated. For installations using shielded cables, a ground pin must be tied to the connector shell.

2 GDU 37X

Figure 2-1 GDU 37X Unit View

2.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GDU 37X.

The GDU 37X provides a central display and user interface for the G3X system. The display is mounted flush to the aircraft instrument panel using four #6 captured screws with a 3/32" head. The GDU 37X is available in two models, GDU 370 and GDU 375. The GDU 370 is a Garmin Display Unit with a VFR WAAS-GPS receiver. The GDU 375 provides these same features plus an XM receiver.

NOTE

Only a single GPS antenna is required for installations using more than one GDU 37X unit, as the GDU 37X will "share" the GPS information with all GDU 37X units.

2.1.1 Navigation Functions

- Display of position and ground speed
- Display of stored navigation and map databases
- Area navigation functions using the determined position/velocity and stored navigation data
- Advisory approach navigation functions and associated databases

2.1.2 Interface Summary

The GDU 37X uses CAN and RS-232 communications interfaces. The GDU 37X communicates with the following Garmin LRUs:

- Other GDU 37X
- GSU 73
- SL30 Nav/Comm Transceiver
- SL40 Comm Transceiver
- GNS 400/500 Series Units
- GTN 600/700 Series Units
- GTX 23/327/330 Transponder

2.2 Electrical Specifications

2.2.1 Electrical Characteristics

Table 2-1 GDU 37X Supply Voltages

Characteristics	Specifications
Power Requirements	14/28 VDC

2.2.2 Power Consumption

Table 2-2 GDU 37X Power Requirements

LRU	14V (Maximum)	14V (Typical)	28V (Maximum)	28V (Typical)
GDU 370	15W, 1.10 Amp	8.5W, .600 Amp	15W, 0.540 Amp	8.5W, .300 Amp
GDU 375	15W, 1.10 Amp	9.5W, .675 Amp	15W, 0.540 Amp	9.25W, .330 Amp

2.2.3 GPS Specifications

The GDU 37X uses a high-sensitivity GPS receiver that continuously tracks and uses up to 12 satellites to compute and update its position. In an installation with multiple GDU 37X units, each GDU can be configured to use its own internal GPS receiver, or to receive GPS data transmitted by another GDU. At least one GDU must be equipped with a GPS antenna. See section 7.3.9 for further information.

Table 2-3 GDU 37X GPS Specifications

Characteristics	Specifications
Acquisition Time	a) Warm Start (position known to 10 nm, time known to 10 minutes, with valid almanac and ephemeris): Less than 5 seconds b) Cold Start (position known to 300 nm, time known to 10 minutes, with valid almanac): Less than 45 seconds c) AutoLocate™ (with almanac, without initial position or time): Less than 60 seconds
Update Rate	5/second, continuous
Positional Accuracy	<10 meters
Antenna Power Supply	Voltage (4.5 to 5.0), current (50 mA max)

2.2.4 Antennas

Refer to Section 6 for antenna information

2.3 Environmental Specifications

The GDU 37X has an Operating Temperature Range of -20°C to +60°C.

2.4 Installation Requirements

2.4.1 Required Accessories

Each of the following accessories is provided with the GDU 37X unit. The connector kit is required to install the unit (Figure 2-2). The GDU 37X Nutplate is available to reinforce the panel cutout in thin panel installations.

The contents of the GDU 37X Connector Kit are listed in Table 2-4. One kit is required for each GDU 37X installed.

Table 2-4 Contents of GDU 37X Connector Kit (011-01921-00)*

Item	Garmin P/N	Quantity
Sub-Assy, bkshl w/Hdw, Jackscrew	011-01855-04	1
Conn, Rcpt, D-Sub, Crimp Socket, C	330-00625-50	1
Contact, Sckt, D-Sub, Crimp, Size 20	336-00094-00	20

2.4.2 Additional Equipment Required

A 3/32” hex drive tool is required to secure the GDU 37X to the panel as described in Section 2.7 Unit Installation.

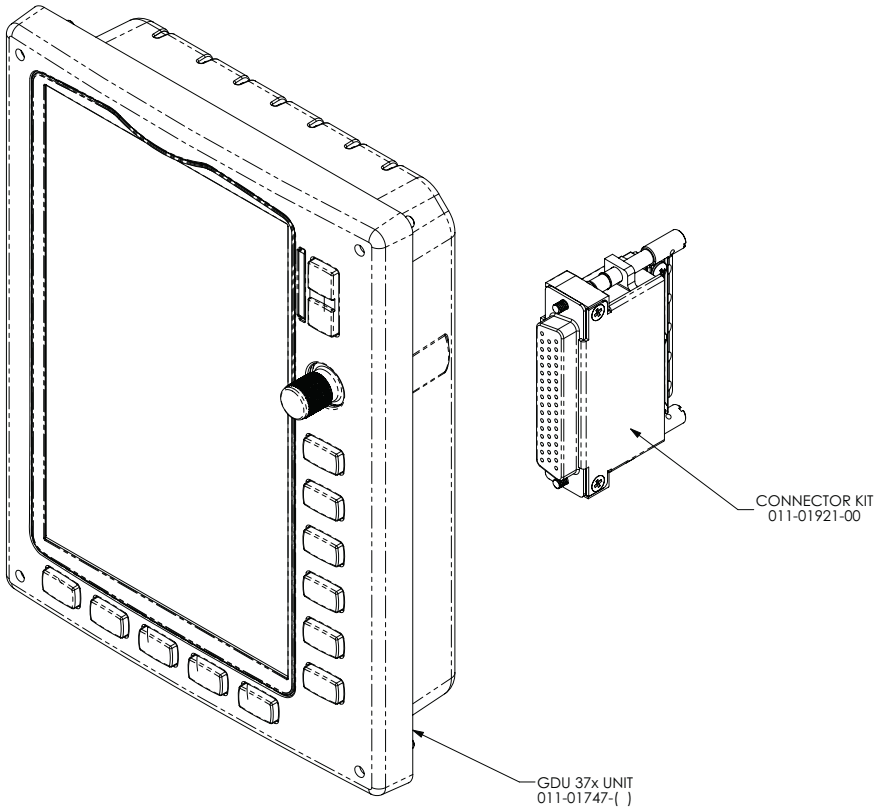

Figure 2-2 GDU 37X Mounting Accessories

2.5 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GDU 37X. Refer to Section 1.6 for wiring considerations, and to Appendix A.1 for pinouts.

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. The instructions needed to assemble the backshell connector w/Shield Block grounding system are located in Appendix B.

NOTE

The GDU 37X rear connector (J3701) is electrically isolated. For installations using shielded cables, a ground pin must be tied to the connector shell.

2.6 Mounting Requirements

Refer to Appendix D for outline and installation drawings.

2.7 Unit Installation

The GDU 37X is installed by holding the unit flush with the instrument panel and fastening the four captured 3/32" hex socket head screws to the panel as shown in Figures D-1.1 and D-1.2.

2.8 Continued Airworthiness

Maintenance of the GDU 37X is "on condition" only. Periodic maintenance of the GDU 37X is not required. Instructions for Continued Airworthiness (ICA) are not required for this product under 14 CFR Part 21 since the GDU 37X has received no FAA approval or endorsement.

2.9 Panel Cutout Template

Figure 2-3 can be used as a template when marking the panel for cutout. Dimensions below are to verify accuracy of printout only, see Figure C-1.2 for complete dimensions.

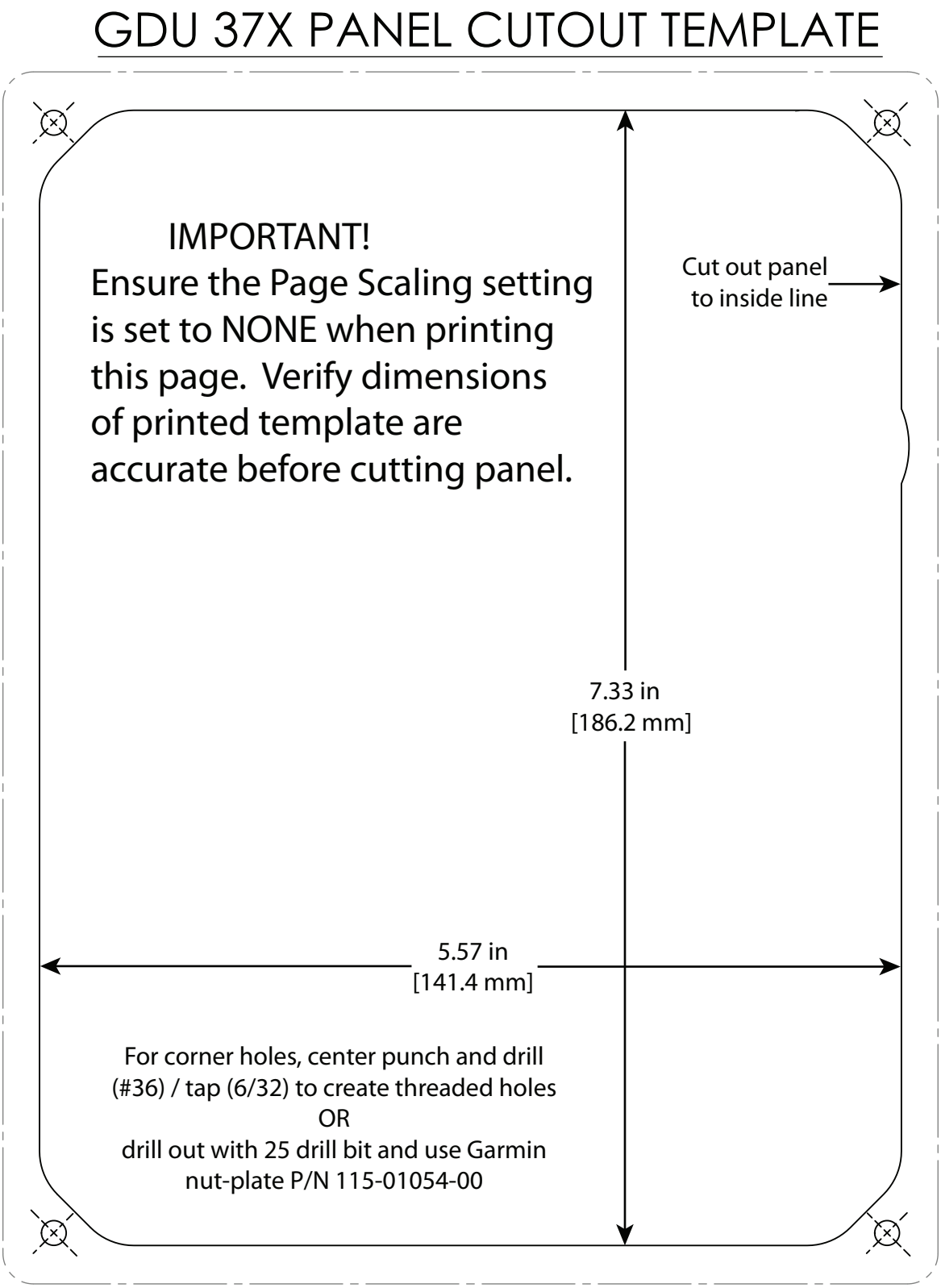

Figure 2-3 GDU 37X Panel Cutout Template

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3 GMU 44

Figure 3-1 GMU 44 Unit View

3.1 Equipment Description

The Garmin GMU 44 Magnetometer is a remote mounted device that interfaces with a Garmin GSU 73 to provide flight attitude and heading data for flight instrumentation.

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 ADAHRS and magnetometer replace traditional rotating mass instruments.

Using long-life solid-state sensing technology, the GMU 44 Magnetometer uses magnetic field measurements to create an electronically stabilized AHRS.

The GMU 44 magnetometer provides magnetic information to support the function of the GSU 73. The GSU 73 provides operating voltage to the GMU 44 Magnetometer.

3.1.1 Interface Summary

The following is an interface summary for the GMU 44.

- GMU 44 to GSU 73 Interface: Power, RS-232, RS-485 (19,200 baud)

3.2 Electrical Specifications

Table 3-1 GMU 44 Electrical Specifications

Specification	Characteristic
Power Requirements	Supply Voltage: 14/28 VDC. See Table 1-3 for current specifications.

3.3 Environmental Specifications

Table 3-2 lists general environmental specifications.

Table 3-2 GMU 44 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

3.4 GMU 44 TSO/ETSO Compliance

Table 3-3 TSO/ETSO Compliance

Function	TSO/ETSO/SAE/ RTCA/EUROCAE	Category	Applicable LRU SW Part Numbers	Applicable Custom Logic Device Part Numbers
Direction Instrument, Magnetic (Gyroscopically Stabilized)	TSO-C6d ETSO-C6d AS8013A		All 006-B0224-(__) except 006-B0224-Z(_)	All 006-C0048-0(_)

3.4.1 TSO/ETSO Deviations

The following table provides a list of applicable TSO and SAE deviations for the GMU 44.

Table 3-4 TSO/ETSO Deviations

TSO	Deviation
TSO-C6d (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.
	4. Garmin was granted a deviation from TSO-C6d to list this secondary TSO in the Installation Manual rather than on the article itself.
	5. Garmin was granted a deviation from TSO-C6d to list the DO-178B software level in the Installation Manual rather than on the article itself.
ETSO-C6d (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.

3.5 Installation Requirements

3.5.1 Equipment Available

Table 3-5 GMU 44 Part Numbers

Model	Catalog Part Number	Unit Part Number	Installation Rack
GMU 44	010-00296-10*	011-00870-10	No

*Included in G3X LRU Kit (K10-00016-00)

Table 3-6 GMU 44 Accessories

Item	Garmin P/N	Quantity
Sub Assy, Connector Kit, GMU 44	011-00871-00**	1
GMU 44 Universal Mount	011-01779-01***	1 (optional)
Installation Rack, GMU 44	115-00481-10**	1

**Included in G3X Installation Kit (K10-00017-00)

***Refer to AHRS Magnetometer Installation Considerations (190-01051-00) from www.garmin.com

3.6 Installation Considerations

NOTE

If the requirements listed in Table 3-7 cannot be met, a magnetometer interference test must be performed to ensure proper operation of the G3X system. Refer to the AHRS/Magnetometer Installation Considerations document (190-01051-00) available from the Garmin website (www.garmin.com).

The following guidelines describe proper mechanical installation of the Garmin 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.

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GMU 44. Refer to Section 1.6 for wiring considerations and to Appendix A for pinouts.

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, when choosing a mounting location for the GMU 44, observe the following distances from objects or devices that can disturb the magnetic field. Table 3-7 specifies required distances from magnetic disturbances for GMU 44 location.

Table 3-7 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 wing tips with nonmagnetic stainless steel screws).

In general, wing mounting of the GMU 44 magnetometer is preferred (unless as noted in Appendix C). Fuselage mounting is less desirable because of numerous potential disturbances that interfere with accurate operation.

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.

Level the GMU 44 mounting rack to within 3.0° of the in-flight level cruise attitude.

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. The heading offset procedure is described in Section 8.3.4.

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.

3.6.1 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 D for outline and installation drawings.

3.7 GSU 73/GMU 44 Interconnect Harness Fabrication Instructions

Table 3-8 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 D-2.4. The instructions needed to assemble the connector are located in Appendix B.

Table 3-8 Parts Needed for GMU 44 Installation

Figure D-2.4 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

*Included in G3X Installation Kit (K10-00017-00)

Table 3-9 lists material in the GMU 44 connector kit and the associated reference number, as shown in Figure D-2.4. The GMU 44 magnetometer has an attached pigtail with male polarity. The harness connector for the GMU 44 has female polarity.

Table 3-9 GMU 44 Connector Kit (011-00871-00) Contents, Reference Figure D-2.4**

Item	Garmin P/N	Quantity	Figure D-2.4 Ref
Screw,6-32x.250,PHP,BR,w/Nyl	211-60037-08	3	9
Conn,Circular,Female,9 Ckt	330-00360-00	1	4
Backshell,Circular,Kit,SS	330-90005-01	1	4
Cont,Sckt,Mil Crp,Size 20	336-00022-00	10	3

**Included in G3X Installation Kit (K10-00017-00)

3.8 Mounting Instructions

After evaluation of the mounting location has been completed and ensuring that requirements are met, assemble the GMU 44 mounting plate kits according to the dimensions given in Appendix D. Install the unit assemblies.

Mount the GMU 44 to its mounting plate, taking care to tighten the mounting screws firmly. Use of non-magnetic tools (e.g. beryllium copper or titanium) is recommended when installing or servicing the GMU 44. Do **not** use a screwdriver that contains a magnet when installing or servicing the GMU 44.

The metal components in the GMU 44 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 C: Magnetometer Calibration (Section 8.3.3).

NOTE

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.

3.9 Maintenance

Maintenance of the GMU 44 is ‘on condition’ only. Periodic maintenance of the GMU 44 is not required.

4 GSU 73

4.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GSU 73.

The GSU 73 is intended for the LSA (light sport aircraft) and experimental aircraft markets. The Garmin GSU 73 Sensor Unit is not a TSO-certified product and has received no FAA approval or endorsement. The GSU 73 is intended to be used as a part of the G3X system and it is not suitable for installation in type-certificated aircraft.

The GSU 73 is an LRU that provides AHRS and Air Data information as well as an interface to Engine/ Airframe sensors in a single mechanical package. The GSU 73 interfaces to a remote mounted GMU 44 for heading information and also computes OAT and TAS from inputs provided by the GTP 59.

The GSU 73 is capable of maneuvers through a range of 360° in bank and pitch. The rotation rate capability is ±200° 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.

Due to unsuitability of the magnetic fields near the Earth's poles, operational accuracy is unknown in the following regions:

1. North of 72° North latitude at all longitudes
2. South of 70° South latitude at all longitudes
3. North of 65° North latitude between longitude 75° W and 120° W (Northern Canada)
4. North of 70° North latitude between longitude 70° W and 128° W (Northern Canada)
5. North of 70° North latitude between longitude 85° E and 114° E (Northern Russia)
6. South of 55° South latitude between longitude 120° E and 165° E (Region South of Australia and New Zealand)

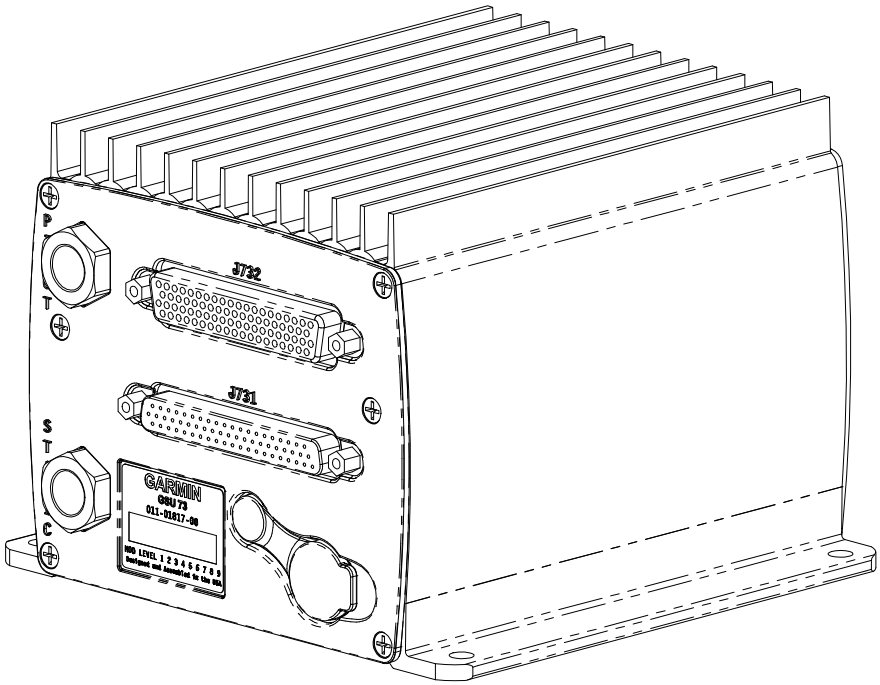


Figure 4-1 GSU 73 Unit View

4.1.1 Features Summary

Air Data

Pressure Altitude
Density Altitude
Vertical Speed
Mach Number
Indicated Airspeed
True Airspeed

Interfaces

CAN (1)
RS-232 (2 TX/2 RX)
ARINC 429 (4 RX/2 TX)
OAT Probe (GTP 59)
Magnetometer (GMU 44) (1 RS-232 TX/ 1 RS-485 RX)

AHRS

Magnetic Heading
Pitch Angle
Roll Angle
Linear Accelerations
Pitch, Roll, Yaw Rotation Rates

Engine/Airframe

28 Analog inputs, including those allocated as per below:
Dedicated Ammeters (2)
Constant Current Source Capability (6)
Divider Circuits to handle large input voltages (12)
Frequency Counter Inputs (4)
Discrete I/O (4 In/2 Out)

4.2 Electrical Specifications

Table 4-1 GSU 73 Supply Specifications

Characteristic	Specification
Input Voltage Range	10-29 Vdc*
Power Input	1.75 Amp @ 14 Vdc (Max) 0.80 Amp @ 28 Vdc (Max)

*Garmin recommends using Mod 1 level GSU 73 in aircraft that use a +28V supply voltage and intend to monitor current on high voltage devices such as the aircraft alternator.

4.3 Environmental Specifications

Table 4-2 lists general environmental specifications.

NOTE

The GSU 73 may require a warm-up period of 15 minutes to reach full air data accuracy (30 minutes if the environmental temperature is less than 0°C).

Table 4-2 GSU 73 Environmental Specifications

Characteristic	Specification
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	-40°C to +70°C
Max Outer Case Temperature	+73°C

4.4 Installation Requirements

4.4.1 Required Equipment

Table 4-3 lists the kits available for the GSU 73.

Table 4-3 GSU 73 Available Equipment

Item	Garmin P/N	Quantity
Configuration Module w/EEPROM and Jackscrew, Kit	011-00979-20**	1
Thermocouple Kit	011-00981-00**	1
Unit Assembly, GSU 73	011-01817-00*	1
P731 Connector Kit, GSU 73	011-01818-00**	1
P732 Connector Kit, GSU 73	011-01818-01**	1

*Included in G3X LRU Kit (K10-00016-00)
**Included in G3X Installation Kit (K10-00017-00)

Table 4-4 Contents of P731 Connector Kit (011-01818-00)**

Item	Garmin P/N	Quantity
Sub-Assy,Backshell w/Hdw,Jackscrew	011-01855-03	1
Connector ,Hi Dens, D-Sub, Mil Crimp 62ck	330-00185-62	1
Contact Pin, Mil Crimp, Size 22D	336-00021-00	20

**Included in G3X Installation Kit (K10-00017-00)

Table 4-5 Contents of P732 Connector Kit (011-01818-01)**

Item	Garmin P/N	Quantity
Sub-Assy,Backshell w/Hdw,Jackscrew	011-01855-04	1
Connector ,Hi Dens, D-Sub, Mil Crimp 78ck	330-00185-78	1
Contact Pin, Mil Crimp, Size 22D	336-00021-00	30

**Included in G3X Installation Kit (K10-00017-00)

4.4.2 Additional Equipment Required

- Cables: The installer will fabricate and supply all system cables.
- An example of mounting hardware is: #10-32 pan or hex head screw (4 ea.) and #10-32 self-locking nut (4 ea)
- Air hoses and fittings to connect pitot and static air to the GSU 73. The GSU 73 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.

4.5 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices should be used for installation of the GSU 73. Refer to Section 1.6 for wiring considerations, and to Appendix A for pinouts.

Connector kits include backshell assemblies. The backshell assembly houses the configuration module (P732 only) and a thermocouple reference junction (if applicable). Garmin's backshell connectors give the installer the ability to quickly and easily terminate shield grounds at the backshell housing. The instructions needed to install the Jackscrew Backshell, Configuration Module, and Thermocouple are located in Appendix B.

4.5.1 Pneumatic Plumbing

The GSU 73 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 (see Figure 4-2). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

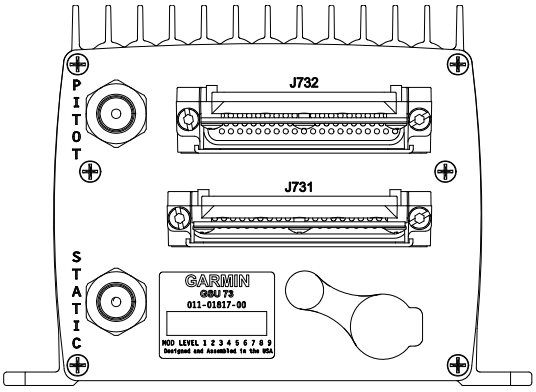


Figure 4-2 GSU 73 Air Hose Fitting Locations

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 GSU 73 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.

4.5.2 Pneumatic Connections

The following steps should be used to aid in the fabrication of pneumatic hose connections and in attaching the aircraft pitot pressure source and aircraft static pressure source to the GSU 73.

NOTE

Check pneumatic connections for errors before operating the GSU 73. 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 GSU 73.

The installer must fabricate any additional mounting equipment needed. Use outline and installation drawings in Appendix D for reference.

4.6 Mounting Requirements

Mount the GSU 73 with the connectors aligned within 1.0 deg of either the longitudinal or lateral axis of the aircraft. The direction of the unit will be accounted for during the calibration procedure as shown in Figure 4-3.

Figure 4-3 . GSU 73 Orientation Calibration

The GSU 73 includes an extremely sensitive strap-down inertial measurement unit. It must be mounted rigidly to the aircraft primary structure, preferably to a metallic structure to conduct heat away from the unit. Do not mount the GSU 73 in an enclosed area, it should be mounted in a location that provides adequate airflow to comply with the maximum outer case temperature listed in Section 4.3.

Do not use shock mounting to mount the GSU 73. Shock mounts used for other types of inertial systems are not acceptable for the GSU 73 AHRS. The mounting system must have no resonance with the unit installed. Excessive vibration 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.

The GSU 73 should be mounted within 13 feet (4.0 meters) longitudinally and 6.5 feet (2.0 meters) laterally of the aircraft center of gravity. In cases where the longitudinal distance from the CG is planned to be greater than 6.5 feet (2.0 meters), it is preferable to mount the GSU 73 forward of the aircraft center of gravity if possible, to enable better acceleration outputs for autopilot use. The mounting location for the GSU 73 should be protected from rapid thermal transients, in particular, large heat loads from nearby high-power equipment.

The GSU 73 must be leveled to within 3.0° of the flight level cruise altitude and an aircraft leveling and offset calibration procedure carried out prior to flight. (This procedure is described in Section 8.) Alternatively, if the GSU 73 can be guaranteed level to within 0.25° of the aircraft level reference, the aircraft leveling and offset calibration procedure is not required.

Avoid placing the GSU 73 within 1 inch of magnetically mounted antennas, speaker magnets, or other strongly magnetic items.

4.7 Unit Installation

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

1. Assemble the wiring harness and backshell connectors.
2. Assemble the pneumatic hoses and connectors.
3. Mount the unit to a suitable mounting location using (4 ea) #10-32 pan or hex head screws (example) per the requirements in Section 4.6.
4. Connect backshell connector and hoses.

NOTE

When mounting the GSU 73 to the airframe, it is important to ensure that fastening hardware is tight for proper unit operation.

4.8 Maintenance

Per Part 43 Appendix E, paragraph (b)(2), Garmin specifies a test procedure equivalent to part 43 Appendix E, paragraph (b)(1) with two exceptions. The tests of sub-paragraph (iv)(Friction) and (vi) (Barometric Scale Error) are not applicable because the digital outputs of the GSU 73 are not susceptible to these types of errors.

A GSU 73 Field Calibration Tool (not yet available) can be used to adjust the calibration of GSU 73 units that have failed the 14 CFR Part 43 Appendix E tests due to altitude drift.

The GSU 73 utilizes an Earth magnetic field model which is updated once every five years. This IGRF (International Geomagnetic Reference Field) 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 GSU 73 remains a Garmin –supported product. The IGRF model can be updated by the end user via the Garmin website (www.garmin.com), it is not necessary to return the GSU 73 to Garmin for this update. Otherwise maintenance of the GSU 73 is 'on condition' only.

5 GP 59

Figure 5-1 GTP 59

5.1 Equipment Description

The Garmin GTP 59 is an outside mounted temperature probe that provides raw air temperature data. The temperature input device is a three-wire temperature probe interface. OAT Power Out and OAT High are connected internally at the OAT probe. The GTP 59 is a Resistive Temperature Device (RTD).

5.1.1 Available Equipment

The GTP 59 is available per the following part number.

Table 5-1 GTP 59 Part Number

Item	Garmin Part Number
GTP 59 OAT Probe Kit	011-00978-00*

*Included in G3X LRU (K10-00016-00)

5.2 Installation Requirements

Table 5-2 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 5-2 GTP 59 Outside Air Temperature Kit*

Item	Garmin P/N	Quantity
Nut, 5/16”, Hex, Skirt	210-00055-00	1
Screw, 4-40 x .250, PHP, SS/P, w/NYL	211-60234-08	2
Washer, Lock, Self-Sealing, 5/16	212-00026-00	1
Contact, Pin, Mil Crimp, Size 22D	336-00021-00	5
GTP 59 OAT Probe	494-00022-xx	1

*Included in G3X LRU Kit (K10-00016-00)

5.2.1 Additional Equipment Required

- Cables - The installer will supply all system cables.

5.3 TSO/ETSO Compliance

The following table provides a list of applicable TSO/ETSOs for the GTP 59.

Table 5-3 Applicable TSO/ETSOs for the GTP 59

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

5.3.1 TSO/ETSO Deviations

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

Table 5-4 TSO/ETSO Deviations for the GTP 59

TSO/ETSO	Deviation
TSO-C106	1. Garmin was granted a deviation from TSO-C106 to use RTCA DO-160D, including changes 1, 2, and 3, 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-C106 to use Society of Automotive Engineers (SAE) AS 8002 Rev A instead of SAE AS 8002 as the Minimum Performance Standard.
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 as the Minimum Performance Standard.

5.4 Installation Considerations

5.4.1 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).

5.4.2 GTP 59 OAT Probe Installation

NOTE

The following instructions are general guidance.

NOTE

Do not mount the GTP 59 where aircraft exhaust gases will flow over it.

Table 5-5 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 D-4.1.

Table 5-5 Parts Needed for GTP 59 Installation

Figure D-4.1	Description	Qty. Included	GPN
1	Ring Terminal	1	494-00022-xx
2	3-Conductor Cable		
3	OAT Sensor		
4	Nut	1	210-00055-00
5	Washer	1	212-00026-00

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.
   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 (1) over the end of the OAT probe (3). Insert the probe and ring terminal into the hole in the skin of the aircraft. Place the washer (5) over the end of the OAT probe on the outside skin of the aircraft. Thread the nut (4) onto the OAT probe. Holding the OAT probe on the inside, tighten the nut (4) to 100 inch-lbs. ±20 inch-lbs.
3. Route the OAT probe cable (2) to the GSU 73.
4. Cut the OAT Probe cable (2) to the required length. Strip back 2.0” to 3.5” of jacket while retaining the shield on the OAT Probe cable (2). Trim away enough to leave 0.5” of shield exposed.
5. Strip back 1/8” (0.125”) of insulation and crimp pins to each of the conductors in the shielded cable.
6. Cut an AWG #16 wire to 3” long. Strip back 0.5” of insulation from this cable. Connect the shield of the OAT Probe cable (2) to the AWG #16 wire.
7. Attach the ring terminal to the backshell, using the screw provided in the OAT Probe Kit and one of the tapped holes on the backshell termination area.
8. Insert newly crimped pins into the D-Sub connector and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
9. Verify that all necessary pins for the GSU 73 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.

5.5 Unit Installation

Refer to Figure D-4.1 GTP 59 O.A.T. Probe Wiring Detail for wiring and mounting instructions.

5.6 Maintenance

Maintenance of the GTP 59 is “on condition” only. Periodic maintenance of the GTP 59 is not required.

6 GPS/XM Antennas

In an installation with multiple GDU 37X units, each GDU can be configured to use its own internal GPS receiver, or to receive GPS data transmitted by another GDU. At least one GDU must be equipped with a GPS antenna. See section 7.3.9 for further information.

NOTE

Only a single GPS antenna is required for installations using more than one GDU 37X unit, as the GDU 37X will "share" the GPS information with all GDU 37X units.

6.1 Non-Garmin Antennas

Table 6-1 lists non-Garmin antennas currently supported by the GDU 37X. For non-Garmin antennas, follow the manufacturer's installation instructions. It is the installer's responsibility to ensure that their choice of antenna meets FAA standards according to the specific installation.

NOTE

The GPS antenna should provide a gain of 16 to 25dB. The GDU 37X supplies power to the antenna at 4.5V–5V with a maximum current of 50mA.

Table 6-1 GDU 37X Supported Antennas

Model	Mount Style	Conn Type	Antenna Type	Mfr	Antenna Part Number	Garmin Order Number
Comant 2480-201 VHF/GPS*	Screw Mount, Teardrop Footprint	BNC TNC	VHF COM, GPS	Comant	CI 2480-201	N/A
Comant 420-10 XM only Antenna	Screw Mount, ARINC 743 Footprint	TNC	XM	Comant	CI 420-10	N/A

*The GPS antenna connector is TNC type. The VHF COM antenna connector is BNC type.

6.2 Garmin Antennas

If using a Garmin GA 26C or GA 26XM, refer to the accompanying installation instructions (190-00082-00 or 190-00522-03). For GA 55/55A, or GA 56 or GA 57X antennas, refer to this section and the drawings in Appendix C.

Garmin recommends the antennas shown in Table 6-2. However, any equivalent GPS or XM antenna that meets the specifications listed in Tables 6-3 and 6-4 should work with the G3X.

Table 6-2 Garmin Antennas

Model	Part Number	Description	Weight	Mounting Configuration
GA 26C	011-00149-04	GPS Antenna	NA	Flange, Magnetic, or Suction Cup Mount (for in-cabin mounting)
GA 26XM	013-00268-10	XM Antenna	NA	Flange, Magnetic, or Suction Cup Mount (for in-cabin mounting)
GA 55	011-01033-00	XM Antenna	0.25 lbs (0.11 kg)	Stud mount (Tear-drop form factor)
GA 55A	011-01153-00	XM Antenna	0.43 lbs (0.20 kg)	Thru-mount (ARINC 743 style mount)
GA 56	011-00134-00	GPS Antenna	0.24 lbs (0.11 kg)	Stud mount (Tear-drop form factor)
GA 57X	011-01032-10	GPS/XM Antenna	0.47 lbs (0.21 kg)	Thru-mount (ARINC 743 style mount)

Table 6-3 GPS Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Gain	16 to 25 dB typical, 40dB max.
Noise Figure	<4.00 dB
Nominal Output Impedance	50 ohms
Supply Voltage	4.5 to 5.5 VDC
Supply Current	up to 50 mA
Output Connector	BNC

Table 6-4 XM Satellite Radio Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	2332.5 to 2345 MHz
Gain (Typical)	24 dB*
Noise Figure	<1.2 dB
Nominal Output Impedance	50 ohms
Supply Voltage	3.6 to 5.5 VDC
Supply Current (maximum)	55 mA
Operating Temperature Gain	-50 to +85°C

*For each 1 dB gain over 24 dB, add 1 dB of attenuation into the antenna cable path between the antenna and the GDU 375.

It is the installer's responsibility to ensure that their choice of antenna meets FAA standards according to the specific installation. This installation manual discusses only the antennas listed in Table 6-2. Other antennas may be acceptable but their installation is not covered by this manual.

There are several critical factors to take into consideration before installing an antenna for a satellite communications system. These factors are addressed in the following sections.

6.3 Antenna Mounting Considerations

The information in this section does not pertain to in-cabin (internal) mounted antennas such as the GA 26C, refer to the accompanying installation instructions (190-00082-00).

No special precautions need be taken to provide an electrical bonding path between the GPS Antenna and the aircraft structure.

6.3.1 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 GDU 37X does not interfere with its own GPS receiver. However, placement of the GPS antenna relative to a COM transceiver and COM antenna, ELT antenna, and DF receiver antenna is critical.

Use the following guidelines, in addition to others in this document, when locating the GDU 37X and its antennas.

- GPS Antenna—Locate as far as possible from all COM antennas and all COM transceivers, 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 GDU 37X 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.

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 GDU 37X unit, VHF COM and a good ground.
3. Shield the VHF COM wiring harness.

6.3.2 GPS/XM Antenna Mounting Location

The GPS antenna is a key element in the overall system performance and integrity for a GPS 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 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. 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 4 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 on top of the aircraft in a location with an unobstructed view of the sky, 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.
3. The GPS antenna should ideally be located at the opposite end of the aircraft from the COM unit in order to make the GPS less vulnerable to harmonics radiated from the COM itself.

4a. The GPS antenna should be mounted no closer than two feet (edge to edge) and ideally three feet from any VHF COM antenna or any other antenna which may emit harmonic (or other) 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

The separation requirement does not apply to GPS and COM combination antennas, provided the antenna has been tested to meet Garmin's minimum performance standards. The separating requirement includes the combination with an XM antenna element as well.

4b. The GPS antenna should be mounted no closer than two feet (edge to edge) and ideally three 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.

4c. 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.

5. To maintain a constant gain pattern and limit degradation by the windscreen, avoid mounting the antenna closer than 3 inches from the windscreen.
6. 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 6-1 shows the recommended placement of antennas.

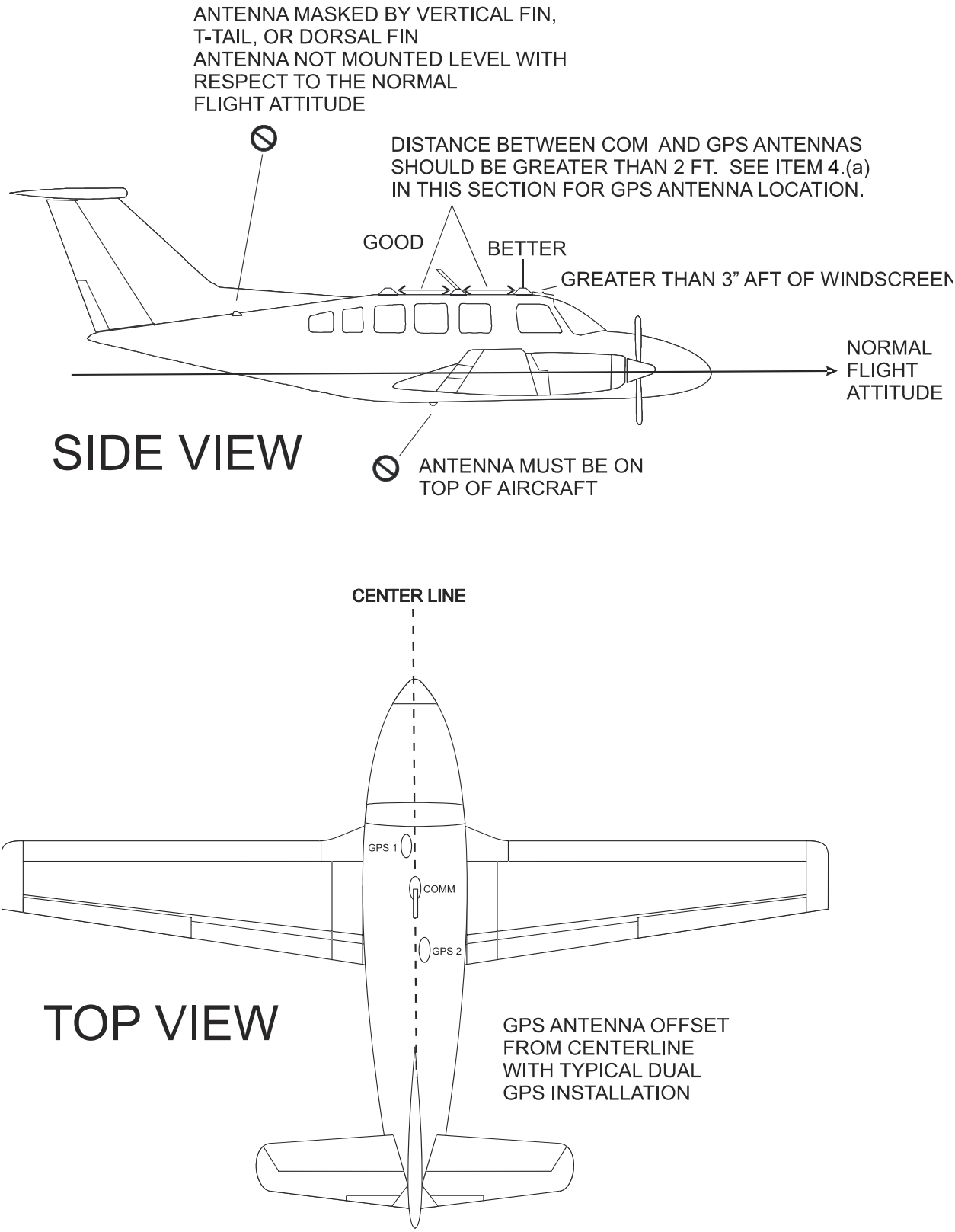


Figure 6-1 Recommended Antenna Placement

6.3.3 Buried Antenna (below the skin covering or glareshield) Mounting

There are potential performance issues related to buried antennas that the kit builder/installer should be aware of prior to electing to install a buried antenna. See also Section 6.6.3, Non-structural Installation to Glareshield.

- Some gain of the antenna may be lost as the signal needs to penetrate through the skin of the aircraft. The loss may not be apparent, but under the some of the worst case signal scenarios signal availability may be affected.
- The materials in some aircraft are not suitable for GPS signals to penetrate, care should be taken to properly modify the aircraft structure to accommodate this. Modifications of this sort are not recommended or inferred by Garmin or the installation of the GDU 37X, and the installer should seek the guidance of the kit manufacture for such modifications.
- XM – FIS antennas may typically be buried without performance impact if the overlying material is fairly transparent to the satellite signal.

Figure 6-2 shows example areas of some mounting locations which have been used. Low satellite reception and tracking are compromised in these installations due to fuselage and tail blockage. It is not possible to determine the full impact of these locations, however initial flight testing has not shown any significant impact to availability, your results may vary.

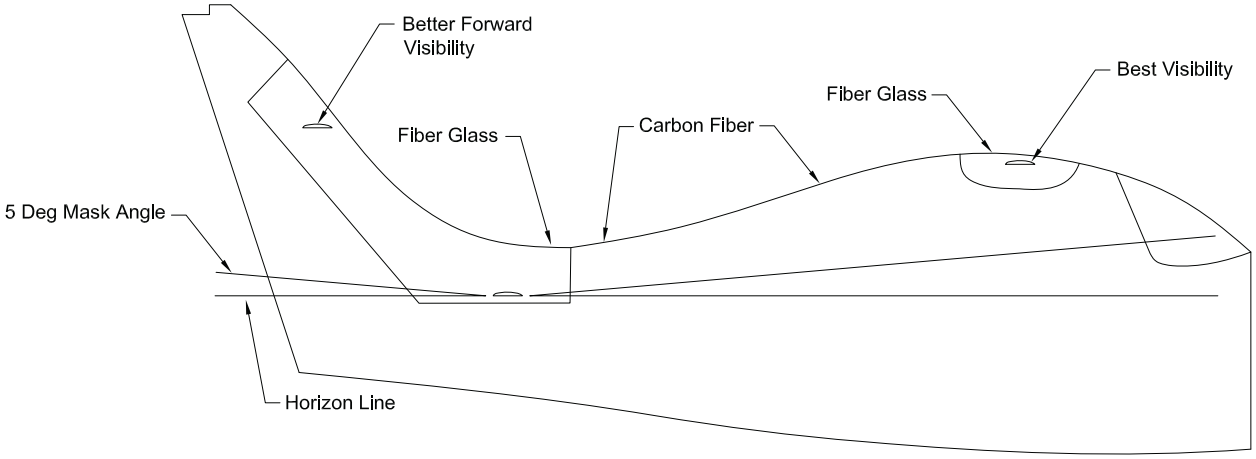


Figure 6-2 Carbon/Glass Buried Antenna Area

Mounting the antenna under the glare shield (Figure 6-3) is a good option for XM – FIS antennas, although it is not typically the best option for a GPS antenna. This location results in the aft fuselage shading the antenna.

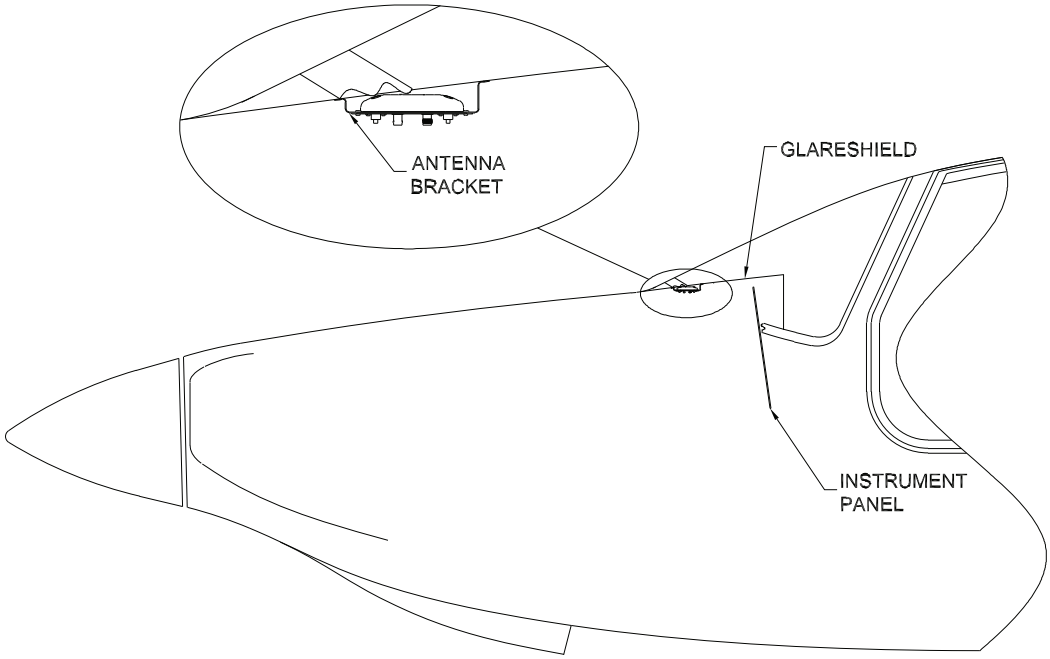


Figure 6-3 Glare Shield Buried Antenna Area

NOTE

Due to the excessive temperature environment and large areas of signal blockage caused by the fuselage, mounting the antenna under the engine cowling (forward of the firewall) is not recommended and likely will not provide adequate GPS reception.

6.3.4 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). When penetrating the skin with a large hole (i.e. for the coax connector) a doubler plate is required to re-instate the integrity of the aircraft skin. Never weaken the aircraft structure when choosing a mounting area. Make use of any available reinforcements where appropriate.

6.3.5 Antenna Grounding Plane

Although no ground plane is required, the antennas typically perform better when a ground plane is used. 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.

6.3.6 Antenna Grounding

The antenna is grounded through the mounting hardware and the coax connection. The mounting hardware (washers and nuts) and doubler plate should make contact with an unpainted grounded surface ensuring proper antenna grounding. It is important to have good conductivity between the coaxial shield and the ground plane. The bottom of the antenna does not need to make contact with the ground plane (i.e.

the surface may be painted). The antenna will capacitively couple to the ground plane beneath the paint or aircraft cover.

6.4 Teardrop Footprint Antenna Installation (GA 55 and GA 56)

This section describes the structural mounting of the teardrop footprint antenna installation.

An acceptable installation method is to use Garmin P/N: 115-00846-10 doubler plate with the GA 55 or GA 56 stud mount antennas. Another acceptable method is to fabricate and install one of three doublers (Figure 6-4, Figure 6-5, and Figure 6-6), 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. Table 6-5 provides a summary of design and installation details for selecting the appropriate antenna doubler/backplate.

Figure 6-7 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 6-5 Teardrop Footprint Antenna Doubler Design and Installation

Aircraft Skin Thickness	0.032" to 0.049"	0.049" to 0.051"	0.051" to 0.063"
Doubler Design (Figure)	Figure 6-4	Figure 6-5	Figure 6-6
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 6-8	Figure 6-9	Figure 6-10
Doubler Installation (Figure)	Figure 6-11	Figure 6-12	Figure 6-13

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

Refer to Appendix D for Garmin Antenna installation drawings.

6.4.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-10, or refer to Table 6-5 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.
2. 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).
3. 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 the rivets identified for use through the skin cutout detail (Figure 6-8) and doubler installation (Figure 6-11) are required.

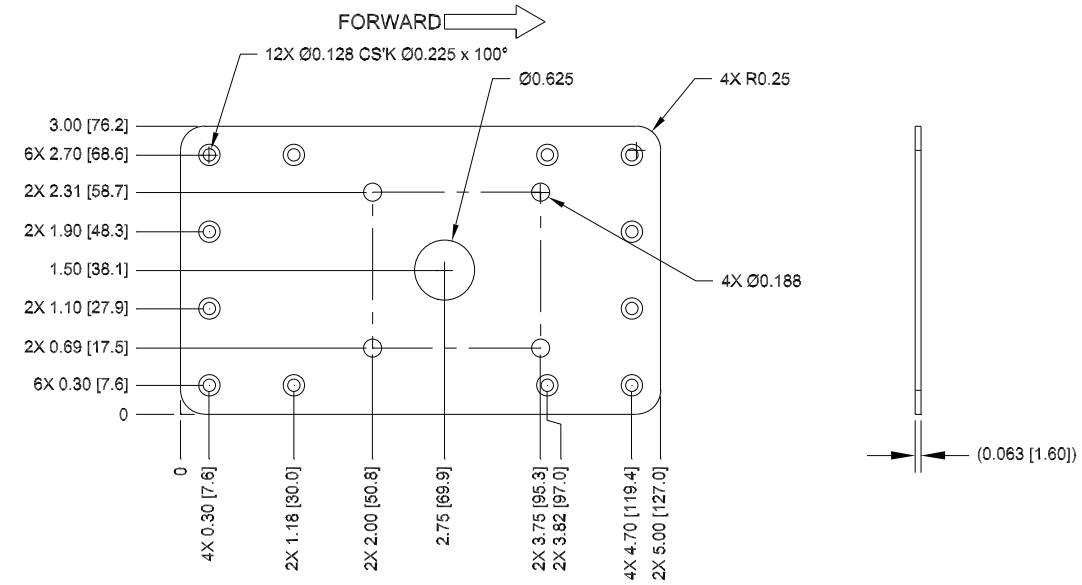
6.4.2 Antenna Installation Instructions

1. Refer to Table 6-5 and Appendix D for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).
2. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 6.4.1 for doubler preparation and Table 6-5 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.
3. For the stud mount teardrop footprint antenna, place install gasket on top of aircraft skin using the four screw holes to align the gasket.
4. 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.
5. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket or o-ring, as appropriate to the antenna model.
6. 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

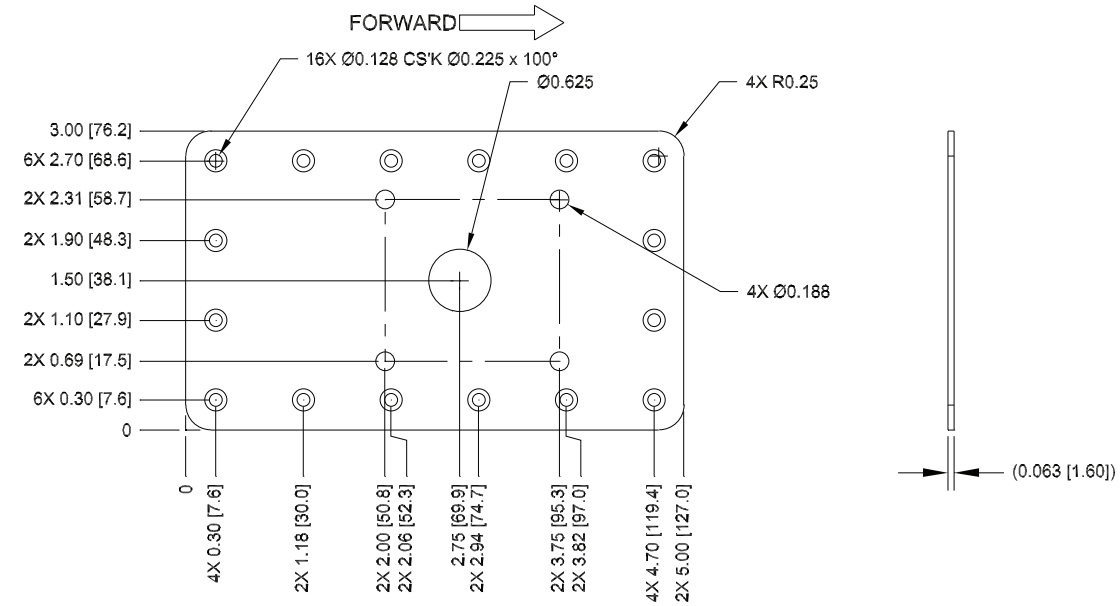
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

6.4.3 Reference Figures



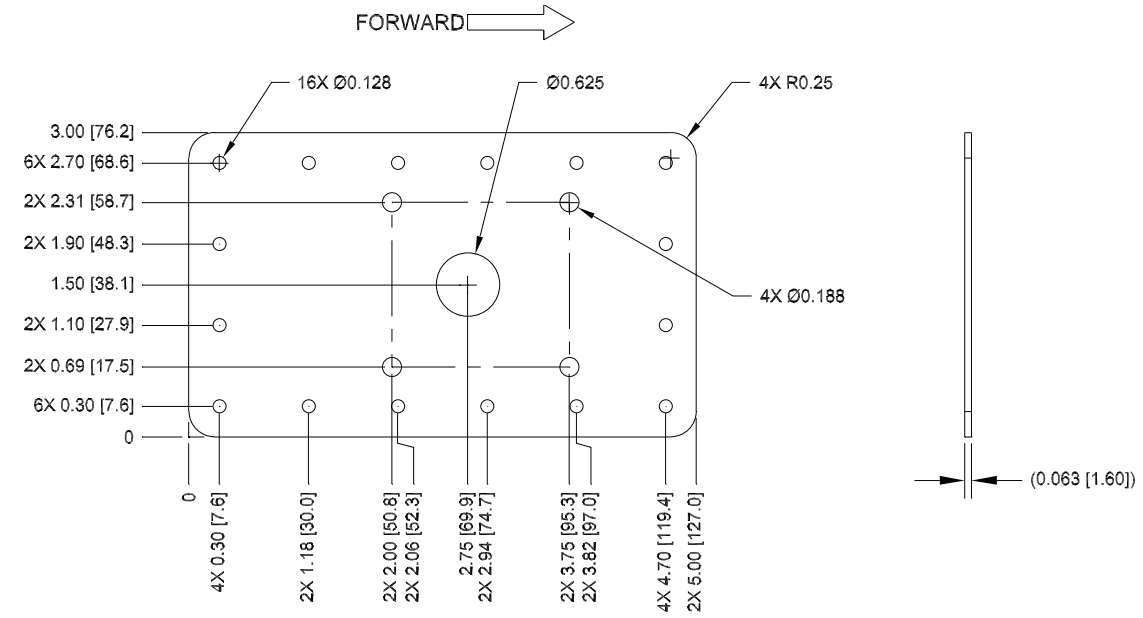
NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 6-4 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 6-5 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 6-6 Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

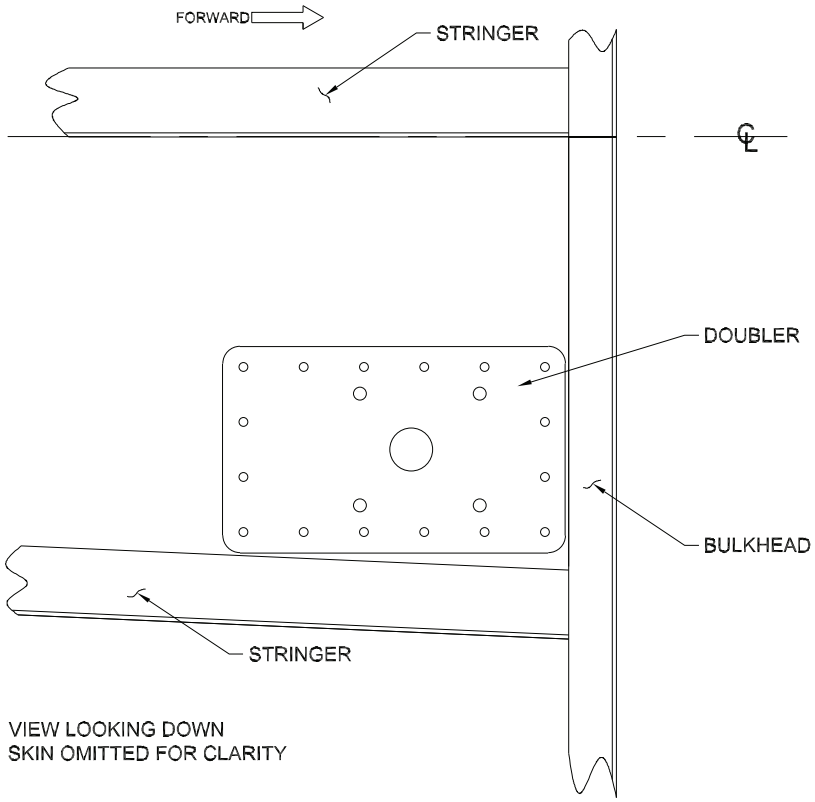
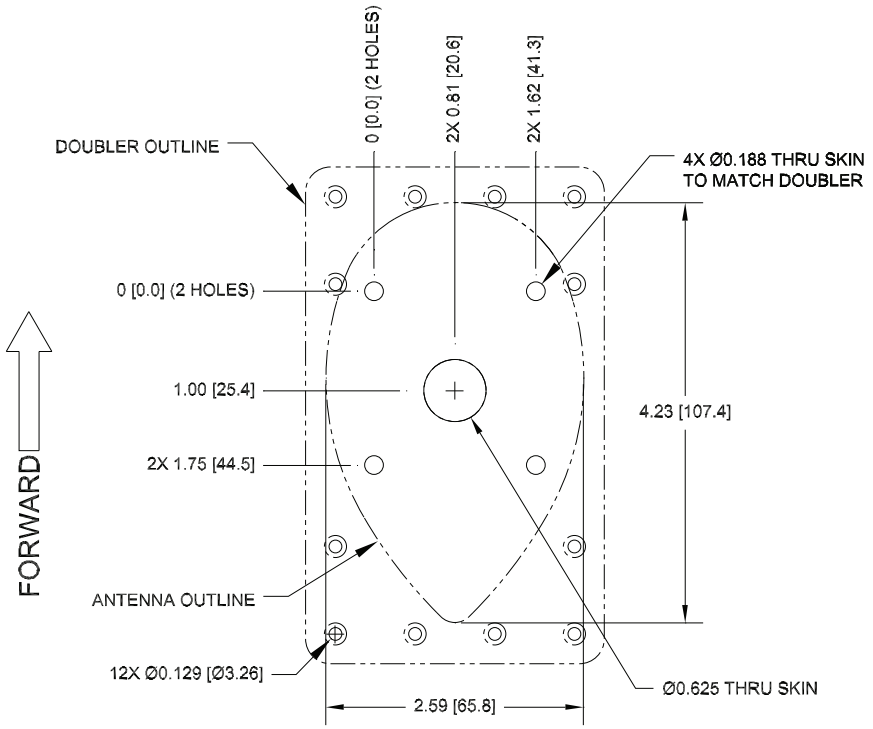
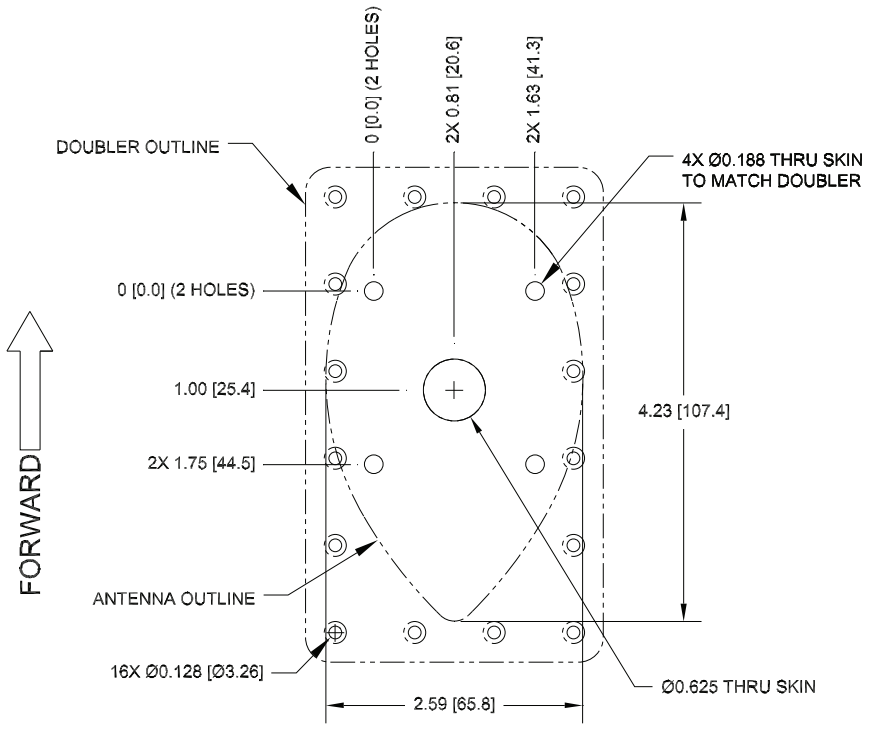


Figure 6-7 Sample Doubler Location, Teardrop Footprint Antenna, Metal Skin Aircraft



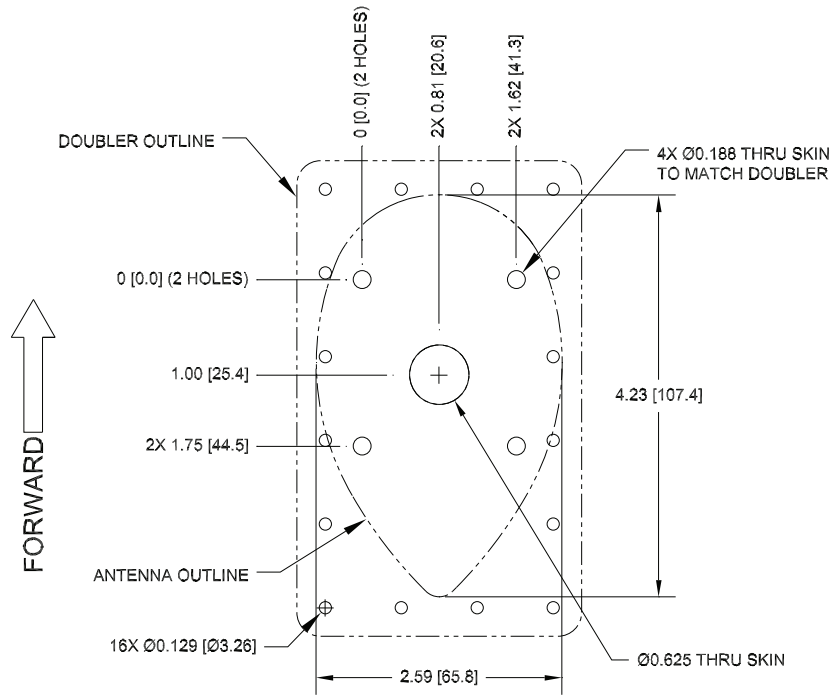
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-8 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



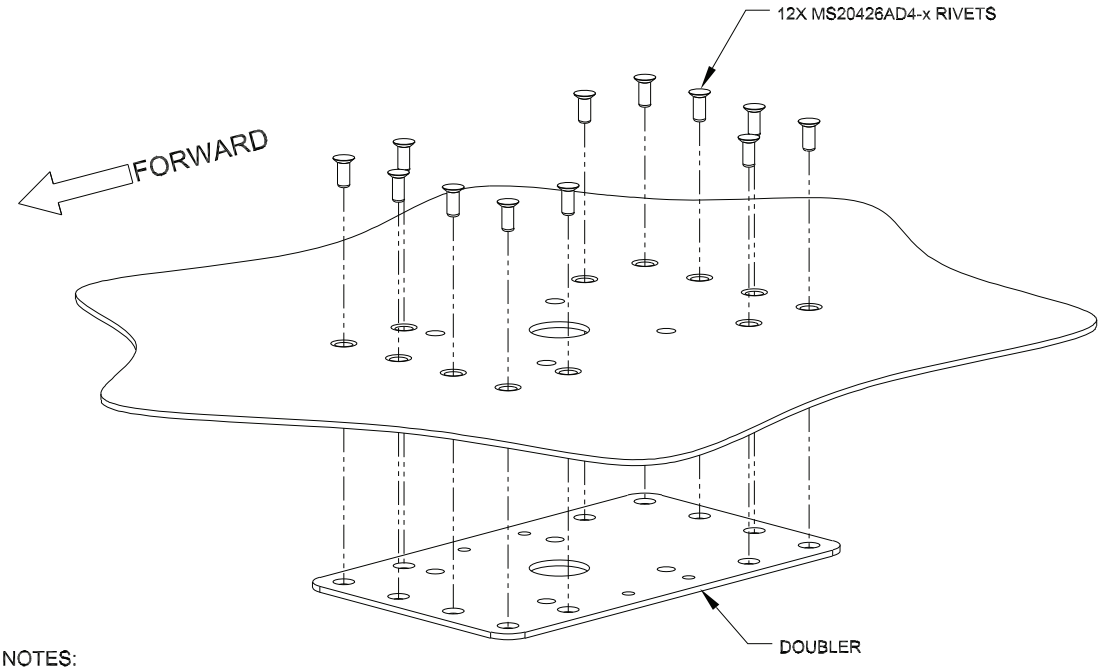
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-9 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



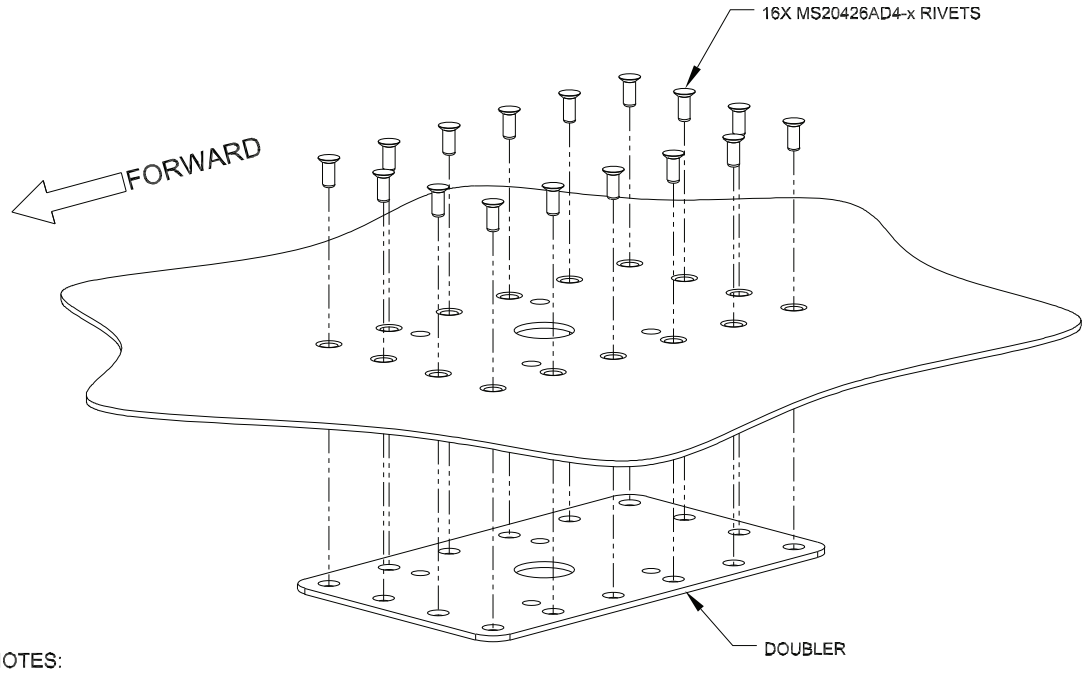
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-10 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"



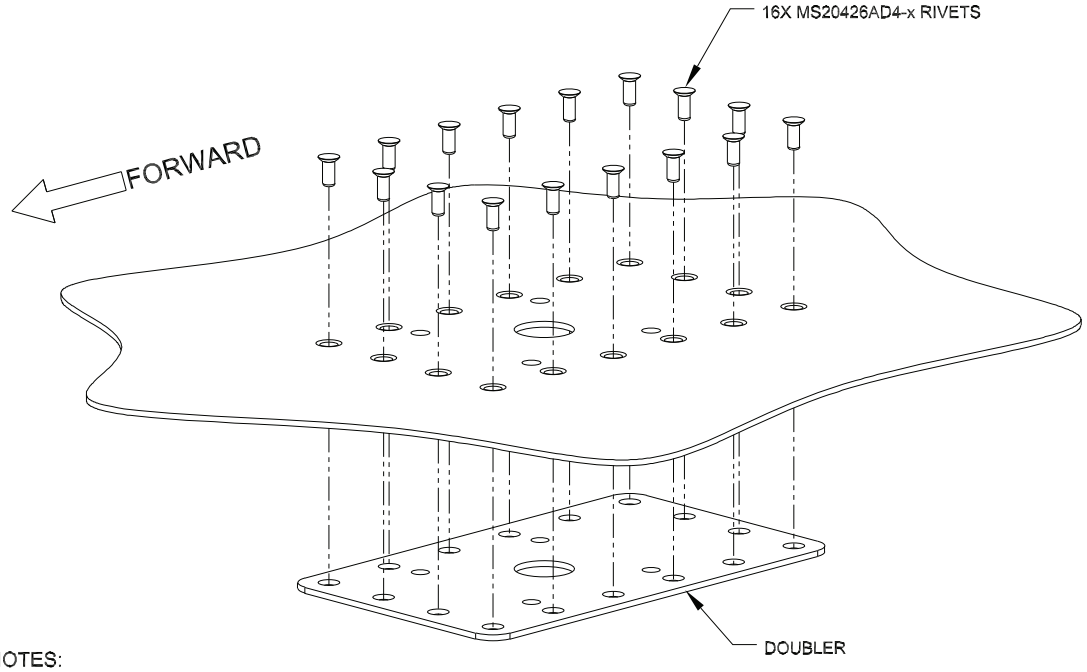
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-11 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 6-12 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 6-13 Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

6.5 ARINC 743 Footprint Antenna Installation (GA 55A, GA 57X)

This section describes the structural mounting of the ARINC 743 footprint antenna (GA 55A, GA 57X) 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 6-14, Figure 6-15, or Figure 6-16, 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 6-24 shows installation of the ARINC 743 footprint antenna.

Table 6-6 provides a summary of design and installation details for the antenna doubler. Figure 6-17 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 6-6 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 6-14	Figure 6-15	Figure 6-16
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 55A)	Figure 6-18	Figure 6-19	Figure 6-20
Doubler Installation (Figure)	Figure 6-21	Figure 6-22	Figure 6-23

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

6.5.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-00, or refer to Table 6-6 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.
2. 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).
3. When using Garmin P/N: 115-00846-00 doubler, sixteen rivet holes exist in the part. For installation of Garmin P/N: 115-00846-00 in skins of thickness between 0.032" and 0.049", only the rivets identified for use through the skin cutout detail (Figure 6-18) and doubler installation (Figure 6-21) are required.

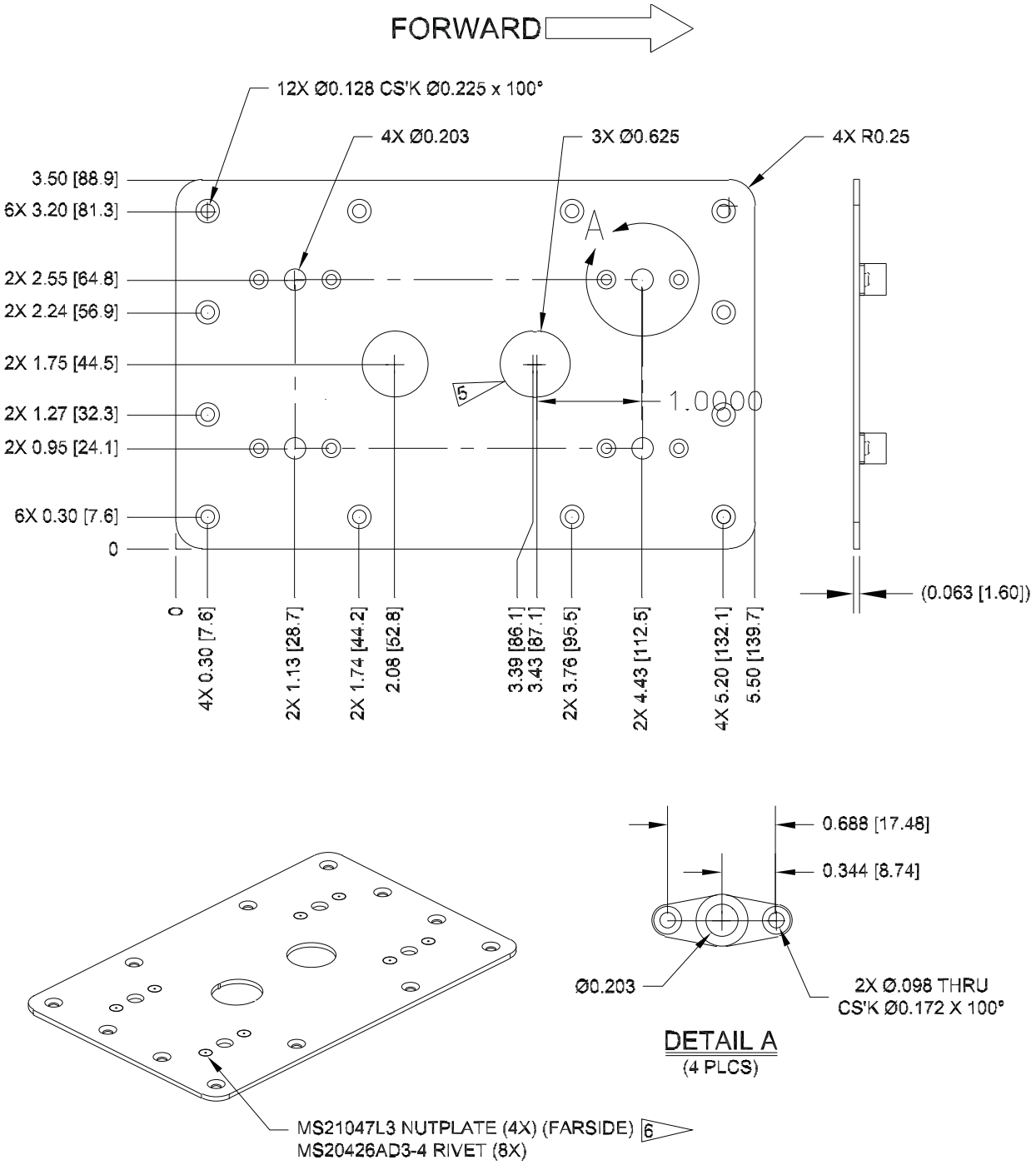
6.5.2 Antenna Installation Instructions

1. Refer to Table 6-6 (and to Figures in Appendix C) for guidance on selecting the appropriate mounting cutout. Drill or punch the holes to match the mating part (doubler).
2. Install a doubler plate to reinforce the aircraft skin, as required. Refer to Section 6.5.1 for doubler preparation and Table 6-6 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.
3. Place the install gasket on top of aircraft skin using the four screw holes to align the gasket.
4. Locking nuts are required to secure the antenna (locking nuts 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.
5. Ensure that the antenna base and aircraft skin are in continuous contact with the gasket.
6. 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

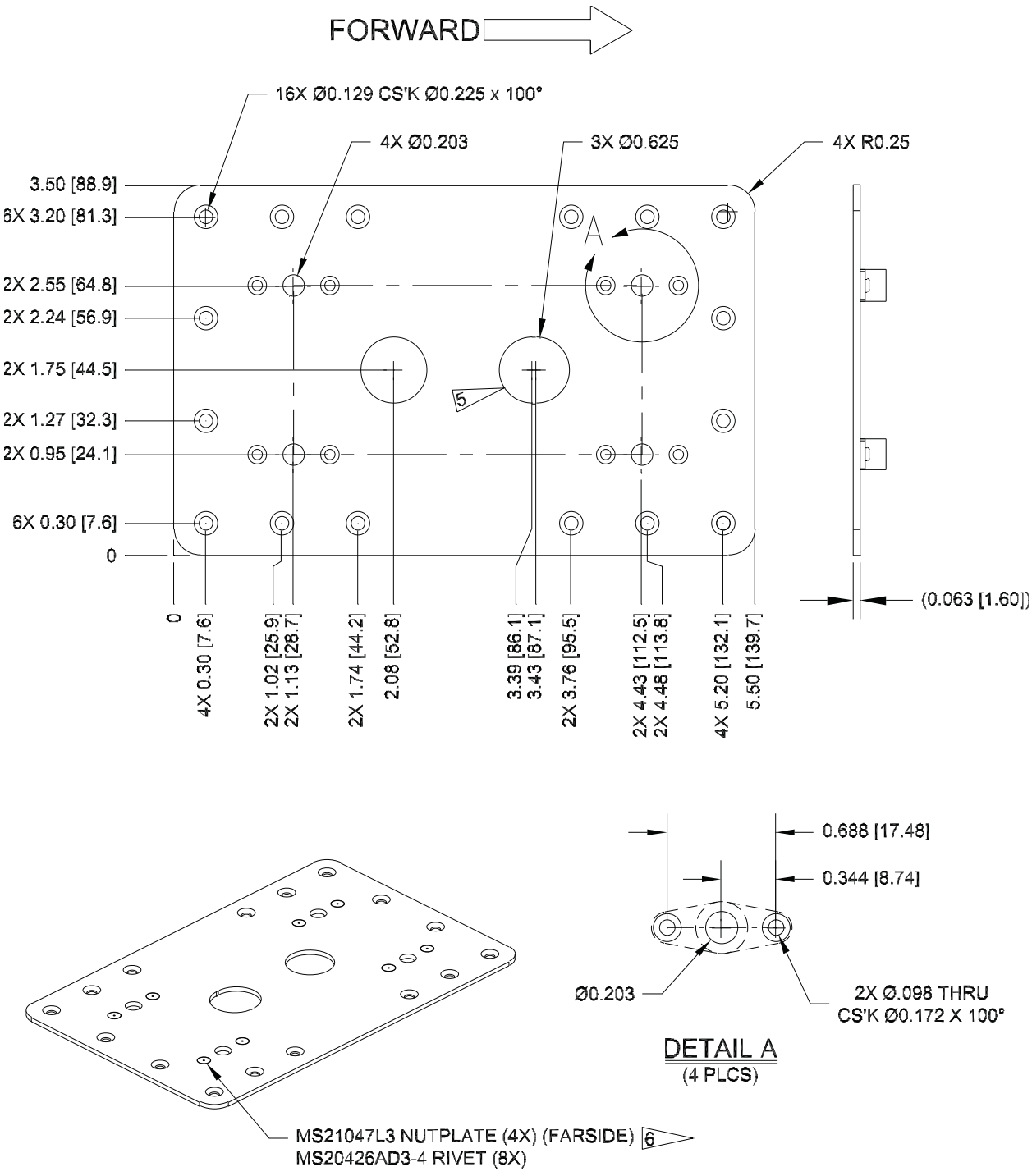
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

6.5.3 Reference Figures



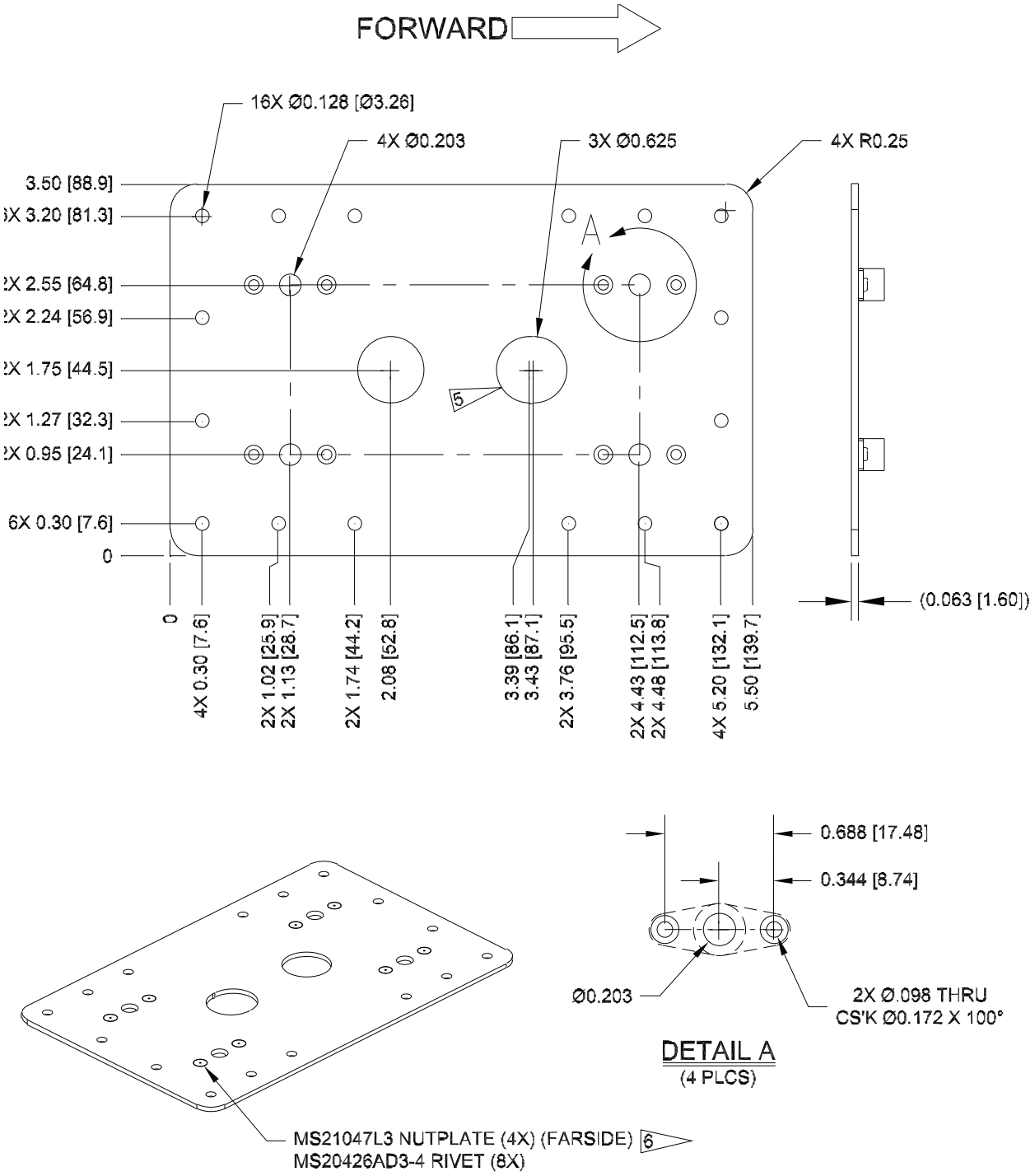
NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-14 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. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-15 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. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 6-16 Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"

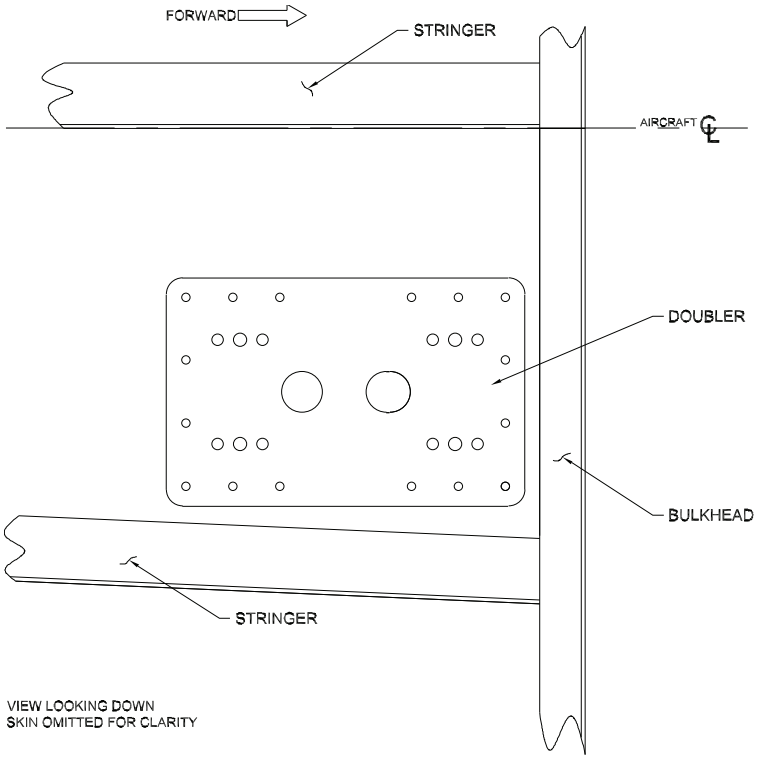
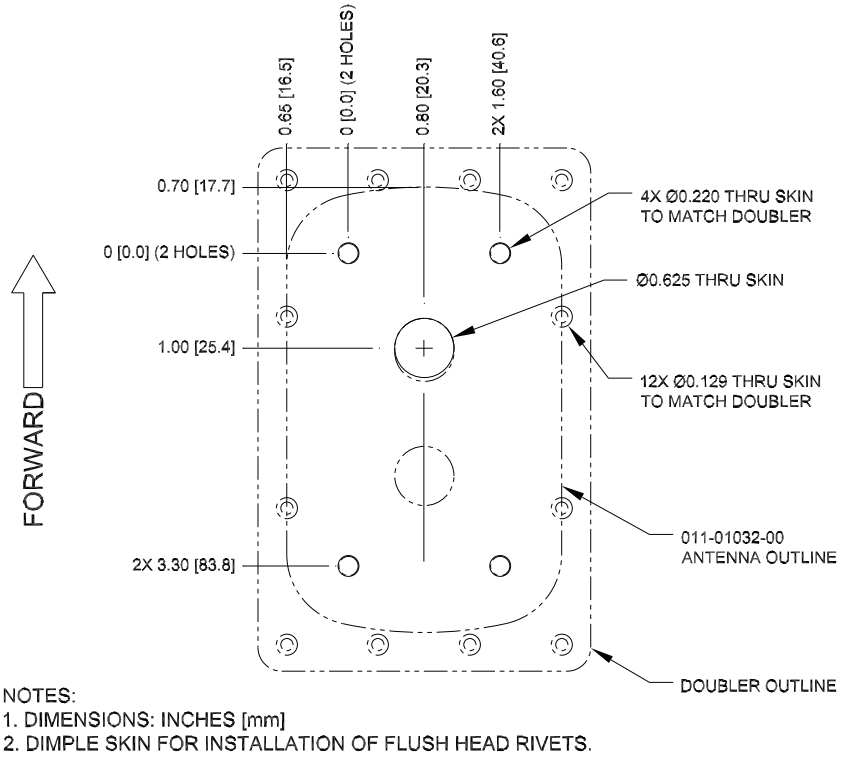
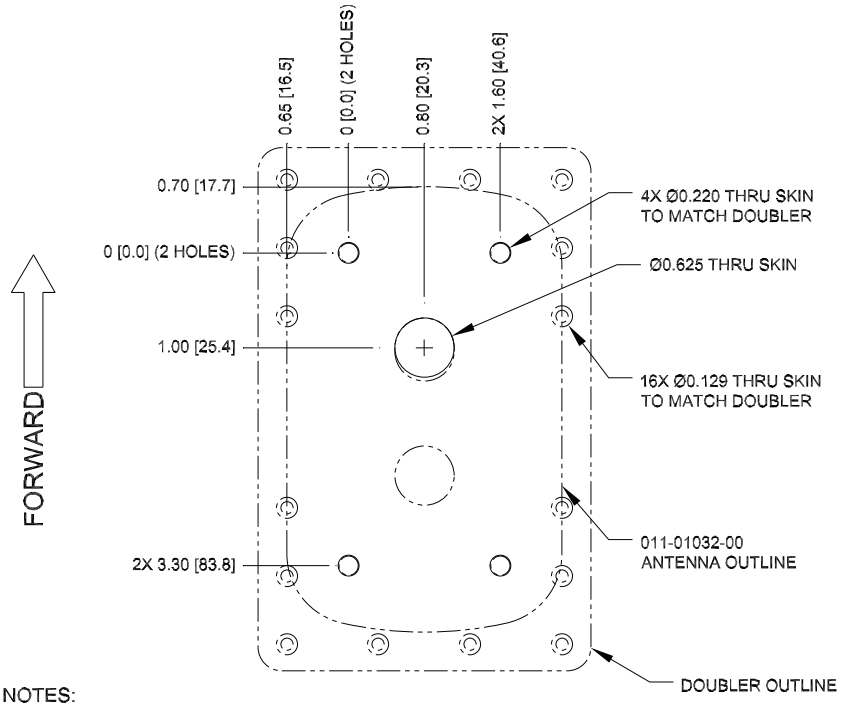


Figure 6-17 Sample Doubler Location, ARINC 743 Antenna, Metal Skin Aircraft



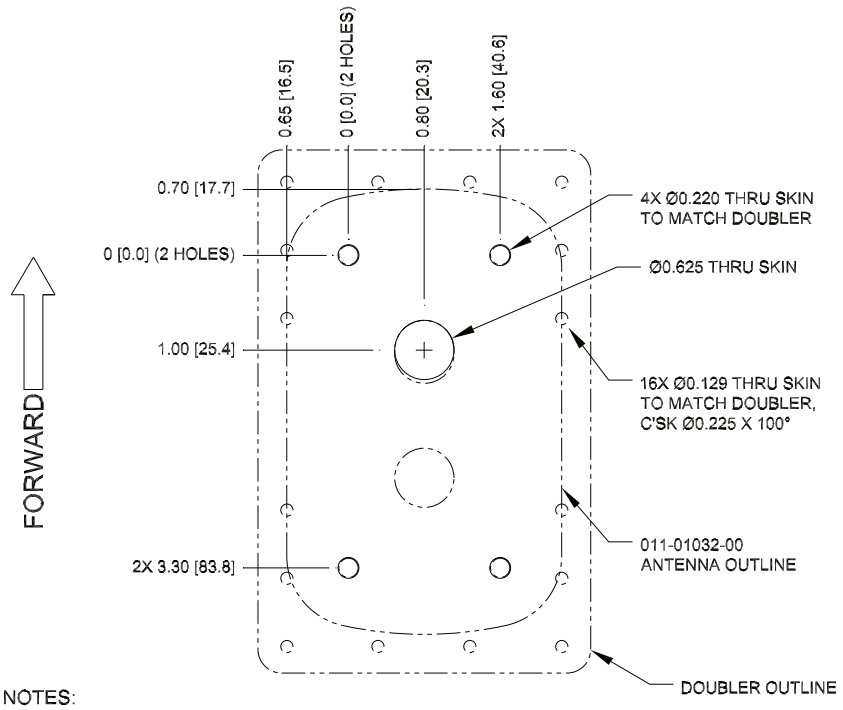
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-18 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



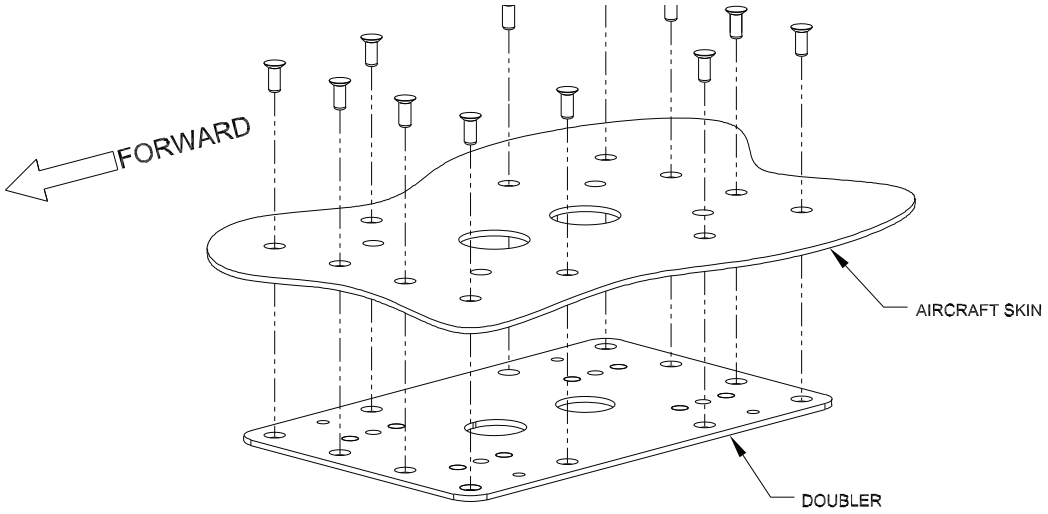
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 6-19 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



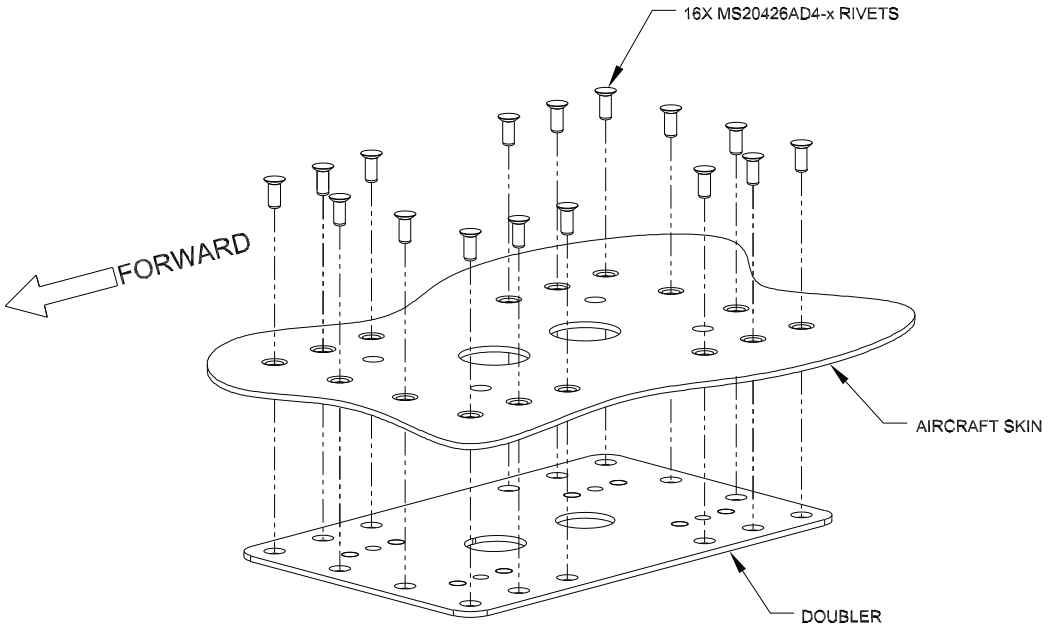
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH RIVETS.

Figure 6-20 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"



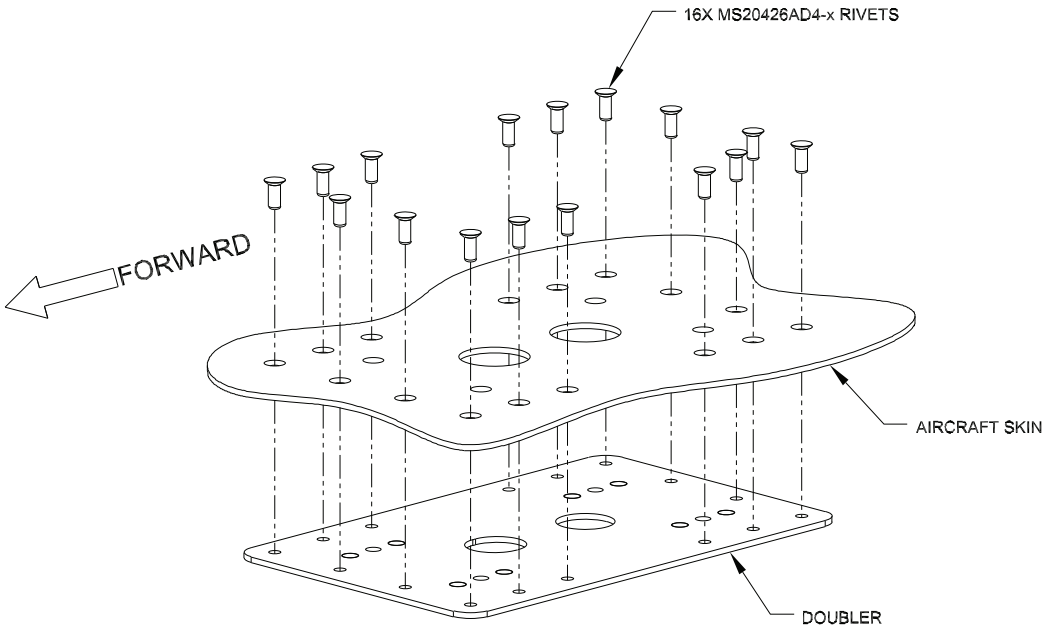
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 6-21 Doubler Installation, ARINC 743 Footprint Antenna, SkinThickness 0.032" to 0.049"



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

Figure 6-22 Doubler Installation, ARINC 743 Footprint Antenna, SkinThickness 0.049" to 0.051"



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

Figure 6-23 Doubler Installation, ARINC 743 Footprint, Skin Thickness 0.051" to 0.063"

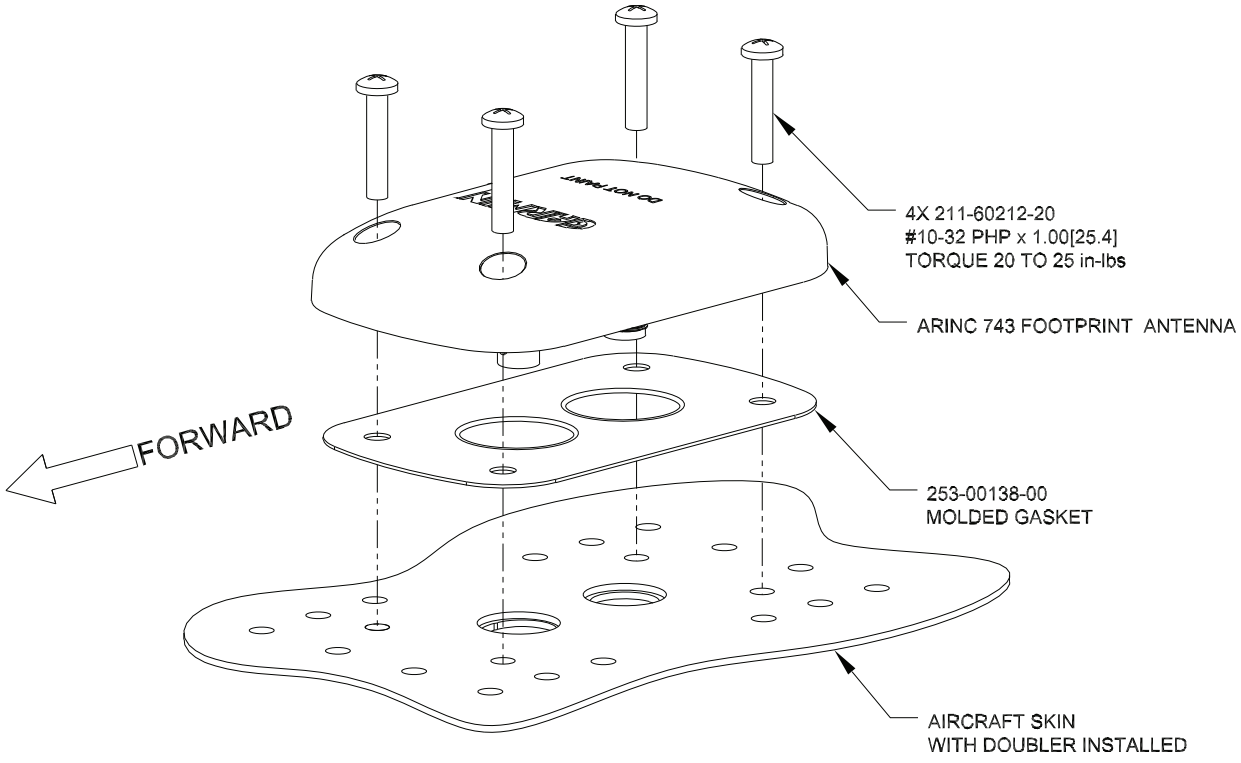


Figure 6-24 Installation of ARINC 743 Footprint Antenna

6.6 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.

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 equal to the aircraft typical cruise attitude.

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.

6.6.1 Generic Non-structural Antenna Installation

Figure 6-25 shows the generic non-structural installation for the ARINC 743 footprint (GA 55A/GA 57X) antenna. The teardrop footprint antennas (GA55, GA56 stud mount) can also be installed in this manner.

For mounting the teardrop style antenna (GA 55 or GA56), a doubler plate similar to Figure 6-4 or 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 as shown in Appendix C are required to secure the Teardrop style antenna to the mounting surface. Torque the locking nuts to 12-15 in-lbs, torque should be applied evenly across all mounting studs.

A doubler plate similar to Figure 6-14, or P/N 115-00846-00 (ARINC 743 style) 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. Locking nuts are required to secure the ARINC 743 antenna (locking nuts 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.

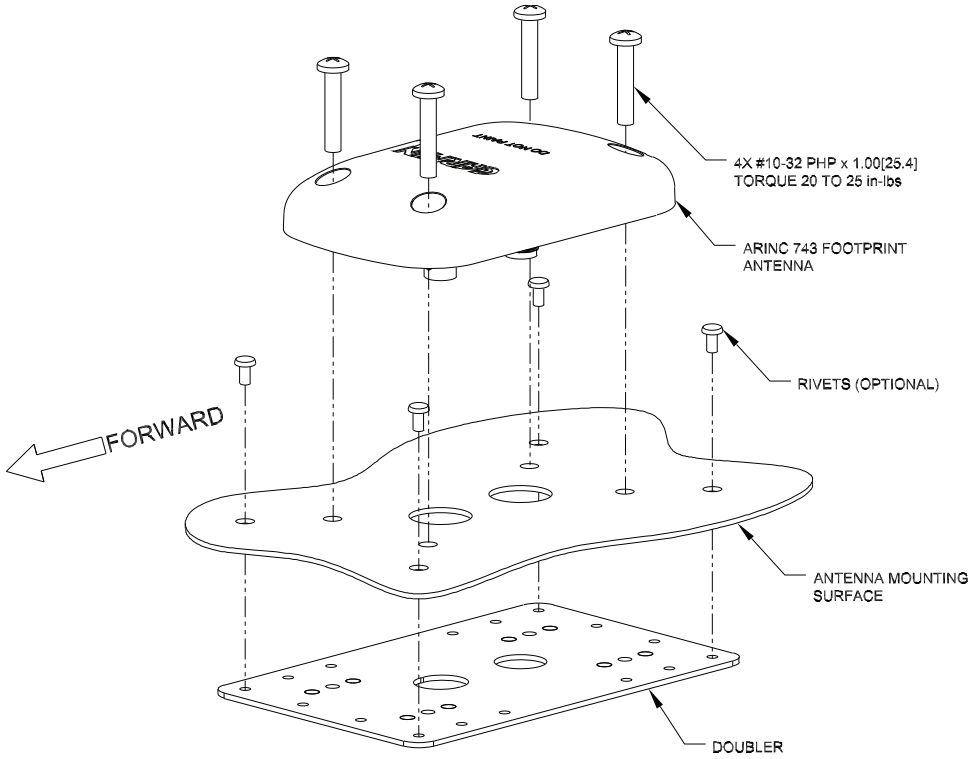


Figure 6-25 Generic Non-structural ARINC 743 Footprint Antenna Installation

6.6.2 Non-structural Installation to Glareshield

Figure 6-26 shows an example of a bracket created to support an antenna mounted on the underside of the glare shield. Figure 6-27 shows the non-structural mounting of the antenna under the glareshield, with the bracket assembly shown in Figure 6-26.

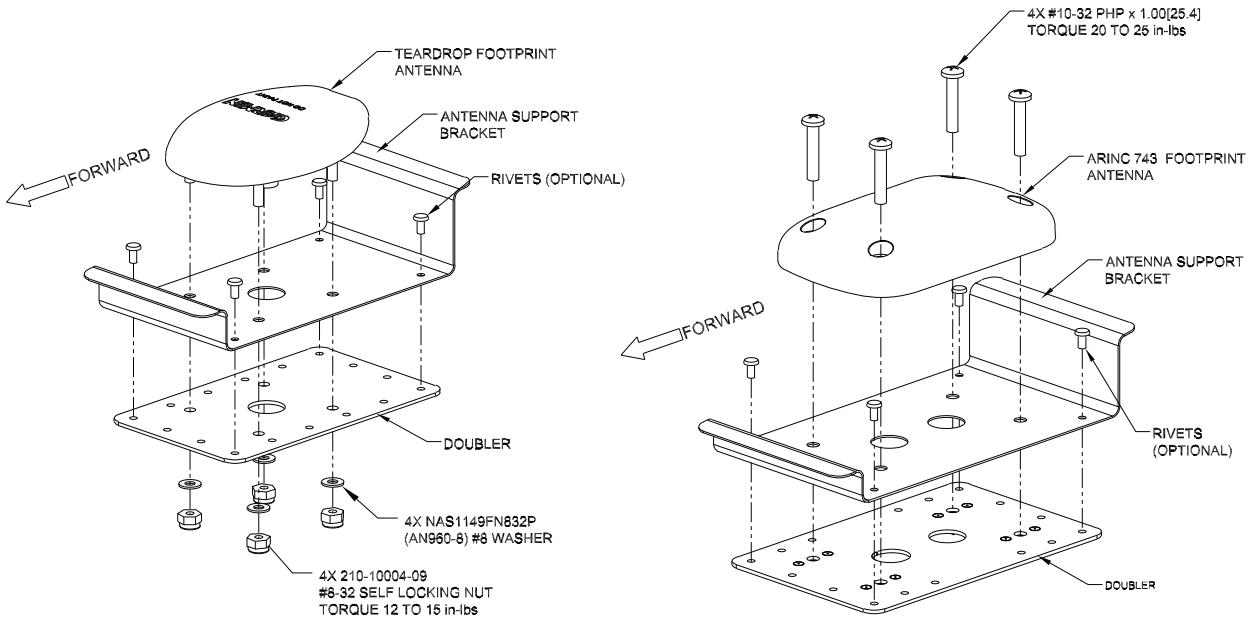


Figure 6-26 Example Bracket Antenna Mounting Under Glareshield

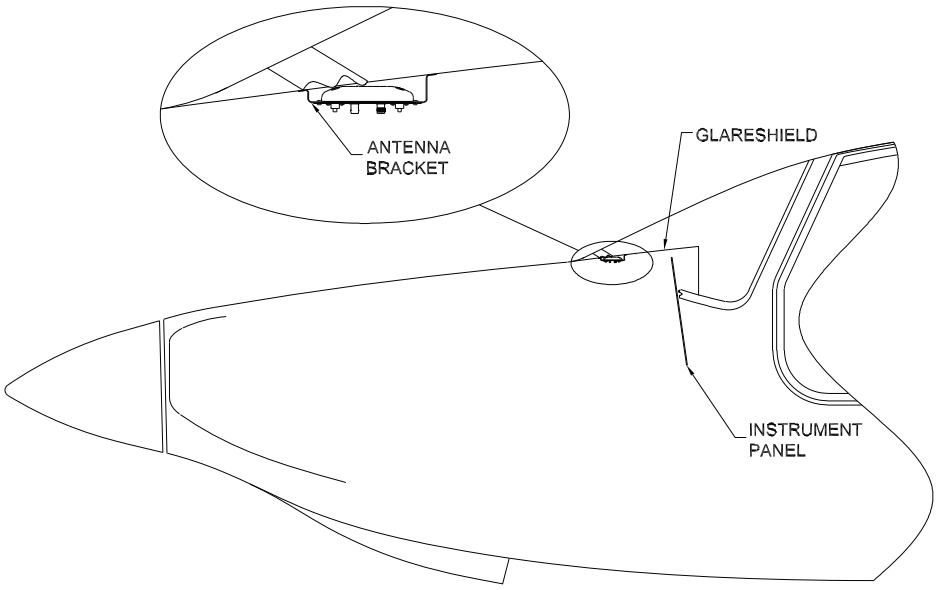


Figure 6-27 Example Non-structural Antenna Mounting Under Glareshield

6.6.3 Non-structural Installation to Airframe

Internal Non-structural Installation

Figure 6-28 and Figure 6-29 show examples of under the fabric skin non-structural mounting of the antenna to the airframe of a tube-and-fabric aircraft.

In Figure 6-28, a bracket is made to attach to the airframe, just under the fabric for a teardrop antenna installation. The doubler plate and mounting hardware described in the generic installation (Section 6.6.1) are used with the bracket as the antenna mounting surface. In Figure 6-29, a similar case is shown using the generic installation of the ARINC 743 footprint antenna. The doubler plate is optional for this type of installation with either the Teardrop or the ARINC 743 antenna.

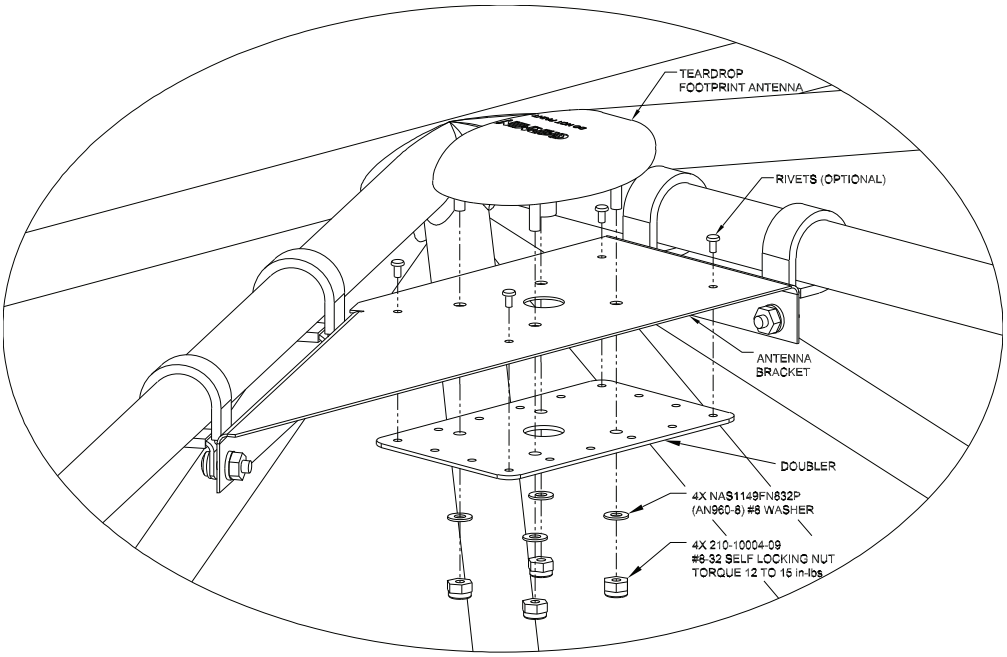


Figure 6-28 Example Teardrop Antenna Installation In Airframe Under Fabric Skin

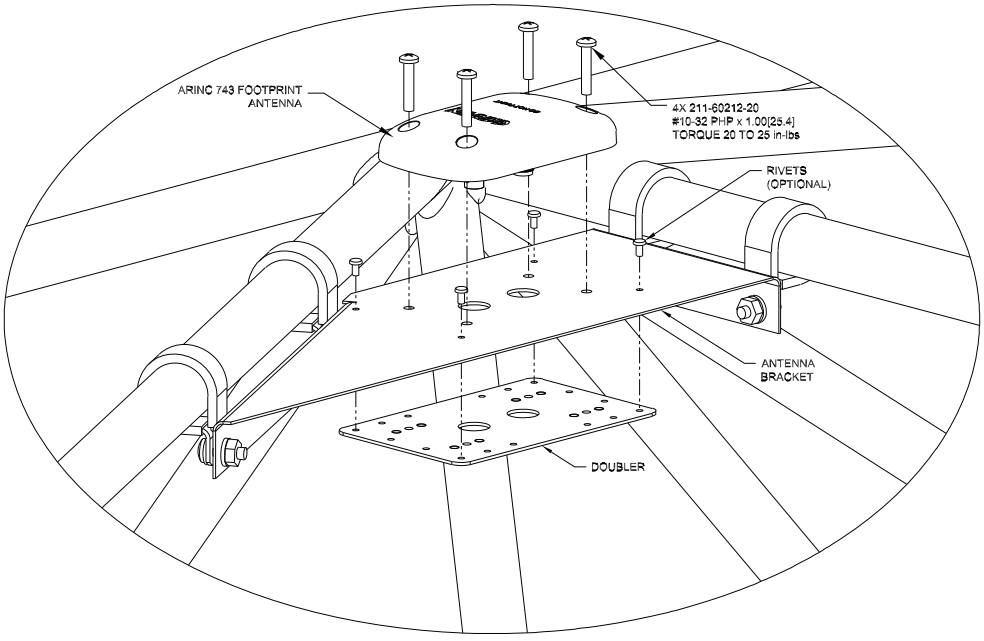


Figure 6-29 Example ARINC 743 Footprint In Airframe Under Fabric Skin

External Non-structural Installation

Figure 6-30 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 installation of the (Section 6.6.1) antenna is used, with the antenna support bracket as the mounting surface. Follow the applicable gasketing and sealant instructions in Section 6.4.2 (Teardrop style) or Section 6.5.2 (ARINC 743 style).

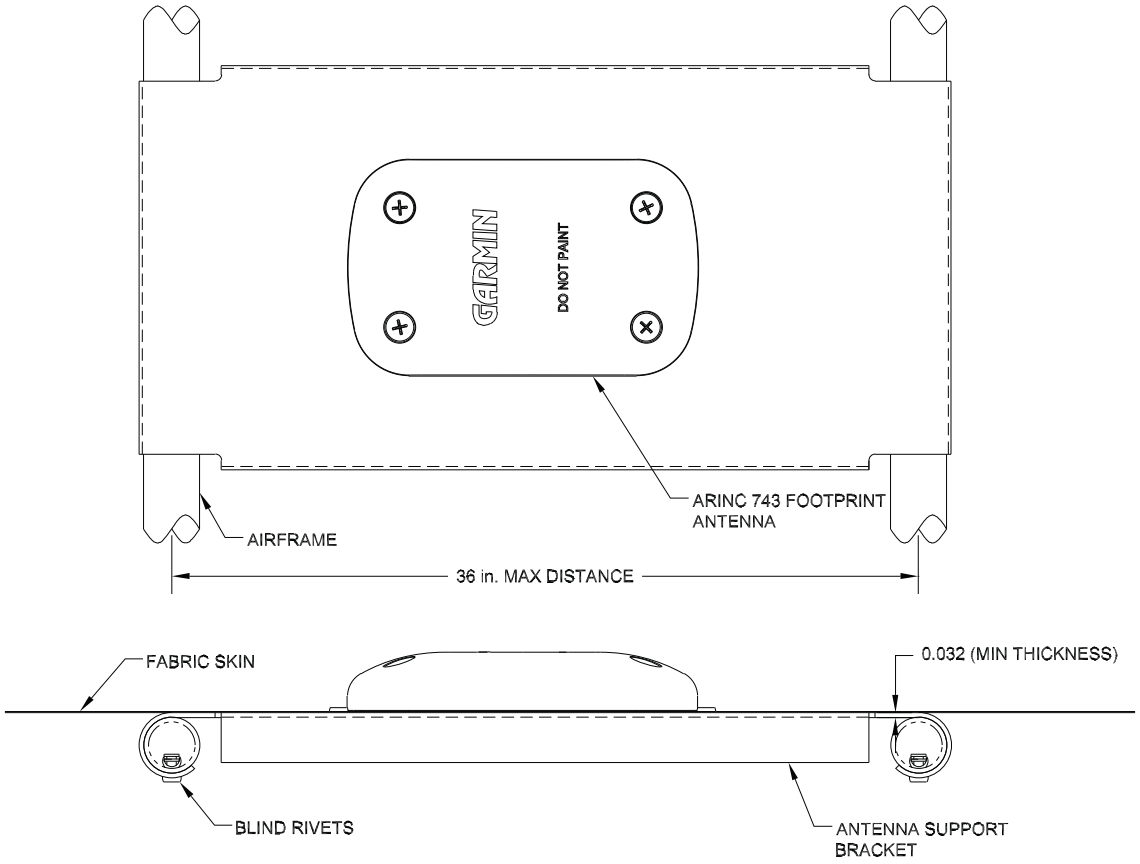


Figure 6-30 Example Non-structural Antenna Mounting On Airframe

Minimum Distance from Metal Tube Structure Requirements

Figure 6-31 shows minimum distance from metal tube structure requirements for internal, non-structural mounting of the antenna. Table 6-7 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 6-31 illustrates the tube diameter (d) and minimum distance (l) references in the Table 6-7.

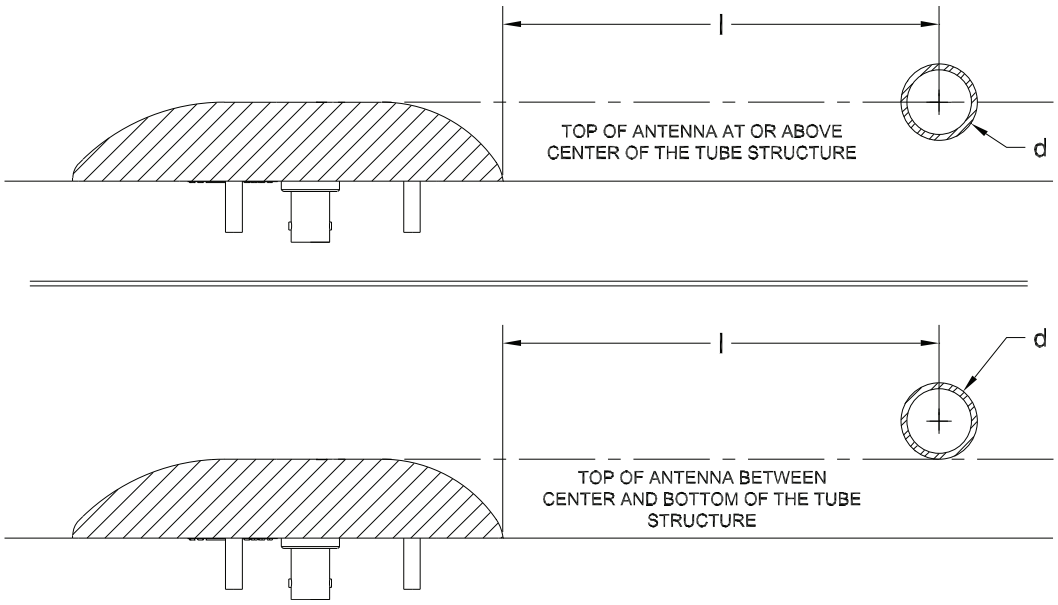


Figure 6-31 Example Teardrop Footprint Antenna Mounting Under Fabric Skin

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Table 6-7 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 6-31, 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 6-31, bottom)	0.625	7.2
	0.75	8.6
	1.00	11.5
	1.25	14.3

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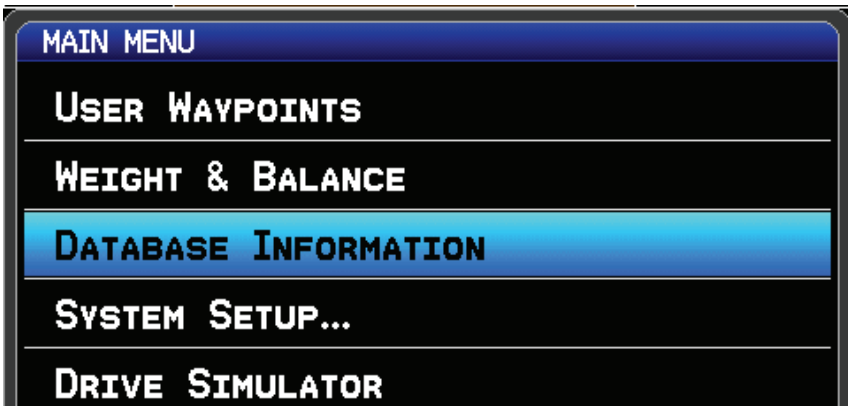
7 Software, Configuration, Databases, and XM Activation

7.1 Software, Database, and Audio Data Identification

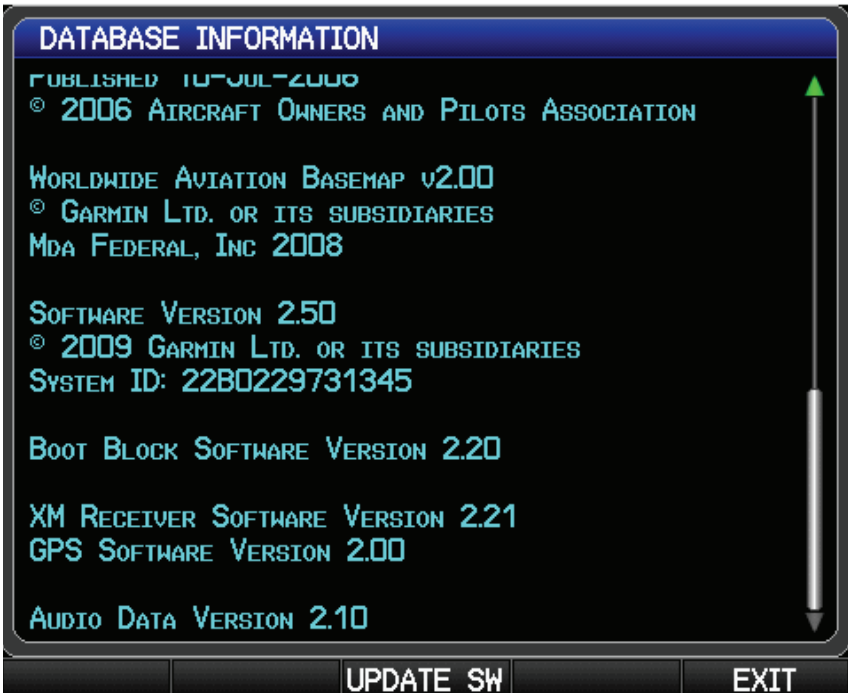
GDU 37X Software, Bootblock, Database, and Audio Data versions are listed on the Database Information page in normal mode. All database and software versions can be viewed on the MAIN page in configuration mode (Section 7.3).

Do the following steps to view the Database Information page:

1. Turn on the unit in normal mode.
2. Press the ENT key to accept the map and terrain data use statement.
3. Press the MENU key twice to display the Main Menu.
4. Use the FMS Joystick to select Database Information.



5. Press the ENT key to display the Database Information page, use the FMS Joystick to scroll through the list if needed.



7.2 Software Loading Procedure

GDU software loading can be performed in either normal or configuration mode (Section 7.3), while GSU software loading is performed only in configuration mode. Sections 7.2.1 and 7.2.2 describe the GDU and GSU software load procedure.

7.2.1 GDU Software Loading Procedure

1. Power on the GDU in normal mode, then insert the properly formatted SD card into the SD card slot.

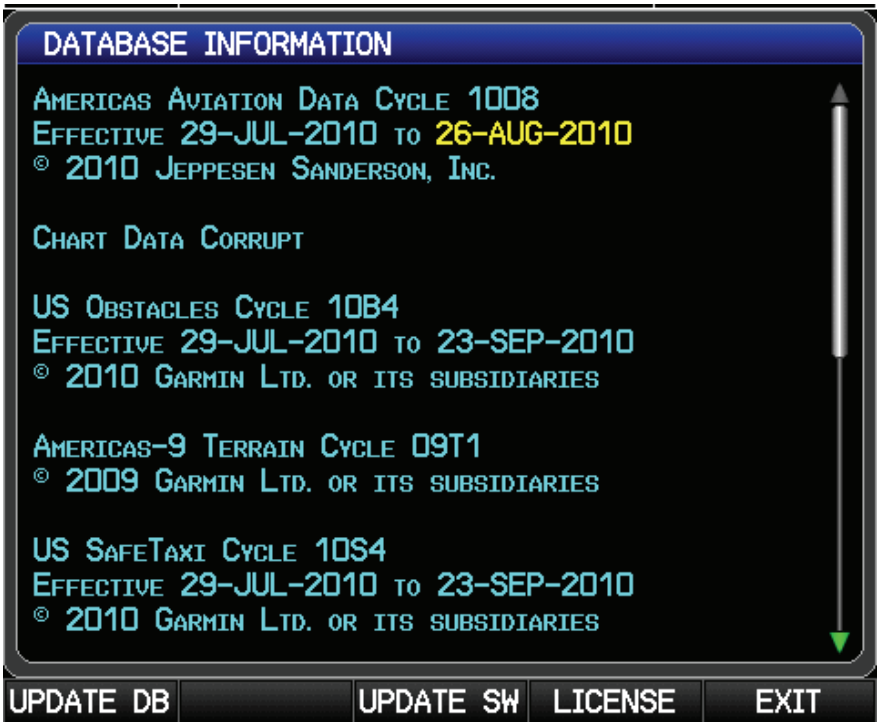
NOTE

It is also acceptable to insert the SD card before powering on the unit.

2. A software update pop-up will appear on the screen, highlight YES and press the ENT key to begin the update.

NOTE

If the preceding software update pop-up does not appear, select the Database Information Menu to update the software using the UPDATE SW softkey.



3. The unit will reboot, then GDU software update will begin automatically.
4. Ensure power is not removed while the update is being performed.
5. The unit will reboot after the update is complete,
6. Repeat for each GDU in the aircraft, then proceed to Section 7.2.2.

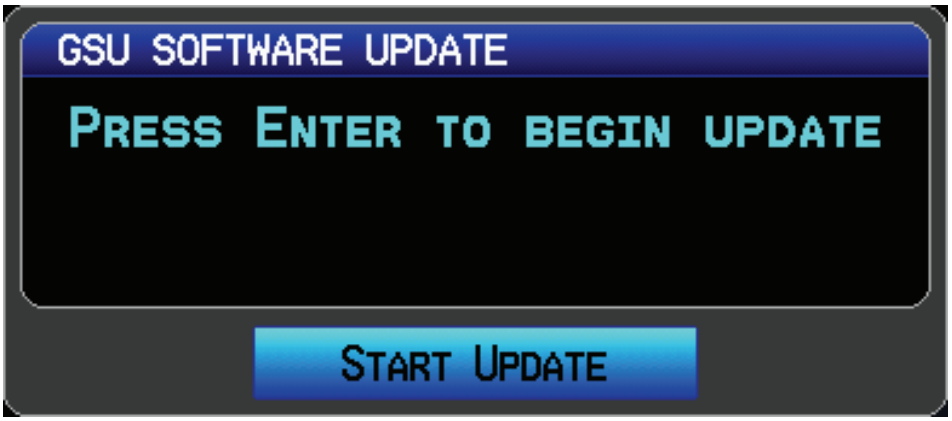
7.2.2 GSU Software Loading Procedure

The GSU software is loaded through the GDU. Use the following instructions to load GSU software if needed.

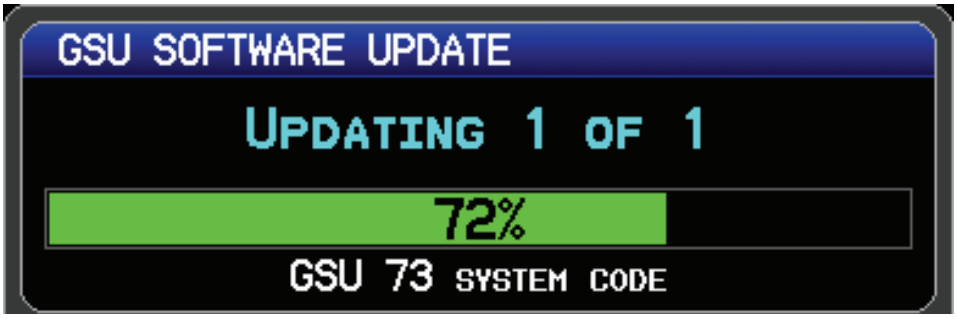
1. After doing the steps in Section 7.2.1, the GDU can now identify the software version currently in use for the GSU and compare it to a GSU software update that has been loaded to internal GDU memory. If the current GSU software is different than the GSU software stored in GDU memory, a "GSU 73 Software Update Required"message will be displayed on the MESSAGES page. The MESSAGES page is accessed by pressing the MESSAGES softkey on the INFO page in normal mode.

2. Turn the GDU off, and then back on in configuration mode (Section 7.3). A UPDATE SW softkey (in yellow text) and update note is shown on the GSU page in configuration mode when an update is available. The UPDATE SW softkey appears subdued or gray when no update is available. Press the UPDATE SW softkey to initialize a GSU software update.

3. After pressing the UPDATE SW softkey a confirmation will be requested. Press the ENT Key to begin updating the GSU software.



4. Allow the software load to complete.



NOTE

A software update may include multiple GSU 73 software regions, ensure all updates are completed successfully. If a region fails to load, retry the load. If the problem persists contact Garmin product support.

5. If the update is successful, an UPDATE COMPLETE message appears, press the ENT key to acknowledge the completion.

6. An unsuccessful update is indicated by an UPDATE FAILED message. Attempt the load again, or reload GDU software and then attempt to load the GSU software again.

7.3 Configuration Mode

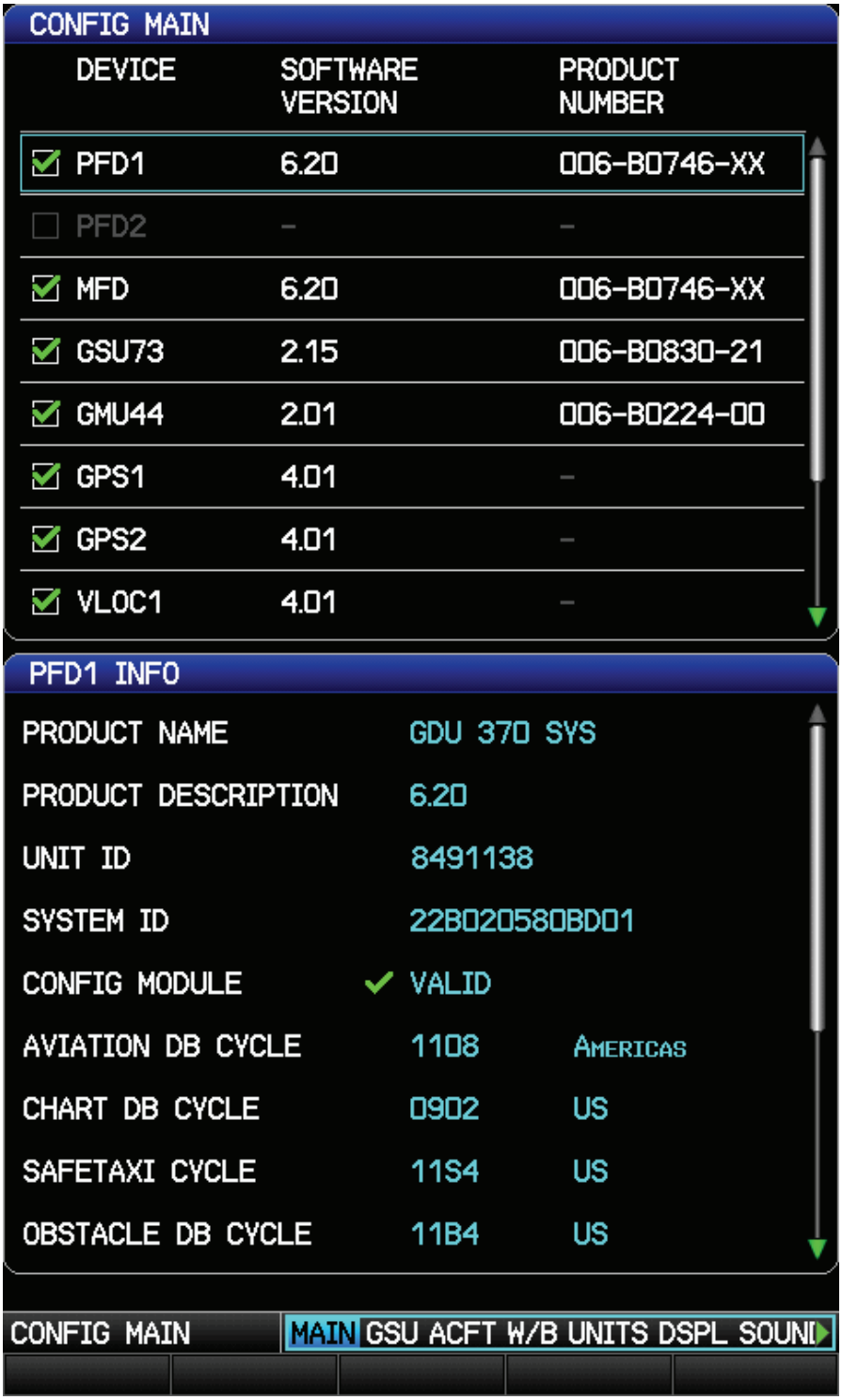
Some of the software loading, and all of the configuration settings are performed in the configuration mode. To enter configuration mode, hold down the left-hand softkey (softkey #1) while powering on the GDU 37X. In a two-display system hold down softkey #1 on the PFD.

The Configuration pages (MAIN, GSU, ACFT, W/B, UNITS, DSPL, SOUND, COMM, GPS, XPDR, LOG, ENG) are only available in Configuration mode.

7.3.1 Main Configuration Page

The Main Configuration Page is used to display LRU (device) specific information such as Software Version, Unit ID's, System ID's, and Database information for the various databases used by the G3X. This page has no user-selectable options.

1. In configuration mode, use the FMS Joystick to select and view the MAIN Page. The user may also review info in the device INFO box by using the FMS Joystick to scroll through the items in the list.



7.3.2 GSU Configuration Page

If an SD card is inserted into the GDU 37X, a SAVE LOG softkey is displayed at the bottom of the GSU Page. Pressing this softkey writes GSU log data to the Garmin\Diag directory on the SD card. This data may be requested by Garmin Product Support during GSU troubleshooting.

See Sections 7.2.2 (GSU SW loading procedure) , 8.3 (GSU 73/GMU 44 Calibration), and 9.6 (Calibration Procedures) for further information regarding the GSU Configuration Page.

7.3.3 ACFT Configuration Page

The Aircraft Configuration Page allows setting the parameters for Reference Speeds and Flight Planning. The aircraft identifier and map symbol can also be entered on this page.

Reference Speeds–The aircraft Vspeeds can be entered using the FMS Joystick. A label can be added to the Custom (1-4) reference speed fields. The entered label text will be displayed on the airspeed tape (in normal mode) at the entered speed. If no text is entered for the label, a small triangle will appear instead.

To clear a reference field:

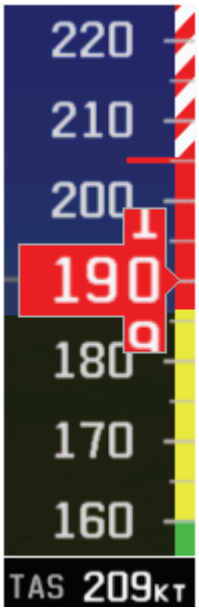
1. Highlight the desired reference speed field.
2. Press the CLR key, or set the speed to 0.

To clear a label field:

1. Highlight the desired label field.
1. Press the CLR key.

The IAS (Indicated Air Speed)/TAS (True Air Speed) selection controls how Vne (never exceed Velocity) is displayed on the PFD airspeed tape. If Vne is set to IAS, the redline indication for Vne is always displayed at a constant indicated airspeed, as it would be indicated on a mechanical airspeed gauge. In the following example, Vne will alwas be displayed at 205 knots indicated airspeed. At an IAS of 190 knots, the aircraft speed is below Vne.

For certain aircraft types, maximum airspeed is limited by true airspeed (TAS), not indicated airspeed. If Vne is configured to show true airspeed, the PFD airspeed tape will use a red color band to show the *indicated airspeed* at which the aircraft's *true airspeed* will exceed the value of Vne. In the following example, the aircraft is flying at a density altitude such that a TAS of 205 knots can be achieved at 186 knots IAS (displayed as a solid red color band). At an IAS of 190 knots, the aircraft's TAS has already exceeded the adjusted Vne.



At sea level and standard conditions, IAS and TAS are equal, so these two ways of displaying Vne would appear identical. As altitude increases (and air density decreases), the margin by which TAS exceeds IAS becomes greater, thus the effect on adjusted Vne is also greater.

Flight Planning–The flight planning fields let you adjust the default values (cruise speed and fuel flow) used in normal mode for flight planning calculations (ETE, Leg Fuel, etc.).

Aircraft Identifier–The aircraft identifier is used in the data log file and on the Flight Log page, it can be entered using the FMS Joystick.

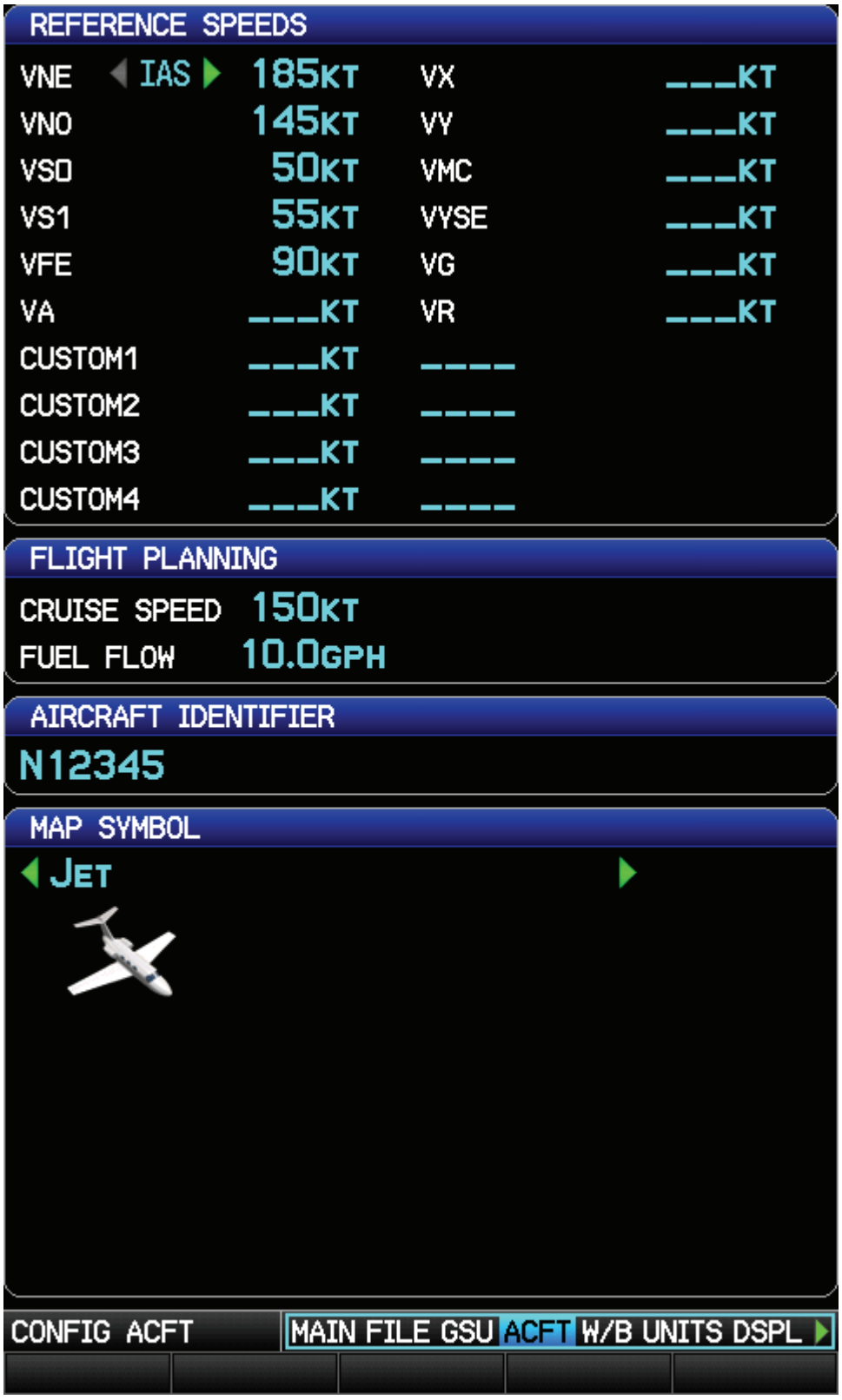
Map Symbol–The aircraft symbol that is displayed on the Map page can be selected.

NOTE

The aircraft symbols are stored as .srf files located in the 'Garmin/Vehicle/' directory on the SD card(s). For installations with multiple GDUs, the .srf file must be present on each SD card inserted into each of the GDUs. If the file is not present, the GDU will use the default black-and-white airplane symbol.

1. In configuration mode, use the FMS Joystick to select the ACFT Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.


REFERENCE SPEEDS
VNE
IAS
185KT
VX
___KT
VNO
145KT
VY
___KT
VSO
50KT
VMC
___KT
VS1
55KT
VYSE
___KT
VFE
90KT
VG
___KT
VA
___KT
VR
___KT
CUSTOM1
___KT
____
CUSTOM2
___KT
____
CUSTOM3
___KT
____
CUSTOM4
___KT
____
FLIGHT PLANNING
CRUISE SPEED
150KT
FUEL FLOW
10.0GPH
AIRCRAFT IDENTIFIER
N12345
MAP SYMBOL
JET
CONFIG ACFT
MAIN FILE GSU ACFT W/B UNITS DSPL

7.3.4 W/B (Weight/Balance) Configuration Page

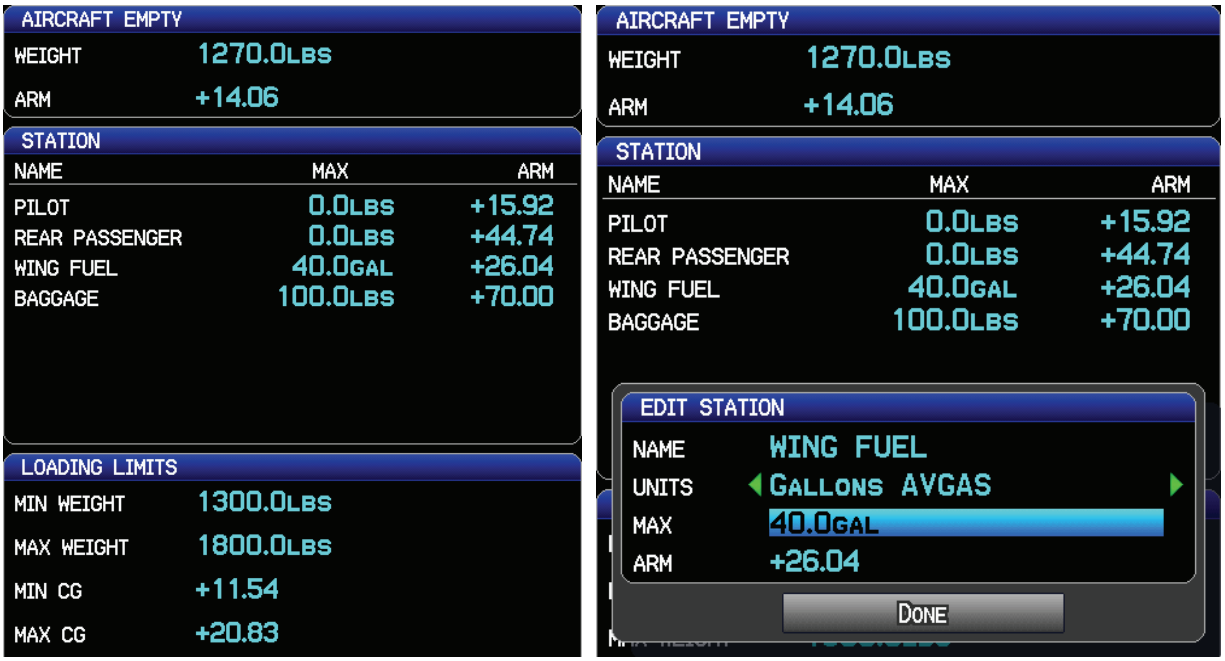
The W/B Configuration Page allows setting the weight and balance parameters for the airplane. These parameters are then used on the Main Menu W/B Page in normal mode. Weight/Balance may be used during pre-flight preparations to verify the weight and balance conditions of the aircraft. By entering the weight and arm values into the Aircraft Empty window, the GDU 37X can calculate the total weight, moment, and center of gravity (CG).

Before entering the various figures, the empty weight of the airplane and the arm (or "station") for each weight should be determined. These figures should be determined using the pilot's operating handbook for the airplane, which also notes the weight limitations and fore/aft CG limits. Compare those figures to the values calculated by the GDU 37X.

Each station listed in the Station window has an editable name and arm location. This allows the setting of the units of measure used for that station (weight, or units of avgas or jet fuel). An optional maximum value can be set for a particular station (e.g. a fuel tank might have a max capacity of 50 gallons) or the max can be set to zero so that no maximum will be imposed.

The Loading Limits window contains fields for the entry of minimum and maximum aircraft weight, and the minimum and maximum CG location.

1. In configuration mode, use the FMS Joystick to select the W/B Page.



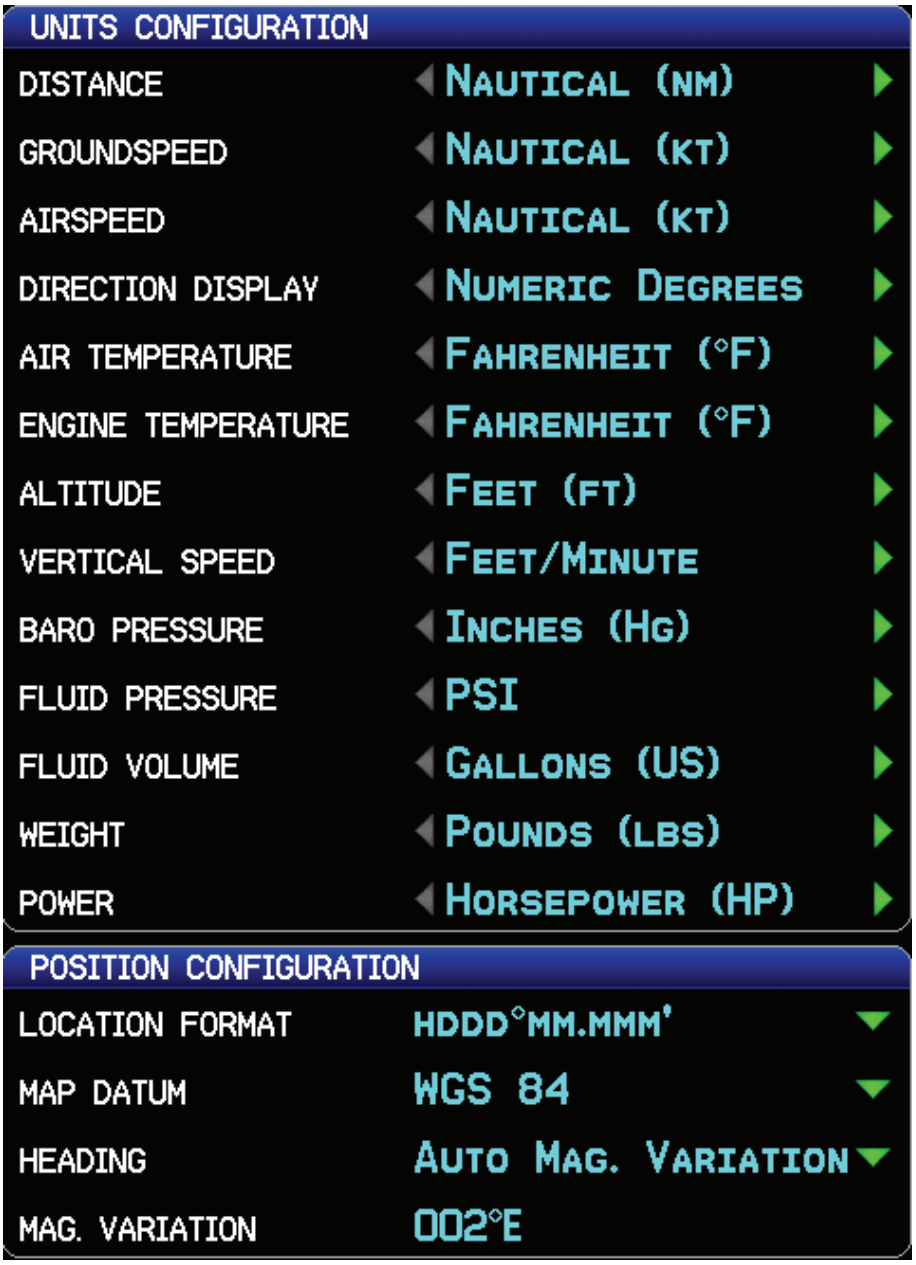
2. Use the FMS Joystick to select the desired configurable item and make the desired change, then press the ENT Key or use the FMS Joystick to select the next item.
3. To create a new station, highlight a blank line (in the Station window), press the ENT key, enter the name, units, max weight, and arm, then highlight DONE and press the ENT key.
4. To edit or delete a station, highlight the desired station, then press the ENT softkey.
5. Press the FMS Joystick to move the cursor to the page selection menu when finished.

7.3.5 UNITS Configuration Page

The Units Configuration Page allows selection of the desired displayed units for the listed items in the Units Configuration window. The various settings for Location Format, Map Datum, and Heading can be accessed in the Position Configuration window. See the G3X Pilot's Guide for a description of Location Format and Map Datum.

1. In configuration mode, use the FMS Joystick to select the UNITS Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.

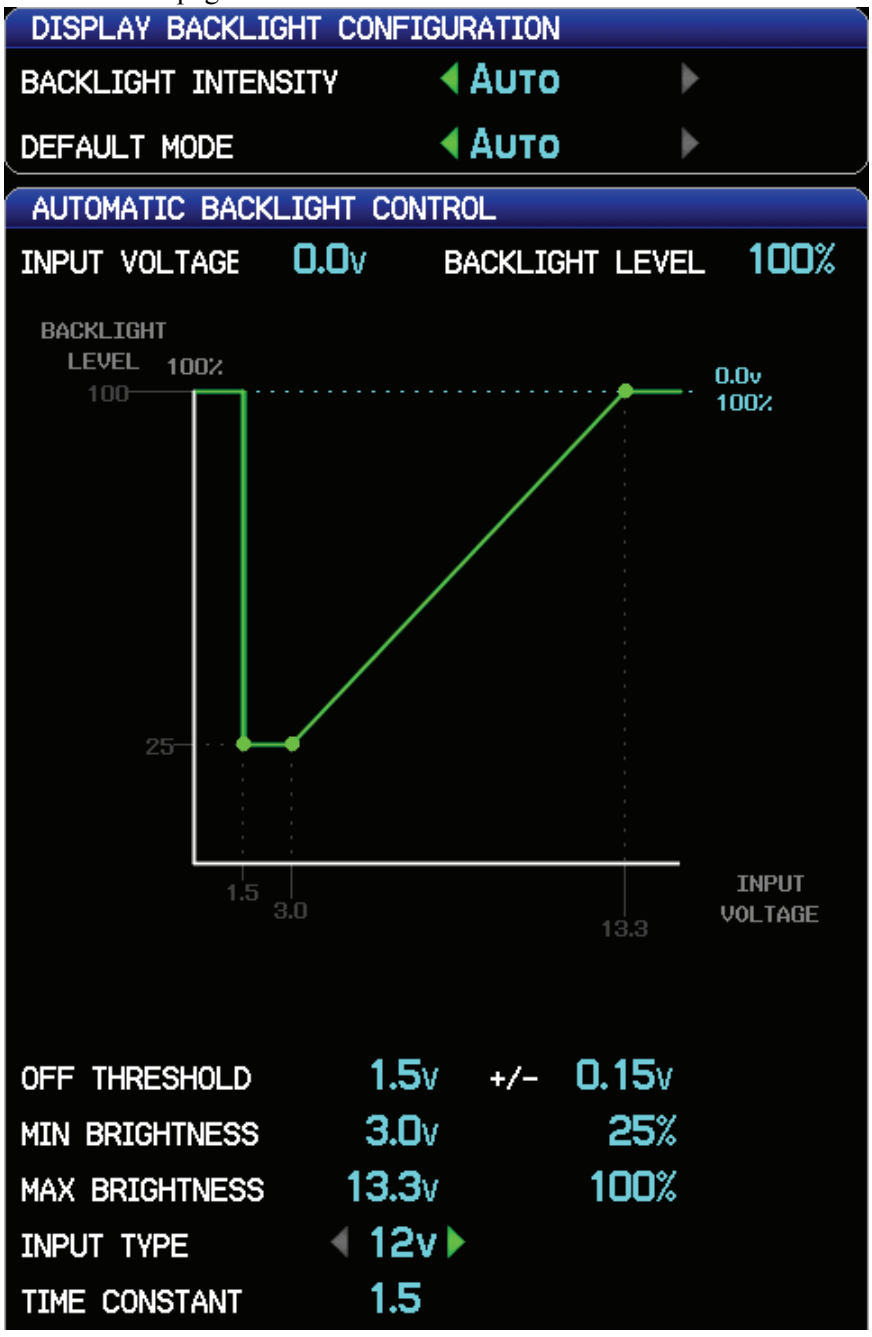


7.3.6 DSPL (Display) Configuration Page

The DSPL Configuration Page allows setting the parameters for Display and Backlight Control configuration. The aircraft lighting bus voltage can be set for either 12 or 24V input to match the aircraft lighting bus voltage.

1. In configuration mode, use the FMS Joystick to select the DSPL Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



Display Configuration Window:

Backlight Intensity: Can be set to Auto or Manual (this setting is also available in normal mode on the Display Setup page).

Auto–Sets the backlight intensity (display brightness) based on the aircraft's instrument lighting bus voltage.

Manual–Allows setting the display brightness by changing the Backlight Intensity (0-9) setting found beside the 'Manual' setting.

Default Mode: Can be set to Auto or Manual (described above). This controls the backlight mode that will be active each time the system is powered on.

Automatic Backlight Control Window (settings apply only to 'Auto' setting):

Input Voltage–Displays the current lighting bus voltage

Backlight Level–Displays the current backlight level (0-100%)

Graph–Brightness is displayed as the vertical (Y) axis, and aircraft lighting bus voltage is displayed as the horizontal (X) axis. The graph changes according to the auto backlight control settings, and the lighting bus voltage.

Off Threshold–Sets the lighting bus threshold voltage. At the threshold voltage, the backlighting is turned on per the Min Brightness setting. Below the threshold voltage, the backlighting defaults to a Backlight Level of 100% . The '±' setting controls the range that the Off Threshold voltage is in effect. Default values are 2.9V & ±0.15V. If the Off Threshold value is set to 0.0V, it will be be ignored, and the display brightness will remain at the Min Brightness level for any voltage between zero volts and the Min Brightness voltage setting.

Min Brightness (Voltage and Percentage)–Sets the lower bus voltage required to turn the backlighting on to the percentage of brightness set by the Min % setting. Default values are 3.0V and 10%.

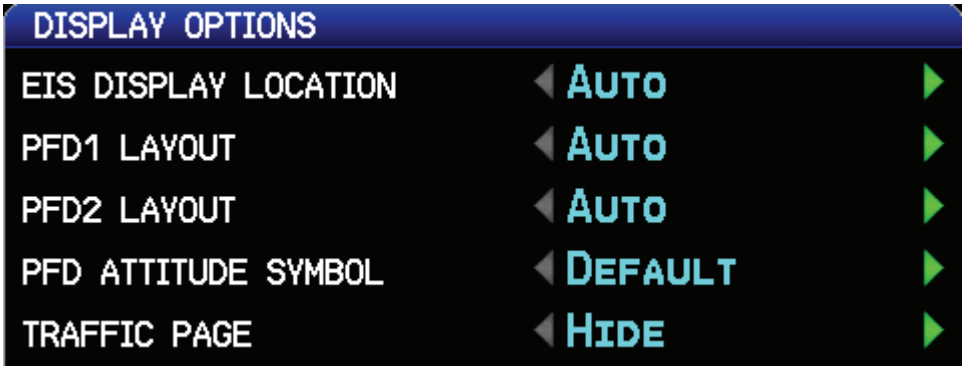
Max Brightness (Voltage and Percentage)–Sets the upper bus voltage required to turn the backlighting on to the percentage of brightness set by the Max % setting. Default values are 12.0V and 100%.

Input Type–Sets the aircraft lighting bus voltage for either 12 or 24V input to match the aircraft lighting bus voltage.

Time Constant–Adjusts the speed (in seconds), that the brightness level responds to changes in the input voltage level.

Options Softkey:

Press the Option softkey to adjust the following non-backlight-related display options. Press the Backlight softkey to return to the DSPL Configuration Page.



EIS Display Location–Controls which GDU the EIS Display (Engine Bar) appears on in a multi-screen system.

Auto–In a single-display system (or in a reversionary condition) the EIS Display appears on the PFD; in a two or three display system the EIS Display appears on the MFD.

PFD–The EIS Display will always appear on the PFD, even in a multi-display system.

PFD1 Layout/PFD2 Layout–Allows the user to optionally keep the split-screen (PFD on top half/MFD on bottom half) view on PFD1 or PFD2, even when not in reversionary mode.

Auto–Allows the split-screen view only in reversionary mode or in single-screen installations.

Split Screen–Keeps PFD1 or PFD2 in split-screen mode at all times.

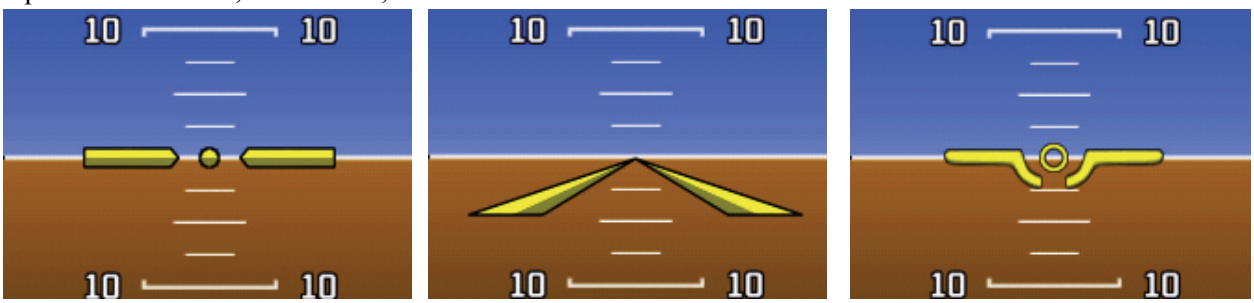
User Selected-Default setting, allows changing the screen layout (Auto or Split) of the PFD1 GDU in normal mode (via the Display Setup page).

PFD2 Layout (options for 3 display systems only)–Allows the user more PFD2 configuration options for 3 display systems.

Full PFD/MFD–Enables a full-screen PFD page in the page sequence, along with full-screen MFD pages.

User Selected–When selected, adds a PFD2 Display Layout option to the Display Setup page (in normal mode) which allows the user to change the layout of PFD2 during normal operation (Auto, Split, or PFD/MFD).

PFD Attitude Symbol–Affects the appearance of the airplane symbol on the PFD attitude display. Options are Default, Alternate 1, and Alternate 2.



Default Symbol **Alternate 1 Symbol** **Alternate 2 Symbol**

Traffic Page–Sets the dedicated Traffic page to displayed (SHOW) or not displayed (HIDE). Only applicable when configured for traffic input, otherwise not displayed.

7.3.7 SOUND Configuration Page

The SOUND Configuration Page allows setting the parameters for various alert and message tones. A TEST softkey is used to test audio volume and configuration.

1. In configuration mode, use the FMS Joystick to select the SOUND Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.

The configuration options for the SOUND Configuration Page are listed/described as follows:

Alert Volume – Controls the volume level (settings 1-10) of audio alerts (Altitude, CAS, Integrated Autopilot, Terrain, Traffic)

Message Volume – Controls the volume level (settings 1-10, or OFF) of message tones (Airspace Advisory Messages, Approaching VNAV Target Altitude Message, etc.)

Terrain Audio – Enables/disables terrain awareness audio alerts

Traffic Audio – Enables/disables Traffic Audio alerts

Traffic N/A – Enables/disables Traffic Not Available alerts

Altitude Alert – Enables/disables the Altitude Alert tone

Altitude Minimums – Enables/disables the Altitude Minimums tone

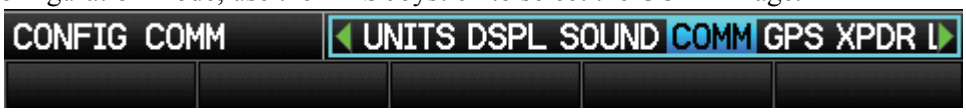
Alert Source – If more than one GDU 37X is installed, an Alert Source field will appear on the SOUND Configuration page. The Alert Source field allows the user to select which GDU will generate the alert sounds. The Alert Source options are: PFD1, PFD2, MFD, or Auto (which will use whichever unit is present, in the order PFD1, MFD, PFD2).

Alert Output – If set to MONO + STEREO, alert tones and messages will be output on both the mono and stereo outputs. If set to MONO ONLY, alert tones and messages will be output only on the mono output.

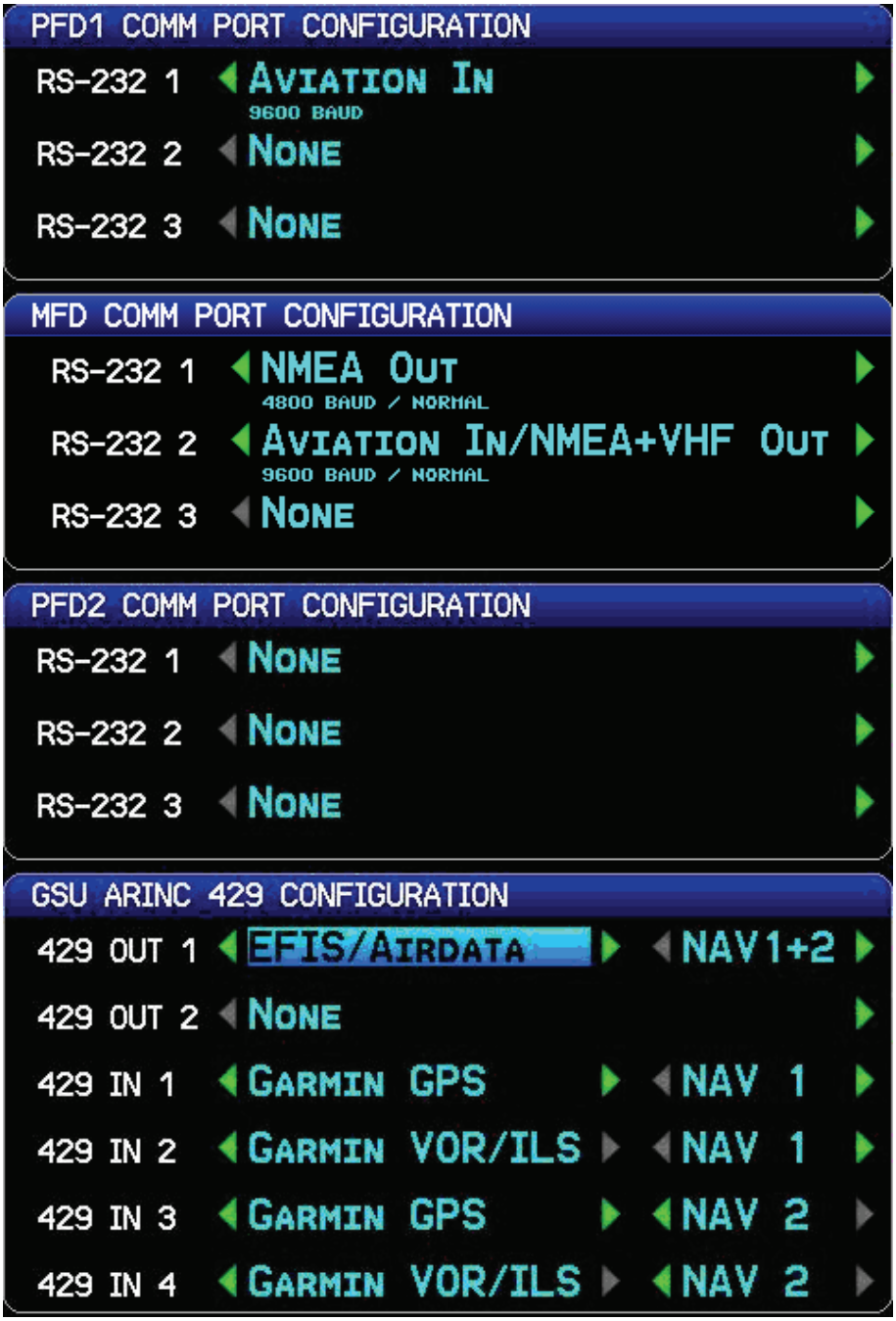
7.3.8 COMM Configuration Page

The COMM Configuration Page allows setting the parameters for the communication ports.

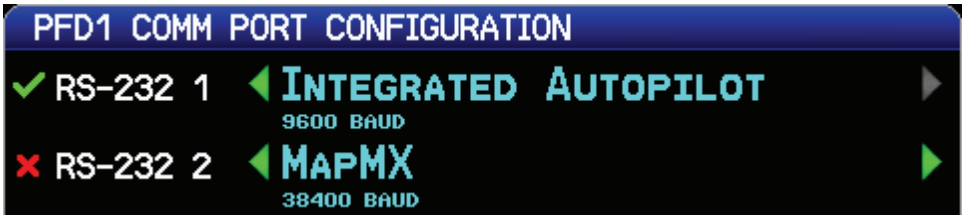
1. In configuration mode, use the FMS Joystick to select the COMM Page.



2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



A green checkmark will appear next to the name of each Comm port when it is receiving valid data. No checkmark is displayed if data has not yet been received. A red X is diplayed if data has been received, then interrupted.



G3X installations with a single GDU 37X will display the RS-232 and ARINC 429 configuration settings on separate soft-key selectable pages.

PFD 1, MFD, and PFD 2 Comm Port Configuration options

Each connected GDU 37X has three configurable RS-232 channels, the optional settings are:

Garmin Data Transfer - The proprietary format used to exchange data with a PC.

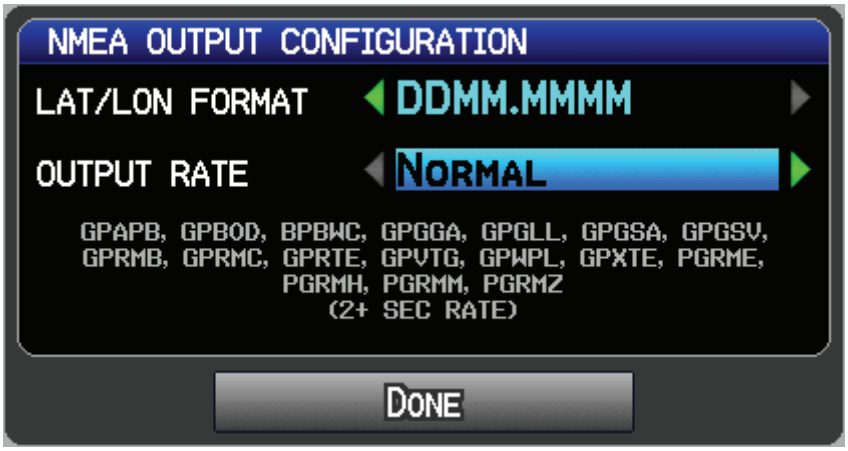
NMEA Out - Supports the output of standard NMEA 0183 version 3.01 data at a baud rate of 4800. The GDU outputs data from the selected GPS source (internal GPS or external GPS1/GPS2) via NMEA sentences.

A setting that allows switching the NMEA output between "Normal" and "Fast" speeds is accessed by pressing the MENU Key on the Comm Page (at least one output must be set to NMEA Out) followed by the ENT Key.

A pop-up window appears which allows the selection of the Lat/Lon format and the output rate. These settings affect all RS-232 ports that are configured to output NMEA data. The selected speed is displayed following the baud rate now for all ports configured for NMEA output. This feature is useful for sending data to devices that require the full set of NMEA sentences at a slower pace.

Fast (every second): GPBOD, GPRMB, GPRMC, PGRMH, PGRMZ

Normal (every two seconds): GPAPB, GPBOD, BPBWC, GPGGA, GPGLL, GPGSA, GPGSV,GPRMB, GPRMC, GPRTE, GPVTG, GPWPL, GPXTE, PGRME, PGRMH, PGRMM, PGRMZ



Aviation In - The proprietary format used for input to the G3X (baud rate of 9600) from an FAA certified Garmin panel mount unit. Allows the G3X to display a Go To or route selected on the panel mount unit, which eliminates the need to enter the destination on both units.

Aviation In/NMEA & VHF Out - Receives aviation data and transmits out both NMEA data, at 9600 baud, and VHF frequency tuning information to a Garmin Nav/Comm radio.

MapMX - The preferred data source when interfacing with an external navigator, and is only available from Garmin units with a WAAS GPS receiver. When MapMX data is received, the G3X display can show more accurate information about the external navigator flight plan (e.g. DME, arcs, and holding patterns).

TIS In - Receives TIS data from a Garmin Mode S transponder. Note that if a transponder is connected to the GSU 73 (as shown in Appendix F), it is not necessary to select TIS In, as the transponder data is received via the GSU 73.

TIS In/NMEA & VHF Out - Receives TIS data and transmits out both NMEA data, at 9600 baud, and VHF frequency tuning information to a Garmin Nav/Comm radio. Note that if a transponder is connected to the GSU 73 (as shown in Appendix F), it is not necessary to select TIS In, as the transponder data is received via the GSU 73.

SL30 Nav/Comm - Outputs frequency tuning and radial selection data to an SL30, and receives lateral and vertical NAV deviation signals.

SL40 Comm - Outputs frequency tuning data to an SL40.

Integrated Autopilot – For use with Autopilots that use both ARINC 429 and bi-directional RS-232 data (ARINC 429 output set to Autopilot). Integrated Autopilot is a proprietary serial format that provides autopilot control softkeys and status annunciations on the G3X PFD. See wiring examples in Appendix F.

Note the following when configuring the communication settings:

- Each GNS 400/500 or GTN 600/700 series unit must be connected to an MapMX/Aviation RS-232 input on one of the GDU 37X units (in addition to the GSU ARINC connection). ARINC 429 data input from a GNS 400/500 or GTN 600/700 series unit will be ignored unless a corresponding MapMX/Aviation RS-232 input is also configured.

- When connecting two GNS 400/500 or GTN 600/700 series units to the G3X system, connect the MapMX/Aviation RS-232 output from NAV 1 to an RS-232 input on PFD1, and connect the MapMX/Aviation RS-232 output from NAV 2 either to an RS-232 input on the MFD, or to a higher-numbered RS-232 input on PFD1.

- Highlight the ‘GPS1’, ‘GPS2’, etc. fields on the Main Configuration page to verify which RS-232 and ARINC 429 inputs the G3X system is currently using for NAV 1 and NAV 2.

GSU ARINC 429 Configuration options

The configuration options for the 2 output and 4 input GSU ARINC 429 channels are detailed in this section.

NOTE

The GSU ARINC 429 Configuration options only appear when a GSU 73 is connected to the GDU 37X.

ARINC 429 Outputs:

EFIS/Airdata – Outputs EFIS and air data labels to a 4XX/5XX series unit. A second selection is used to determine if the EFIS/Airdata output is addressed to NAV 1, NAV 2, or both (NAV 1+ 2). The transmitted labels are as follows:

100P	Selected Course 1	203	Pressure Altitude	204	Baro Corrected Altitude
206	Indicated Airspeed	210	True Airspeed	211	Total Air Temperature
212	Vertical Speed	213	Static Air Temperature	235	Baro Setting (BCD)
320	Magnetic Heading	371G	Manufacturer ID	377	Equipment ID

Autopilot - For use with Autopilots that use both RS-232 and ARINC 429 data. The transmitted labels are as follows:

001	Distance To Waypoint (BCD)	012	Ground Speed (BCD)	100P	Selected Course 1
101	Selected Heading	102	Selected Altitude	104	Selected Vertical Speed
114	Desired Track (True)	115	Waypoint Bearing (True)	116G	Cross Track Distance
117G	Vertical Deviation	121	Roll Command	122	Pitch Command
147G	Magnetic Variation	203	Pressure Altitude	204	Baro Corrected Altitude
206	Indicated Airspeed	212	Vertical Speed	235	Baro Setting (BCD)
251	Distance To Waypoint	312	Ground Speed	313	Ground Track
320	Magnetic Heading	324	Pitch Angle	325	Roll Angle
371G	Manufacturer ID	377	Equipment ID		

ARINC 429 Inputs:

Garmin GPS – Receives GPS labels from a GNS 400/500 or GTN 600/700 series unit. A second selection is used to determine if the GPS input is from NAV 1 or NAV 2.

Garmin VOR/ILS – Receives VOR/ILS labels from a GNS 400/500 or GTN 600/700 series unit. A second selection is used to determine if the GPS input is from NAV 1 or NAV 2.

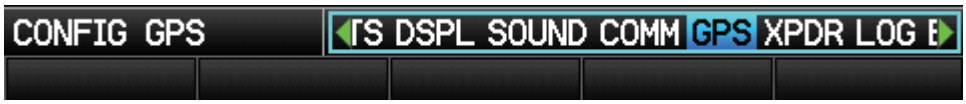
7.3.9 GPS Configuration Page (multiple GDU installations only)

The GPS Configuration Page allows selecting the GPS source for each GDU. Each installed GDU can select either the GPS antenna directly connected to that GDU, or 'No GPS Antenna Connected'. If 'No GPS Antenna Connected' is selected, that GDU will use GPS data from the GDU that is connected to a GPS Antenna. Only one GDU need be connected to a GPS Antenna, that GDU will "share" the GPS info will all other GDUs. This page does not appear if only a single GDU (and no GSU 73) is installed.

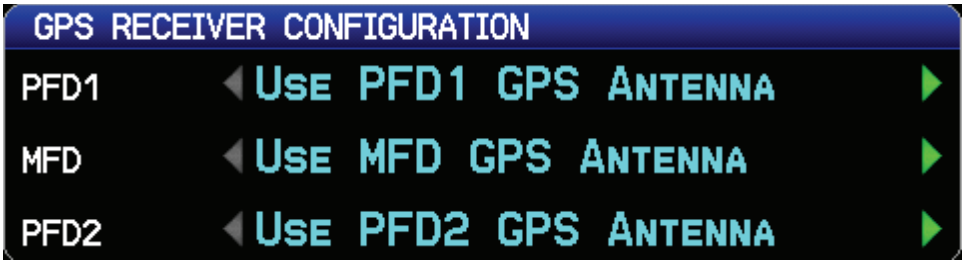
NOTE

Failure of a single GDU or GPS antenna (in a multi-display/multi-antenna installation) would cause the system to use GPS information from the remaining functional GDU. If no GPS data is available from any operating GDU, the remaining GDUs will use GPS position data from an external GPS navigator (GNS 400/500 or GTN 600/700 series unit). Accuracy will be degraded when using an external GPS navigator.

1. In configuration mode, use the FMS Joystick to select the GPS Page.



2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



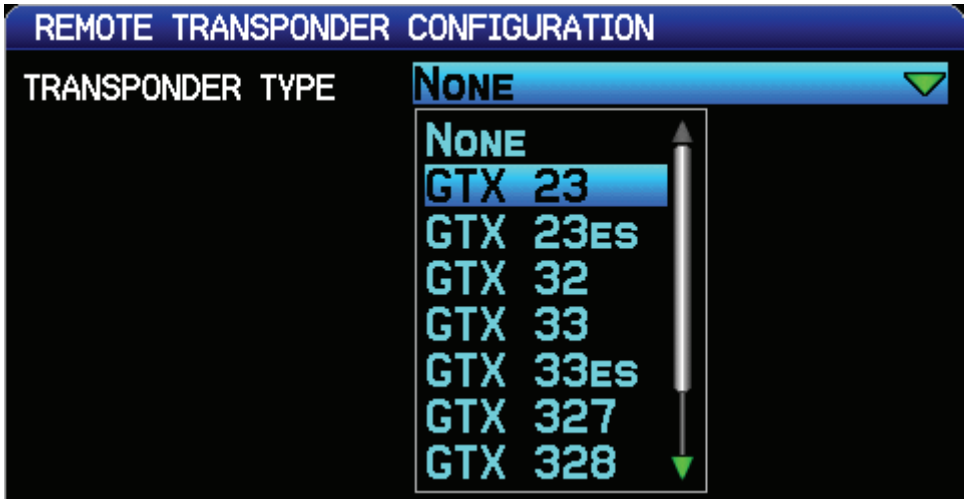
If an external GPS navigator is configured, the GPS config page displays "Select External GPS At Powerup". This setting controls whether the user's choice to use the internal GPS nav source will be retained between power cycles (disabled), or if the system should always return to using the configured external GPS nav source at powerup (enabled).

7.3.10 XPDR Configuration Page

The Transponder Configuration Page allows selection of the installed Garmin Transponder. .

1. In configuration mode, use the FMS Joystick to select the Transponder Page.

2. Use the FMS Joystick to select the applicable Transponder Type, then press the ENT Key.



3. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished

Configurable items are as follows (note that available configurable items differ by model):

Mode S Address: Can be set to US Tail #, Octal, or Hex, as applicable. A valid Mode S Address will be indicated by a green status box, an invalid Mode S address or other invalid Mode S configuration data is indicated by a red X in the status box.

Aircraft Type: Can be set to Unknown, Fixed Wing, or Rotorcraft, as applicable. If Fixed Wing is selected, a field to enter the aircraft's approximate maximum weight is displayed.

Flight ID: Can be set to Set By Pilot or Other, as applicable. If Set By Pilot is selected, the flight ID can be entered in normal mode. Flight ID can also be set to Same As Tail Number if US Tail # was selected as the Modes S Address.

Aircraft Max Speed: Enter aircraft maximum speed.

Aircraft Length: Enter Aircraft Length.

Aircraft Width: Enter Aircraft Width.

TIS Traffic Data: Can be set to Enabled or Disabled, as applicable. Controls only if traffic information will be displayed, it does not affect whether the transponder will output traffic data.

ADS-B Transmit: Sets Automatic Dependent Surveillance-Broadcast (ADS-B) to DISABLE, ENABLE, or PILOT SET. DISABLE is the default. When ADS-B is set to DISABLE the BDS items that are marked "ES Enabled Units Only" are not active (no extended squitter). When ADS-B is set to PILOT SET, ADS-B transmissions are active at power-on.

Enhanced Surveil: Sets Enhanced Surveillance (EHS) to DISABLE or ENABLE. ENABLE is the default. When EHS is set to DISABLE the BDS items that are marked “EHS Only” are not active (no enhanced surveillance).

GPS Integrity: Refers to the integrity level of the separate TSO WAAS GPS input that can be connected to the transponder. Can be set to 1E-3, 1E-5 (recommended for 4XX/5XX W), or 1E-7, as applicable. Refer to the applicable TSO GPS receiver Installation Manual for the recommended GPS Integrity setting

VFR Code: This field is the four-digit code that is selected when the user presses the VFR key. In the United States, 1200 is the VFR code for any altitude. The default is set to 1200.

7.3.11 LOG Configuration Page

The Data Logging Configuration page enables the storage of flight data as .csv files to the "data_log" folder on an SD card. If data logging is enabled, the files are automatically written to the SD card after it is inserted into the card slot. These files can be opened in Excel, or imported into Google Earth for viewing using the Garmin Flight Log Conversion tool. The tool and instructions needed to import the files into Google Earth are available from the G3X Product Page found on the Garmin website www.garmin.com.

Select On or Off for SD Card Data Logging and set the maximum number of log files to be stored.

7.3.12 ENG Configuration Page

The Engine/Airframe Input Configuration section of the Engine Configuration Page allows enabling/disabling and customization of the engine/airframe input options that make up the EIS display and the Engine Page on the MFD. Refer to Section 8 Engine/Airframe Sensor Installation and Configuration, for configuring items listed in the Engine/Airframe Input Configuration section of the Engine Configuration page.

7.3.12.1 Configuration Sync Status

The Configuration Sync Status items appear at the bottom of the Engine Configuration Page. A green checked box indicates a GDU or GSU that is communicating with PFD1, and that "agrees" with PFD1's engine configuration . A red X in the config sync status box indicates a GDU that is connected but has different data from PFD1. After a few seconds it should change back to a green checkmark as the units get back in sync. Units that are not connected are shown in subdued (gray) text.

7.4 Garmin Database Updates

The G3X database updates can be obtained by visiting the 'flyGarmin' website (www.fly.garmin.com). The 'flyGarmin' website requires the unit's System ID to update databases, this allows the databases to be encrypted with the unit's unique System ID when copied to the SD Card. The System ID is displayed on the System Setup Menu in normal mode, or on the Main Page in configuration mode..

NOTE

A single database update purchased from flyGarmin will allow all displays in the G3X system with matching System ID to be updated, therefore a database purchase is not required for each display.

Since all databases are stored internally in each GDU(except the Chartview database which resides on the SD card), each GDU will need to be updated separately. The SD card may be removed from the applicable GDU after installing the database(s). After the databases have been updated, check that the appropriate databases are initialized and displayed on the splash screen during power-up.

7.4.1 Updating Garmin Databases

Equipment required to perform the update is as follows:

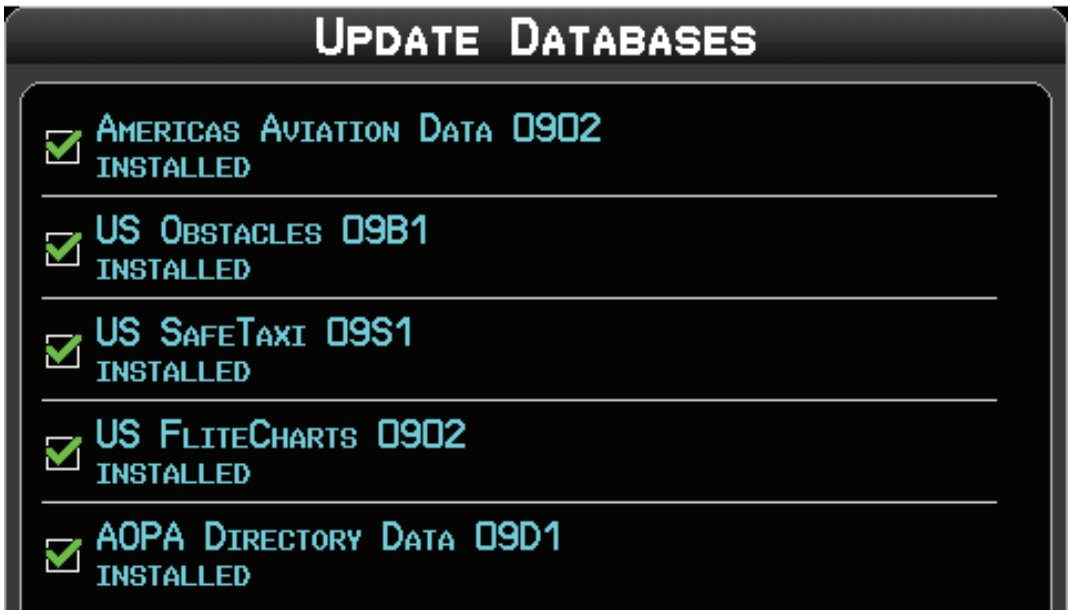
- Windows-compatible PC computer (Windows 2000 or XP recommended)
- Verbatim 96504 SD Card Reader or equivalent card reader
- Updated database obtained from the flyGarmin website
- SD Card, 2 GB recommended (Garmin recommends SanDisk® brand)

After the data has been copied to the SD card, perform the following steps:

1. Insert the SD card in the card slot of the GDU 37X to be updated.
2. Turn on the GDU 37X to be updated (in normal mode).
3. Upon turn-on, a screen appears which lists the databases on the SD card. A green checkbox indicates that the database already installed on the G3X is up to date, an empty checkbox indicates that the database on the SD card is more current and should be installed.

4. The database(s) can be updated by either highlighting UPDATE ALL and pressing the ENT key; or by using the FMS Joystick to highlight a single database and pressing the ENT Key.

5. When the update process is complete, the screen displays the database status.



6. Once the database(s) have been updated, the SD card can be removed from the unit

7. The unit must be restarted by pressing the Restart softkey.
8. Repeat steps 1-7 for each installed GDU 37X.

7.4.2 Available Databases

Jeppesen® Aviation Data (NavData™)
The Jeppesen database contains the general aviation data (NavData) used by pilots (Airports, VORs, NDBs, SUAs, etc.) and is updated on a 28-day cycle.

Jeppesen® Chartview™ Database
ChartView is an optional feature that must be activated by purchasing a ChartView unlock card (010-00769-53). ChartView resembles the paper version of Jeppesen terminal procedures charts. The ChartView database is stored on an SD memory card that remains in the display during normal operation. The ChartView database is updated by removing the database card, updating the database on the card, and reinserting the card. ChartView data is updated by purchasing database subscription updates from Jeppesen Sanderson.

Terrain
The terrain database contains the elevation data which represents the topography of the earth. This database is updated on an "as needed" basis and has no expiration date.

Basemap
The basemap contains data for the topography and land features, such as rivers, lakes, and towns. It is updated only periodically, with no set schedule. There is no expiration date.

Obstacle
The obstacle basemap contains data for obstacles, such as towers, that pose a potential hazard to aircraft. Obstacles 200 feet and higher are included in the obstacle database. It is very important to note that not all obstacles are necessarily charted and therefore may not be contained in the obstacle database. This database is updated on a 56-day cycle.

SafeTaxi
The SafeTaxi database contains detailed airport diagrams for selected airports. These diagrams aid in following ground control instructions by accurately displaying the aircraft position on the map in relation to taxiways, ramps, runways, terminals, and services. This database is updated on a 56-day cycle.

FliteCharts
The FliteCharts database contains terminal procedure charts for the United States only. This database is updated on a 28-day cycle. If not updated within 180 days of the expiration date, FliteCharts will no longer be user-accessible.

AOPA Airport Directory
The AOPA Airport Directory provides data on airports and heliports throughout the U.S. and offers detailed information for over 5,300 U. S. airports, along with the names and phone numbers of thousands of FBOs. Used to look up taxi services, plan an overnight, and choose fuel stops; plus find ground transportation, lodging, restaurants, local attractions, etc. This database is updated every 56 days.

7.5 XM Activation Instructions (GDU 375 only)

Follow the below instructions to activate the XM receiver in the GDU 375.

Before XM Satellite Weather can be used, the service must be activated by calling XM at 1.800.985.9200. Service is activated by providing XM Satellite Radio with a Radio ID. XM Satellite Radio uses the Radio ID to send an activation signal that allows the G3X MFD to display weather data and/or entertainment programming. XM service should activate in 45 to 60 minutes.

1. The Radio ID can be displayed by accessing the XM Audio Page, and then pressing the INFO Softkey. Record the Radio ID for reference during XM Activation.
2. Make sure that the aircraft's XM antenna has an unobstructed view of the southern sky. It is highly recommended that the aircraft be outside of and at least 25 feet away from the hangar.
3. Hook up the aircraft to external power if available. The complete activation process may take 45-60 minutes or more, depending on the demand on the XM activation system.
4. Power on the avionics and allow the G3X to power up. Do not power cycle the units during the activation process.
5. Go to the XM Info Page. During the activation process the unit may display several different activation levels, this is normal and should be ignored. When the service class (Aviator Lite, Aviator, or Aviator Pro) and all of the weather products for the class that you subscribed to are displayed, the activation is complete. Wait 30 seconds to allow the GDU 375 to store the activation before removing power.

NOTE

During the activation process do not change channels or pages.

If the XM receiver will not receive, an Activation Refresh may resolve the issue. An Activation Refresh may be performed by visiting the link http://www.xmradio.com/refresh/rapidrefresh.xmc and following the instructions listed there.

7.6 GDU Splash Screen

Users can create a custom splash screen (screen displayed during power up) by storing a bitmap file on the root directory of the SD card which is inserted into the SD card slot. This function is not available on a single display system. File details are as follows:

- File must be named logo.bmp
- Must be uncompressed Windows bitmap, 8bpp or 24bpp with no alpha mask
- Max size 480x480 pixels
- Store file on root directory of an SD card, inserted in the MFD before power on

7.7 Checklist Editor

The Aviation Checklist Editor (ACE) is available for free download from the Garmin website www.garmin.com. Click on the Software link on the G3X product page and follow the on-screen instructions to download the checklist editor software.

NOTE

The checklist file should be named with a '.ace' file extension, and placed in the root directory of the SD card. Only one checklist file should be placed on the SD card

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8 Engine/Airframe Sensor Installation and Configuration

8.1 Engine/Airframe Sensor Options

Table 8-1 lists the types of engine/airframe sensors that may be used for the various engine/airframe inputs. Many of these sensors are included in the Garmin G3X Sensor Kits (Section 8.2). Each of the sensors must be correctly installed (Section 8.3) and configured (Section 8.4) prior to use.

Table 8-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*
Cylinder Head Temperature (CHT)	Alcor 86253 Type K thermocouple	494-70000-00
	Rotax 965531	N/A
	Type J thermocouple	N/A
Exhaust Gas Temperature (EGT)	Alcor 86255 Type K	494-70001-00
Oil Temperature	UMA 1B3-2.5R RTD*** (Resistive Temperature Detector)	494-70004-00
	Rotax 965531	N/A
	Jabiru	N/A
Oil Pressure	Kavlico P4055-150G-E4A, 0-150 psiG pressure transducer	494-30004-00
	UMA N1EU150G-CS, 0-150 psiG pressure transducer	N/A
	Rotax 956413	N/A
	Rotax 956415	N/A
	Jabiru	N/A
Manifold Pressure	Kavlico P4055-30A-E4A, 0-30 psiA pressure transducer	494-30004-01
	UMA N1EU70A-CS, 0-70 psiA pressure transducer	N/A
Fuel Pressure (Injected)	Kavlico P4055-50G-E4A, 0-50 psiG pressure transducer	494-30004-02
	UMA N1EU70G-CS, 0-70 psiG pressure transducer	N/A
Fuel Pressure (Carbureted)	Kavlico P4055-15G-E4A, 0-15 psiG pressure transducer	494-30004-03
	UMA N1EU35G-CS, 0-35 psiG pressure transducer	N/A

Table 8-1 Compatible Engine/Airframe Input Sensors (continued)

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*
RPM	UMA 1A3C-2	N/A
	UMA T1A9-1 (Slick Mag)	494-50005-00
	UMA T1A9-2 (Bendix Mag)	494-50005-01
	4 Cylinder Electronic Ignition (2 pulses/rev)	N/A
	6 CylinderElectronic Ignition (3 pulses/rev)	N/A
	Rotax Trigger Coil	N/A
	Jabiru Alternator Output (Single Phase, 6 pulses/rev)	N/A
Fuel Quantity	Resistive	N/A
	Capacitive (requires conversion to a voltage signal or pulsed output), refer to Appdx G	N/A
Turbine Inlet Temperature (TIT)	Type K thermocouple	494-70002-00
Coolant Pressure	Kavlico P4055-50G-E4A, 0-50 psiG pressure transducer	494-30004-02
Bus Voltage	10-29Vdc input	N/A
Bus Current	Shunt Type – UMA 1C4 +/-50 Amp, 100 Amp	909-D0000-00
	Hall Effect Type - Amploc KEY100* +/-100 Amp	N/A
Fuel Flow	EI FT-60**	494-10001-00
	Floscan Series 200**	N/A
Discrete Inputs	Active High or Low: Canopy Warning, Gear Down Reminder, etc.	N/A
Carburetor Temperature	UMA 1B10R***	494-70005-00
	Rotax 965531	N/A
Position Sensor	Integrated trim servo with position sensor or standalone slide potentiometer (0-5 KΩ variable resistor)	N/A

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 8.2), and are available individually from Garmin Dealers

**Two sensors required for differential fuel flow

***UMA temperature sensors without the "R" designation are not compatible with the G3X system

The Engine inputs being monitored are displayed as gauges on the EIS display (Figure 8-1) and also on the MFD's Engine Page.

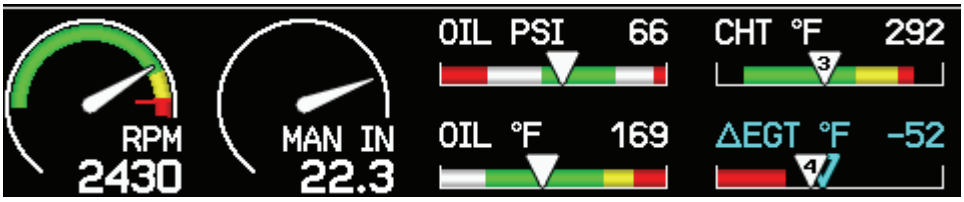

Figure 8-1 EIS Display (Engine Bar)

The following list of gauges, (if configured) are specifically required by FAR 91.205 and will always be displayed on the EIS display (engine bar). Other gauges will be displayed as space permits based upon hierarchy and user selections.

RPM	Manifold Pressure	Oil Temperature
Oil Pressure	Coolant Temperature	Fuel Quantity

8.2 Garmin G3X Sensor Kits

Tables 8-2, 8-3, and 8-4 list Garmin sensor kits available for G3X installations. Refer to Sensor Interface drawing Figure H-1.1 when installing Sensor Kits K00-00512-00 and K00-00513-00. Refer to Sensor Interface drawing Figure I-1.1 when installing Sensor Kit K00-00514-00.

Table 8-2 Contents of G3X Sensor Kit, 4 Cylinder Lycoming/Continental (K00-00512-00)

Item	Garmin P/N	Quantity
Fuel Flow Transducer, EI FT-60	494-10001-00	1
Oil Pressure Transducer, Powered, 150 psi, Gage, w/ connector, Kavlico P4055-150G-E4A	494-30004-00	1
Manifold Pressure Transducer, Powered, 30 psi, Absolute, w/ connector, Kavlico P4055-30A-E4A	494-30004-01	1
Type K Thermocouple, Bayonet, CHT, Alcor 86253	494-70000-00	4
Type K Thermocouple, 3/8-24 Bayonet, EGT, Alcor 86255	494-70001-00	4
RTD, Oil Temperature, UMA 1B3-2.5R	494-70004-00	1
Shunt, Ammeter, +/-50mV, 100 amps, UMA 1C4	909-D0000-00	1

Table 8-3 Contents of G3X Sensor Kit, 6 Cylinder Lycoming/Continental (K00-00513-00)

Item	Garmin P/N	Quantity
Fuel Flow Transducer, EI FT-60	494-10001-00	1
Oil Pressure Transducer, Powered, 150 psi, Gage, w/ connector, Kavlico P4055-150G-E4A	494-30004-00	1
Manifold Pressure Transducer, Powered, 30 psi, Absolute, w/ connector, Kavlico P4055-30A-E4A	494-30004-01	1
Type K Thermocouple, Bayonet, CHT, Alcor 86253	494-70000-00	6
Type K Thermocouple, 3/8-24 Bayonet, EGT, Alcor 86255	494-70001-00	6
RTD, Oil Temperature, UMA 1B3-2.5R	494-70004-00	1
Shunt, Ammeter, +/-50mV, 100 amps, UMA 1C4	909-D0000-00	1

Table 8-4 Contents of G3X Sensor Kit, Rotax 912 (K00-00514-00)

Item	Garmin P/N	Quantity
Manifold Pressure Transducer, Powered, 30 psi, Absolute, w/ connector, Kavlico P4055-30A-E4A	494-30004-01	1
Fuel Pressure Transducer, Powered, 15 psi, Gage, w/ connector, Kavlico P4055-15G-E4A	494-30004-03	1
Type K Thermocouple, 3/8-24 Bayonet, EGT, Alcor 86255	494-70001-00	2
Shunt, Ammeter, +/-50mV, 100 amps, UMA 1C4	909-D0000-00	1

8.3 Engine Sensor Installation

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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 kit-plane manufacturer. Additionally, all installation practices should be done in accordance with AC 43.13-1B.

Appendices G, H, I, and J contain interface drawings for sensor installations using the Garmin sensor kits, and for other sensor installations.

8.3.1 CHT (Cylinder Head Temperature)

Type J grounded thermocouple - This type of sensor is typically used on Jabiru engines. See Jabiru Guidance for thermocouple installation.

Type K grounded thermocouple. This type of sensor is applicable to the Lycoming and Continental engines and is installed in CHT well..

NOTE

If ungrounded thermocouples are used, the low side must be connected to a GSU 73 ground pin.

Rotax 965531 CHT Sensor - See Rotax Guidance for CHT Sensor installation.

8.3.1.1 Lycoming and Continental Engine Installation

General Installation Guidance – To maintain measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs of the GSU 73. If the supplied sensor wires are not long enough to connect directly to the GSU 73, 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 is TT-K-22S Type K thermocouple wire from Omega Engineering.

When using Alcor Type K probes, refer to Alcor CHT Installation Instructions (P/N 59167) for complete installation details. 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.

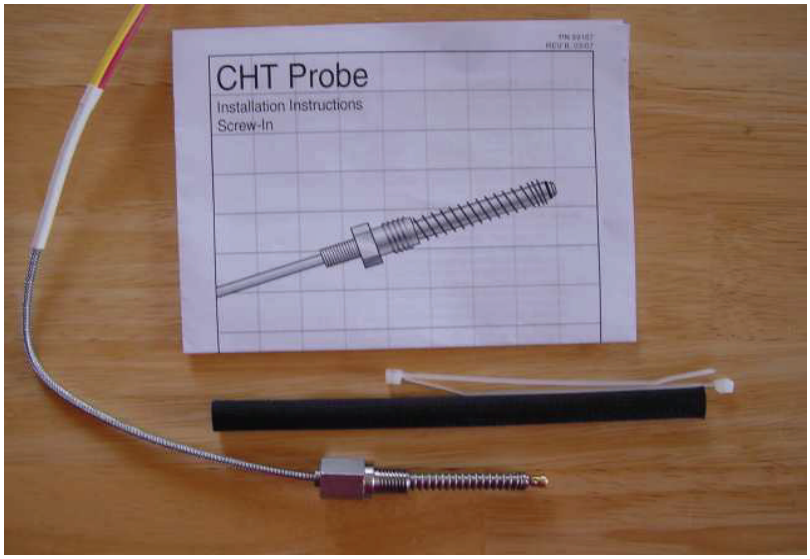


Figure 8-2 CHT Probe Package

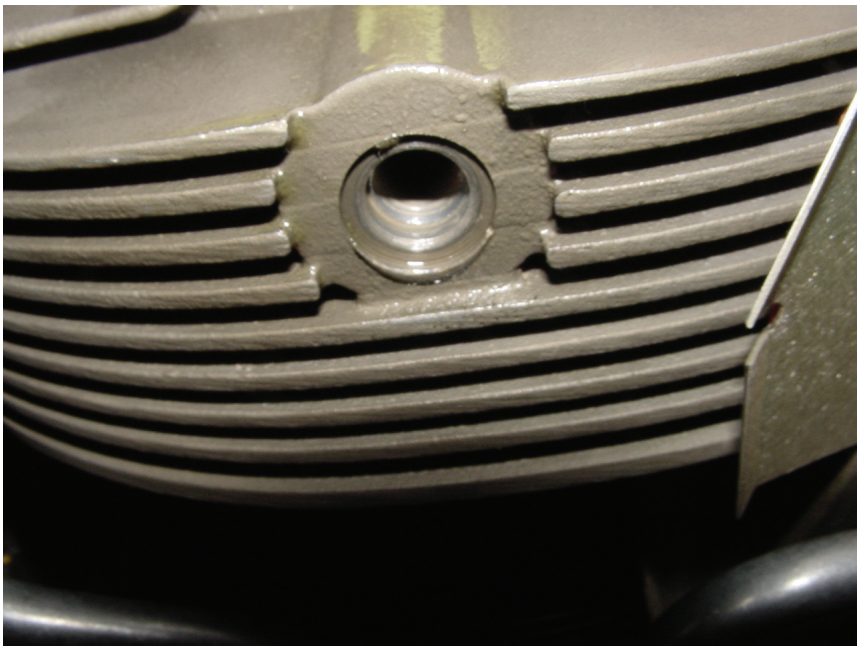


Figure 8-3 CHT Probe Well

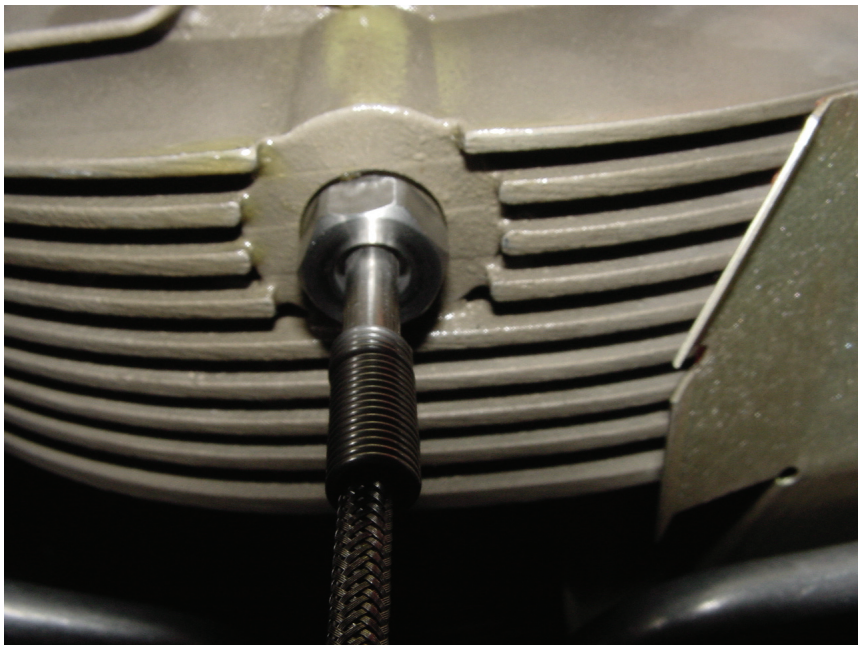


Figure 8-4 One Piece CHT Probe Installed

8.3.2 EGT (Exhaust Gas Temperature)

Sensor Description – Type K grounded thermocouple probe with integrated clamp for mounting in an exhaust pipe. .

NOTE

If ungrounded thermocouples are used, the low side must be taken to a GSU 73 ground pin.

8.3.2.1 Lycoming, Continental, Jabiru, and Rotax Engine Installation

General Installation Guidance – To maintain G3X Engine Indicating System (EIS) measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs of the GSU 73. If the supplied sensor wires are not long enough to connect directly to the GSU 73, 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.

When using Alcor Type K probes, refer to Alcor EGT Installation Instructions (P/N 59180) for complete installation details. Engine manufacturer's guidance should be consulted and followed for proper location of EGT probes.

Perform the following steps and refer to Figures 8-5, 8-6, and 8-7 to install an EGT sensor.

1. EGT probes (Figure 8-5) 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 8-6). It may be desirable to angle the probes towards the rear of the engine to allow efficient wire routing back to the cockpit. If angling the probes towards the rear of the engine, take care to ensure that sufficient clearance is provided to service the spark plugs.
3. Carefully insert probe into the exhaust pipe and tighten the clamp snugly with screwdriver (35 in-lbs torque max.).
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 8-7 for an example of an installed EGT probe.

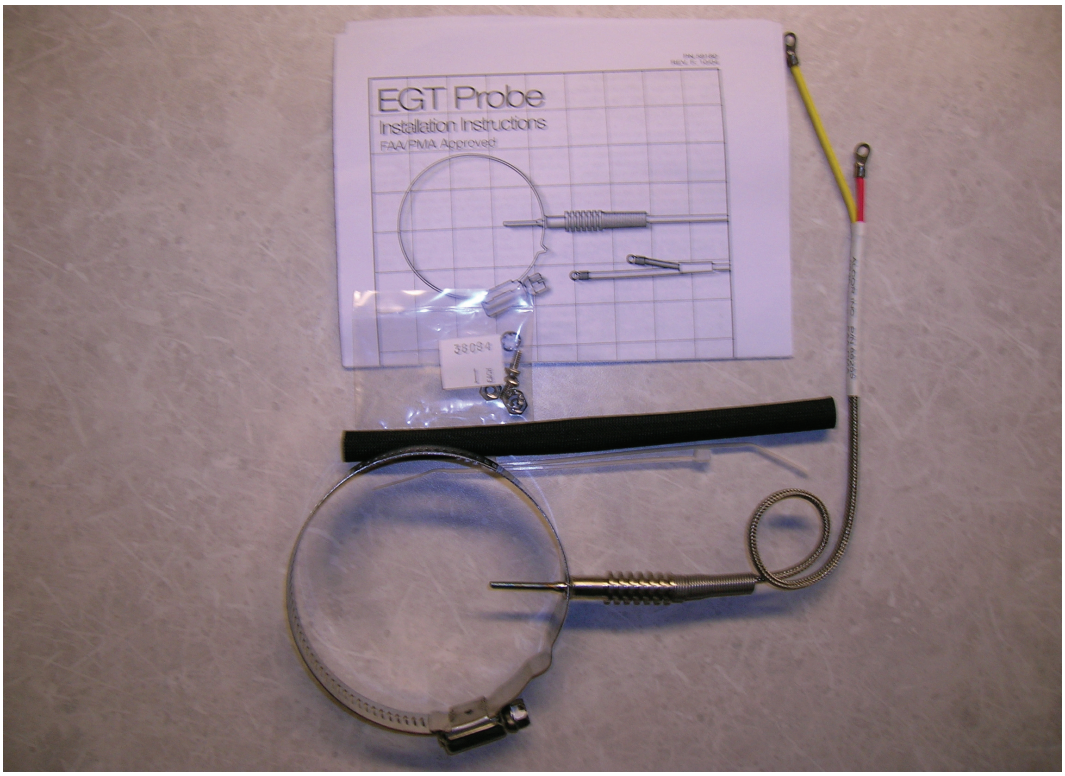


Figure 8-5 EGT Package

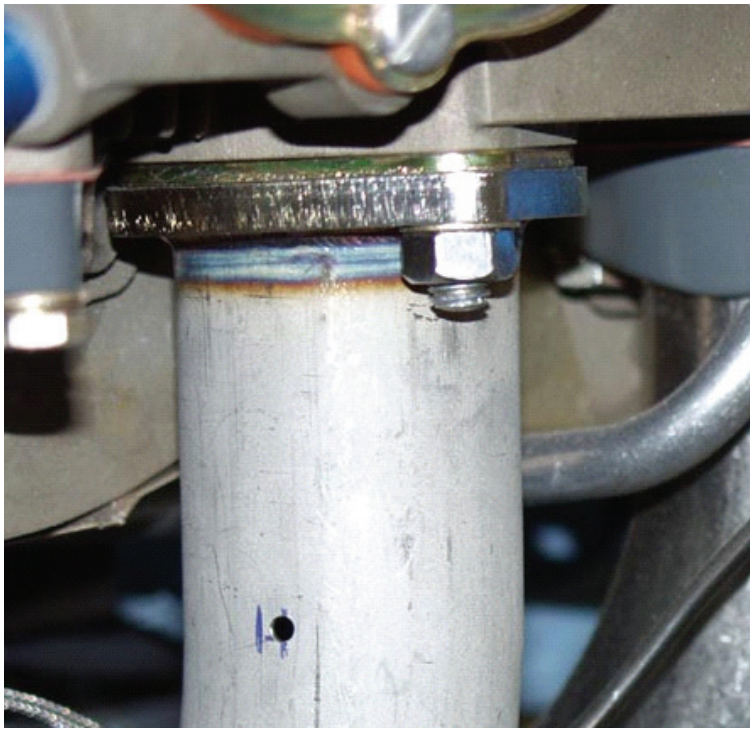


Figure 8-6 Exhaust Pipe Drilled

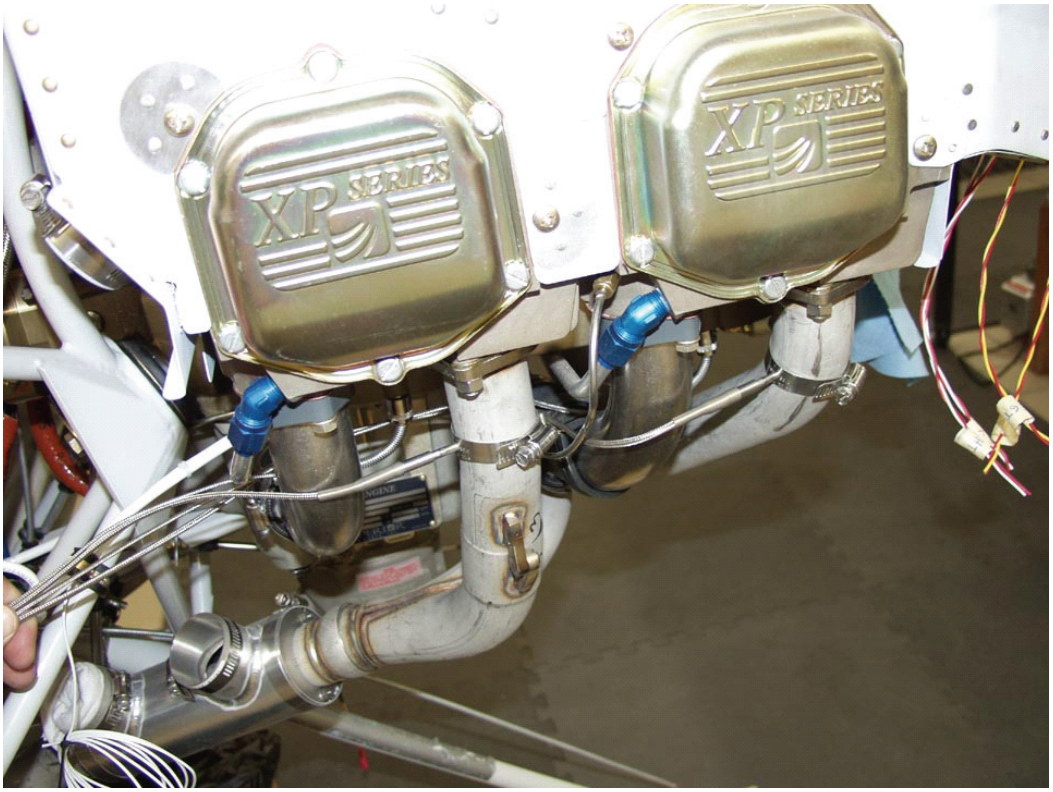


Figure 8-7 Installed EGT Probe Orientation

8.3.3 Oil Temperature

Threaded 5/8-18 Platinum Resistance Temperature Detector (RTD) probe - This sensor is applicable to the Lycoming and Continental engines.

Rotax 965531 Oil Temperature Sensor - See Rotax guidance for 965531 sensor installation.

Jabiru Oil Temperature Sensor - See Jabiru guidance for sensor installation.

8.3.3.1 Lycoming and Continental Engine Installation

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 8-8), 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 GSU 73 as referenced in the G3X interconnects in Appendix H. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

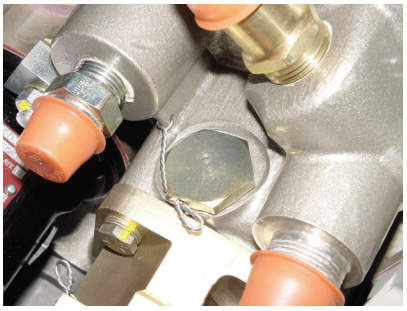


Figure 8-8 Vent Plug

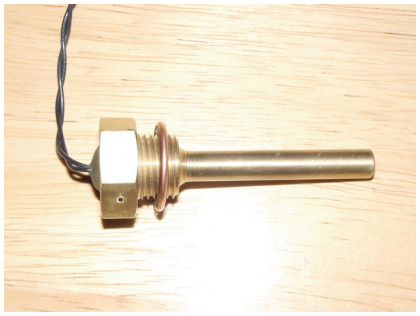


Figure 8-9 Oil Temperature Probe

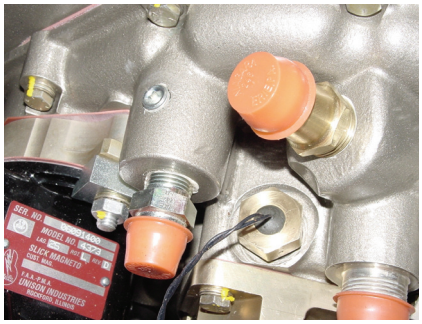


Figure 8-10 Oil Temperature Probe Installed (Crush Gasket Not Shown)

8.3.4 Pressure (Fuel, Manifold, Oil, and Coolant)

General Installation Guidance – The specified pressure transducers provide for two different mounting options:

Figure 8-11 Vent Plug

Figure 8-12 Oil Temperature Probe

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. UMA sensor mounting may require the use of a stainless steel AN911 fitting (union).

NOTE

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, coolant).

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 male threads on Kavlico sensors are designed to mate with a 1/8” NPT female thread. The female threads on UMA sensors are designed to mate with 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 of the GSU 73 as referenced in the Sensor Interface Drawings in Appendices H, I, and J. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

8.3.4.1 Fuel Pressure Sensor

Kavlico P4055-15G-E4A - 0 – 15 psiG pressure transducer for all carbureted engines.

Kavlico P4055-50G-E4A - 0 – 50 psiG pressure transducer for all fuel injected engines.

UMA N1EU35G-CS - 0 – 35 psiG pressure transducer for carbureted engines.

UMA N1EU70G-CS - 0 – 70 psiG pressure transducer for fuel injected engines.

NOTE

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 typically set to correspond with the pressure at the inlet to the fuel injector. Continental EIS display ranges are typically set to correspond to unmetered fuel pressure values.

8.3.4.2 Manifold Pressure Sensor

Kavlico P4055-30A-E4A - 0 – 30 psiA pressure transducer. This pressure sensor is applicable to Continental, Jabiru, Lycoming and Rotax, engines.

UMA N1EU70A-CS - 0 – 70 psiA pressure transducer. This pressure sensor is applicable to Continental, Jabiru, Lycoming and Rotax, engines.

8.3.4.3 Oil Pressure Sensor

Kavlico P4055-150G-E4A - 0 – 150 psiG pressure transducer. This pressure sensor is applicable to Lycoming and Continental engines.

Rotax P/N 956413 or 956415 pressure transducer - These pressure sensors are applicable to Rotax engines.

Jabiru Oil Temperature Sensor - See Jabiru guidance for sensor installation.

UMA N1EU150G-CS - 0 – 150 psiG pressure transducer. This pressure sensor is applicable to Continental, Jabiru, Lycoming and Rotax, engines.

8.3.4.4 Coolant Pressure Sensor

Kavlico P4055-50GE4A - 0 – 50 psiA pressure transducer. This type of sensor is applicable to all liquid-cooled engines.

8.3.5 RPM (Revolutions Per Minute)

UMA 1A3C-2 - Standard mechanical tach drive sensor (0 – 5 volt square wave, 2 pulses per crankshaft rev)

UMA N/T1A9-X - Magnetic pickup tach sensor (installed on mag bleed port)

Electronic Ignition - Tach signal output at 2 pulses/rev (4 cylinder engines) or 3 pulses/rev (6 cylinder engines)

Jabiru Alternator - Direct connection to alternator output

Rotax Trigger Coil RPM Sensor - This pressure sensor is applicable to Rotax engines. Refer to Rotax Installation Instructions for complete installation details.

8.3.5.1 Lycoming and Continental Engine Installation

General Installation Guidance

Electronic Ignition - Refer to vendor documentation for proper installation.

UMA 1A3C-2

1. Remove the cap from the tachometer drive output (Figure 8-13) 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 8-14).
4. Connect the supplied connector to the appropriate inputs on the GSU 73 as referenced in the G3X interconnects in Appendix H. 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).

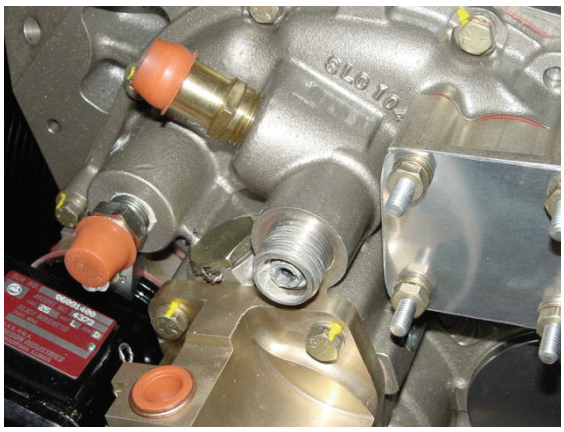


Figure 8-13 Tachometer Drive Output

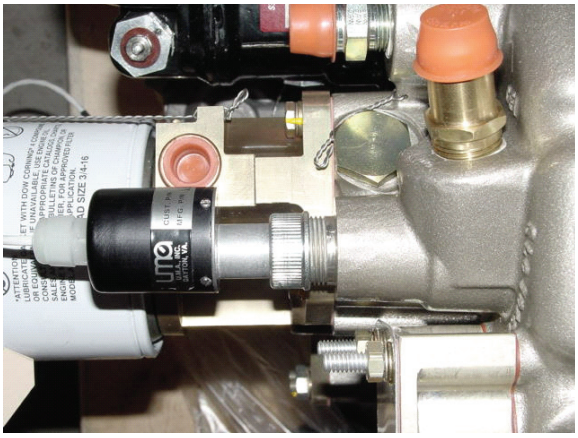


Figure 8-14 Installed Tachometer Sensor

UMA N/T1A9-X

The magnetic pickup tach sensor 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 sensors 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 sensor part number is appropriate for the magneto type.

1. Remove the existing vent plug from the magneto bleed port (Figure 8-15).
2. Lightly apply thread sealer such as Loctite 242 (or equivalent) to the threads of the sensor. 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 8-16). The sensor should be installed finger tight plus 1/6 turn. Do not over-tighten.
4. Connect the supplied connector to the appropriate inputs on the GSU 73 as referenced in the G3X interconnects in Appendix H. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

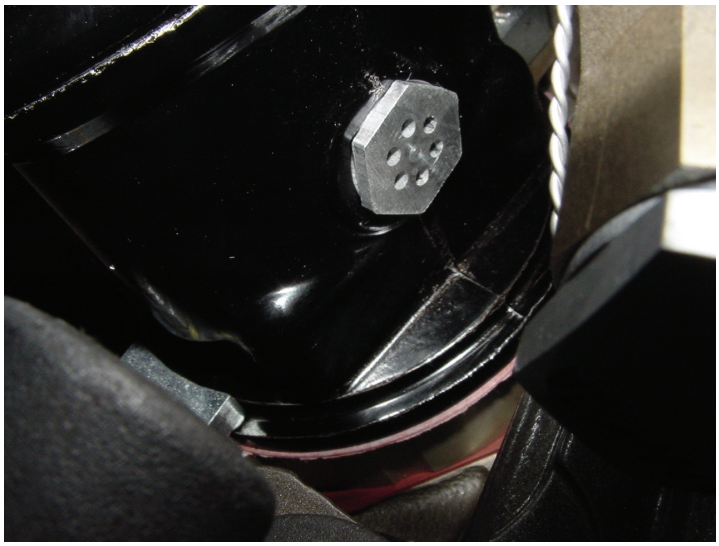


Figure 8-15 Magneto Bleed Port

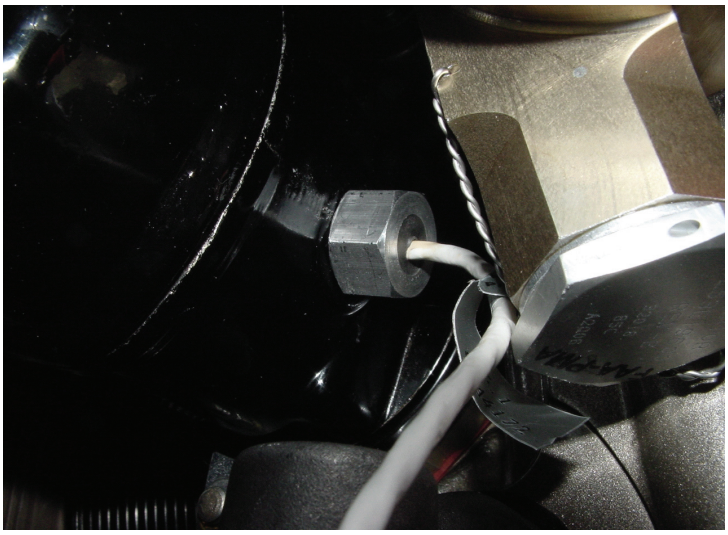


Figure 8-16 Magneto Tach Sensor Installed

8.3.6 Fuel Quantity

8.3.6.1 Resistive Type Fuel Quantity Sensors

Resistive type fuel quantity sensors with a 0–500 Ω range are currently supported. Wiring methods vary based on the GSU 73 channel being used. Please see the interconnect documentation for proper wiring considerations.

8.3.6.2 Capacitive Type Fuel Quantity Sensors

The P-300C receives a +5V excitation input from the GSU 73 and outputs ±5V square wave from 600 Hz to 3.8 KHz. See Appendix G for proper wiring considerations.

8.3.7 TIT (Turbine Inlet Temperature) Sensor

Sensor Description – Type K grounded thermocouple probe with screw-in type adapter. This type of sensor is applicable to all turbocharged engines.

General Installation Guidance – To maintain G3X Engine Indicating System (EIS) measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs of the GSU 73. If the supplied sensor wires are not long enough to connect directly to the GSU 73, 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 is TT-K-22S Type K thermocouple wire from Omega Engineering.

8.3.8 Bus Voltage Monitor

Refer to Appendix G for interface drawings.

8.3.9 Bus Current

8.3.9.1 Hall Effect Ammeter Sensor

Sensor Description – Hall Effect: Amploc KEY100, +/- 100 Amp or equivalent. Sensor output is 15.9 mV/Amp. This type of sensor is applicable to all engines.

8.3.9.2 Ammeter Shunt

Sensor Description – 1C4: 100 Amp / 50 mv shunt. This type of sensor is applicable to all engines.

General Installation Guidance – Current sensing on the G3X can be done via the use of a traditional ammeter shunt (Figure 8-17). 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.

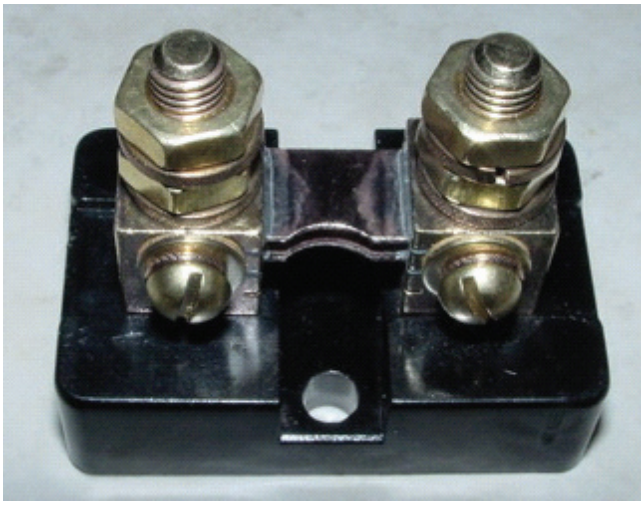


Figure 8-17 Ammeter Shunt

NOTE

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 GSU 73 inputs to prevent inadvertent damage to the GSU 73. Connect the two sense wires (attached to the #8 terminals) to the appropriate inputs on the GSU 73 as referenced in the G3X interconnects in Appendices G, H, and I . If the ammeter readings are shown with the opposite polarity, check to see if the sense wire connections are reversed.

An alternator ammeter shunt should be installed inline in the alternator output ("B" terminal). A battery ammeter shunt should be installed between the battery positive terminal and the battery contactor. Depending on the location of the alternator or battery relative to its supported electrical bus, it is typically desirable to install the shunt on the firewall near where the alternator or battery output would normally penetrate the firewall.

8.3.10 Fuel Flow

Electronics International FT-60 (Red Cube) - This sensor is applicable to all engines. Refer to the Electronics International FT-60 Flow Transducer (Red Cube) document # 1030032 for installation guidance.

General Installation Guidance (Floscan Series 200) – This sensor is applicable to all engines. 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 sensor should be mounted with approximately 5-6" of straight tubing before and after the sensor. If special circumstances exist that prevent an extended length of straight tubing before and after the sensor, 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 sensor mounting location is left to the builder. Ideally, the sensor should be placed prior to the fuel distribution device (carburetor or fuel injection distribution device). O
4. n a Continental fuel injected engine, the transducer must be located between the metering unit and the flow divider valve.
5. Sensor wires should be connected to the appropriate inputs on the GSU 73 as referenced in the G3X interconnects in Appendices G and H.

8.3.10.1 K-Factor for Floscan 201B-6

The Floscan 201B-6 (201-030-000) fuel flow sensor ranges from 28,000 to 31,000 pulses/gallon.

The G3X default K factor for the 201B-6 is set to 29,500 pulses/gallon. Some Floscan fuel flow sensors come with a tag that lists the K factor number measured during unit calibration (see Figure 8-16).

NOTE

If the Floscan tag shown in Figure 8-18 is lost, the serial number of the Floscan sensor can be supplied to Floscan to obtain the calibrated K factor value.

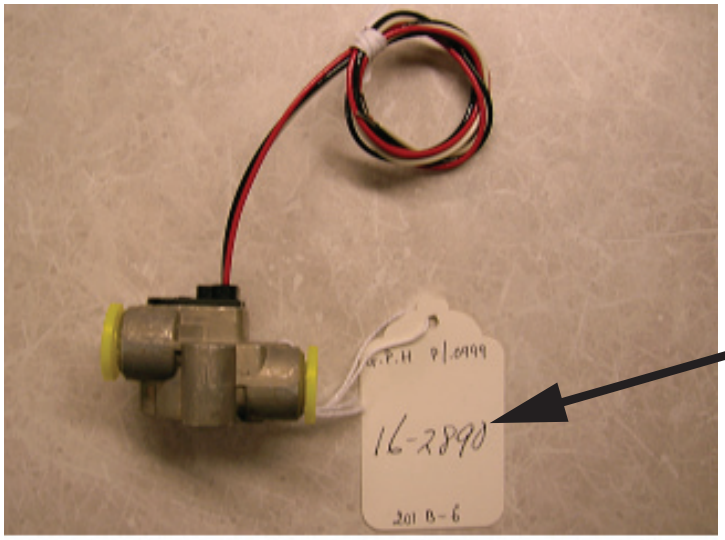


Figure 8-18 Example Floscan Fuel Flow Sensor

The tag shown in Figure 8-18 lists a K Factor of 16-2890. The first two digits (16) represent Gallons Per Hour, while the last four digits (2890) represent the number of electrical pulses (divided by 10) output by the sensor per gallon of fuel flow. The numbers on the tag are used in determining the K-Factor to be entered as part of the Fuel Flow Calibration described in Section 8.3.3. To determine this number, a zero should be added to the four digit number on the tag. In the example above after adding the zero to 2890, the resulting K-Factor to be entered on the Fuel Flow Calibration page would be 28900.

8.3.10.2 K-Factor for Electronics International FT-60 (Red Cube)

The G3X default K factor for the FT-60 is set to 68,000 pulses/gallon. No sensor specific calibration is required for the FT-60 but variations in the installation can affect the K factor. Reference Electronics International document #1030033 and Section 8.3.3 for additional information.

8.3.11 Carburetor Temperature Sensor

UMA 1B10R - Threaded ¼-28 Platinum Resistance Temperature Detector (RTD) probe. This sensor is applicable to all carbureted Lycoming and Continental engines.

Rotax 965531 - This sensor is applicable to all carbureted Rotax engines. Refer to Rotax Installation Instructions for complete installation details.

8.3.11.1 Lycoming and Continental Engine Installation

General Installation Guidance:

1. Locate and remove the threaded ¼-28 brass plug (Figure 8-19 and Figure 8-20) on the side of the carburetor as shown in Figure 8-19. If a threaded plug is not present (as is the case with many older 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 8-21).
3. Connect the supplied connector to the appropriate inputs of the GSU 73 as referenced in the G3X interconnects in Appendices H and I. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

Figure 8-19 Carb Temp Sensor Mounting Location

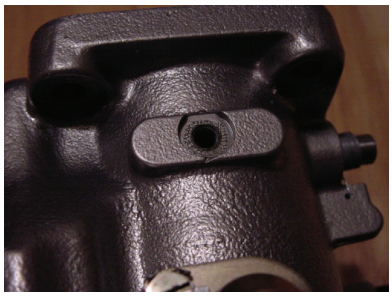


Figure 8-20 Carb Temp Sensor Mounting Location w/Screw Removed

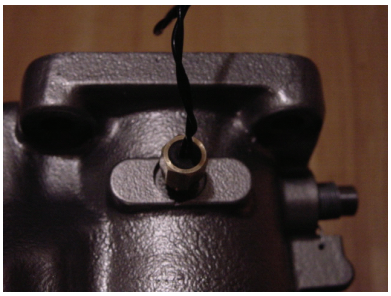


Figure 8-21 Carb Temp Sensor Installed

8.3.12 Position Sensor

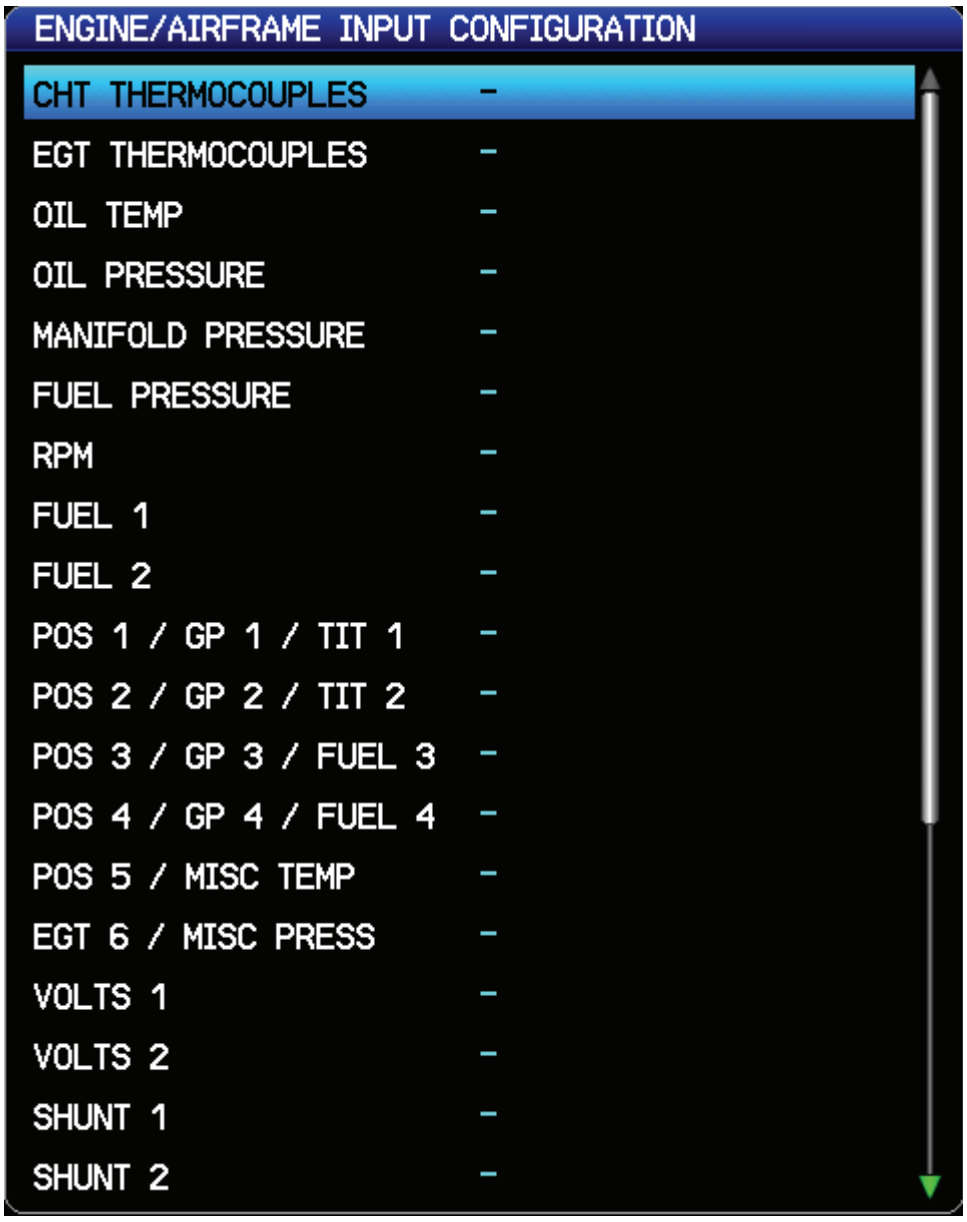
Sensor Description – Integrated trim servo with position sensor or standalone slide potentiometer (0 – 5 KOhm variable resistor)

General Installation Guidance – 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.

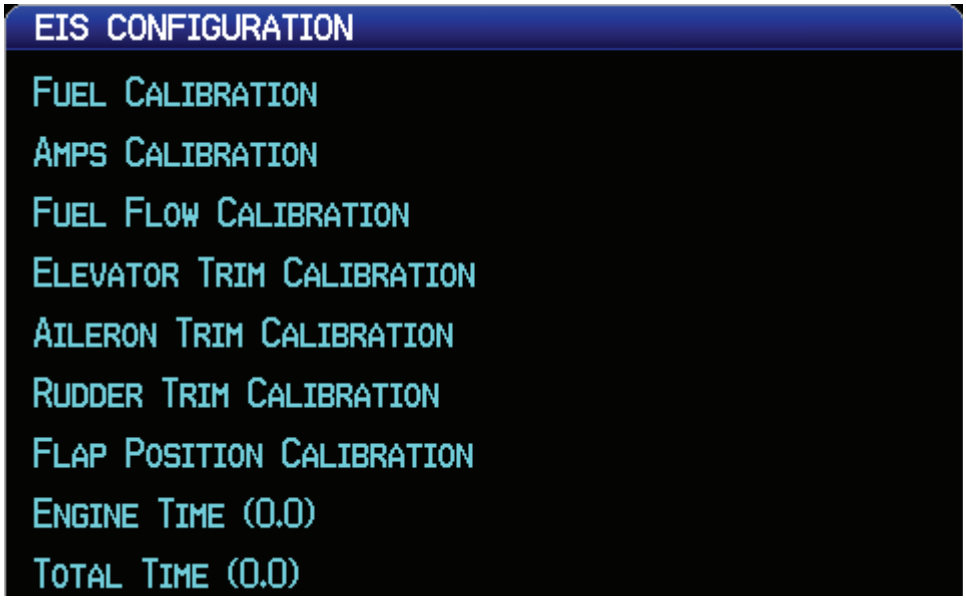
Refer to the supplied servo or sensor installation manual and G3X interconnects in Appendix G for proper wiring connections. Section 8.3.3 provides calibration instructions.

8.4 Engine/Airframe Input Configuration

The Engine/Airframe Input Configuration section of the Engine Configuration Page allows enabling/disabling and customization of the engine/airframe input options that are shown on the EIS display and the Engine Page on the MFD.



For factory-installed systems, the Engine/Airframe Input Configuration section is replaced with an EIS Configuration page that allows access to calibration functions and time adjustments, but does not allow changing EIS configuration values. See Section 8.3.3 for calibration information, and Section 8.3.2 for Engine Time and Total Time information.



Refer to Sections 7.3 for configuration mode instructions, then follow the below steps to make changes to the Engine/Airframe Input Configuration.

1. In configuration mode, use the FMS Joystick to select the Engine/Airframe Input Configuration Page.

2. Use the FMS Joystick to select the desired configurable item and make the desired change(s) (Sections 8.3.1 – 8.3.3).
3. Press the Save softkey to store settings or press the Cancel softkey to cancel changes and return to the Engine Configuration Page.

4. Press the FMS Joystick to move the cursor to the page selection menu when finished.

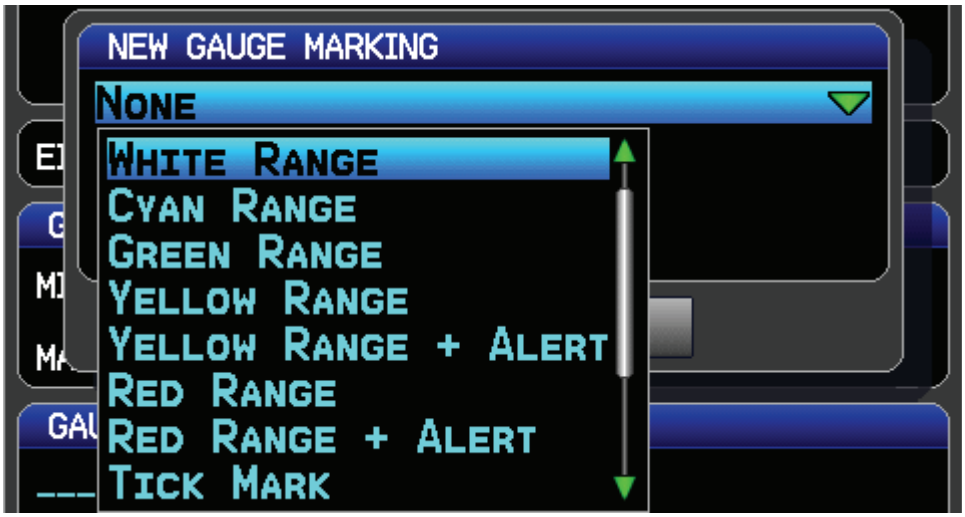
8.4.1 Common Configuration Options

Many of the items listed in the Engine/Airframe Input Configuration section of the Engine Configuration Page have the same (or similar) configuration options, this section describes those similar configuration options.

Gauge Configuration – Nearly all of the configuration options (except Discrete 1– 4, Engine Time, & Total Time) have a Gauge Marking and a Gauge Display Range section. These gauge options are uniform for all applicable items and are described below.

Gauge Markings – Used to select the desired color displayed on the applicable gauge. The Yellow Range + Alert and Red Range + Alert settings will issue a CAS (Crew Alerting System) on-screen alert anytime the value is within that range. The Red Range + Alert settings will issue a CAS audible and on-screen alert anytime the value is within that range The following are the available gauge marking options:

White Range	Cyan Range	Green Range
Yellow Range	Yellow Range +Alert	Red Range
Red Range + Alert	Tick Mark	Cyan Line
Green Line	Yellow Line	Red Line

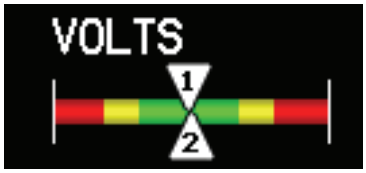


Gauge Display Range – The Gauge Display Range allows for setting the minimum and maximum values of each gauge.

The below screenshot of the CHT Input Configuration page shows an example of the Gauge Display Range and Gauge Markings settings and the resultant CHT gauge.

Dual Gauge

The EIS display will show a "dual gauge" (two pointers on the same scale, no number) for related quantities, whenever possible for fuel quantity, volts, amps, TIT, and for CHT and EGT (if set for two cylinders). To be displayed, the two sides must have the same values for min and max. If the software can't pair up two related gauges, it will display them as separate gauges with unique names (chosen by the software), such as "VOLTS 1" and "VOLTS 2". If there is not enough room to display both related gauges then neither gauge will be displayed in the EIS display (but will be displayed on the MFD's Engine Page).



EIS Display – The Hide setting removes the item from the EIS display, although the item will be displayed on the MFD ENG page. The Auto setting displays items based upon hierarchy and the availability of EIS display space.

The following list of gauges, (if configured) are specifically required by FAR 91.205 and will always be displayed on the EIS display. These required gauges do not have an EIS Display setting. Other gauges will be displayed as space permits based upon hierarchy.

RPM	Manifold Pressure	Oil Temperature
Oil Pressure	Coolant Temperature	Fuel Quantity

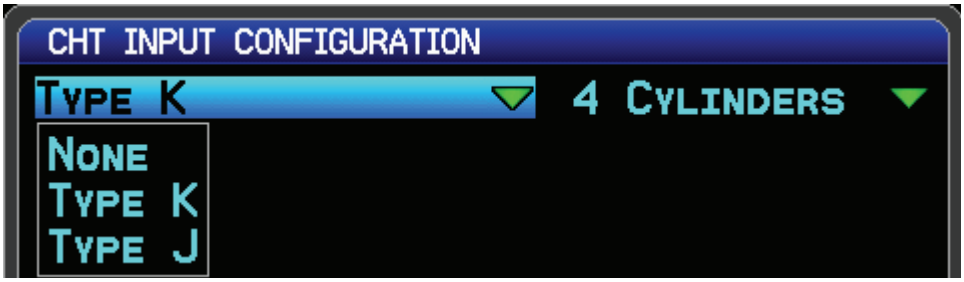
8.4.2 Engine/Airframe Input Configuration Items

This section briefly describes each of the items listed in the Engine/Airframe Input Configuration section of the Engine Configuration Page. Settings previously described in Section 8.3.1 are not listed here.

CHT (Cylinder Head Temperature) and EGT (Exhaust Gas Temperature) Thermocouples Input Configuration – CHT T inputs can be configured as Type J or K inputs and EGT inputs are configured as Type K inputs. This page allows the user to select the number of cylinders in the aircraft's engine. If the 6 Cylinders option is selected for EGT THERMOCOUPLES, the EGT 6/MISC PRESS input is used and therefore is not selectable from the list of configurable items.

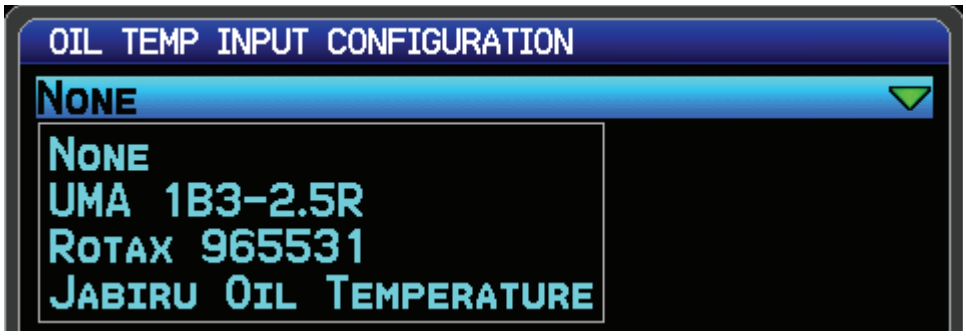
NOTE

Rotax engines must use the General Purpose inputs for CHT sensor configuration.



Lean Assist – A Lean Assist enable/disable field appears when editing an EGT or TIT input. Selecting Disable prevents the LEAN softkey from appearing on the ENG page. Lean Assist should be disabled for engines that do not have a pilot-controllable fuel/air mixture.

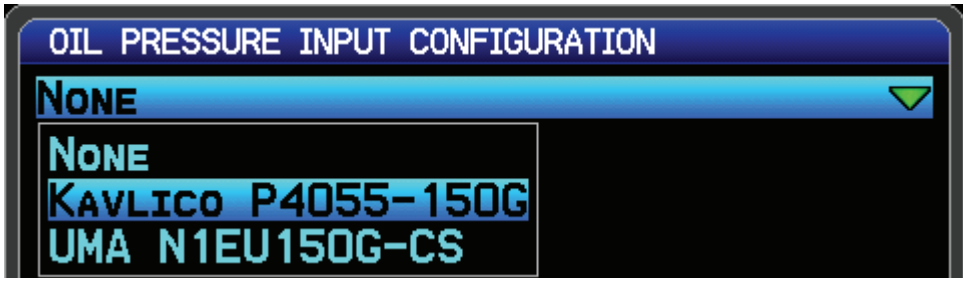
Oil Temperature Input Configuration – Select None, UMA 1B3-2.5R, Rotax 965531, or Jabiru as applicable to the aircraft's engine.



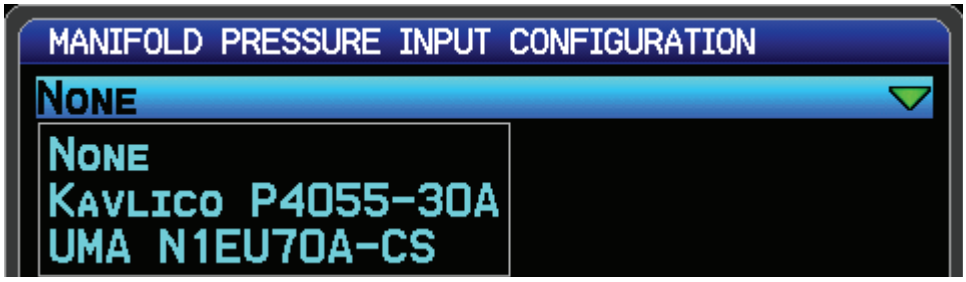
Oil Pressure Input Configuration – Select None, Kavlico P4055-150G, or UMA N1EU150G-CS as applicable to the aircraft's engine.

NOTE

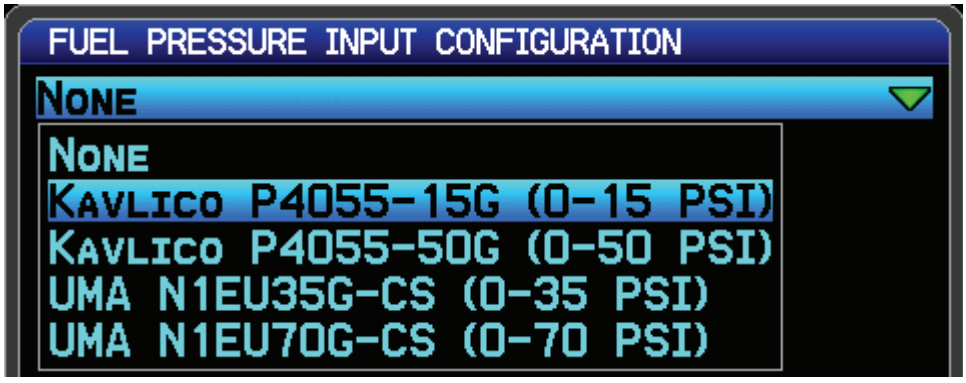
Rotax engines must use the General Purpose inputs for Oil Pressure sensor configuration.



Manifold Pressure Input Configuration – Select None, Kavlico P4055-30A, or UMA N1EU70A-CS as applicable to the aircraft's engine.

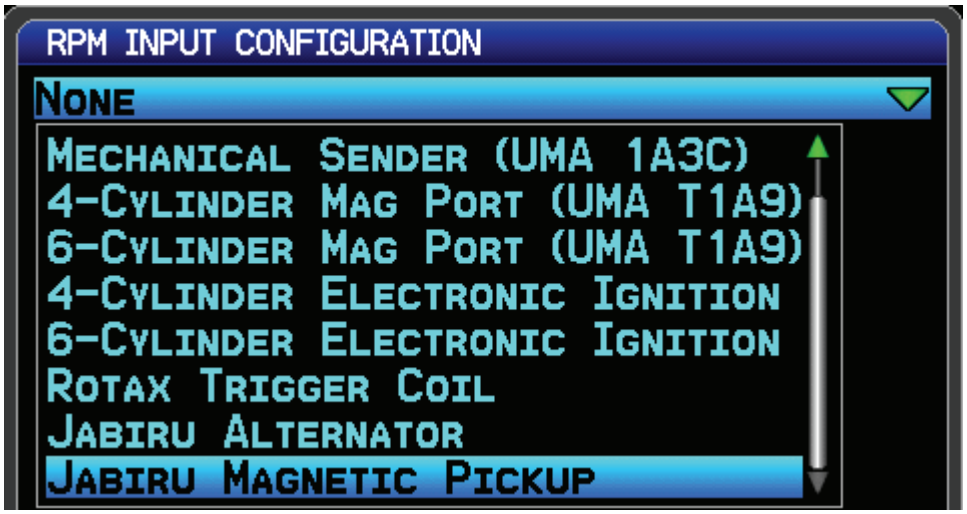


Fuel Pressure Input Configuration – Select None, Kavlico P4055-15G (0-15 PSI), Kavlico P4055-50G (0-50 PSI), UMA N1EU35G-CS (0-35 PSI), or UMA N1EU70G-CS (0-70 PSI) as applicable to the aircraft's engine.



RPM Input Configuration – Select None, Mechanical Sensor (UMA 1A3C), 4 Cylinder Mag Port (UMA T1A9), 6-Cylinder Mag Port (UMA T1A9), 4 Cylinder Electronic Ignition, 6 Cylinder Electronic Ignition, Rotax Trigger Coil, Jabiru Alternator, or Jabiru Magnetic Pickup as applicable to the aircraft's engine.

An RPM2 selection is available from the CAP FUEL 1/RPM 2 Input Configuration page. If both RPM and RPM 2 inputs are configured, the highest RPM of the two inputs is displayed. This setup is useful for aircraft with dual electronic ignitions, where the tach signal ceases to function during a mag check. If the tach signal from both electronic ignitions are configured, an RPM value is displayed even with one input shut off.



Fuel 1 and Fuel 2 Inputs – The Fuel 1 and Fuel 2 configuration pages allow configuration of resistive type fuel sensors. Choices are None, Fuel Quantity 1 (or 2), Main Fuel 1 (or 2), and Aux Fuel 1 (or 2). See Section 8.3.3 for calibration instructions.

Only one item can be selected from each of the following groups:

Group 1 Fuel Quantity 1, Main Fuel 1
Group 2 Fuel Quantity 2, Main Fuel 2
Group 3 Aux Fuel 1
Group 4 Aux Fuel 2

.

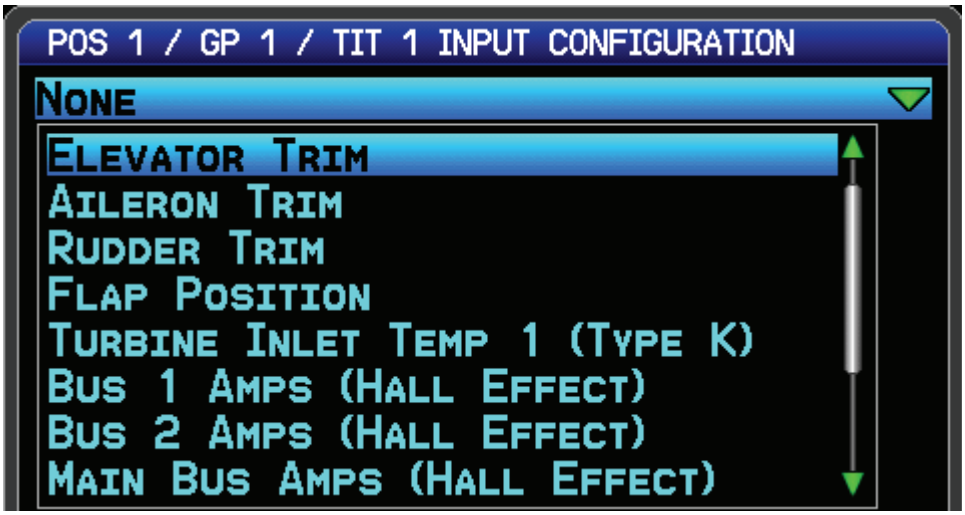
NOTE

Aux Fuel 1 and 2 selections are also available from the POS 3/GP 3/Fuel 3 and POS 4/GP 4/Fuel 4 Input Configuration pages.

The Fuel Quantity and Main Fuel selections are functionally the same, only the displayed text differs. It is advised to back up calibration data to an SD card (Section 8.3.3) when configuring the fuel inputs, as changing the Fuel 1 Input or Fuel 2 Input selection may delete the calibration data. This info applies equally to the Cap (capacitive) Fuel Inputs described in the following pages of this section. Resistive and/or Capacitive Inputs may be configured interchangeably for the above listed Groups 1-4.

Position Inputs – The Position 1-5 inputs can be configured for several different inputs.

POS 1 – 5 – Position inputs 1 – 5 can be used for Elevator Trim, Aileron Trim, Rudder Trim, and Flap Position inputs. These inputs require calibration (Section 8.3.3).



GP (General Purpose) 1-4 – Hall Effect current measurements use the GP inputs (Bus 1, Bus 2, Main Bus, or Essential Bus) and may be calibrated (Section 8.3.3).

Rotax engines use GP inputs for CHT (Rotax 965531) and oil pressure (Rotax 956413 or 956415).

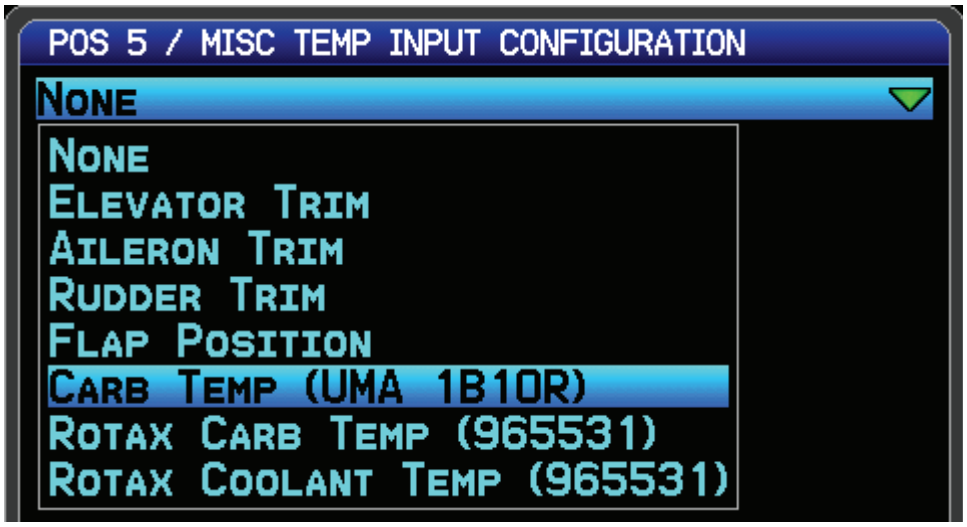
Jabiru engines use GP inputs for Jabiru oil pressure.

TIT (Turbine Inlet Temp) 1 and 2 – Turbine Inlet Temp is only available if Turbine Inlet Temp 1 is selected.

A Lean Assist enable/disable field appears when editing an EGT or TIT input. Selecting Disable prevents the LEAN softkey from appearing on the ENG page. Lean Assist should be disabled for engines that do not have a pilot-controllable fuel/air mixture.

Fuel 3 and 4 – Settings include Aux Fuel 1 & 2 inputs for resistive fuel sensors, which require calibration (Section 8.3.3). See drawings in Appendix G for details on adding resistors required this configuration.

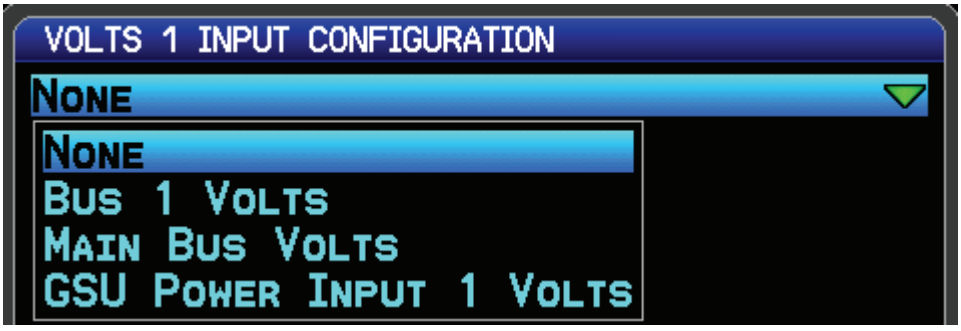
Misc Temp (Temperature) Input – Carb Temp (UMA 1B10R), Rotax Carb Temp (965531), and Rotax Coolant Temp (965531) settings are available.



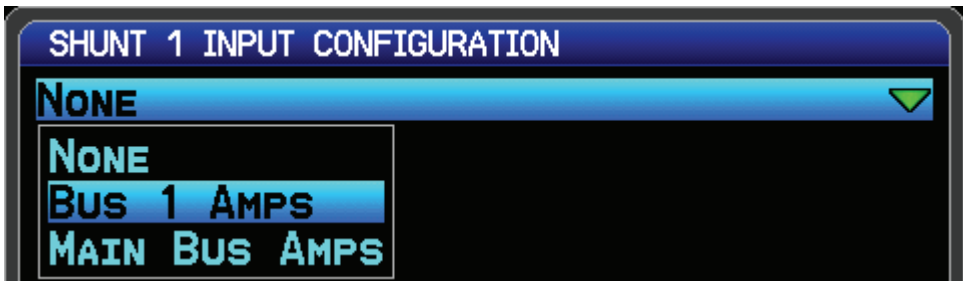
EGT 6 – If the user has selected the 6 Cylinders option for EGT Thermocouples, the EGT 6/Misc Press input is used and therefore is not accessible.

Misc Press (Pressure) Input – Coolant Press (Kavlico P4055-50G) can be selected for coolant pressure input.

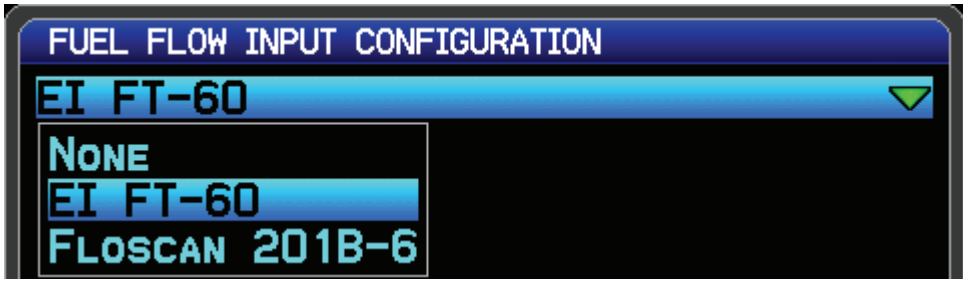
Volts 1 and Volts 2 Inputs – Choices for Volts 1 configuration are None, Bus 1 Volts, Main Bus Volts, and GSU Power Input 1 Volts. Choices for Volts 2 configuration are None, Bus 2 Volts, Essential Bus, and GSU Power Input 2 Volts. Selecting GSU Power Input 1 Volts and/or GSU Power Input 2 Volts will cause the corresponding GSU bus voltage reading to be used in place of the VOLTS input pin on the GSU.



Shunt 1 and Shunt 2 – Choices for Shunt 1 are None, Bus 1 Amps, and Main Bus Amps. Choices for Shunt 2 are None, Bus 2 Amps, and Essential Bus Amps. The Shunt 1 and Shunt 2 inputs can be calibrated (see Section 8.3.3) or the default values may be used. These inputs are used for shunt current measurements only, use the GP Inputs for Hall Effect current measurements.



Fuel Flow Input – Choices are None, EI FT-60, and Floscan 201B-6. The fuel flow input requires calibration, see Section 8.3.3.



Cap (Capacitive) Fuel 1 and Cap Fuel 2 – The Cap Fuel 1 and Cap Fuel 2 configuration pages allow the user to select from None, Fuel Quantity 1 (or 2), Main Fuel 1 (or 2), and Aux Fuel 1 (or 2). These capacitive sensor selections require calibration (Section 8.3.3).

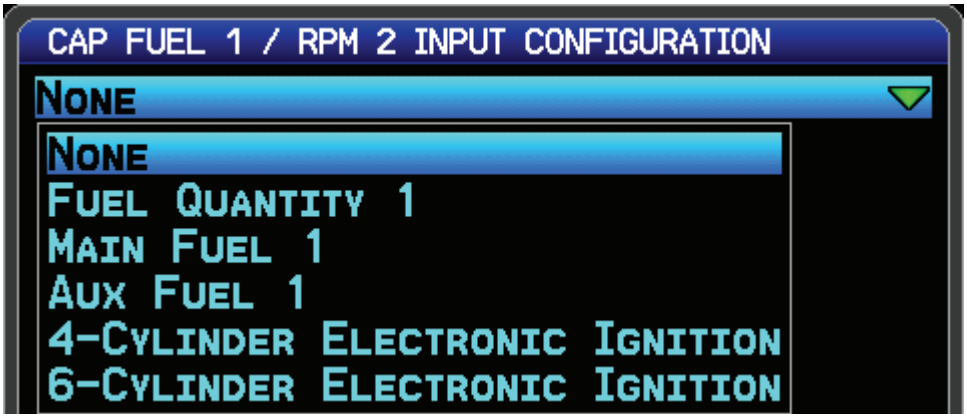
The CAP FUEL inputs are for capacitive fuel level sensors that output a frequency. For certain capacitive fuel level sensors that use a voltage ouput instead, use the FUEL inputs and see Appendix G for wiring guidance.

Only one item can be selected from each of the following groups:

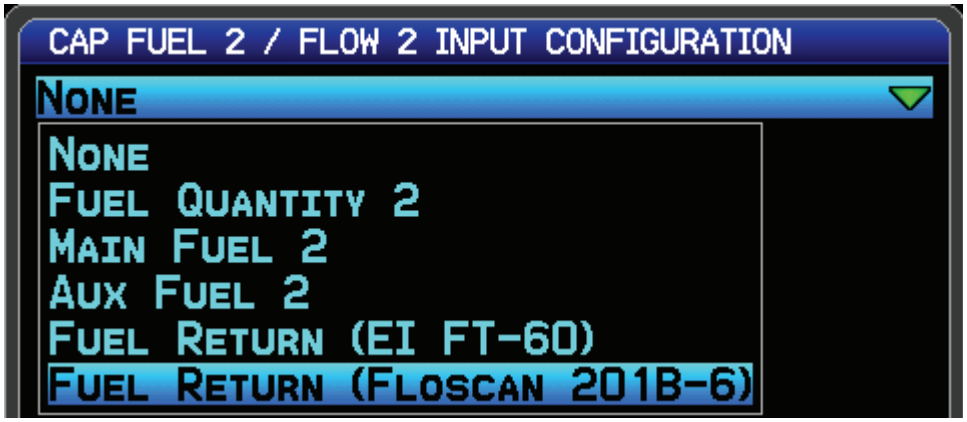
Group 1 Fuel Quantity 1, Main Fuel 1
Group 2 Fuel Quantity 2, Main Fuel 2
Group 3 Aux Fuel 1
Group 4 Aux Fuel 2

The Fuel Quantity and Main Fuel selections are functionally the same, only the displayed text differs. It is advised to back up calibration data to an SD card (Section 8.3.3) when configuring the fuel inputs, as changing the Fuel 1 Input or Fuel 2 Input selection may delete the calibration data. Resistive and/or Capacitive Inputs may be configured interchangeably for the above listed Groups 1-4.

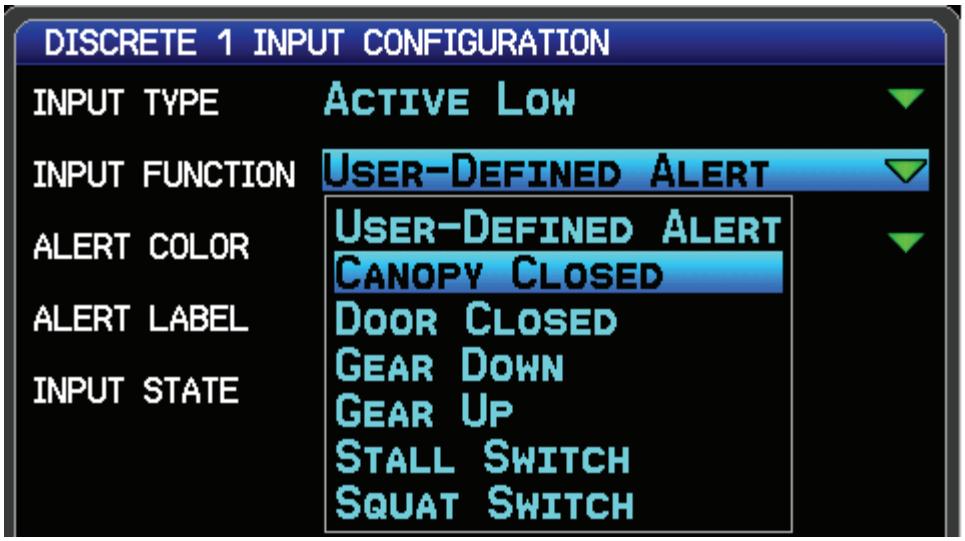
Electronic Ignition Input – The RPM 2 input allows for the configuration of 4 or 6-cylinder electronic ignition systems. If both RPM and RPM 2 inputs are configured, the highest RPM of the two inputs is displayed. This setup is useful for aircraft with dual electronic ignitions, where the tach signal ceases to function during a mag check. If the tach signal from both electronic ignitions are configured, an RPM value is displayed even with one input shut off.



Fuel Flow 2 Input – The Fuel Flow 2 input selections are Fuel Return (EI FT-60) and Fuel Return (Floscan 201B-6). This input can be used for a second fuel flow sensor to measure differential fuel flow (Displayed Fuel Flow = Flow 1[feed] – Flow 2[return]).



Discrete 1-4 Inputs – These inputs can be configured for a variety of alerts. For example, to generate a CAS (Crew Alerting System) alert when pulled low (if configured as Active Low). The CAS alerts are displayed on the PFD when active. See following text for detailed info.



Input Type - Determines the voltage level that will cause the input to be considered active (see A.3.6 for specific voltage levels).

- None - Discrete input is not used
- Active Low - Discrete input is considered active when input voltage is low (pulled to ground)
- Active High - Discrete input is considered active when input voltage is high (pulled to power supply voltage) or when the input is left floating (not connected).

Input Function - Determines the behavior of the CAS alert associated with the discrete input

- User-Defined Alert - When the input is active, a CAS alert with a user defined color and text label is displayed on the PFD.
- Canopy Closed - Used with a switch that activates the input when the aircraft canopy is closed and locked. A solid yellow CANOPY OPEN message will appear on the PFD if the Canopy Closed input is not active. If engine power is increased or the aircraft is airborne, the CANOPY OPEN message will flash red and an alert tone will sound.
- Door Closed - Same as Canopy Closed except alert text is DOOR OPEN.
- Gear Down - Used with a switch that activates the input when the aircraft's landing gear is down and locked. When active, a solid green GEAR DOWN indication is displayed on the PFD. If inactive, and the aircraft is at a low engine power setting and a low altitude, a red CHECK GEAR alert message appears and a warning tone sounds continuously.
- Gear Up - Used with a switch that activates the discrete input when the aircraft's landing gear is fully retracted. A Gear Up input should be used in conjunction with another discrete input that is configured for the Gear Down function. If neither the Gear Up nor Gear Down inputs are active, a red GEAR UNSAFE alert will be displayed if the landing gear is in transition (neither fully up nor fully down).
- Stall Switch - When the input is active, a red flashing STALL message appears on the PFD and a warning tone sounds continuously.
- Squat Switch - Used with a weight-on-wheels switch that activates the input when the aircraft is on the ground. If a Stall Switch input is also configured, the Squat Switch input will override it (to reduce nuisance alerting when the stall switch is activated while the aircraft is on the ground). The Squat Switch input is also used as an additional factor for determining airborne/on-ground status.

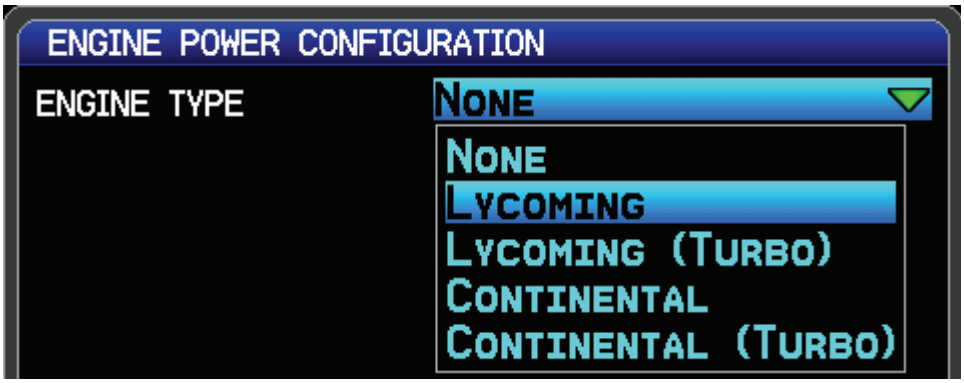
Alert Color - Controls the color used to display a user-defined alert for a discrete input. If the color red is used for a user-defined alert, a warning tone will sound when the alert initially appears (if the aircraft is airborne).

Alert Label - The text used to display a user-defined alert for a discrete input.

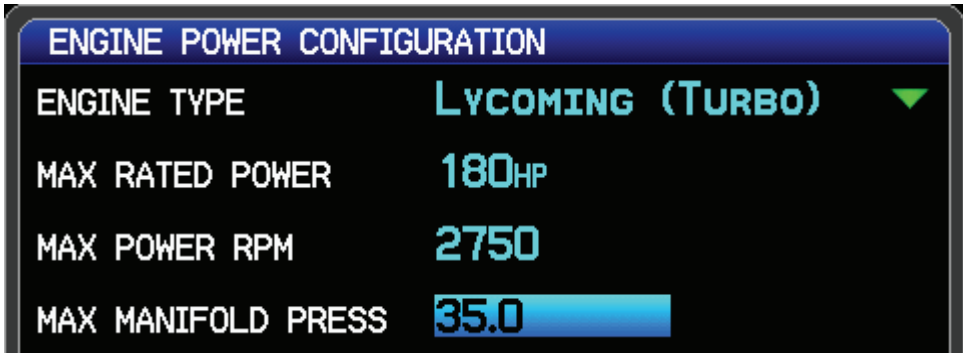
Input State - Shows the current state of the discrete input (for troubleshooting purposes).

Discrete 1-2 Outputs – The GSU 73 has 2 annunciator outputs, these outputs do not require any configuration and can be optionally wired to an external annunciator. Discrete Out 1 acts as a master warning annunciator and is active any time a warning CAS message (Red Alert) is displayed on the PFD. Discrete Out 2 acts as a master caution annunciator and is active any time a caution CAS message (Yellow Alert) is displayed on the PFD. Reference Appendix G for wiring guidance.

Engine Power – Configurable for Lycoming and Continental engines only. Select engine type (also normally-aspirated or turbocharged) from the pull-down list. Engine power requires data from RPM, manifold pressure, and fuel flow.

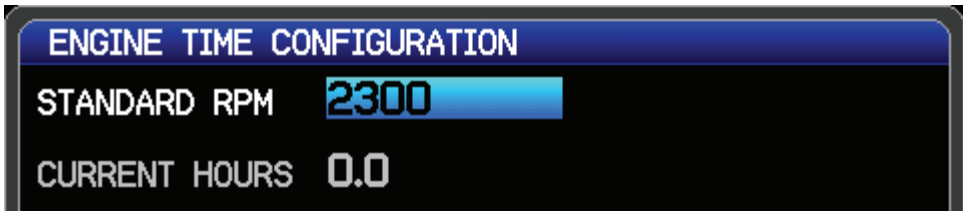


Enter the engine's max rated power and RPM (e.g. 180 horsepower @ 2750 RPM). For a turbocharged engine, enter the manifold pressure for max rated power. Max manifold pressure is not entered for a normally aspirated engine (it's assumed to produce max power at sea level pressure).



Engine power is displayed (in percentage) between the RPM and manifold pressure gauges in the EIS strip and on the ENG page.

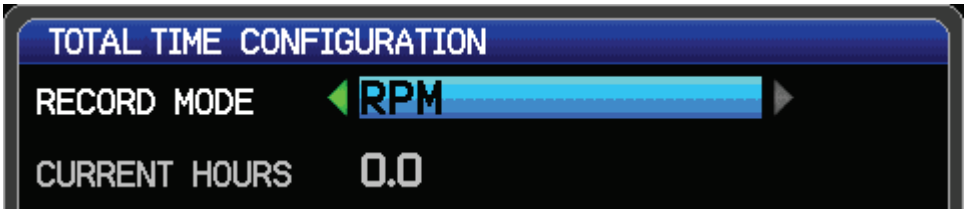
Engine Time – The Engine Time displays the total operating time in hours of the engine. This time is displayed on both the Engine Configuration Page and the Engine Time Configuration Page. The Engine Time (Current Hours) can only be changed after unlocking the Engine Time Configuration page by pressing softkeys 2, 3, and 4 in order, then using the FMS Joystick to highlight the Current Hours field. The standard value of 2300 RPM is used as a default setting for 1 hour of engine time (i.e. 1 hour of engine operation at 2300 RPM equals 1 hour of engine time). This value can be changed on the Engine Time Configuration Page (shown below).



Total Time – The Total Time displays the total operating time in hours of the aircraft. This time is displayed on both the Engine Configuration Page and the Total Time Configuration Page. The Total Time (Current Hours) can only be changed after unlocking the Total Time Configuration page by pressing softkeys 2, 3, and 4 in order, then using the FMS Joystick to highlight the Current Hours field. The Record Mode selections are listed in Table 8-5

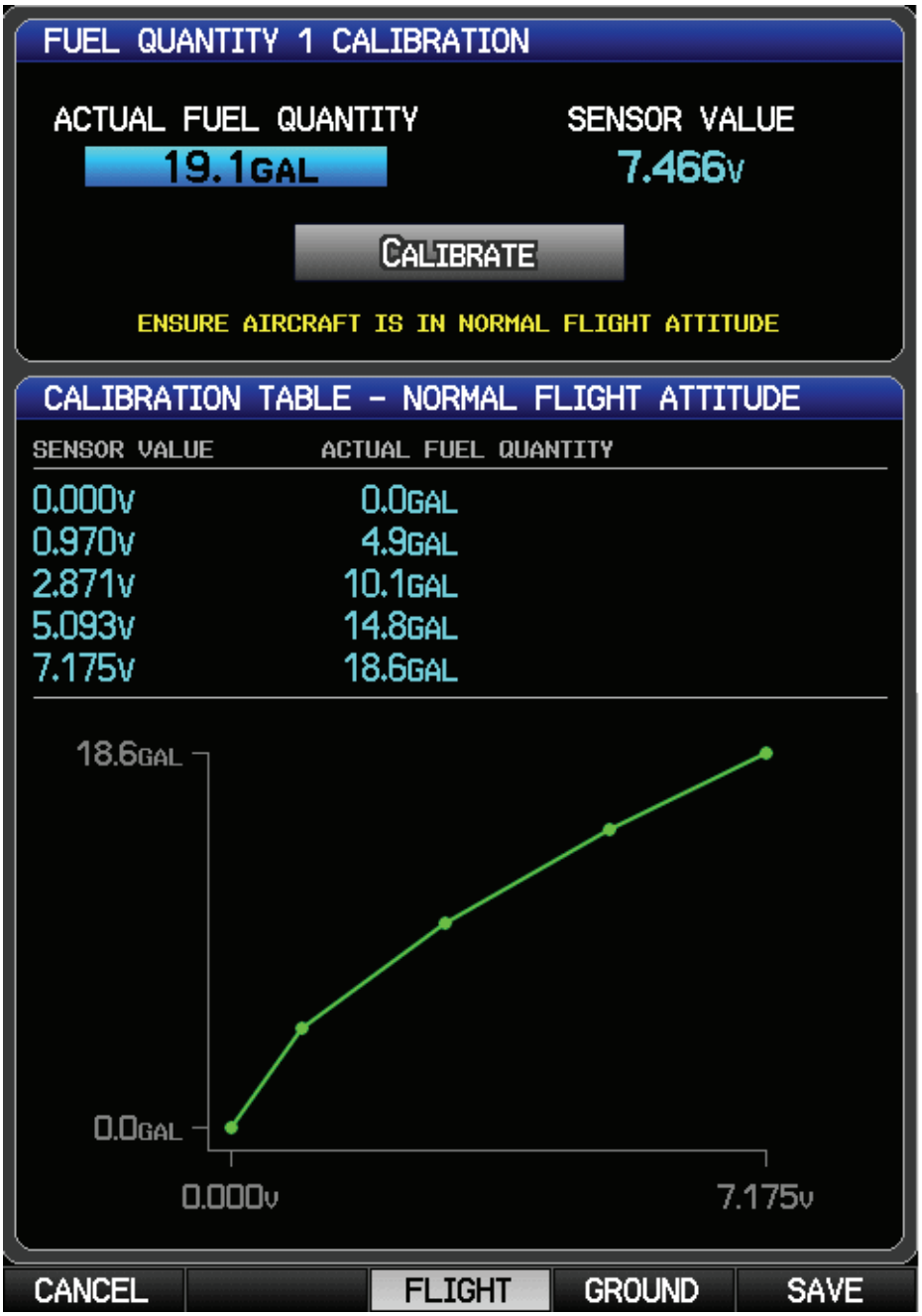
Table 8-5 Record Mode Selections

Record Mode Selections	Description
None	Total Time is not recorded
Oil Pressure	Records Total Time when engine oil pressure is greater than 5 PSI
Flight Time	Records Total Time when aircraft is airborne as determined by GPS data and the indicated airspeed
RPM	Records Total Time when engine RPM is greater than 100



8.4.3 Input Configuration Items Requiring Calibration

Fuel Input Calibration – The Fuel 1–4 and Cap Fuel 1–2 inputs require calibration.



The G3X has two fuel calibration curves, the standard 'in-flight' or normal flight attitude calibration curve and an optional 'on-ground' or ground/taxi attitude calibration curve. The ground/taxi calibration curve can be used for aircraft that have a significantly different attitude when on the ground, such as tailwheel aircraft. If no calibration data is entered for the ground/taxi curve, the normal flight calibration curve will be used when the aircraft is in flight and on the ground. The calibration curve being used to display fuel quantity switches automatically and is determined by GPS groundspeed, indicated airspeed, and height above ground.

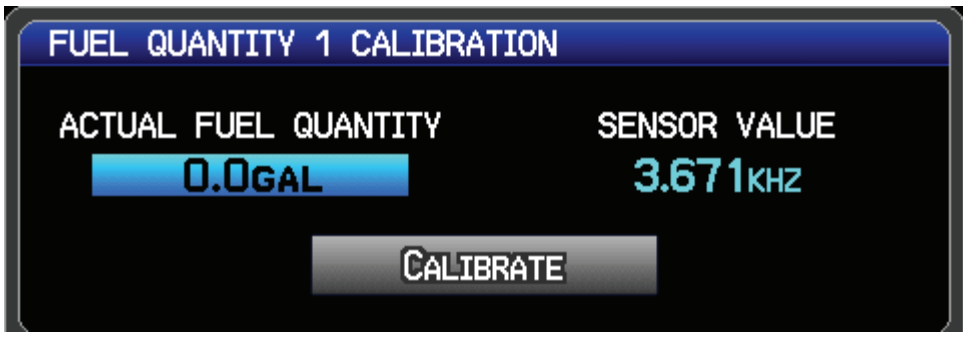
Softkeys on the calibration page are used to switch between the normal flight and the ground/taxi calibration curves. Since the ground/taxi attitude calibration is optional and only availabe when the normal flight attitude calibration data has been entered, the 'GROUND' softkey is greyed out (unavailable) until calibration points are entered for the normal flight attitude curve.

To perform the Fuel Quantity calibration:

1. Press the Calibrate softkey to display the Calibration Page.
2. Orient the aircraft appropriately for the calibration curve (normal flight or ground/taxi) being performed.
3. Drain all usable fuel from the tank and calibrate at 0.0 gallons.
4. Put a known quantity of fuel (e.g. 5.0 gallons) into the empty fuel tank and enter that same amount into the Actual Fuel Quantity field.
5. Note the resulting sensor value displayed in the Sensor Value field (the sensor value should change with each added amount of fuel), wait at least 2 minutes for the reading to stabilize.
6. Highlight and press the Calibrate button.
7. Repeat this process until the fuel tank is full.

The user determines the best interval values of fuel to most accurately calibrate the full range of the tank. The greater number of calibration points that are used (maximum of 50 points), the more accurate the calibration will be. A yellow line on the graph indicates potentially incorrect/invalid info.

The Cap (capacitive) Fuel Inputs are calibrated in the same manner as the resistive fuel inputs, except that the resulting frequency (in kHz) from the sensor is displayed instead of the voltage.



To delete a calibration value, highlight the desired data point in the list and press the CLR Key. Then highlight Yes on the pop-up window, and press the ENT Key, the calibration data is removed.

Fuel Quantity Calibration Data Backup – This option allows the user to back up fuel calibration data to an SD card placed in the SD card slot of the PFD. Access the Read/Write Calibration File menu by pressing the Menu key when displaying the Fuel Quantity Calibration Page

Write Calibration File – Stores fuel quantity calibration data to a file on the SD card. Calibration data is saved to the /Garmin/cal/ directory on the card. This data storage must be repeated for each calibrated tank (if backup is desired).

Read Calibration File – Reads the stored fuel quantity calibration data from the SD card.

Fuel Flow Calibration – The Fuel Flow input requires calibration as detailed below.

K-Factor – Enter the 'K' factor for the fuel flow sensor (Section 8.2.11).

When installing the fuel flow sensor, the installer should take note of number on the tag attached to the sensor (if applicable). This number is the calibrated K factor of the sensor. For sensors that are not supplied with a specific calibration value, use the default K factor value provided.

The K-Factor represents the number of electrical pulses output by the sensor per gallon of fuel flow. Aspects unique to each installation will affect the accuracy of the initial K-Factor, and as a result, the K-Factor must generally be adjusted up or down to increase the accuracy of the fuel flow calibration.

If the fuel usage reported by the G3X differs from the actual fuel usage, as measured at the fuel pump (or other trusted method of measurement), use the following formula to calculate a corrected K-Factor, which can then be used to calibrate the fuel flow.

Corrected K-Factor = ([G3X reported fuel used] x [previous K-factor]) / [actual fuel used].

Full Fuel – Sets the Full Fuel quantity for the fuel computer. Set according to the fuel tank capacity (set to zero if not used).

Partial Fuel 1 & 2 – The Partial Fuel values may be used if the fuel tanks have 'tabs' or some other method of putting in a known quantity of fuel (other than completely full tanks). If the Partial Fuel function is not applicable or not desired, these settings can be left blank or set to zero.

Trim/Flap Position Input Calibration – The Pos 1 – 5 inputs require calibration if configured for any of the trim positions (elevator, aileron, rudder) or flap position.

To perform the Trim/Flap Position calibration:

1. Press the Calibrate softkey to display the Calibration Page.
2. Position the elevator to match the trim position (up/left, neutral, down/right) displayed on the calibration page, or position the flap to the desired position.
3. Note the resulting sensor value (in volts) displayed in the Sensor Value field (the sensor value should change with each change in trim/flap position.
4. Highlight and press the Calibrate button.
5. Repeat this process for each of the Trim/Flap Positions.

.

NOTE

Flap position values (up to 8) should coincide with the angle of the flap position as expressed in degrees (-90° – +90°).

To delete a calibration value, highlight the desired data in the list, and press the CLR Key. Then highlight Yes on the pop-up window, and press the ENT Key, the calibration data is removed.

Bus 1 and Bus 2 Amps (Hall Effect) Calibration – The Bus 1 and Bus 2 inputs can be calibrated (if desired) as detailed below.

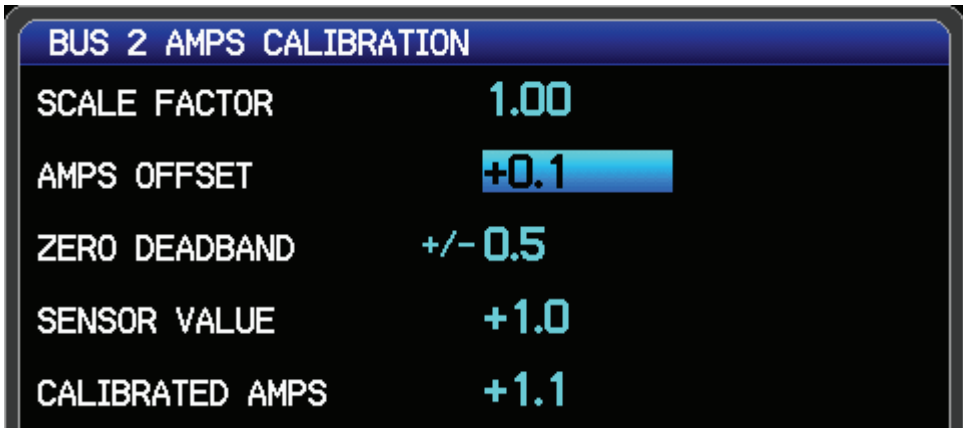
Scale Factor – For most installations, the scale factor will remain set to the default (1.00) value. A typical use for the scale factor is for a Hall Effect current sensor that has the current-carrying conductor looped through the sensor twice; in that case the scale factor should be set to 0.50 to give the correct current reading.

Amps Offset – The Amps Offset calibration can be performed to compensate for any residual current readings that cannot be "zero'ed out". For example, if the Amps gauge reads +0.2 Amps, with no current being drawn, an Amps Offset of -0.2 can be entered and saved, thus correcting the Amps gauge reading to 0.0 Amps. If no compensation is needed, calibration is not necessary and the default value of 0.0 will be used. This setting is most commonly used with Hall effect current sensors because of the inherent variability of some of these type sensors.

Zero Deadband – Sets a range of values that will be displayed as zero on the gauge. In the example shown in the following screenshot, any readings from -0.5 to +0.5 will be displayed as zero.

Sensor Value – Displays the actual or 'raw' current value as measured by the sensor.

Calibrated Amps – Value shown will be displayed on current gauge. This value is derived from the Sensor Value plus any adjustments made by the Scale Factor, Amps Offset, and Zero Deadband settings. The measured current is first multiplied by the scale factor, then the offset value is added. If the resulting current value is less than the deadband value, the displayed current will be zero.



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9 Post-Installation Checkout and Calibration Procedures

The checkout procedures in this section are recommended to be performed after installing the G3X. The calibration procedures are required to be performed after installing the G3X. It is assumed that the person performing these checks is familiar with the aircraft, has a working knowledge of typical avionics systems, and has experience using the test equipment defined in this section.

The calibration procedures in this section are performed in the configuration mode. To enter configuration mode, hold down the left-hand softkey while powering on the GDU 37X. In a two-display or three-display system hold down the left-hand softkey on the PFD while powering on the unit.

The calibration procedures (Sections 9.3.1 – 9.3.6) may require that certain status boxes on the GSU Page (config mode) indicate a positive state (green check marks) before starting the procedure. Tables 9-2 and 9-3 list the status box requirements for each calibration procedure.

The CONFIG GSU Page must be "unlocked" by pressing the softkeys 2, 3, 4 in order (Figure 9-1) to select a calibration procedure (Sections 9.3.1 – 9.3.6).

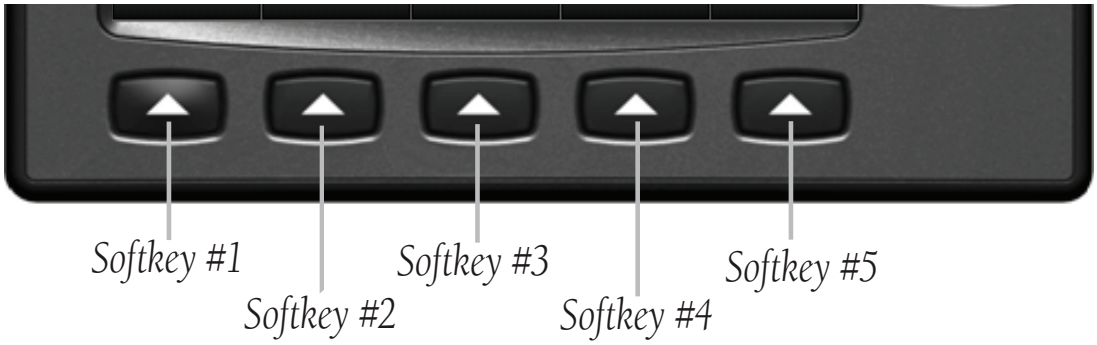

Figure 9-1 Softkey Positions

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NOTE

Some procedures in this section require that the GPS receiver is receiving sufficient satellite signal to compute a present position (Table 9-2). This requires outdoor line-of-site to GPS satellite signals or a GPS indoor repeater

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NOTE

As these procedures involve engine run-up and moving the aircraft, it is recommended that the installer read this entire section before beginning the checkout procedure.

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NOTE

Unless otherwise noted, all procedures apply to one, two, and three display systems.

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CAUTION

Be sure to check all aircraft control movements before flight is attempted to ensure that the wiring harness does not touch any moving part.

9.1 Recommended Test Equipment

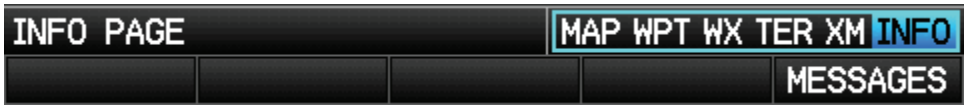
The following test equipment is recommended to conduct and complete all post installation checkout procedures in this section: (All test equipment should have current calibration records)

- Pitot/static ramp tester
- Digital Multi-Meter (DMM)
- Ground power unit capable of supplying 14/28 Vdc power to the aircraft systems and avionics
- Outdoor line-of-site to GPS satellite signals or GPS indoor repeater
- Digital Level or equivalent

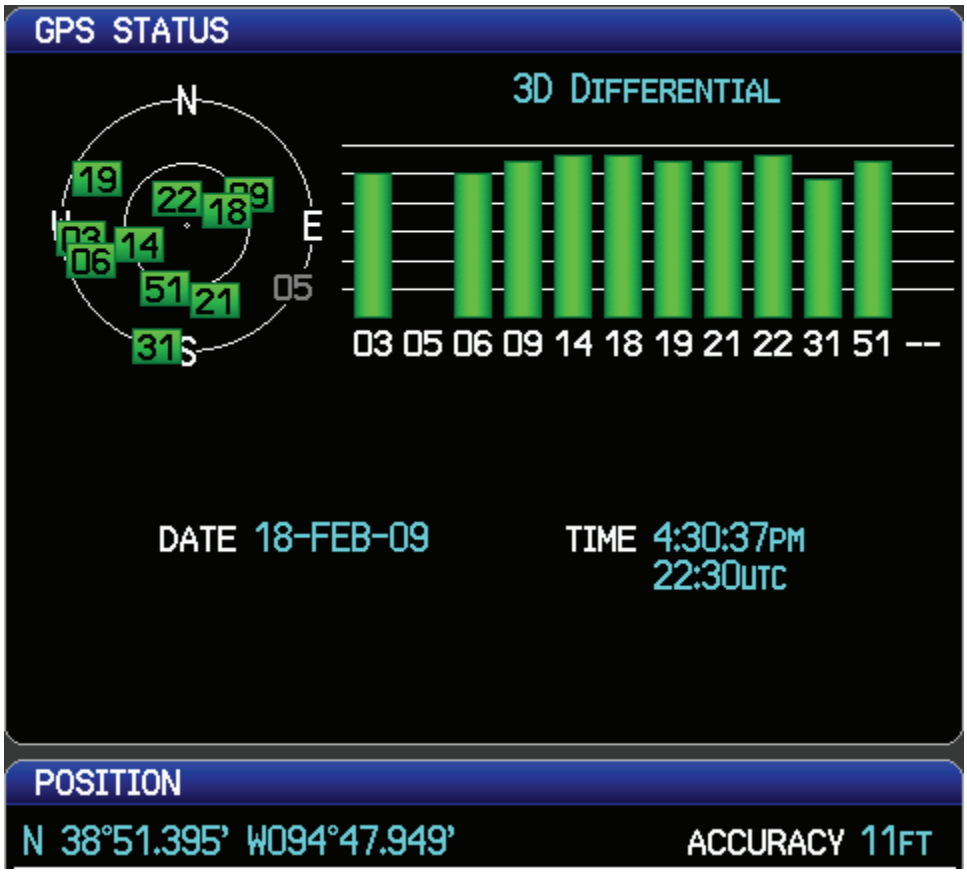
9.2 GDU 37X Test Procedure

Test the GPS Receiver:

1. Power on unit and use the FMS Joystick to select the Info Page.



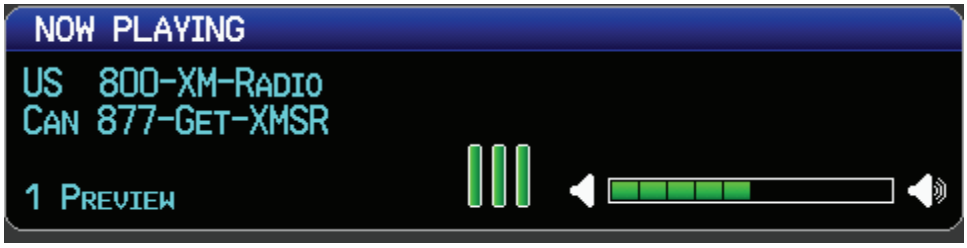
2. Verify that the GPS receiver is functional and able to calculate its present position.



Test the XM Receiver (if applicable):

1. Power on unit and use the FMS Joystick to select the XM Page.

2. Verify that the XM receiver is functioning correctly as indicated by the green signal strength bars. See Section 7.5 for XM Activation Instructions if needed.



9.3 GSU 73/GMU 44 Post-Installation Calibration Procedures

After mechanical and electrical installation of the GSU 73 AHRS and GMU 44 magnetometer have been completed, prior to operation, a set of post-installation calibration procedures must be carried out.

Table 9-1 describes the calibration procedures:

Table 9-1: Post-Installation Calibration Procedure Summary

Calibration Procedure	Procedure Name	Procedure Description	Installations Requiring Procedure
A	AHRS Orientation	Validate GSU 73 Orientation	Procedure A is required for all installations
B	Pitch/Roll Offset Compensation	Level Aircraft	Procedure B is required for all installations
C	Magnetometer Interference Test	Validate no magnetic interference with GMU 44	Procedure C is required for initial installation verification. This test should also be repeated to verify all subsequent electrical changes associated with devices within 10.0 feet of the GMU 44 magnetometer. Such changes include, but are not limited to, wiring, shielding or grounding changes to any light, strobe, beacon or other electrical device located in the vicinity of the GMU 44 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 44. Such changes include, but are not limited to, addition, removal or modification of ferrous or electrically conductive materials located in the vicinity of the GMU 44 unit. Garmin recommends this test be performed at least once every 12 months.
D	Magnetometer Calibration	Compass Rose Taxi Maneuver	Procedure D is required for all installations. This calibration must be performed after every Pitch/Roll Offset Compensation and following a removal or replacement of the GMU 44 unit, or degaussing of the area near the GMU 44 location.
E	Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Procedure E is required for all installations
F	Heading Offset Compensation	Compass Rose Alignment with Magnetic North	Installations in which GMU 44 alignment is not within 0.5° of aircraft longitudinal axis

For each Calibration Procedure, Table 9-2 lists the LRU's that require valid calibration data.

Table 9-2 Data Validity Requirements for AHRS Calibration Procedures

AHRS Calibration Procedure	Valid Status Required
AHRS Mounting Orientation Identification	None
Pitch/Roll Offset	GPS or Air Data
Magnetometer Calibration	GPS or Magnetometer
Heading Offset	GPS or Air Data. Magnetometer always required.
Engine Run-Up	GPS or Air Data
Magnetometer Interference Test	GPS or Air Data. Magnetometer always required.

Table 9-3 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table 9-2.

Table 9-3 Configuration Mode GSU Page Status Boxes

Status Box	Valid Status
Magnetometer	Measurement of local 3D magnetic field available
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid.
GPS	3D or 3D Differential GPS solution available
Sensor Power	Sensor Power Supplies are Functional

The GSU Page status boxes referred to in Table 9-3 are shown in the following figure.

If removal and replacement of a GMU 44 unit is required after post-installation calibration has been completed, the GMU 44 mounting rack must not be moved. If the mounting screws that secure the GSU 73 unit or the GMU 44 mounting rack are loosened for any reason, post-installation calibration procedure, A, B, D and E (plus F if required initially) must be repeated before the aircraft can be returned to service.

Any GMU 44 removal or replacement requires repeating the magnetometer calibration, and if required initially, the heading offset compensation.

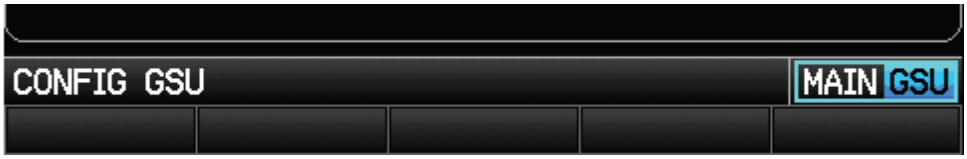
A repeat of the pitch/roll offset procedure (Procedure B) requires a repeat of the magnetometer calibration procedure (Procedure D), and also (if previously required) a repeat of the heading offset compensation procedure (Procedure F).

The addition, removal, or modification of components that are ferrous, or otherwise magnetic, within 10.0 feet of the GMU 44 magnetometer location after the magnetometer interference test or magnetometer calibration procedure were completed requires a repeat of both procedures.

Furthermore, electrical changes to the installation that affect components within 10.0 feet of the GMU 44 magnetometer after the magnetometer calibration and magnetometer interference procedures were completed will require a repeat of the magnetometer interference test. If new magnetic interference is detected, it must be resolved and then the magnetometer calibration procedure must be repeated. Wiring or grounding changes associated with a device located in the vicinity of the GMU 44 is a good example of such a change.

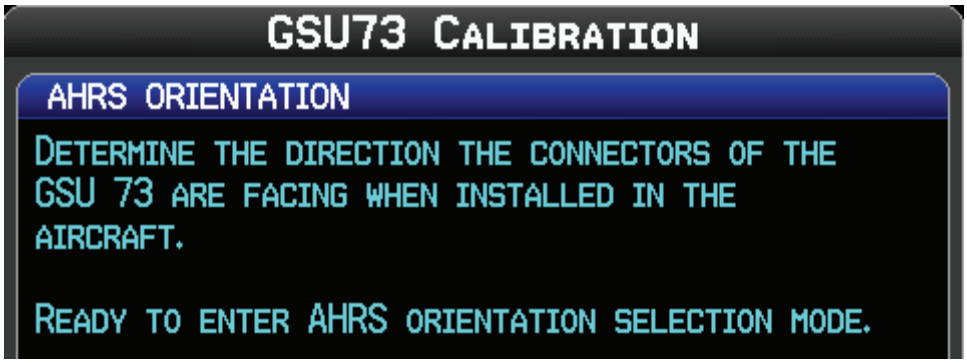
9.3.1 Calibration Procedure A: AHRS ORIENTATION

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X.
2. Use the FMS Joystick to select the GSU Page.

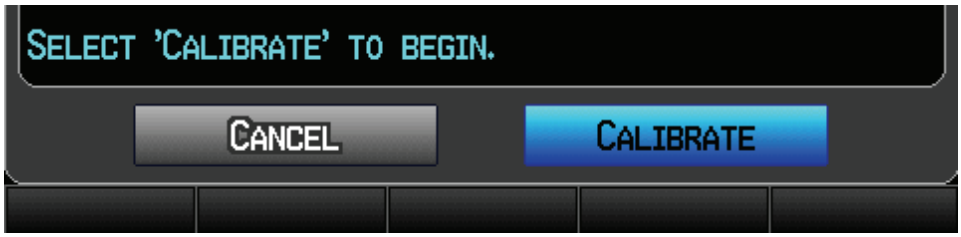


3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order.
4. Use the FMS Joystick to select AHRS ORIENTATION (if not already selected).

5. Determine the orientation of the GSU 73 per the on-screen instructions.

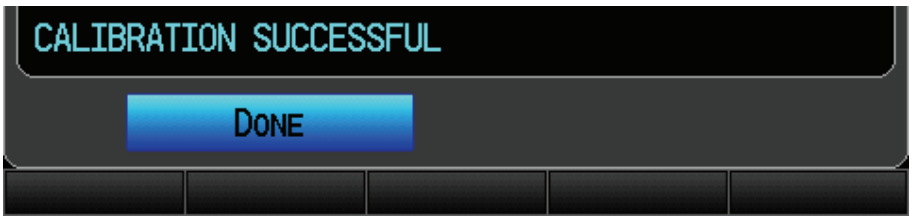


6. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



7. Use the FMS Joystick to select the direction of the GSU 73 connectors per the on-screen instructions, select OK and press the ENT Key to continue.

8. After a few minutes the calibration will finish and a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



9.3.2 Calibration Procedure B: Pitch/Roll Offset Compensation by Aircraft Leveling

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NOTE

This procedure requires orienting the aircraft to normal flight attitude (can be done by using jacks or placing wood blocks under the nose-wheel, for example). As another example, if the number of degrees 'nose high' the aircraft flies in straight and level cruise is known, a digital level can be used to orient the aircraft to normal flight attitude prior to the calibration.

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NOTE

The GSU 73 must be leveled within 3.0 degrees of the aircraft in flight level cruise attitude. In flight level cruise attitude is not necessarily the same as the level reference provided by the manufacturer (such as fuselage longerons).

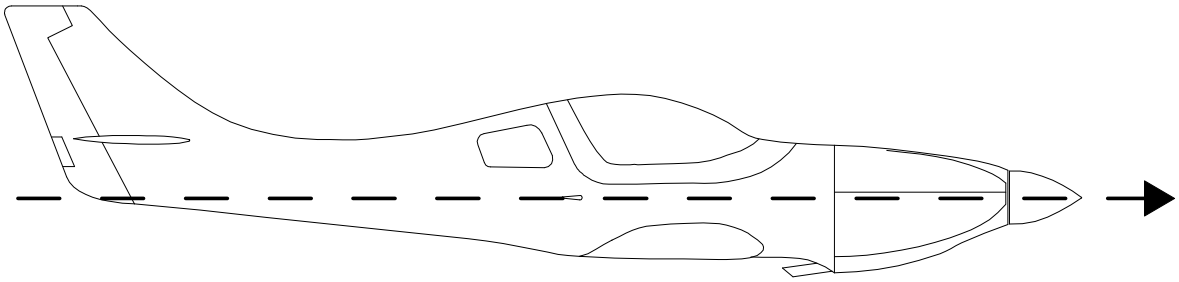
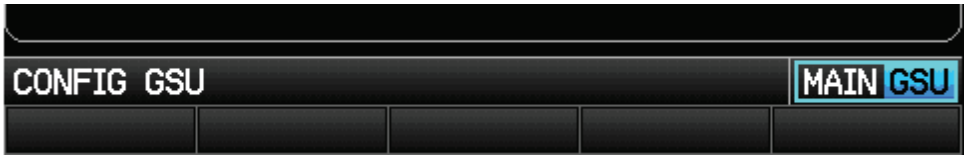


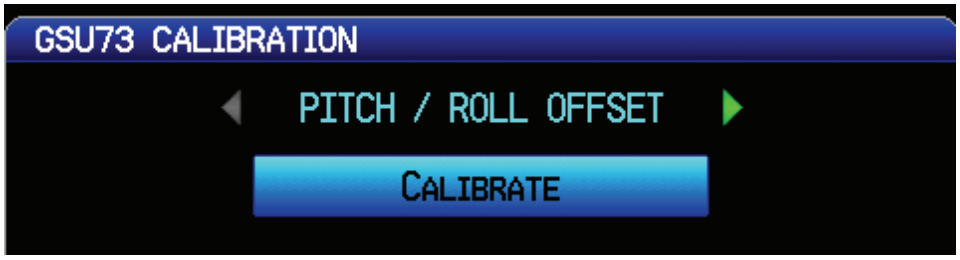
Figure 9-2 Flight Level Cruise Attitude

1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).

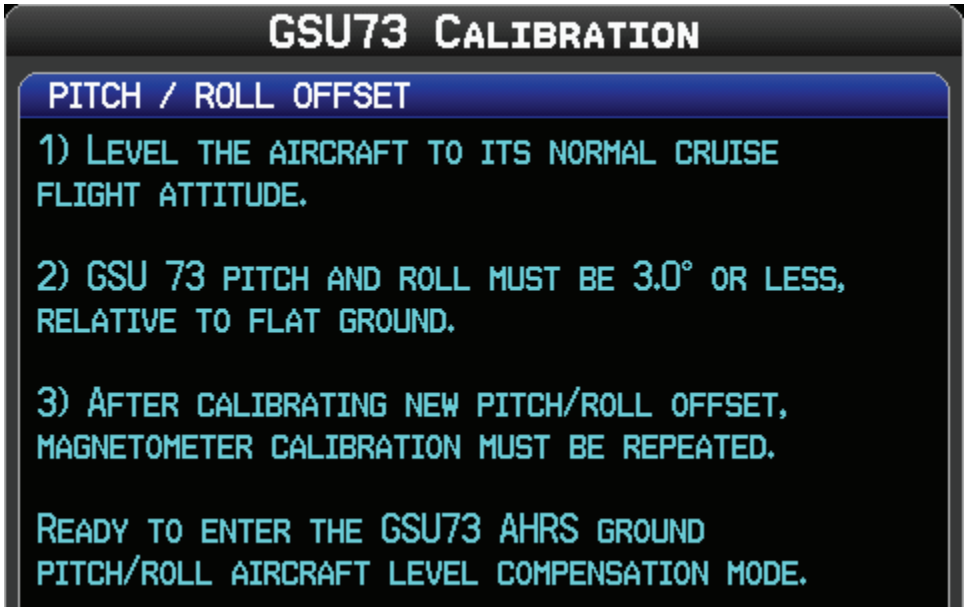


3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. Ensure that all the required status boxes are checked (Tables 9-2 and 9-3).
5. Use the FMS Joystick to select PITCH/ROLL OFFSET.

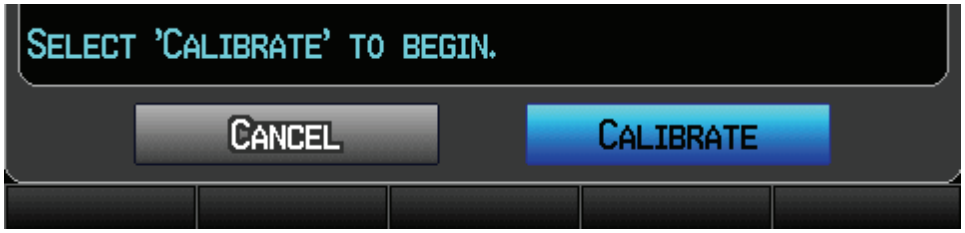
6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.



7. Ensure that the aircraft has been properly leveled per the on-screen instructions.



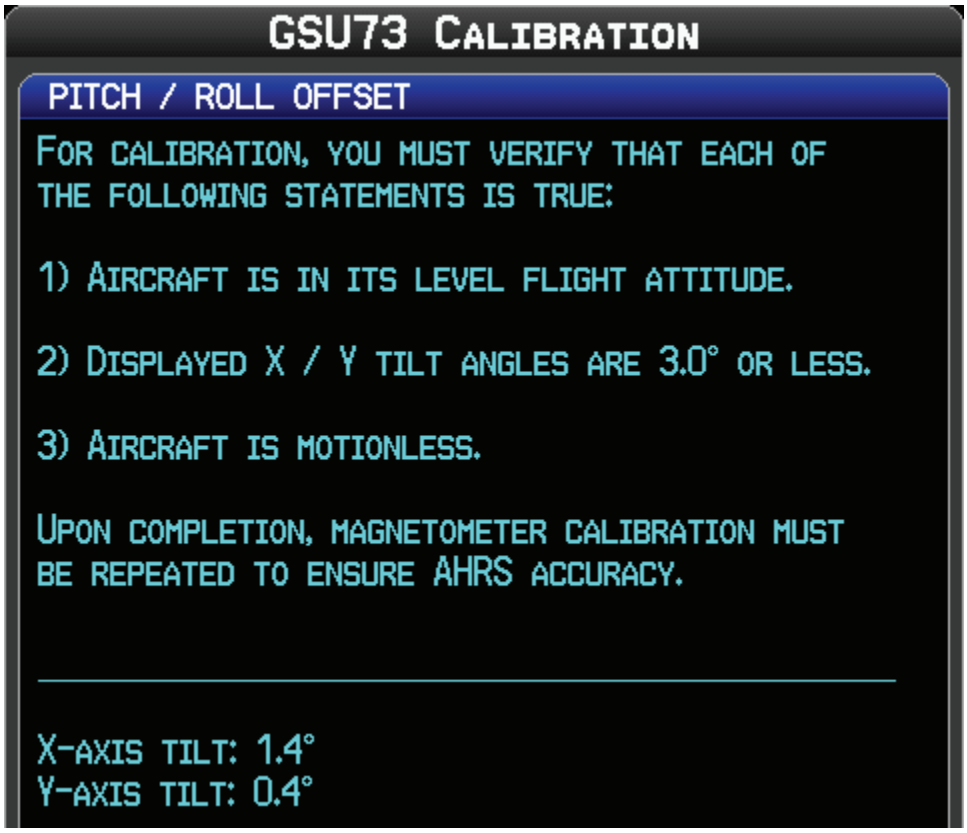
8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. Verify that the 3 on-screen statements are true. If either tilt angle is greater than 3.0 degrees, "Out of spec" is displayed..

NOTE

To accommodate multiple mounting orientations, the reported tilt angles are displayed as "X and Y" instead of "Pitch and Roll".



10. After verifying the statements 1-3 are true, select OK to store the cal values. Ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.

The magnetometer calibration (Calibration Procedure D) must be completed after each pitch/roll offset calibration.

9.3.3 Calibration Procedure C: Magnetometer Interference Test

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NOTE

Calibration Procedure C is only required for initial installation verification. This test should also be repeated to verify all subsequent electrical changes associated with devices within 10.0 feet of the GMU 44 magnetometer. Such changes include, but are not limited to, wiring, shielding, or grounding changes to any light, strobe, beacon, or other electrical device located in the vicinity of the GMU 44 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 44. Such changes include but are not limited to: addition, removal, or modification of ferrous or electrically conductive materials located in the same wing as a GMU 44 unit. This procedure validates that no electronic device is interfering with the operation of the GMU 44 magnetometer which directly impacts the determination of attitude and heading by the GSU 73 AHRS. Calibration Procedures A and B are not required prior to this execution of this procedure.

.

CAUTION

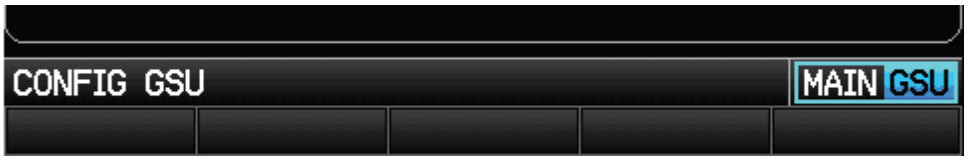
The real time readout displayed during the interference test is only valid for the location of the GMU when the test was initiated. If using this procedure to evaluate multiple mounting locations, the test must be started over for each location, failure to do so could provide incorrect test results.

.

NOTE

Garmin recommends this test be performed at least once every 12 months.

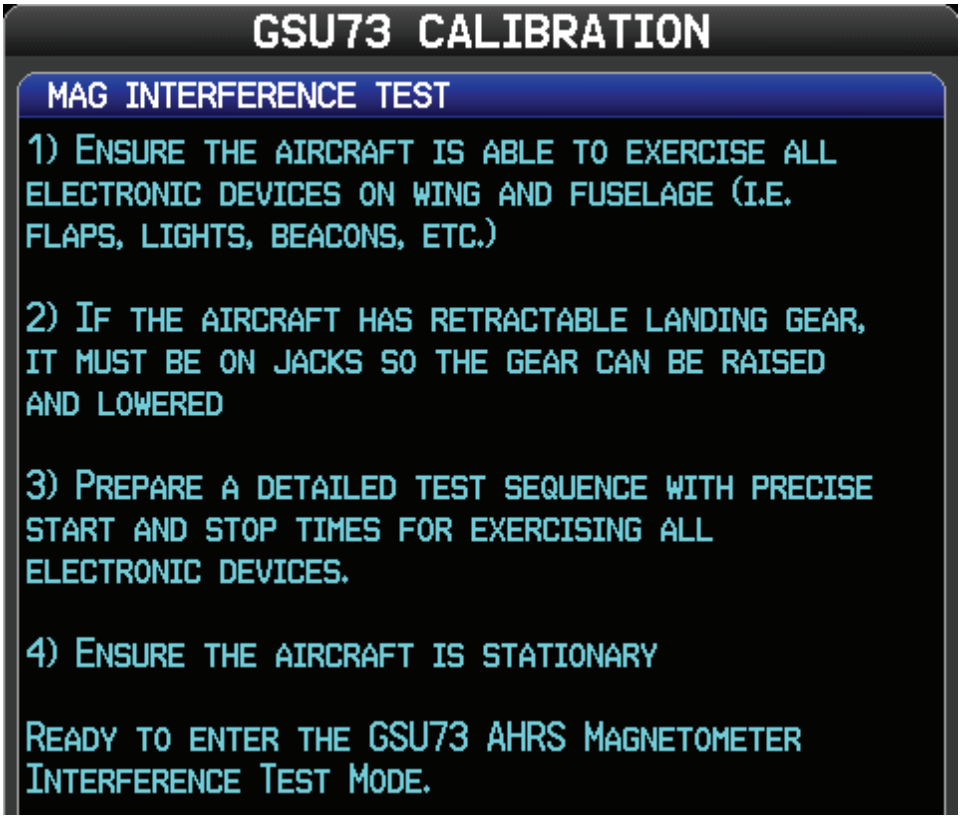
1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).



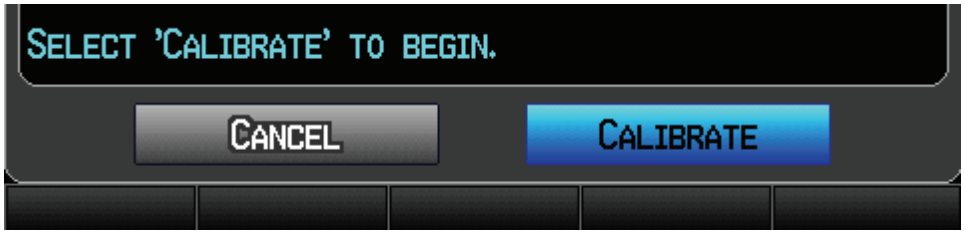
3. Unlock GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. Ensure that all the required status boxes are checked (Tables 9-2 and 9-3).
5. Use the FMS Joystick to select MAG INTERFERENCE TEST.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

7. Ensure that the aircraft has been properly prepared per the on-screen instructions. See Table 9-4 for a sample test sequence.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.

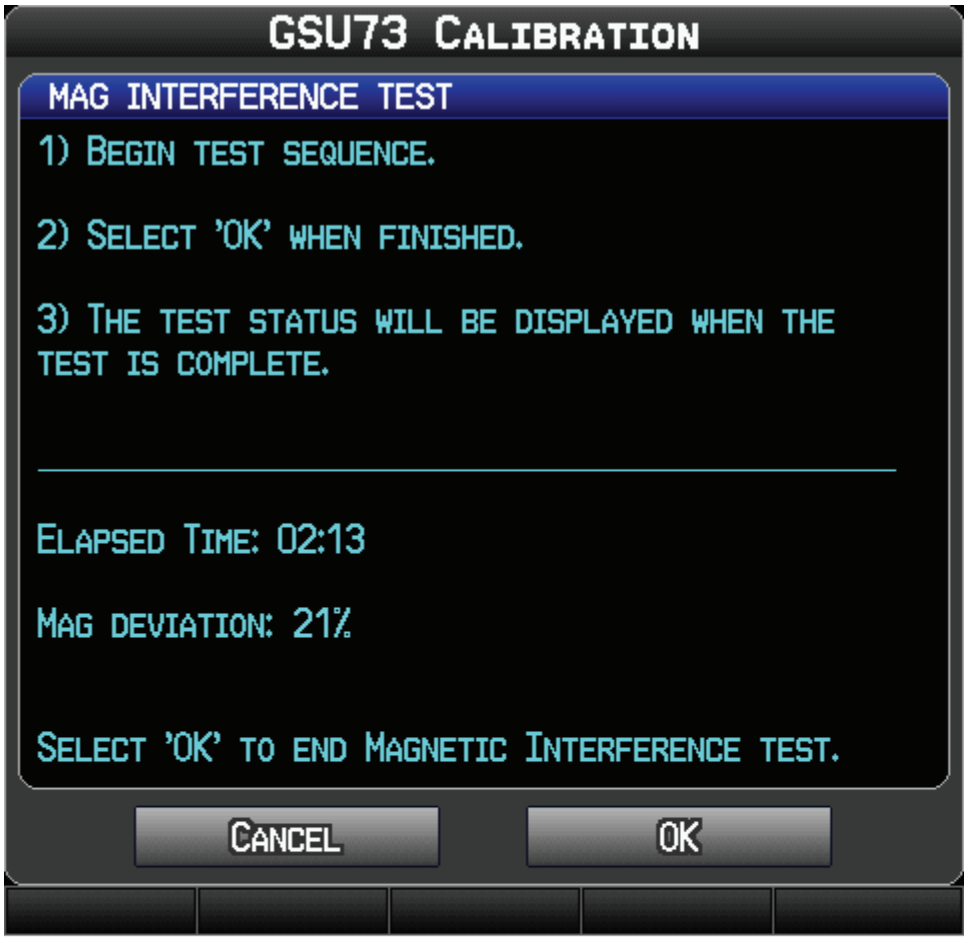


9. The operator should carry out the actions called for in the prepared test sequence. During calibration, a real-time value is displayed that represents the current magnetic field strength as a percentage of the maximum limit.

.

NOTE

It is important that all actions are carried out in the order and at the precise elapsed time as specified in the prepared test sequence.



10. After the calibration is finished, press the OK Softkey, a Done Key will appear at the bottom of the display. Ensure that a MAG INTERFERENCE TEST PASSED message appears at the bottom of the display. The magnetic deviation value is displayed to indicate the pass or fail margin of the test. Press the ENT Key to return to the GSU Status Page.

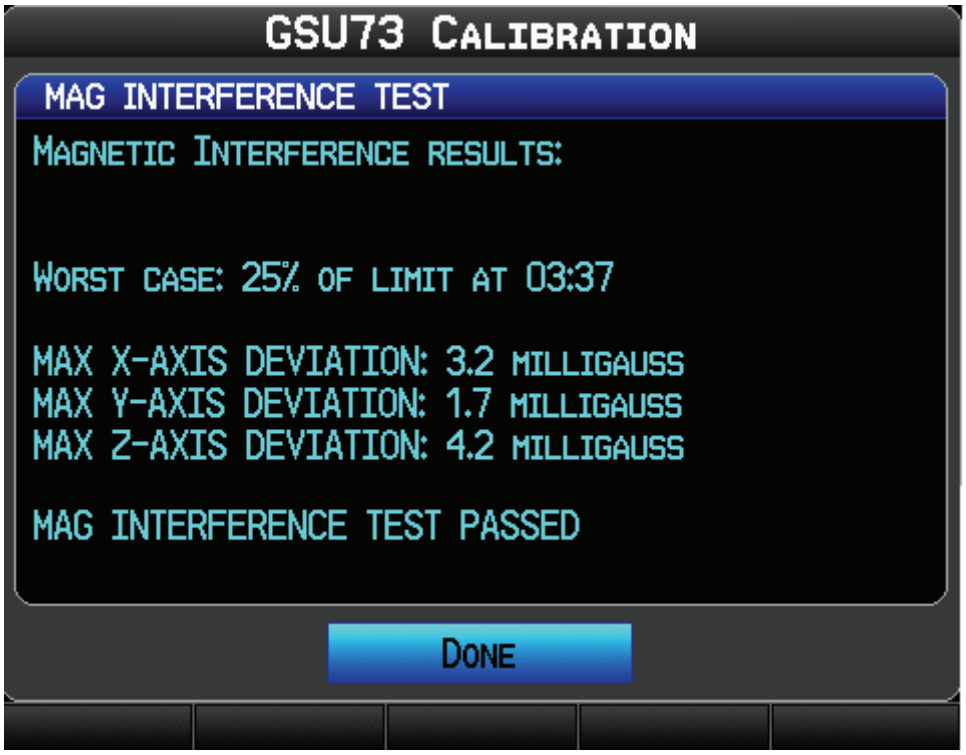


Table 9-4 Magnetometer Interference Test Sequence Example

Elapsed Time Since Start of Test (min:secs)	Action
0:00	Test begins
0:10	Aileron full right
0:20	Aileron full left
0:30	Aileron level
0:40	Elevator up
0:50	Elevator down
1:00	Elevator level
1:20	Rudder left
1:40	Rudder right
1:50	Rudder center
2:00	Flaps down
2:10	Flaps up

Table 9-4 Magnetometer Interference Test Sequence Example

Elapsed Time Since Start of Test (min:secs)	Action
2:20	Autopilot on
2:30	Autopilot off
2:40	Landing gear up
2:50	Landing gear down
3:00	Speed brake up
3:10	Speed brake down
3:20	Navigation lights on
3:30	Navigation lights off
3:40	Landing lights on
3:50	Landing lights off
4:00	Taxi lights on
4:10	Taxi lights off
4:20	Landing + Taxi lights on
4:30	Landing + Taxi lights off
4:40	Strobes on
4:50	Strobes off
5:00	Recognition lights on
5:10	Recognition lights off
5:20	Turn on all wing-tip lights simultaneously (typically will include navigation lights, recognition lights and strobe)
5:30	Turn off all wing-tip lights simultaneously
5:40	Beacon on
5:50	Beacon off
6:00	Pitot heat on
6:10	Pitot heat off
6:20	End of test

If the test fails, the installation should be considered unreliable until the source of magnetic interference is identified and remedied. The magnetometer interference test must be repeated until passed. When the magnetometer interference test fails, record the three magnetometer maximum deviation values and their corresponding timestamps. A maximum deviation value greater than 5.0 milliGauss in either the X or Y axes, or greater than 8.0 milliGauss in the Z axis indicates a problem that must be resolved. Compare the corresponding timestamps with the prepared test sequence to identify which action produced the problem. Contact Garmin for assistance in resolving the problem.

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NOTE

Two common reasons for a failed magnetometer interference test are:

1) New equipment is installed in close proximity to the GMU 44 magnetometer.

2) An existing or new electronic device has become grounded through the aircraft structure instead of via the proper ground wire in a twisted shielded pair.

9.3.4 Calibration Procedure D: Magnetometer Calibration

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NOTE

Calibration Procedure B must be successfully completed prior to Calibration Procedure D.

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NOTE

Calibration Procedure D must be carried out at a location that is determined to be free of magnetic disturbances, such as a compass rose. Attempting to carry out this maneuver on a typical ramp area will not yield a successful calibration. The accuracy of the AHRS cannot be guaranteed if this calibration is not performed at a magnetically clean location. A method for evaluating the magnetic disturbances at a candidate site is described in Section 9.3.7.

Taxi the aircraft to a site that has been determined to be free of magnetic disturbances. Ensure that there are no nearby magnetic materials on or near the perimeter of the site. If unavoidable, maneuver the aircraft to keep the magnetometer from passing within twenty feet (6.1 meters) of such objects. Additionally ensure that vehicles or other aircraft are an adequate distance [forty feet (12.2 meters)] away from the aircraft under test.

At the site, align the aircraft to a heading of magnetic north (±5°). It is best to offset the aircraft position to the left (west) of the North/South axis to allow turning clockwise around the site as indicated in Figure 9-3.

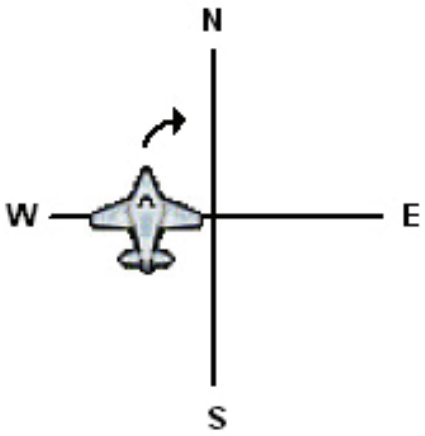
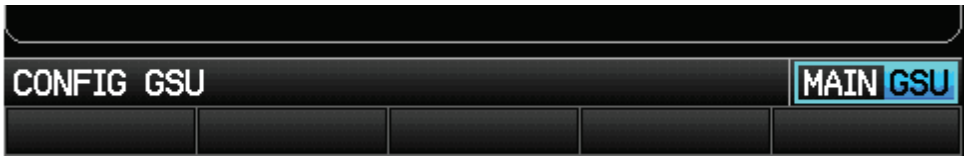


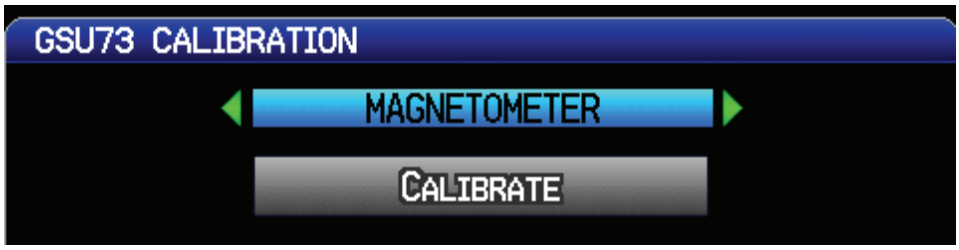
Figure 9-3 Aircraft Alignment

With the aircraft stationary, initiate the GSU 73 AHRS magnetometer calibration procedure as follows:

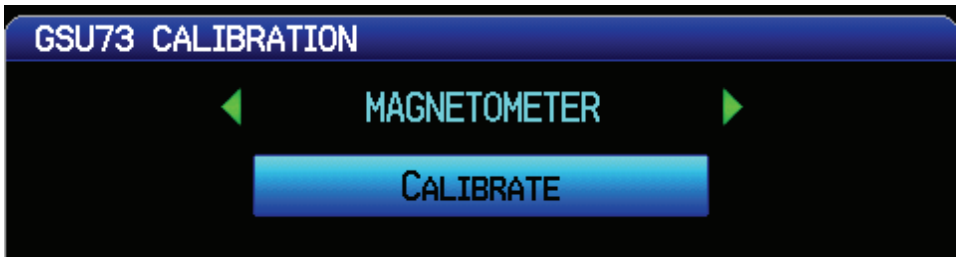
1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).



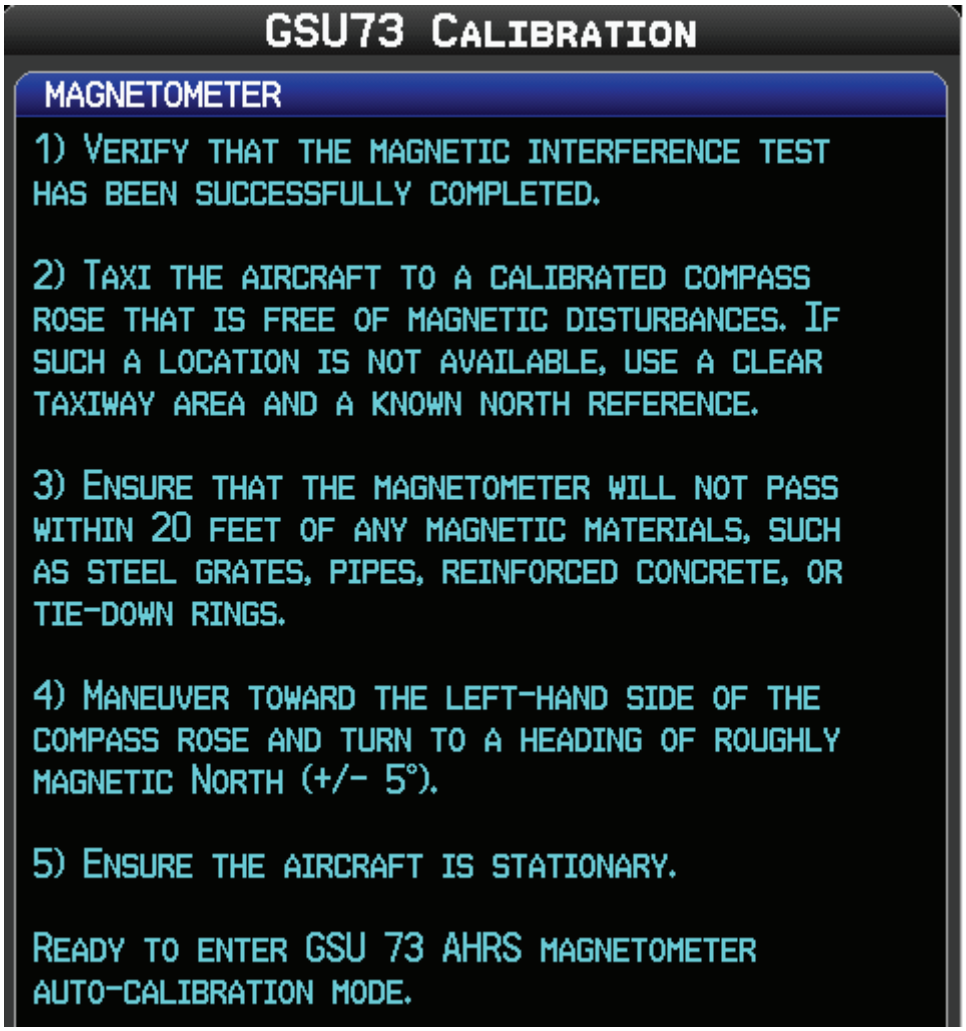
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. Ensure that all the required status boxes are checked (Tables 9-2 and 9-3).
5. On the GSU Status Page, use the FMS Joystick to select MAGNETOMER.



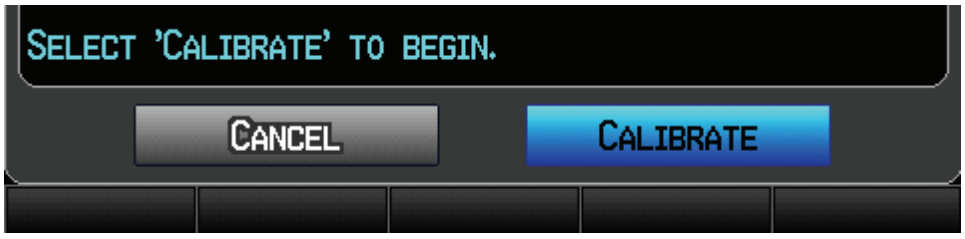
6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.



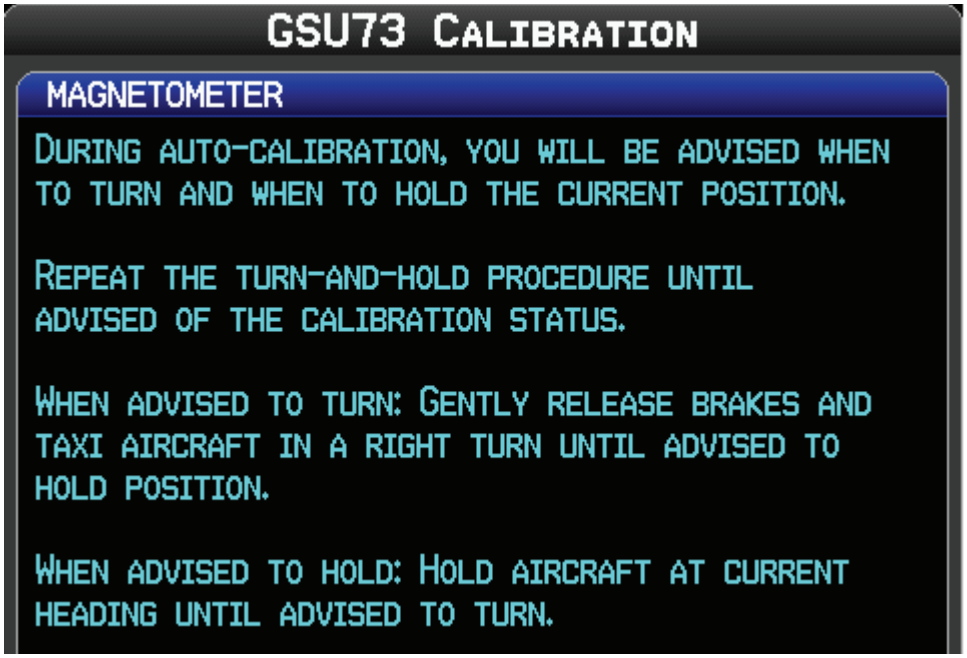
7. Ensure that all on-screen instructions have been complied with.



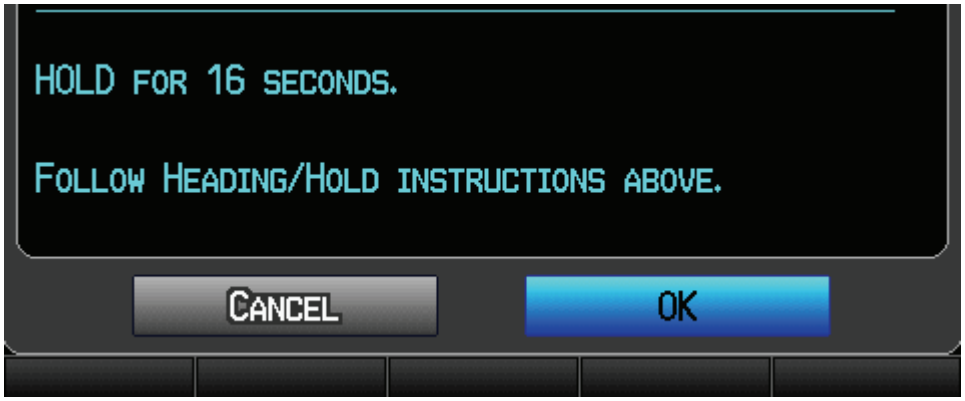
8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. On-screen instructions are displayed.



10. The PFD advises the operator when to turn the aircraft, when to stop, and when to turn again.



11. Upon instruction to turn, taxi the aircraft in a right turn. After approximately 30° of turn from the last heading, the PFD instructs the operator to stop the aircraft.

.

NOTE

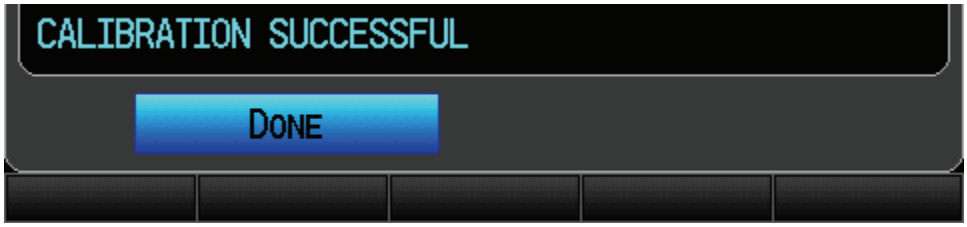
Due to the difficulties in executing smooth, accurate turns the PFD may incorrectly interpret a station and instruct to "HOLD POSITION" prior to full completion of a 30° turn. If this occurs, it is best for the operator to ignore the "HOLD POSITION" command and instead use outside references to complete the approximate 30° of 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 a successful calibration.

12. 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 if stations are skipped, a minimum of 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."

13. When the calibration is finished, a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



9.3.5 Calibration Procedure E: Engine Run-Up Vibration Test

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NOTE

Calibration Procedure E is required for all installations to validate the vibration characteristics of the installation. Calibration Procedures B through D are not required prior to this procedure.

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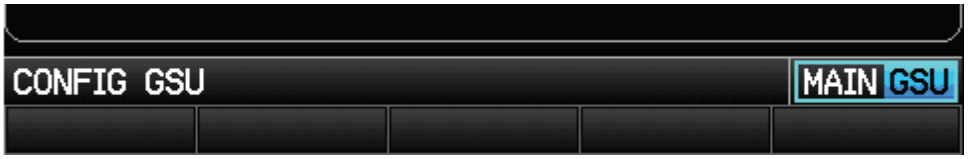
NOTE

Passing the Engine Run-Up Vibration test does not remove the requirement to rigidly mount the GSU 73 to the aircraft primary structure. The Engine Run-Up Vibration Test is intended to help discover mounting issues but successful completion of the test does not validate the mounting of the GSU and GMU, and does not account for all possible vibration profiles that may be encountered during normal aircraft operation

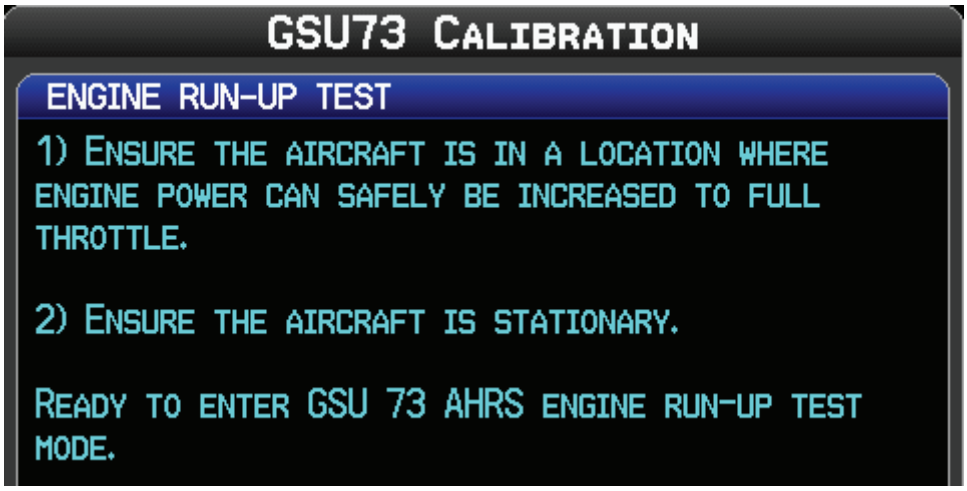
1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).



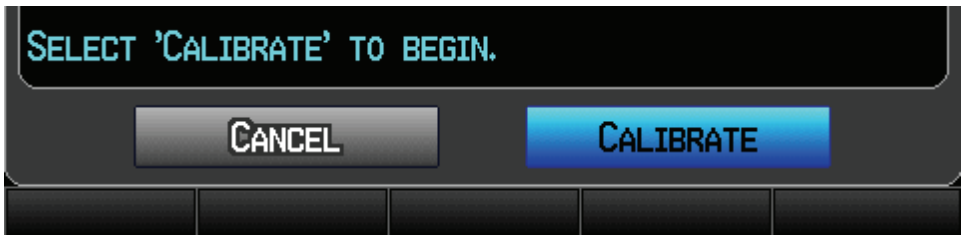
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. Ensure that all the required status boxes are checked (Tables 9-2 and 9-3).
5. Use the FMS Joystick to select ENGINE RUN-UP TEST.

6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

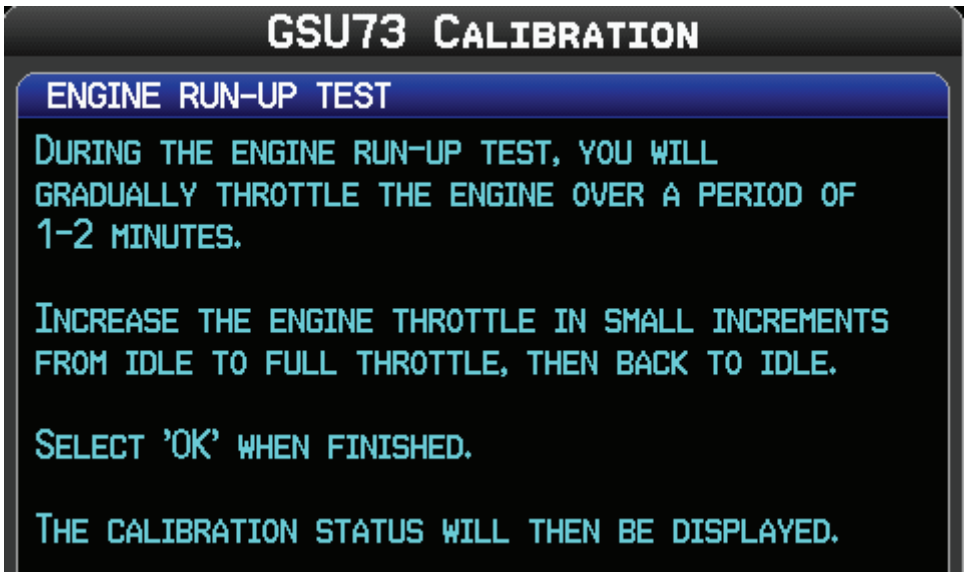
7. Ensure that the aircraft has been properly positioned per the on-screen instructions.



8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



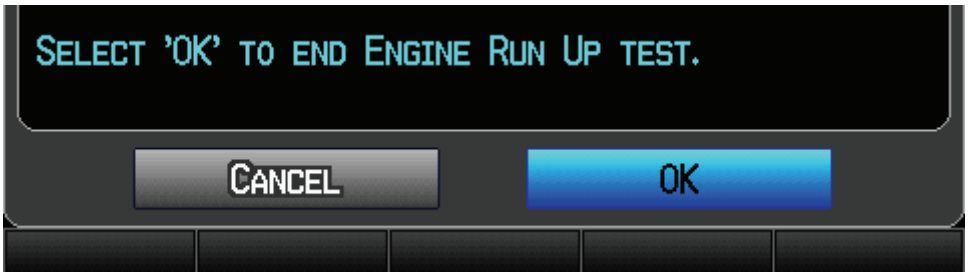
9. The PFD display instructs the operator to gradually increase power from idle to full throttle and back to idle over the course of 1-2 minutes, follow the on-screen instructions.

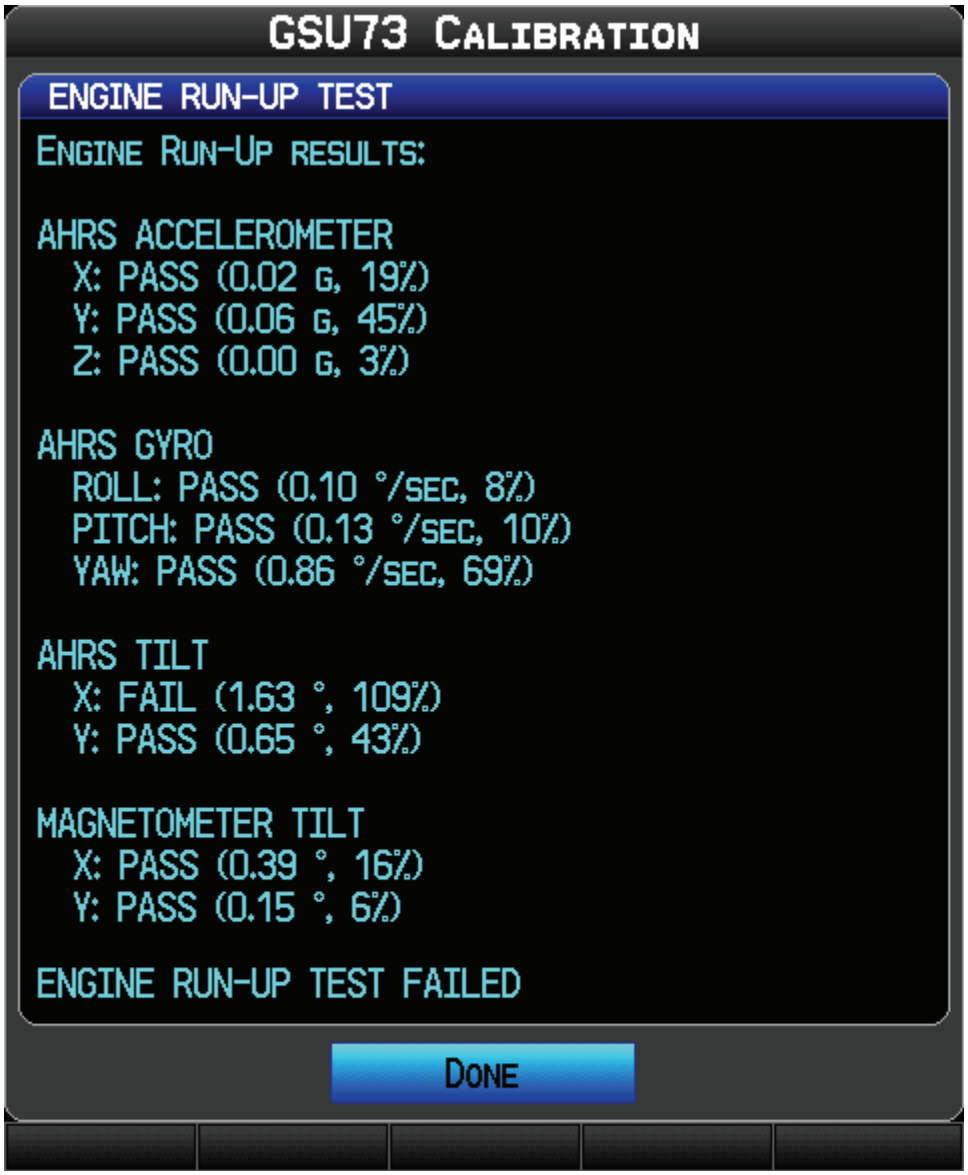


NOTE

If failures are indicated, the engine run-up test may be repeated up to three times. If the test does not pass after three attempts, the installation should be considered unreliable until the source of the vibration problem is identified and remedied. If the engine run-up test fails repeatedly, record the values that are reported to be out of range for future reference.

10. Select OK to end the test, the test results will be displayed.





The following are potential causes for failure of the engine run-up test:

a) Excessive flexing of GSU 73 and/or GMU 44 mechanical mounting with respect to airframe (See Sections 4 and 5 for applicable mounting requirements and instructions).

b) Vibration or motion of GSU 73 and/or GMU 44 caused by neighboring equipment and/or supports.

c) Mounting of GSU 73 at a location that is subject to severe vibrations (example; close to an engine mount.)

d) Mounting screws and other hardware for GSU 73 and/or GMU 44 not firmly attached.

e) Absence of recommended mounting supports.

f) GSU 73 connector not firmly attached to unit.

g) Cabling leading to GSU 73 or GMU 44 not firmly secured to supporting structure.

h) An engine/propeller combination that is significantly out of balance.

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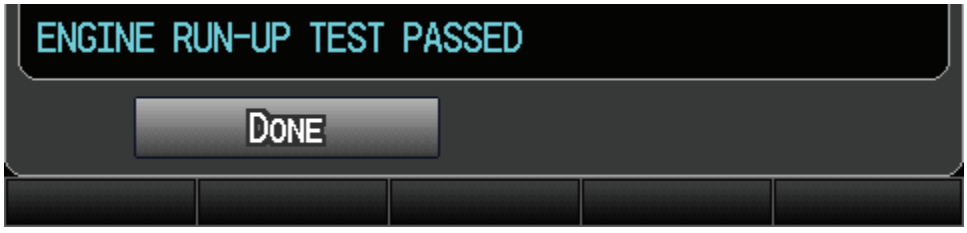
NOTE

In some aircraft, attempting the engine run-up test on a day with very strong and/or gusty winds may cause the test to occasionally fail. However, windy conditions should not be taken as evidence that the test would pass in calm conditions; an actual pass is required before the installation can be considered adequate.

10. After a few minutes the calibration will finish and a Done button will appear at the bottom of the display, ensure that a ENGINE RUN-UP TEST PASSED message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



9.3.6 Calibration Procedure F: Heading Offset Compensation

This procedure is optional, and generally not recommended as it is difficult to orient the entire aircraft with an absolute accuracy of less than a few degrees. This procedure is required only when the GMU 44 Magnetometer has not been installed facing forward and parallel to within 0.5º of the aircraft longitudinal axis. For calibration accuracy, maneuver the aircraft with assistance from outside the cockpit to precisely align the aircraft to cardinal compass heading reference lines on the compass rose.

In order to accomplish the necessary degree of accuracy in heading alignment, it is generally required that the aircraft be physically towed by hand. Towing tugs should not be used as they distort the magnetic field in their vicinity.

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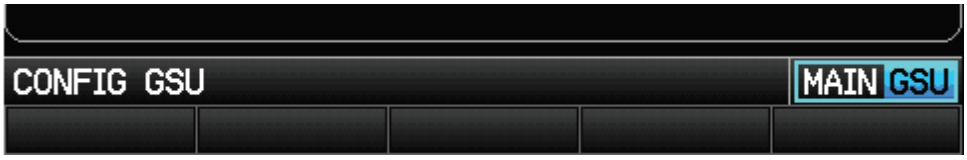
NOTE

Calibration Procedures B and D must have been successfully completed before Calibration Procedure F can be performed.

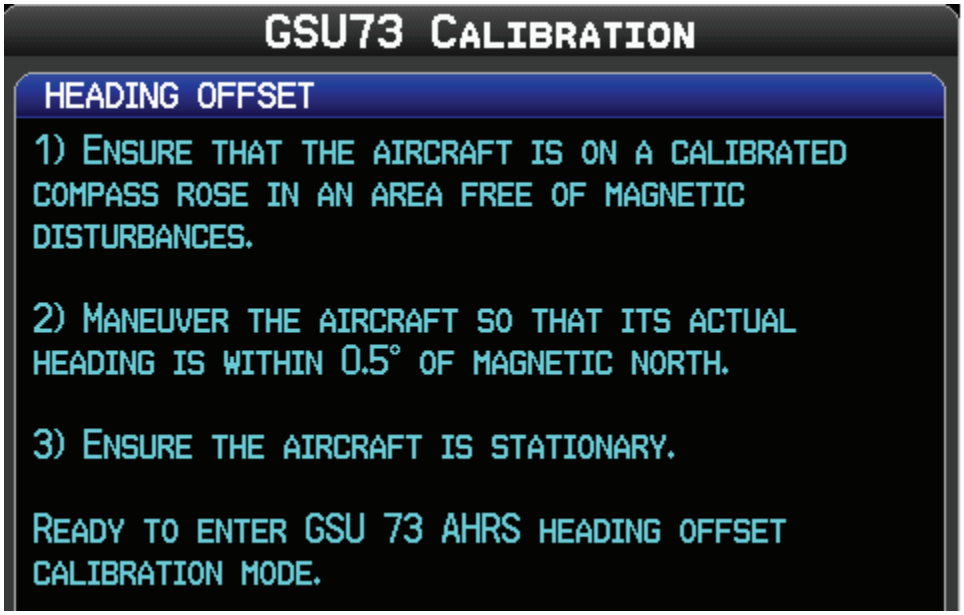
1. Enter configuration mode by holding down the left-hand softkey while powering on the GDU 37X (if needed).
2. Use the FMS Joystick to select the GSU Page (if needed).



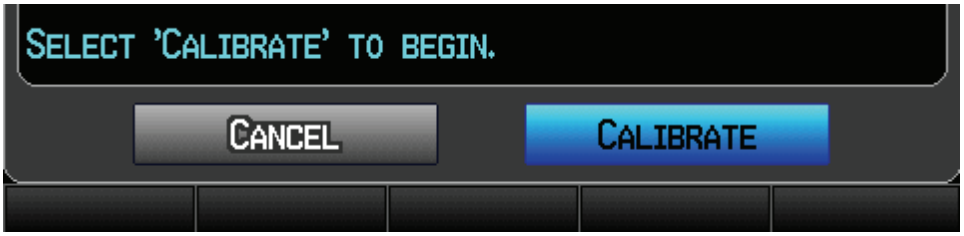
3. Unlock the GSU Page by pressing softkeys 2, 3, 4 in order (if needed).
4. On the GSU Status Page, use the FMS Joystick to select HEADING OFFSET.

5. Ensure that all the required status boxes are checked (Tables 9-2 and 9-3).
6. Use the FMS Joystick to highlight the Calibrate button, press the ENT Key.

7. Ensure that the aircraft has been properly positioned per the on-screen instructions.

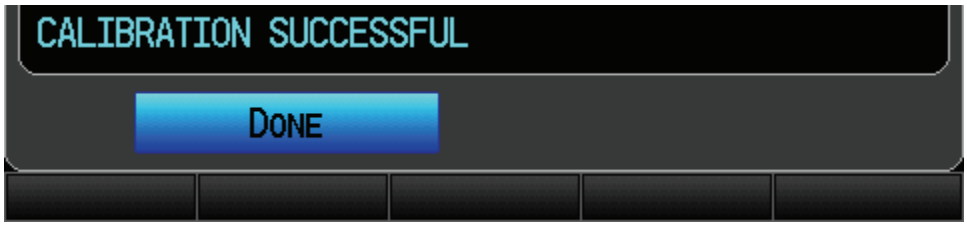


8. Use the FMS Joystick to highlight the Calibrate button at the bottom of the display, press the ENT Key to begin the calibration.



9. The PFD display advises the operator when to turn the aircraft to a cardinal heading, when to stop, and when to turn to another heading. During the procedure, the operator turns to magnetic headings of 360, 090, 180, and 270 degrees, within a tolerance of ±0.25°. Maneuver the aircraft with the longitudinal axis aligned with the desired heading line of the compass rose.
10. Repeat the preceding steps 6, 7, 8, and 9 until a Calibration OK message is displayed.

11. After the complete calibration is finished, a Done button will appear at the bottom of the display, ensure that a CALIBRATION SUCCESSFUL message appears at the bottom of the display, press the ENT Key to return to the GSU Status Page.



9.3.7 Site Evaluation of Magnetic Disturbances for Magnetometer Calibration Procedure

As mentioned in Section 9.3.4, the Magnetometer Calibration Procedure (Calibration Procedure D) must be carried out at a site that is determined to be free of magnetic disturbances.

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 G3X-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 G3X-equipped airplane installation used to evaluate the site must have already completed the pitch/roll offset compensation procedure (Procedure B). However, prior completion of the Magnetometer Calibration Procedure (Procedure C) 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 9.3.3 of this document, with the exception of the direction of turns around the site.

NOTE

Although Section 9.3.4 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 both the clockwise and counter-clockwise directions, 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 perform the procedure 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.

NOTE

The Magnetometer Calibration Procedure must consistently report “CALIBRATION SUCCESSFUL / SITE IS CLEAN” in both the clockwise and counter-clockwise directions for the site to be considered acceptable. More than one failure out of ten attempts in a given direction would be sufficient reason to conclude the site is not acceptable.

A site that is used repeatedly to perform the Magnetometer Calibration Procedure should be re-evaluated every 12 months, and after any significant construction or placement of magnetic objects (above or below ground) within 50 meters of the location.

9.4 External Interface Configuration (Garmin units only)

Refer to Appendix F for wiring the interface connections between GDU 37X LRUs and any external Garmin units such as the GNS 4XX/5XX and GTX transponder products. See the Configuration Guidance instructions on the drawings in Appendix F for specific unit configuration settings. This section lists specific instructions for changing the configuration settings of the external Garmin units (the SL30 and SL40 units do not require configuration).

9.4.1 GNS 400/500 Series Units (including 'A', 'TAWS', & 'WAAS' models)

Entering Configuration Mode:

1. With power applied to the aviation rack and the 400/500 Series unit turned off, press and hold the ENT key and turn the unit on.
2. Release the ENT key when the display activates. The unit is now in configuration mode. After the database pages, the first page displayed is the MAIN ARINC 429 CONFIG page.
3. While in configuration mode, pages can be selected by ensuring the cursor is off and rotating the small right knob, select the desired Config Page.

NOTE

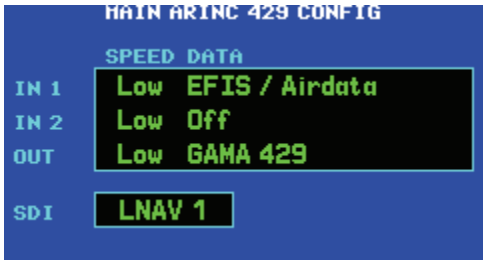
Make configuration changes only as described in this section, changing other configuration settings is not recommended and may significantly alter the unit's operation. Garmin recommends recording all configuration settings (before making any changes) for reference.

Changing data on the displayed configuration pages:

1. Press the small right knob to turn on the cursor.
2. Turn the large right knob to change between data fields.
3. Turn the large or small right knob to change data in the selected field.
4. Press the ENT key to accept the entry.
5. Turn unit off and then back on to return to normal operation.

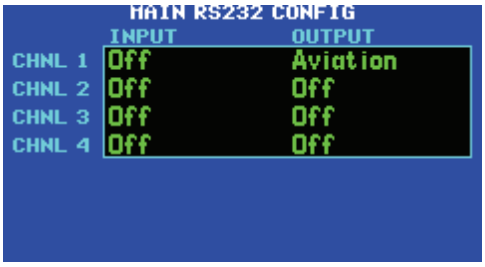
Installation Configuration Pages

The configuration pages are in the order found when rotating the right small knob clockwise starting at the MAIN ARINC 429 CONFIG page. Follow the preceding procedures to enter configuration mode and to select the desired configuration setting (see following figures).

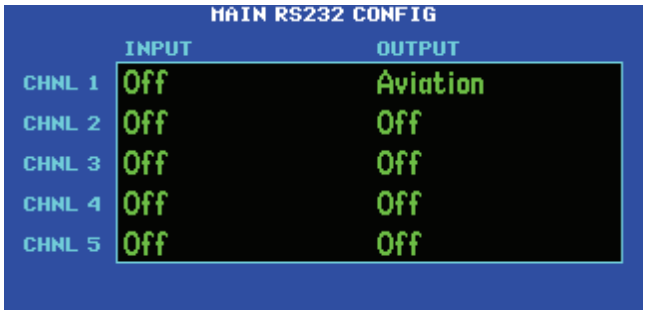


4XX Main ARINC 429 Config Page

5XX Main ARINC 429 Config Page

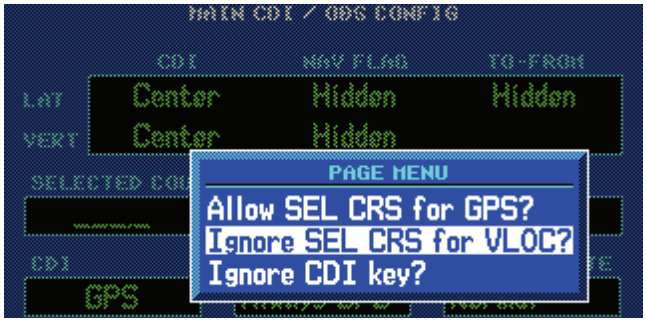


4XX Main RS232 Config Page



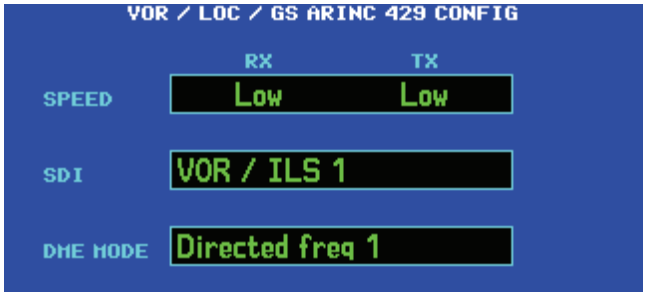
5XX Main RS232 Config Page

4XX Main CDI/OBS Config Page



5XX Main CDI/OBS Config Page

4XX Main VOR/LOC/GS 429 Config Page



5XX Main VOR/LOC/GS 429 Config Page

NOTE

Each output channel can be used to drive up to three RS-232 devices.

9.4.2 GTX 23/327/330 Transponder

Refer to the applicable transponder (GTX 23/327/330) installation manual for configuration mode instructions. The configuration settings are detailed in Appendix F of this document.

NOTE

Make configuration changes only as described in Appendix F, changing other configuration settings is not recommended and may significantly alter the unit's operation. Garmin recommends recording all configuration settings (before making any changes) for reference.

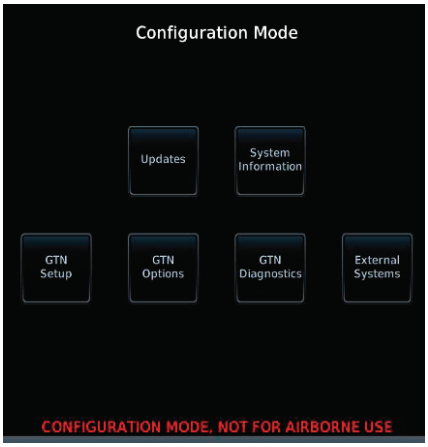
9.4.3 GTN 625/635/650/725/750 Unit

Configuration Mode Operations

Before configuring the GTN, ensure that no Configuration Module service messages are displayed in the message queue. This would indicate that the config module is improperly wired or damaged. Configuration mode is used to configure the GTN settings for each specific installation. While in configuration mode, pages can be selected by touching the desired key on the display. Some pages may require page scrolling to view all of the information and keys on the page. Scrolling is done by touching the screen and dragging the page in the desired direction, or by touching the Up or Down keys.

Entering Configuration Mode:

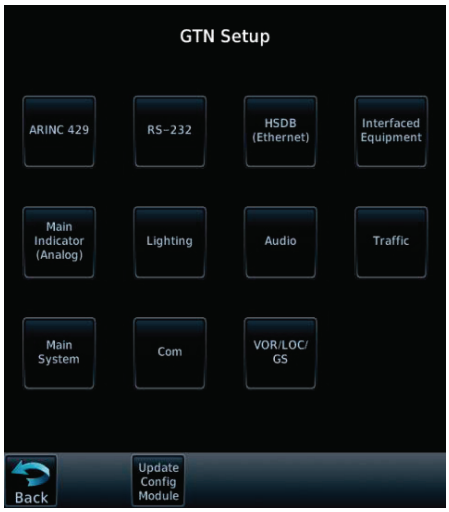
1. With the GTN turned off (circuit breaker pulled), touch and hold the HOME key and reapply power to the GTN (push in the circuit breaker).
2. Release the HOME key when the display activates and the name 'Garmin' appears fully lit on the screen.
3. The first page displayed is the Configuration Mode Home Page.
4. Touch the GTN Setup key.



GTN 7XX Configuration Mode Home Page

5. Follow configuration instructions per applicable drawing in Appendix F.

GTN 6XX GTN Setup Page



GTN 7XX GTN Setup Page

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10 Troubleshooting

In this section the term 'Red-X' refers to a red "X" that appears on different areas of the display to indicate the failure of that particular function.

Refer to the G3X Pilot's Guide (190-01115-00) for a complete listing of System Status Messages.

For additional assistance, contact your G3X Dealer, then for further help (if needed), contact Garmin Aviation Product Support at US Toll Free Number 1-888-606-5482, or US 1-913-397-8200.

NOTE

The information in this section is for troubleshooting use only and does not supersede any approved Maintenance or Installation Manual instructions.

10.1 General Troubleshooting

1. Review the airframe logbook to verify if any G3X or other avionics or electrical maintenance had been performed recently that may have contributed to the failure.
2. Check for loose wire terminals on the circuit breaker connections on the power wire(s) causing intermittent power connections. Also, check for intermittent circuit breakers.
3. Have ground power put on the aircraft.
4. Turn on the G3X and record the system software level on the GDU start up page.
5. After the system is initialized, note any Red-X's on the displays, ALERT messages and Red-X's on the GDU.

If the failure cannot be verified, proceed to the following physical inspection.

1. Turn off the G3X and remove the interior panels to gain access to the GSU 73. Inspect the physical installation of the GSU 73.
2. Check that the connectors are fully seated, and that the jack screw connectors are fully tightened on both sides of the GSU 73 connector.
3. Check for a loose wire harness that is able to move around during flight. This condition may cause the wire to pull on or vibrate the connector, making intermittent connections.
4. Ensure that the GSU 73 is mounted securely. Use a screwdriver to check the tightness of the four mounting screws.
5. Look in the vicinity of the GSU 73 for any heavy objects that may not be fastened tight to the structure and induce GSU 73 vibration.
6. Look for evidence of water or fluid contamination in the area around the GSU 73.
7. Unplug the GSU 73 connector and check for bent pins.
8. Inspect the wire harness clamp on the rear of the connector to verify that it is not too tight and smashing/shorting the wires. If the wire clamp is installed upside down, it has sharp edges that can cut into the wires. Verify the presence of protective wire wrap between the wires and the clamp.

If the condition is not resolved by following the preceding instructions, contact Garmin Product Support for additional assistance. A Garmin Field Service Engineer may ask the technician to download the fault logs to a PC (via the USB port on the GSU 73) and email the logs back to Garmin to help determine if the problem is in the GSU 73 or in the aircraft.

10.2 GDU 37X

10.2.1 SD Card Slot

A stuck or sticking SD card issue can sometimes be caused by the card thickness variability (especially if there is more than one label on the card). This is usually caused by the card sticking in the overlay opening, not by the card sticking to the socket inside the unit. Try another card (without a label if possible) to confirm the problem before returning. If the second card sticks, the SD socket board inside the unit may be misaligned with the overlay and the GDU 37X will require repair. If the thickness of the card was the cause, see if more than one label was on the card. If the labels weren't the cause, determine what brand of SD card was being used (Garmin recommends using SanDisk® brand cards).

10.2.2 Crosstalk Error (Two or Three GDU Systems)

Crosstalk Error messages occur if there is a mismatch in GDU 37X software versions. If this occurs, the GDU's will not communicate with each other, and a software mismatch message will be reported on the INFO page (press the MSG softkey). Ensure both displays are running the same software version to clear the issue.

10.3 Air Data Troubleshooting

Under normal operating conditions, the GSU 73 provides the following air data information:

- Total Air Temperature is measured
- Outside Air Temperature (OAT)
- Indicated Airspeed (IAS)
- True Airspeed (TAS)
- Barometric Altitude
- Density Altitude
- Pressure Altitude
- Static Pressure
- Differential Pressure

NOTE

TAS information can only be displayed at speeds greater than 20 Knots (TAS is invalid when the aircraft is sitting still, or if no OAT probe is connected).

If the TAS indication remains dashed out at speeds greater than 20 knots and/or the OAT indication is dashed out (as shown in Figure 10-1):

1. Check the GTP 59 OAT probe wiring and connection for faults.
2. Check GSU 73 configuration module wiring for damage, replace if any is found.
3. Replace the GTP 59 OAT probe.
4. If the problem persists, replace the GSU 73 with a known good unit.

Figure 10-1 No info for TAS & OAT

If the Airspeed and/or Altitude is failed and shows a Red-X condition as shown in Figure 10-2:

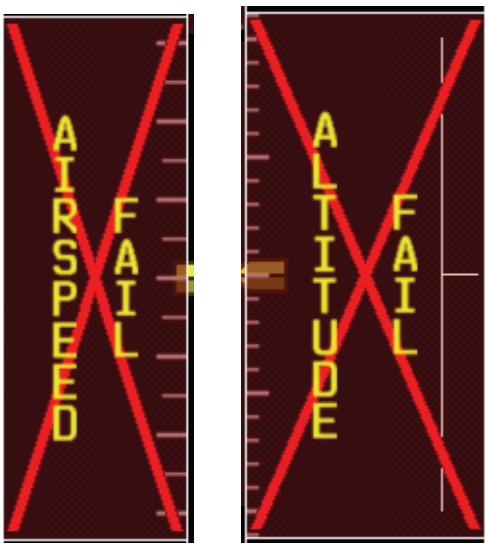

Figure 10-2 Airspeed and Altitude Failure Indications

1. Inspect GSU73 pitot/static plumbing integrity.
2. Inspect pitot/static ports and associated equipment.
3. If the problem persists replace the GSU 73 with a known good unit.

10.4 Engine Indication Troubleshooting

To troubleshoot an Engine Indication failure (Figure 10-3), gather answers to the following questions. This information may be helpful to the installer/pilot, the G3X Dealer, or to Garmin Aviation Product Support in troubleshooting the failure.

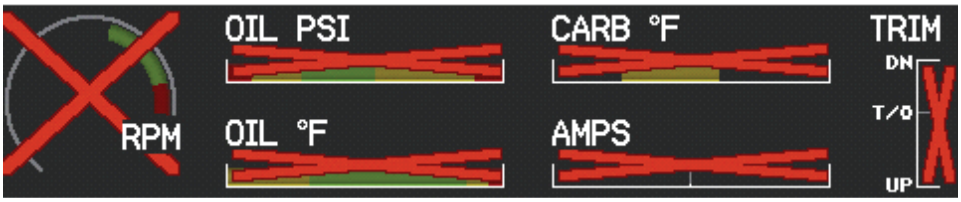

Figure 10-3 Engine/Airframe Failure Indications (Reversionary or Split-Screen PFD)

1. Does cycling power restore operation?
2. Did the operator give it sufficient time to start and initialize?
3. Did the problem begin after a software or configuration load?
4. Did the problem happen on the ground or while airborne?
5. Is only the EGT/CHT (i.e. thermocouple inputs) Red-X'd? If so, the GSU 73 configuration module, configuration module wiring, thermocouple reference, or applicable thermocouple is defective. Check the wiring and replace the configuration module or applicable thermocouple.
6. Are there one or more temperatures that drop as the electrical load increases? If a temperature probe shorts (usually where the bayonet is crimped) a ground loop is created forcing the reference (low side) to increase which causes the temperature reading to decrease.
7. Does the EGT temperature slowly drift up and eventually flag? This is an indication of an (electrical) open in the temperature probe or wiring.
8. Is the air data information on the PFD intermittently Red-X'ing? If the GSU 73 +5VDC transducer power supply is shorted to ground, it will cause an intermittent air data Red-X issue to occur.
9. If the AMP indication is Red-X'd, check the Alternator Shunt for correct resistance. Refer to the applicable sensor documentation.
10. If the Position Indication is Red-X'd, check the sensor and wiring.
11. For single wire temperature inputs, ensure that the LO input pin is tied to ground as close as is practical to the sensor, grounding the LO input pin away from the sensor may result in inaccurate or invalid readings.

10.5 AHRS Troubleshooting

10.5.1 GSU 73 Operational Conditions

GSU 73 ground operation is heavily dependent on GPS data inputs. Be sure to correct any GPS performance problems (i.e. interference caused by anything that transmits in the area) before troubleshooting the GSU 73/GMU 44. For GPS data to be considered usable, the receiver must be tracking at least 4 satellites and have a 3D GPS Solution.

GSU 73 AHRS operation needs at least two of three inputs from the GPS receiver, the GMU 44, and the Air data (also part of the GSU 73) for proper operation. See Table 10-1 below for the attitude and heading outputs the GSU 73 can provide based on the available data inputs.

Table 10-1 GSU 73 AHRS Operating Mode Table

GSU 73 Mode	GSU 73 Input			GSU 73 Output		
	GPS Data	GMU44 Data	Air Data	Heading	Pitch	Roll
Primary	Good	Good	Doesn't matter	Valid	Valid	Valid
Reversion No GPS	Bad	Good	Good	Valid	Valid	Valid
Reversion No Mag	Good	Bad or anomaly	Good	Invalid	Valid	Valid
Reversion No Mag, No Air	Good	Bad or anomaly	Bad	Invalid	Valid	Valid
Coast On Gyros	Bad	Either or Both Bad		Invalid	Invalid	Invalid
Output Unreliable	Bad	Either or Both Bad		Invalid	Invalid	Invalid

Table 10-2 shows the pitch and roll limits that the pilot must maintain for the GSU 73 to realign itself (Figure 10-4) these may be helpful if the pilot feels that the in-flight realignment is taking too long or does not seem to be reinitializing. If the pilot was performing maneuvers outside these limits, the GSU 73 may not properly reinitialize.

Table 10-2 GSU 73 AHRS Pitch/Bank Limitations for Cold Start While Airborne

	Sensor Inputs Available and Valid					
Mode of Operation Entered Following Initialization	All Inertials	GPS	Mag	Air Data (internal)	Bank Limit in Degrees	Pitch Limit in Degrees
Primary	YES	YES	YES	NA	± 20.0	± 5.0
Reversion No GPS	YES	NO	YES	YES	± 10.0	± 5.0
Reversion No Mag	YES	YES	NO	YES	± 10.0	± 5.0
Reversion No Mag, No Air	YES	YES	NO	NO	± 10.0	± 5.0

Figure 10-4 AHRS Align Message (PFD)

10.5.2 Heading Red-X

Figure 10-5 Heading Failure Indication (Full-Screen PFD)

If a Red-X (steady or intermittent) is displayed on the heading (Figure 10-5), check the following while the aircraft is on the ground:

1. When taxiing without reliable GPS information, heading performance is susceptible to the presence of magnetic anomalies (metal buildings, underground steel culverts, steel grates in the ramp, rebar). Localized sources of interference on the ground may consistently cause a Red-X to be displayed on the heading in the same spot while taxiing, this is not caused by a failure of the GMU 44 or its calibration.
2. When the aircraft is taxiing on the ground with a yaw rate of less than 1.5 degrees/second (i.e., taxiing essentially in a straight line) GPS track information is used to update heading information. This logic is applied regardless of magnetic anomaly detection.
3. The GDU may display Red-X on the heading if the GSU 73 does not have GPS information, or if it senses a magnetic anomaly.

4. While a magnetic anomaly is detected and the aircraft is determined to be stationary, the value of the heading output is frozen. When either the aircraft is determined to be no longer stationary or the magnetic anomaly ceases, heading will be unfrozen and determined as useable. In this context, the aircraft is considered to be stationary when its yaw rate is less than 1.0 degrees/second and all other angular rate and acceleration values are sufficiently small. (moving or shaking the wings or tail for example can cause a Red-X to be displayed).
5. Check to see if any new equipment has been installed on the aircraft, and reference Table 3-7 for minimum distances for installed equipment from the GMU 44 to prevent interference.

If the GMU 44 heading is not present on the GDU 37X, there may be a problem with the RS-232 or RS-485 line between the GSU 73 and GMU 44. Troubleshoot any possible wiring/connector issues before replacing either unit.

10.5.3 Attitude/Heading Failure Troubleshooting

Figure 10-6 Attitude and Heading Failure Indications (Reversionary or Split-Screen PFD)

Prior to troubleshooting an Attitude Failure, gather answers to the following questions. This information may be helpful to the installer/pilot, the G3X Dealer, or to Garmin Aviation Product Support in troubleshooting the failure.

1. What specifically was the nature of the failure? Was it a Red-X of only heading, only pitch/roll, or both?
2. If there was a Red-X of pitch or roll information, did the PFD display the "AHRS Align: Keep Wings Level" message (which is indicative of an AHRS reset), or the "Attitude Fail" message (which is indicative of either AHRS invalidating its output, or a communication path failure)?
3. What exactly was the aircraft doing in the two minutes that preceded the failure (taxing on the ground, flying straight-and-level flight, turning, climbing, etc)? If the problem occurred on the ground, was it within 100 feet of a hanger using GPS repeaters?
4. How long did the failure last? Was it brief or sustained? Was it repetitive in nature? If it was repetitive, about how many times did it happen? Did it happen on more than one day?

5. Was the problem correlated with a specific maneuver or a specific geographic area?
6. Can the problem be repeated reliably?
7. Were any of the following message advisory alerts observed (must navigate to the INFO page and press the MSG softkey to see them) within an hour of the occurrence of the problem?
   - AHRS not receiving airspeed
   - AHRS not receiving any GPS information
   - AHRS magnetic-field model out of date
   - AHRS extended operation in no-GPS mode
8. Did the onset of the problem occur shortly after a software upload to one or more of the G3X LRU's, or shortly after a repeat of the magnetometer calibration procedure?
9. Were there any GPS Alert messages or loss of position lock?

The GSU 73 may not be able to provide valid heading/pitch/roll data for the following reasons:

1. If an "AHRS not Calibrated" message is displayed, the GSU 73 external memory module in the harness (that stores the installation configuration parameters) is either not present or not wired properly. In this case, either:
   - The GSU 73 configuration module is inoperative. OR
   - The external installation configuration parameters are not calibrated and the AHRS and/or Magnetometer calibration needs to be performed. If either of these is not calibrated, the GSU 73 heading, pitch, and roll may all be flagged as invalid. Calibrate the unit to the installation.
2. There is not sufficient or valid sensor information being provided to the GSU 73 for it to compute valid attitude information. Table 10-1 summarizes the inputs the GSU needs to provide Attitude and Heading information.

10.6 Post Installation Calibration Procedures

The calibration procedures in Sections 9.3.3 and 9.3.5 may be performed during troubleshooting. Tables 9-2 and 9-3 list the status box requirements for each calibration procedure. The Magnetometer Interference Test may be used to determine if the location of the GMU 44 is susceptible to magnetic interference. The Engine Run-Up Vibration Test can be used to determine if the mounting of the GSU 73 and GMU 44 are susceptible to aircraft vibration.

NOTE

Passing the Engine Run-Up Vibration test does not remove the requirement to rigidly mount the GSU 73 to the aircraft primary structure. The Engine Run-Up Vibration Test is intended to help discover mounting issues but successful completion of the test does not validate the mounting of the GSU and GMU, and does not account for all possible vibration profiles that may be encountered during normal aircraft operation

10.7 GSU 73 Data Logging

The GSU 73 Data Logger may be used to help troubleshoot G3X issues. Operational data can be gathered from the GSU 73 during flight or on ground, and stored in a data file on a PC. The data file can then be uploaded to the Garmin website and used by Garmin product support to diagnose the issue.

10.7.1 Downloading and Installing the GSU 73 Data Logger

The GSU 73 Data Logger can be downloaded for free via the G3X product page on the Garmin website www.garmin.com. Download and install the data logger by using the link and following the on-screen prompts.

The installation wizard for the GSU 73 USB logging tool creates a desktop shortcut, adds the tool to the program menu, and installs any required programs that could not be found on the target machine. The wizard allows the installer to choose the folder location that will store the program and the associated data logger files. The installation requires that the target machine has a Windows XP or later operating system and that the user is an administrator on that PC. Once the file has been downloaded and installed, it can be used to create a diagnostic data file to be uploaded to Garmin product support.

10.7.2 GSU 73 USB Logging Tool Operation

Connect one end of a USB cable to the USB port of the PC, and the other end to the mini-USB connector on the GSU 73. The cable can be connected before or after the PC and the G3X are powered on.

NOTE

The "found new hardware" pop-up may be displayed during the initial connection of the GSU 73 to the PC. Follow the on-screen prompts to locate the device driver, disconnect and reconnect the GSU 73, then proceed with the following instructions.

1. Make sure that the PC and the G3X are powered on.
2. Start the GSU 73 Data Logger by double-clicking on the desktop shortcut.
3. To begin USB logging, click the 'Start' button.

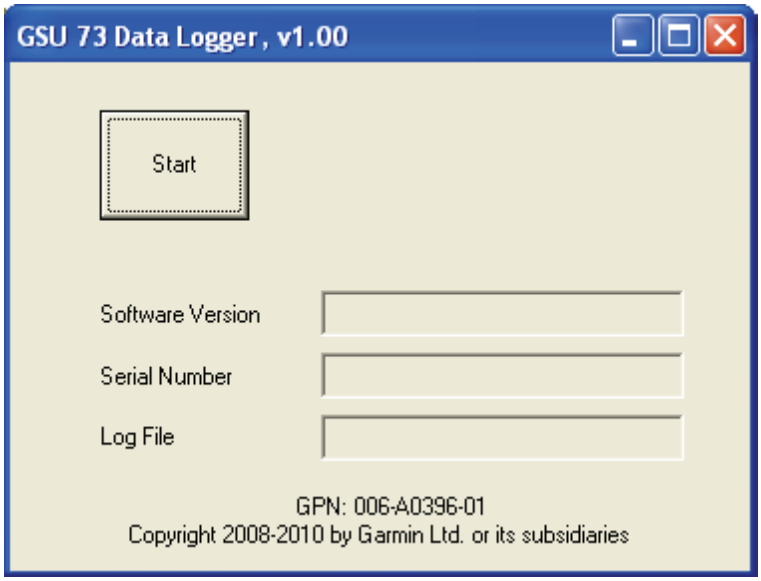

Figure 10-7 Data Logger, Start Screen

4. The Data Logger requests product data, then downloads 7 regions from the GSU 73 to the PC. The full path is displayed on the user interface of the logging tool. The log file name includes the date and time when the logging began. Each power-on of the GSU 73 or Start/Stop of the tool has a separate log file.

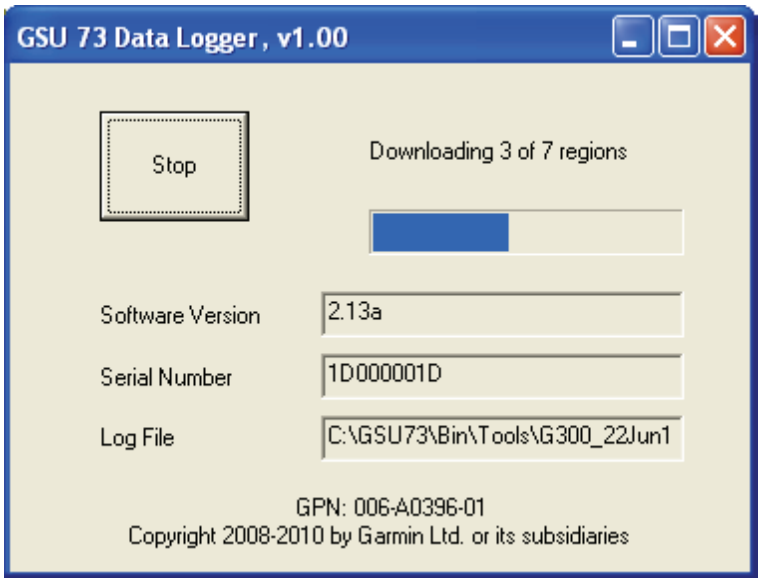

Figure 10-8 Data Logger, Download Screen

5. After the region download process has completed, 'Recording!' is displayed and the logging tool begins storing received data in the specified log file.
6. Click on the Stop button to end the data recording session.

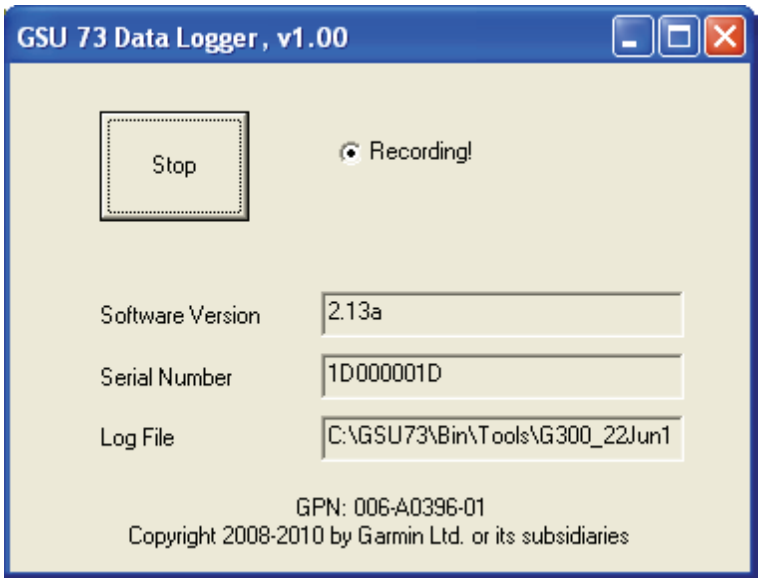

Figure 10-9 Data Logger, Recording Screen

7. If the logging tool loses data connection to the GSU 73, it will continuously check to see if the connection has been reestablished. This allows the tool to auto-restart, and eliminates the need for pilots to interact with the tool in flight.

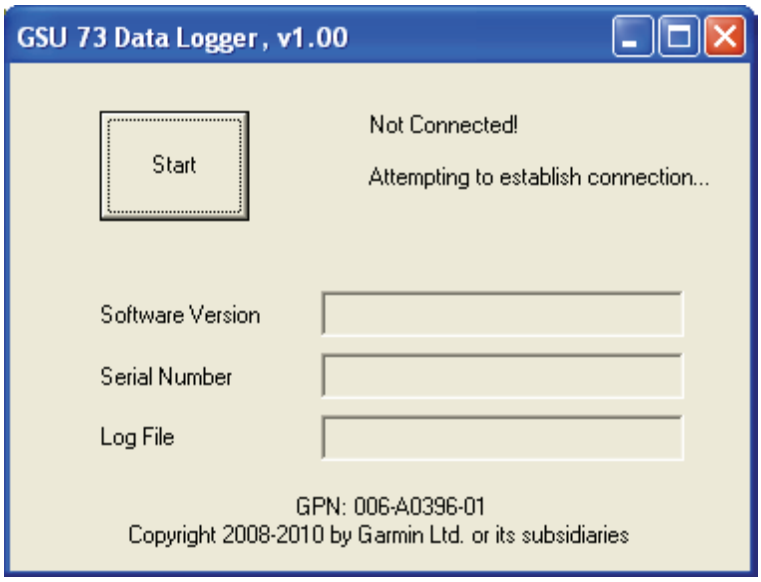

Figure 10-10 Data Logger, Connection Screen

10.7.3 Uploading the Data File

To upload a data file created with the GSU 73 Data Logging Tool, return to the G3X product page (on the Garmin website www.garmin.com) and select the Data Log Upload Form.

Follow the on-screen instructions to enter the required information and attach the data file to upload, then select Submit. The file and associated information is then sent to the Garmin Aviation Product Support team for analysis.

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11 Return to Service Information

These return to service procedures are intended to verify the serviceability of the appliance only. These tests alone do not verify or otherwise validate the airworthiness of the installation.

11.1 GDU 37X

11.1.1 Original GDU 37X is Reinstalled

No software or configuration loading is required if the original GDU 37X is reinstalled. Continue to Section 11.2.

11.1.2 Original GDU 37X(s) Installed in a Different Position

No software or configuration loading is required if the GDU 37X is installed in a different location. Continue to Section 11.2.

11.1.3 New GDU 37X(s) Installed

If a new GDU 37X is installed (new serial number), verify the correct software version on the MAIN page in configuration mode. Additionally verify that all installed displays have the same software version, as well as NavData, terrain, and obstacle databases. If the correct software version is not installed, update the displays to the current G3X system software available on the web. No configuration is required if the configuration module is still operational. Continue to Section 11.2.

11.1.4 New GDU 37X (PFD) Configuration Module Installed

Ensure that a new configuration module is obtained for the replacement installation. If a new configuration module is installed and no change is made to the PFD, the PFD will write the required configuration information to the configuration module. If the PFD and the configuration module are both replaced, the system will need to be configured (Section 7).

NOTE

Do not use a used GDU configuration module as a replacement. Data that may reside on the used configuration module may cause system configuration errors.

11.2 GSU 73

NOTE

A pitot/static check as outlined in 91.411 and Part 43 Appendix E must be completed if the pitot/static lines are broken.

11.2.1 Original GSU 73 is Reinstalled

No software or configuration loading is required if the original GSU 73 is reinstalled. Continue to Section 11.3.

11.2.2 New GSU 73 Installed

If a new GSU 73 is installed (new serial number), verify the correct software version on the MAIN page in configuration mode. If the correct software version is not installed, load the GSU 73 software contained in the G3X system software loaded to the displays. If the configuration module is operational, no software configuration is required. Continue to Section 11.3.

11.3 GMU 44

NOTE

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

11.3.1 GMU 44 is Reinstalled

Any time a GMU 44 is reinstalled, a new magnetometer calibration is required (Section 9.3.4). Continue to Section 11.3.2

11.3.2 New GMU 44 Installed

If a new GMU 44 is installed (new serial number), a new magnetometer calibration (Section 9.3.4) and verification of the correct software version (Section 7.3.1) is required. If the correct software version is not installed, load the GMU 44 software contained in the G3X system software which is loaded to the displays (Section 7.2). Following a successful magnetometer calibration, and software verification the Return to Service Procedure is complete.

APPENDIX A Pinouts

A.1 GDU 37X

A.1.1 P3701 Connector

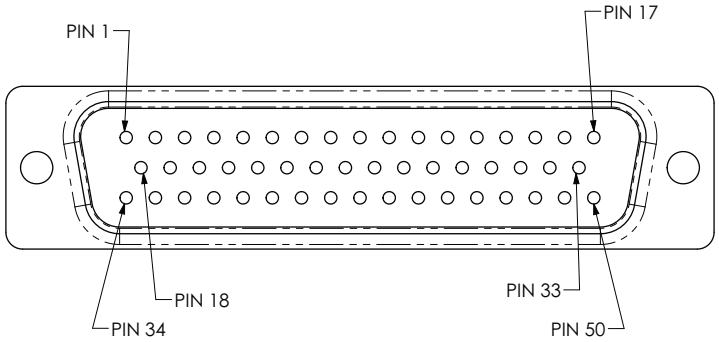

Figure A-1 View of J3701 Connector from Back of Unit

Pin	Pin Name	I/O
1	MONO AUDIO OUT HI	Out
2	STEREO AUDIO OUT LO	--
3	STEREO AUDIO OUT LEFT	Out
4	SPARE	--
5	SPARE	--
6	SPARE	--
7	SPARE	--
8	SPARE	--
9	CDU SYSTEM ID PROGRAM* 2	In
10	CDU SYSTEM ID PROGRAM* 1	In
11	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	--
12	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	--
13	RS-232 OUT 3	Out
14	RS-232 IN 2	In
15	POWER GROUND	--
16	POWER GROUND	--
17	CONFIG MODULE POWER OUT	Out
18	MONO AUDIO OUT LO	--
19	STEREO AUDIO OUT RIGHT	Out
20	STEREO AUDIO OUT LO	--
21	SPARE	--
22	SPARE	--
23	SPARE	--
24	SPARE	--
25	CDU SYSTEM ID PROGRAM* 3	In
26	28V LIGHTING BUS HI	In

P3701 Connector, continued

Pin	Pin Name	I/O
27	SIGNAL GROUND	--
28	CAN BUS TERMINATION	--
29	RS-232 IN 3	In
30	RS-232 OUT 2	Out
31	AIRCRAFT POWER 2	In
32	AIRCRAFT POWER 1	In
33	CONFIG MODULE CLOCK	I/O
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	SPARE	--
39	SPARE	--
40	SPARE	--
41	SPARE	--
42	CDU SYSTEM ID PROGRAM* 4	In
43	14V LIGHTING BUS HI	In
44	SIGNAL GROUND	--
45	CAN BUS LO	I/O
46	CAN BUS HI	I/O
47	RS-232 IN 1	In
48	RS-232 OUT 1	Out
49	CONFIG MODULE GROUND	--
50	CONFIG MODULE DATA	I/O

* Indicates Active Low

A.1.2 Aircraft Power

AIRCRAFT POWER 1 AND AIRCRAFT POWER 2 are “diode ORed” to provide aircraft power redundancy. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P3701	32	In
AIRCRAFT POWER 2	P3701	31	In
POWER GROUND	P3701	15	--
POWER GROUND	P3701	16	--

A.1.3 Mode Selections

Configure the GDU 37X units per the following tables.

A GDU 37X can be manually placed in reversionary mode by wiring Pin 25 to a two pole switch that toggles between open and ground. When the switch is open, the display will operate normally. When the switch is grounded, the display changes to reversionary mode, showing the engine bar at the top of the display and a split screen PFD and MFD below. Other displays in the system will not be affected by manually placing a display into reversionary mode.

Do not connect a switch to ground for pins 9 or 10, doing so can cause communication errors.

Grounding pin 42 will place the GDU 37X in Demo mode, which is for in-store demonstration use only, never ground pin 42 in an aircraft installation.

CDU SYSTEM ID PROGRAM* 1, P3701 Pin 10	CDU SYSTEM ID PROGRAM* 2, P3701 Pin 9	GDU Mode
Open	Open	MFD
Ground	Open	PFD1
Open	Ground	PFD2
Ground	Ground	Do Not Use

CDU SYSTEM ID PROGRAM* 3 P3701 Pin 25	GDU Mode
Open	Auto Reversionary
Ground	Forced Reversionary

CDU SYSTEM ID PROGRAM* 4 P3701 Pin 42	GDU Mode
Open	Normal Operation
Ground	Demo Mode

A.1.4 Serial Data

A.1.4.1 RS-232

3 Channels of RS-232 I/O data.

Pin Name	Connector	Pin	I/O
RS-232 IN 1	P3701	47	In
RS-232 OUT 1	P3701	48	Out
RS-232 IN 2	P3701	14	In
RS-232 OUT 2	P3701	30	Out
RS-232 IN 3	P3701	29	In
RS-232 OUT 3	P3701	13	Out

A.1.4.2 CAN Bus

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 for the GDU that is located at the end of the bus (farthest from the GSU 73).

Pin Name	Connector	Pin	I/O
CAN BUS HI	P3701	46	I/O
CAN BUS LO	P3701	45	I/O
CAN BUS TERMINATION	P3701	28	--

A.1.4.3 Configuration Module

In multiple GDU 37X installations, it is only necessary to connect a configuration module to PFD1.

Pin Name	Connector	Pin	I/O
CONFIG MODULE CLOCK	P3701	33	I/O
CONFIG MODULE DATA	P3701	50	I/O
CONFIG MODULE POWER OUT	P3701	17	Out
CONFIG MODULE GROUND	P3701	49	--

A.1.5 Lighting

The GDU 37X display and keys can be configured to track 28 VDC or 14 VDC lighting busses using these inputs.

Pin Name	Connector	Pin	I/O
14V LIGHTING BUS HI	P3701	43	In
28V LIGHTING BUS HI	P3701	26	In

A.1.6 Audio

A.1.6.1 Mono Audio

Pin Name	Connector	Pin	I/O
MONO AUDIO OUT HI	P3701	1	Out
MONO AUDIO OUT LO	P3701	18	--

A.1.6.2 Stereo Audio

Pin Name	Connector	Pin	I/O
STEREO AUDIO OUT LEFT	P3701	3	Out
STEREO AUDIO OUT LO	P3701	20	--
STEREO AUDIO OUT RIGHT	P3701	19	Out
STEREO AUDIO OUT LO	P3701	2	--

The left and right common pins (pins 2 and 20) may be tied together or only one may be used. It is not necessary to use both common pins.

A.2 GMU 44

A.2.1 P441 Connector

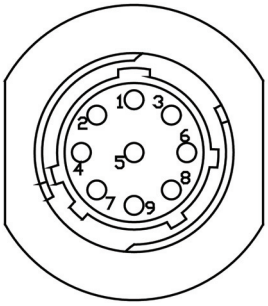

Figure A-2 View of J441 Connector Looking at Rear of Unit

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.2.2 Power Function

Power-input pins accept supply voltage from GSU 73.

Pin Name	Connector	Pin	I/O
+12 VDC POWER, GMU 44	P441	9	In
POWER GROUND, GMU 44	P441	6	--

A.2.3 Serial Data

A.2.3.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 IN	P441	8	In

A.2.3.2 RS-485

Pin Name	Connector	Pin	I/O
RS-485 OUT A	P441	4	Out
RS-485 OUT B	P441	2	Out

A.3 GSU 73

A.3.1 Connector Description

The GSU 73 has one 62-pin connector (J731) and one 78-pin connector (J732) located on the connector end of the unit, as shown below. J731 and J732 are clearly marked on the connector end plate.

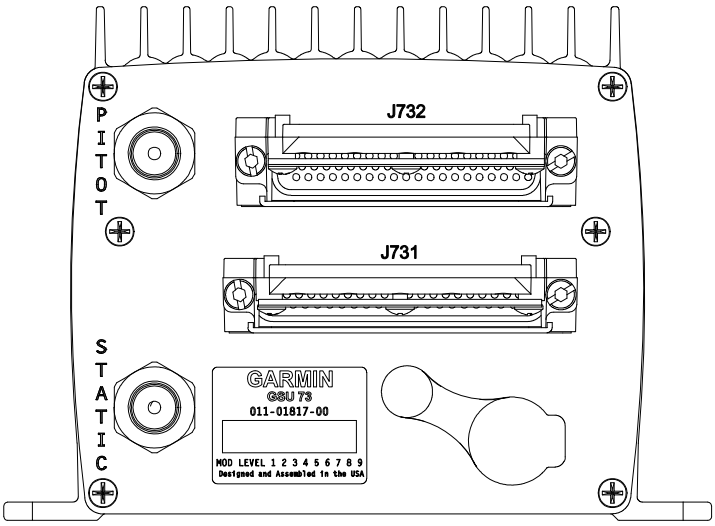

Figure A-3 Rear View of Connector End Plate

A.3.2 Pin List

A.3.2.1 P731 Connector

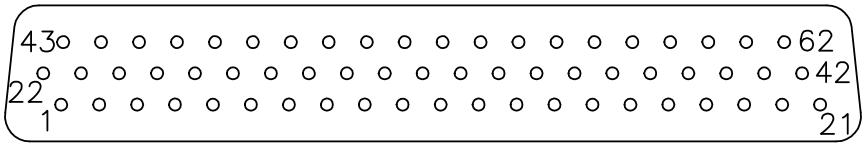

Figure A-4 Rear Connector J731 Viewed from Connector End of Unit

J731 pins are configured as shown in preceding figure. J731 pin assignments are given in the following table, additional tables group pin connections by function.

Pin	Pin Name	I/O
1	MAGNETOMETER RS-485 IN B	In
2	MAGNETOMETER RS-485 IN A	In
3	SIGNAL GROUND	--
4	GSU SYSTEM ID PROGRAM* 1	In
5	GSU SYSTEM ID PROGRAM* 2	In
6	RESERVED	--
7	CAN BUS HI	I/O
8	CAN BUS LO	I/O
9	DISCRETE IN* 1	In
10	DISCRETE IN* 2	In
11	DISCRETE IN* 3	In
12	DISCRETE IN* 4	In
13	DISCRETE OUT* 1	Out
14	DISCRETE OUT* 2	Out

*Indicates Active Low

Connector P731, continued

Pin	Pin Name	I/O
15	MAGNETOMETER RS-232 OUT	OUT
16	RS-232 IN 2 (RESERVED)	In
17	RS-232 OUT 2 (RESERVED)	Out
18	RS-232 IN 3 (RESERVED)	In
19	RS-232 OUT 3 (GPS/ALT ENCODER)	Out
20	ARINC 429 OUT 1 A	Out
21	ARINC 429 OUT 1 B	Out
22	ARINC 429 OUT 2 A	Out
23	ARINC 429 OUT 2 B	Out
24	SIGNAL GROUND	--
25	ARINC 429 IN 1 A	In
26	ARINC 429 IN 1 B	In
27	ARINC 429 IN 2 A	In
28	ARINC 429 IN 2 B	In
29	CAN BUS TERMINATION	--
30	ARINC 429 IN 3 A	In
31	ARINC 429 IN 3 B	In
32	ARINC 429 IN 4 A	In
33	ARINC 429 IN 4 B	In
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	MAGNETOMETER POWER OUT	Out
39	MAGNETOMETER GROUND	--
40	SIGNAL GROUND	--
41	SPARE	--
42	SPARE	--
43	SIGNAL GROUND	--
44	SPARE	--
45	SPARE	--
46	SPARE	--
47	AIRCRAFT POWER 1	In
48	SPARE	--
49	AIRCRAFT POWER 2	In
50	SPARE	--
51	SPARE	--
52	SPARE	--
53	SIGNAL GROUND	--
54	SIGNAL GROUND	--
55	SPARE	--
56	SPARE	--
57	SPARE	--
58	SIGNAL GROUND	--
59	POWER GROUND	--
60	SIGNAL GROUND	--
61	POWER GROUND	--
62	SPARE	--

A.3.2.2 P732 Connector

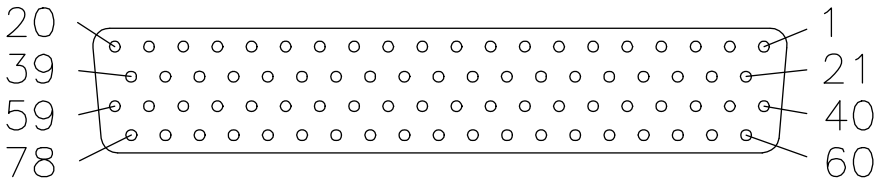

Figure A-5 Rear Connector J732 Viewed from Connector End of Unit

Pin	Pin Name	I/O
1	CHT 2 LO	In
2	CHT 3 HI	In
3	EGT 2 LO	In
4	EGT 3 LO	In
5	FUEL 1 LO	In
6	MAN PRESS LO	In
7	POS 3/GP 3/FUEL 3 LO	In
8	POS 2/GP 2/TIT 2 LO	In
9	THERMOCOUPLE REF IN LO	In
10	THERMOCOUPLE REF IN HI	In
11	EGT 6/MISC PRESS LO	In
12	VOLTS 2 LO	In
13	CHT 6 LO	In
14	OIL TEMP LO	In
15	OAT PROBE IN HI	In
16	OAT PROBE POWER OUT	Out
17	RPM	In
18	SIGNAL GROUND	--
19	FUEL FLOW	In
20	CONFIG MODULE CLOCK	Out
21	CHT 2 HI	In
22	CHT 3 LO	In
23	EGT 2 HI	In
24	EGT 3 HI	In
25	FUEL 1 HI	In
26	FUEL PRESS HI	In
27	POS 3/GP 3/FUEL 3 HI	In
28	POS 2/GP 2/TIT 2 HI	In
29	EGT 5 LO	In
30	EGT 5 HI	In
31	EGT 6/MISC PRESS HI	In
32	VOLTS 2 HI	In
33	CHT 6 HI	In
34	OIL TEMP HI	In
35	OAT PROBE IN LO	In
36	CAP FUEL 1	In
37	SIGNAL GROUND	--
38	CAP FUEL 2/FUEL FLOW 2	In
39	CONFIG MODULE DATA	I/O

*Indicates Active Low

Connector P732, continued

Pin	Pin Name	I/O
40	CHT 4 LO	In
41	CHT 1 LO	In
42	EGT 4 LO	In
43	EGT 1 LO	In
44	FUEL 2 LO	In
45	FUEL PRESS LO	In
46	POS 4/GP 4/FUEL 4 LO	In
47	POS 1/GP 1/TIT 1 HI	In
48	SHUNT 2 HI	In
49	OIL PRESS LO	In
50	SHUNT 1 LO	In
51	VOLTS 1 LO	In
52	POS 5/MISC TEMP LO	In
53	CHT 5 LO	In
54	SPARE	--
55	+12 VDC TRANSDUCER POWER OUT	Out
56	TRANSDUCER POWER OUT LO (GROUND)	--
57	TRANSDUCER POWER OUT LO (GROUND)	--
58	+10 VDC TRANSDUCER POWER OUT	Out
59	CONFIG MODULE POWER OUT	Out
60	CHT 4 HI	In
61	CHT 1 HI	In
62	EGT 4 HI	In
63	EGT 1 HI	In
64	FUEL 2 HI	In
65	MAN PRESS HI	In
66	POS 4/GP 4/FUEL 4 HI	In
67	POS 1/GP 1/TIT 1 LO	In
68	SHUNT 2 LO	In
69	OIL PRESS HI	In
70	SHUNT 1 HI	In
71	VOLTS 1 HI	In
72	POS 5/MISC TEMP HI	In
73	CHT 5 HI	In
74	TRANSDUCER POWER OUT LO (GROUND)	--
75	+5 VDC TRANSDUCER POWER OUT	Out
76	FUEL SENSOR PULL-UP 2 (FUEL 2)	Out
77	FUEL SENSOR PULL-UP 1 (FUEL 1)	Out
78	CONFIG MODULE GROUND	--

*Indicates Active Low

A.3.3 Power I/O

A.3.3.1 Aircraft Power

The GSU 73 has four inputs for aircraft power bus inputs of 14/28Vdc. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

Pin	Connector	Pin Name	I/O
47	P731	AIRCRAFT POWER 1	IN
49	P731	AIRCRAFT POWER 2	IN
59	P731	POWER GROUND	--
61	P731	POWER GROUND	--

A.3.3.2 Transducer Output Power

The GSU 73 supplies output power for engine/airframe sensors that may require supply voltage excitation. The GSU 73 outputs voltage levels of +5, +10, and +12 Vdc, these outputs may be spliced to allow connection to multiple sensors if needed. Max current specs are listed in the following table.

Power Supply Output	Maximum Continuous Output Current
+5VDC Transducer Power Out	125 mA
+10VDC Transducer Power Out	100 mA
+12VDC Transducer Power Out	150 mA

Pin	Connector	Pin Name	I/O
55	P732	+12VDC TRANSDUCER POWER OUT	OUT
56	P732	TRANSDUCER POWER OUT LO (GROUND)	--
58	P732	+10VDC TRANSDUCER POWER OUT	OUT
57	P732	TRANSDUCER POWER OUT LO (GROUND)	--
75	P732	+5VDC TRANSDUCER POWER OUT	OUT
74	P732	TRANSDUCER POWER OUT LO (GROUND)	--

A.3.3.3 Magnetometer Power

The GSU 73 outputs supply voltage to the GMU 44 via pins 38 & 39.

Pin	Connector	Pin Name	I/O
38	P731	MAGNETOMETER POWER OUT	OUT
39	P731	MAGNETOMETER GROUND	--

A.3.4 GSU System ID Program

Pins 4 & 5 must be left open (floating) for proper G3X configuration.

Pin	Connector	Pin Name	I/O
4	P731	GSU SYSTEM ID PROGRAM* 1	IN
5	P731	GSU SYSTEM ID PROGRAM* 2	IN

*Indicates Active Low

A.3.5 Serial Data Electrical Characteristics

A.3.5.1 ARINC 429 Input/Output

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers.

Pin	Connector	Pin Name	I/O
20	P731	ARINC 429 OUT 1A	OUT
21	P731	ARINC 429 OUT 1B	OUT
22	P731	ARINC 429 OUT 2A	OUT
23	P731	ARINC 429 OUT 2B	OUT
25	P731	ARINC 429 IN 1A	IN
26	P731	ARINC 429 IN 1B	IN
27	P731	ARINC 429 IN 2A	IN
28	P731	ARINC 429 IN 2B	IN
30	P731	ARINC 429 IN 3A	IN
31	P731	ARINC 429 IN 3B	IN
32	P731	ARINC 429 IN 4A	IN
33	P731	ARINC 429 IN 4B	IN

A.3.5.2 RS-232 Input/Output

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. RS-232 OUT 2 is not currently active. RS-232 OUT 3 is used for output to a transponder, and is not configurable (always on by default).

Pin	Connector	Pin Name	I/O
15	P731	MAGNETOMETER RS-232 OUT	OUT
16	P731	RS-232 IN 2 (RESERVED)	IN
17	P731	RS-232 OUT 2 (RESERVED)	OUT
18	P731	RS-232 IN 3 (RESERVED)	IN
19	P731	RS-232 OUT 3 (GPS/ALT ENCODER)	OUT

A.3.5.3 RS-485 Input

The GSU 73 contains one channel of RS-485 serial data communications.

Pin	Connector	Pin Name	I/O
1	P731	MAGNETOMETER RS-485 IN B	IN
2	P731	MAGNETOMETER RS-485 IN A	IN

A.3.5.4 CAN Bus

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. One GDU 37X should be terminated (CAN BUS TERMINATION connected to CAN BUS LO) and the GSU should be terminated if GSU is located at the end of the bus (see Appendix D).

Pin	Connector	Pin Name	I/O
7	P731	CAN BUS HI	I/O
8	P731	CAN BUS LO	I/O
29	P731	CAN BUS TERMINATION	--

A.3.5.5 Configuration Module Interface

Pin	Connector	Pin Name	I/O
20	P732	CONFIG MODULE CLOCK	OUT
39	P732	CONFIG MODULE DATA	I/O
59	P732	CONFIG MODULE POWER OUT	OUT
78	P732	CONFIG MODULE GROUND	--

A.3.6 Discrete I/O

A.3.6.1 Active Low Discrete Inputs

The GSU 73 has 4 configurable discrete inputs conforming to:

a) Low: 0 VDC < Vin < 3.5 VDC, OR Rin < 375 ohms (active)

b) High: 8 VDC < Vin < 36 VDC

c) OR Rin> 100k ohms (inactive)

Pin	Connector	Pin Name	I/O
9	P731	DISCRETE IN* 1	IN
10	P731	DISCRETE IN* 2	IN
11	P731	DISCRETE IN* 3	IN
12	P731	DISCRETE IN* 4	IN

*Indicates Active Low

A.3.6.2 Discrete Outputs

The GSU 73 has 2 annunciator outputs, these outputs do not require any configuration and can be optionally wired to an external annunciator. Discrete Out 1 acts as a master warning annunciator and is active any time a warning CAS message (Red Alert) is displayed on the PFD. Discrete Out 2 acts as a master caution annunciator and is active any time a caution CAS message (Yellow Alert) is displayed on the PFD. Reference Appendix G for wiring guidance.

DISCRETE OUT 1 is "master warning" - goes low when a red (warning) CAS alert is active.

DISCRETE OUT 2 is "master caution" - goes low when a yellow (caution) CAS alert is active.

The two states of these outputs are as follows:

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

Pin	Connector	Pin Name	I/O
13	P731	DISCRETE OUT* 1	OUT
14	P731	DISCRETE OUT* 2	OUT

*Indicates Active Low

A.3.7 Analog Input Configuration

Some analog inputs are multi-purpose capable and have several configuration options. These inputs are configured by the GDU (refer to Section 8).

NOTE

If installing an ungrounded thermocouple to an Analog In input, a DC reference must be added to the LO input. This can be accomplished by adding a resistance of 1 MΩ or less between ground and the Analog In LO input that the ungrounded thermocouple is installed on.

Pin	Connector	Pin Name	I/O
61	P732	CHT 1 HI	IN
41	P732	CHT 1 LO	IN
21	P732	CHT 2 HI	IN
1	P732	CHT 2 LO	IN
2	P732	CHT 3 HI	IN
22	P732	CHT 3 LO	IN
60	P732	CHT 4 HI	IN
40	P732	CHT 4 LO	IN
73	P732	CHT 5 HI	IN
53	P732	CHT 5 LO	IN
33	P732	CHT 6 HI	IN
13	P732	CHT 6 LO	IN
63	P732	EGT 1 HI	IN
43	P732	EGT 1 LO	IN
23	P732	EGT 2 HI	IN

Analog Inputs (continued)

Pin	Connector	Pin Name	I/O
3	P732	EGT 2 LO	IN
24	P732	EGT 3 HI	IN
4	P732	EGT 3 LO	IN
62	P732	EGT 4 HI	IN
42	P732	EGT 4 LO	IN
30	P732	EGT 5 HI	IN
29	P732	EGT 5 LO	IN
34	P732	OIL TEMP HI	IN
14	P732	OIL TEMP LO	IN
72	P732	POS 5 / MISC TEMP HI	IN
52	P732	POS 5 / MISC TEMP LO	IN
25	P732	FUEL 1 HI	IN
5	P732	FUEL 1 LO	IN
64	P732	FUEL 2 HI	IN
44	P732	FUEL 2 LO	IN
26	P732	FUEL PRESS HI	IN
45	P732	FUEL PRESS LO	IN
65	P732	MAN PRESS HI	IN
6	P732	MAN PRESS LO	IN
71	P732	VOLTS 1 HI	IN
51	P732	VOLTS 1 LO	IN
32	P732	VOLTS 2 HI	IN
12	P732	VOLTS 2 LO	IN
31	P732	EGT 6 / MISC PRESS HI	IN
11	P732	EGT 6 / MISC PRESS LO	IN
69	P732	OIL PRESS HI	IN
49	P732	OIL PRESS LO	IN
47	P732	POS 1 / GP 1 / TIT 1 HI	IN
67	P732	POS 1 / GP 1 / TIT 1 LO	IN
28	P732	POS 2 / GP 2 / TIT 2 HI	IN
8	P732	POS 2 / GP 2 / TIT 2 LO	IN
27	P732	POS 3 / GP 3 / FUEL 3 HI	IN
7	P732	POS 3 / GP 3 / FUEL 3 LO	IN
66	P732	POS 4 / GP 4 / FUEL 4 HI	IN
46	P732	POS 4 / GP 4 / FUEL 4 LO	IN
70	P732	SHUNT 1 HI	IN
50	P732	SHUNT 1 LO	IN
48	P732	SHUNT 2 HI	IN
68	P732	SHUNT 2 LO	IN
10	P732	THERMOCOUPLE REF IN HI	IN
9	P732	THERMOCOUPLE REF IN LO	IN

A.3.8 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 GSU 73 installation. The GTP 59 is a Resistive Temperature Device (RTD). Refer to Figure D-1.2 for the temperature probe interconnect.

Pin	Connector	Pin Name	I/O
15	P732	OAT PROBE IN HI	IN
16	P732	OAT PROBE POWER OUT	OUT
35	P732	OAT PROBE IN LO	IN

A.3.9 Frequency Counter Inputs

Digital signals are updated to the display at a rate of 10 times per second (10 Hz). Digital inputs are low when the signal is ≤ 2 Vdc or the resistance to ground is ≤ 375 Ω, and high when the signal is > 3.5 Vdc or the resistance to ground is > 100 k Ω.

Pin	Connector	Pin Name	I/O
17	P732	RPM	IN
19	P732	FUEL FLOW	IN
36	P732	CAP FUEL 1	IN
38	P732	CAP FUEL 2/FUEL FLOW 2	IN

*Indicates Active Low

The following table lists the minimum frequency, maximum frequency, and duty cycles for each of these inputs.

Pin Name	Minimum Frequency	Maximum Frequency	Duty Cycle
RPM	1 Hz	500 Hz/100 KHz*	50%
FUEL FLOW	1 Hz	500 Hz/100 KHz*	50%
CAP FUEL 1	1 Hz	500 Hz/100 KHz*	50%
CAP FUEL 2/FUEL FLOW 2	1 Hz	500 Hz/100 KHz*	50%

*Each frequency counter channel will be configured for a high or low speed input based on the signal being measured.

A.3.10 Fuel Select Outputs

If a resistive fuel level sensor is connected to the FUEL 1 or FUEL 2 inputs, the corresponding FUEL SENSOR PULL-UP 1 or 2 pin must be connected to the +10V TRANSDUCER POWER pin (58) for the fuel level sensor to work properly. If using resistive fuel level sensors with the GP 3/FUEL 3 or GP 4/ FUEL 4 inputs, connect the high side of the input to +10V power through a 1 kΩ resistor, as shown in Appendix G.

Pin	Connector	Pin Name	I/O
76	P732	FUEL SENSOR PULL-UP 2 (FUEL 2)	OUT
77	P732	FUEL SENSOR PULL-UP 1 (FUEL 1)	OUT

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Appendix B Connector Installation Instructions

B.1 Thermocouple Installation into a Backshell

Table B-1 lists parts needed to install a Thermocouple. Parts for this installation are included in the Thermocouple Kit (011-00981-00), which is included in the G3X Installation Kit (K10-00017-00).

Table B-1 Thermocouple Kit GPN 011-00981-00

Figure Ref	Description	Qty. Needed	PN or MIL spec
1	3” Thermocouple, K type	1	925-L0000-00
2	Pins #22 AWG	2	336-00021-00
3	Screw	1	211-60234-08

NOTE

For the following steps please refer to indicated item numbers in Figures B-1 and B-2.

1. Strip back approximately 0.17 inches of insulation from both the positive and negative thermocouple leads (item 1) and crimp a pin (item 2) to each lead. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-1.

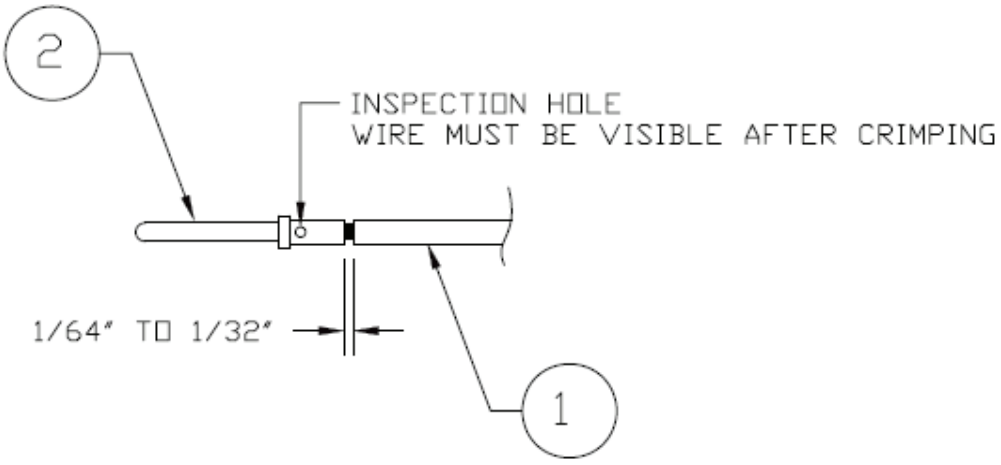

Figure B-1 Insulation/Contact Clearance

2. Insert newly crimped pins and wires (items 1 & 2) into the appropriate connector housing (item 4) location as specified by the installation specific wiring diagram.
3. Place thermocouple (item 1) body onto backshell (item 5) boss. Upon placing the thermocouple (item 1) body, orient it such that the wires exit downward.
4. Attach thermocouple (item 1) tightly to backshell (item 5) using screw (item 3).
5. Attach cover (item 6) to backshell (item 5) using screws (item 7).

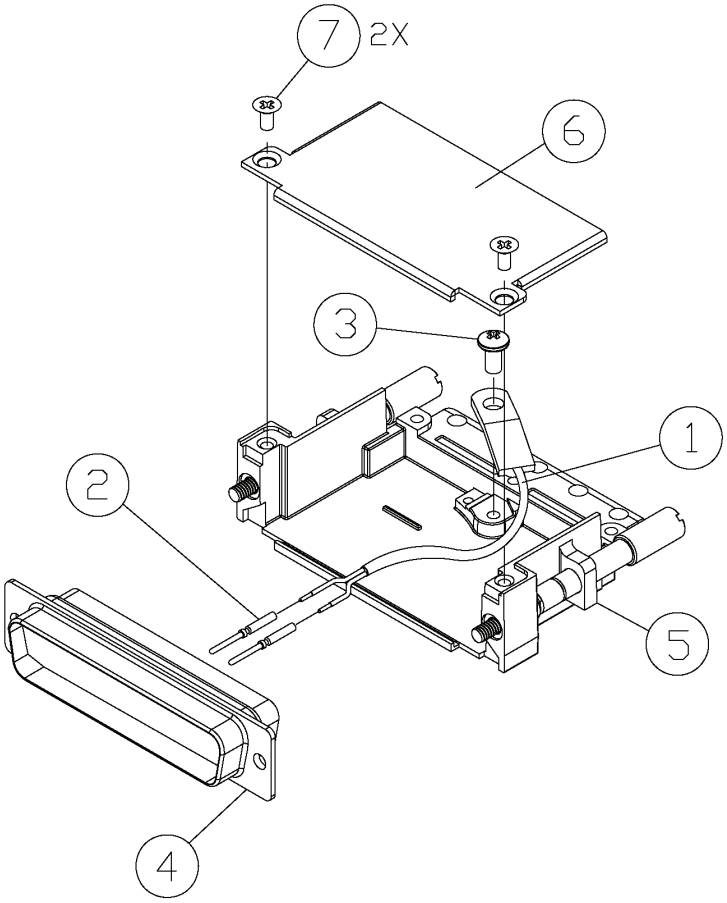

Figure B-2 Jackscrew Backshell Thermocouple Installation

B.2 Jackscrew Configuration Module Installation into a Jackscrew Backshell

Tables B-2 & B-3 list parts needed to install a Jackscrew Configuration Module with pins or with sockets. Parts for these installations are included in the 011-00979-20 and 011-00979-22 kits, which are included in the G3X Installation Kit (K10-00017-00).

Configuration modules are to be installed in the backshells of the P732 connector for the GSU 73 (use 011-00979-20, below), and the P3701 connector for the GDU 37X designated as PFD1 (use 011-00979-22, below).

Table B-2 GPN: 011-00979-20 – Kit (w/EEPROM and pins)

Figure Ref	Description	Qty. Needed	GPN or MIL spec
1	Potted Module (w/EEPROM and Temp.sensor)	1	011-02179-00
3	4 cond. Cable harness	1	325-00122-00
4	Pins Size 22D	4	336-00021-00
10	Pan head screw	1	211-60232-07

Table B-3 GPN: 011-00979-22 – Kit (w/EEPROM and sockets)

Figure Ref	Description	Qty. Needed	GPN or MIL spec
1	Potted Module (w/EEPROM and Temp.sensor)	1	011-02179-00
3	4 cond. Cable harness	1	325-00122-00
9	Socket, Size 20, 26-30 AWG	4	336-00022-01
10	Pan head screw	1	211-60232-07

NOTE

For the following steps please refer to Figures B-3 & B-4.

1. Strip back approximately 0.17 inches of insulation from each wire of the four conductor wire harness (item 3) and crimp either a pin (item 4) or a socket (item 9) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-3.

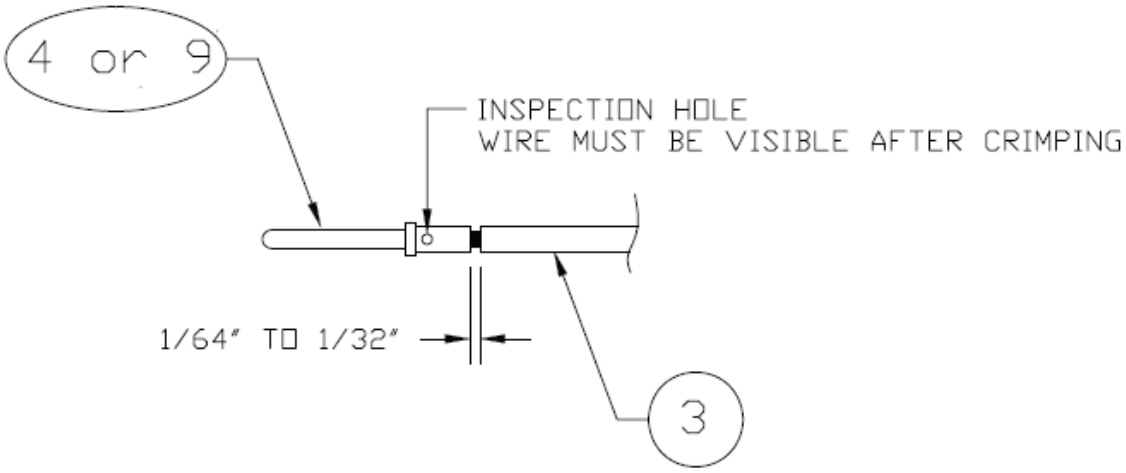

Figure B-3 Insulation/Contact Clearance

2. Insert newly crimped pins (or sockets) and wires (items 3 and 4) into the appropriate connector housing (item 5) location as specified by the installation specific wiring diagram.
3. Attach the module (item 1) to backshell (item 6) using screw (item 10).
4. Plug the four conductor wire harness (item 3) into the connector on the module (item 1).
5. Orient the connector housing (item 5) so that the inserted four conductor wire harness (item 3) is on the same side of the backshell (item 6) as the module (item 1)—as shown in drawing.
6. Attach cover (item 7) to backshell (item 6) using screws (item 8).

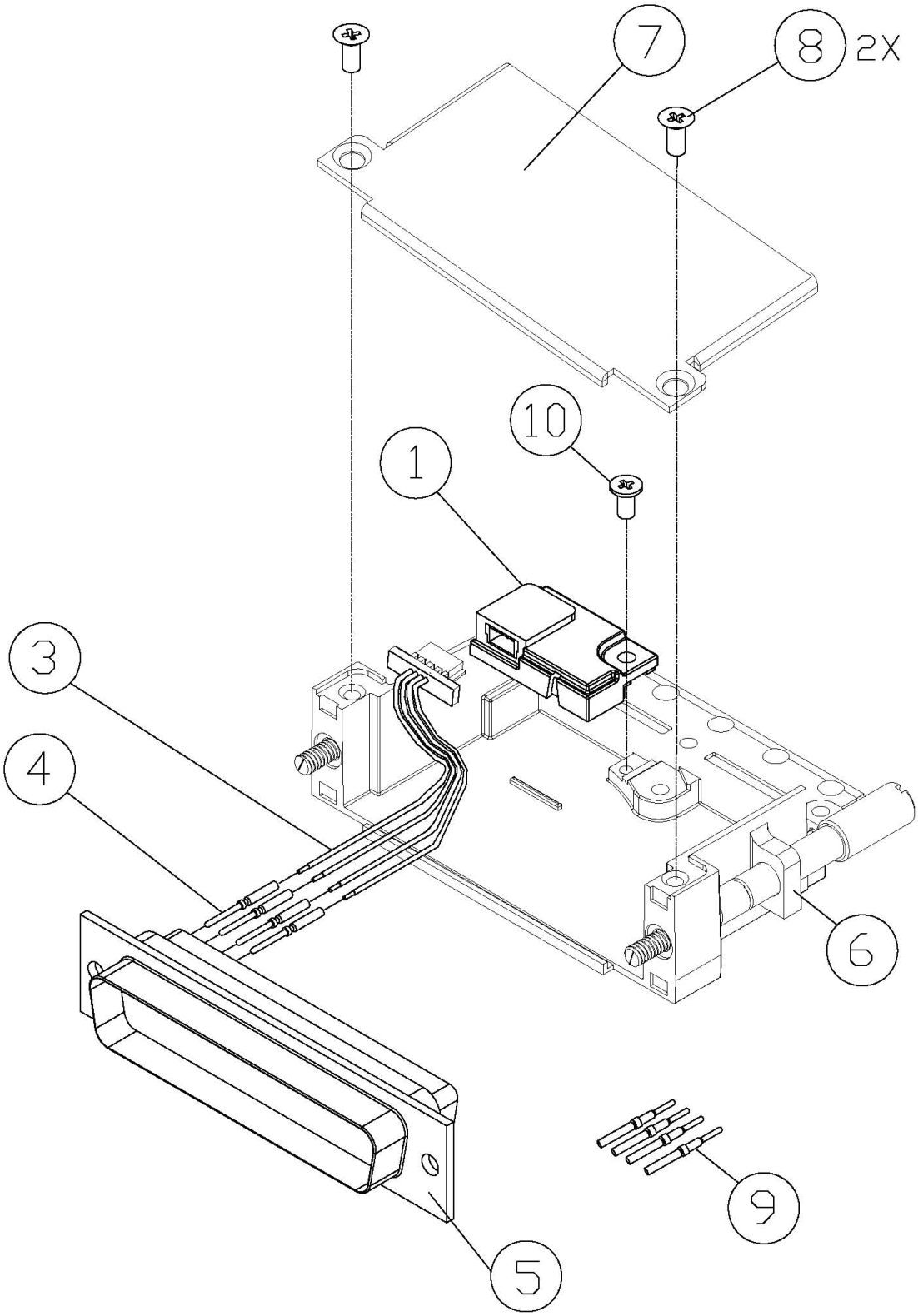

Figure B-4 Jackscrew Backshell Installation

B.3 Jackscrew Backshell Installation Instructions

B.3.1 Shield Block Installation Parts

Tables B-4 and B-5 list the parts needed to install a Shield Block. Parts listed in Table B-4 are supplied in the GDU 37X Connector Kit (011-01921-00). Parts listed in Table B-5 are to be provided by the installer.

Table B-4 Parts supplied for a Shield Block Installation (Figure B-1)

Figure Ref	Description	GPN or MIL spec
1	Cast Backshell Housing	125-00175-00
6	Contacts	336-00094-00
12	Clamp	115-01078-04
13	Screw,4-40x.375,PHP,SS/P,w/Nylon	211-60234-10
14	Cover	115-01079-04
15	Screw,4-40x.187,FLHP100,SS/P,w/Nylon	211-63234-06

Table B-5 Parts not supplied for a Shield Block Installation (Figure B-1)

Figure Ref	Description	GPN or MIL spec
2	Multiple Conductor Shielded Cable (2-conductor shown in Figure B-1)	Parts used depend on method chosen
3	Drain Wire Shield Termination (method optional)	Parts used depend on method chosen
4	Braid, Flat (19-20 AWG equivalent, tinned plated copper strands 36 AWG, Circular Mil Area 1000 -1300)	Parts used depend on method chosen
5	Floating Shield Termination (method optional)	Parts used depend on method chosen
7	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
8	Screw, PHP, 8-32x.312", Stainless	MS51957-42
	Screw, PHP, 8-32x.312", Cad Plated Steel	MS35206-242
9	Split Washer, #8, (.045" compressed thickness) Stainless	MS35338-137
	Split Washer, #8, (.045" compressed thickness) Cad-plated steel	MS35338-42
10	Flat Washer, Stainless, #8, .032" thick, .174"ID, .375" OD	NAS1149CN832R
	Flat washer, Cad-plated Steel, #8, .032" thick, .174"ID, .375" OD	NAS1149FN832P
11	Silicon Fusion Tape	-

NOTE

In Figure B-5, “AR” denotes quantity “As Required” for the particular installation.

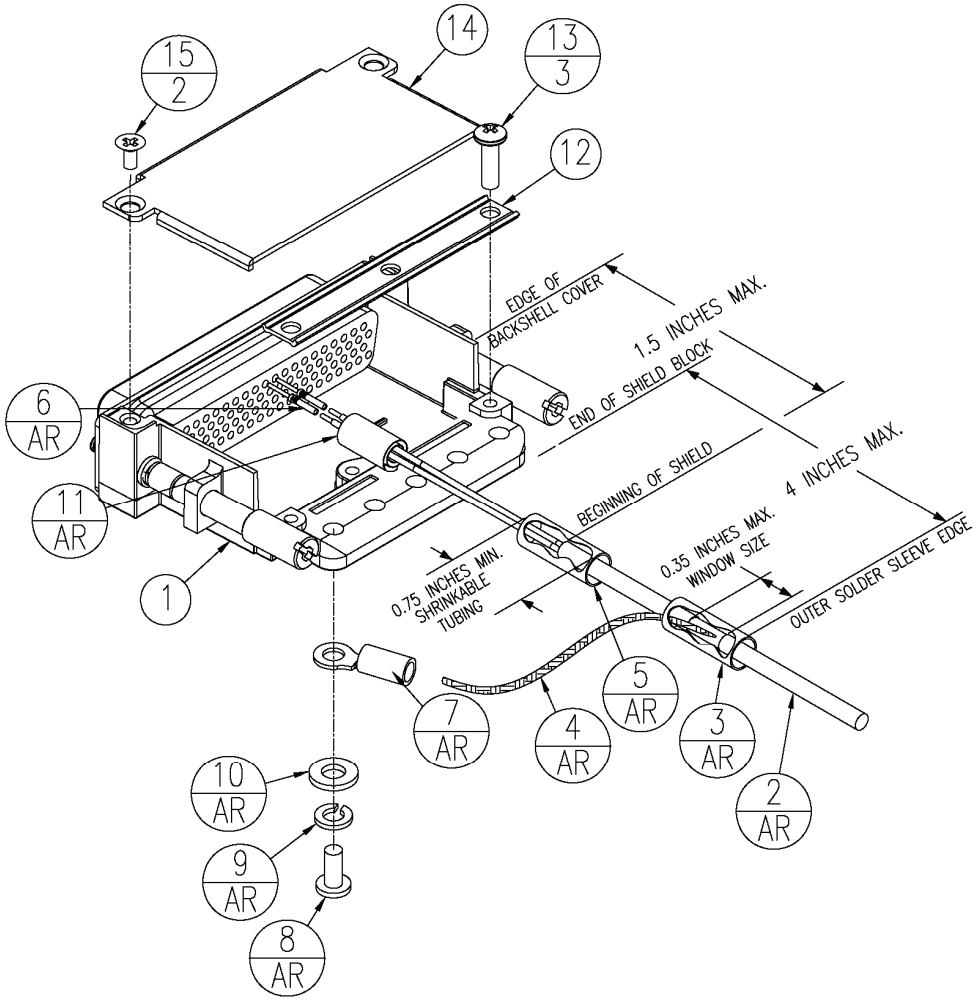

Figure B-5 Shield Install onto a Jackscrew Backshell (78 pin example)

B.3.2 Shield Termination Technique – Method A.1 (Standard)

NOTE

For the following steps please refer to the drawings showing the installation of a Jackscrew Backshell.

1. The appropriate number of Jackscrew Backshells will be included in the particular LRU connector kit.

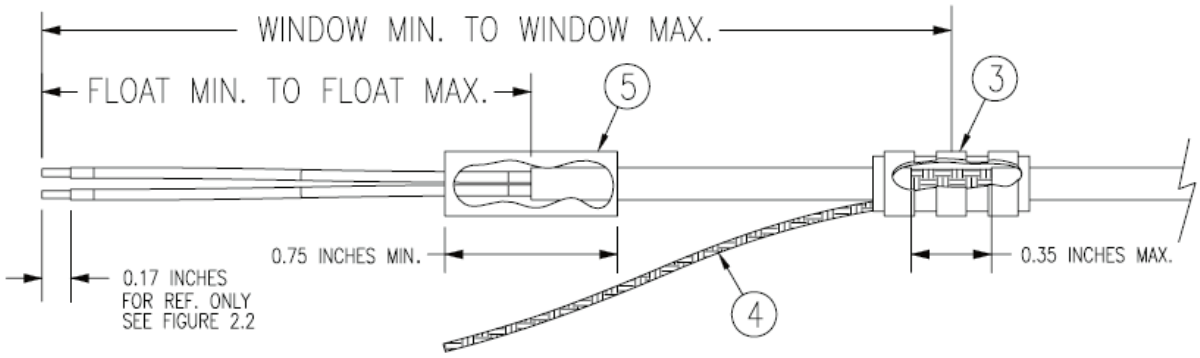

Figure B-6 Method A.1 for Shield Termination

Table B-6 Shielded Cable Preparations for Garmin Connectors

Backhell 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 2) measure a distance between “Window Min” to “Window Max” (Table B-6) and cut a window (max size 0.35”) in the jacket to expose the shield (Figure B-6). 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.

   Suggested tools to accomplish the window cut:
   - Coaxial Cable Stripper
   - Thermal Stripper
   - Sharp Razor Blade

3. Connect a Flat Braid (item 4) to the shield exposed through the window of the prepared cable assembly (item 2) 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 (Figure B-6). 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.

Preferred Method:

Slide a solder sleeve (item 3) onto the prepared cable assembly (item 2) and connect the Flat Braid (item 4) 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 4) 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 3 and 4. 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.

Secondary Method:
Solder a Flat Braid (item 4) to the shield exposed through the window of the prepared cable assembly (item 2). 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 3) 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 4) 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 2) and ahead of the previous shield termination, strip back "Float Min" to "Float Max" (Table B-6) length of jacket and shield to expose the insulated center conductors (Figure B-6). 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 5) 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 5) 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 approximately 0.17 inches of insulation from each wire of the shielded cable (item 2) and crimp a contact (item 6) to each conductor. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-7.

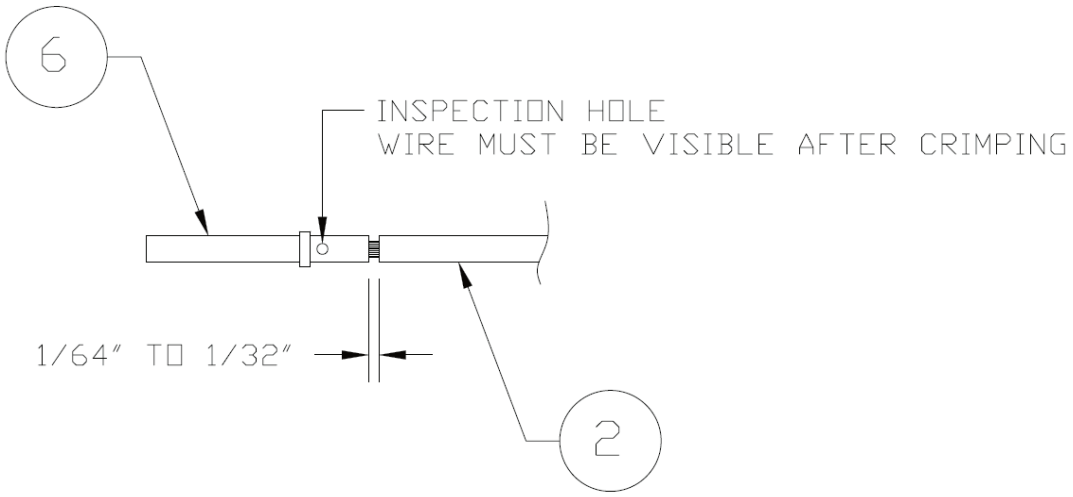

Figure B-7 Insulation/Contact Clearance

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 4) to a length that, with the addition of a ring terminal, will reach one of the tapped holes of the Jackscrew backshell (item 1) (Figure B-5). An appropriate amount of excess length without looping should be given to the Flat Braid (item 4) to allow it to freely move with the wire bundle.

NOTE

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

8. Guidelines for terminating the newly cutoff Flat Braid(s) (item 4) with insulated ring terminals (item 7):
    - Each tapped hole on the Jackscrew Backshell (item 1) may accommodate only two ring terminals (item 7).
    - It is preferred that only two Flat Braid(s) (item 4) 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 Jackscrew Backshell (item 1) by placing items on the Pan Head Screw (item 8) in the following order: Split Washer (item 9), Flat Washer (item 10) first Ring Terminal, second Ring Terminal (if needed) before finally inserting the screw into the tapped holes on the Jackscrew Backshell. 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 11) (GPN: 249-00114-00 or a similar version) at the point where the backshell clamp 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 clamp (item 12) across the cable bundle and secure using the three screws (item 13). Warning: Placing the grooved side of the clamp across the cable bundle may risk damage to wires.
13. Attach the cover (item 14) to the backshell (item 1) using the two screws (item 15).

B.3.3 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 (Figure B-8). 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.

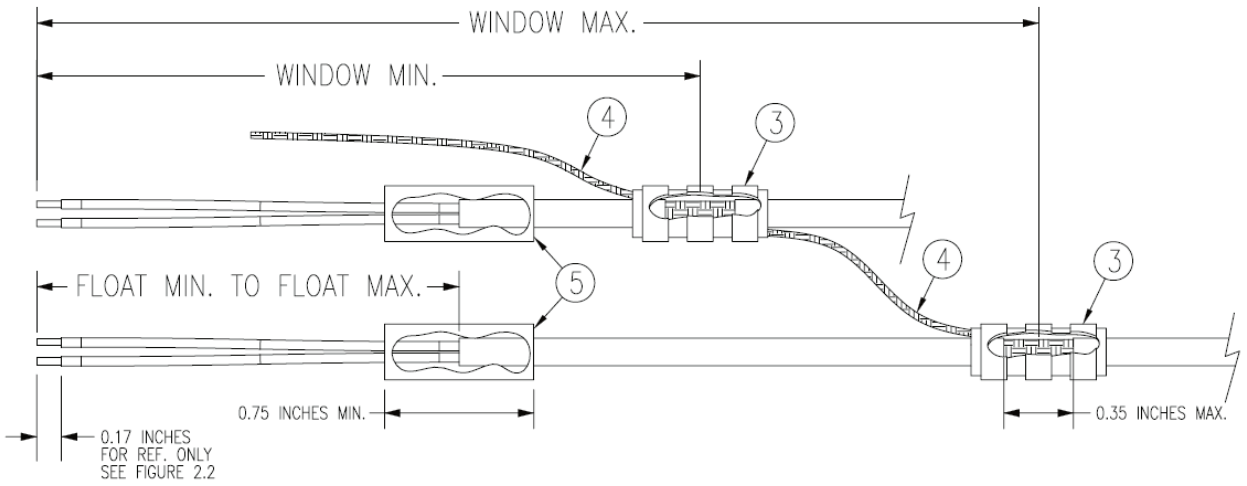

Figure B-8 Method A.2 (Daisy Chain) for Shield Termination

B.3.4 Shield Termination – Method B.1 (Quick Term)

If desired, the drain wire termination (item 3) and the floating shield termination (item 5) 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 B-9.

NOTE

The original purpose for separating the shield drain termination (item 3) from the float termination (item 5) in Method A was to allow for a variety of lengths for the drain wires so that the shield drain terminations (item 3) 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 3) a larger area to be dispersed across.

Using this method, the instructions from Section B.3.2 (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 2), strip "Quick Term Min" to "Quick Term Max" (Table B-7) 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 4) 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. (Figure B-9). 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.

Preferred Method:

Slide a solder sleeve (item 3) onto the prepared cable assembly (item 2) and connect the Flat Braid (item 4) 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 4) to be attached.

NOTE

Reference Section B.3.2 for recommended solder sleeves and flat braid. The same recommendations are applicable to this technique.

Secondary Method:

Solder a Flat Braid (item 4) to the folded back shield on the prepared cable assembly (item 2). 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 3) 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 as well as the Flat Braid (item 4) to be attached.

Teflon Heat Shrinkable Tubing:

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

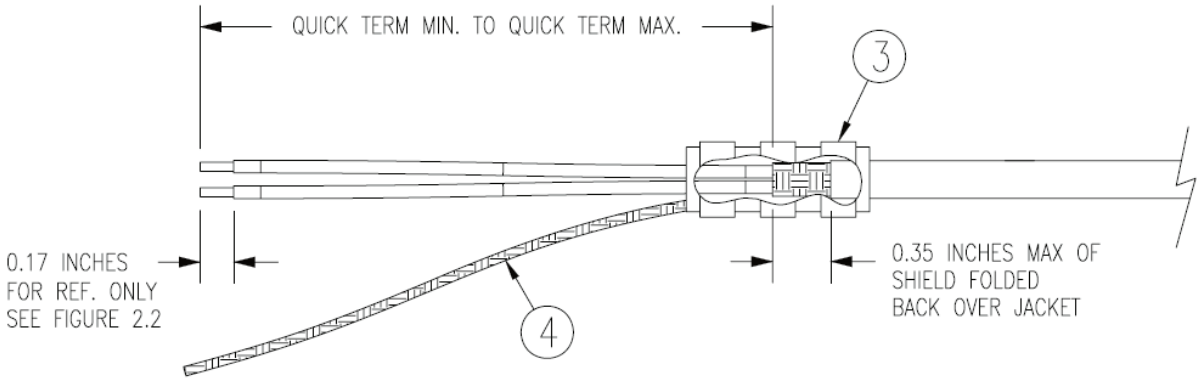

Figure B-9 Method B.1 (Quick Term) for Shield Termination

Table B-7 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

B.3.5 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 (Figure B-10). 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.

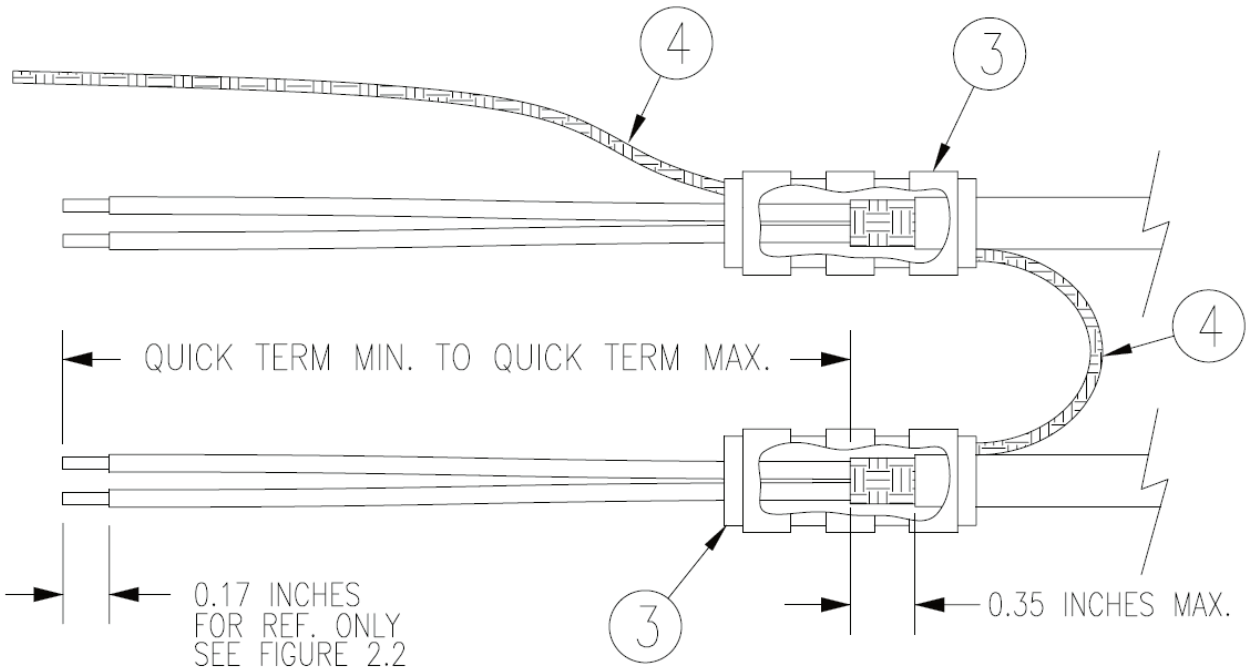

Figure B-10 Method B.2 (Daisy Chain-Quick Term) for Shield Termination

B.3.6 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 (Figure B-11). 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.

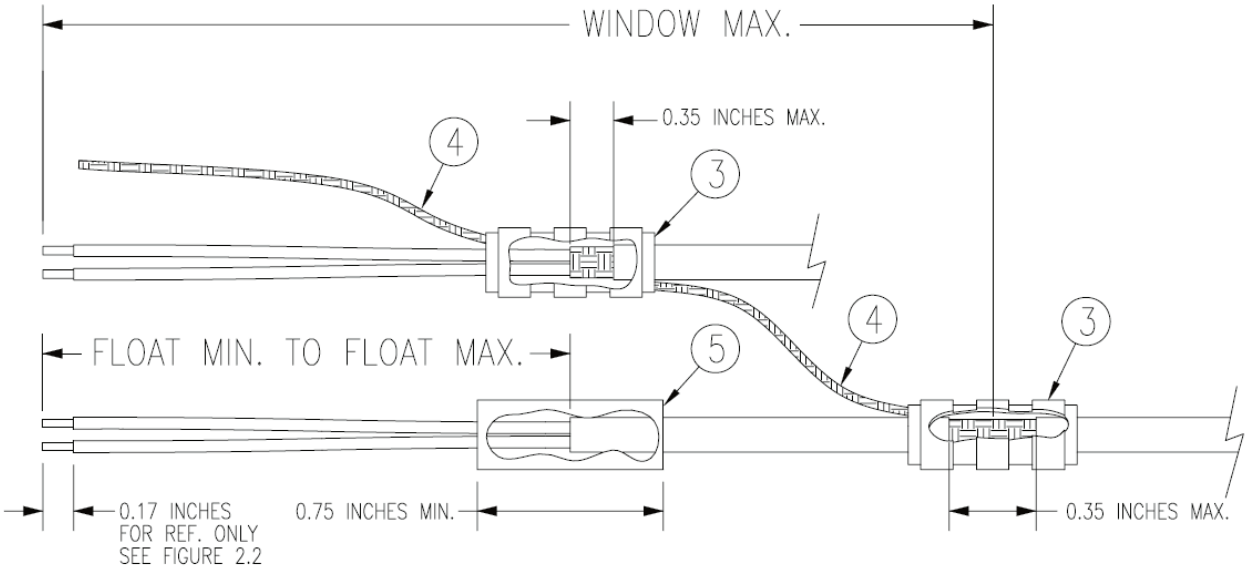

Figure B-11 Daisy Chain between Methods A and B

B.3.7 ID Program Pins (Strapping)

NOTE

The GDU 37X rear connector (J3701) is electrically isolated. For installations using programming pins, a ground pin must be tied to the connector shell.

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 Jackscrew Backshell:

1. 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.

2. Strip back approximately 0.17 inches of insulation and crimp a contact (item 6) to the 4” length of 22 AWG insulated wire. It is the responsibility of the installer to determine the proper length of insulation to be removed. Wire must be visible in the inspection hole after crimping and the insulation must be 1/64 – 1/32 inches from the end of the contact as shown in Figure B-7.
3. Insert newly crimped pins and wires into the appropriate connector housing location as specified by the installation wiring diagrams.
4. At the end opposite the pin on the 22 AWG insulated wire strip back 0.2 inches of insulation.
5. 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).

B.3.8 Splicing Signal Wires

NOTES

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

WARNING

Keep the splice out of the backshell for pin extraction, and outside of the strain relief to avoid preloading.

Figure B-12 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.

Splice part numbers:

- •Raychem D-436-36/37/38
- •MIL Spec MIL-S-81824/1

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

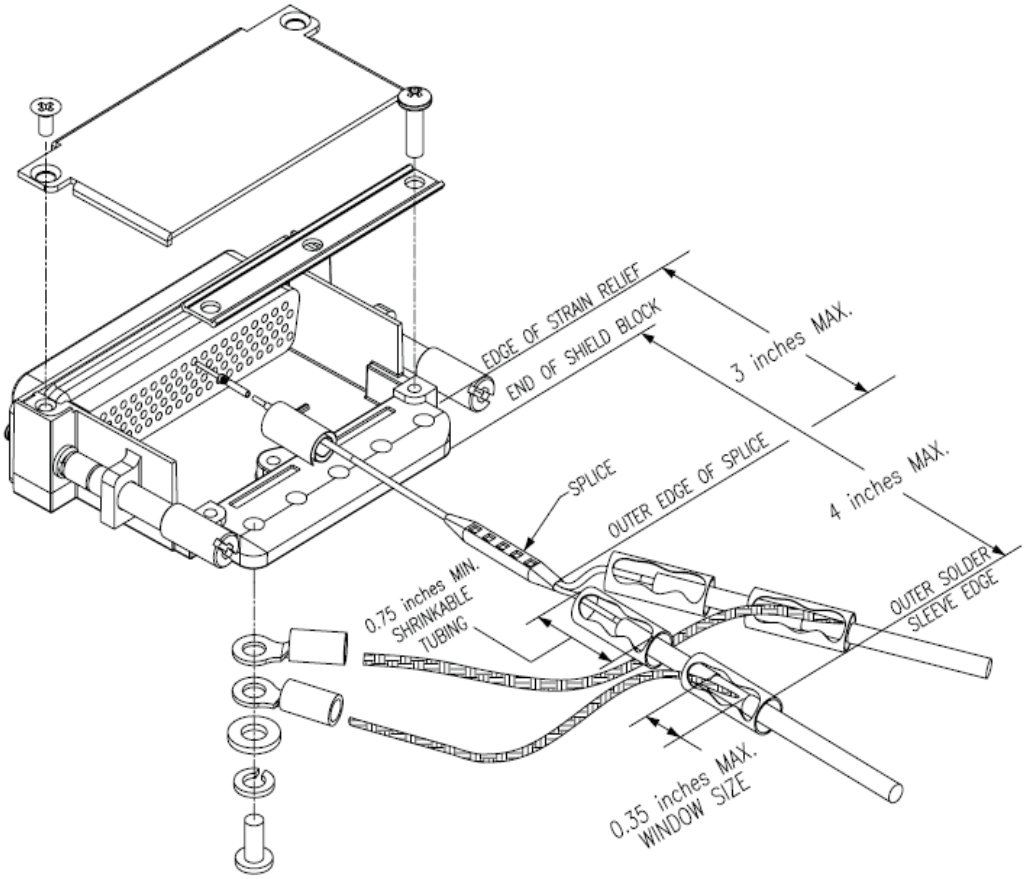

Figure B-12 D-Sub Spliced Signal Wire illustration

Appendix C Airframe Specific Installation Guidance

C.1 Introduction

Garmin has included in this manual some installation guidelines to aid the builder in the placement of various units which make up the G3X. It is at the discretion of the builder whether he or she wants to follow a typical layout or design an installation completely unique to their aircraft. **The following information is provided as guidance only and does not account for variations in specific installations.**

NOTE

Although the potential GMU 44 mounting locations shown in this manual have been tested on appropriate type aircraft, Garmin cannot take into account the wide variation of aircraft specific installations and therefore cannot guarantee the provided locations will work for all installations in a particular aircraft type. Garmin strongly recommends the installer conduct a thorough review of Section 3.6 when choosing an appropriate mounting location for the GMU 44. In addition to reviewing the guidance provided in Section 3.6, the installer should use the Garmin GLS tool to conduct a GMU 44 site evaluation prior to permanent installation of the GMU 44 mounting bracket. The GLS tool and the AHRS/ Magnetometer Installation Considerations document (which contains instructions) can be downloaded from www.Garmin.com. Please contact your G3X dealer for additional information on setup and use of the GLS tool.

The typical installations contained in this manual are known to fit each aircraft. In addition, custom brackets and mounting which should be incorporated to properly support the units are detailed in the typical installation. Unsupported avionics or inferior mounting brackets can contribute to cracking of the mounting trays or a unit becoming dislodged, intermittent or to fail completely. The guidance of FAA advisory circulars AC 43.13-1B and AC 43.13-2A may be found useful.

It is recommended the builder at least review the typical installation prior to embarking on his/her own design, and determine what additional components may be required to suit their particular installation.

C.1.1 GMU 44

The integrity and reliability of the G3X heading and attitude information is entirely dependent upon the installation quality of the GMU 44 Magnetometer. Garmin strongly recommends the purchase of the pre-fabricated parts indicated in Table C-1. Failure to use Garmin approved brackets may result in severe degradation of system performance. Garmin cannot guarantee acceptable system performance if any variations from these designs are made. It is essential that installation accuracy requirements specified in the following sections be maintained in any GMU 44 installation, if the installer chooses to follow the typical installation guidance.

Table C-1 GMU 44 Mount Kits

Airframe	GMU 44 Mount Kit
Lancair IV/IV-P	011-01788-00
Lancair ES/ES-P	011-01779-00
RV-7/7A, -9/9A	011-01796-00
RV-10	011-01779-00

C.2 Van's Aircraft

C.2.1 RV-7/9

C.2.1.1 GMU 44 Mounting Bracket

An RV-7/9 GMU 44 Mounting Bracket Kit is available under Garmin part number 011-01796-00, see Figure C-1. The aft deck was chosen as an installation location, as it provides a level pitch and roll reference and acceptable separation from excessive magnetic disturbances. The mounting bracket is pre-drilled to ensure proper alignment with the longitudinal (yaw) axis.

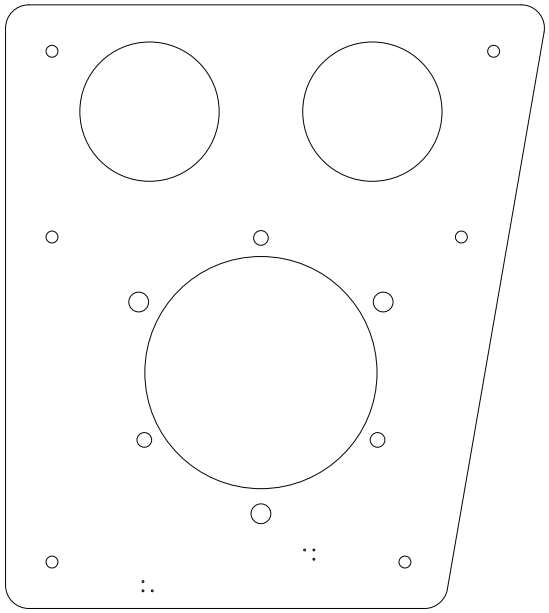

Figure C-1 RV-7/9 GMU 44 Mounting Bracket (115-01027-00)

C.2.1.1.1 GMU 44 Mounting Bracket Installation Guidance

The RV-7/9 GMU 44 Mounting Bracket can be installed on the F-714 aft deck forward of the horizontal stabilizer. Prior to installing the mounting bracket on the aft deck, the GMU 44 mounting plate (115-00481-00) should be riveted to the mounting bracket. When riveting the mounting plate to the bracket, ensure that the "Forward" arrow is pointing towards the front of the airplane and is parallel to the longitudinal axis of the aircraft. As shown in Appendix E, the mounting plate should be attached to the bracket with the supplied AN426AD5-6 rivets.

NOTE

The GMU 44 mounting bracket outer dimensions are used for alignment. To minimize inadvertent misalignment caused by edge alteration, it is recommended that the installer NOT deburr the edges of the GMU 44 mounting bracket.

After the GMU 44 mounting plate has been installed on the mounting bracket, the following procedure should be followed to attach the mounting bracket to the F-714 aft deck:

1. Draw a centerline down the middle of the F-714 aft deck.
2. Place the GMU 44 mounting bracket on the F-714 aft deck (see Figure C-2).
3. Slide the GMU 44 mounting bracket forward, ensuring the front edge is against the vertical portion of the F-714 aft deck (see Figure C-2).

NOTE

It is vital that the front edge be squarely positioned against the flange. The GMU 44 rack alignment points are based on the mount being perpendicular to the flange. The inner edge should be aligned with the centerline on the fuselage.

4. SECURELY clamp the mounting bracket to the aft deck so that no movement occurs with the front edge flush with the vertical portion of the F-714 aft deck.
5. Drill the six attach points with a #30 drill bit.
6. Rivet the mounting bracket to the aft deck using AN470AD4 or LP4-3 rivets. Alternatively, the builder may elect to install the mounting bracket with non-ferrous fasteners (screws, washers, and nuts).

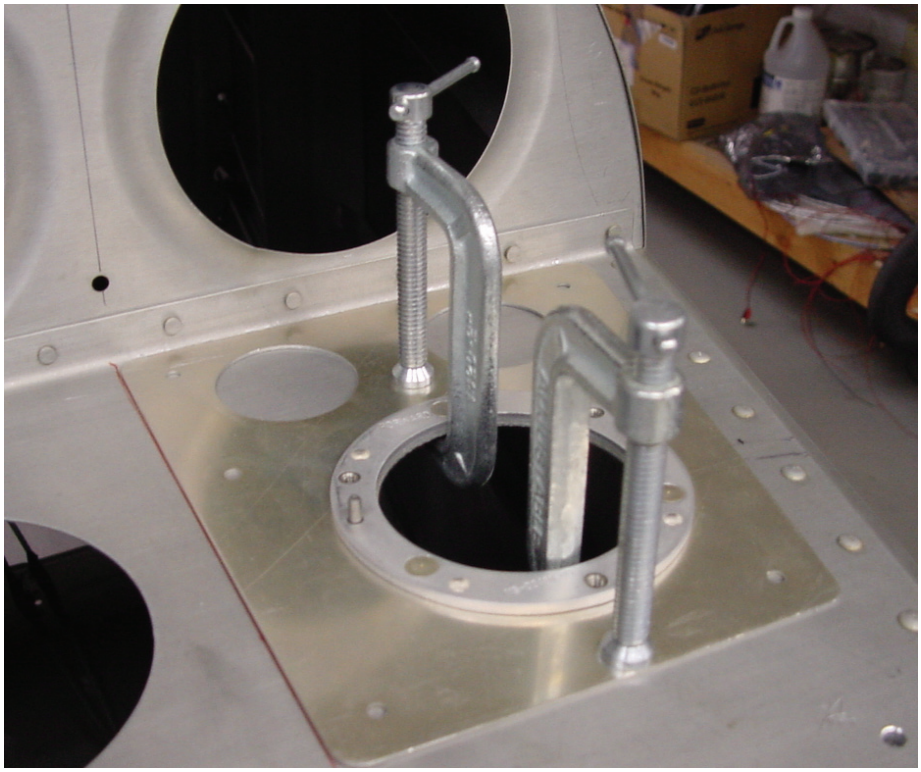

Figure C-2 RV-7/9 GMU 44 Mounting Bracket on the F714 Aft Deck

C.3 Lancair Aircraft

C.3.1 Lancair IV/IV-P

Differences exist between the Lancair IV/IV-P and the ES series aircraft that result in different mounting techniques for the GMU 44.

C.3.1.1 GMU 44 Mounting Bracket

The Lancair IV/IV-P GMU 44 mount (011-01788-00) is composed of a top (115-01052-00) and bottom (115-01052-01) assembly. An aircraft specific mounting bracket has been developed to accommodate the full wing tank option and thin wing tip area remaining. The bracket is specific to the ***right wing tip***, and can be used with the standard tip or winglet.

C.3.1.1.1 GMU 44 Mount Installation Guidance

One possible mounting location for the GMU 44 is in the right wingtip (refer to Figure C-3). The bottom assembly should be screwed and glued to the bottom of the wingtip using the dimensions below. Care must be taken to accurately align the mount parallel to the edge of the wingtip. This will ensure the finished installation will have the proper alignment with the aircraft's heading.

NOTE

It is recommended the wingtip antenna option be omitted from this wingtip to prevent interference with the magnetometer.

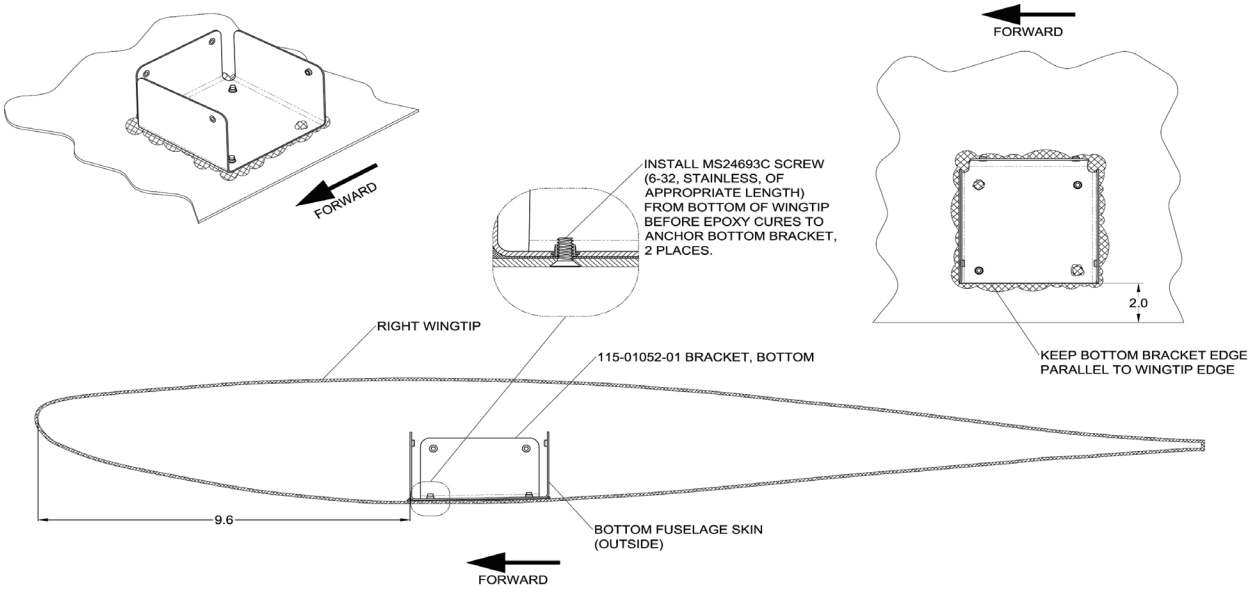

Figure C-3 Lancair IV/IV-P Right Wingtip GMU 44 Installation

1. Rivet the GMU 44 Installation Rack (115-00481-00) to the Top Bracket Assembly (115-01052-00) as shown in Figure C-4.

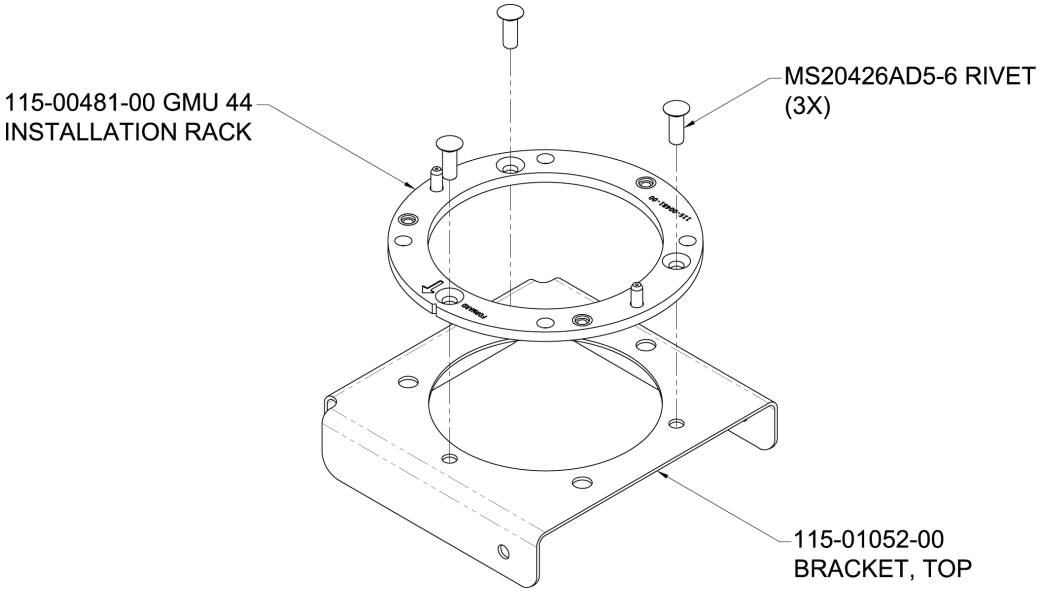

Figure C-4 Lancair IV/IV-P GMU 44 Mounting Bracket

2. Attach the GMU 44 to the Top Bracket Assembly (115-01052-00) using screws (211-60037-08) as shown in Figure C-5.

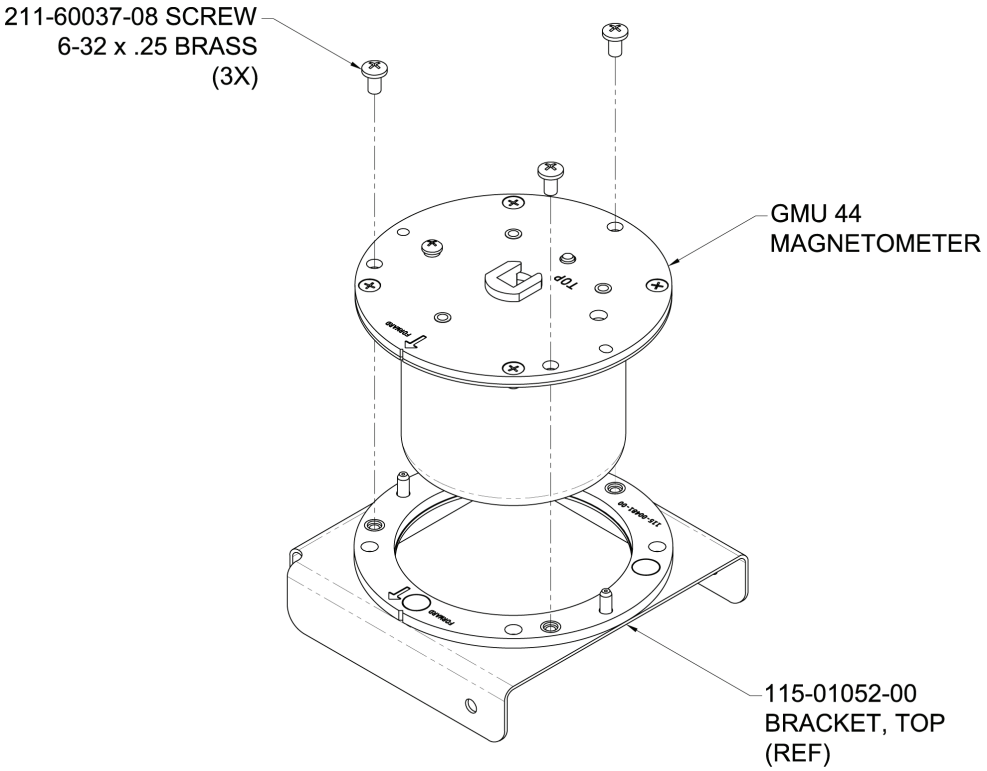

Figure C-5 Lancair IV/IV-P GMU 44 Mounting Bracket

3. Attach the Top Bracket Assembly (115-01052-00) to the Bottom Bracket Assembly (115-01052-01) as shown in Figure C-6.

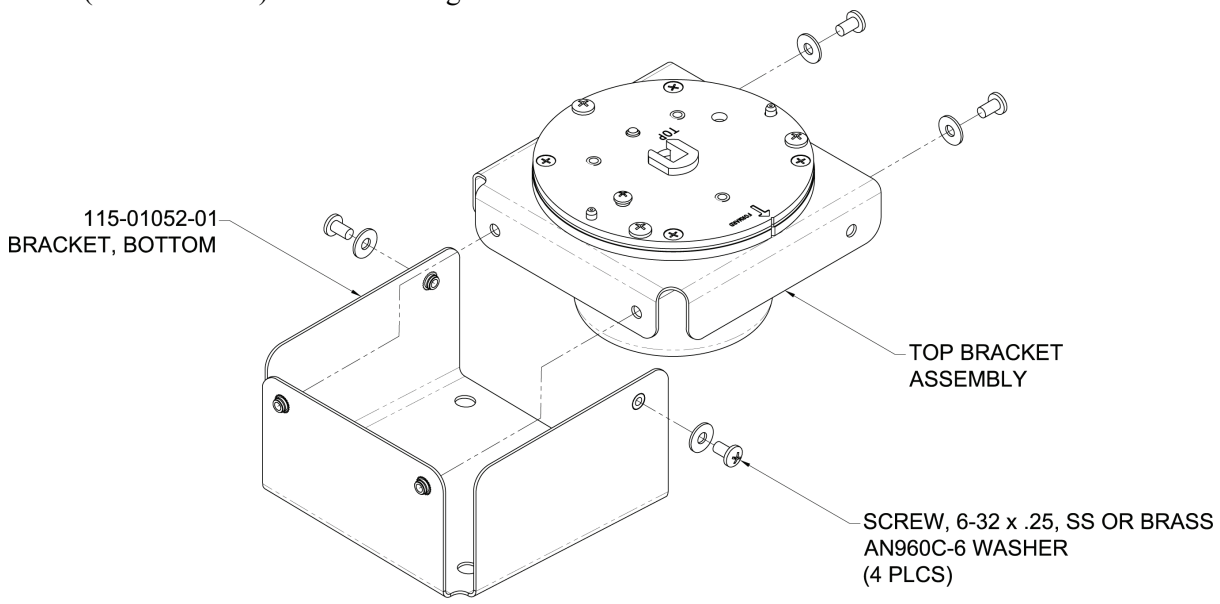

Figure C-6 Lancair IV/IV-P GMU 44 Mounting Bracket

4. After the installation, the pigtail of the GMU 44 should mate with the aircraft wiring that is routed through the wing. Due to the narrow thickness of the wingtip in this location, install chafe protection between the pigtail of the GMU 44 and all surfaces of the wingtip that may come in contact with the pigtail.
    - When routing the GMU 44 wiring with other power sources, ensure each power source contains an adequate return ground. It is important to route the return ground with the power wire to help cancel stray magnetic fields.
    - Route NAV light wiring as far as practical away from the GMU 44.
5. Refrain from installing any ferrous metals near the GMU 44, including the mounting screws and nut plates used to attach the wingtip. Stainless steel fasteners are recommended.

C.3.2 Lancair ES/ES-P

C.3.2.1 GMU 44 Mounting Bracket

The Lancair ES/ES-P uses the G3X generic GMU 44 mount. The mount is comprised of two sheet metal parts, a bottom bracket (Garmin part number 115-00939-00) and a top bracket (Garmin part number 115-01017-00) that holds the GMU 44 mounting plate. The set is purchased as a sub-assembly kit under Garmin part number 011-01779-00.

C.3.2.1.1 GMU 44 Mount Installation Guidance

One possible mounting location for the GMU 44 is the last wing rib in the right wingtip (refer to Figure C-7). The wing tip should be removable to gain proper access to the GMU 44. At a minimum, a removable access panel under the wingtip is required.

The GMU 44 is removed by lifting the unit up and out, the entire bracket assembly would need to be unscrewed from the rib in order to service it from underneath. Considerations for both GMU 44 bracket attachments and wingtip attachments should be made to ensure access to the GMU 44.

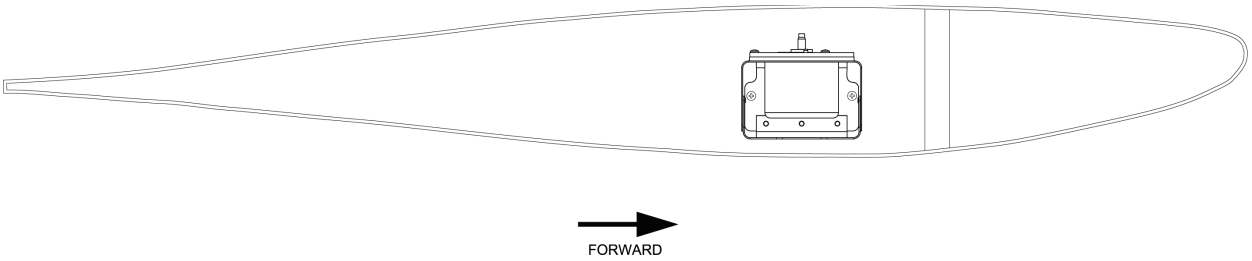

Figure C-7 Right Wingtip GMU 44 Installation

- The GMU 44 Installation Rack (115-00481-00) should be installed parallel to the mounting surface of the Magnetometer Bracket (115-01017-00) to ensure the finished GMU 44 installation will be in alignment with the Lancair ES/ES-P aircraft heading.
- The GMU 44 Installation Rack (115-00481-00) should be installed with the forward arrow (marked on the ring) indicating a direction parallel with the outboard wing rib, which acts as a reference for the aircraft's forward direction.

NOTE

There are two small alignment holes on the GMU 44 bracket and a "V" cut into the GMU 44 Installation Rack. Temporarily placing a drill bit in this hole will aid in making a perfectly parallel alignment of the GMU 44.

1. Clamp the GMU 44 Installation Rack (Figure C-8) in place and match drill the GMU 44 Bracket through three countersunk mounting holes.
2. Mark the center of the three mounting screw holes.
3. Remove the GMU 44 mounting plate.
4. Drill the clearance holes in the GMU 44 Mounting Bracket.

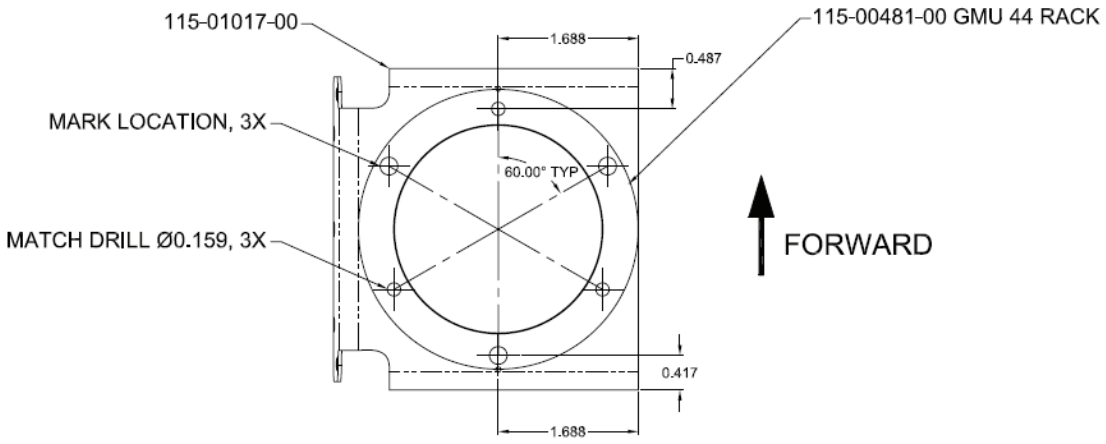

Figure C-8 GMU 44 Installation Rack (ES / ES-P)

5. Rivet the GMU 44 Installation Rack (115-00481-00) to the Top Bracket Assembly (115-01017-00) as shown in Figure C-9.

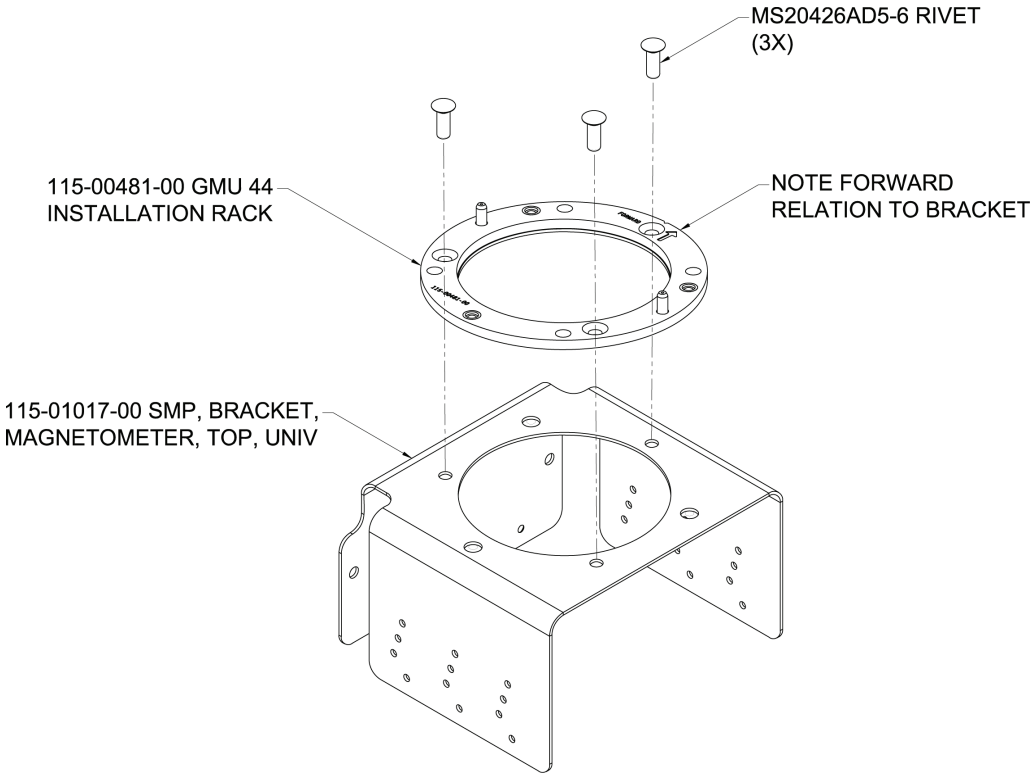

Figure C-9 GMU 44 Installation Rack (ES/ES-P)

6. Rivet the Top Bracket Assembly (115-01017-00) to the Universal Bracket Assembly (115-00939-00) as shown in Figures C-10 and C-11.

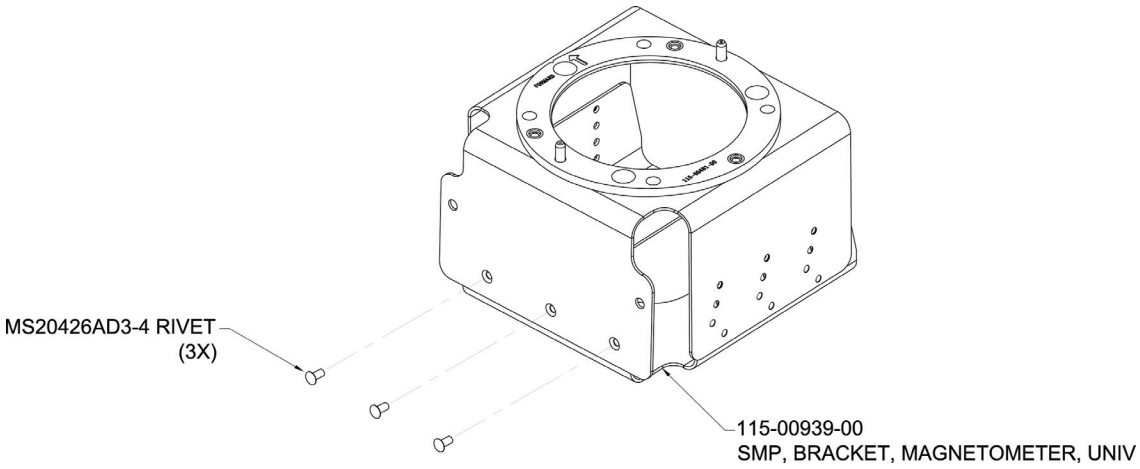

Figure C-10 Lancair IV/IV-P GMU 44 Mounting Bracket Assembly

NOTE

The assembled bracket can be shifted to accommodate for wing dihedral. Figure C-11 illustrates the offset rivet holes which may be utilized to tilt the GMU 44 up (plus) from the mounting surface or down (minus) from the mounting surface.

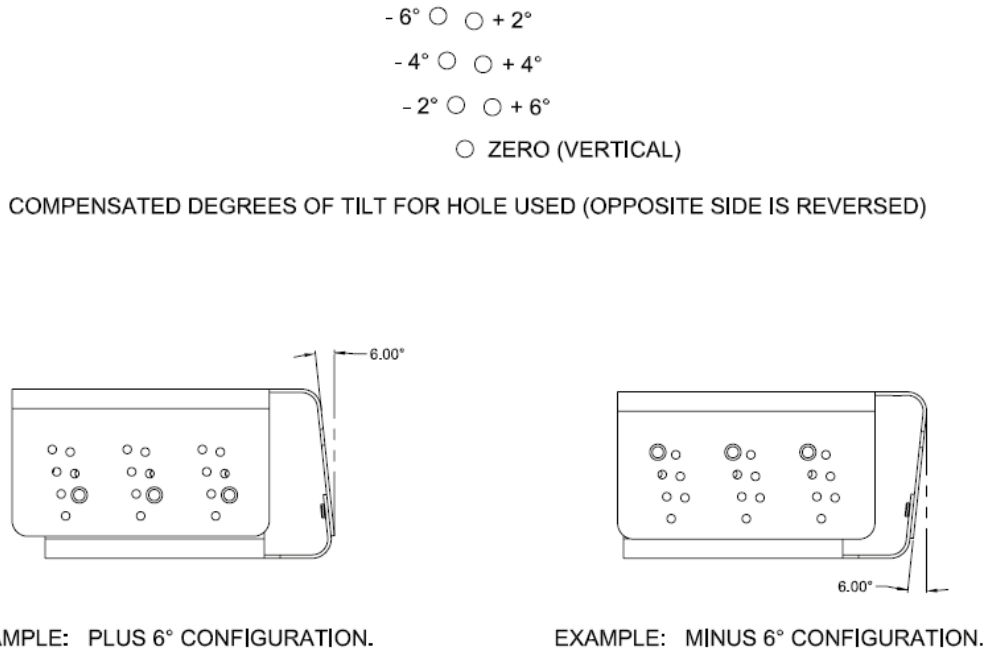

Figure C-11 Adjusting for Wing Dihedral

7. With the GMU 44 mount setup for installation in the right wing, shift the bracket to the minus 2 degree setting and rivet it in place using six 1/8" button head rivets as illustrated in Figure C-12.

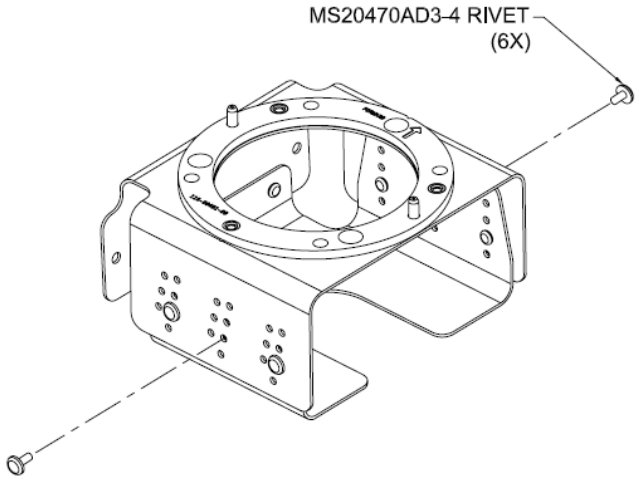

Figure C-12 Rivet shifted Magnetometer Mount

8. Attach the GMU 44 to the GMU 44 Mounting Bracket as illustrated in Figure C-13 using brass screws.

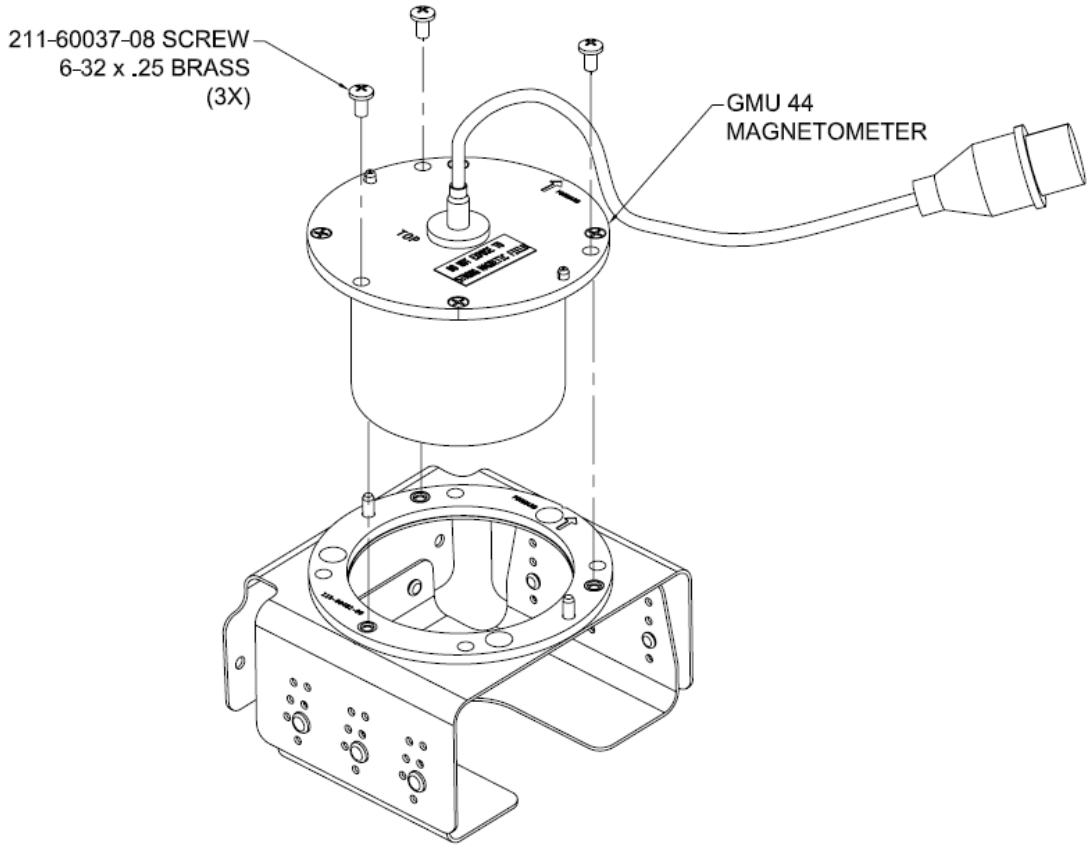

Figure C-13 Secure GMU 44 to the Mounting Bracket Assembly

9. Fabricate two disks from 2 BID sheet to the dimensions shown in Figure C-14.

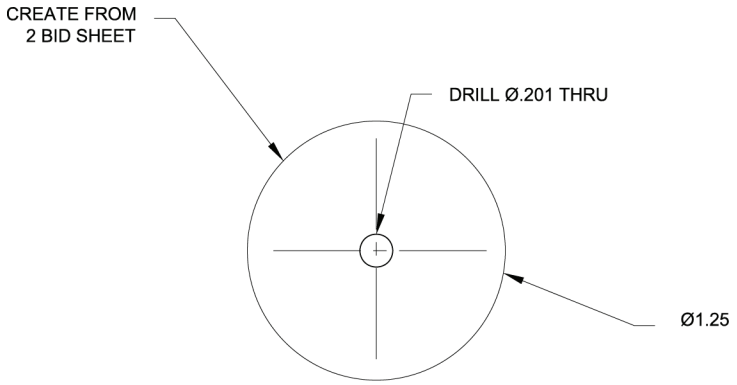

Figure C-14 2 BID Sheet Disk

10. Align one *stainless steel* nutplate MS21048-3 (or K1001-3) to each disk using the center hole as a guide. Match drill 0.098 holes to nutplate and countersink 100° on one side. Refer to Figure C-15.

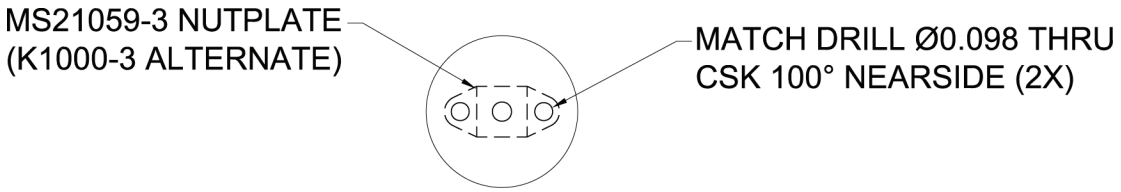

Figure C-15 Aligned Nutplate And Disk

11. Rivet nutplate to disk with MS20426AD3-4 rivets as shown in Figure C-16.

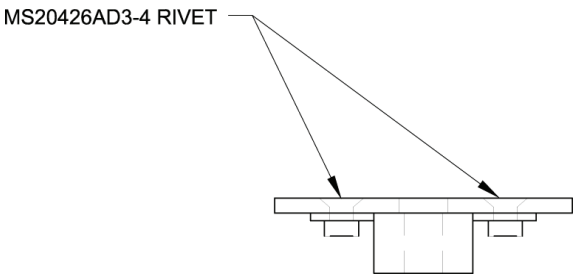

Figure C-16 Riveted Nutplate And Disk

12. Place the Magnetometer Mounting Assembly aft of the spare and level with the typical flight attitude. Make sure there is sufficient head room for the pig tail to bend clear of the wing tip.
13. Match drill the Magnetometer Bracket to the wing rib.
14. Apply epoxy resin to the flat side of the nutplate washers, see Figure C-17.

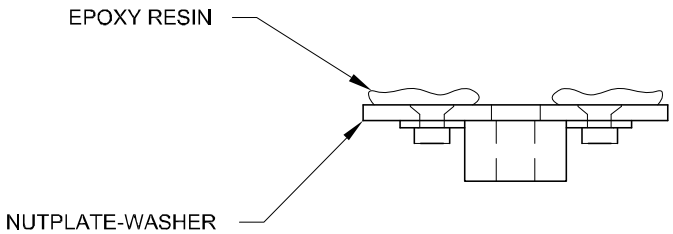

Figure C-17 Nutplate Washers

15. Apply a small amount of release agent on the *stainless steel* MS51958 screw threads.
16. Attach GMU assembly to wing rib as shown in Figure C-18.

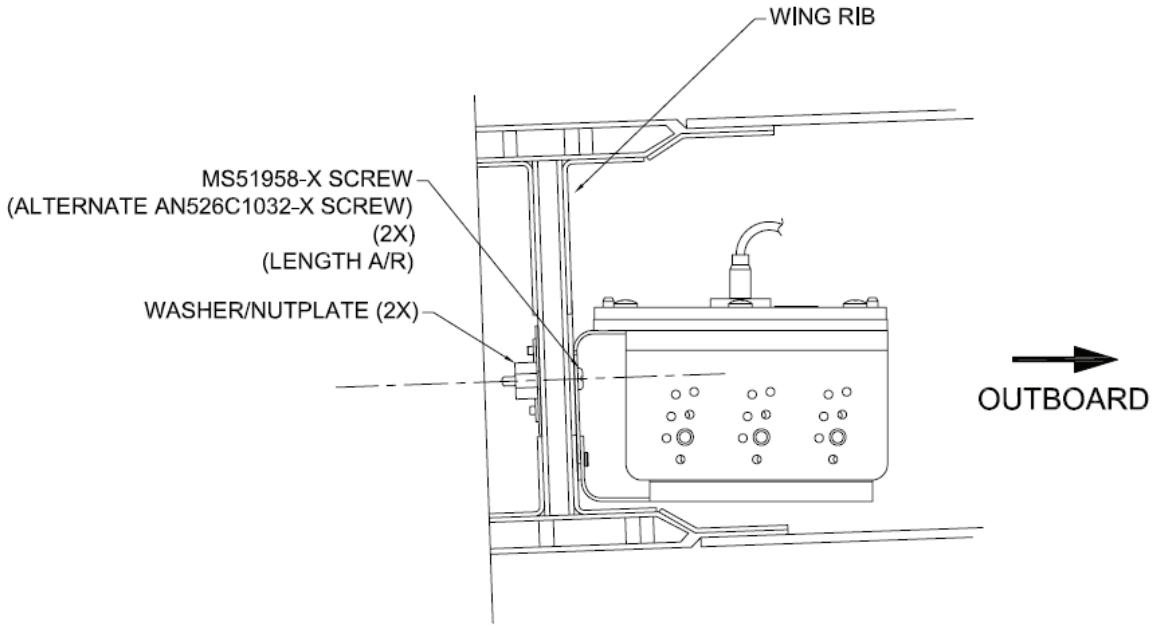

Figure C-18 Magnetometer Assembly attached to Wing Rib

NOTES

- Stainless steel hardware (nutplates and screws) must be used to attach the GMU 44 bracket to the wing.
- The wing tip should also be attached with stainless steel hardware (nutplates and screws).
- Never use a magnetic screwdriver to remove or install wingtip hardware.

C.3.3 Lancair Legacy

C.3.3.1 GMU 44 Magnetometer Installation Guidance

1. A possible mounting location is in the upper section of the fuselage cavity, just forward of the vertical tail section. The recommended location is shown in Figure C-19.

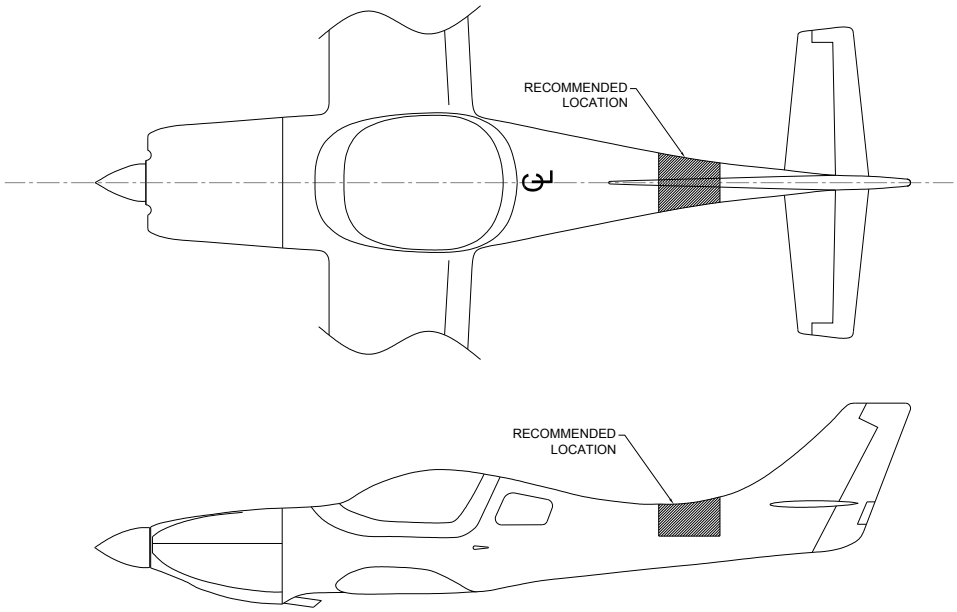

Figure C-19 Lancair Legacy Magnetometer Location

2. In determining a shelf location, ensure there is enough room above the shelf to install or remove the magnetometer, as well as provide clearance for the associated cable harness as demonstrated in Figure C-20.

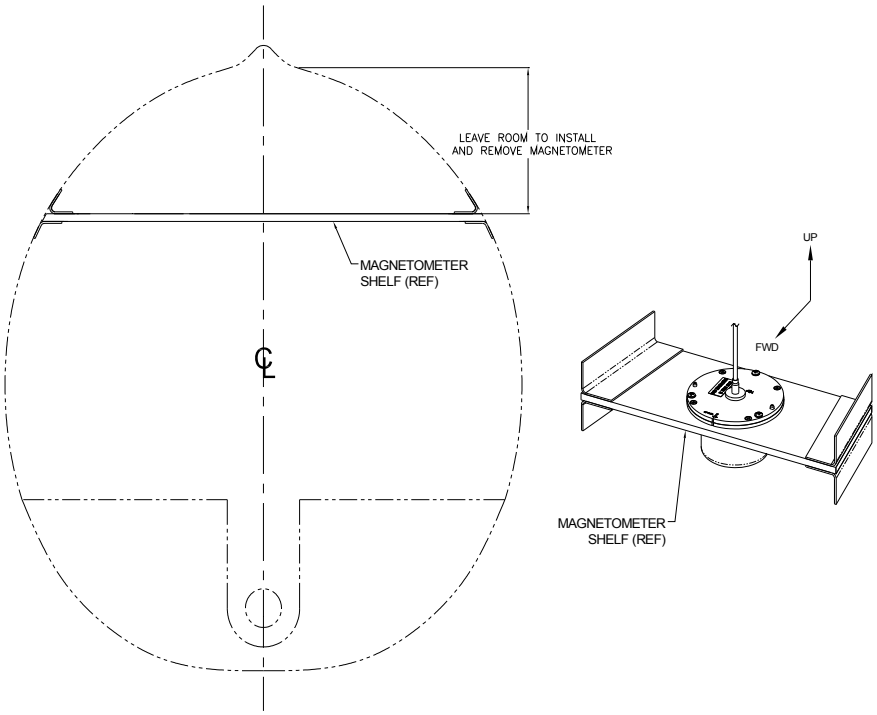

Figure C-20 View Looking AFT At Recommended Magnetometer Location

3. Measure the fuselage in multiple locations to determine the size of the shelf. The shelf will have an approximate trapezoidal shape and should have a depth of at least 4.0 in. Cut the shelf from 0.25 in. thick, 2-ply per side prepreg. Cut a 2.50 in. diameter hole in the center of the shelf, as indicated in Figure C-21. Alternately, the 2.50 in. diameter hole can move left or right on the shelf, so long as there is adequate clearance to install or remove the magnetometer. By placing the hole in the center of the shelf, the elevator control tube can be used more effectively in a later step to align the GMU 44 Installation Rack with the aircraft's forward direction. Prepare for shelf installation by sanding, roughing up, and cleaning all bonding areas on the shelf and fuselage for best adhesion.

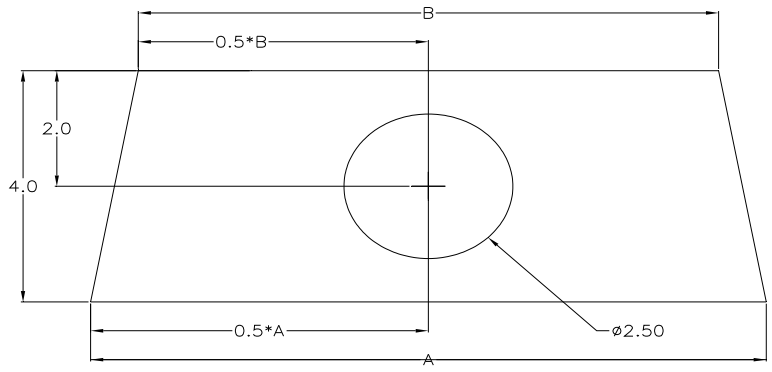

Figure C-21 Example Magnetometer Shelf

4. Fill gap between sides of fuselage and shelf with epoxy/flox mixture. Be sure to make a radius at the corners as demonstrated in Figure C-22 to smooth the corners for laying glass in the following steps. When aligning the shelf, ensure the shelf remains level to within 3° of the pitch and roll axes.

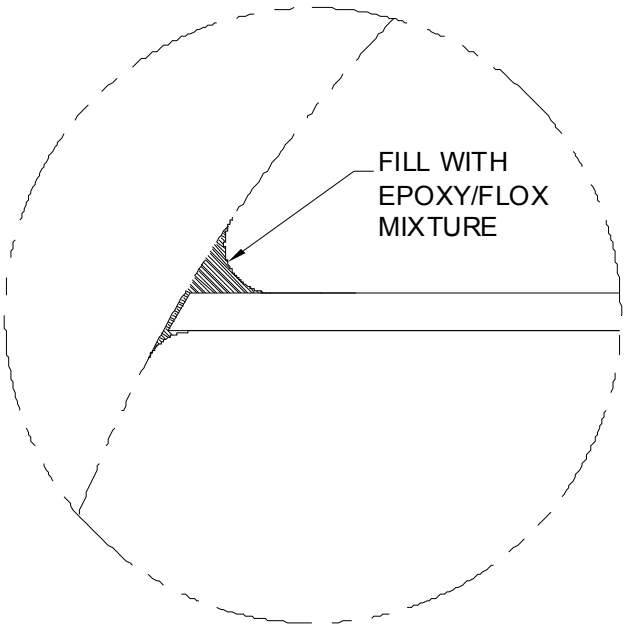

Figure C-22 Fill Detail For Corner Radii And Magnetometer Shelf

5. Secure the shelf to the fuselage with one layer of 3.0 in. wide, 2 bid strips at each corner above and below the shelf. The lay up is shown in Figure C-23.

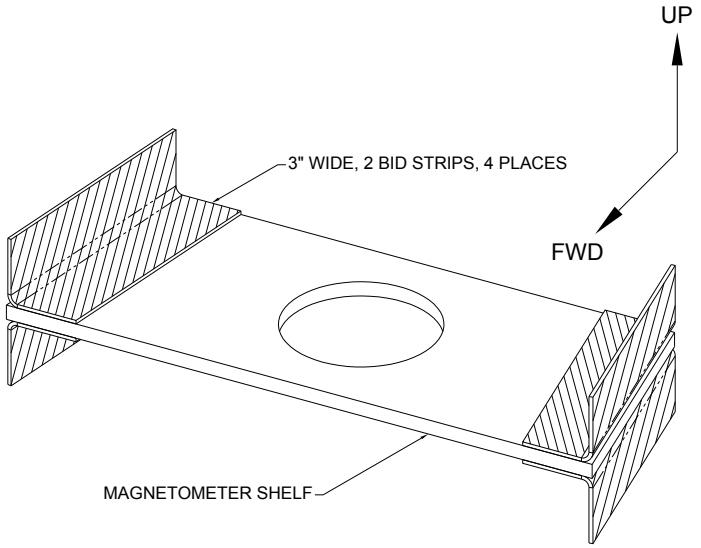

Figure C-23 Magnetometer Shelf With Lay up

6. The shelf installation must be fully cured before proceeding with the magnetometer installation. Using the elevator control tube as the aircraft centerline reference, project a parallel line on to the magnetometer shelf. The parallel line serves as an indication of the aircraft's forward direction, as demonstrated in Figure C-24. The alignment of the magnetometer is critical and needs to be within 0.5° of the aircraft's forward direction.

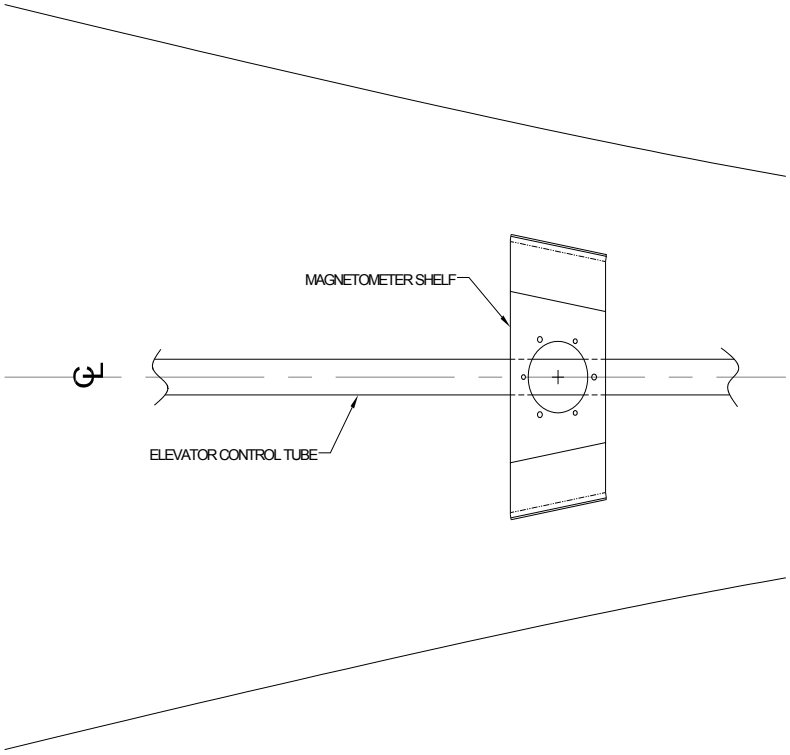

Figure C-24 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction

Alternately, if the 2.50 in. diameter hole is drilled off of centerline as indicated in Figure C-25, project a parallel line to the aircraft's centerline reference using the elevator control tube as a reference line. Mark a parallel line at the offset cutout to create the forward direction reference.

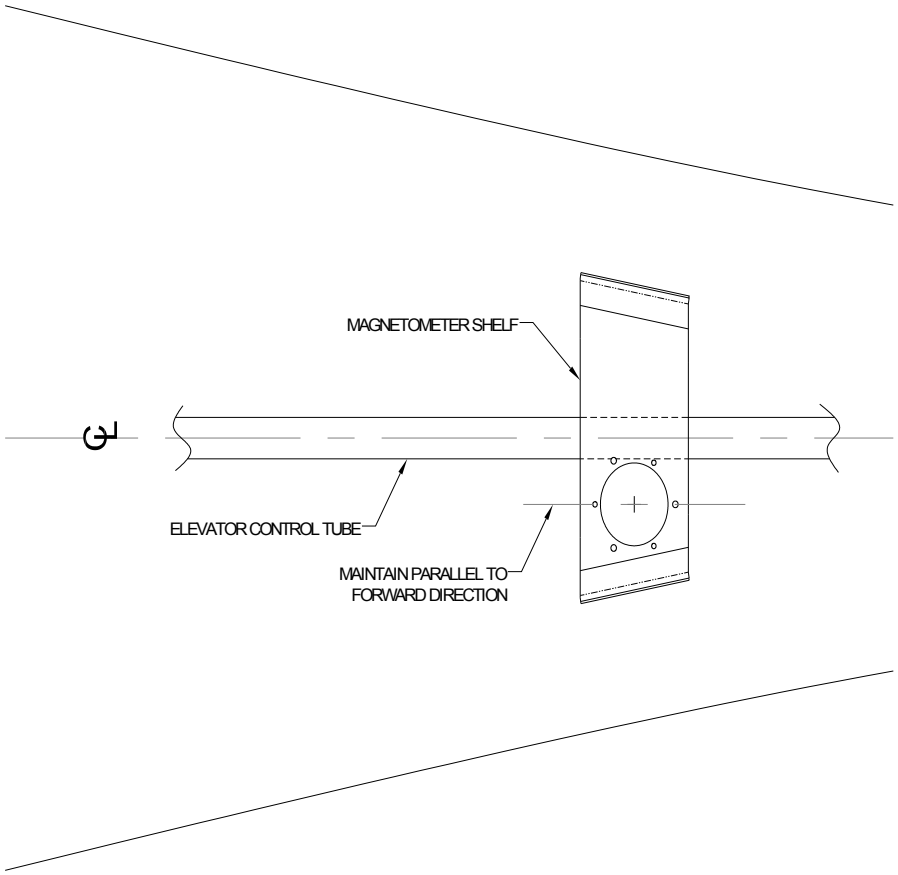

Figure C-25 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction With Offset Magnetometer Cutout

Clamp the GMU 44 Installation Rack (115-00481-00) in place above or below the shelf, whichever corresponds to the side with the centerline reference mark, allowing the inside diameter of the cutout in the GMU 44 Installation Rack to be concentric with the circular cutout in the magnetometer shelf. Align the notch on the GMU 44 Installation Rack (indicating forward direction) with the aircraft centerline mark at the forward end of the shelf. The cutout alignment needs to be within 0.5° of the aircraft's forward direction.

Address the six holes for the magnetometer install rack as shown in Figure C-26 by either match drilling or marking the holes as shown. Match drill the magnetometer shelf through the three countersunk holes found on the Installation Rack. Mark the center of the three mounting screw holes. Remove the GMU 44 Installation Rack and drill the three marked locations to 0.203 in. diameter, as these are clearance holes for the GMU 44 Magnetometer unit installation.

NOTE

The GMU 44 Installation Rack must be set, drilled, and installed after the shelf has been mounted in the aircraft and cured.

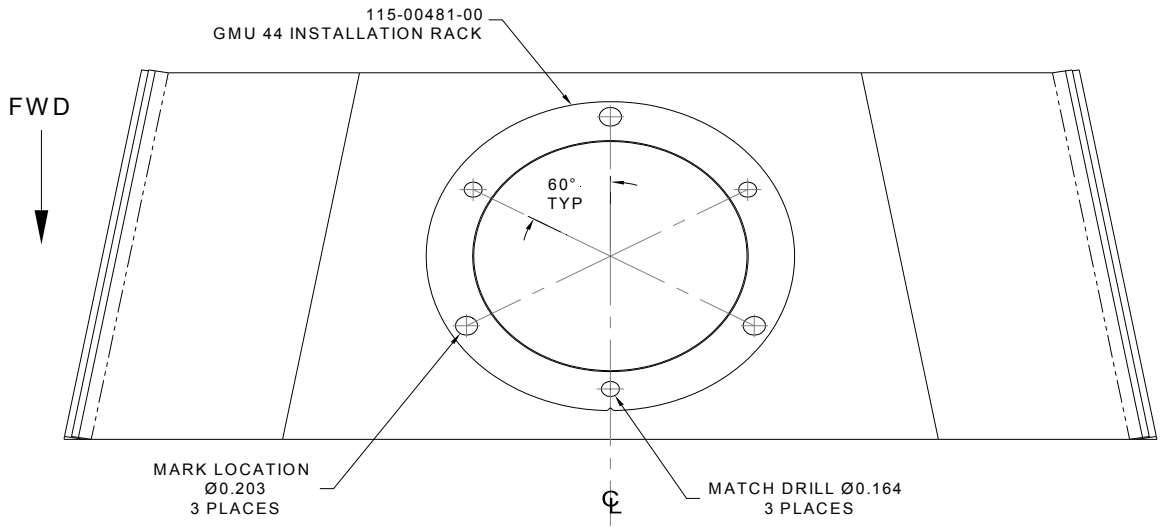

Figure C-26 Magnetometer Shelf With Hole Pattern For GMU 44 Installation Rack

7. Assemble the GMU 44 Installation Rack to the magnetometer shelf as shown in Figure C-27.

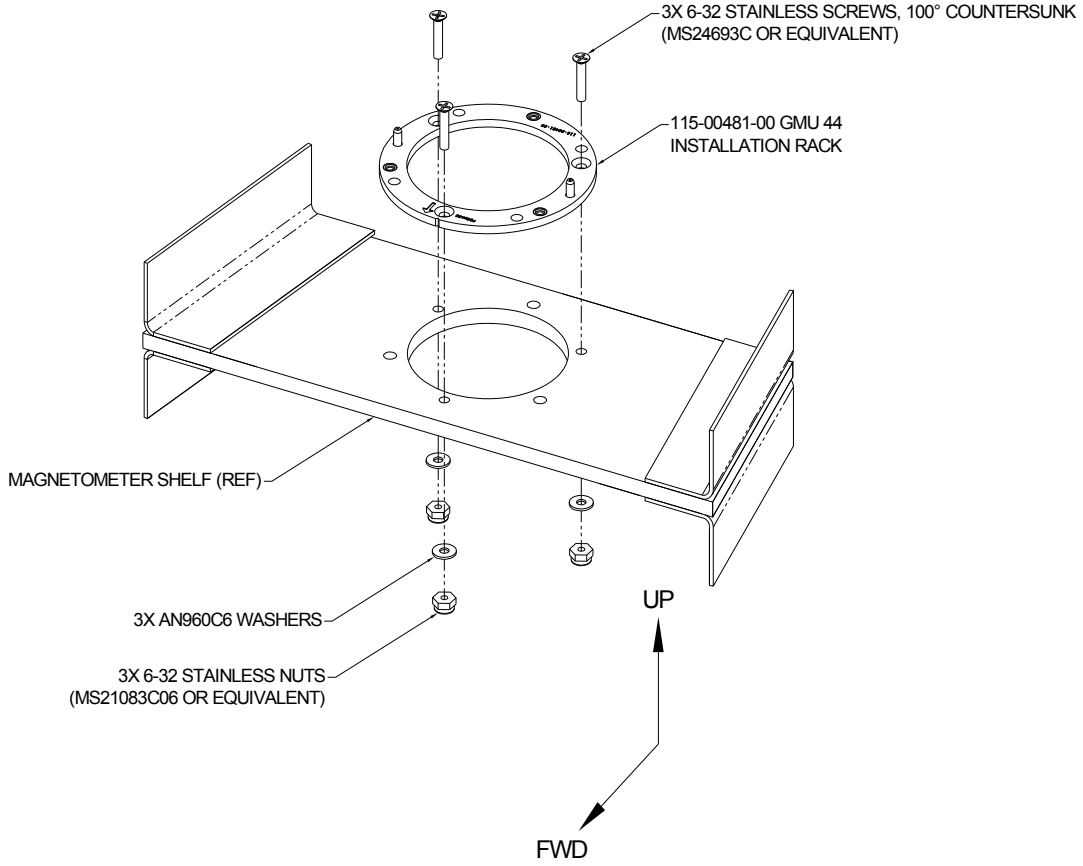

Figure C-27 Assembly Of GMU 44 Installation Rack To Magnetometer Shelf

8. Install the GMU 44 Magnetometer in the installation rack with the hardware provided as shown in Figure C-28.

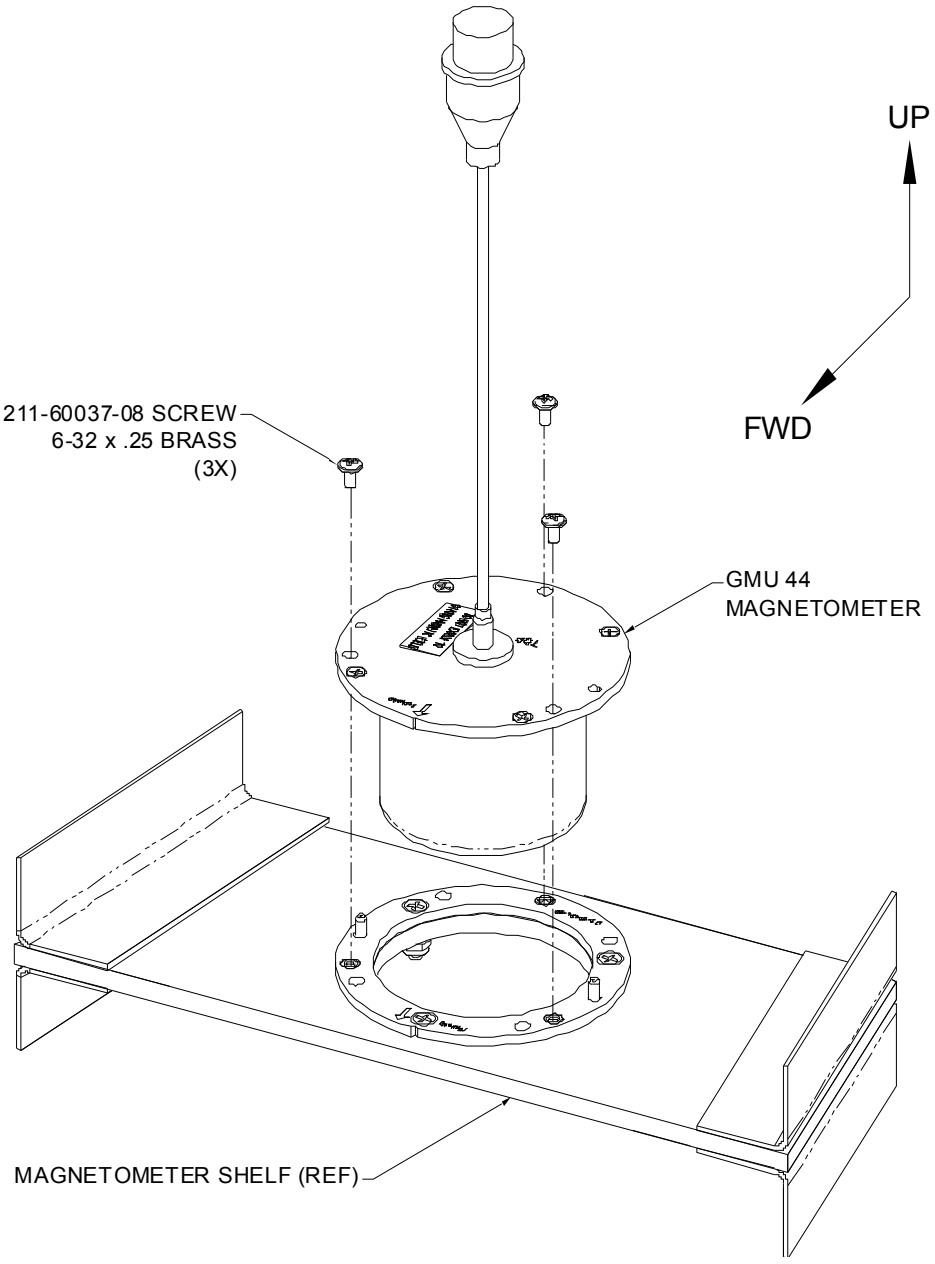

Figure C-28 Installation Of GMU 44 Magnetometer

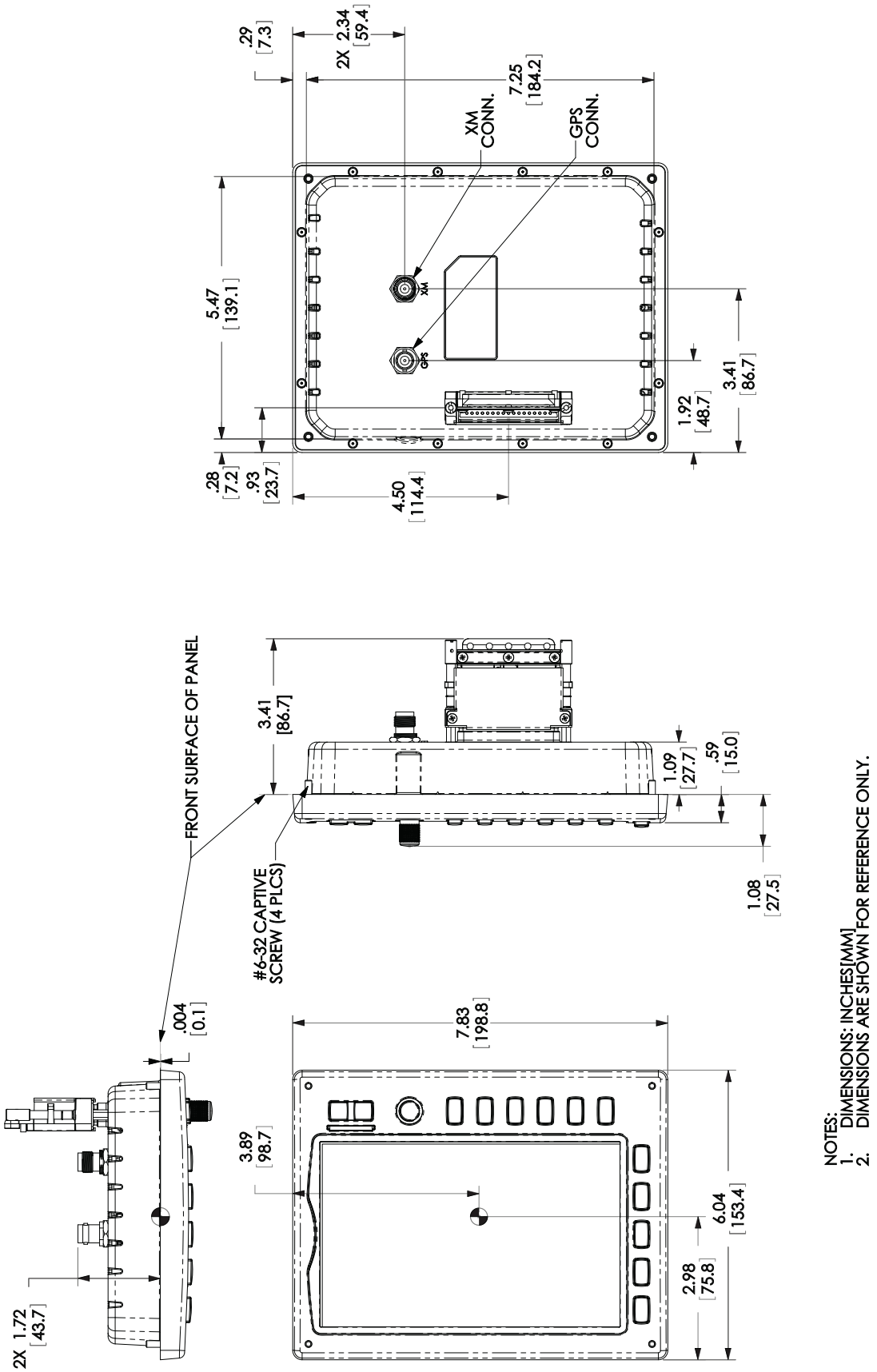

Figure D-1.1 GDU 37X Outline Drawing

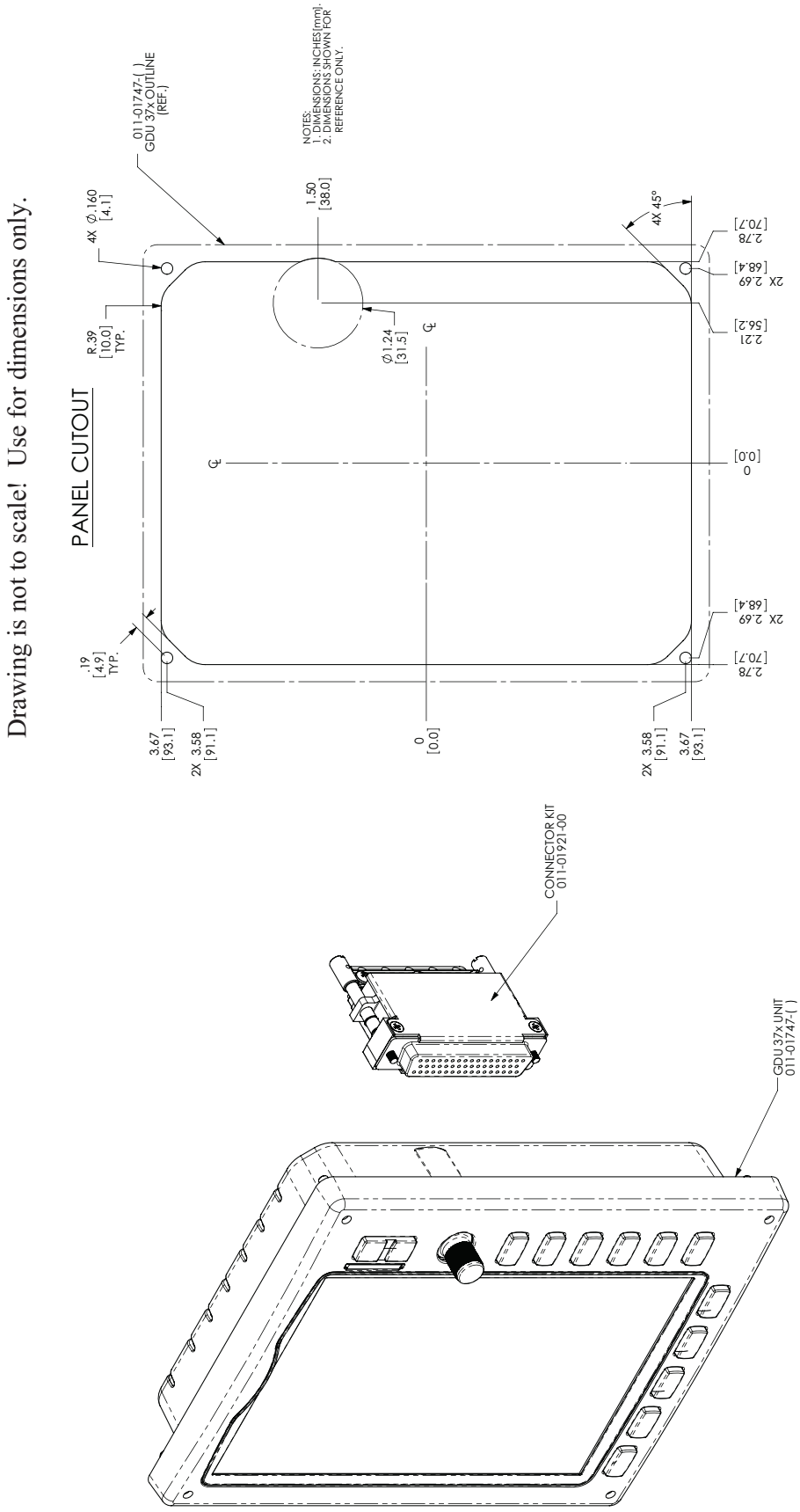

Figure D-1.2 GDU 37X Panel Cutout Drawing

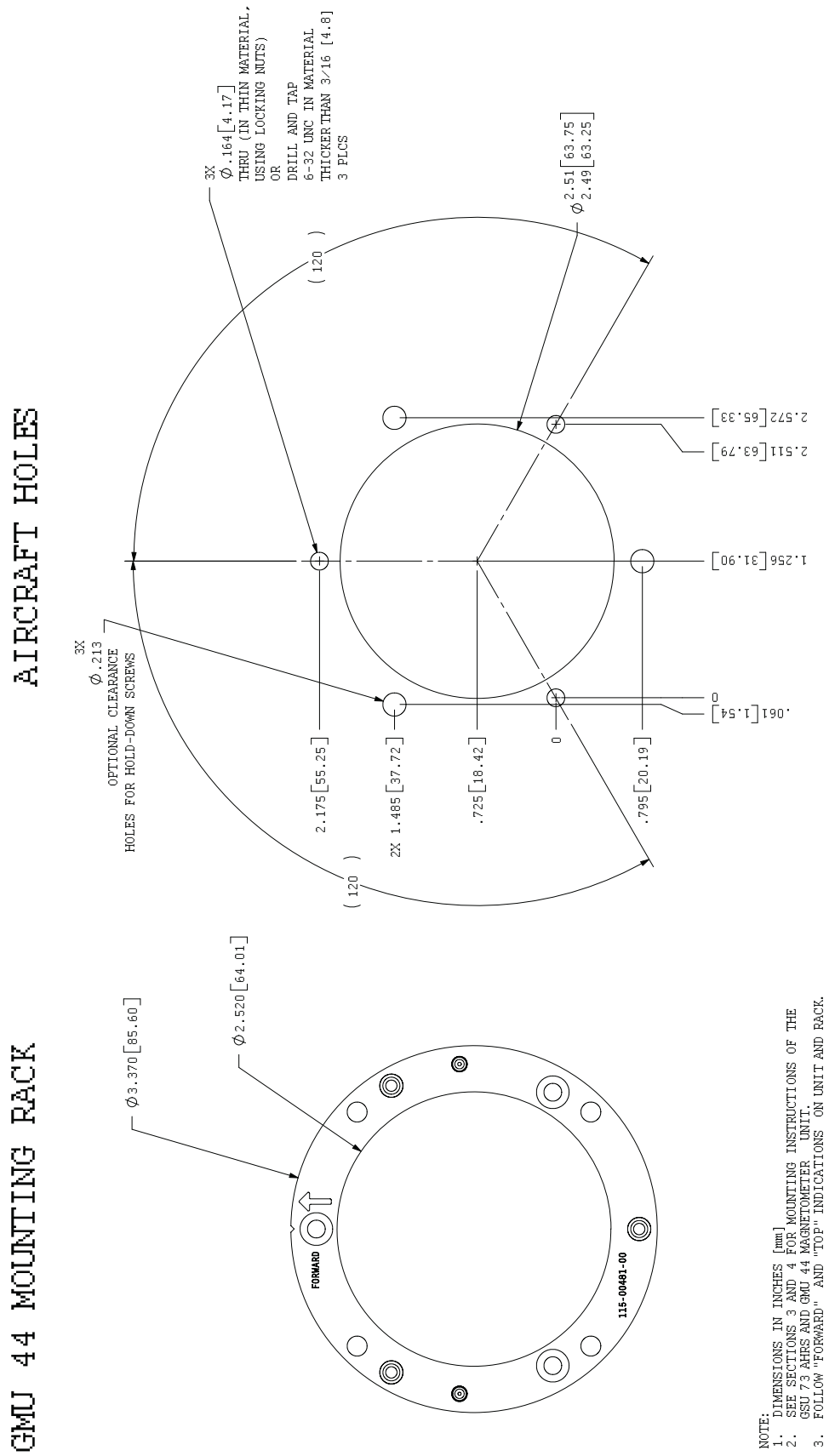

Figure D-2.1 GMU 44 Mounting Rack

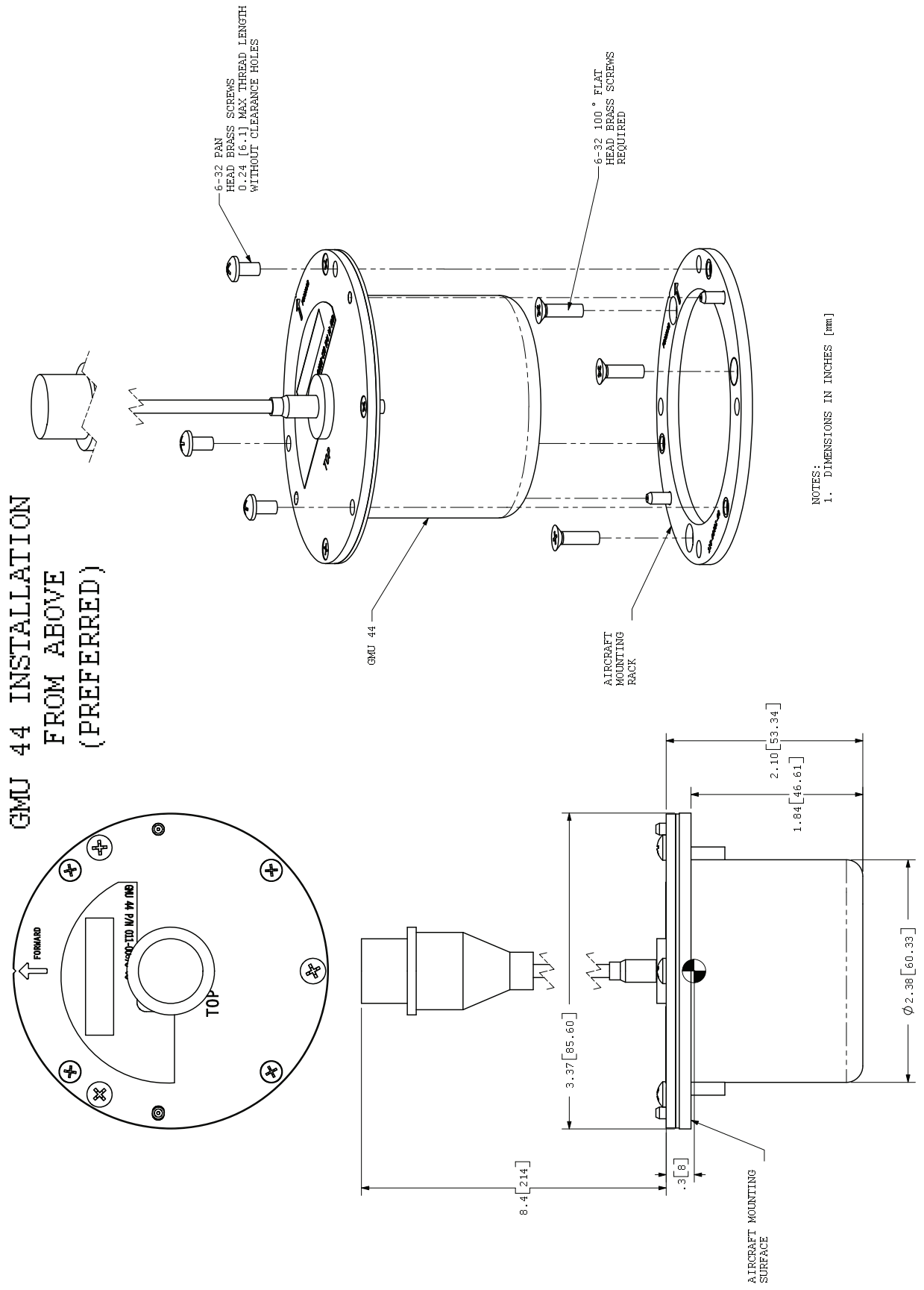

Figure D-2.2 GMU 44 Top Mounted Installation

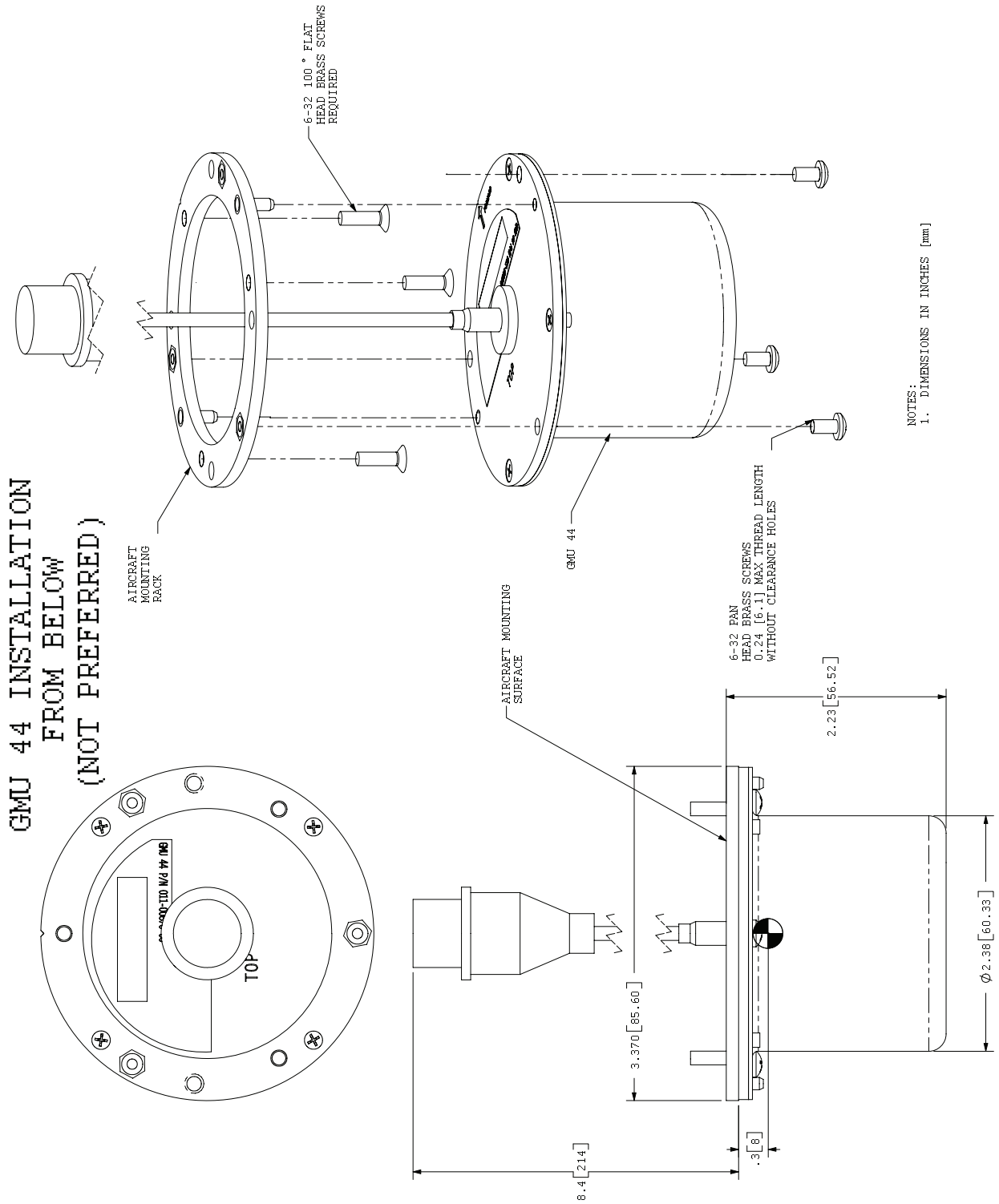

Figure D-2.3 GMU 44 Bottom Mounted Installation

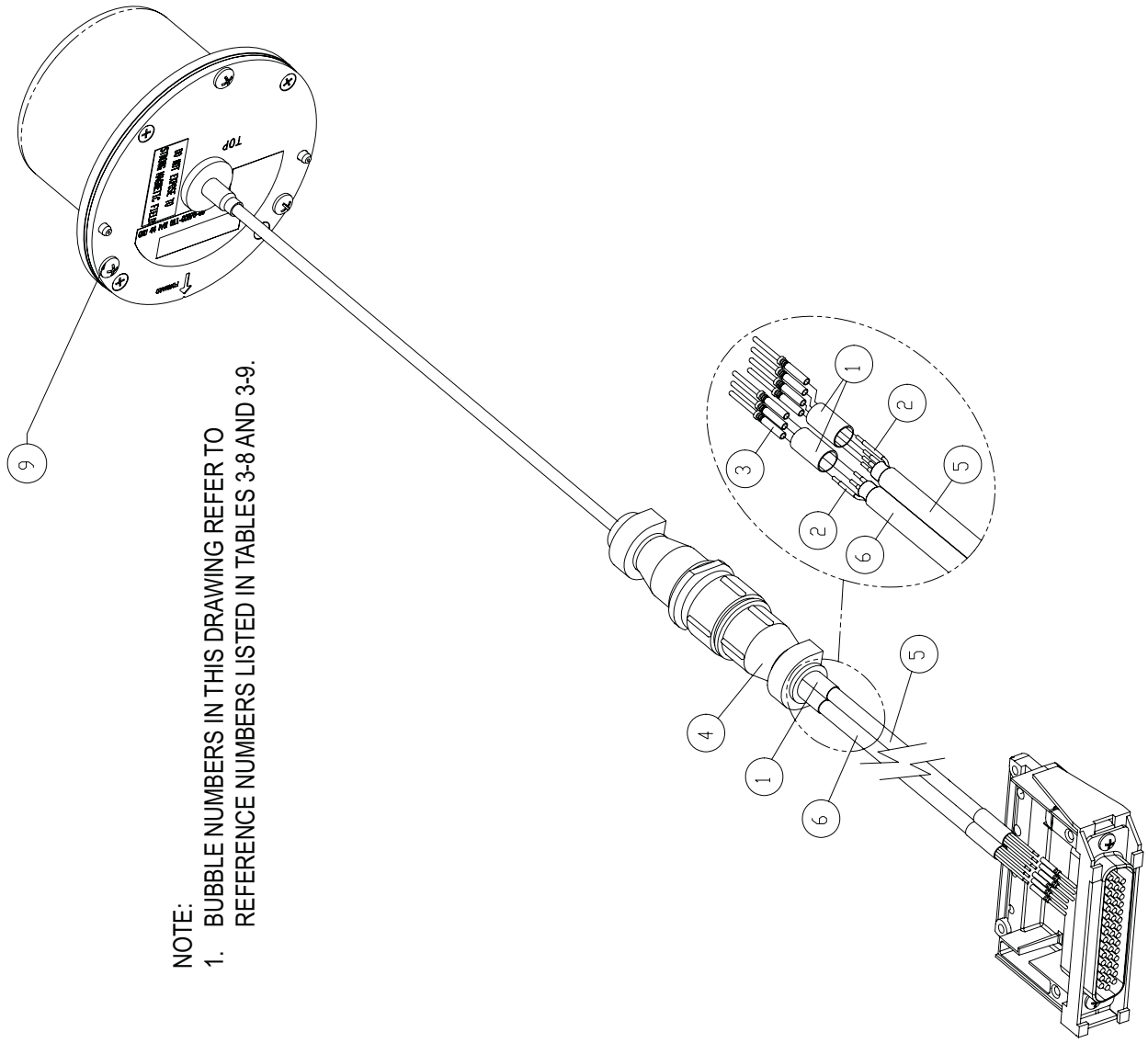

Figure D-2.4 GMU 44 Wiring Details

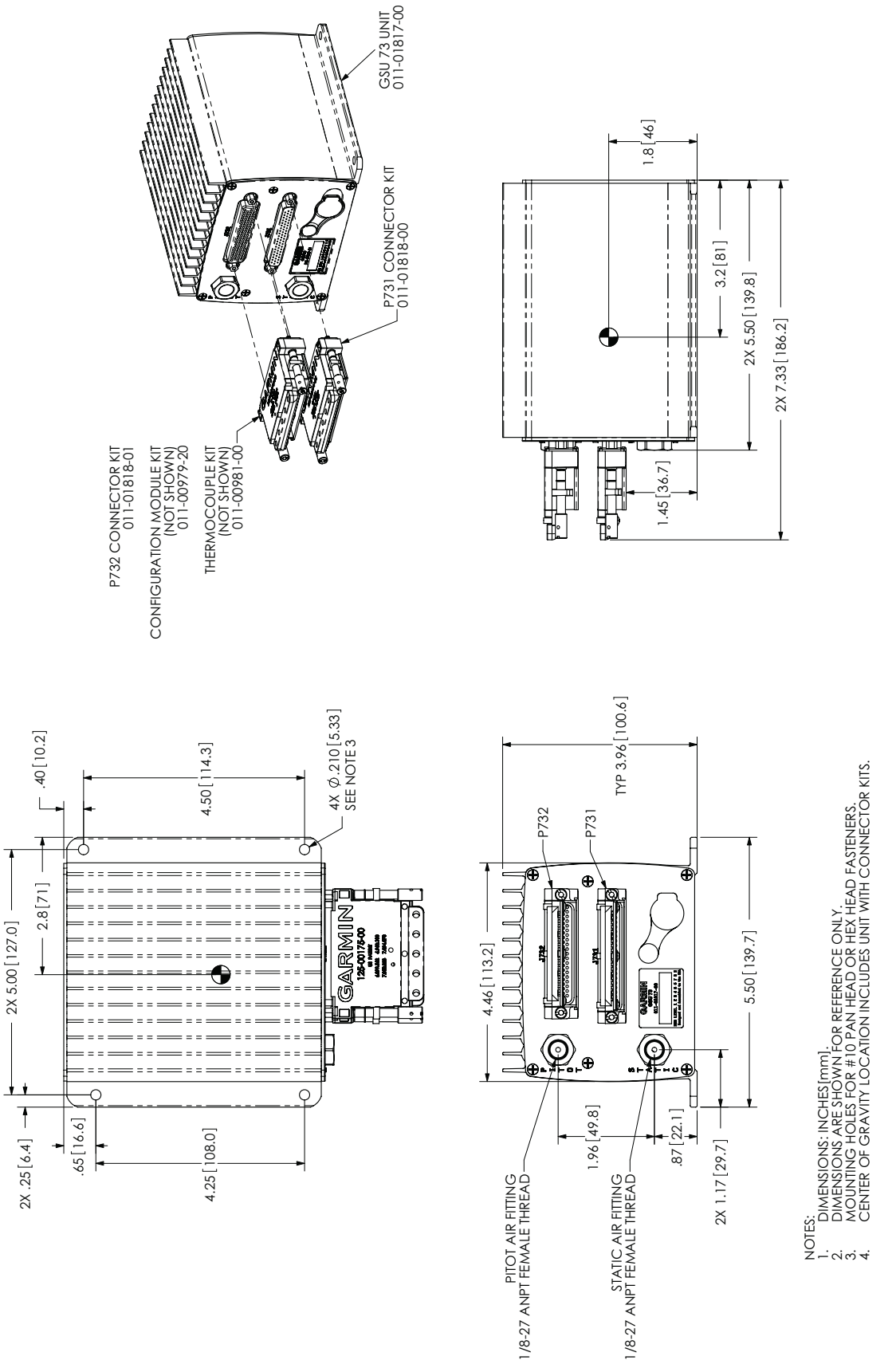

Figure D-3.1 GSU 73 Outline Drawing

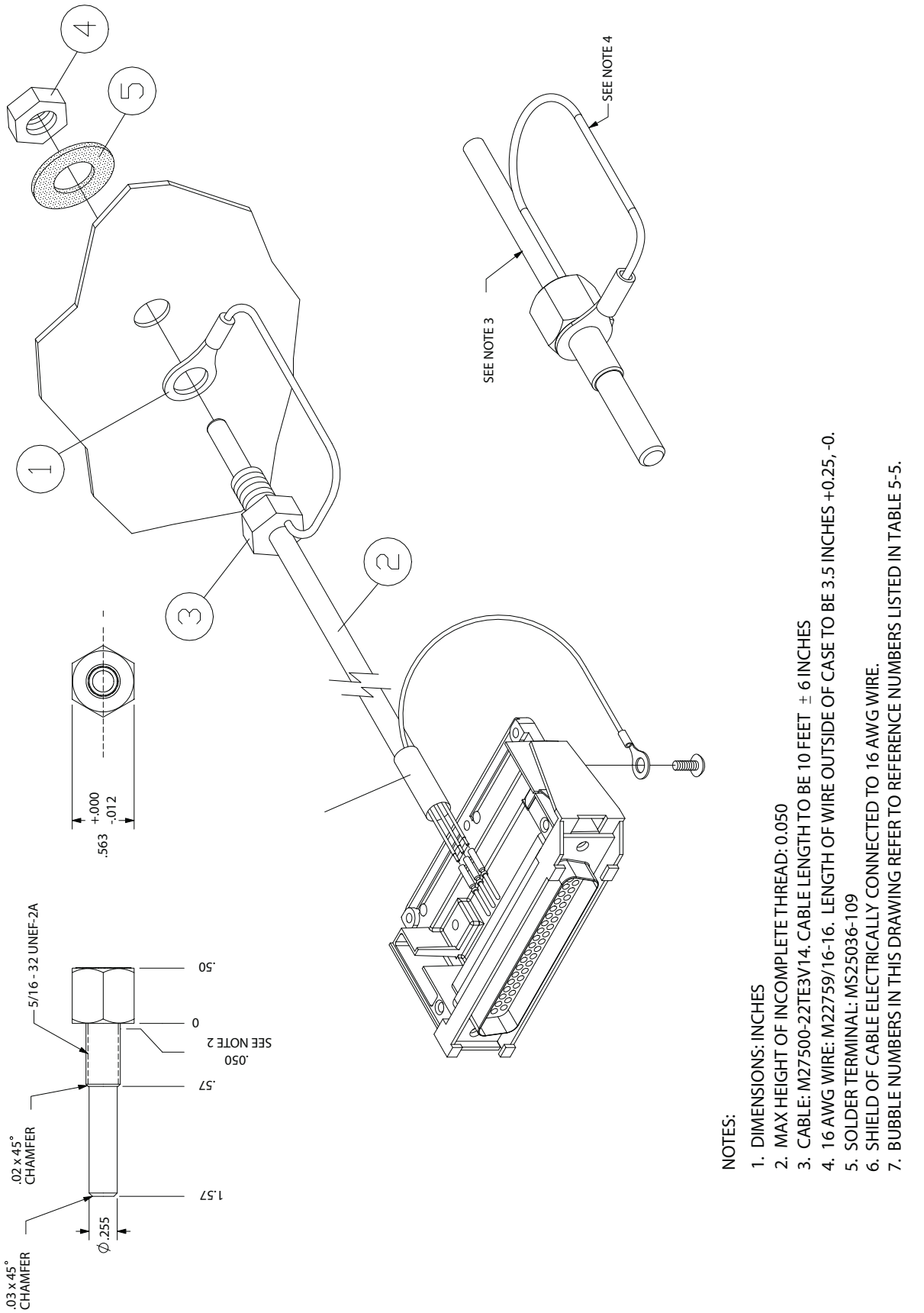

Figure D-4.1 GTP 59 O.A.T. Probe Installatin Drawing

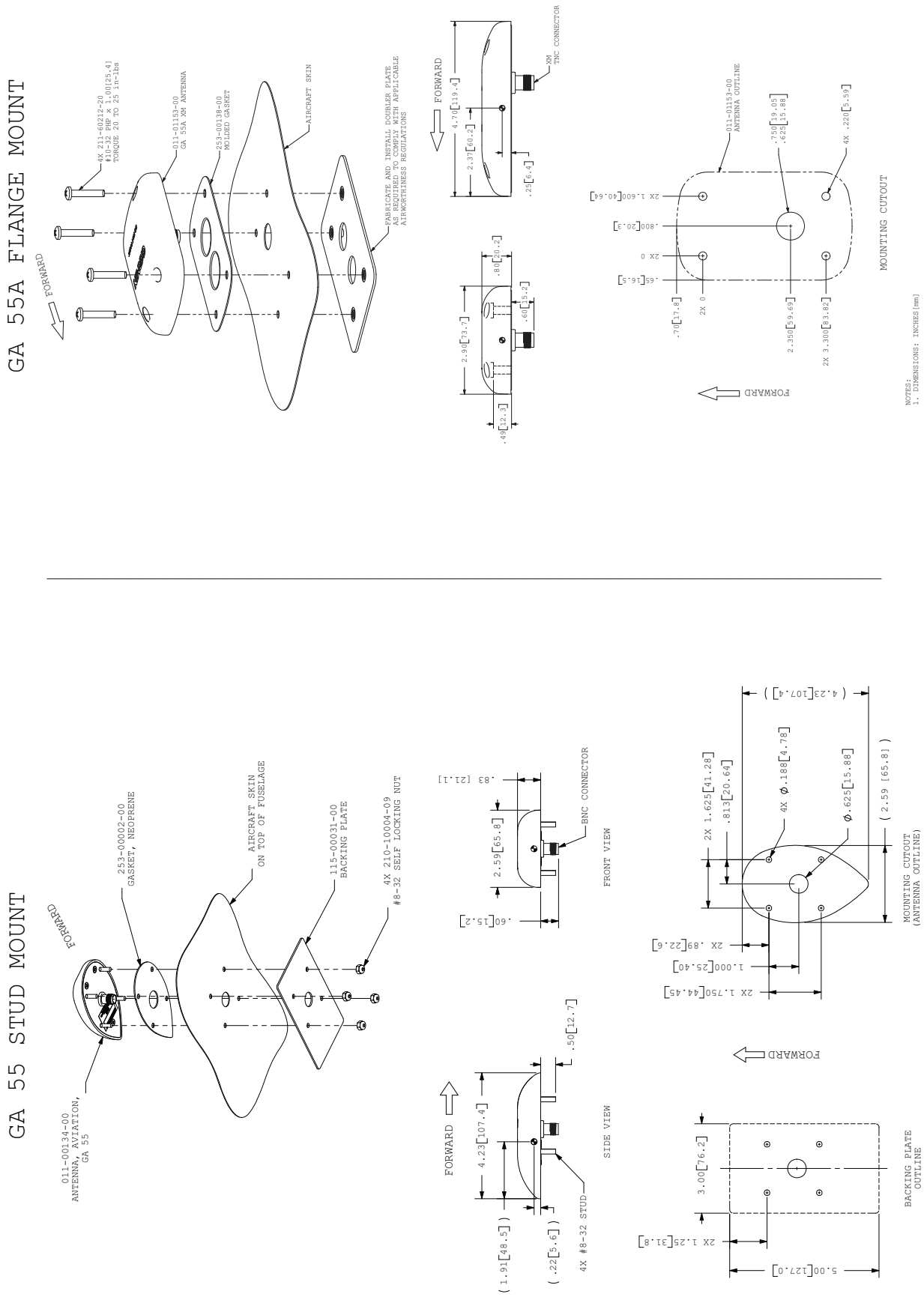

Figure D-5.1 GA 55/55A Installation Drawing

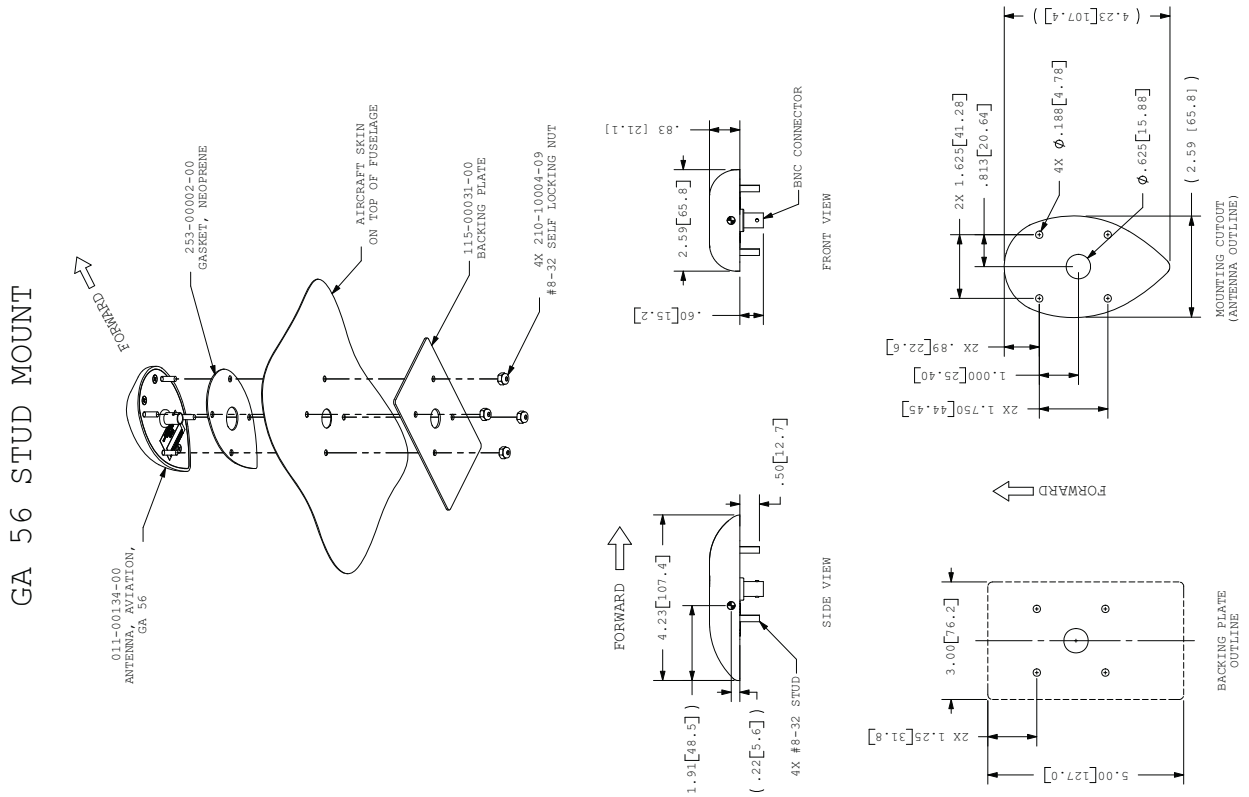

Figure D-5.2 GA 56 Installation Drawing

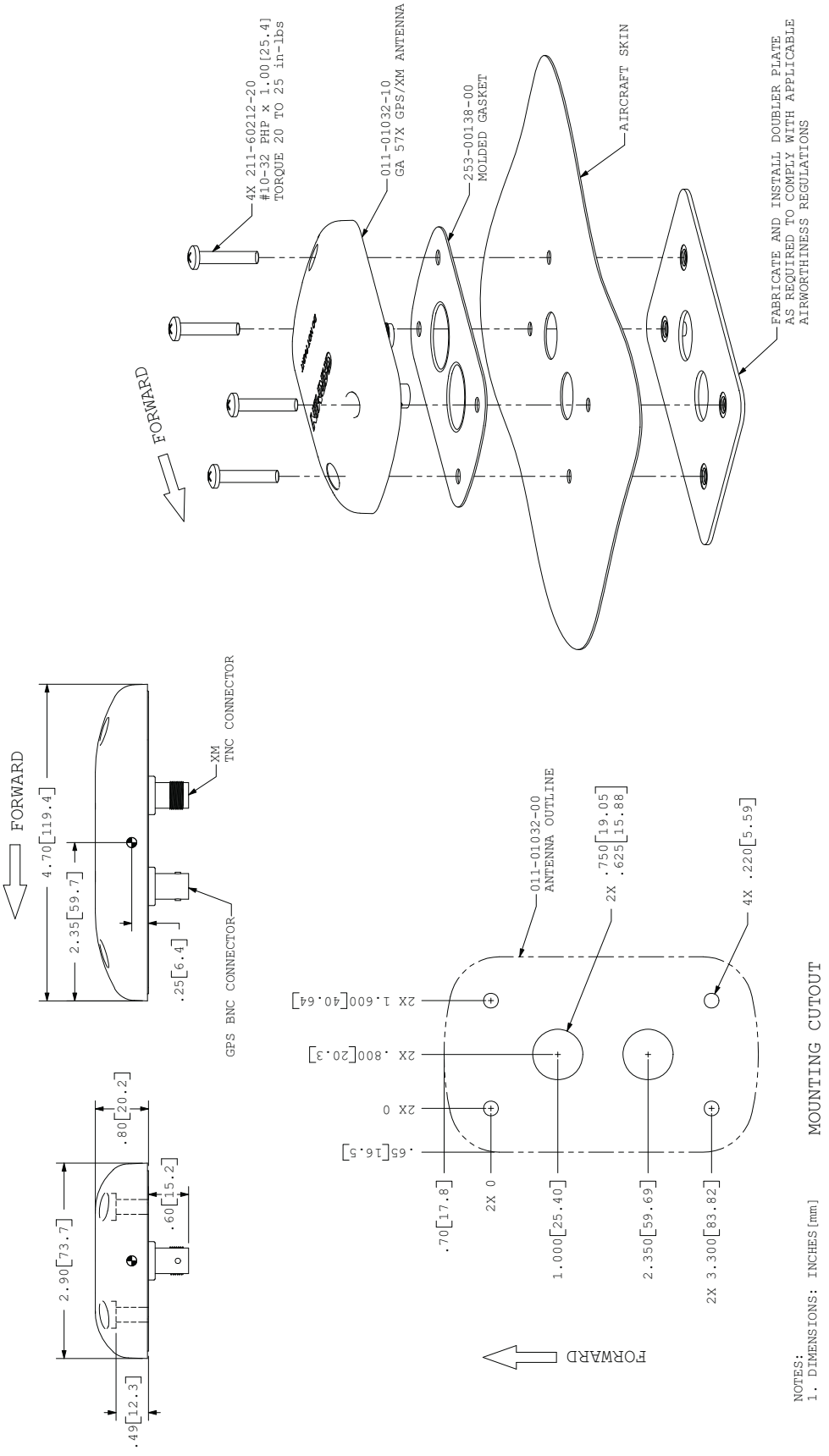

Figure D-5.3 GA 57X Installation Drawing

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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

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.
8. INSTALLATION INSTRUCTIONS FOR OAT PROBE, GMU 44, GND HARNESS, CONFIGURATION MODULES AND THERMOCOUPLES ARE PROVIDED IN THE G3X INSTALLATION MANUAL.
9. IN A 2 DISPLAY INSTALLATION, THE SECOND DISPLAY CAN BE CONNECTED AS SHOWN.
10. OPTIONAL INTERFACE.
11. THE GDU 37X CAN BE CONFIGURED TO ACCEPT A 14V OR 28V LIGHTING BUS INPUT. SEE THE G3X INSTALLATION MANUAL FOR DETAILS ON CONFIGURATION AND SETUP OF A LIGHTING CURVE.
12. ONLY ONE GDU 37X GPS ANTENNA CONNECTION IS REQUIRED FOR THE G3X SYSTEM. ADDITIONAL ANTENNAS CAN BE ADDED FOR REDUNDANCY IF DESIRED. SEE THE G3X INSTALLATION MANUAL FOR DETAILS REGARDING GDU 37X GPS ANTENNA CONFIGURATION.
13. THE CAN BUS SHOULD ONLY BE TERMINATED AT ONE GDU 37X. THE CAN BUS SHOULD ALWAYS BE TERMINATED AT THE GSU 73.
14. TO MINIMIZE THE CHANCE OF THE SYSTEM RESETTING DURING ENGINE CRANKING, THE OPTIONAL REDUNDANT (DIODE OR'D) POWER INPUTS MAY BE CONNECTED TO AN AUXILIARY BATTERY (SUCH AS THE TCW TECHNOLOGIES INTEGRATED BACK-UP BATTERY SYSTEM) OR STABILIZED POWER INPUT (SUCH AS THE TCW TECHNOLOGIES INTELLIGENT POWER STABILIZER IPS-12V-8A) TO MAINTAIN THE NECESSARY LRU MINIMUM INPUT VOLTAGE. HAVING A STABLIZED SOURCE OF POWER DURING ENGINE CRANKING SHOULD ALLOW THE SYSTEM TO PROVIDE CONTINUOUS ENGINE INDICATING SYSTEM (EIS) OPERATION DURING ENGINE START AND MAINTAIN ANY DESIRED PRE-FLIGHT SYSTEM SETUP OR FLIGHT PLANNING THAT WAS ACCOMPLISHED PRIOR TO ENGINE START. VISIT WWW.TCWTECH.COM FOR ADDITIONAL DETAILS.
15. THE DISCRETE OUTPUT FROM THE TCW IBBS CAN BE WIRED TO A DISCRETE INPUT ON THE GSU 73 TO PROVIDE THE PILOT WITH AN ANNUNCIATION WHEN THE BACK-UP BATTERY IS BEING UTILIZED. SEE THE G3X INSTALLATION MANUAL FOR MORE INFORMATION ON CONFIGURATION OF GSU 73 DISCRETE INPUTS.

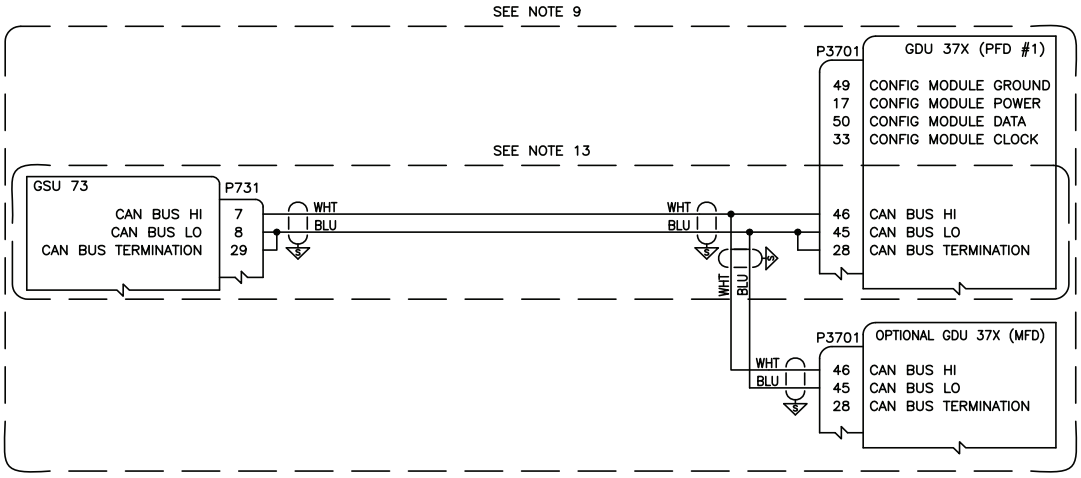

Figure E-1.1 Notes and 2 Display CAN Bus

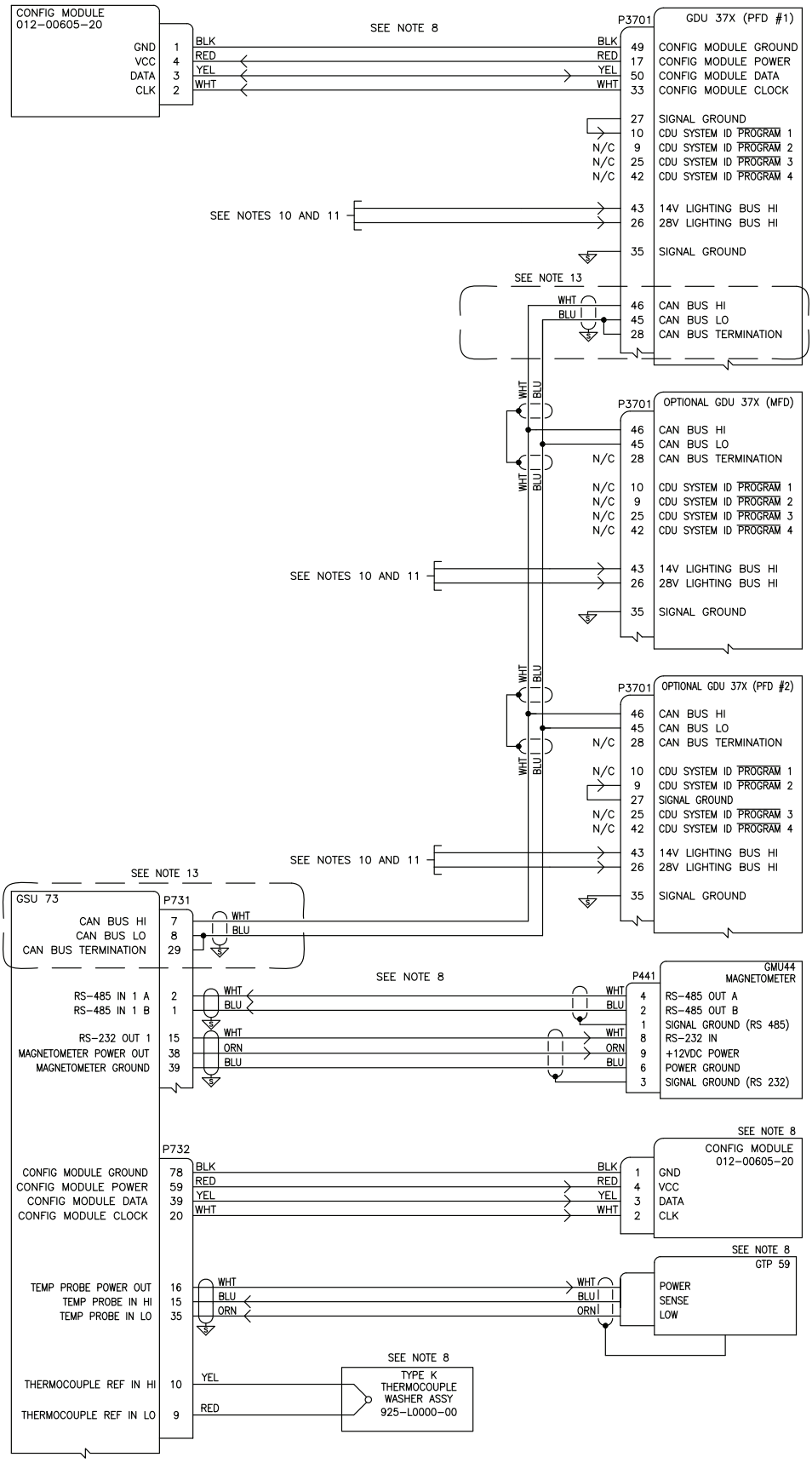

Figure E-1.2 GDU 37X and GSU 73

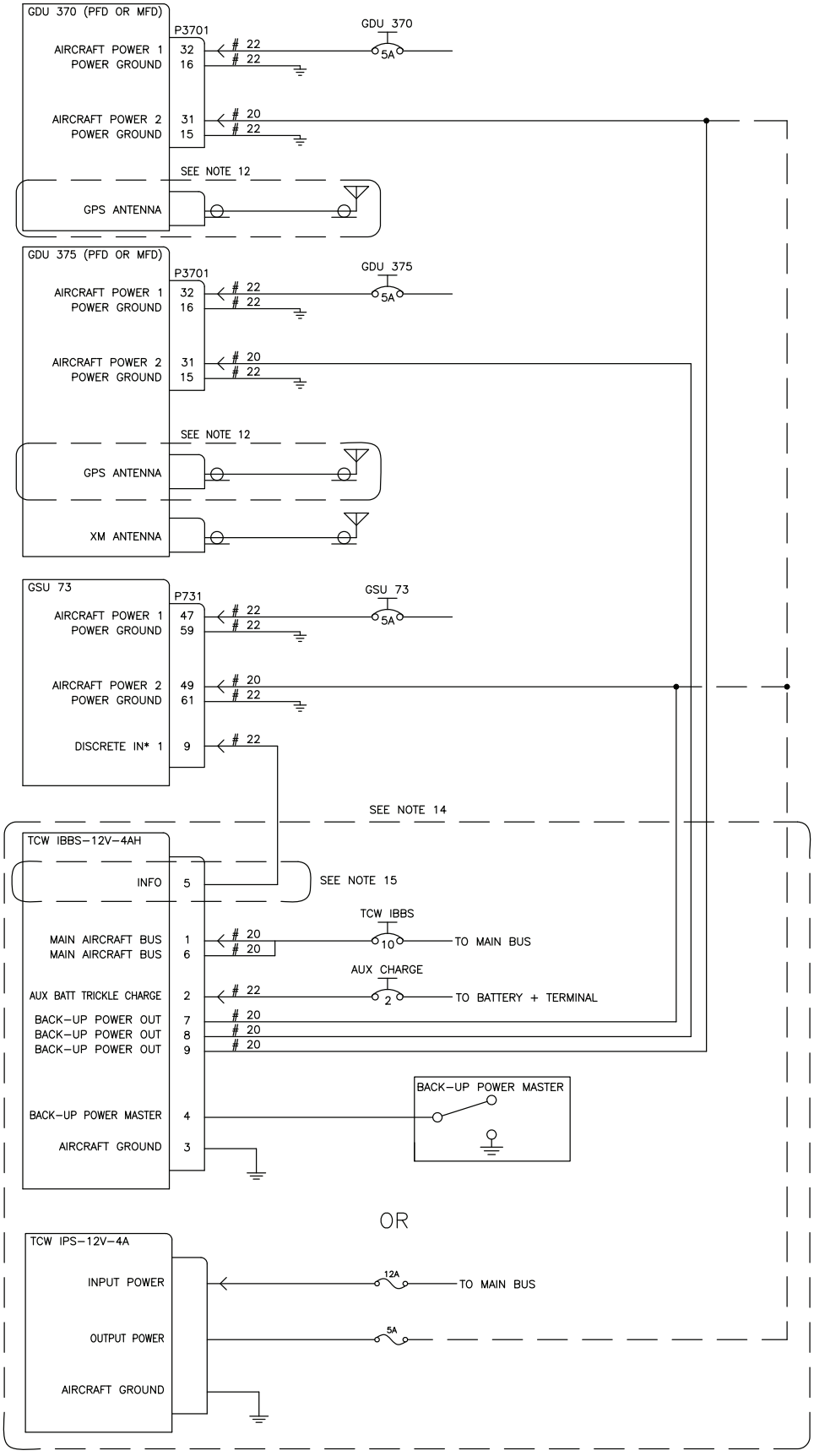

Figure E-1.3 14V Power and Antennas

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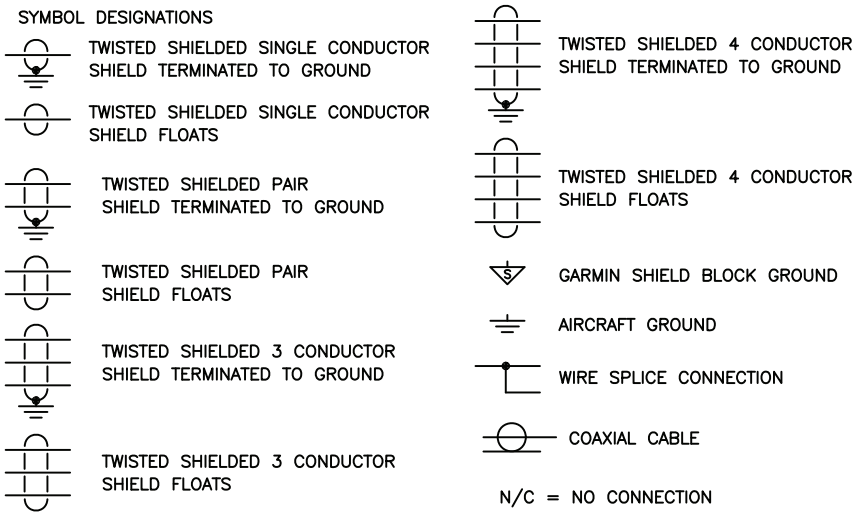
NOTES:

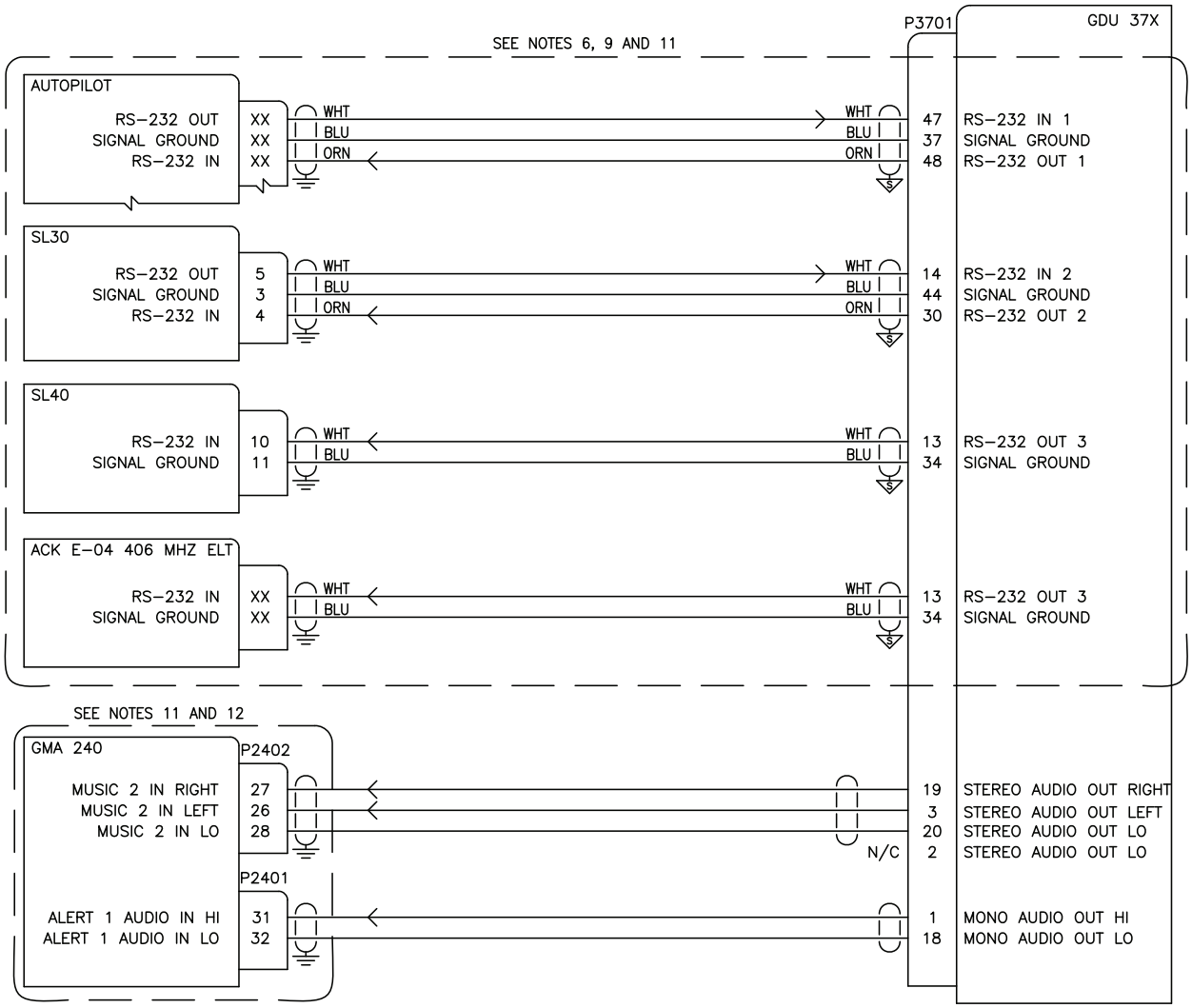
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS



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. RS-232 CHANNEL ASSIGNMENTS ARE SHOWN FOR REFERENCE ONLY. CONNECTIONS CAN BE REASSIGNED TO DIFFERENT CHANNELS OR TO CHANNELS ON AN OPTIONAL SECOND OR THIRD DISPLAY. RS-232 INPUT/OUTPUT LINES SHOULD ONLY BE CONNECTED TO ONE DEVICE AT A TIME. SEE THE G3X INSTALLATION MANUAL FOR RS-232 INPUT/OUTPUT CONFIGURATION GUIDANCE.
7. RESERVED.
8. CONNECTIONS FOR AUTOPILOT SERVOS, AP DISCONNECT AND OTHER AUTOPILOT FUNCTIONALITY NOT SHOWN. CONSULT AUTOPILOT VENDOR DOCUMENTATION FOR ADDITIONAL DETAILS.
9. REFERENCE SHEET 5 FOR MORE DETAILED INFORMATION ON CONNECTION OF THIRD PARTY AUTOPILOTS.
10. THE GSU 73 PROVIDES AIR DATA AND GPS INFORMATION TO THE GTX SO NO SEPARATE ALTITUDE ENCODER IS REQUIRED. THE GTX INPUT SHOULD BE CONFIGURED FOR REMOTE.
11. OPTIONAL INTERFACE.
12. THE GMA 240 IS SHOWN HERE FOR REFERENCE ONLY. OTHER INTERCOM/AUDIO PANEL PRODUCTS MAY BE COMPATIBLE WITH THE GDU 37X. THE ALERTS GENERATED BY THE GDU 37X CAN BE CONFIGURED TO TRANSMIT ON MONO AND STEREO AUDIO LINES OR MONO ONLY. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL DETAILS ON CONFIGURATION OF THE GDU 37X ALERT OUTPUTS.
13. INSTALLING THE CROSS-TALK CONNECTION WILL ALLOW FLIGHT PLAN SHARING BETWEEN TWO GNS 430(W)/530(W) UNITS (VIA RS-232) OR TWO GNS 6XX/7XX UNITS (VIA ETHERNET). THE G3X SYSTEM ALWAYS DISPLAYS FLIGHT PLAN INFORMATION FROM THE ACTIVE NAV SOURCE.
14. ARINC 429 OUT 2 CAN BE OPTIONALLY CONNECTED TO A GNS 400/500 SERIES UNIT FOR DISPLAY OF TIS-A. THE G3X SYSTEM WILL CONFIGURE REMOTE MOUNT GARMIN TRANSPONDERS ARINC 429 OUT 1 FOR LOW SPEED TIS DATA AND ARINC 429 OUT 2 FOR HIGH SPEED TIS DATA BY DEFAULT. GNS 400/500 SERIES UNITS REQUIRE THE DATA TO BE HIGH SPEED. PANEL MOUNT TRANSPONDERS MUST BE CONFIGURED MANUALLY.
15. RS-232 ADS-B OUT FROM A GNS 400/500 SERIES WAAS UNIT WITH MAIN SOFTWARE VERSION 3.20 OR LATER OR A GTN 600/700 SERIES UNIT IS REQUIRED TO SUPPORT ADS-B TRANSMISSIONS. IF ADS-B TRANSMISSION FROM THE GTX 23 ES IS NOT REQUIRED, THIS CONNECTION IS NOT REQUIRED.
16. THE GTN 6XX/7XX UNITS RECEIVE ALTITUDE ENCODER DATA FROM THE GSU 73 VIA ARINC 429 AND RELAY THAT DATA TO THE TRANSPONDER. IF TWO GTN 6XX/7XX UNITS ARE INSTALLED, RS-232 CHANNEL 2 TRANSMIT AND RECEIVE ON THE TRANSPONDER COULD BE CONNECTED TO THE SECOND GTN INSTEAD OF THE GDU 37X AND GSU 73 IF DESIRED. NOTE THIS CONFIGURATION WOULD REQUIRE AT LEAST ONE GTN UNIT TO BE OPERATING IN ORDER FOR THE TRANSPONDER TO RECEIVE PRESSURE ALTITUDE DATA.

Figure F-1.1 Notes

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF AN SL 30 OR SL 40 UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.

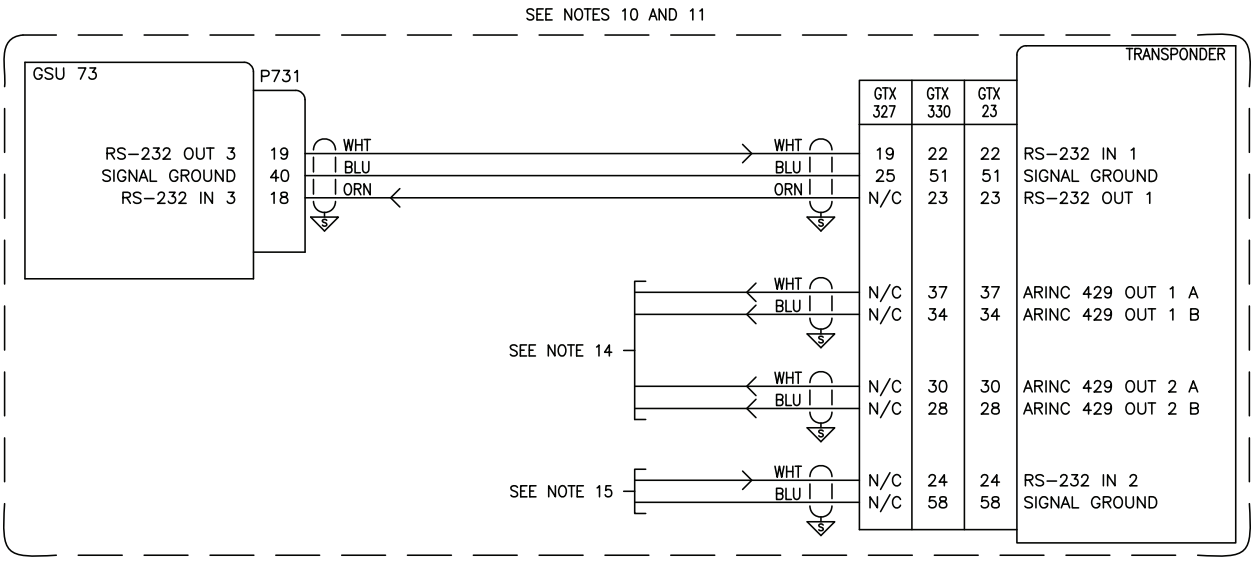


CONFIGURATION GUIDANCE

1. **GDU 37X TO SL40**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "SL40 COMM"
   - B. NO SL40 CONFIGURATION REQUIRED
2. **GDU 37X TO SL30**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "SL30 NAV/COMM"
   - B. NO SL30 CONFIGURATION REQUIRED

Figure F-1.2 GDU 37X Examples

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 327, OR 330 UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GTX 327/330

A. ON THE GTX 327/330 RS-232 CONFIG MODE PAGE
- SET CONNECTED GTX 327/330 RS-232 INPUT FORMAT TO "REMOTE"
- SET CONNECTED GTX 330 RS-232 OUTPUT FORMAT TO "REMOTE+TIS" OR GTX 327X RS-232 OUTPUT FORMAT TO "REMOTE"

B. ON THE GTX 327/330 SQUAT SWITCH CONFIG MODE PAGE
- SET THE SQUAT SWITCH FIELD TO "NO"

C. IF REMOTE CONTROL OF THE TRANSPONDER FROM THE GDU 37X IS DESIRED
- ON THE GDU 37X XPDR CONFIG MODE PAGE SET TRANSPONDER TYPE TO "GTX 327" OR "GTX 330" AS APPROPRIATE

D. NO GSU 73 CONFIGURATION REQUIRED

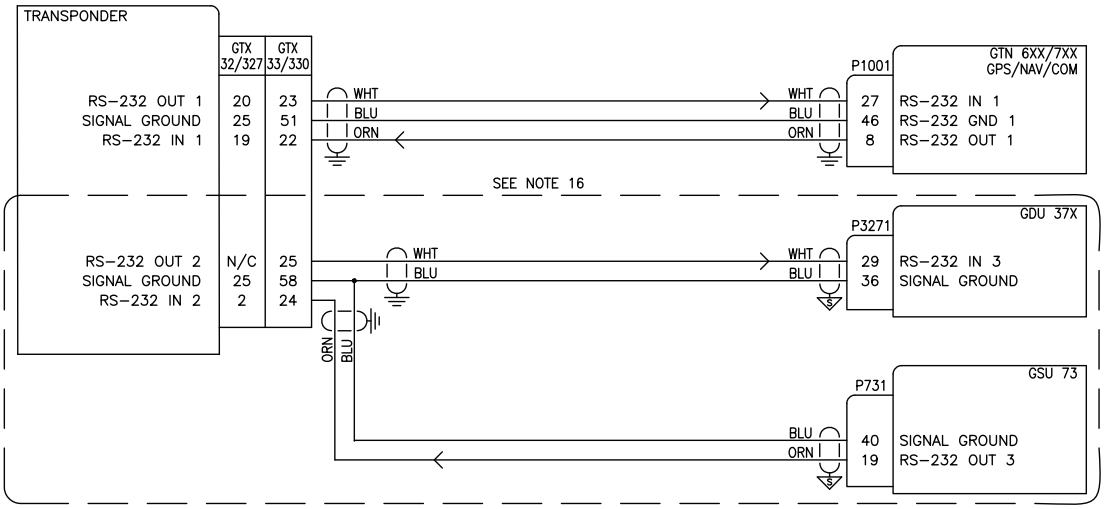
2. GTX 23

A. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 23 ES"

B. NO GSU 73 CONFIGURATION REQUIRED

Figure F-1.3 G3X Transponder Control Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 32, 327, 33, OR 330 UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.

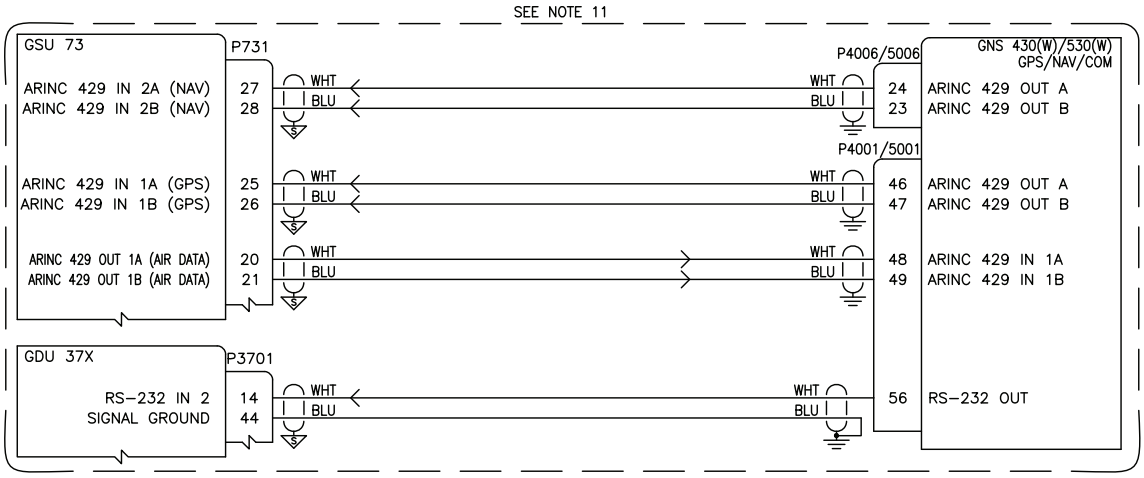


CONFIGURATION GUIDANCE

1. **GTX 32**
   - A. ON THE GTN 6XX/7XX RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT AND OUTPUT FORMATS TO "GTX MODE C #1"
   - B. ON THE GTN 6XX/7XX XPDR1 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT AND OUTPUT FORMATS TO "REMOTE"
     - SET RS-232 CHANNEL 2 INPUT FORMAT TO "REMOTE"
   - C. NO GDU 37X OR GSU 73 CONFIGURATION REQUIRED
2. **GTX 327**
   - A. ON THE GTN 6XX/7XX RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT FORMAT TO "ALTITUDE FORMAT 1"
     - SET RS-232 CHANNEL 1 OUTPUT FORMAT TO "AVIATION OUTPUT 1"
   - B. ON THE GTX 327 RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT FORMAT TO "GPS"
     - SET RS-232 CHANNEL 1 OUTPUT FORMAT TO "ICARUS ALT"
     - SET RS-232 CHANNEL 2 INPUT FORMAT TO "REMOTE"
   - C. NO GSU 73 CONFIGURATION REQUIRED
3. **GTX 33**
   - A. ON THE GTN 6XX/7XX RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT AND OUTPUT FORMATS TO "GTX w/TIS #1"
   - B. ON THE GTN 6XX/7XX XPDR1 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT FORMAT TO "REMOTE"
     - SET RS-232 CHANNEL 1 OUTPUT FORMAT TO "REMOTE w/TIS"
     - SET RS-232 CHANNEL 2 INPUT FORMAT TO "REMOTE"
     - SET RS-232 CHANNEL 2 OUTPUT FORMAT TO "REMOTE w/TIS"
   - C. ON THE GDU 37X RS-232 CONFIG MODE PAGE
     - SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"
   - D. NO GSU 73 CONFIGURATION REQUIRED
4. **GTX 330**
   - A. ON THE GTN 6XX/7XX RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT AND OUTPUT FORMATS TO "PANEL GTX w/TIS #1"
   - B. ON THE GTX 330 RS-232 CONFIG PAGE
     - SET RS-232 CHANNEL 1 INPUT FORMAT TO "REMOTE"
     - SET RS-232 CHANNEL 1 OUTPUT FORMAT TO "REMOTE+TIS"
     - SET RS-232 CHANNEL 2 INPUT FORMAT TO "REMOTE"
     - SET RS-232 CHANNEL 2 OUTPUT FORMAT TO "REMOTE+TIS"
   - C. ON THE GDU 37X RS-232 CONFIG MODE PAGE
     - SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"
   - D. NO GSU 73 CONFIGURATION REQUIRED
5. **GTX 23 ES**
   - A. THE GTX 23 MUST BE CONNECTED AS SHOWN IN FIGURE F-1.3
   - B. CONTROL OF GTX 23 FROM THE GTN 6XX/7XX IS NOT SUPPORTED

Figure F-1.4 GTN 6XX/7XX Transponder Control Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GNS 430W/530W

A. ON THE MAIN ARINC 429 CONFIG PAGE
- SET IN 1 SPEED TO "LOW"
- SET IN 1 DATA TO "EFIS/AIR DATA"
- SET OUT SPEED TO "LOW"
- SET OUT DATA TO "GAMA 429"
- SET SDI TO "LNAV 1"
- SET VNAV TO "ENABLE LABELS" FOR GNS #1 (WAAS UNITS ONLY)

B. ON THE MAIN RS-232 CONFIG PAGE
- SET CHNL 1 INPUT TO "OFF"
- SET CHNL 1 OUTPUT TO "MAPMX" (WAAS UNITS ONLY) OR "AVIATION" (NON-WAAS UNITS)

C. ON THE MAIN CDI/OBS CONFIG PAGE
- PRESS MENU AND SELECT THE "IGNORE SEL CRS FOR VLOC?" OPTION
  NOTE: MENU WILL SAY "ALLOW SEL COURSE FOR VLOC?" WHEN SET CORRECTLY

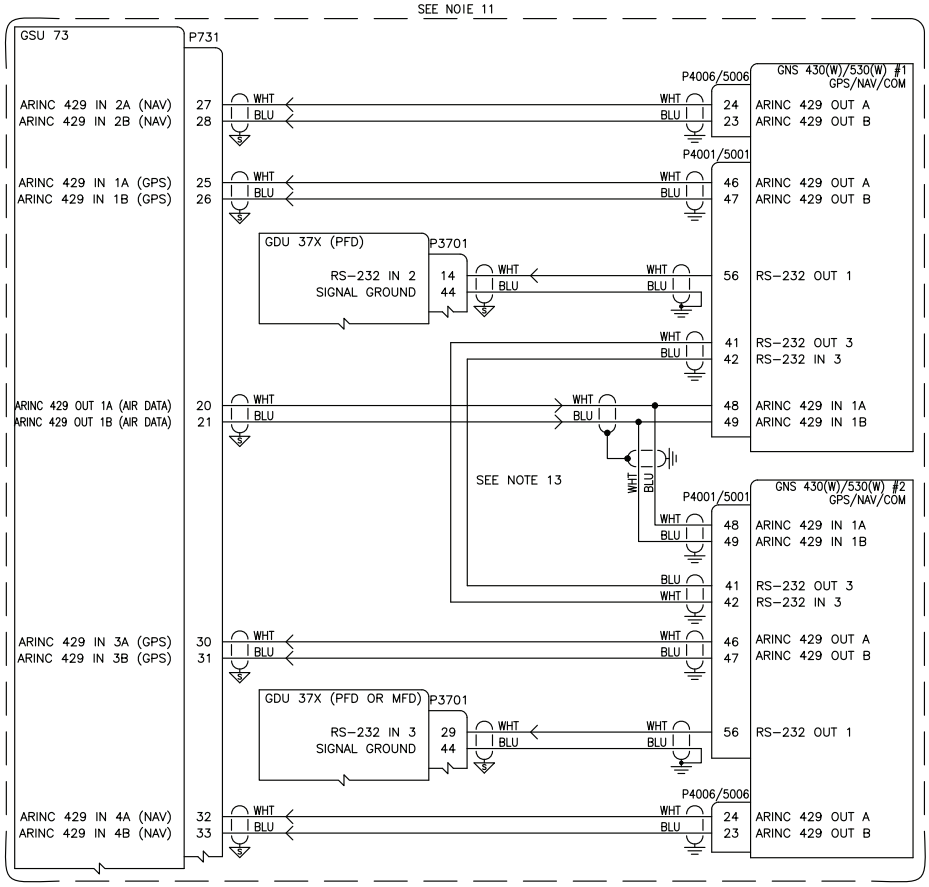
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET RX AND TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX" (IF CONNECTED TO A WAAS UNIT) OR "AVIATION IN" (IF CONNECTED TO A NON-WAAS UNIT)
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure F-1.5 Single GNS 430(W)/530(W) Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



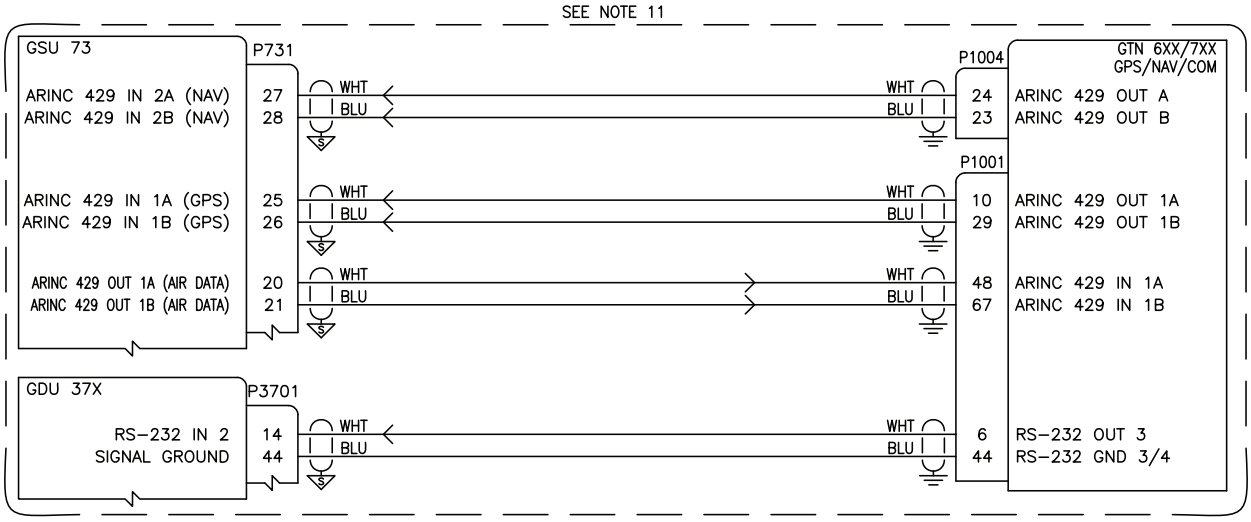
CONFIGURATION GUIDANCE

1. **GNS #1 AND #2**
   - A. ON THE MAIN ARINC 429 CONFIG PAGE
     - SET IN 1 SPEED TO "LOW"
     - SET IN 1 DATA TO "EFIS/AIR DATA"
     - SET OUT SPEED TO "LOW"
     - SET OUT DATA TO "GAMA 429"
     - SET SDI TO "LNAV 1" FOR GNS #1 AND "LNAV 2" FOR GNS #2
     - SET VNAV TO "ENABLE LABELS" FOR GNS #1 AND GNS #2 (WAAS UNITS ONLY)
   - B. ON THE MAIN RS-232 CONFIG PAGE
     - SET CHNL 1 INPUT TO "OFF"
     - SET CHNL 1 OUTPUT TO "MAPMX" (WAAS UNITS ONLY) OR "AVIATION" (NON-WAAS UNITS)
   - C. ON THE MAIN CDI/OBS CONFIG PAGE
     - PRESS MENU AND SELECT THE "IGNORE SEL CRS FOR VLOC?" OPTION
       NOTE: MENU WILL SAY "ALLOW SEL COURSE FOR VLOC?" WHEN SET CORRECTLY
   - D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
     - SET RX AND TX SPEED TO "LOW"
     - SET SDI TO "VOR/ILS 1" FOR GNS #1 AND "VOR/ILS 2" FOR GNS #2
2. **G3X**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX" (IF CONNECTED TO A WAAS UNIT) OR "AVIATION IN" (IF CONNECTED TO A NON-WAAS UNIT) FOR GNS #1
     - SET THE CONNECTED GDU 37X (PFD OR MFD) RS-232 CHANNEL TO "MAPMX" (IF CONNECTED TO A WAAS UNIT) OR "AVIATION IN" (IF CONNECTED TO A NON-WAAS UNIT) FOR GNS #2
     - SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
     - SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
     - SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
     - SET GSU ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
     - SET GSU ARINC 429 RX 4 FORMAT TO "GARMIN VOR/ILS" AND "NAV 2" FOR GNS #2

IMPORTANT: GNS #1 AND #2 ARE DIFFERENTIATED IN THE G3X SYSTEM BY THE GDU 37X RS-232 PORT ASSIGNMENTS. GNS #1 SHOULD ALWAYS BE CONNECTED TO A LOWER NUMBERED PORT ON THE PFD. GNS #2 CAN BE CONNECTED TO A HIGHER NUMBERED PORT ON THE PFD OR TO ANY PORT ON THE MFD.

Figure F-1.6 Dual GNS 430(W)/530(W) Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GTN 6XX/7XX

A. ON THE ARINC 429 CONFIG PAGE
- SET IN 1 SPEED TO "LOW"
- SET IN 1 DATA TO "EFIS FORMAT 2"
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 DATA TO "GAMA FORMAT 1"
- SET SDI TO "LNAV 1"

B. ON THE RS-232 CONFIG PAGE
- SET CHNL 3 INPUT TO "OFF"
- SET CHNL 3 OUTPUT TO "MAPMX"

C. ON THE MAIN MAIN INDICATOR (ANALOG) CONFIG PAGE
- SET SELECTED COURSE FOR VLOC TO "IGNORED"

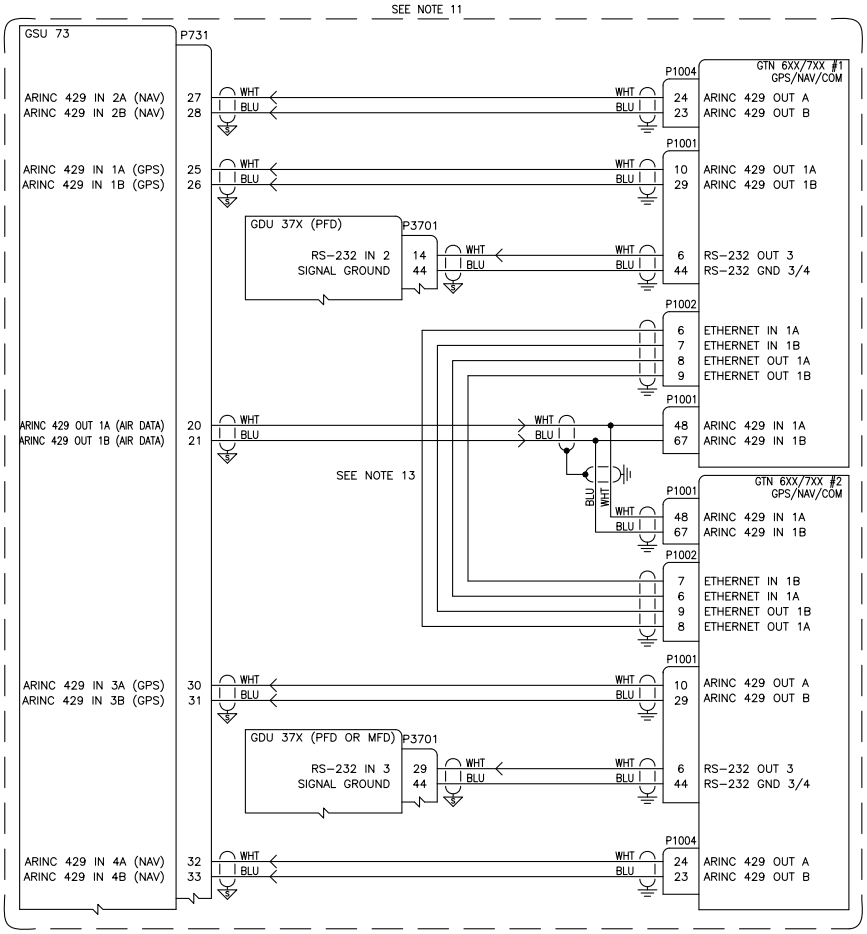
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET NAV RADIO TO "ENABLED"
- SET TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure F-1.7 Single GTN 6XX/7XX Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



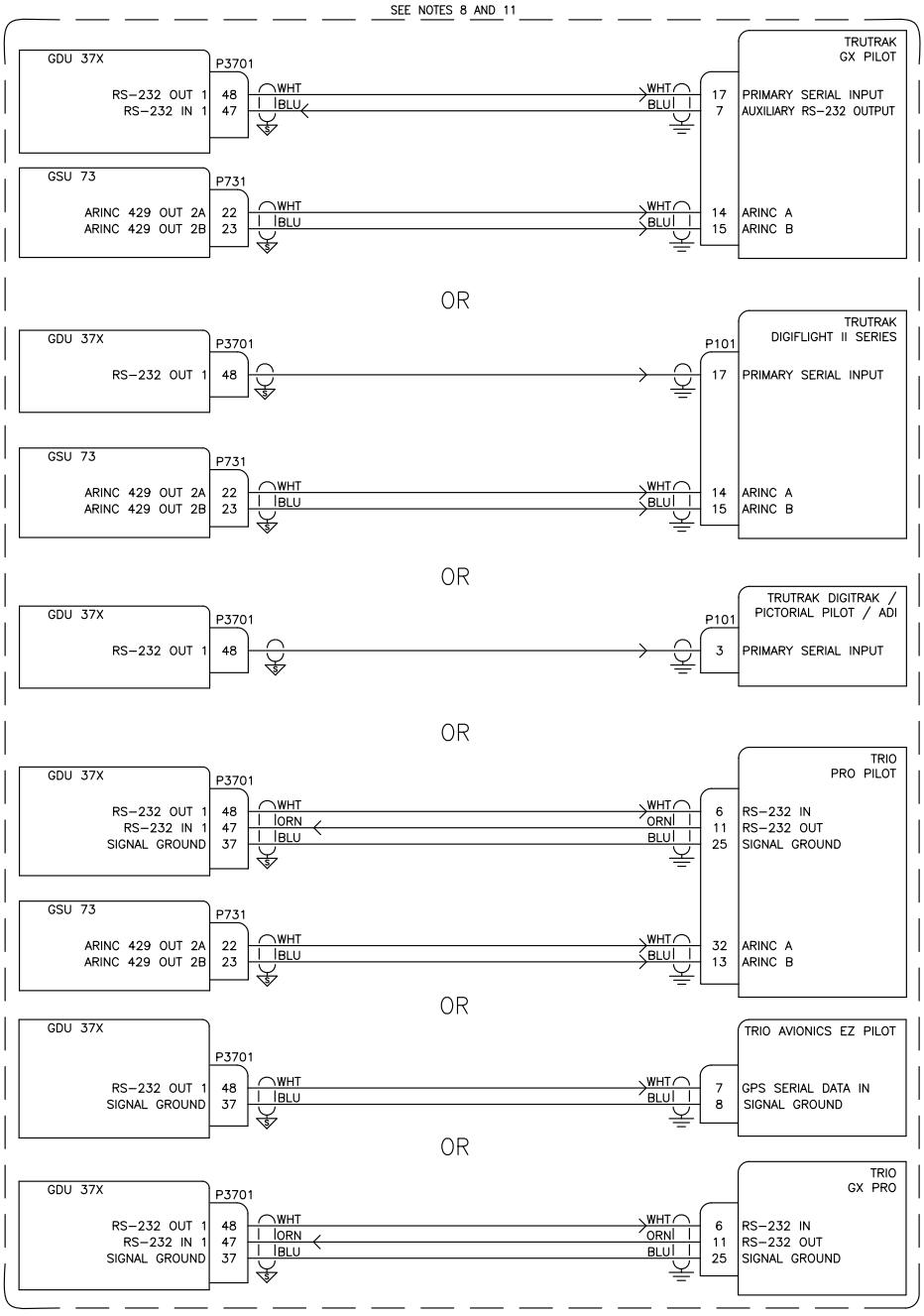
CONFIGURATION GUIDANCE

1. **GTN 6XX/7XX #1 AND #2**
   - A. ON THE ARINC 429 CONFIG PAGE
     - SET IN 1 SPEED TO "LOW"
     - SET IN 1 DATA TO "EFIS FORMAT 2"
     - SET OUT 1 SPEED TO "LOW"
     - SET OUT 1 DATA TO "GAMA FORMAT 1"
     - SET SDI TO "LNAV 1" FOR GTN #1 and "LNAV 2" FOR GTN #2
   - B. ON THE RS-232 CONFIG PAGE
     - SET CHNL 3 INPUT TO "OFF"
     - SET CHNL 3 OUTPUT TO "MAPMX"
   - C. ON THE MAIN MAIN INDICATOR (ANALOG) CONFIG PAGE
     - SET SELECTED COURSE FOR VLOC TO "IGNORED"
   - D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
     - SET NAV RADIO TO "ENABLED"
     - SET TX SPEED TO "LOW"
     - SET SDI TO "VOR/ILS 1" FOR GTN #1 AND "VOR/ILS 2" FOR GTN #2
   - E. ON THE INTERFACED EQUIPMENT CONFIG PAGE
     - SET CROSS-SIDE NAVIGATOR TO "PRESENT"
2. **G3X**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #1
     - SET THE CONNECTED GDU 37X (PFD OR MFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #2
     - SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
     - SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
     - SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
     - SET GSU ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
     - SET GSU ARINC 429 RX 4 FORMAT TO "GARMIN VOR/ILS" AND "NAV 2" FOR GNS #2

IMPORTANT: GTN #1 AND #2 ARE DIFFERENTIATED IN THE G3X SYSTEM BY THE GDU 37X RS-232 PORT ASSIGNMENTS. GTN #1 SHOULD ALWAYS BE CONNECTED TO A LOWER NUMBERED PORT ON THE PFD. GTN #2 CAN BE CONNECTED TO A HIGHER NUMBERED PORT ON THE PFD OR TO ANY PORT ON THE MFD.

Figure F-1.8 Dual GTN 6XX/7XX Example

AUTOPILOT INTERCONNECTS SHOWN FOR REFERENCE ONLY. AUTOPILOT VENDOR DOCUMENTATION SHOULD BE CONSULTED FOR PROPER PIN CONNECTIONS.

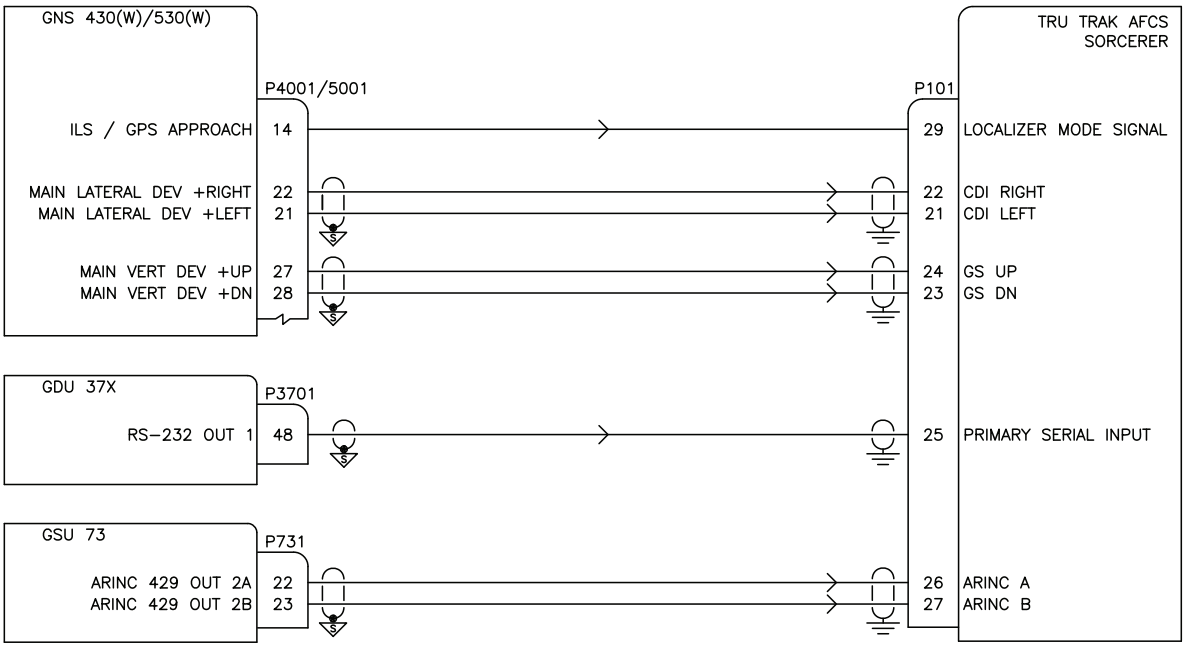


CONFIGURATION GUIDANCE

1. **TRUTRAK GX PILOT**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"
     - SET GSU ARINC 429 TX 2 FORMAT TO "AUTOPILOT"
2. **TRUTRAK DIGIFLIGHT II SERIES / TRIO PRO PILOT**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
     - SET GSU ARINC 429 TX 2 FORMAT TO "AUTOPILOT"
3. **TRUTRAK DIGITRAK / PICTORIAL PILOT / ADI OR TRIO AVIONICS EZ PILOT**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
4. **TRIO GX PRO**
   - A. ON THE GDU 37X COMM CONFIG MODE PAGE
     - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"

Figure F-1.9 Auto Pilot Example, page 1 of 2

AUTOPILOT INTERCONNECTS SHOWN FOR REFERENCE ONLY. AUTOPILOT VENDOR DOCUMENTATION SHOULD BE CONSULTED FOR PROPER PIN CONNECTIONS.



CONFIGURATION GUIDANCE

1. TRUTRAK SORCERER

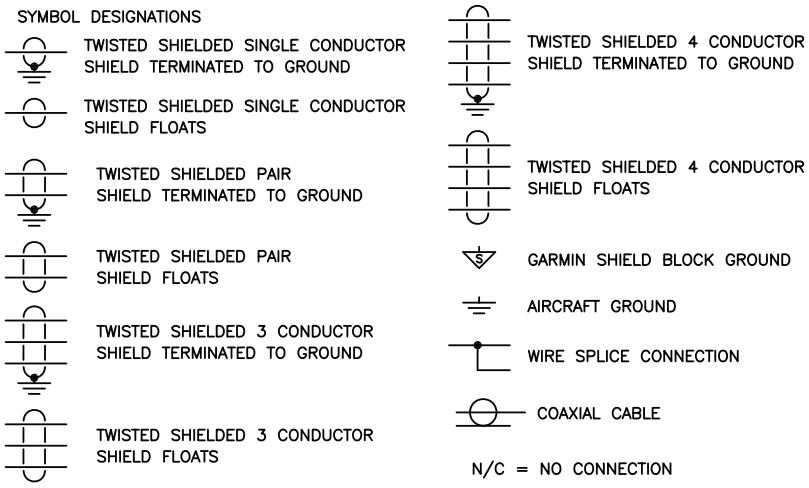
A. ON THE GDU 37X COMM CONFIG MODE PAGE

- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"
- SET GSU ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

Figure F-1.10 Auto Pilot Example, page 2 of 2

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



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. UP TO 4 FUEL QUANTITY GAUGES CAN BE CONFIGURED. THE FUEL QUANTITY 1/2 AND MAIN FUEL 1/2 CONFIGURATION OPTIONS ARE MUTUALLY EXCLUSIVE AND EACH LABEL CAN ONLY BE USED FOR ONE CHANNEL. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL GUIDANCE ON FUEL QUANTITY GAUGE CONFIGURATION.
7. EI P-300C CAPACITANCE TO FREQUENCY CONVERTERS CAN BE USED FOR MEASUREMENT OF CAPACITIVE FUEL QUANTITY.
8. IF FUEL 1 AND 2 CHANNELS ARE USED FOR RESISTIVE TYPE FUEL QUANTITY INPUTS, THE ASSOCIATED FUEL PULL UP PINS MUST BE WIRED TO THE +10V TRANSDUCER POWER OUTPUT AS SHOWN FOR PROPER OPERATION. FUEL PULL UP PINS SHOULD NOT BE USED IF INSTALLING THE SKYSPORTS OR WESTACH FUEL SENDERS. IF USING WESTACH SENDERS, VERIFY THE SPECIFIC MODEL USED IS COMPATIBLE WITH +12VDC AND PROVIDES A 0-5V OUTPUT.
9. THE CHANNELS USING FUEL 3 AND FUEL 4 AS PART OF THEIR INPUT NAME CAN BE CONFIGURED TO MEASURE A RESISTIVE TYPE FUEL QUANTITY SENSOR. RESISTORS MUST BE RATED TO A MINIMUM OF 1/4 WATT. EXTERNAL PULL UP RESISTORS SHOULD NOT BE USED IF INSTALLING THE SKYSPORTS FUEL PROBES. IF USING WESTACH SENDERS, VERIFY THE SPECIFIC MODEL USED IS COMPATIBLE WITH +12VDC AND PROVIDES A 0-5V OUTPUT.
10. THE CAP 2 / FUEL FLOW 2 CHANNEL CAN OPTIONALLY BE CONFIGURED TO MEASURE EI P-300C FUEL QUANTITY, OR CONFIGURED TO MEASURE RETURN LINE FUEL FLOW. IF A FUEL FLOW TRANSDUCER IS WIRED TO THIS INPUT THE MEASURED FUEL FLOW WILL BE SUBTRACTED FROM THE MEASURED FUEL FLOW 1 INPUT AS PART OF A DIFFERENTIAL FUEL FLOW CALCULATION.
11. THE CHANNELS USING GP (GENERAL PURPOSE) AS PART OF THEIR INPUT NAME CAN BE CONFIGURED TO MEASURE AMPS THROUGH A HALL EFFECT TRANSDUCER. THE CHANNEL WILL BE CONFIGURED TO EXPECT A 15.9 MV / AMP SIGNAL. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL GUIDANCE ON CONFIGURATION AND CALIBRATION OF A HALL EFFECT TRANSDUCER.
12. IF MEASURING BATTERY CURRENT, PLACE THE SHUNT BETWEEN THE BATTERY POSITIVE TERMINAL AND THE BATTERY CONTACTOR. IF MEASURING ALTERNATOR CURRENT, PLACE THE SHUNT BETWEEN THE ALTERNATOR B LEAD AND THE POWER DISTRIBUTION BUS.
13. WHEN USING A DISCRETE INPUT FOR ITEMS FOR DETECTING ITEMS SUCH AS CANOPY CLOSURE, IT IS RECOMMENDED TO USE THE GROUNDED STATE AS THE NORMAL SWITCH POSITION (E.G. CANOPY CLOSED) TO AVOID THE POSSIBILIY OF A LATENT FAILURE SUCH AS A BROKEN WIRE OR MICROSWITCH. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL DETAILS ON CONFIGURATION OF DISCRETE INPUTS.
14. FLAPS/TRIM INPUTS CAN BE WIRED TO ANY AVAILABLE INPUT WITH "POS" IN THE NAME. UP TO 4 POSITION INDICATORS CAN BE DISPLAYED.
15. THE USE OF "XX" AS A GROUND CONNECTION PIN NUMBER ON THIS DRAWING INDICATES THE SENSOR GROUND CAN BE TIED TO ANY SIGNAL GROUND OR TRANSDUCER LOW GROUND PIN ON THE GSU 73 J732 CONNECTOR. MULTIPLE SENSOR GROUNDS MAY NEED TO BE TIED TO A SINGLE GSU 73 GROUND PIN.
16. FOLLOW THIS WIRING GUIDANCE IF USING UMA PRESSURE TRANSDUCERS INSTEAD OF THE TRANSDUCERS PROVIDED IN THE GARMIN SENSOR KIT.
17. WHEN A DISCRETE OUTPUT IS ACTIVE, IT IS PULLED TO GROUND AND CAN SINK UP TO 20 MA OF CURRENT MAXIMUM. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL DETAILS ON USE OF DISCRETE OUTPUTS.

Figure G-1.1 Notes

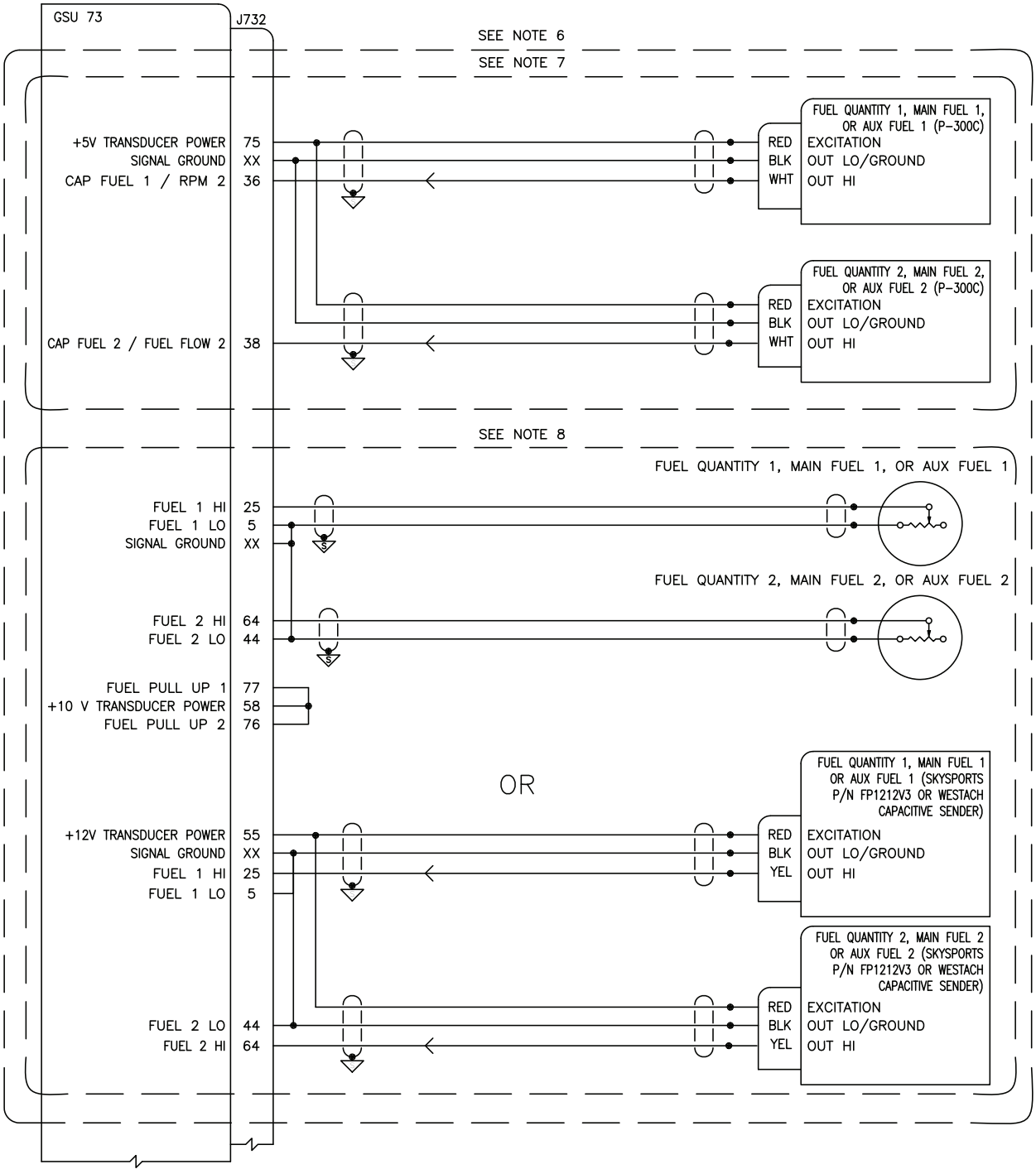


Figure G-1.2 Page 1 of 2 Fuel Quantity and Fuel Flow Examples

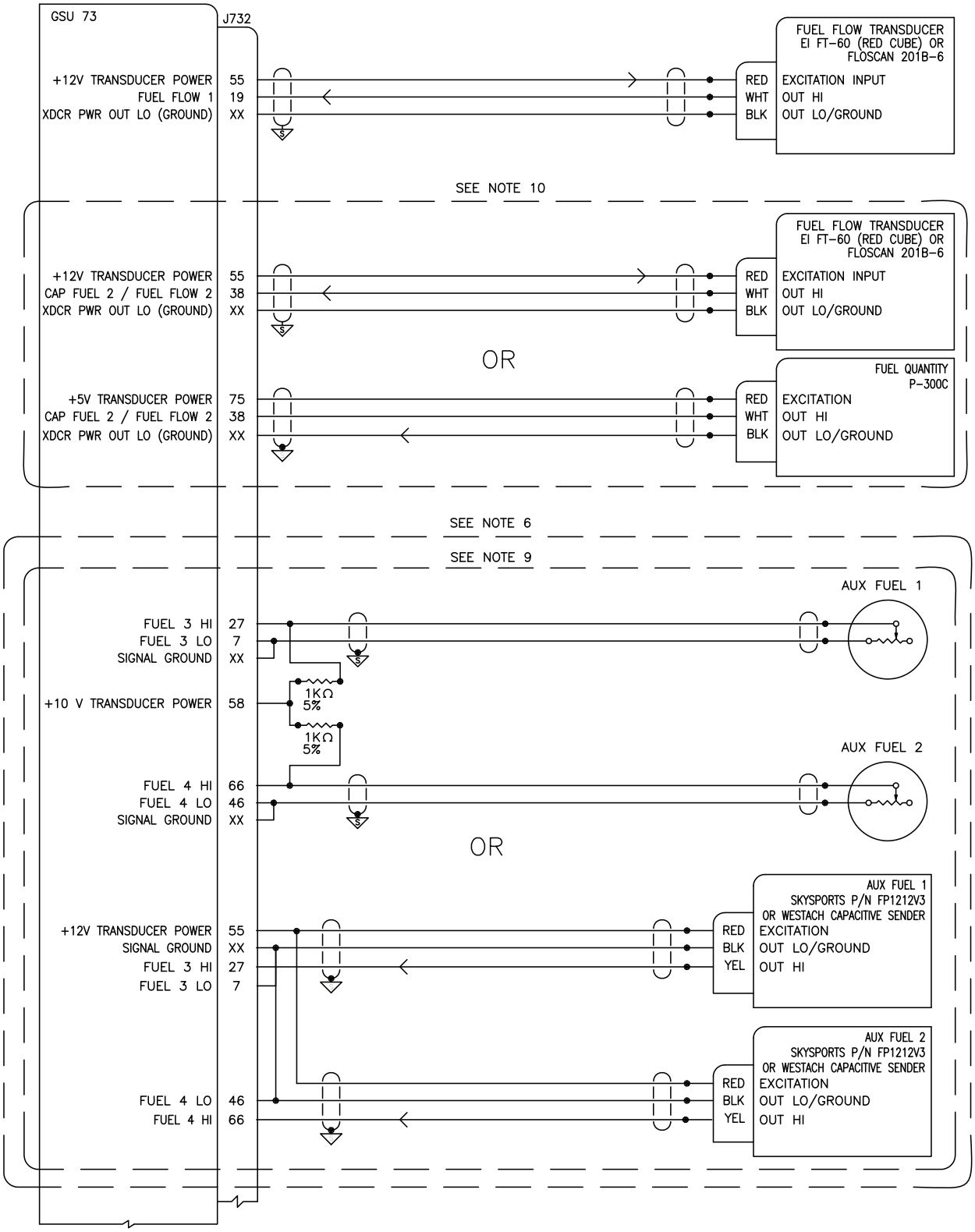


Figure G-1.2 Page 2 of 2 Fuel Quantity and Fuel Flow Examples

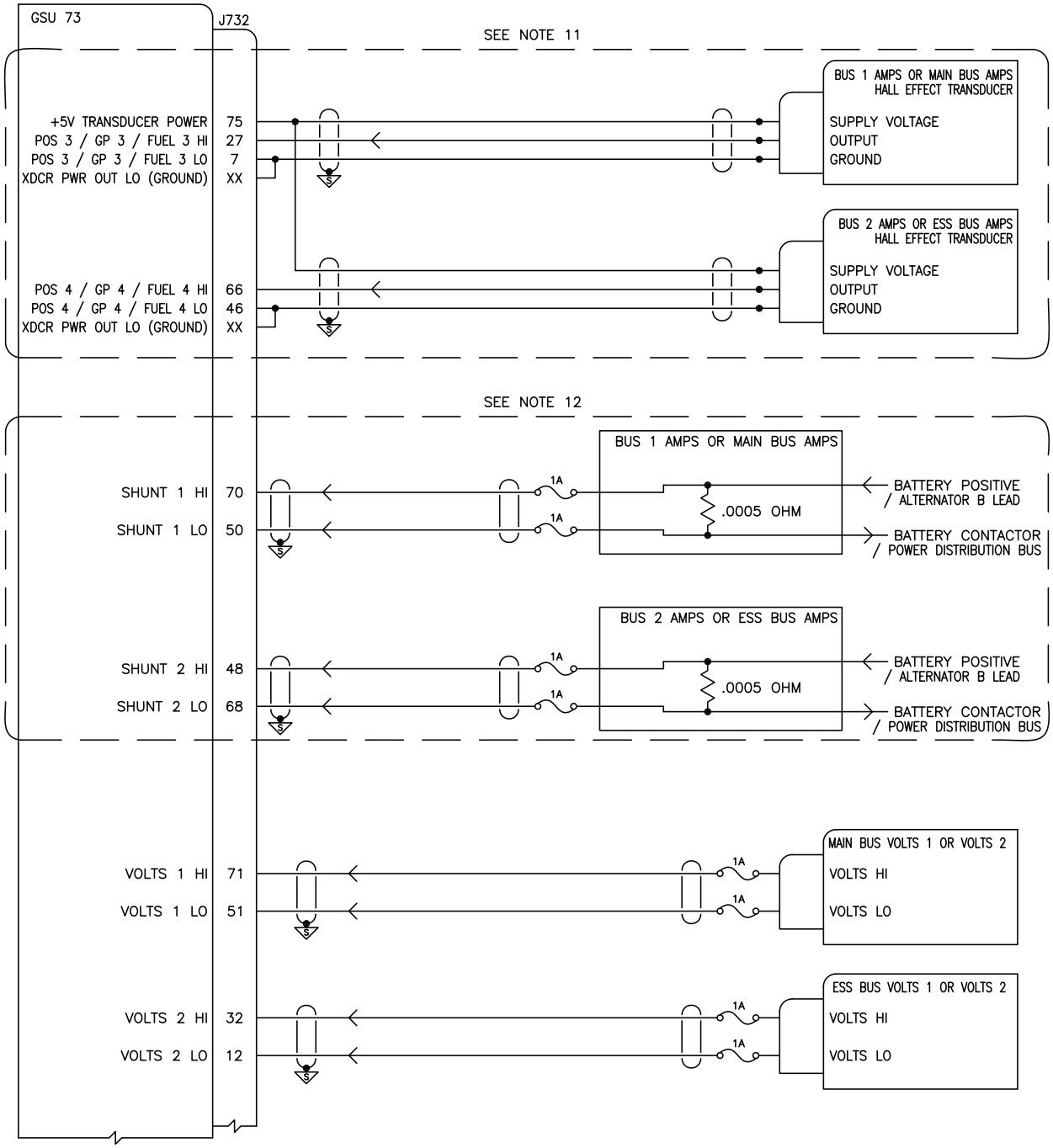


Figure G-1.3 Page 1 of 2 Electrical and Discrete Input/Output Examples

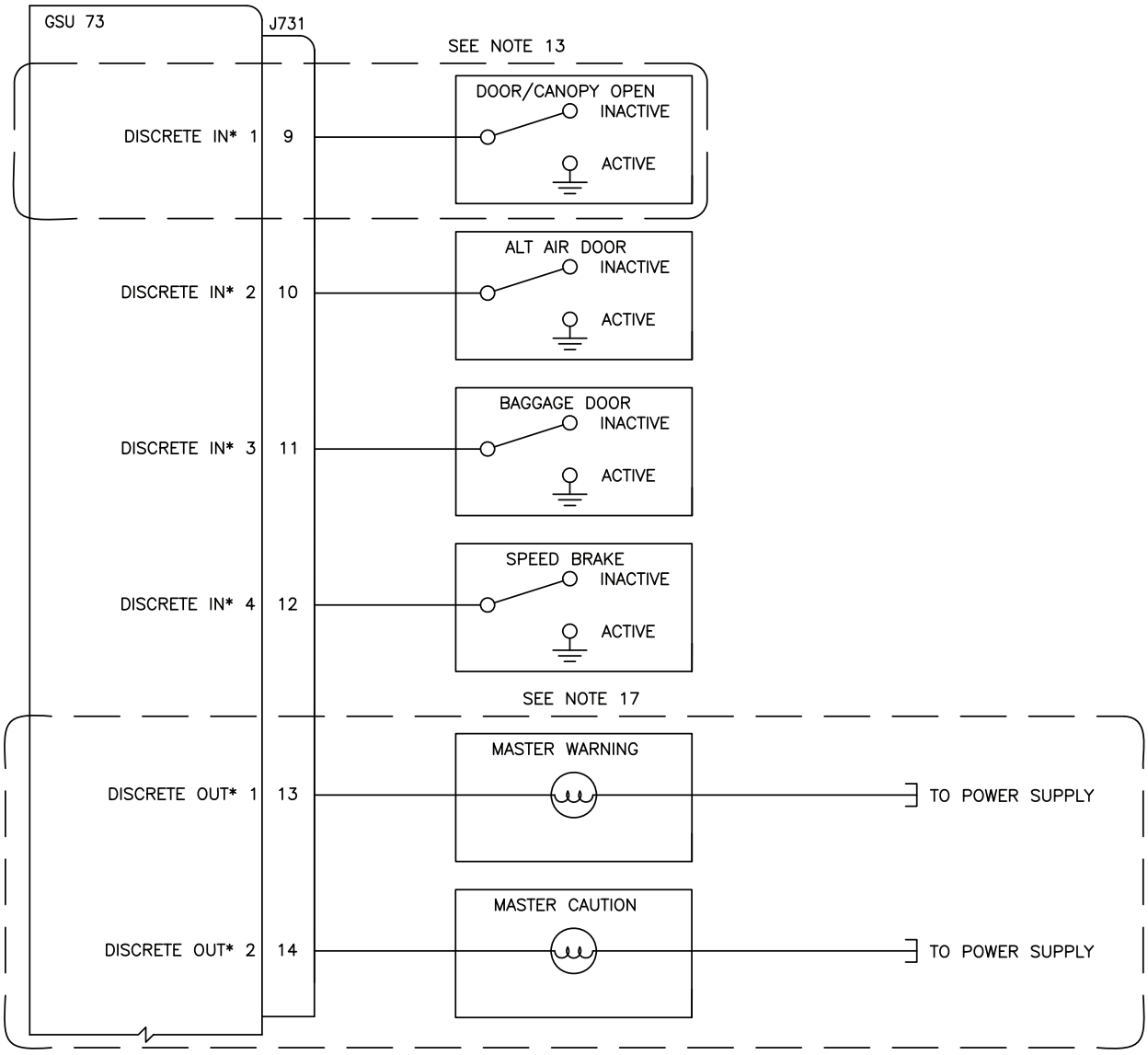


Figure G-1.3 Page 2 of 2 Electrical and Discrete Input/Output Examples

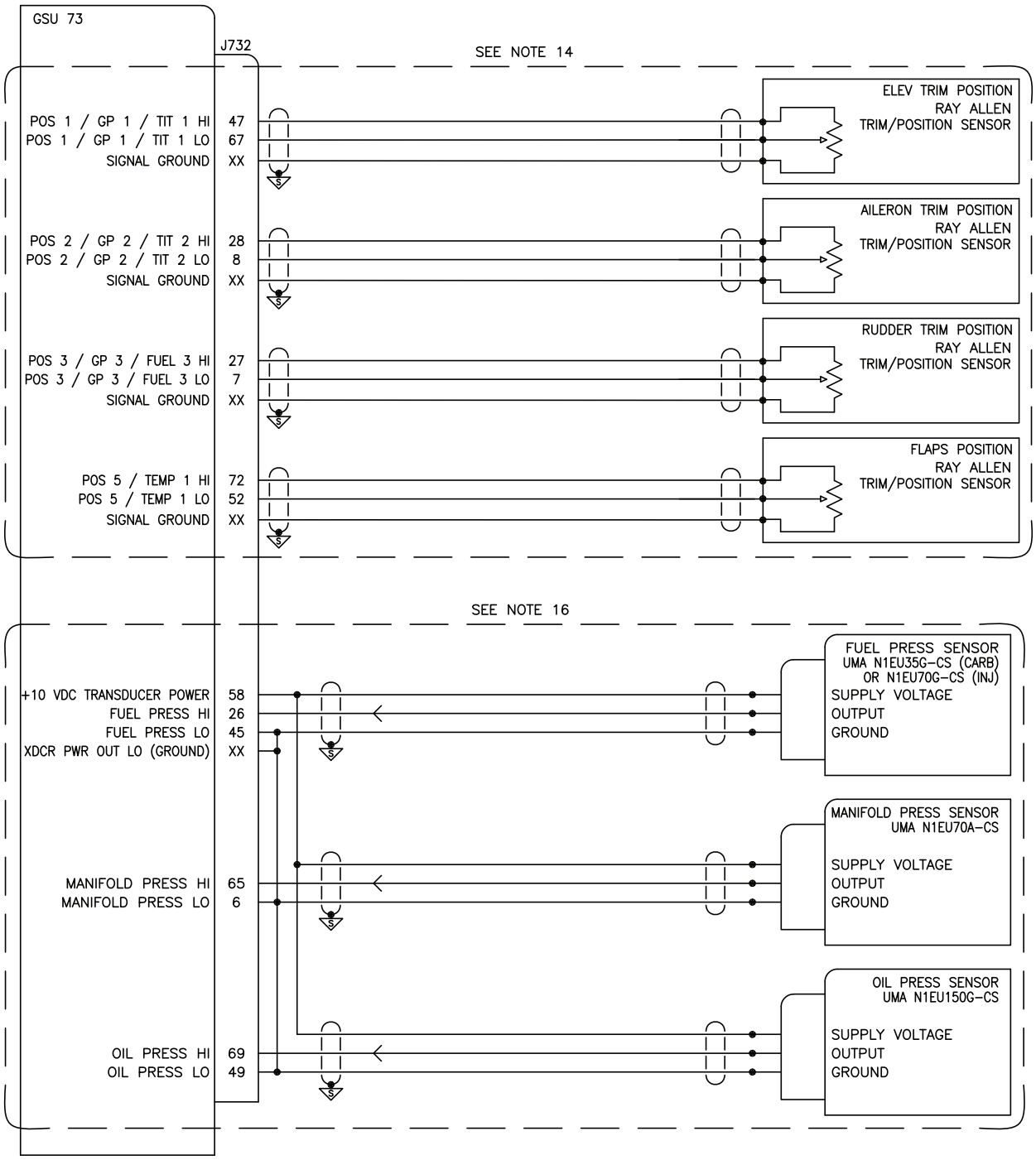
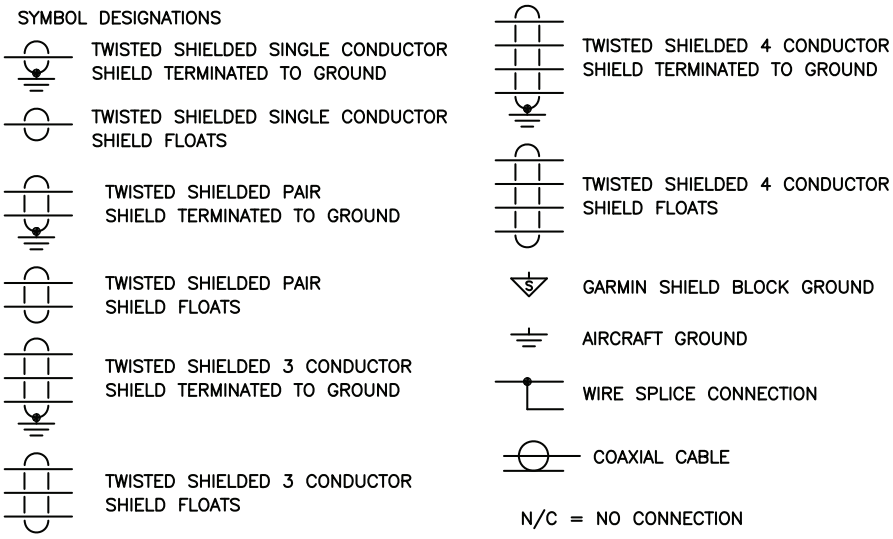


Figure G-1.4 Flaps/Trim and UMA Pressure Transducer Examples

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



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. THE RPM CHANNEL CAN BE CONFIGURED FOR UMA TACH SENDERS SHOWN OR 4 OR 6 CYLINDER ELECTRONIC IGNITION INPUTS.
7. GROUNDING METHODS FOR ELECTRONIC IGNITION TACH SIGNALS MAY VARY BASED ON THE MANUFACTURER. CONSULT THE ELECTRONIC IGNITION MANUFACTURER DOCUMENTATION FOR SPECIFIC GROUNDING GUIDANCE. THE CAP FUEL 1 / RPM 2 INPUT CAN BE OPTIONALLY USED ON AIRCRAFT WITH DUAL ELECTRONIC IGNITION.
8. SENSORS SHOWN ARE INCLUDED IN THE GARMIN 4 AND 6 CYLINDER SENSOR KIT P/N K00–00512–00 OR K00–00513–00.
9. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS.
10. IF MEASURING BATTERY CURRENT, PLACE THE SHUNT BETWEEN THE BATTERY POSITIVE TERMINAL AND THE BATTERY CONTACTOR. IF MEASURING ALTERNATOR CURRENT, PLACE THE SHUNT BETWEEN THE ALTERNATOR B LEAD AND THE POWER DISTRIBUTION BUS.
11. ONLY APPLICABLE TO SIX CYLINDER ENGINES.
12. NOT INCLUDED IN THE GARMIN 4 AND 6 CYLINDER SENSOR KIT P/N K00–00512–00 OR K00 513–00.
13. ONLY APPLICABLE TO TURBOCHARGED ENGINES.
14. ONLY APPLICABLE TO CARBURETED ENGINES.
15. A 10K EXTERNAL RESISTOR MAY BE REQUIRED FOR LIGHT SPEED ENGINEERING ELECTRONIC IGNITION INTERFACES.

Figure H-1.1 Notes

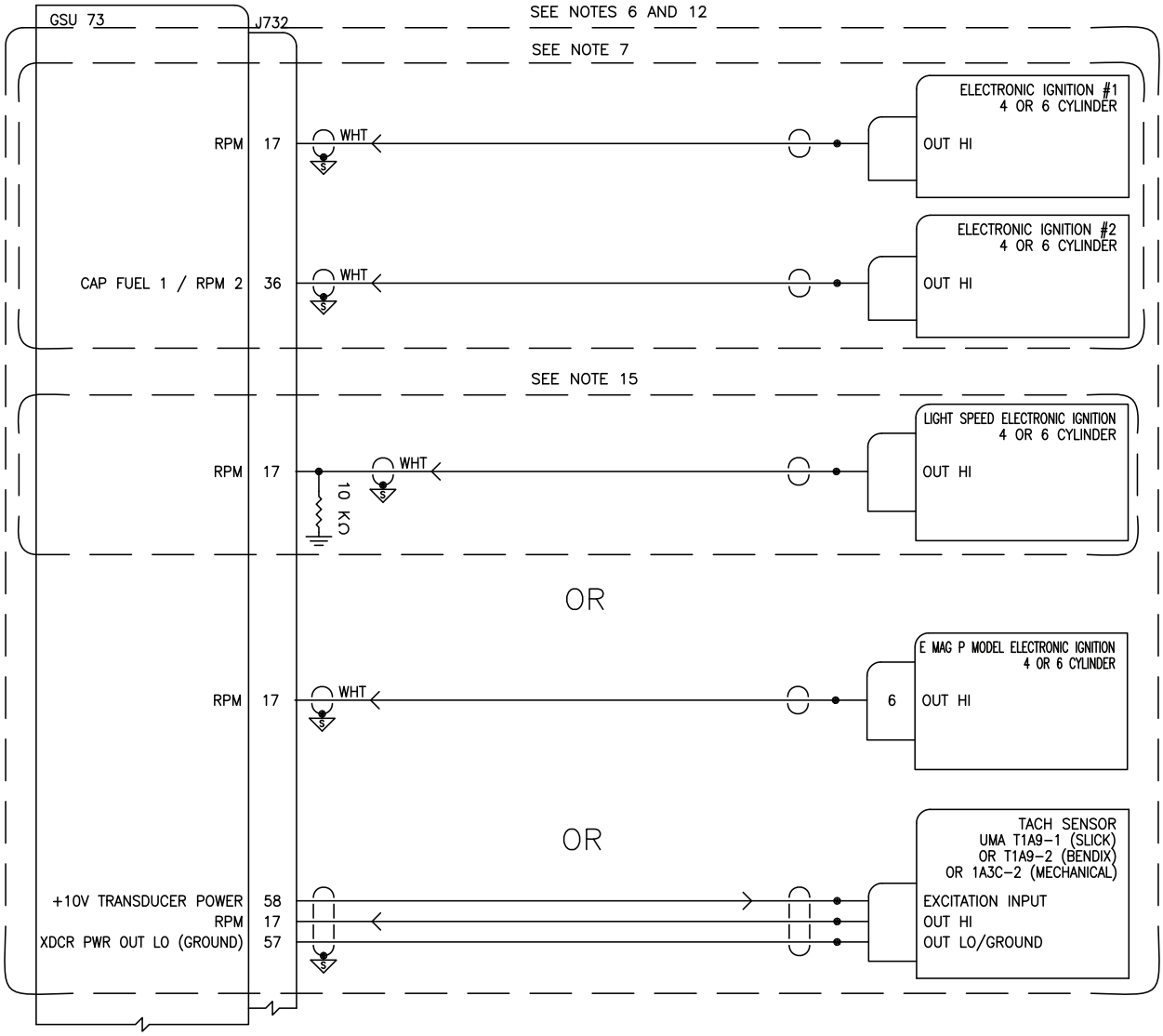


Figure H-1.2 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 1 of 3

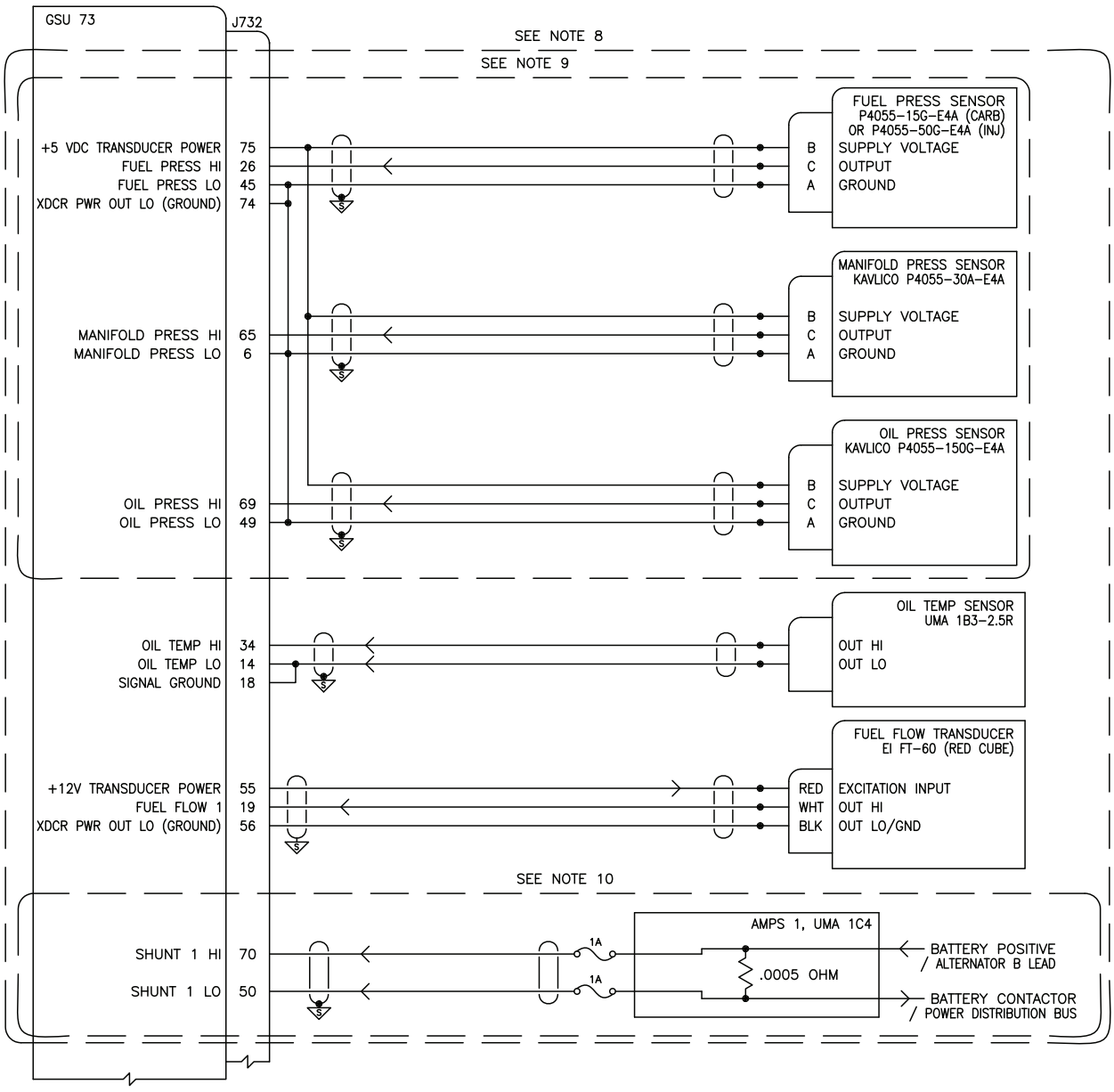


Figure H-1.2 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 2 of 3

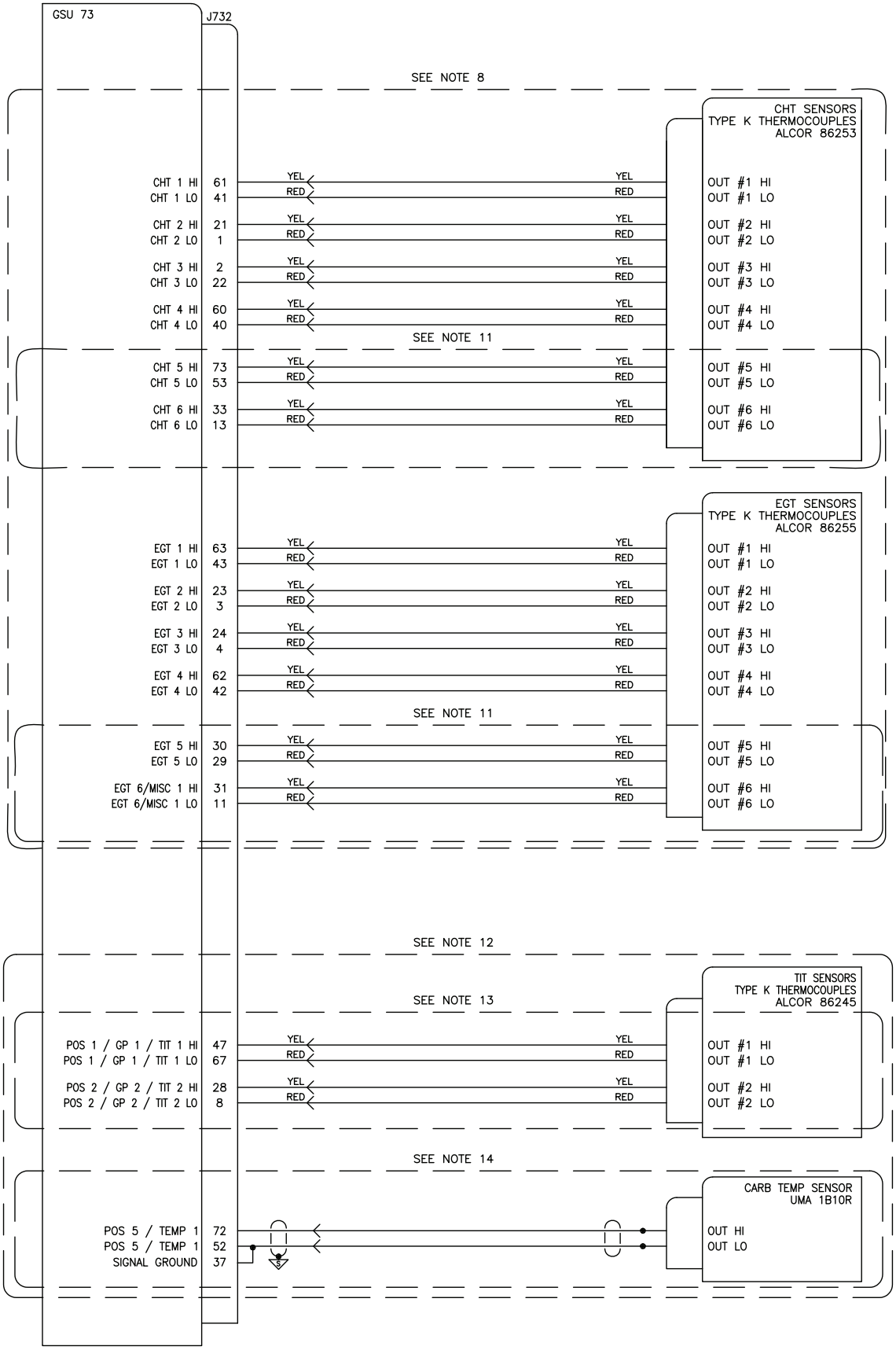
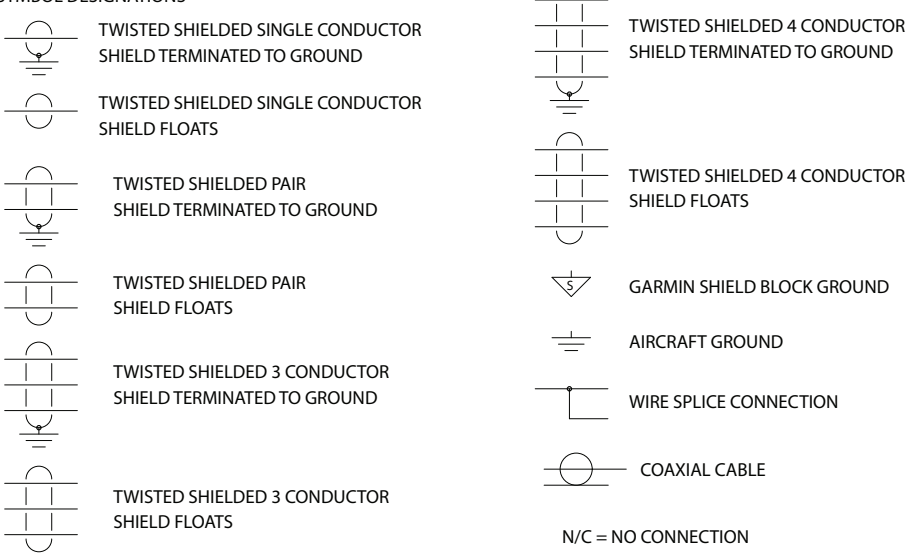


Figure H-1.2 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 3 of 3

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



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. SENSORS SUPPLIED WITH THE ENGINE.
7. SENSORS SUPPLIED WITH THE GARMIN ROTAX 912 SENSOR KIT P/N K00-00514-00.
8. ROTAX P/N 956413 OR 956415 MAY BE CONFIGURED.
9. WARNING: EXTERNAL COMPONENTS PROVIDED WITH THE G3X INSTALLATION KIT (GARMIN P/N K10-00017-00) MUST BE INSTALLED CORRECTLY TO PREVENT THE GSU FROM BEING PERMANENTLY DAMAGED.
10. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS.
11. IF MEASURING BATTERY CURRENT, PLACE THE SHUNT BETWEEN THE BATTERY POSITIVE TERMINAL AND THE BATTERY CONTACTOR. IF MEASURING ALTERNATOR CURRENT, PLACE THE SHUNT BETWEEN THE ALTERNATOR B LEAD AND THE POWER DISTRIBUTION BUS.
12. NOT INCLUDED IN THE GARMIN ROTAX 912 SENSOR KIT P/N K00-00514-00. THE KAVLICO P4055-50G-E4A CAN BE PURCHASED THROUGH A GARMIN G3X DEALER.

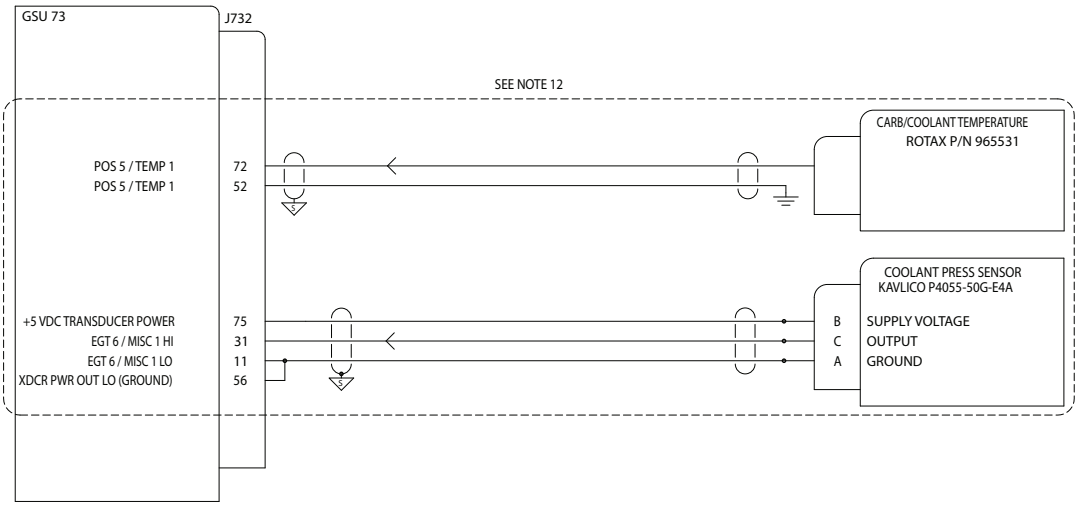


Figure I-1.1 Notes and Rotax 912 Sensor Wiring Examples, Page 1 of 2

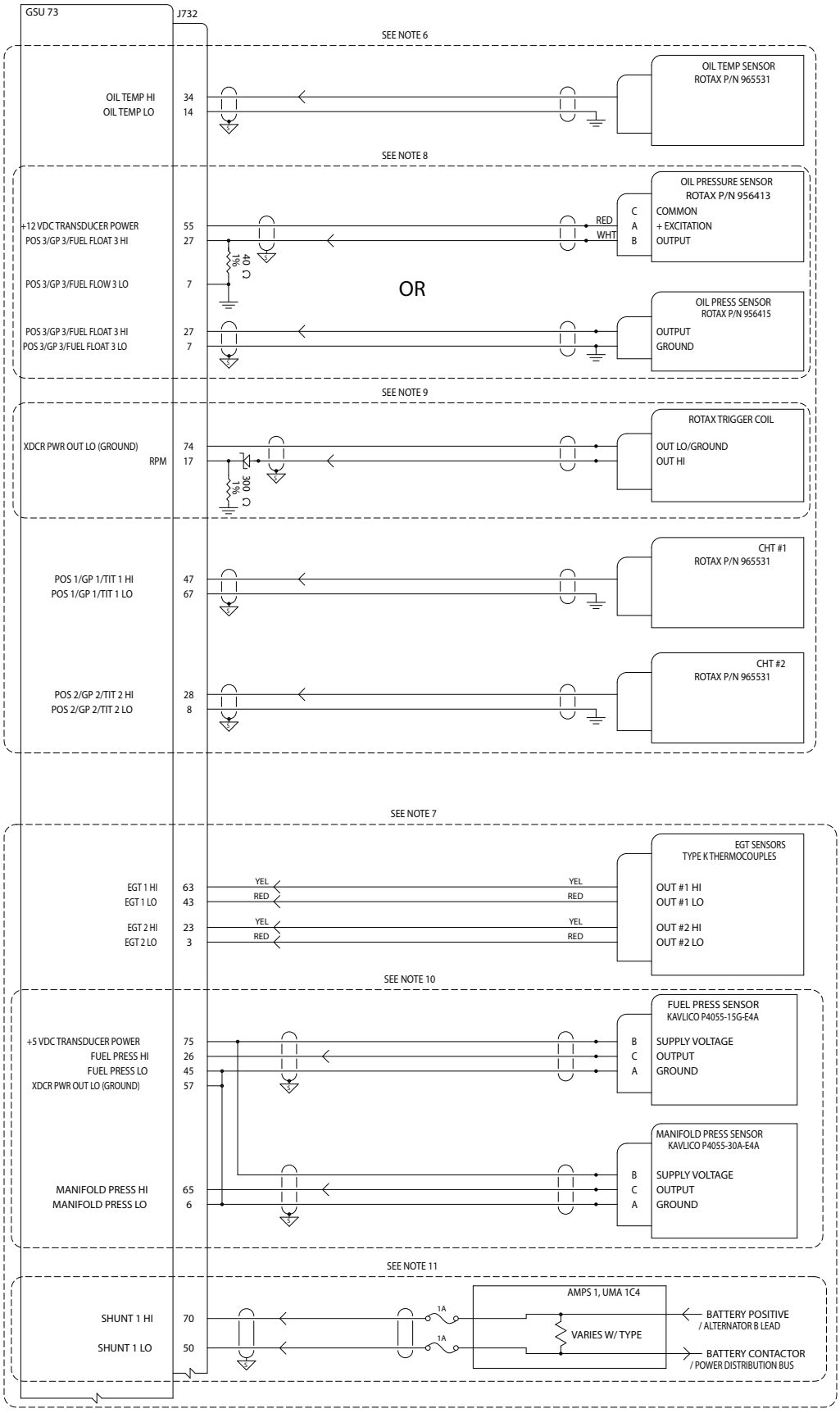
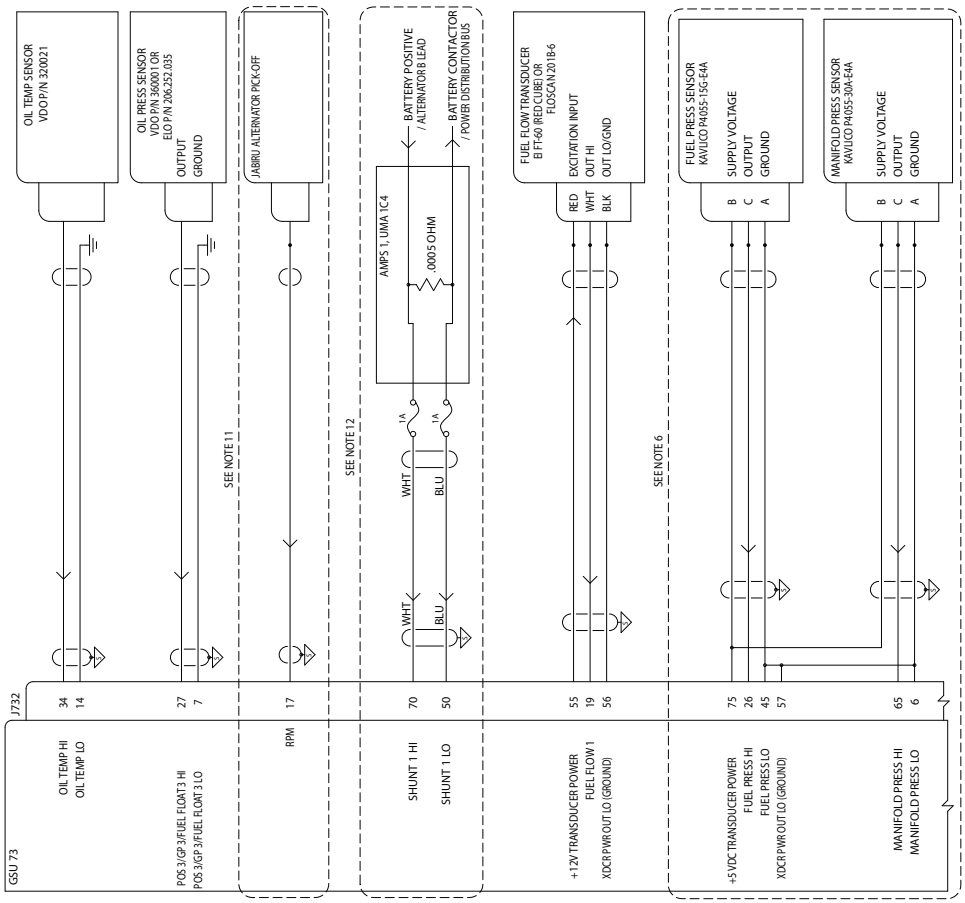


Figure I-1.1 Rotax 912 Sensor Wiring Examples, Page 2 of 2



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 4 CONDUCTOR, SHIELD TERMINATED TO GROUND
   - TWISTED SHIELDED SINGLE CONDUCTOR, SHIELD FLOATS
   - TWISTED SHIELDED 4 CONDUCTOR, SHIELD FLOATS
   - TWISTED SHIELDED PAIR, SHIELD TERMINATED TO GROUND
   - GARMIN SHIELD BLOCK GROUND
   - TWISTED SHIELDED PAIR, SHIELD FLOATS
   - AIRCRAFT GROUND
   - TWISTED SHIELDED 3 CONDUCTOR, SHIELD TERMINATED TO GROUND
   - WIRE SPLICE CONNECTION
   - TWISTED SHIELDED 3 CONDUCTOR, SHIELD FLOATS
   - 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. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS.
7. RESERVED.
8. IN THIS DOCUMENT, AN ASTERISK (*) IS USED FOR SIGNALS THAT ARE ACTIVE LOW (GROUND TO ACTIVATE). ON INSTALLATION WIRING DIAGRAMS, THE MORE TRADITIONAL OVERLINE SYMBOLOGY IS USED.
9. OPTIONAL INSTALLATION.
10. IF INSTALLING UNGROUNDED THERMOCOUPLES, THE LO SIDE MUST BE TAKEN TO A GSU SIGNAL GROUND.
11. THE RPM SIGNAL FOR THE JABIRU 3300 IS TYPICALLY OBTAINED BY TYING INTO ONE OF THE TWO WIRES RUNNING BETWEEN THE ALTERNATOR AND THE ALTERNATOR REGULATOR. ONE OF THE TWO WHITE WIRES ON THE ALTERNATOR SIDE OR ONE OF THE TWO PALE BLUE WIRES ON THE REGULATOR SIDE CAN BE USED FOR THE SIGNAL.
12. IF MEASURING BATTERY CURRENT, PLACE THE SHUNT BETWEEN THE BATTERY POSITIVE TERMINAL AND THE BATTERY CONTACTOR. IF MEASURING ALTERNATOR CURRENT, PLACE THE SHUNT BETWEEN THE ALTERNATOR B LEAD AND THE POWER DISTRIBUTION BUS.

Figure J-1.1 Notes and Jabiru Sensor Wiring Examples, Page 1 of 2

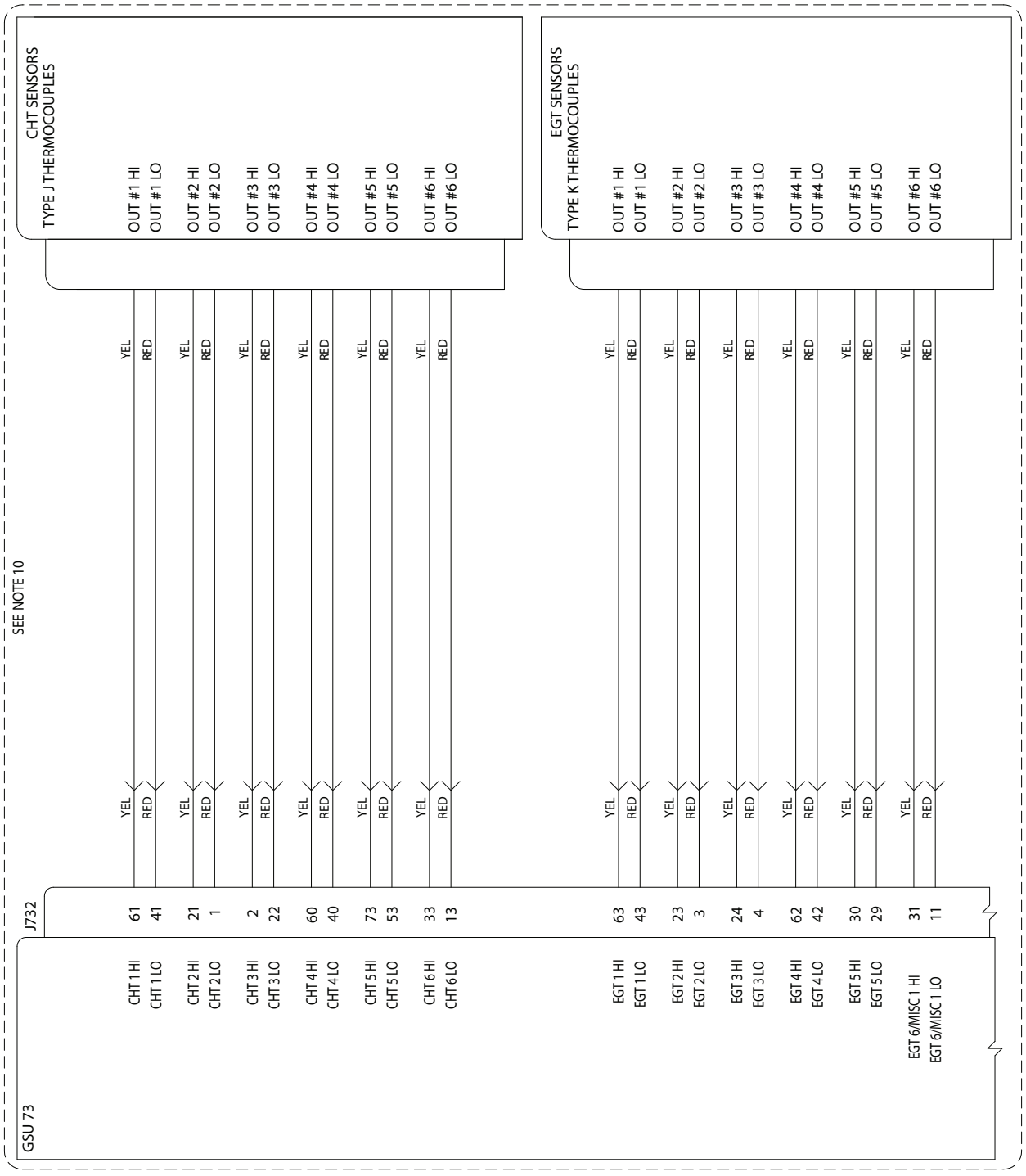


Figure J-1.1 Jabiru Sensor Wiring Examples, Page 2 of 2

Appendix K RS-232 Text Output Format

K.1 Electrical Interface

The output signals are compatible with RS-232C. Data is generated at 115,200 baud with a word length of 8 bits, one stop bit, and no parity.

K.2 Message Output Selection

Individual text output messages may be enabled or disabled in configuration mode. Enabling or disabling a particular text output message has no effect on other text output messages.

K.3 General Message Output Format

Most text output messages have the following general format:

- Escape character ('=' symbol, 0x3D hex)
- ID character
- Version character
- Data characters (length determined by message ID)
- Checksum - 2-character (1-byte) ASCII hex value that is the simple sum of all previous bytes, including the escape character
- Carriage return (0x0D hex)
- Line feed (0x0A hex)

An exception to the above is the GPS Data message, which is backwards compatible with the Garmin Simple Text Output format described at:http://www8.garmin.com/support/text_out.html. The GPS Data Message has the following general format:

- Escape character ('@' symbol, 0x40 hex)
- Data characters
- Carriage return (0x0D hex)
- Line feed (0x0A hex)

All text output messages use only printable ASCII characters. For all messages, a value that is out of range, missing, not configured, uncalibrated, or otherwise invalid is indicated by replacing the corresponding bytes within the message with the underscore character ('_', 0x5F hex).

K.4 Attitude/Air Data Message Format

The Attitude/Air Data message is transmitted approximately 10 times per second.

Table K-1 Attitude/Air Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'='		
Sentence ID	1	1		'1'		
Sentence version	2	1		Currently '1'		
UTC hour	3	2	hours		00	23
UTC minute	5	2	minutes		00	59
UTC second	7	2	seconds		00	59
UTC second fraction	9	2	10 ms		00	99
Pitch	11	4	0.1 degree	positive = up	-900	+900
Roll	15	5	0.1 degree	positive = right	-1800	+1800
Heading	20	3	1 degree	magnetic	000	359
Airspeed	23	4	0.1 knots		0000	9999
Pressure altitude	27	6	1 foot		-01000	+60000
Rate of turn	33	4	0.1 degree/sec	positive = right	-999	+999
Lateral acceleration	37	3	0.01 G	positive = leftward	-99	+99
Vertical acceleration	40	3	0.1 G	positive = upward	-99	+99
Reserved	43	2		Reserved for future use		
Vertical speed	45	4	10 fpm	positive = up	-999	+999
Outside air temperature	49	3	1 degree C		-99	+99
Altimeter setting	52	3	0.01 inHg	offset from 27.50"	000	400
Checksum	55	2	ASCII hex	sum of all previous bytes		
CR/LF	57	2		0x0D / 0x0A		
Total length	59					

K.5 Engine Data Message Format

The Engine Data message is transmitted approximately 5 times per second.

Table K-2 Engine Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'='		
Sentence ID	1	1		'3'		
Sentence version	2	1		Currently '1'		
UTC hour	3	2	hours		00	23
UTC minute	5	2	minutes		00	59
UTC second	7	2	seconds		00	59
UTC second fraction	9	2	10 ms		00	99
Oil pressure	11	3	1 PSI		000	999
Oil temperature	14	4	1 degree C		-999	+999
RPM	18	4	1 RPM		0000	9999
Unused	22	4				
Manifold pressure	26	3	0.1 inHg		000	600
Fuel flow	29	3	0.1 gallon/ hour		000	999
Unused	32	3				
Fuel pressure	35	3	0.1 PSI		000	999
Fuel quantity 1	38	3	0.1 gallon		000	999
Fuel quantity 2	41	3	0.1 gallon		000	999
Calculated fuel remaining	44	3	0.1 gallon	calculated from fuel computer	000	999
Volts 1	47	3	0.1 V		000	320
Volts 2	50	3	0.1 V		000	320
Amps 1	53	4	0.1 A		-999	+999
Total aircraft time	57	5	0.1 hour		00000	99999
Engine time	62	5	0.1 hour		00000	99999
CHT6	67	4	1 degree C		-999	+999
EGT6	71	4	1 degree C		-999	+999
CHT5	75	4	1 degree C		-999	+999
EGT5	79	4	1 degree C		-999	+999
CHT4	83	4	1 degree C		-999	+999
EGT4	87	4	1 degree C		-999	+999
CHT3	91	4	1 degree C		-999	+999
EGT3	95	4	1 degree C		-999	+999
CHT2	99	4	1 degree C		-999	+999
EGT2	103	4	1 degree C		-999	+999
CHT1	107	4	1 degree C		-999	+999
EGT1	111	4	1 degree C		-999	+999
TIT1	115	4	1 degree C		-999	+999
TIT2	119	4	1 degree C		-999	+999

Table K-2 Engine Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Elevator trim position	159	5	1% of travel	0 = up, 50 = neutral, 100 = down	+0000	+0100
Units indicator	164	1		'T'		
Flap position	177	5	1 degree		-0090	+0090
Units indicator	182	1		'T'		
Carb temp	123	5	0.1 degree C		-9999	+9999
Units indicator	128	1		'C'		
Coolant pressure	153	5	0.01 PSI		+0000	+9999
Units indicator	158	1		'P'		
Coolant temperature	147	5	0.1 degree C		-9999	+9999
Units indicator	152	1		'C'		
Amps 2	129	5	0.1 A		-9999	+9999
Units indicator	134	1		'A'		
Aileron trim position	165	5	1% of travel	0 = left, 50 = neutral, 100=right	+0000	+0100
Units indicator	170	1		'T'		
Rudder trim position	171	5	1% of travel	0 = left, 50 = neutral, 100=right	+0000	+0100
Units indicator	176	1		'T'		
Fuel quantity 3	135	5	0.1 gallon		+0000	+9999
Units indicator	140	1		'G'		
Fuel quantity 4	141	5	0.1 gallon		+0000	+9999
Units indicator	146	1		'G'		
Unused	183	18				
Discrete input 1	201	1		1 = active, 0 = inactive		
Discrete input 2	202	1		1 = active, 0 = inactive		
Discrete input 3	203	1		1 = active, 0 = inactive		
Discrete input 4	204	1		1 = active, 0 = inactive		
Unused	205	12				
Checksum	217	2	ASCII hex	sum of all previous bytes		
CR/LF	219	2		0x0D / 0x0A		
Total length	221					

K.6 GPS Data Message Format

The GPS Data message is transmitted once per second.

Table K-3 GPS Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'@'		
UTC year	1	2	years	last two digits of UTC year	00	99
UTC month	3	2	months		01	12
UTC day	5	2	days		01	31
UTC hour	7	2	hours		0	23
UTC minute	9	2	minutes		0	59
UTC second	11	2	seconds		0	59
Latitude hemisphere	13	1		'N' for north or 'S' for south		
Latitude degrees	14	2	degrees		0	90
Latitude minutes	16	5	0.001 minutes	minutes x 1000	0	59999
Longitude hemisphere	21	1				
Longitude degrees	22	3	degrees	'E' for east or 'W' for west	0	180
Longitude minutes	25	5	0.001 minutes	minutes x 1000	0	59999
Position status	30	1		'g' = 2D GPS position 'G' = 3D GPS position 'd' = 2D differential GPS position 'D' = 3D differential GPS position 'S' = simulated position '_' = invalid position		
Horizontal position error	31	3	meters		000	999
Altitude	34	6	meters	height above or below MSL	-99999	+99999
East/west velocity direction	40	1		'E' for east or 'W' for west		
East/west velocity magnitude	41	4	meters/ sec		0000	9999
North/south velocity direction	45	1		'N' for north or 'S' for south		
North/south velocity magnitude	46	4	meters/ sec		0000	9999
Vertical velocity direction	50	1		'U' for up or 'D' for down		
Vertical velocity magnitude	51	4	meters/ sec		0000	9999
CR/LF	55	2		0x0D / 0x0A		
Total length	57					

For more information on the GPS Data message, see http://www8.garmin.com/support/text_out.html

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