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
G	07/09/12	Reorganized document and added various updates
H	04/19/13	Added new LRUs and various updates
J	05/15/13	Updated for current software, various updates
K	07/23/13	Added angle of attack info, various updates

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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CURRENT REVISION DESCRIPTION

Revision	Page Number(s)	Section Number	Description of Change
K	2-2	2.1.1	Updated G3X Interconnect Example Figure 2-1
	2-9	2.4.1	Updated GSU 25 and GSU 73 info in Table 2-4
	8-5	8.4.3	Added Figure 8-2 recommended minimum clearance
	9-7	9.5.2.4	Added CWS/Disconnect note
	15-1–15-52	15	Removed references to connector "P" plug throughout section
	19-26–19-36	19.4	Added AOA calibration info
	C-7	Appdx C	Made corrections to Figure C-2.2
	C-8	Appdx C	Updated Figure C-2.3
	D-4	Appdx D	Added Figure D-1.4 GDU 37X/GMC 305/GSA 28 Interconnect Drawing for GSU 73
	E-5	Appdx E	Made corrections to Figure E-2.2
	F-1–F-3, F-6	Appdx F	Made updates and corrections to Figures F-1.1–F-2.1, F-3.1
	G-1–G-5	Appdx G	Made updates to Figures G-1.1–G-3.2
	H-1–H-5	Appdx H	Made updates to Figures H-1.1–H-3.1
	I-2	Appdx I	Corrected AOA info in Table I-1

DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

WARNING

Warnings *are used to bring to the installer's immediate attention that not only damage to the equipment but personal injury may occur if the instruction is disregarded.*

CAUTION

Cautions are used to alert the individual that damage to equipment may result if the procedural step is not followed to the letter.

NOTE

Notes *are used to expand and explain the preceding step and provide further understanding of the reason for the particular operation.*

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 non-TSO certified products that 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.

NOTE

The term LRU, as used throughout this manual is an abbreviation for Line Replaceable Unit. LRU is used generically in aviation for a product (such as a GDU 37X or GTP 59) that can be readily "swapped out" (usually as a single component) for troubleshooting/ repair.

NOTE

All GMU 22 information in this Installation Manual also applies to the GMU 44. The GMU 44 had previously been used as the G3X magnetometer but has been replaced by the GMU 22.

NOTE

Connector references JXXX(X) and PXXX(X) are used throughout this document. The letter "J" or "P" designates the connector (whether on the LRU or wiring harness). "J" (Jack) refers to the connector on the LRU, and "P" (Plug) refers to the connector on the wiring harness. "J" or "P" designate the connector only, regardless of contact type (pin or socket).

DOCUMENT PAGINATION

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 +28 V supply
2	N/A	N/A	Improved backup capacitor circuit to increase backup time in certain under-voltage conditions

Limited Warranty for G3X Products

Garmin G3X LRUs GAP 26, GDU 37X, GEA 24, GMC 305, GMU22, GMU 44, GSA 28, GSU 25, GSU 73, & 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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1 INVENTORY OF MATERIALS

This manual provides all of the mechanical and electrical information required for the installation of the G3X system. This manual is intended to be a step-by-step guide to the installation, therefore it is important that the steps in all sections be performed in order. All materials that are required/optional for the installation of the G3X are listed in this section (as such, some of the information in this section is repeated in following sections).

Before beginning the G3X installation, it is recommended that the installer perform a complete inventory of all materials listed in this section (some materials are optional and may not be applicable to the installation). Section 1 should be used to verify that all components ordered from Garmin have been delivered correctly, and to identify any required materials that are not provided by Garmin.

1.1 Unpacking Unit

Carefully unpack the equipment and make a visual inspection of all contents 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 Required Garmin Equipment

1.2.1 Garmin LRU (Line Replaceable Unit) List

Table 1-1 through Table 1-8 list the available core G3X LRUs. The G3X LRU Kit (Table 1-1) is for G3X installations using the GSU 73, the kits in Table 1-2 through Table 1-8 are for G3X installations using the GSU 25. Each GDU 37X (010-00667-XX) comes with all equipment needed for installation (Table 1-9).

Table 1-1 Contents of G3X w/GSU 73 LRU Kit (K10-00016-00)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GMU 44 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 73 ADAHRS/EIS, Unit Only	010-00691-00	1	011-01817-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00

Table 1-2 Contents of GDU 370 Single Display Kit, no EIS (K10-00016-05)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	1	011-01747-15
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-3 Contents of GDU 370 Single Display Kit w/EIS (K10-00016-10)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	1	011-01747-15
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-4 Contents of GDU 370 Dual Display Kit (K10-00016-20)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	2	011-01747-15
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-5 Contents of GDU 370 Triple Display Kit (K10-00016-30)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	3	011-01747-15
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-6 Contents of GDU 375 w/XM Single Display Kit (K10-00016-15)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 375 Display, Unit Only	010-00667-25	1	011-01747-30
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-7 Contents of GDU 370/375 w/XM Dual Display Kit (K10-00016-25)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	1	011-01747-15
GDU 375 Display, Unit Only	010-00667-25	1	011-01747-30
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Table 1-8 Contents of GDU 370/370/375 w/XM Triple Display Kit (K10-00016-35)

LRU	Assembly Part Number	Quantity	Unit Only Part Number
GDU 370 Display, Unit Only	010-00667-15	2	011-01747-15
GDU 375 Display, Unit Only	010-00667-25	1	011-01747-30
GEA 24 EIS, Unit Only	010-01042-00	1	011-02848-00
GMU 22 Magnetometer, Unit Only	010-01196-00	1	011-03269-00
GSU 25 ADAHRS, Unit Only	010-01071-00	1	011-02929-00
GTP 59 OAT Probe Kit	011-00978-00	1	011-00978-00
Config Module w/Sockets, Jackscrew (for PFD1)	011-00979-22	1	011-00979-22

Each GDU 37X Assembly (010-00667-XX) listed in Table 1-2 through Table 1-8 includes the GDU and the items listed in Table 1-9.

Table 1-9 Contents of GDU 37X Assembly (010-00667-XX)

Item	Part Number	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

1.2.2 Garmin LRU Installation Kits

The G3X w/GSU 73 Installation Kit contains the items listed in Table 1-10 which are required for the installation of the G3X.

NOTE

The GDU 37X is not included in either the G3X w/GSU 73 Installation Kit (K10-00017-00) or the G3X w/GSU 73 LRU Kit (K10-00016-00).

NOTE

Each item listed in Table 1-10 contains its own parts list to verify that all parts are included.

Table 1-10 Contents of G3X w/GSU 73 Installation Kit (K10-00017-00)

Item	Part Number	Quantity
GMU 22, 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 22, Install Rack, Modified	115-00481-10	1

Table 1-11 LRU Installation Kits

LRU	Installation Kit Part Number	Installation Kit Included with LRU?
GAD 29 ARINC 429 Adapter	011-03271-00 (Table 3-3)	N
GAP 26 Air Data Probe	N/A	N
GDU 37X Display	011-01921-00 (Table 1-9)	Y
GEA 24 EIS	011-02886-00 (Table 6-3)	N
GMC 305 Mode Controller	010-01234-00 (Table 7-2)	N
GMU 22 Magnetometer	011-00871-10, Conn Kit (Table 8-3)	N
GSA 28 Servo Actuator	011-02950-00, Conn Kit (Table 9-7)	N
GSU 25 ADAHRS	K10-00181-00, Conn Kit (Table 10-2)	N
GSU 73 ADAHRS/EIS	K10-00017-00 (Table 1-10)	Y
GTP 59 Temperature Probe	011-00978-00 (Table 12-2)	Y
Garmin GPS and/or XM Antennas	NA	N

1.2.3 GPS/XM Antenna(s)

A Garmin or non-Garmin GPS antenna is required for a G3X installation. A Garmin or non-Garmin XM antenna is required for G3X installations using XM weather. See Section 13 for required materials for antenna installation including mounting brackets, doubler plates, rivets, hardware, cables, connectors, and sealant.

1.3 Optional Garmin LRUs

Table 1-12 lists optional Garmin LRUs that can be installed with the G3X system. If any of these LRUs are to be used in this installation, verify that all required installation materials such as connector kits have been acquired. Installation information for LRUs not documented in this manual can be found in the Installation Manual for each respective LRU.

Table 1-12 Optional Garmin LRUs

LRU	All Install Info Included In This Manual?	Section
GAD 29 ARINC 429 Adapter	Yes	Section 3
GAP 26 Air Data Probe	Yes	Section 4
GDL 39/GDL 39R Data Link	No	NA
GDU 37X Display (if installing more than one)	Yes	Section 5
GEA 24 EIS	Yes	Section 6
GMC 305 Mode Controller	Yes	Section 7
GNS 400/500 Series Units	No	NA
GNS 480 GPS/Comm Navigator	No	NA
GSA 28 Servo Actuator	Yes	Section 9
GSU 25* ADAHRS	Yes	Section 10
GSU 73* ADAHRS/EIS	Yes	Section 11
GTN 600/700 Series Units	No	NA
GTX 23/327/330 Transponder	No	NA
SL30 Nav/Comm Transceiver	No	NA
SL40 Comm Transceiver	No	NA

*One GSU 25 and/or GSU 73 is required

1.4 Required non-Garmin Equipment

1.4.1 Wiring/Cabling Considerations

The installer will provide all wiring and cabling unless otherwise noted. 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. RG400 or RG142 coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation.

1.4.2 Contact and Crimp Tools

Table 1-13 lists recommended crimp tools used to build the wiring harnesses for the G3X LRUs, other equivalent tooling may also be used.

Table 1-13 Pin Contact and Crimp Tools Part Numbers

<table>
<tr><th>LRU</th><th>Contact Type</th><th>Garmin Contact Part Number</th><th>Recommended Positioner</th><th>Recommended Insertion/ Extraction Tool</th><th>Recommended Hand Crimping Tool</th></tr>
<tr><td>GDU 37X</td><td>Socket, Size 20</td><td>336-00094-00</td><td>M22520/2-08, Daniels K13-1</td><td rowspan="14">M81969/1-04 for size 22D pins and M81969/1-02 for size 20 pins</td><td rowspan="14">M22520/2-01</td></tr>
<tr><td>GMC 305</td><td rowspan="5">Pin, Size 22D</td><td rowspan="5">336-00021-00 (MIL P/N M39029/58-360)</td><td rowspan="5">M22520/2-09 Positronic P/N 9502-4, Daniels P/N K42</td></tr>
<tr><td>GSU 73</td></tr>
<tr><td>GTP 59</td></tr>
<tr><td>011-00979-20 (Config module w/ EEPROM kit)</td></tr>
<tr><td>011-00981-00 (thermocouple kit)</td></tr>
<tr><td>GMU 22</td><td>Socket, Size 20</td><td>336-00022-00 (MIL P/N M39029/63-368)</td><td>M22520/2-08, Daniels K13-1</td></tr>
<tr><td>011-00979-22 (Config module w/ Sockets & Jackscrew kit)</td><td>Socket, Size 20, 26-30 AWG</td><td>336-00022-01</td><td>Positronic P/N 9502-5</td></tr>
<tr><td>GAD 29</td><td rowspan="4">Socket, Size 20, 20-24 AWG</td><td rowspan="4">336-00022-02</td><td rowspan="6">M22520/2-08, Daniels K13-1</td></tr>
<tr><td>GEA 24 (J241, J243, J244)</td></tr>
<tr><td>GSA 28</td></tr>
<tr><td>GSU 25</td></tr>
<tr><td>GAD 29</td><td rowspan="2">Pin, Size 20</td><td rowspan="2">336-00024-00 (MIL P/N M39029/64-369)</td></tr>
<tr><td>GEA 24 (J242 only)</td></tr>
</table>

NOTE

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

1.4.3 BNC/TNC Connectors

Either BNC or TNC connectors may be required to terminate the antenna cable, depending upon which antenna is used. Check the antenna installation instructions for detailed information.

1.4.4 Hex Driver

A 3/32” hex drive tool is required to secure the GDU 37X to the panel as described in Section 5.5.1 Unit Installation.

1.4.5 SD Card

An SD Card is required to be used as a DataCard. Garmin recommends a 2 GB SanDisk® brand SD card. See Section 17.4.1 and Section 20.2.1 for detailed information.

1.4.6 Non-Magnetic Tools

Use of non-magnetic tools (e.g. beryllium copper or titanium) is recommended when installing or servicing the GMU 22. Do not use a screwdriver that contains a magnet when installing or servicing the GMU 22.

1.4.7 Pneumatic Hoses and Connectors.

Air hoses and fittings are required to connect pitot and static air to the ADAHRS (GSU 25/73). The ADAHRS (GSU 25/73) has a female 1/8-27 ANPT fitting for each pitot and static port. Use appropriate aircraft fittings to connect to pitot, static, and Angle of Attack (AOA on GSU 25 only) system lines.

1.4.8 Hardware for GAD 29/GEA 24/GSU 25

If the installer does not use supplied hardware, an example of alternate mounting hardware is: (4 ea.) AN3 Bolt and (4 ea.) AN960 Cad Plate #10 Washer.

1.4.9 Hardware for GSU 73

An example of GSU 73 mounting hardware is: #10-32 pan or hex head screw (4 ea.) and #10-32 self-locking nut (4 ea). (see Section 11.4.4)

1.5 Optional Garmin Equipment (non-LRU)

1.5.1 Optional GMU 22 Mounting Racks

The Universal Mounting Rack is an optional mounting rack for the GMU 22, refer to the AHRS Magnetometer Installation Considerations (190-01051-00) document available from www.garmin.com.

Refer to Appendix A for airframe specific GMU 22 mounting racks and related mounting hardware.

1.5.2 Antenna Brackets/Doubler Plates

See Section 13 for detailed information.

1.5.3 Silicon Fusion Tape

Garmin Part Number 249-00114-00 or similar, used to wrap the wiring/cable bundles.

1.6 Optional non-Garmin Equipment

1.6.1 Engine/Airframe Sensors

See Section 14.1 for a list of compatible sensors, and Section 14.3 for a list of available sensor kits.

1.6.2 Mounting Hardware

Some sensors may require a torque screwdriver, copper crush gasket, #10 screws, or #8 ring terminals for installation.

1.7 Optional 3rd Party Sensors/LRUs

Refer to Appendix E, Appendix F, Appendix G, and Appendix H for wiring/configuration guidance of supported third party equipment.

1.8 Garmin Software and Documents

The below are available for free download from www.garmin.com.

- AHRS Magnetometer Installation Considerations
- Aviation Checklist Editor (ACE) software
- Flightlog Conversion Software
- GDU 37X Cockpit Display Unit Software
- GMU 22 Location Survey Tool
- GSU 73 Data Logger Software
- GSU 73 Field Calibration Tool
- Panel Cut-out DXF File

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2 INSTALLATION PREPARATION

This section provides electrical and mechanical information needed for planning the physical layout of the G3X system installation. This information is applicable to all items comprising the G3X installation. Each LRU/Sensor has unique installation requirements. These requirement are detailed in the Installation portion of Section 4 through Section 14.

Use all of Section 2 to become familiar with all aspects of the installation before actually beginning the physical installation of any equipment into the aircraft. Some information from this section is repeated in following sections of this document.

Garmin recommends that the installer become familiar with all sections of this document before beginning the installation. The sections of this document are (as much as possible) in the order that should be followed for most installations. In general terms, the below steps are recommended to be followed in order.

1. Inventory of all needed parts
2. Planning/layout of the installation
3. Installation of LRUs, antennas, and sensors
4. Construction of wiring harness, cables, and connectors
5. Software installation/configuration
6. Post-installation checkout procedure and calibration

2.1 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 mounted to the panel in the case of the GDU 37X) 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 (3-13) of this manual.

2.1.1 System Architecture

Figure 2-1 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. Only one GDU 37X display is required, but up to three may be used.

Refer to Figure 2-1 to determine which of the optional LRUs will be used in the installation and to determine the required interface connections.

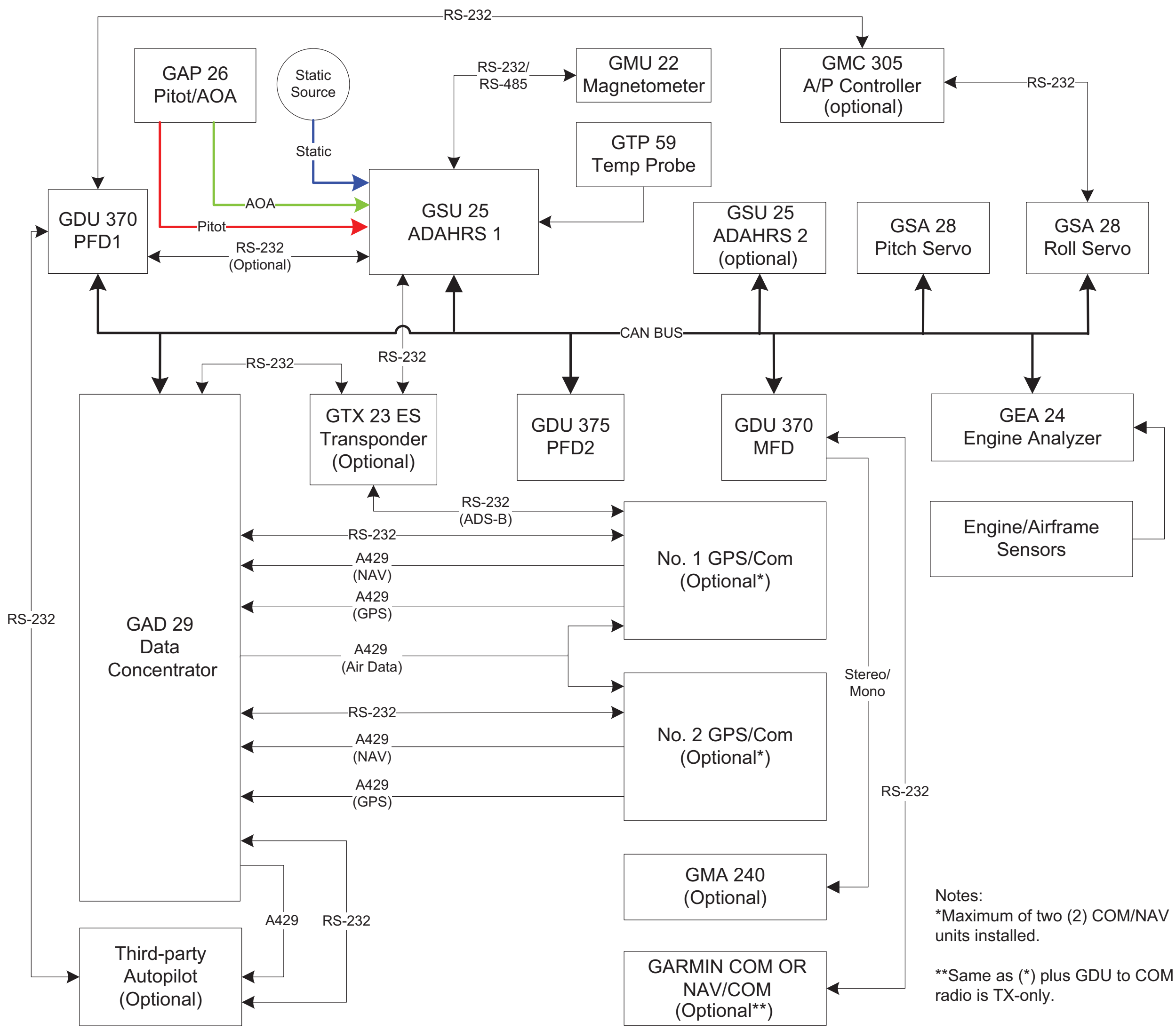

Figure 2-1. G3X Interconnect Example

2.2 Electrical Considerations

This section presents information required for planning the electrical layout of the G3X installation.

2.2.1 Power Specifications

All G3X LRUs are capable of operating at either 14 or 28 VDC (except the GAP 26, 010-01074-10). Table 2-1, Table 2-2, and Table 2-3 list supply voltage and current draw for the G3X LRUs, use this information when determining power supply requirements. All installed electrical appliances must be considered when determining total power requirements.

2.2.1.1 GAP 26

The 010-01074-00 version of the GAP 26 does not require power as it does not have a heater. The initial current vs temperature requirements for the 010-01074-10 are listed in Table 2-1. Supply voltage for the GAP 26 is 14 Vdc, Connect aircraft power directly to GAP 26 heater wires by any preferred means for the given current draw. See Table 4-2 for acceptable wire gauge and run length for given configurations. Use of 14 AWG wire and a 20 Amp circuit breaker are recommended for most installations.

CAUTION
Do not connect the GAP 26 to 28 VDC.

Table 2-1 GAP 26 Initial Current Draw vs Temperature (-10 unit only)

Temperature	-40°C	0°C	50°C	100°C	175°C
Amps	12 A	9.25 A	7.3 A	5.85 A	4.36 A

2.2.1.2 GDU 37X

NOTE
GDU 37X current draw must be multiplied by the number of installed GDU 37X units.

Table 2-2 GDU 37X Power Requirements

LRU	14 V (Maximum)	14 V (Typical)	28 V (Maximum)	28 V (Typical)
GDU 370	15 W, 1.10 Amp	8.5 W, 0.600 Amp	15 W, 0.540 Amp	8.50 W, 0.300 Amp
GDU 375	15 W, 1.10 Amp	9.5 W, 0.675 Amp	15 W, 0.540 Amp	9.25 W, 0.330 Amp

2.2.1.3 Other LRU Power Requirements

Table 2-3 G3X LRU Power Requirements

LRU	Supply Voltage	Current Draw
GAD 29	14 Vdc	0.2 A
	28 Vdc	0.1A
GEA 24	14 Vdc	0.43 A max (typical external sensor loading)
	28 Vdc	0.21 A max (typical external sensor loadiing)
GMC 305	14 Vdc	0.50 mA
	28 Vdc	0.28 mA
GMU 22	12 Vdc (from GSU 25/GSU 73)	Inc. in GSU 25/GSU 73 Current Draw
GSA 28	14 Vdc	0.36 Amp (typical) 1.80 Amp (max) 2.80 Amp (max with 1 Amp trim motor at full load)
	28 Vdc	0.20 Amp (typical) 0.90 Amp (max) 1.40 Amp (max with 1 Amp trim motor at full load)
GSU 25	14 Vdc	0.2 Amp (includes GMU 22 load)
	28 Vdc	0.11 Amp (includes GMU 22 load)
GSU 73*	14 Vdc	1.75 Amp (max)
	28 Vdc	0.80 Amp (max)

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

2.3 Wiring/Cabling Considerations

Section 15 lists the pin information for all LRU connectors. Section 15 lists the connector (including configuration modules) installation information. Appendices C-H contain interconnect drawings for all required/optional LRUs and sensors. These appendices, along with the following sections 3–14 contain all the information needed to construct the wiring harnesses/cables. It is recommended that LRUs/sensors be installed prior to constructing the wiring harnesses and cables.

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.

2.3.1 Wiring Harness Installation

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, RF sources, EMI interference 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.
- 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 w/GSU 73 Installation Kit (K10-00017-00). Electrical connections for the GMU 22 are made through a round 9-pin connector, and are made through D subminiature connectors for all other LRUs. Section 15 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 1-13 lists contact part numbers (for reference) and recommended crimp tools.

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

2.3.1.1 Backshell Assemblies

Connector kits include backshell assemblies. The backshell assembly houses the configuration module and a thermocouple reference junction. 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 Section 16.

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.

2.3.1.2 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 2-2 shows the configuration module that installs on both the GDU 37X (PFD 1) and the GSU 73 connector backshell. In systems using a GSU 25, only the GDU 37X (PFD 1) will use a configuration module. See Section 16 for installation instructions.

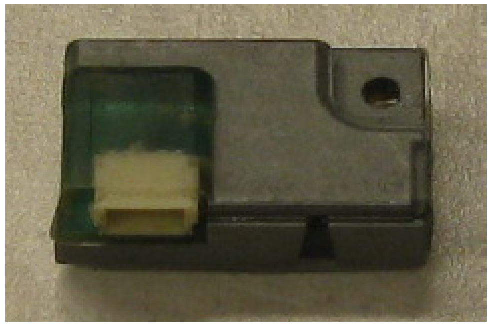

Figure 2-2. Configuration Module

2.3.1.3 CAN Bus Considerations

The CAN (controller area network) bus (Figure 2-3) is an interface format used to establish communication between several LRUs in the G3X system. Each end of the CAN Bus "backbone" must be terminated by a 120 Ω resistor. Each node length (distance from CAN bus backbone to each LRU) must be 1 meter or less in length (keeping the node lengths as short as practicable is recommended). There is no minimum node length.

LRUs that can connect to the CAN Bus are: GAD 29, GDU 37X, GEA 24, GSA 28, GSU 25, GSU 73. The GEA 24 and GSU 25 installation kits provide a DB-9 CAN Bus terminator that contains a 120 Ω resistor connected between pin 1 and 2 (Figure 2-4). The GDU 37X and GSU 73 units are terminated by connecting the CAN Bus Lo pin to the CAN Bus Termination pin (Figure 2-5). The GDU 37X, GSU 73, and GSA 28 units all contain a 120 Ω resistor inside the unit that provides the termination when connected externally (as shown in Figure 2-5, Figure 2-6). The GSA 28 servos are terminated by connecting pin 3 to pin 4 (Figure 2-6).

NOTE

Use only two CAN Bus terminations per installation (even if provided more than two from associated G3X installation kits). Using less than or more than two terminations (one at each end of the backbone) will make the CAN Bus unusable or unreliable.

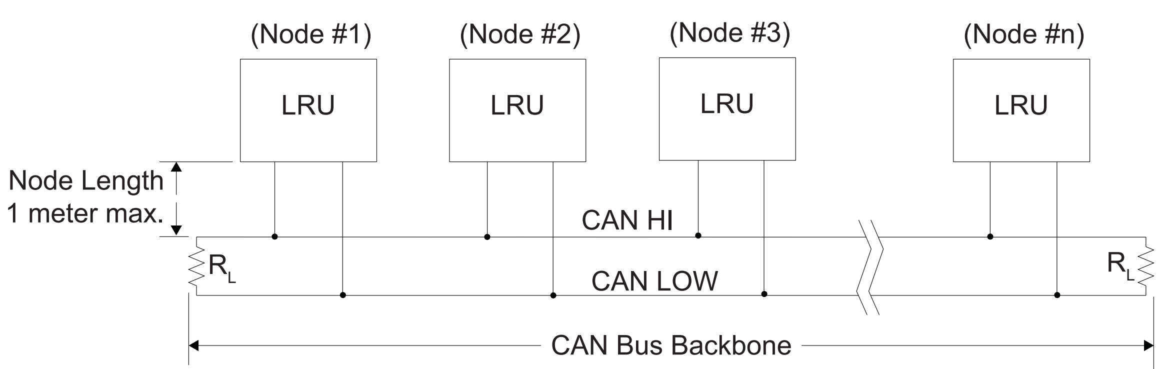

Figure 2-3. CAN Bus Configuration

The following items should be considered when installing/removing/replacing LRU's on the CAN bus:

1. CAN bus node connections must be made on the connector of each LRU that connects to the CAN bus, do not tie CAN bus nodes from individual LRUs together into a single connection point.
2. Keep all node lengths as short as practicable, and allow only one 'lengthy' node if possible.
3. If a GAD 29, GEA 24, and/or GSU 25 unit (that was used as a CAN bus termination) is removed, the CAN bus will remain terminated as long as the CAN bus terminator (Figure 2-4) is left connected.
4. If a GDU 37X and/or GSU 73 unit (that was used as a CAN bus termination) is removed, the CAN bus will be unusable until the CAN bus is properly terminated at both ends of the 'backbone' (Figure 2-3).
5. A removal adapter (GPN 011-03158-00) is provided (with each GSA 28 connector kit) that can be used when a GSA 28 is removed. The adapter keeps that node on the CAN bus in the same state as when the servo was connected (either terminated or un-terminated). The adapter also allows trim signals to pass through when the servo is removed.
6. Based on preceding points 2-4, it is recommended that CAN bus terminations are placed at a GAD 29, GEA 24, GSA 28, GSU 25 unit, if possible.

NOTE

The 120 Ω termination resistors described in the preceding paragraphs are "built-in" to the termination methods shown in the following figures. Do not install a separate "discrete" 120 Ω resistor to terminate the CAN bus in addition to the termination methods shown in Figure 2-4, Figure 2-5, and Figure 2-6.

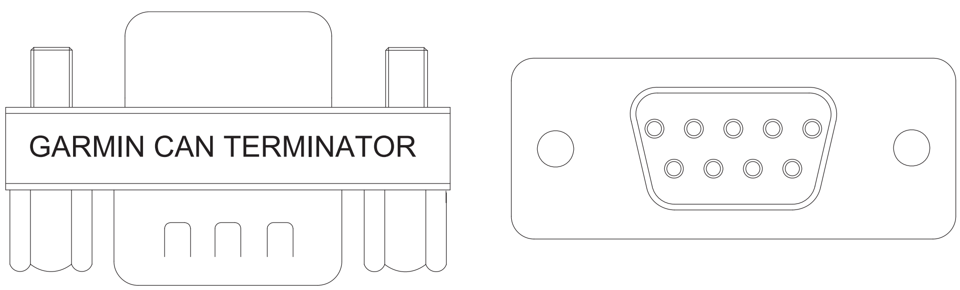

Figure 2-4. CAN Bus Termination (011-02887-00) for GAD 29, GEA 24, and GSU 25

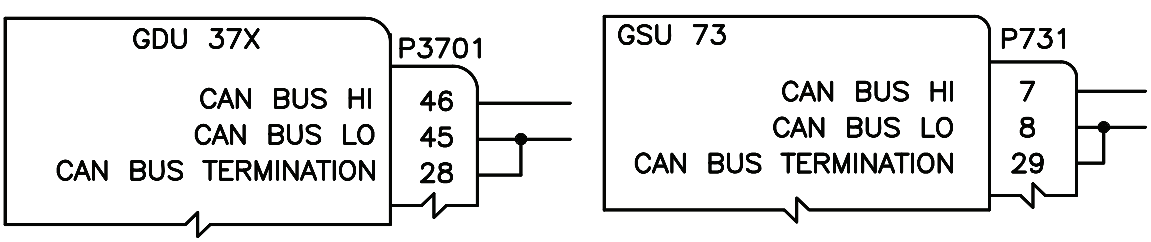

Figure 2-5. CAN Bus Termination for GDU 37X and GSU 73

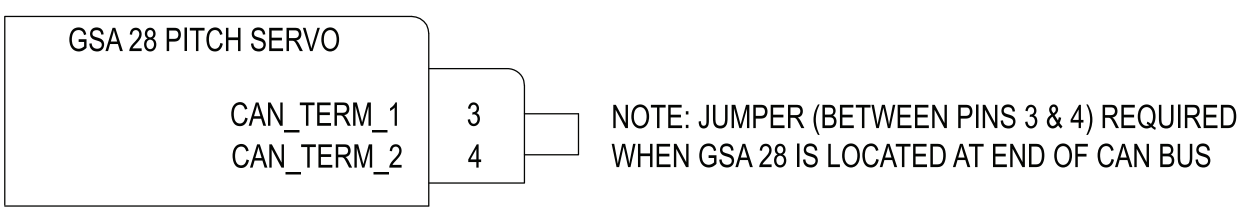

Figure 2-6. CAN Bus Termination for GSA 28

2.3.1.4 Cable Connector Installation

Coaxial cables are required for antenna connections for GPS, XM, transponder, comm, VHF Nav, and ADS-B functions.

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 2-7) connector. If provided, follow the connector manufacturer's instructions for cable preparation.

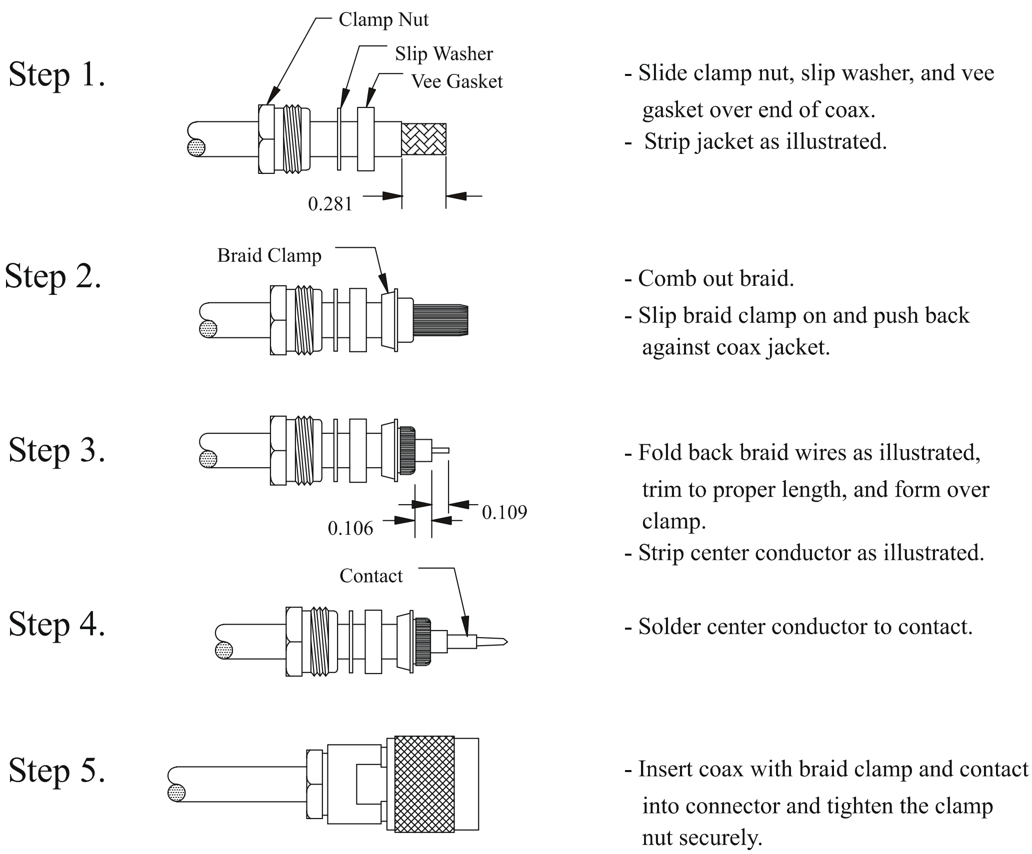

Figure 2-7. TNC Connector Installation

2.4 Mechanical Considerations

This section presents all information required for planning the physical layout of the G3X installation.

2.4.1 Physical Specifications

Use Table 2-4 to determine panel requirements. All width, height, and depth measurements are taken with unit rack (if applicable) and connectors, dimensions are also listed in Appendix B. Figure 5-4 and Figure 7-2 are panel cutout templates for the GDU 37X and GMC 305 respectively.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Unit Weight w/ Nutplate & Connector Weight
GAD 29 (ARINC 429 Adapter)	6.10 inches [154.9 mm]	1.48 inches [37.6 mm]	3.23 inches [82.0 mm] no connector 5.10 inches [129.4 mm] w/connector 5.54 inches 140.7 mm] w/connector and CAN terminator	.38 lb (0.172 kg)	NA
GAP 26 (Air Data Probe)	.821 inches [20.9 mm]	16 inches [406.4 mm]	6.12 inches [157.7 mm]	-00 unit: 0.33 lb (0.149 kg) -10 unit: 0.39 lb (0.176 kg)	NA
GDU 370 (Display)	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.6 mm)	1.6 lbs (0.713 kg)	1.8 lbs (0.803 kg)
GDU 375 (Display)	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.6 mm)	1.7 lbs (0.771 kg)	1.9 lbs (0.862 kg)
GEA 24 (EIS)	6.5 inches (165.1 mm)	1.9 inches (48.3 mm)	3.0 inches (76.2 mm) 5.0 inches (127.0 mm) w/connectors	0.71 lbs (0.322 kg)	1.6 lbs (0.725 kg)
GMC 305 (Mode Controller)	6.25 inches (158.8 mm)	1.85 inches (47.0 mm)	3.30 inches (83.8 mm)	0.5 lbs. (0.226 kg)	0.6 lbs. (0.272 kg)
GMU 22 (Magnetom-eter)	N/A	2.10 inches (53.3 mm)	3.37 inches (85.6 mm) Diameter	0.35 lbs. (0.158 kg)	0.50 lbs. (0.226 kg)
GSA 28 (Servo Actuator)	2.5 inches (63.5 mm)	4.0 inches (101.6 mm)	2.8 inches (71.1 mm)	1.40 lbs (0.635 kg)	NA
GSU 25 (ADAHRS)	4.0 inches (101.6 mm)	2.12 inches (53.8 mm) 2.61 inches (66.2 mm) w/conn	2.5 inches (63.5 mm)	0.48 lbs (0.217 kg)	0.684 lbs (0.310 kg)
GSU 73 (ADAHRS/ EIS)	5.50 inches (139.7 mm)	3.96 inches (100.6 mm)	5.50 inches (139.8 mm) 7.33 inches (186.2 mm) w/connectors	3.1 lbs (1.406 kg)	3.5 lbs (1.587 kg)

2.4.2 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 GAD 29
- No cooling air is required for the GDU 37X
- No cooling air is required for the GEA 24
- No cooling air is required for the GMC 305
- No cooling air is required for the GMU 22
- No cooling air is required for the GSA 28
- No cooling air is required for the GSU 25
- 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 11.

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.

2.5 LRU/Sensor Installation Information

Each LRU/sensor has unique considerations that the installer should be familiar with before beginning the physical installation. Become familiar with all installation information by studying sections 3-13 of this document before actually beginning the installation of the LRUs/sensors.

3 GAD 29 INSTALLATION (OPTIONAL LRU)

This section contains general information as well as installation information for the GAD 29. Use this section to mount the GAD 29 unit.

NOTE

A GAD 29 cannot be installed in a system that also includes a GSU 73. For ARINC 429 I/O, use the appropriate pins on the GSU 73 instead.

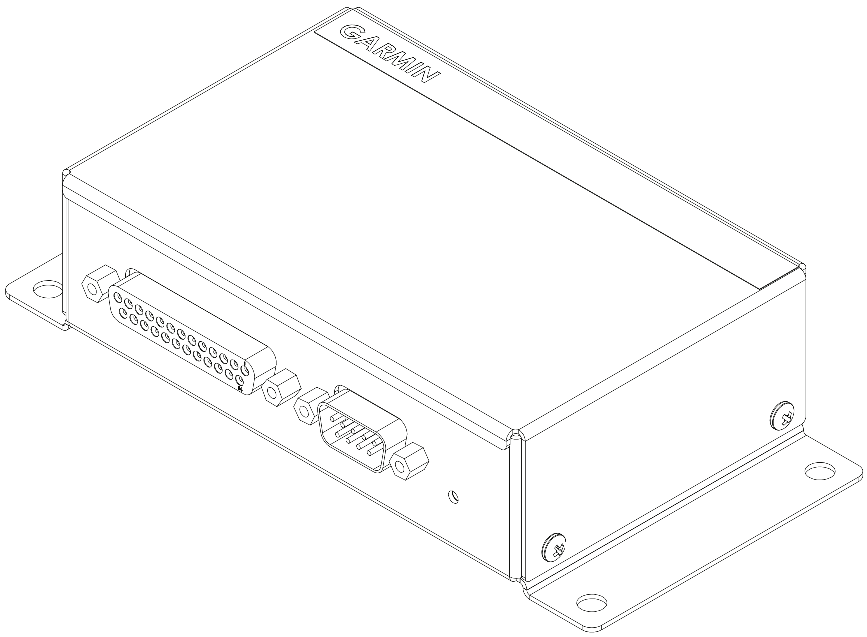

Figure 3-1 GAD 29 Unit View

3.1 Equipment Description

The GAD 29 allows the G3X system to interface to IFR navigators such as the GNS and GTN series. The GAD 29 has a 25 pin D-sub connector and a 9 pin D-sub connector. These connectors will provide the following functionality:

- 2 Low Speed ARINC 429 Transmitters
- 4 Low Speed ARINC 429 Receivers
- 1 CAN Network Port

NOTE

A GAD 29 cannot be installed in a system that also includes a GSU 73, use the GSU 73 for ARINC 429 I/O connections in these (GSU 73) installations.

3.1.1 Status LED

The GAD 29 has an LED on its outer case that indicates its current status. The status indications are:

Table 3-1 Status LED Indications

LED Indication	Status
No Light	No Power
Steady Green	On, but not communicating via CAN Bus
Flashing Green	On and communicating via CAN Bus
Red	Hardware Fault
Alternating Red/Green	CAN bus network error two similar devices are configured with the same unit ID

3.2 Equipment Available

3.2.1 Required Equipment

Table 3-2 GAD 29 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GAD 29	010-01172-00	011-03236-00

3.2.2 Additional Equipment Required

The connector kit in Table 3-3 is required to install the unit, it is not provided with the GAD 29 unit.

Table 3-3 Contents of GAD 29 Connector Kit (011-03271-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 9 Pin	011-01855-00	1
Backshell w/Hdw, Jackscrew, 25 Pin	011-01855-02	1
Conn, Plug,D-Sub, Crimp Pin, Commercial, 25 CKT	330-00624-25	1
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 09 CKT	330-00625-09	1
Contact, Socket, Military Crimp, Size 20	336-00022-02	11
Contact ,Pin, Military Crimp, Size 20	336-00024-00	27

3.3 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

3.4 Unit Installation

1. Mount the unit to a suitable mounting location using (4) #10-32 pan or hex head screws.
2. Assemble the connector backshells and wiring harness.
3. Connect CAN terminator to unit if required (Section 2.3.1.3).
4. Connect backshell connectors.

3.5 Mounting Requirements

The GAD 29 will mount remotely. The GAD 29 will be secured to the airframe using four #10-32 pan or hex head screws supplied by the installer.

3.6 Environmental Specifications

Table 3-4 lists general environmental specifications.

Table 3-4 GAD 29 Environmental Specifications

Characteristic	Specification
Unit Operating Temperature Range	-45°C to +70°C

3.7 Continued Airworthiness

The GAD 29 requires no maintenance.

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4 GAP 26 INSTALLATION (OPTIONAL LRU)

This section contains general information as well as installation information for the GAP 26 Pitot/AOA (Angle of Attack) probe. Use this section to mount the GAP 26.

4.1 Equipment Description

The GAP 26 Pitot/AOA (Angle of Attack) probe is an air data probe intended for use in non FAA certified aircraft, including light sport and home-built aircraft. This air data probe is intended to be used as part of the G3X system.

The function of the GAP 26 is to provide pitot and AOA pressures to the GSU 25 for the purpose of displaying airspeed and AOA to the pilot as part of the G3X system. The GAP 26 does not provide a static pressure source to the GSU 25. There are two different versions of the GAP 26, the -00 (unheated) and the -10 (heated, for ice protection). All versions of the GAP 26 have identical aerodynamic performance including identical internal water separation/baffling chambers, drain holes, pressure port locations and pneumatic tubing.

4.1.1 Moisture Protections

Both pitot and AOA pressure chambers have internal baffling and dedicated drain holes to provide moisture protection.

4.1.2 Ice Protection

The heated version of the GAP 26 (010-01074-10) has dual internal electro-thermal heating elements to provide ice protection to the areas of the probe where surface impingement of icing elements is expected to occur.

NOTE

The pneumatic tubing for pitot pressure is the longer of the two tubes extending out of the probe (Figure 4-1).

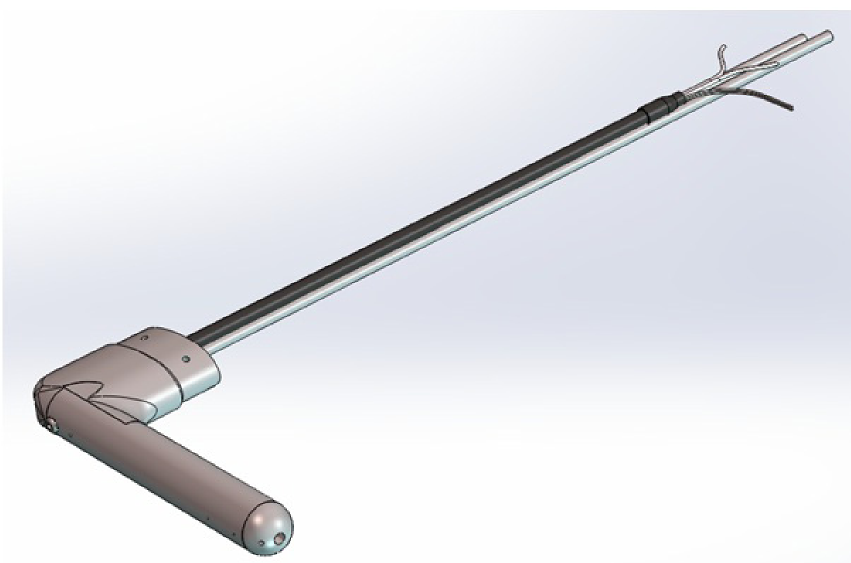

Figure 4-1 GAP 26 Unit View (-10 version shown)

4.2 Equipment Available

Table 4-1 GAP 26 Part Numbers

Model	Assembly Part Number	Unit Only Part Number	Heater Control Box Part Number
GAP 26 Probe Only	010-01074-00	011-02964-00	N/A
GAP 26 Probe Only, Heated	010-01074-10	011-02964-10	N/A

4.3 Required Equipment

- GAP 26 Pitot/AOA Probe (010-01074-00 or 010-01074-10)
- Electrical and pneumatic connectors per installer preference. Length of aluminum pneumatic tubing may be utilized without damage to materials from the probe heater – cutting tubing to a shorter length is not recommended.
- Mount: Standard AN5812 pitot tube mounting kit.
- #6-32 screws (4 pcs), required length (.218” min - .312” max), recommend screws with nylon patch on threads for thread locking.

4.4 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

4.5 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GAP 26. Refer to Section 2.3 for wiring considerations (-10 unit only).

4.5.1 Mounting Location

- The GAP 26 is an under-wing mounted pitot/AOA probe, it is not intended for fuselage mount applications. For proper functionality, the GAP 26 should be mounted in a location where airflow over the probe is relatively undisturbed (typically mid-wing span).
- The tip of the GAP 26 should be located at least 4” from, but not more than 10” below the bottom surface of the wing. The tip should be located 2” to 18” behind the leading edge of the wing.
- Use the designer/manufacturer’s recommended pitot mounting location (if specified).
- The 3/16” diameter aluminum pneumatic tubing is intended to be hand bendable to suit various mounting configurations. Minimum allowable bend radius is 1.5”. It is recommended to bend any given section only once to prevent work hardening and cracking of the aluminum tubing.
- Garmin recommends that the GAP 26 not be used on aircraft where the ship static pressure port is located under the wing (due to the likelihood that the AOA measurement will be significantly impacted). If the static port is located under the wing, it is recommended that the port be moved to an alternate location as part of the GAP 26 installation. If port relocation is required, obtain guidance from the aircraft designer regarding acceptable alternate static port locations.
- Route all GAP 26 power and ground wires away from any audio wires.
- To avoid magnetic interference, do not use the airframe to ground the GAP 26 or any other high-current device. See Section 8.4 for further magnetometer installation considerations.

4.5.2 Heater Wiring Configuration

The GAP 26 uses two internal heaters that may only be powered by 14 Volt systems. Each of the heaters has two wires, one of these two wires is "banded" (Figure 4-2) to help identify individual heaters. These heaters can be connected to a power source as shown in Figure 4-3. Table 4-2 lists the wiring gauge and wiring lengths for the different configurations. For most installations, the use of 14 AWG wire with a 20 Amp circuit breaker is recommended.

CAUTION
Do not connect the heaters to 28 Volts.

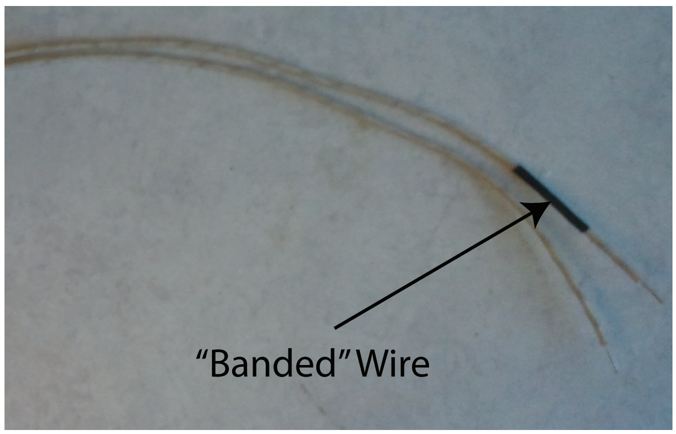

Figure 4-2 GAP 26 Banded Wire

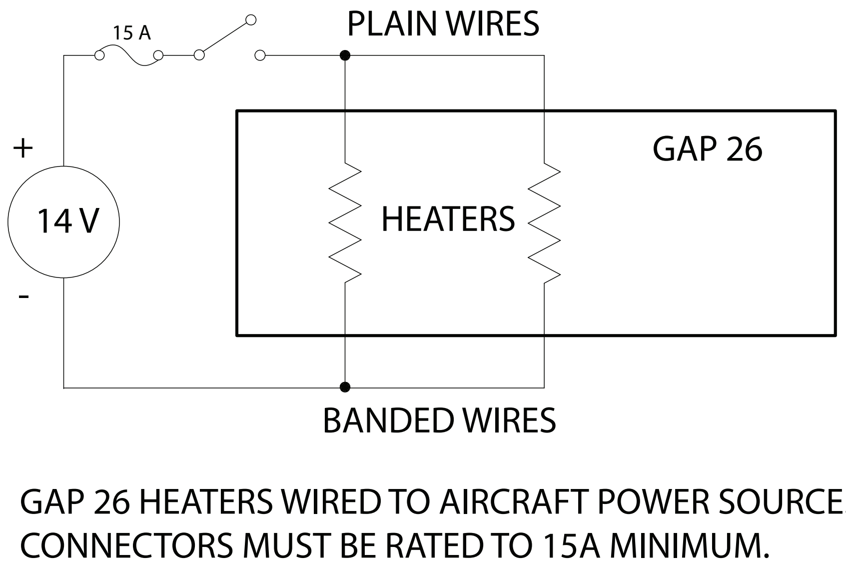

Figure 4-3 GAP 26 Installation Configuration

Table 4-2 GAP 26 Wiring Specifications

Power Source Wiring	
Wire Length	**Wire Gauge**
0 - 12 Feet	14 AWG
13 - 20 Feet	12 AWG
21 - 33 Feet	10 AWG

4.6 Environmental Specifications

- Operating Temperature Range: -55°C to 240°C

4.7 Continued Airworthiness

- Leak Checks in accordance with CFR Part 43, Appendix E, Altimeter System Test and Inspection.
- Visual Inspection of pressure ports and drain holes for debris/blockage once a year.

5 GDU 37X INSTALLATION (CORE G3X LRU)

This section contains general information as well as installation information for the GDU 37X. Use this section to mount the GDU 37X unit(s).

Figure 5-1 GDU 37X Unit View

5.1 Equipment Description

NOTE

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

NOTE

A minimum of one 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. Additional GPS antennas may be used for redundancy, but are not required.

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" hex 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.

5.1.1 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
- Display of flight plan and navigation from an external GPS navigator
- Display of navigation data from an external VOR/ILS NAV radio

5.1.2 Interface Summary

The GDU 37X uses CAN and RS-232 communications interfaces. The GDU 37X can be configured to communicate directly with the following Garmin LRUs:

- GAD 29
- Other GDU 37X
- GDL 39/GDL 39R
- GEA 24
- GNS 400/500 Series Units
- GNS 480
- GSA 28
- GSU 25
- GSU 73
- GTN 600/700 Series Units
- GTX 330 Transponder (TIS-A info only)
- SL30 Nav/Comm Transceiver
- SL40 Comm Transceiver
- GTR/GNC series units

5.2 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

5.3 Installation Information

5.3.1 Required Equipment

Each of the following accessories is provided with the GDU 37X unit (Table 1-8). The connector kit is required to install the unit (Figure 5-2). The GDU 37X Nutplate (Figure 5-2) is available to reinforce the panel cutout in thin panel installations.

The contents of the GDU 37X Connector Kit are listed in Table 5-1. One kit is required for each GDU 37X installed.

Table 5-1 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	330-00625-50	1
Contact, Sckt, D-Sub, Crimp, Size 20	336-00094-00	20

5.3.1.1 GDU 37X PFD Configuration Module

The GDU 37X PFD 1 display 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 other LRUs' configuration and calibration settings except for GSU 73 AHRS calibration settings which are stored in the GSU 73 configuration module. This allows critical data to be retained with the airframe even if the PFD 1 display is replaced.

5.3.2 Additional Equipment Required

A 3/32" hex drive tool is required to secure the GDU 37X to the panel as described in Section 5.5.1 Unit Installation.

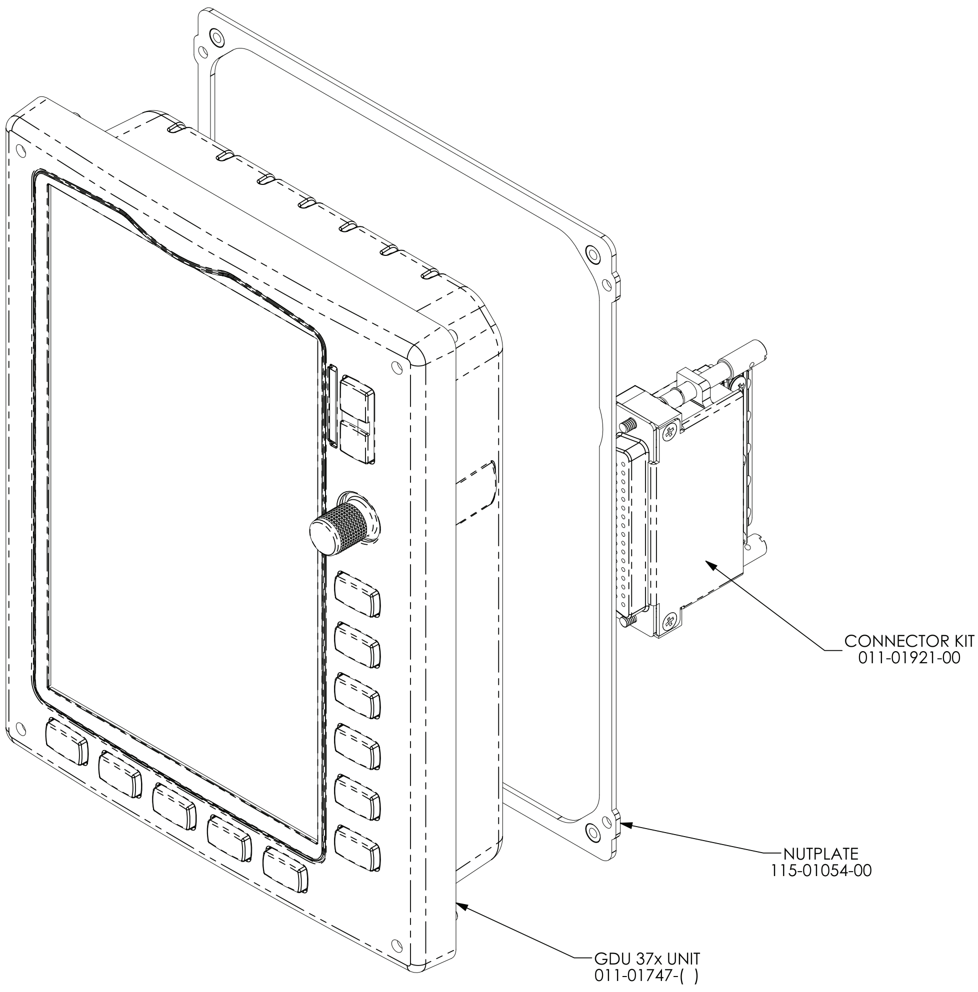

Figure 5-2 GDU 37X Mounting Accessories

5.4 Unit Installation

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 2.3 for wiring considerations, and to Section 15.2 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 Section 16.

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 (Figure 5-3).

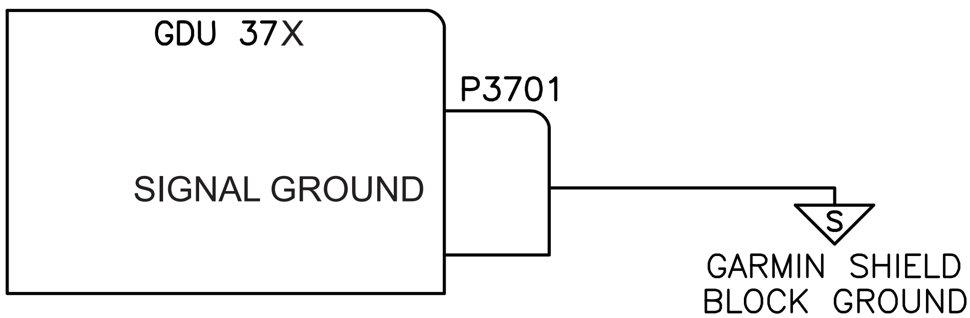

Figure 5-3 Grounded Connector Shell

5.5 Mounting Requirements

Refer to Appendix B for outline and installation drawings.

5.5.1 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 Figure B-4.1.

5.5.2 Panel Cutout Template

Figure 5-4 can be used as a template when marking the panel for cutout. Dimensions on the figure are to verify accuracy of printout only, see Figure B-4.2 for complete cutout dimensions. A .dxf version of the drawing is also available for download at www.garmin.com.

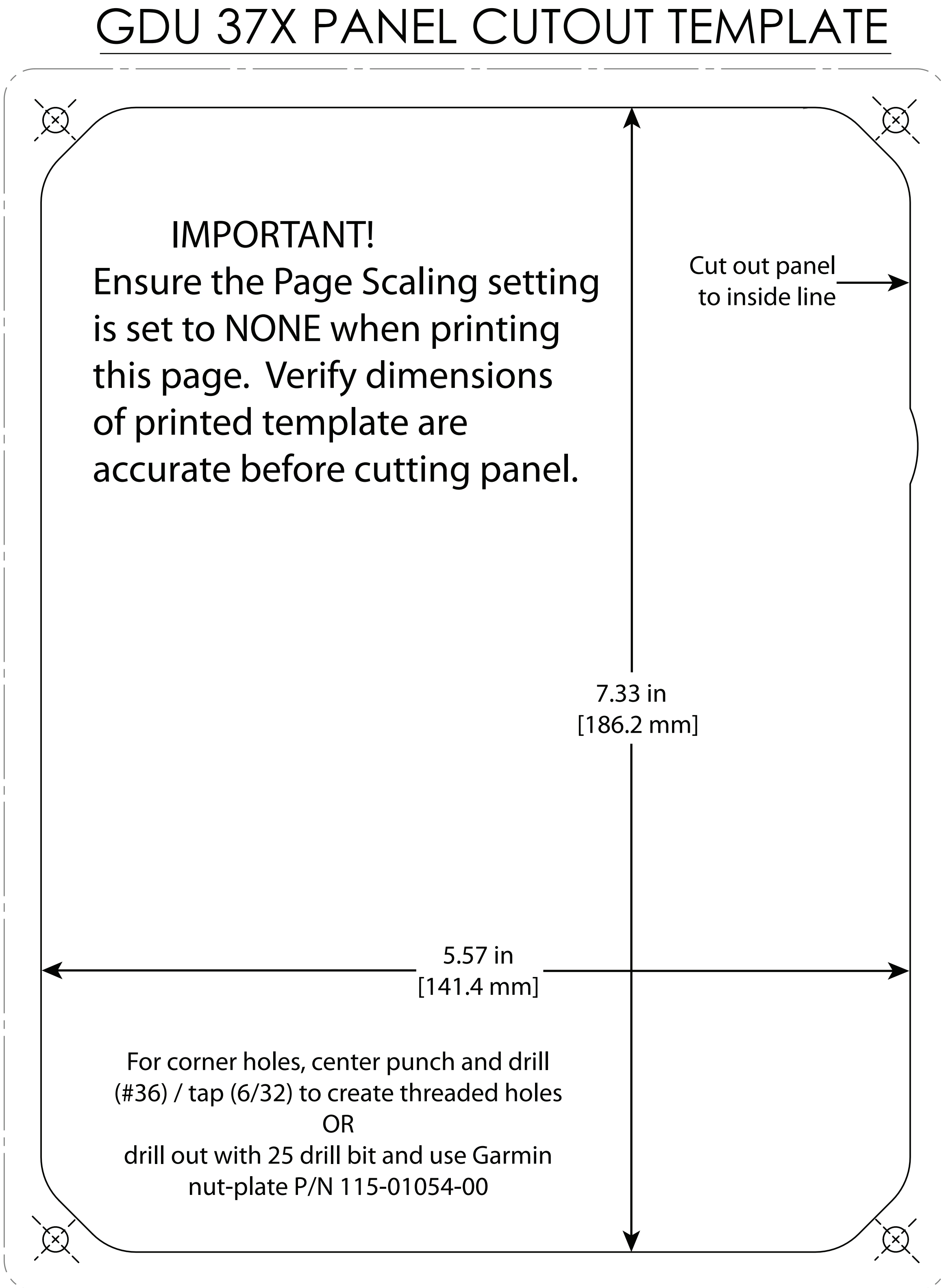

Figure 5-4 GDU 37X Panel Cutout Template

5.6 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 17.3.13 for further information.

Table 5-2 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)

5.7 Environmental Specifications

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

5.8 Antennas

Refer to Section 13 for antenna information

5.9 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.

6 GEA 24 INSTALLATION (OPTIONAL LRU)

This section contains general information as well as installation information for the GEA 24. Use this section to mount the GEA 24 unit.

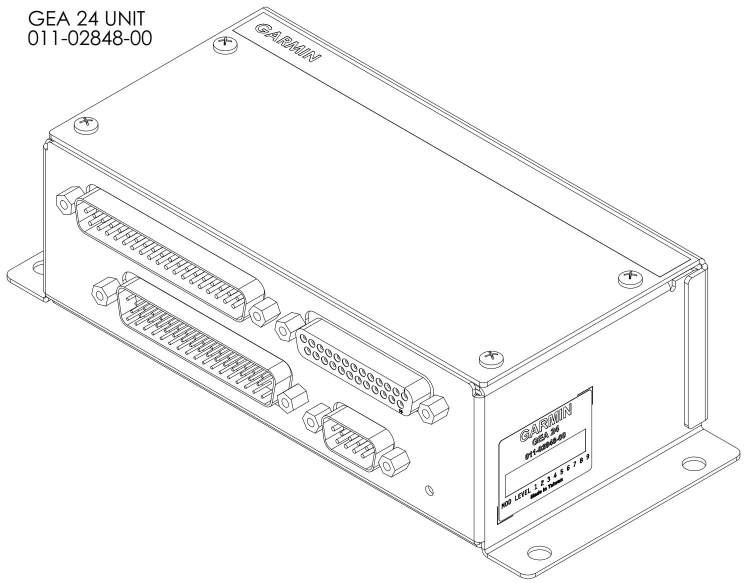

Figure 6-1 GEA 24 Unit View

6.1 Equipment Description

The GEA 24 is an input/output system used to monitor and power engine and airframe sensors for the Experimental – Amateur Built (E-AB) and Light Sport Aircraft (LSA) markets.

- 9 pin network-power connector
- 50 pin miscellaneous connector for airframe sensors
- 25 pin thermocouple input connector
- 37 pin miscellaneous connector (for airframe sensors) will provide for the following input/output functionality:
    - Configure analog, digital, and discrete I/O capability
    - Output digital measurement of analog input resistive sensors
    - Output digital measurement of analog input voltages
    - Output digital state of discrete input sources
    - Output frequency measurement of digital input sources
    - Control of discrete annunciator outputs

NOTE

If a GEA 24 is installed in a system that also includes a GSU 73, the GEA 24 must be configured as EIS #2 as described in Section 15.3.15.

6.1.1 Status LED

The GEA 24 has an LED on its outer case that indicates its current status. The status indications are:

Table 6-1 Status LED Indications

LED Indication	Status
No Light	No Power
Steady Green	On, but not communicating via CAN Bus
Flashing Green	On and communicating via CAN Bus
Red	Hardware Fault
Alternating Red/Green	CAN bus network error two similar devices are configured with the same unit ID

6.2 Equipment Available

6.2.1 Required Equipment

Table 6-2 GEA 24 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GEA 24	010-01042-00	011-02848-00

6.2.2 Additional Equipment Required

Table 6-3 lists the content of the GEA 24 Connector Kit, which is required to install the unit. Use of the CAN Termination Kit is detailed in Section 2.3.1.3.

Table 6-3 Contents of GEA 24 Connector Kit (011-02886-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 9/15 Pin	011-01855-00	1
Backshell w/Hdw, Jackscrew, 25/44 Pin	011-01855-02	1
Backshell w/Hdw, Jackscrew, 37/62 Pin	011-01855-03	1
Backshell w/Hdw, Jackscrew, 50/78 Pin	011-01855-04	1
CAN termination kit	011-02887-00	1
Conn, Plug,D-Sub, Crimp Pin, Commercial, 25 CKT	330-00624-25	1
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 09 CKT	330-00625-09	1
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 37 CKT	330-00625-37	1
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 50 CKT	330-00625-50	1
Contact, Socket, Military Crimp, Size 20	336-00022-02	100
Contact ,Pin, Military Crimp, Size 20	336-00024-00	30

6.3 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

6.4 Unit Installation

1. Mount the unit to a suitable mounting location using (4) #10-32 pan or hex head screws.
2. Assemble the connector backshells and wiring harness.
3. Connect CAN terminator to unit if required (Section 2.3.1.3).
4. Connect backshell connectors.

CAUTION
Do not mount the GEA 24 on the 'hot' side (engine side) of the firewall.

6.5 Mounting Requirements

The GEA 24 will mount remotely. The GEA 24 will be secured to the airframe using four #10-32 pan or hex head screws supplied by the installer.

6.6 Environmental Specifications

Table 6-4 lists general environmental specifications.

Table 6-4 GEA 24 Environmental Specifications

Characteristic	Specification
Unit Operating Temperature Range	-45°C to +70°C

6.7 Continued Airworthiness

The GEA 24 requires no maintenance.

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7 GMC 305 INSTALLATION (OPTIONAL LRU)

This section contains general information as well as installation information for the GMC 305. Use this section to mount the GMC 305 unit.

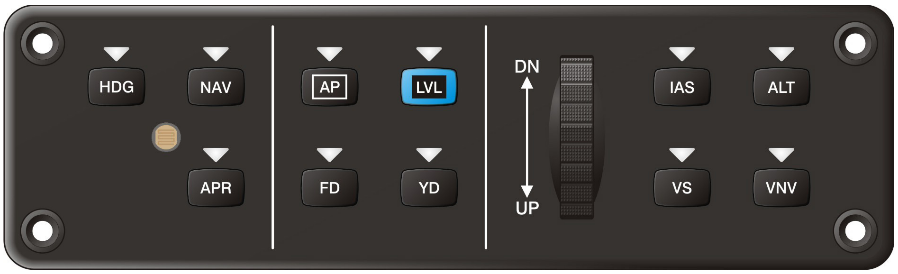


Figure 7-1 GMC 305 Unit View (-20 version shown, -00 version has no YD button)

7.1 Equipment Description

The GMC 305 is a Garmin Automatic Flight Control System (AFCS) Mode Controller that can be used in a G3X installation. The GMC 305 provides user interface for the autopilot function of the G3X system. The GMC 305 mounts flush to the aircraft instrument panel using four threaded cap screws.

7.2 Equipment Available

7.2.1 Required Equipment

Table 7-1 GMC 305 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GMC 305	010-01169-00	011-03226-00
GMC 305 w/Yaw Damper	010-01169-20	011-03226-20

7.2.2 Additional Equipment Required

The following accessories are not provided with the GMC 305 unit. The Installation Kit (Table 7-2) is required to install the unit. The Installation Kit includes the Connector Kit (Table 7-3) and the Mounting Kit (Table 7-4).

Table 7-2 Contents of GMC 305 Installation Kit (010-12034-00)

Item	Garmin P/N	Quantity
Connector Kit, 15 Pin, Hi Density Male w/Jackscrews	011-01824-00	1
Mounting Kit, GMC 305	011-03242-00	1

Table 7-3 Contents of Connector Kit (011-01824-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 9/15 Pin	011-01855-00	1
Connector, Male, High Density D-Sub,15 CKT	330-00366-15	1
Contact, Pin, Military Crimp, Size 22D	336-00021-00	12

Table 7-4 Contents of Mounting Kit (011-03242-00)

Item	Garmin P/N	Quantity
Nut, Self-Locking, Plate, One Lug, 6-32	210-00104-04	4
Screw, Machine, Panel Mounting, 0.550", Black	211-00169-01	4

7.3 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

7.4 Mounting and Wiring Requirements

7.4.1 Fasteners

The GMC 305 is installed using the four #6-32 threaded cap screws supplied in the GMC 305 installation kit using a 3/32" hex wrench. The instrument panel may be drilled and tapped for the #6-32 screws, or the four anchor nuts supplied in the installation kit may be installed using flush-mount rivets.

7.4.2 Panel Cutout Template

Figure 7-2 can be used as a template when marking the panel for cutout. Dimensions on the figure are to verify accuracy of printout only, see Figure B-6.3 for complete cutout dimensions.

7.4.3 Unit Installation

1. Drill holes in panel to locate nut plates and LRU (see Figure 7-2, Figure B-6.2, and Figure B-6.3).
2. Install nut plates using flush-mount rivets.
3. Hold the unit flush with the instrument panel.
4. Install the four mounting screws (Installation Kit 010-12034-00) through the four mounting holes in the GMC 305.
5. Use a 3/32" hex drive tool to turn each of the four mounting screws clockwise until tight (10 in-lbs).

7.4.4 Wiring

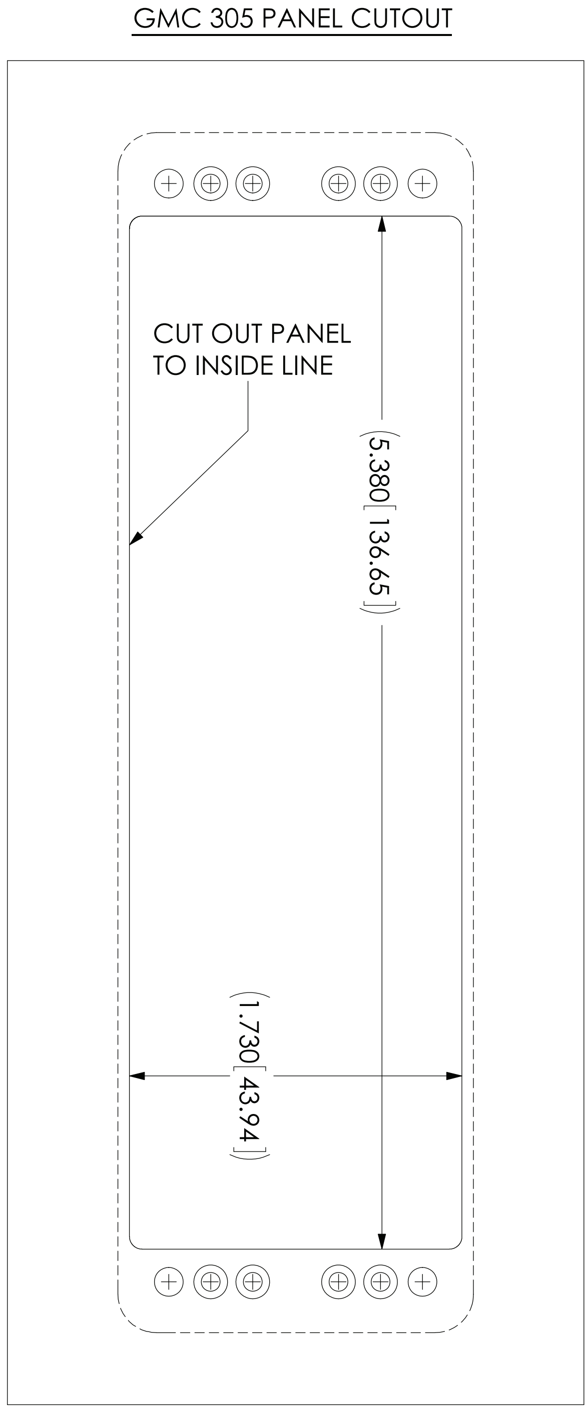
The 15 pin connector, pins, and backshell supplied in the GMC 305 installation kit are used to add wiring for the GMC 305.

It is recommended that a 2 Amp fuse or circuit breaker be used to supply power to the GMC 305 (Figure C-1.5). Backup power is optional.

The GMC 305 is connected via RS-232 to any GDU 37X display (Figure C-1.5). The selected GDU RS-232 channel must be configured for "Garmin Instrument Data".

If the installation includes a Garmin integrated autopilot using GSA 28 servos, the GMC 305 installation also includes an RS-232 connection to the GSA 28 roll servo (Figure C-1.5). GMC 305 RS-232 channel 1 must be connected to any one of the 3 available RS-232 channels on one of the GDU 37X units. The GMC 305 RS-232 channel 2 must be connected to the GSA 28 roll servo RS-232 channel 1 if this roll servo is installed.

For installations using a non-Garmin autopilot with a GMC 305 controller, refer to Figure C-2.12.



IMPORTANT!
Ensure the Page Scaling setting is set to NONE when printing this page. Verify dimensions of printed template are accurate before cutting panel.

NOTES:
1. DIMENSIONS: INCHES[mm]. METRIC VALUES ARE FOR REFERENCE ONLY.
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.

Figure 7-2 GMC 305 Panel Cutout Template

7.5 Environmental Specifications

Table 7-5 GMC 305 Environmental Specification

Characteristics	Specifications
Operating Temperature Range	-45°C to +70°C
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 55,000 ft

7.6 Continued Airworthiness

Maintenance of the GMC 305 is "on condition" only. For regulatory periodic functional checks, refer to approved aircraft maintenance manuals or manual supplements for actual aircraft maintenance requirements.

8 GMU 22 INSTALLATION (CORE G3X LRU)

NOTE

All GMU 22 information in this Installation Manual also applies to the GMU 44, which had previously been the G3X magnetometer but has been replaced by the GMU 22.

This section contains general information as well as installation information for the GMU 22. Use this section to mount the GMU 22 unit. Installers may also benenfit from studying Appendix A, which provides guidance for installing the GMU 22 into specific experimental airframes.

Figure 8-1 GMU 22 Unit View

8.1 Equipment Description

The Garmin GMU 22 Magnetometer is a remote mounted device that interfaces with a Garmin ADAHRS (GSU 25/73) 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 22 Magnetometer uses magnetic field measurements to create an electronically stabilized AHRS.

The GMU 22 magnetometer provides magnetic information to support the function of the ADAHRS (GSU 25/73). The ADAHRS (GSU 25/73) provides operating voltage to the GMU 22 Magnetometer.

8.1.1 Interface Summary

The following is an interface summary for the GMU 22:

- GMU 22 to ADAHRS (GSU 25/73) Interface: Power, RS-232, RS-485 (19,200 baud)

8.2 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

8.3 Equipment Available

Table 8-1 GMU 22 Part Numbers

Model	Assembly Part Number	Unit Only Part Number	Installation Rack
GMU 22	010-01196-00	011-03269-00	No

Table 8-2 GMU 22 Accessories

Item	Garmin P/N	Quantity
GMU 22, Connector Kit	011-00871-10	1
GMU 22 Universal Mount*	011-01779-01	1 (optional)
Installation Rack, GMU 22	115-00481-10	1

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

Table 8-3 Contents of GMU 22 Connector Kit (011-00871-10)

Item	Garmin P/N	Quantity
Modified Install Rack	115-00481-10	1
Screw, 6-32x .250, Pan Head Phillips, Brass, w/Nylon	211-60037-08	3
Circular Connector, Female, 9 Ckt	330-00360-00	1
Circular non-Magnetic Backshell	330-90005-01	1
Socket Contact Mil Crp, Size 20	336-00022-00	10

8.4 Unit Installation

The following guidelines describe proper mechanical installation of the Garmin GMU 22 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 22. Refer to Section 2.3 for wiring considerations and to Section 15 for pinouts.

The GMU 22 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 22, observe the following distances from objects or devices that can disturb the magnetic field. Table 8-4 specifies required distances from magnetic disturbances for GMU 22 location.

NOTE

If the requirements listed in Table 8-4 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).

Table 8-4 Required Distance from Magnetic Disturbances

Disturbance Source	Minimum Distance from GMU 22
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 22 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 22, 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 22 magnetometer is preferred (unless as noted in Appendix A). Fuselage mounting is less desirable because of numerous potential disturbances that interfere with accurate operation.

Mechanical mounting fixtures for the GMU 22 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 22 mounting rack to within 3.0° of the in-flight level cruise attitude.

Align the GMU 22 mounting rack's forward direction to within 0.5° of the longitudinal axis of the aircraft.

In a system with more than one ADAHRS (GSU 25/73), ADAHRS 1 must be connected to a GMU22, but installing additional GMU 22 units for other GSU 25 ADAHRS units is optional. An ADAHRS without a GMU 22connected will use magnetometer data supplied by other ADAHRS as long as they are both communicating via CAN.

8.4.1 Consideration for Wing Grounded Lighting Fixtures

The following installation practices are recommended if the required GMU 22 mounting bracket is located in the wing.

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.

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 22.

These installation practices will prevent magnetically interfering currents from flowing in the wing skin that encloses the GMU 22. 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 Figure B-7.1 for outline and installation drawings.

8.4.2 ADAHRS (GSU 25/73) to GMU 22 Interconnect Harness Fabrication Instructions

Table 8-5 lists parts needed for the GMU 22 interconnect harness. Some of the parts for installation are included in the GMU 22 Connector Installation Kit. Other parts are provided by the installer. Reference numbers refer to item bubble numbers shown in Figure B-7.4.

Table 8-5 Parts Needed for GMU 22 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 22 Connector Kit*	1	011-00871-00
5	3-Conductor Cable	0	M27500-22TE3T14
6	2-Conductor Cable	0	M27500-22TE2T14

*Included in G3X w/GSU 73 Installation Kit (K10-00017-00)

Table 8-6 lists material in the GMU 22 connector kit and the associated reference number, as shown in Figure B-7.4. The GMU 22 magnetometer has an attached pigtail with male polarity. The harness connector for the GMU 22 has female polarity.

Table 8-6 GMU 22 Connector Kit (011-00871-00) Contents, Reference Figure B-7.4**

Item	Garmin P/N	Quantity	Figure B-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 w/GSU 73 Installation Kit (K10-00017-00)

8.4.3 Mounting Instructions

After evaluation of the mounting location has been completed and ensuring that requirements are met, assemble the GMU 22 mounting plate kits according to the dimensions given in Figure B-7.1. Install the unit assemblies.

Mount the GMU 22 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 22. Do **not** use a screwdriver that contains a magnet when installing or servicing the GMU 22.

The metal components in the GMU 22 connector may slightly affect the magnetic field sensed by the GMU 22. Place the connector at least 2 inches from the body of the GMU 22 to minimize this effect. After attaching the GMU 22'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 D: Magnetometer Calibration (Section 19.3.4).

See Figure 8-2 for minimum recommended clearance for bend radius of the GMU 22 cable.

NOTE

If the GMU 22 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 part number 211-60037-08. If original screws must be re-used, coat screw threads with Loctite 242 (blue) thread-locking compound, Garmin part number 291-00023-02, or equivalent. Important: Mounting screws must be brass.

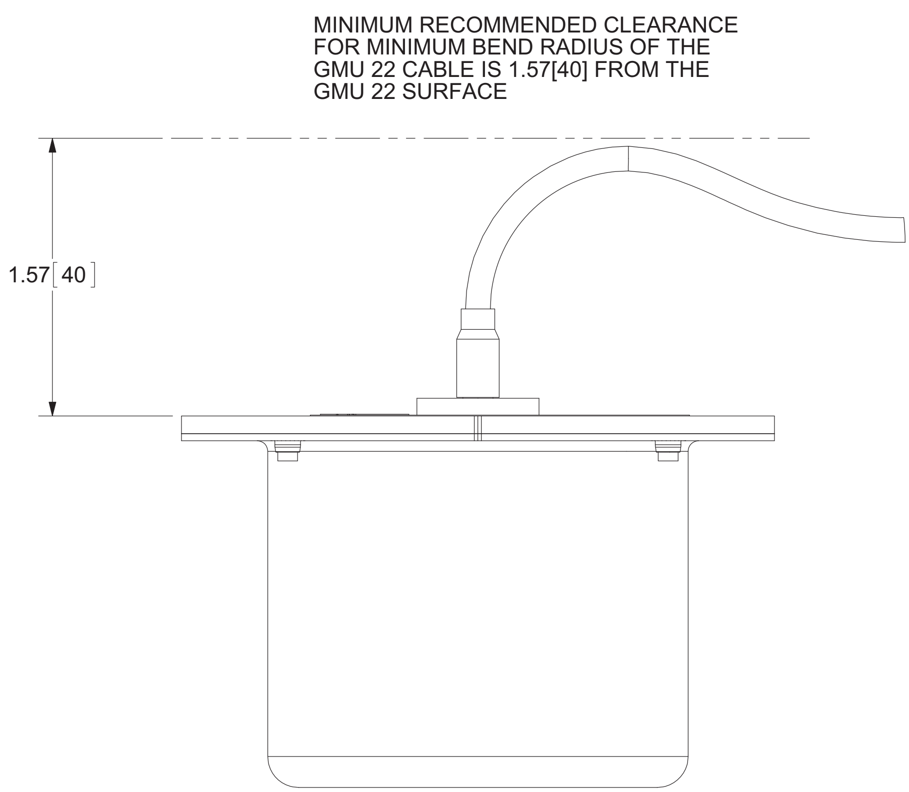


Figure 8-2 GMU 22 Minimum Recommended Clearance

8.5 Environmental Specifications

Table 8-7 lists general environmental specifications.

Table 8-7 GMU 22 Environmental Specifications

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

Maintenance of the GMU 22 is 'on condition' only. Periodic maintenance of the GMU 22 is not required.

9 GSA 28 INSTALLATION/CONFIGURATION (OPTIONAL LRU)

This section contains general information as well as installation information for the GSA 28 Servo Actuator. Use this section to mount the GSA 28 unit.

9.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GSA 28.

The GSA 28 servo is an autopilot servo intended for use in non FAA certified aircraft, including light sport and home-built aircraft. The servo is intended to be used as part of the G3X system.

The function of the GSA 28 is to drive a flight-control axis (pitch, roll) of the aircraft. The servo can also be installed in the rudder control system to provide yaw damping. Trim servo drive support is available for any axis. All configurations can be used with or without auto-trim in each axis.

- Roll autopilot only
- Pitch/roll autopilot
- Pitch/roll autopilot with yaw damper

The GSA 28 servo features an advanced brushless DC motor and gearbox, with an engagement clutch to allow for very low-friction operation of the aircraft flight controls with clutch disengaged. The GSA 28 performs continuous internal monitoring and fault detection, and can also safely be back-driven by the pilot in the event of an engagement clutch fault condition. An advanced electronic slip clutch provides the ability for the pilot to overpower the servo at a configurable torque threshold without requiring use of a consumable shear pin or additional moving parts.

NOTE

The GSA 28 engagement clutch is actuated by an internal solenoid. An audible clicking sound when the servo is engaged or disengaged is normal and expected.

Under normal conditions, the GSA 28 servo operates based on flight director commands from the G3X display units (GDU 370/375). When used with the optional GMC 305 mode controller, the GSA 28 maintains a reversionary capability to engage and fly the aircraft in basic wings-level and altitude-hold modes even if all GDU displays in the aircraft are unavailable.

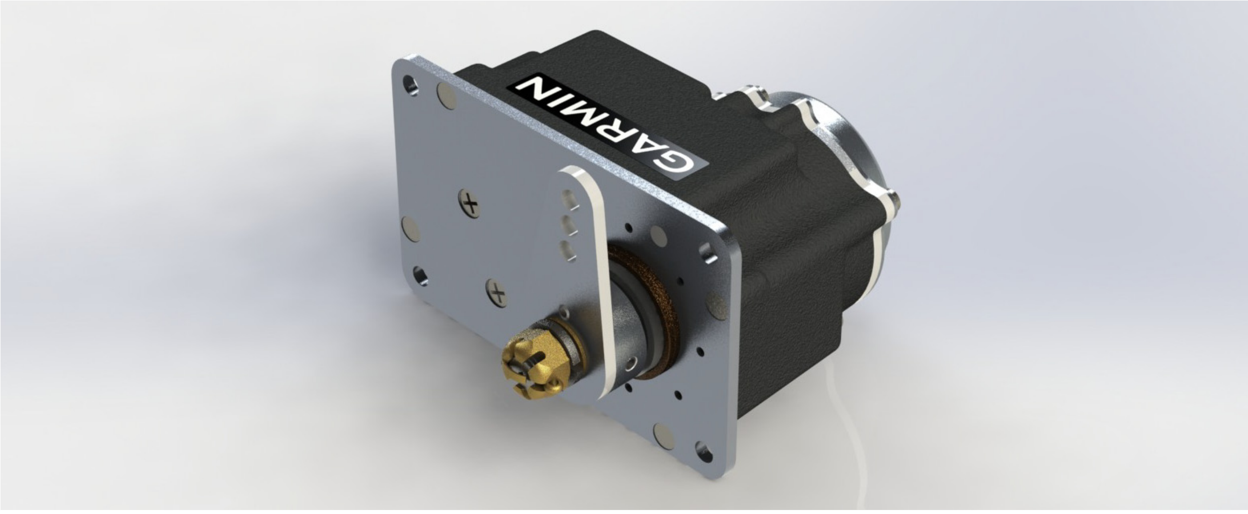


Figure 9-1 GSA 28 Unit View

9.1.1 Status LED

The GSA 28 has an LED on its outer case that indicates its current status. The status indications are:

Table 9-1 Status LED Indications

LED Indication	Status
No Light	No Power
Steady Green	On, but not communicating via CAN Bus
Flashing Green	On and communicating via CAN Bus
Red	Hardware Fault
Alternating Red/Green	CAN bus network error two similar devices are configured with the same unit ID

9.2 Equipment Available

Table 9-2 GSA 28 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GSA 28 Servo Actuator, Unit Only	010-01068-00	011-02927-00

9.3 General Specifications

Table 9-3 General Specifications

Characteristic	Specification
Height	4.0 inches (10.16 cm)
Width	2.5 inches (6.35 cm)
Depth	2.8* inches (7.11 cm)
Weight	1.40** lbs, (0.635 kg)

*Harness connector not included
**Accessories not included

9.3.1 Power Specifications

The trim outputs are capable of sourcing a maximum of 1 Amp of current to drive a brushed DC motor. The trim outputs drive a maximum output voltage of 12 Vdc.

The GSA is compatible with 14 Vdc trim systems only. Do not connect the GSA 28 to a 28 Vdc trim system.

Table 9-4 GSA 28 Power Specifications

Supply Voltage	Current Draw
14 Vdc without Auto-trim	0.36 Amp (typical), 1.80 Amp (max)
28 Vdc without Auto-trim	0.20 Amp (typical), 1.00 Amp (max)
14 Vdc with Auto-trim	0.36 Amp (typical), 2.80 Amp (max)

9.3.2 Torque Specifications

Table 9-5 GSA 28 Torque Specifications

Characteristic	Specification
Maximum Rated Torque	60 in-lbs

9.4 Required Equipment

Table 9-6 lists the kits available for the GSA 28.

Table 9-6 GSA 28 Available Equipment

Item	Garmin P/N
GSA 28 Connector Kit	011-02950-00
GSA 28 Stop Bracket Kit	011-02951-00
GSA 28 Mounting Kit, Generic, Push-Pull	011-02952-00
GSA 28 Mounting Kit, Generic, W/Bracket	011-02952-01
GSA 28 Mounting Kit, Generic, Capstan	011-02952-02
GSA 28 Mounting Kit, RV-6 Roll	011-02952-10
GSA 28 Mounting Kit, RV-4/8 Pitch	011-02952-11
GSA 28 Mounting Kit, RV-7/8/10 Roll	011-02952-12
GSA 28 Mounting Kit, RV-9 Roll	011-02952-13
GSA 28 Mounting Kit, RV-6/7/9 Pitch	011-02952-14
GSA 28 Mounting Kit, RV-10 Pitch	011-02952-15
GSA 28 Removal Adapter	011-03158-00

Table 9-7 Contents of Connector Kit (011-02950-00)

Item	Garmin P/N	Quantity
Sub-Assy, Bkshl w/Hdw, Jackscrew, 15/26 Pin	011-01855-01	1
Connector, Rcpt, D-SUB, Crimp Socket,Commercial,15 Ckt	330-00625-15	1
Cont,Sckt,Mil Crp,Size 20,20-24 AWG,RoHS	336-00022-02	16

9.4.1 Additional Equipment Required

- Cables: The installer will fabricate and supply all system cables.
- Mounting hardware is included in the available mounting kits.

9.5 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices should be used for installation of the GSA 28. Refer to Section 2.3 for wiring considerations, and to Section 15 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 install the Jackscrew Backshell, Configuration Module, and Thermocouple are located in Section 16.

9.5.1 Pinouts

See Section 15.6 for pinout information.

9.5.2 Mounting Requirements

WARNING

It is vital to ensure the autopilot servo and aircraft control linkage is free to move throughout its entire range of travel without binding or interference. Failure to ensure adequate clearance between the moving parts of the control system linkage and nearby structure could result in serious injury or death. If any control system binding or interference is detected during installation or preflight inspection, it must be corrected before flight.

9.5.2.1 Optional attachments

The GSA 28 is supplied from the factory with a standard crank arm attachment (Figure 9-2, Figure 9-6.1, Figure 9-6.2, and Figure 9-6.3). Also available are a long crank arm supplied in the 011-02952-10 RV-6 roll kit and a capstan attachment available in the 011-02952-02 Capstan Kit. If one of these optional attachments will be used, it is up to the installer to remove the standard crank arm and replace it with the optional attachment. When removing the standard arm, keep the castle nut, lock washer, and flat washer as these items will need to be re-used with the optional attachment. Discard cotter pin that was removed from the GSA 28 and replace with pin provided with optional attachment. Refer to Figure 9-6.3 and Figure 9-6.4 for more details and instructions for tightening the castle nut.

WARNING

Cotter pins supplied with GSA 28 are only intended for one time use. If removed from GSA 28 discard and use new cotter pin.

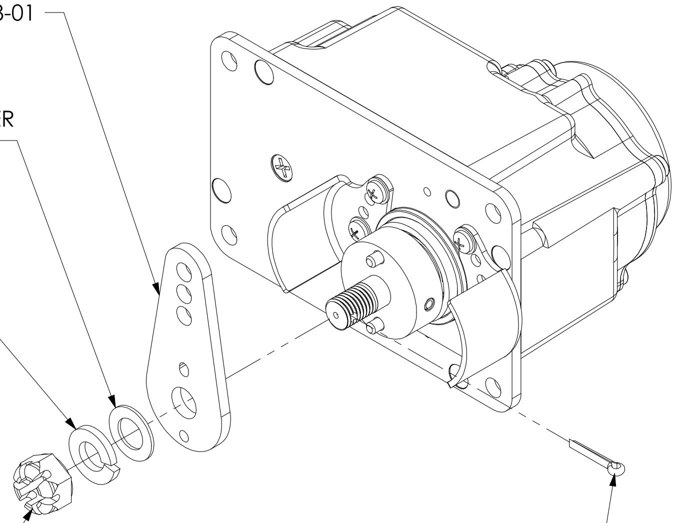


Figure 9-2 Crank Arm Assembly

9.5.2.2 Stop Bracket Kit

Every GSA 28 is supplied with a 011-02951-00 stop bracket kit. The intention of this stop bracket is to create redundant stops for the servo control arm that prevents the servo's arm from going over-center relative to the push rod connected to the servo's arm. It is highly recommended this part gets installed with every push-pull application. The stops created by installing this bracket are redundant in the sense that the aircraft's built-in stops should always be used as the primary means of limiting travel of the servo's control arm. This stop bracket limits the motion of the standard control arm to 100° total travel. This bracket should be positioned such that the stop bracket flanges are as close as practical to being equal distance from the servo's control arm while at the center of travel. Also, to prevent an over-center condition, the servo's push rod should be as close as practical to perpendicular with the servo's control arm while positioned at the center of travel. The position of this bracket can be adjusted in increments of 15°. If necessary, further adjustments can be made by changing the length of the push rod connected to the servo. See Figure 9-6.2, and Figure 9-6.3 for more details.

After installation of the servo is complete, verify that the stop bracket does NOT impede the full movement of the associated control.

WARNING

An over-center position of the servo control arm relative to the attached push rod can cause the flight controls to jam. This could result in serious injury or death. Please be sure this is well understood prior to flying with the GSA 28 servo.

The 011-02951-00 stop bracket kit is supplied with four #4-40 screws used to attach the bracket to the front face of the servo. The screws provided are 0.25” long. This length of screw is appropriate if there is no bracket or spacers in-between the stop bracket and servo. If a mounting bracket or spacers of thickness .040” or greater will be place in-between the stop bracket and servo, longer screws should be used to mount the stop bracket. It is recommended the thread engagement into the GSA 28, as measured from the front face of the servo shall be 0.112” – 0.25”. If screws other than what is provided will be used, be sure to use thread locking compound or a proper thread locking patch combined with the lock washers provided. Also be sure to follow the recommended tightening torque specified in Figure 9-6.2.

CAUTION

If screws are being used to mount the stop bracket to the front face of the GSA 28 are different than the screws provided with the stop bracket kit, care must be taken to ensure these screws are not long enough to contact moving parts inside the GSA 28. Maximum screw insertion, as measured from the front of the GSA 28, must be less than 0.25” to avoid contact with parts inside the GSA 28.

CAUTION

To avoid the possibility of contaminating the internal rotating mechanisms of the GSA 28, do not apply thread locking compound directly to the stop bracket attachment holes in the front face of the servo. Instead, apply a small amount of thread locking compound to the threads of the stop bracket screws before the screws are inserted. Thread locking compound is not required upon initial installation of the included stop bracket screws, which are supplied with thread locking compound already applied.

9.5.2.3 Trim Motor Interface

The GSA 28 provides an optional interface between the pilot's electric trim switch and a 14 Vdc trim motor. When the GSA 28 servo is engaged (i.e. autopilot on), it automatically drives the connected trim motor as required to relieve control forces for the associated pitch, roll, or yaw axis. When the GSA 28 servo is not engaged (i.e. autopilot off), it provides manual electric trim (MET) functionality by running the trim motor in response to pilot input. The GSA 28 can be configured to automatically reduce the speed of the trim motor at higher airspeeds, in order to provide finer control of trim tab position. In the event that power to the GSA 28 is removed, a fail-safe system connects the trim input switch directly to the trim motor. In this condition, the trim switch powers the trim motor directly and the motor runs at its full speed when the switch is pressed. The same condition also occurs if a trim switch and motor are connected to the GSA 28, but the trim control function is disabled.

NOTE

The GSA 28 supports a single trim switch input only. For use with multiple trim switches (e.g. pilot and co-pilot), a third-party trim interface unit or relay board is required. See Figure C-1.6 for additional details.

9.5.2.4 CWS/DISCONNECT

The CWS/DISCONNECT button is used to disengage the autopilot system. It can also optionally be used for autopilot engagement and control wheel steering (see section 9.14.1). The CWS/DISCONNECT input to all servos should be tied together and connected to a normally open momentary push button that connects to ground when pressed (see Figure C-1.5).

NOTE

The CWS/DISCONNECT button must be mounted where it is easily accessible to the pilot during all phases of flight. The pilot must have ability to quickly disconnect the autopilot under all circumstances.

9.5.2.5 GSA 28 Removal Adapter

The GSA 28 connector kit is shipped with a GSA 28 removal adapter (011-03158-00). This part is not intended to be installed with the GSA 28, but is used to replace the GSA 28 when the harness connector is un-plugged. The removal adapter contains an internal 120 Ohm resistor between pins 2 and 3 for CAN termination. It also contains shorts between pins 11 & 13 and 12 & 14 to pass through power for trim motors. The intention of this component is to allow operation of the CAN bus and trim motors when the servos are not plugged into the harness. It is recommended that a removal adapter is kept with each servo installation, in case the GSA 28 needs to be removed without losing functionality of the CAN bus and trim motors.

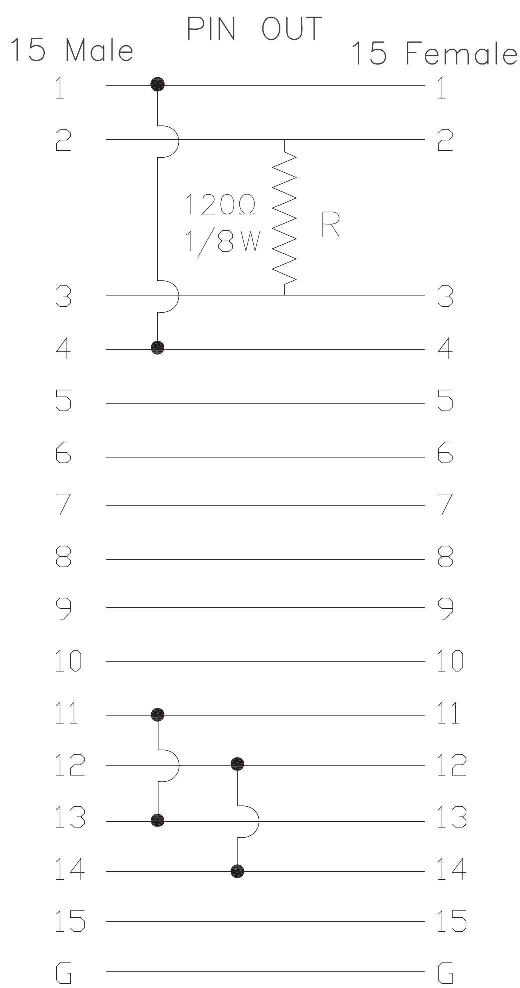


Figure 9-3 Wiring Diagram For GSA 28 Removal Adapter

9.5.2.6 GSA 28 Mounting Kits

Garmin currently provides the mounting kits listed in Table 9-8 for the GSA 28 Servo:

Table 9-8 Mounting Kits

Garmin P/N	Description	Mounting Bracket Included	Install Manual Figures
011-02952-00	Sub-Assy, GSA 28 Mounting Kit, Generic, Push-Pull	No	9-6.7
011-02952-01	Sub-Assy, GSA 28 Mounting Kit, Generic, W/Bracket	Yes	9-6.8
011-02952-02	Sub-Assy, GSA 28 Mounting Kit, Generic, Capstan	No	9-6.4
011-02952-10	Sub-Assy, GSA 28 Mounting Kit, RV-6 Roll	Yes	9-7.1, 9-7.2, 9-7.3
011-02952-11	Sub-Assy, GSA 28 Mounting Kit, RV-4/8 Pitch	Yes	9-8.1, 9-8.2, 9-8.3, 9-8.4
011-02952-12	Sub-Assy, GSA 28 Mounting Kit, RV-7/8/10 Roll	Yes	9-9.1, 9-9.2
011-02952-13	Sub-Assy, GSA 28 Mounting Kit, RV-9 Roll	Yes	9-10.1, 9-10.2
011-02952-14	Sub-Assy, GSA 28 Mounting Kit, RV-6/7/9 Pitch	Yes	9-11.1, 9-11.2
011-02952-15	Sub-Assy, GSA 28 Mounting Kit, RV-10 Pitch	Yes	9-12.1, 9-12.2

The “generic” kits listed in Table 9-8 (011-02952-00, -01, & -02) are not specific to any airframe. The airframe specific kits (GPN 011-02952-10 through -15) are for use with the specified experimental aircraft. The contents of each kit as well as specific instructions for their use are detailed in the figures listed in Table 9-8.

9.5.2.7 Generic Push/Pull Kits

The 011-02952-00 and -01 kits are generic kits for push/pull applications. This kit is supplied with a 3/8" diameter x 8" long solid rod (Figure 9-4). This rod is intended to be used as the attachment link between the GSA 28 and the flight control system. It is the installer's responsibility to cut this rod to the correct length and tap the ends for the male rod end bearings. It is recommended these push rods are tapped to a depth of at least 0.61" to accommodate the entire thread of the rod end bearing (minus the jam nut). The length of the push rod is adjustable by changing the thread engagement between the male rod end bearings and push rod. The acceptable range of thread engagement is 0.492" +/-0.117". It is highly recommended the AN315-3R jam nuts are used and properly tightened. A push rod without a tightened jam nut will create backlash that can diminish autopilot performance.

WARNING

Thread engagement between the male rod end bearings supplied with GSA 28 mounting kits and push rod must not be less than 0.375". This minimum engagement length is recommended to prevent push rod from coming apart.

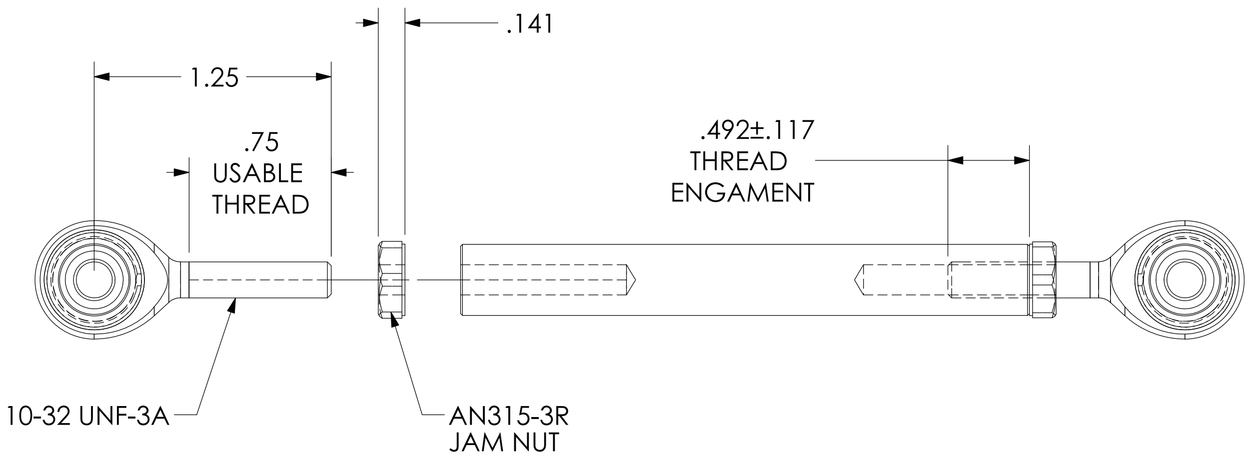


Figure 9-4 General Dimensions For Servo Push Rod And Rod End Bearings

9.5.2.8 Capstan Kit

The 011-02952-02 is the capstan kit. This kit contains a capstan, a cable guard, and fasteners used to attach these items. The capstan was designed to accept a MS20663C2 double shank ball with a 1/16" diameter cable. This kit does not currently include a bridle cable or cable clamps necessary to link the capstan to the flight control cables. Contact Garmin if these items are needed for your application.

The 011-02952-02 capstan kit is provided with four #4-40 screws and lock washers for attaching the cable guard. The screws provided are 0.25" long. This length of screw is appropriate if there is no bracket or spacers in-between the cable guard and servo. If a mounting bracket or spacers of thickness .056" or greater will be place in-between the stop bracket and servo, longer screws should be used to attach the cable guard. It is recommended the thread engagement into the GSA 28, as measured from the front face of the servo shall be 0.112" – 0.25". If screws other than what is provided will be used, be sure to use thread locking compound or a proper thread locking patch combined with the lock washers provided. Also be sure to follow the recommended tightening torque specified in Figure 9-6.4.

CAUTION

If screws are being used to mount the cable guard to the front face of the GSA 28 are different than the screws provided with the stop bracket kit, care must be taken to ensure these screws are not long enough to contact moving parts inside the GSA 28. Maximum screw insertion, as measured from the front of the GSA 28, must be less than 0.25" to avoid contact with parts inside the GSA 28.

9.5.2.9 Aircraft Specific Mounting Kits

GSA 28 mounting kits are available for several experimental airframes. These mounting kits are listed in Table 9-8. All of these kits contain sheet metal mounting brackets and push rods that have been designed for the specific application. The push rods are supplied cut to the appropriate length and tapped for the male rod end bearings provided. Overall push rod length as well as rod end bearing thread engagement length is provided on the drawings for each kit. The lengths specified are considered nominal. This length should be adjusted to fit the specific application. Ideal push rod length results in the push rod being perpendicular to the servo arm when it is at the center of travel.

It is recommended the stop bracket is installed with all push/pull applications. The drawings for each of these mounting kits shows the recommended orientation of this bracket. It is acceptable to deviate from these drawings if a better orientation has been determined by the installer. The best orientation results in the stop bracket flanges being equal distance from the servo arm when at the center of travel. See Section 9.5.2.2 on stop bracket kit for more details on mounting the stop bracket.

9.5.2.10 GSA 28 Installation Into a Non-Garmin Bracket

For installers who intend to fabricate their own brackets or use an existing bracket designed for a non-Garmin servo, consider the following:

The geometry of the GSA 28 varies from other popular servo models.

While the GSA 28 has the same 2.5” x 4.0” footprint, the same mounting hole locations, and uses the same mounting bolts as several other popular brands of autopilot servo, it does not fit into all mounting brackets designed for other servos. Some of the key differences to consider are:

- The GSA 28 servo has a larger bushing protrusion on the front plane of the servo.
- The harness connector is larger and in a different location relative to the output shaft.
- The GSA 28 does not contain tapped holes for mounting, instead it uses through holes and a thinner mounting flange.

Brackets fabricated for other manufacturer’s servos may or may not have enough clearance for the large bushing protrusion. Modification to the bracket may be necessary to avoid interference with bushing protrusion. See Figure 9-5 for details.

CAUTION

Damage may occur to the GSA 28 if the mounting bracket overlaps the bushing protrusion when tightening down the mounting bolts. The damage can occur when the bushing is displaced into the unit. To prevent damage, ensure there is clearance for the bushing protrusion and be sure the GSA 28 mounting plate is flush with the bracket when the mounting bolts are being tightened.

For RV-7/8/9/10 roll installations, the rear support bracket used with other popular servos is not compatible with the GSA 28. This is because of the difference in thickness of the GSA 28 mounting flange relative the other servos.

Refer to Figure 9-6.1 for GSA 28 outline dimensions. See Figure 9-6.5 for recommended bracket cutout dimensions.

NOTE

Garmin cannot validate the structural integrity of non-Garmin brackets.

Mounting brackets provided in the Garmin GSA 28 mounting kits have been designed to withstand (and have been tested to) repetitive stress cycles endured during loads generated by the GSA 28 and aircraft vibrations. If using a non-Garmin mounting bracket, it is the installer’s responsibility to ensure the bracket is structurally adequate for the application. It is important to consider the detrimental effects of bracket displacement and potential for fatigue failures due to reaction forces created by the GSA 28 loading and aircraft vibration.

WARNING

If using a non-Garmin mounting bracket, it is the installer’s responsibility to ensure the bracket is structurally adequate for the application.

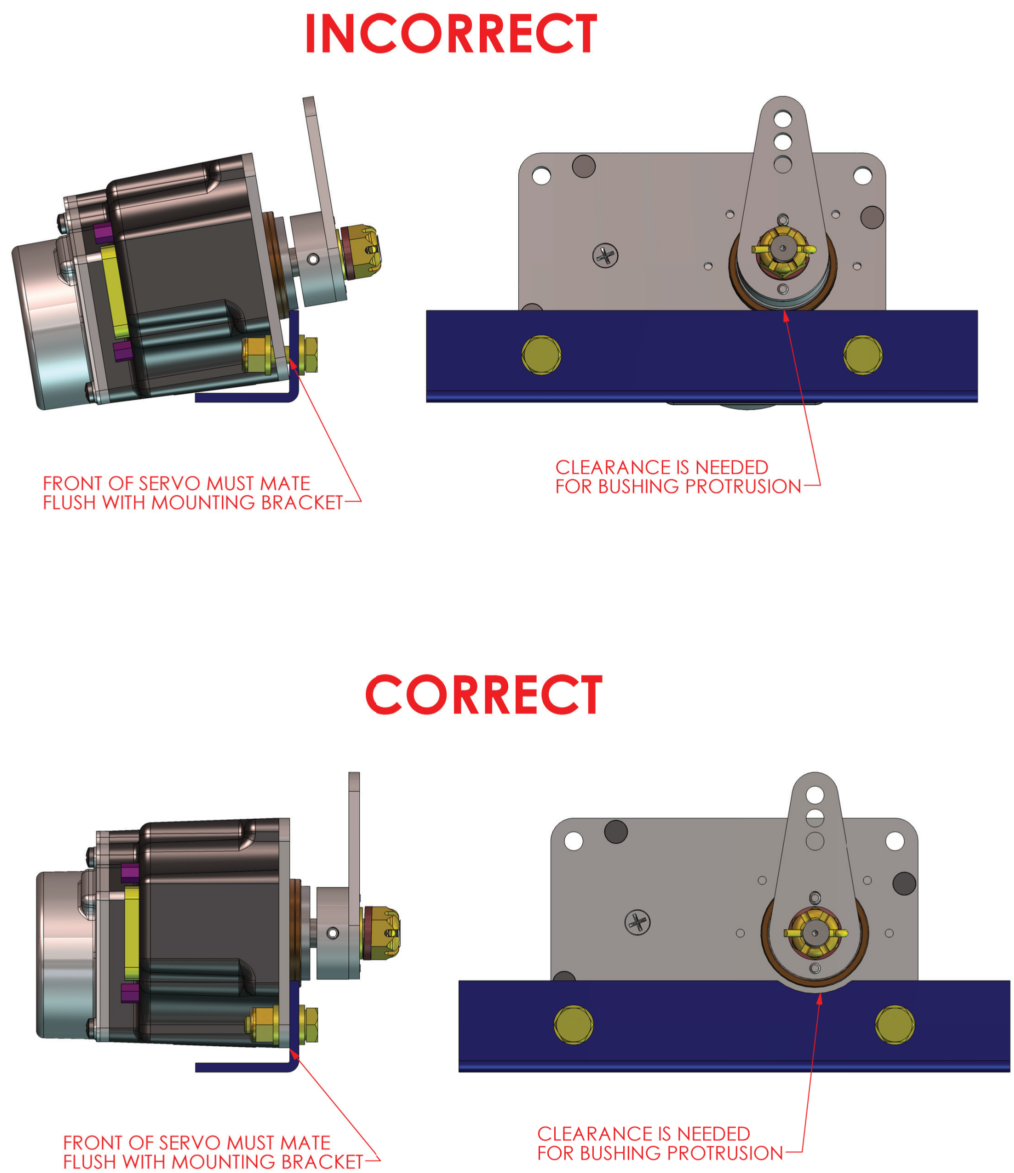


Figure 9-5 Non-Garmin GSA 28 Bracket

9.5.3 Unit Mounting

For final installation and assembly, refer to the outline and installation drawings Figure 9-6.1 through Figure 9-12.2.

9.6 Unit Wiring

Refer to the Appendix C-1.5 interconnect drawing for connecting GSA 28 wiring.

9.7 Environmental Specifications

Table 9-9 lists general environmental specifications.

Table 9-9 GSA 28 Environmental Specifications

Characteristic	Specification
Aircraft Pressure Altitude Range	-1,400 feet to 30,000 Feet
Unit Operating Temperature Range	-45°C to +70°C

9.8 Maintenance

The GSA 28 requires no maintenance.

9.9 Outline and Installation Drawings

Refer to the following figures for GSA 28 installation guidance.

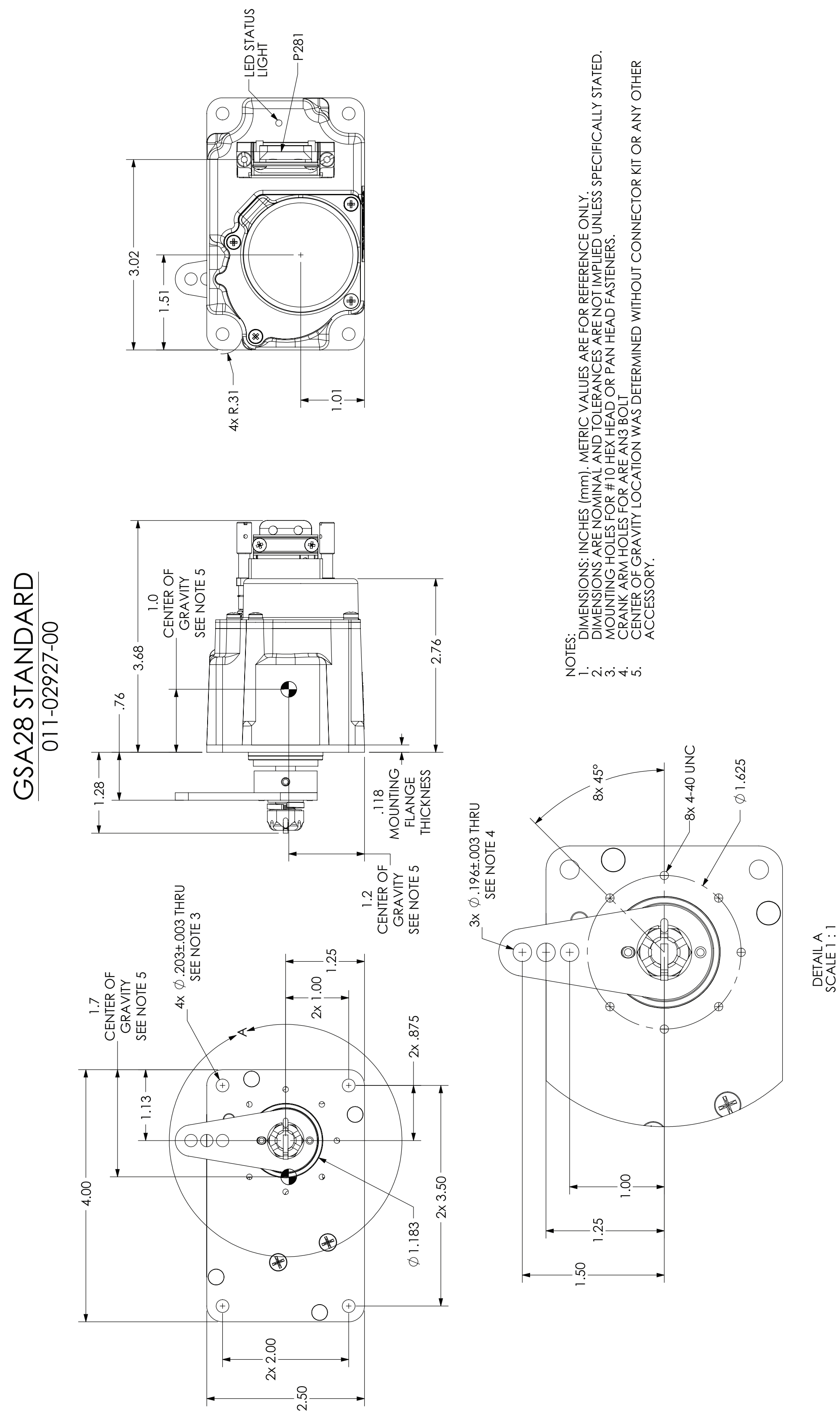
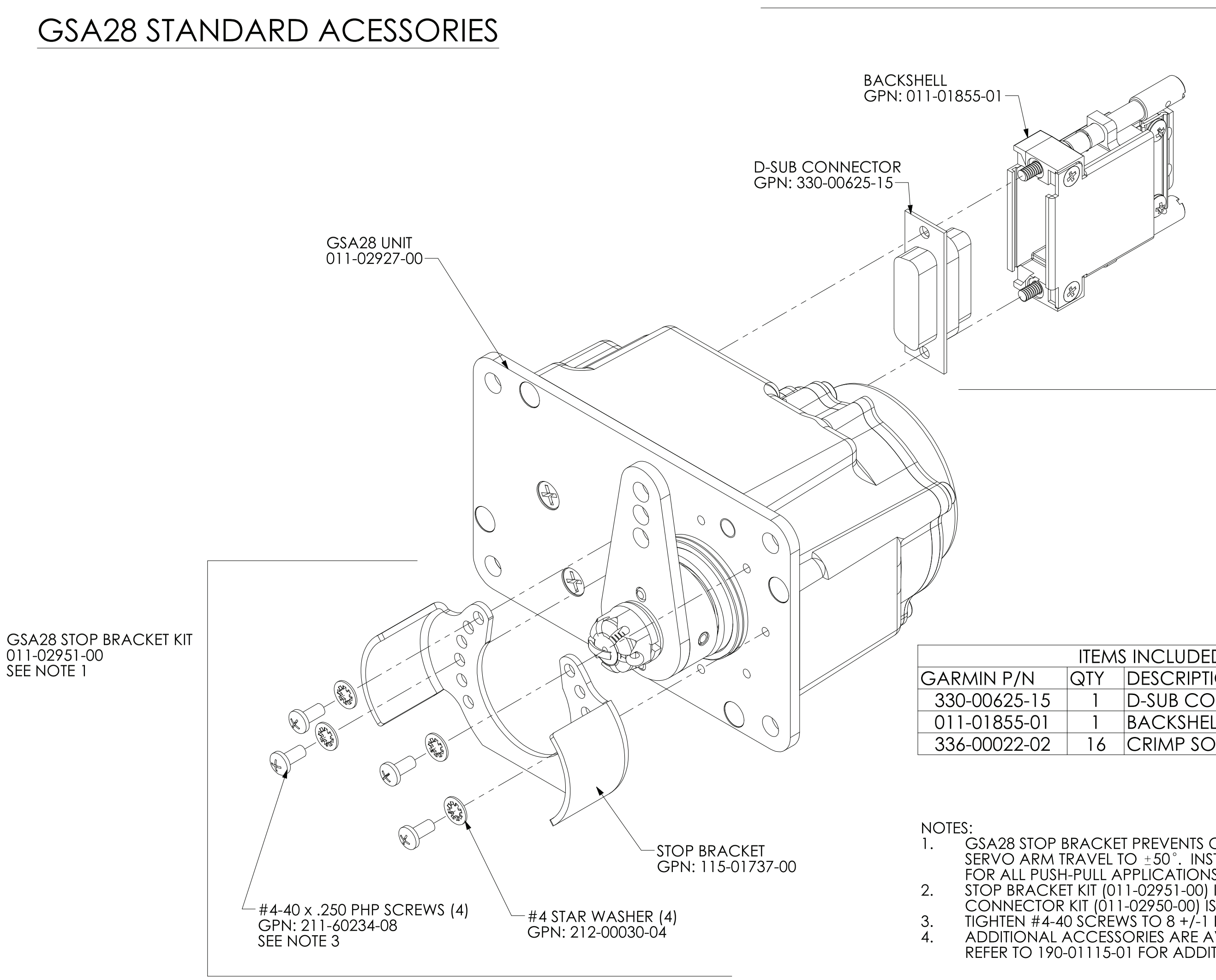


Figure 9-6.1 GSA 28 Outline/Installation Drawing 011-02927-00

GSA28 STANDARD ACESSORIES



ITEMS INCLUDED IN 011-02950-00		
GARMIN P/N	QTY	DESCRIPTION
330-00625-15	1	D-SUB CONNECTOR, 15 PIN, CRIMP SOCKET
011-01855-01	1	BACKSHELL ASSEMBLY, W/JACKSCREWS
336-00022-02	16	CRIMP SOCKETS, M39029/63-368

NOTES:
1. GSA28 STOP BRACKET PREVENTS OVER-CENTER CONDITION BY LIMITING SERVO ARM TRAVEL TO ±50°. INSTALLATION OF THIS PART IS RECOMMENDED FOR ALL PUSH-PULL APPLICATIONS. SEE SHEET 3 FOR MORE DETAILS.
2. STOP BRACKET KIT (011-02951-00) IS INCLUDED AS STANDARD WITH UNIT. CONNECTOR KIT (011-02950-00) IS SOLD SEPERATELY FROM UNIT.
3. TIGHTEN #4-40 SCREWS TO 8 +/-1 IN-LBS.
4. ADDITIONAL ACCESSORIES ARE AVAILABLE BUT NOT SHOWN ON THIS DRAWING. REFER TO 190-01115-01 FOR ADDITIONAL PARTS LISTS.

Figure 9-6.2 GSA 28 Accessory Installation Drawing

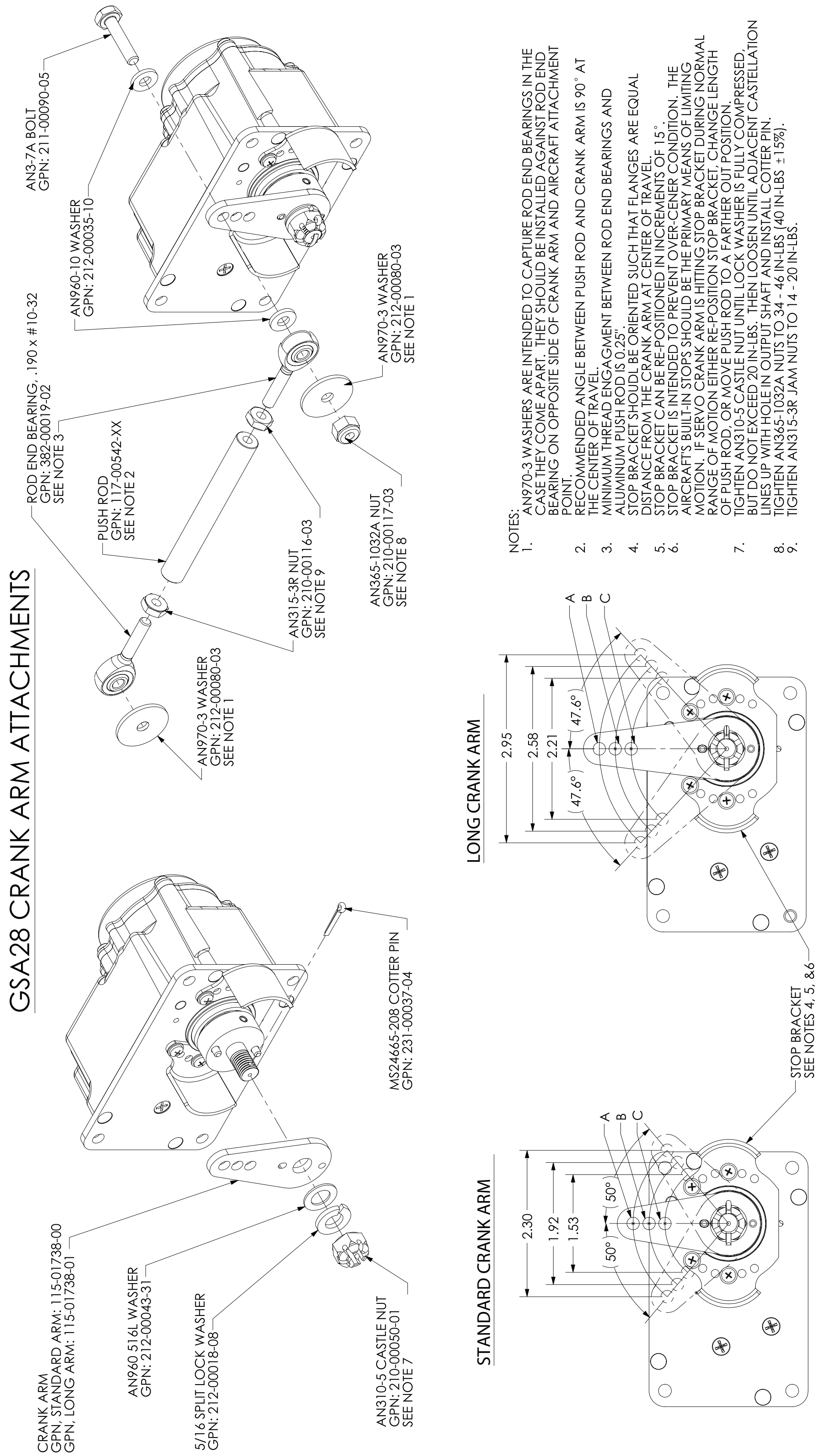
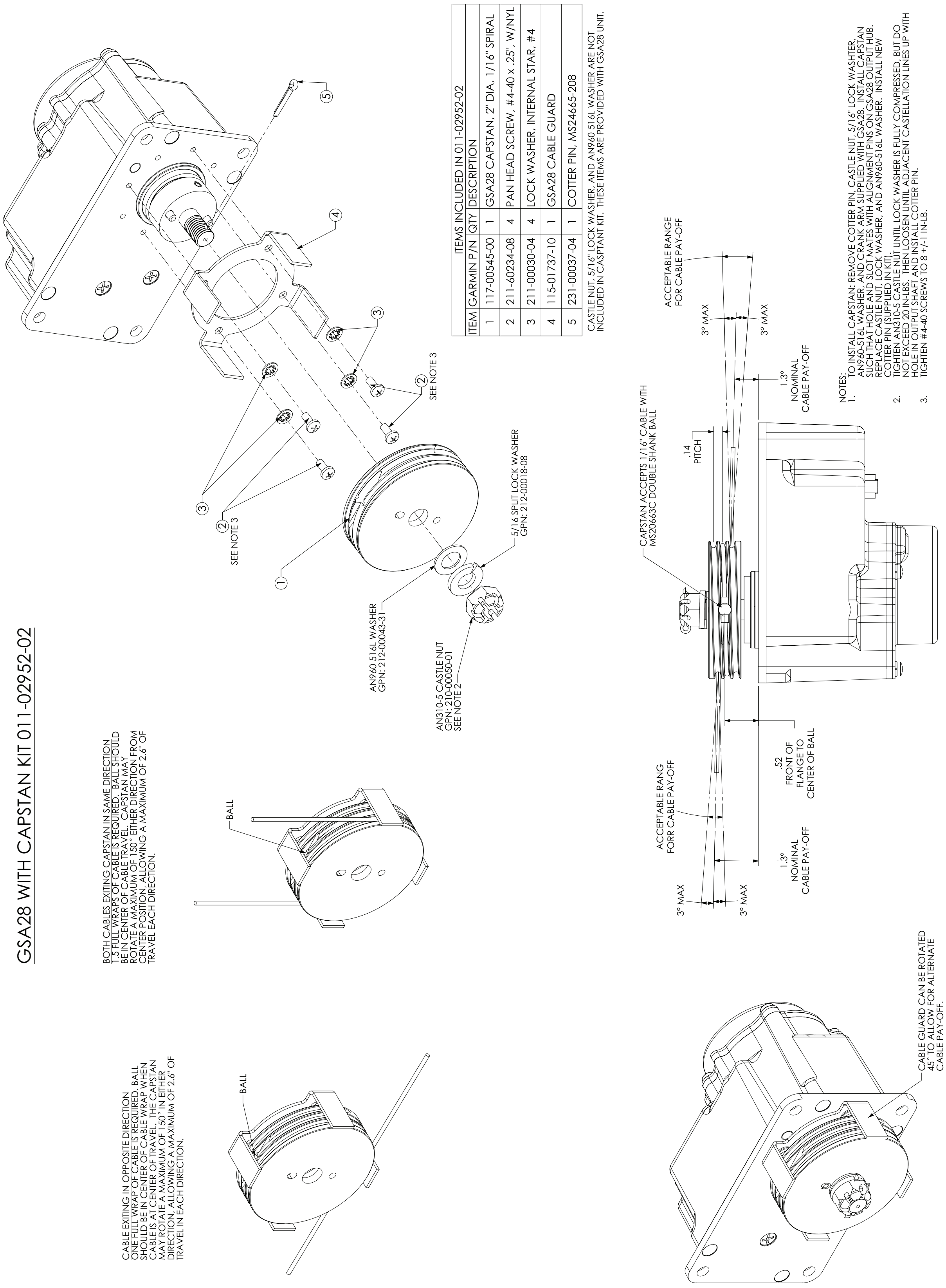


Figure 9-6.3 GSA 28 Crank Arm Attachments Drawing



ITEMS INCLUDED IN 011-02952-02

ITEM	GARMIN P/N	QTY	DESCRIPTION
1	117-00545-00	1	GSA28 CAPSTAN, 2" DIA, 1/16" SPIRAL
2	211-60234-08	4	PAN HEAD SCREW, #4-40 x .25", W/NYL
3	211-00030-04	4	LOCK WASHER, INTERNAL STAR, #4
4	115-01737-10	1	GSA28 CABLE GUARD
5	231-00037-04	1	COTTER PIN, MS24665-208

Figure 9-6.4 GSA 28 with Capstan Kit and Cable Instructions (011-02952-02)

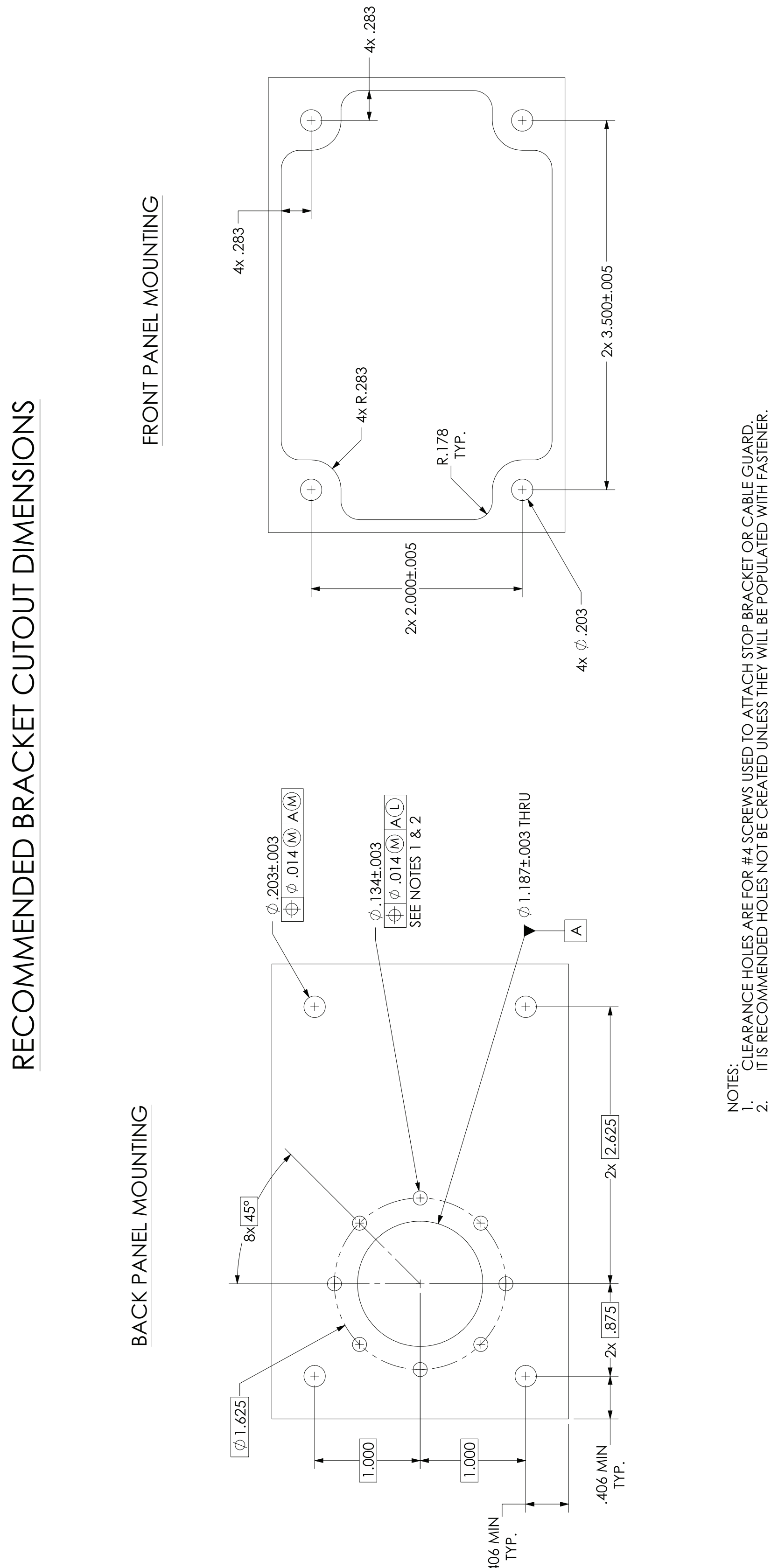


Figure 9-6.5 GSA 28 Recommended Bracket Cutout Dimensions

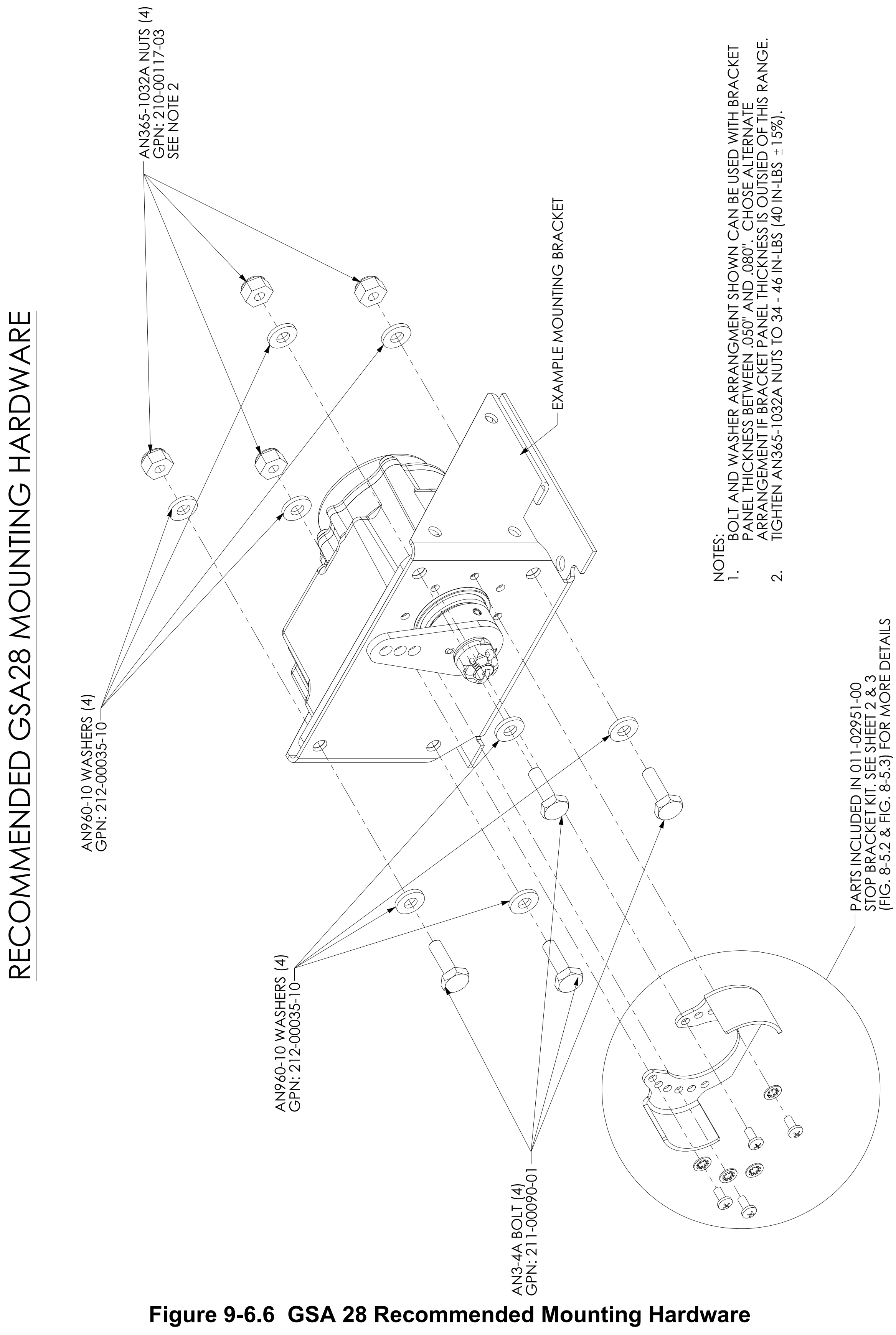
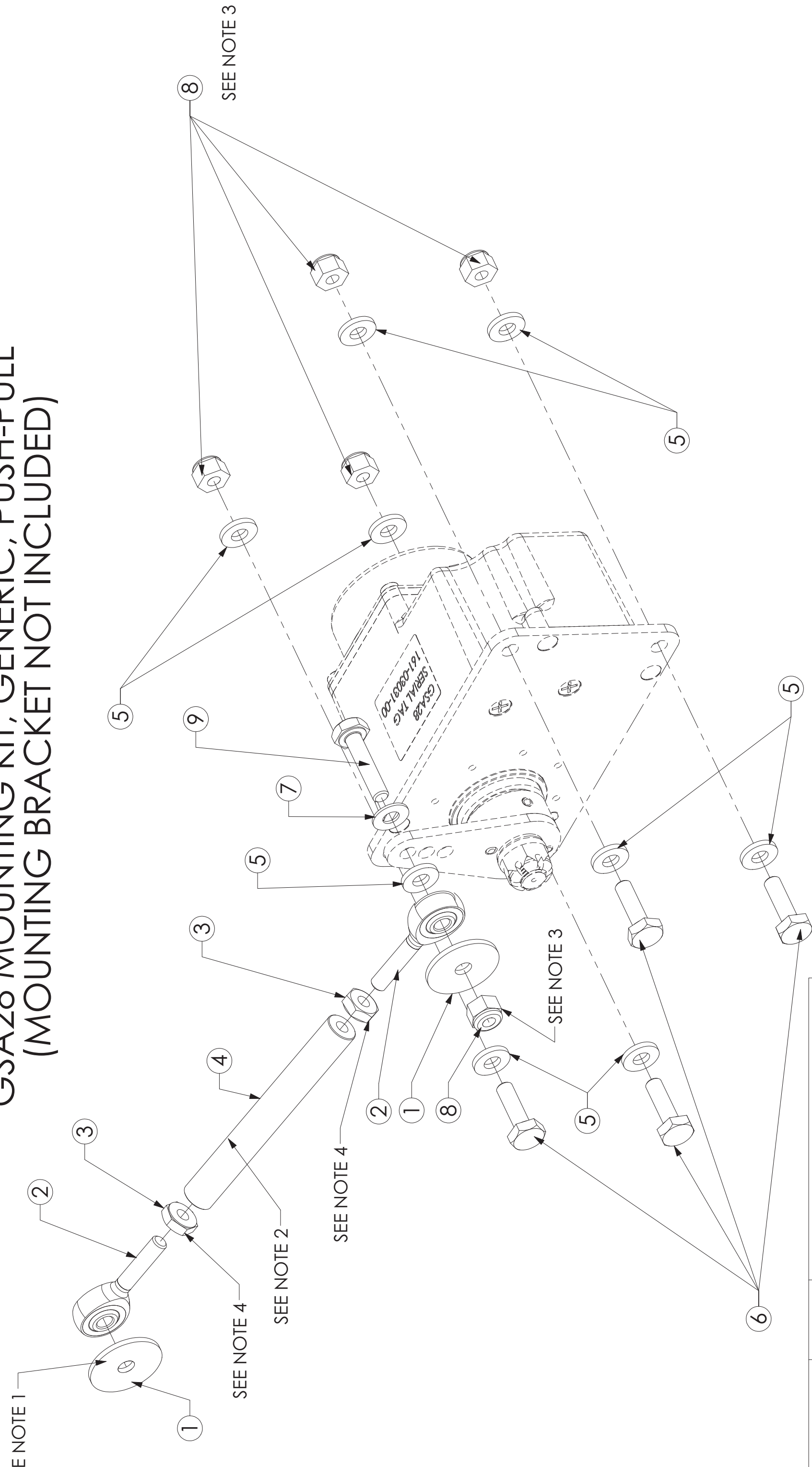


Figure 9-6.6 GSA 28 Recommended Mounting Hardware

011-02952-00
GSA28 MOUNTING KIT, GENERIC, PUSH-PULL
(MOUNTING BRACKET NOT INCLUDED)

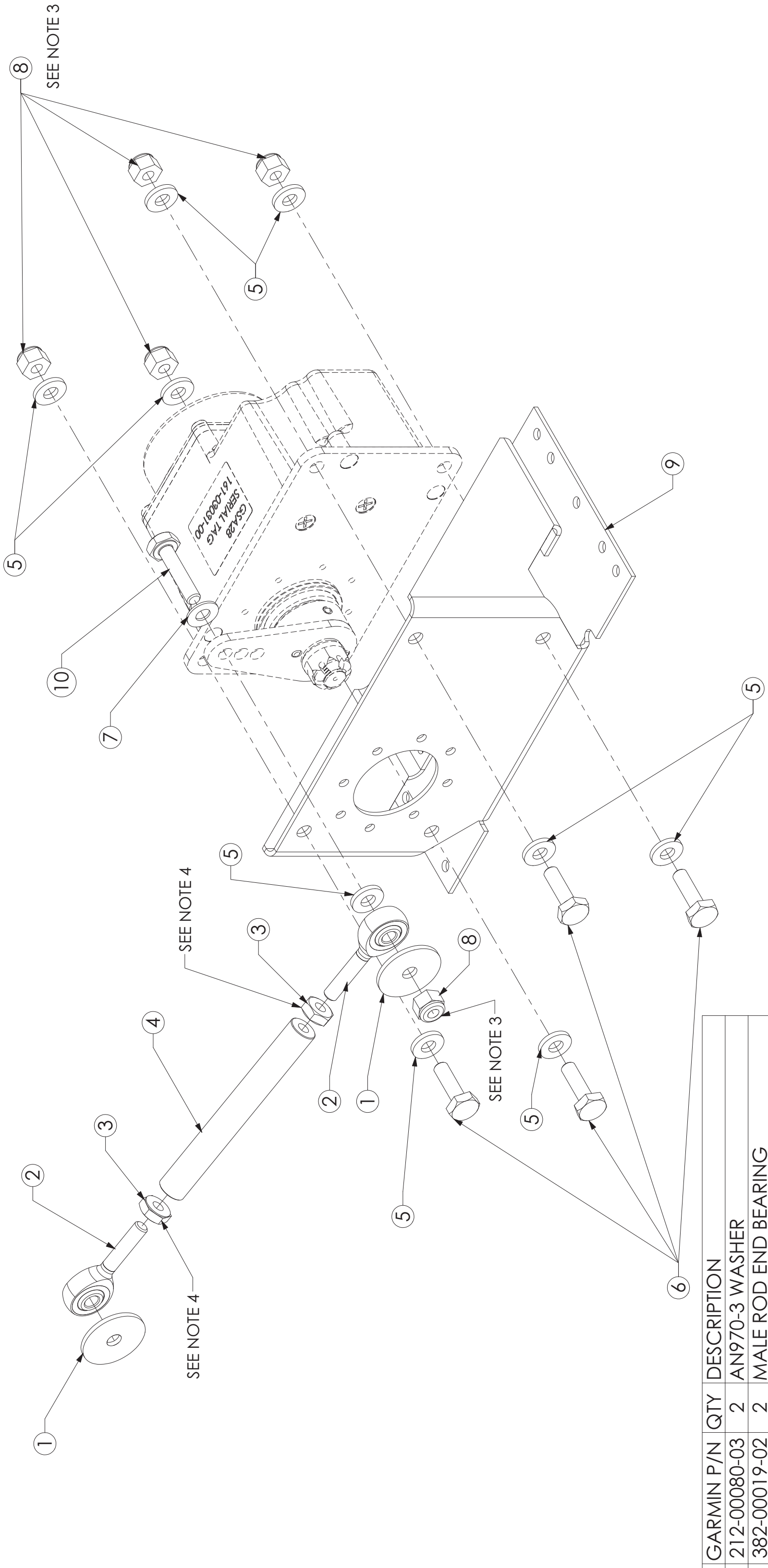


ITEM	GARMIN P/N	QTY	DESCRIPTION
1	212-00080-03	2	AN970-3 WASHER
2	382-00019-02	2	MALE ROD END BEARING
3	210-00116-03	2	AN315-3R JAM JUT
4	117-00542-07	1	PUSH ROD, 8.0" UNTAPPED
5	212-00035-10	9	AN960-10 WASHER
6	211-00090-01	4	AN3-5A BOLT
7	212-00043-10	1	AN960-10L (THIN) WASHER
8	210-00117-03	5	AN365-1032A LOCK NUT
9	211-00090-05	1	AN3-7A BOLT
10	231-00034-04	1	COTTER PIN, MS24665-208

NOTES:
1. PUSH ROD (ITEM 4) IS SUPPLIED 8" LONG AND UNTAPPED. CUT TO DESIRED LENGTH AND TAP #10-32 THREADS X .61" MIN DEEP IN EACH END. ALLOW ENOUGH LENGTH FOR THREAD ENGAMENT BETWEEN PUSH ROD (ITEM 4) AND ROD END (ITEM 2). ACCEPTABLE THREAD ENGAGMENT BETWEEN ITEM 2 AND 4 IS 0.492" ±.117".
2. IF COTTER PIN IS REMOVE FROM GSA28 CASTLE NUT, DISCARD COTTER PIN AND REPLACE WITH NEW COTTER PIN (ITEM 10) INCLUDED.
3. TIGHTEN AN365-1032A NUTS (ITEM 8) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
4. TIGHTEN AN315-3R JAM NUTS (ITEM 3) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).

Figure 9-6.7 GSA 28 Generic, Push-Pull Mounting Kit (No Bracket) 011-02952-00

011-02952-01
GSA28 MOUNTING KIT, GENERIC, PUSH-PULL, W/BRACKET



ITEM	GARMIN P/N	QTY	DESCRIPTION
1	212-00080-03	2	AN970-3 WASHER
2	382-00019-02	2	MALE ROD END BEARING
3	210-00116-03	2	AN315-3R JAM JUT
4	117-00542-07	1	PUSH ROD, 8.0" UNTAPPED
5	212-00035-10	9	AN960-10 WASHER
6	211-00090-01	4	AN3-5A BOLT
7	212-00043-10	1	AN960-10L (THIN) WASHER
8	210-00117-03	5	AN365-1032A LOCK NUT
9	115-01854-00	1	GSA28 MOUNTING BRAKCET, GENERIC
10	211-00090-05	1	AN3-7A BOLT
11	231-00034-04	1	COTTER PIN, MS24665-208

NOTES:
1. PUSH ROD (ITEM 4) IS SUPPLIED 8" LONG AND UNTAPPED. CUT TO DESIRED LENGTH AND TAP #10-32 THREADS X .61" MIN DEEP IN EACH END. ALLOW ENOUGH LENGTH FOR THREAD ENGAMENT BETWEEN PUSH ROD (ITEM 4) AND ROD END (ITEM 2). ACCEPTABLE THREAD ENGAGMENT BETWEEN ITEM 2 AND 4 IS 0.492" ±.117".
2. IF COTTER PIN IS REMOVE FROM GSA28 CASTLE NUT, DISCARD COTTER PIN AND REPLACE WITH NEW COTTER PIN (ITEM 11) INCLUDED.
3. TIGHTEN AN365-1032A NUTS (ITEM 8) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
4. TIGHTEN AN315-3R JAM NUTS (ITEM 3) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).

Figure 9-6.8 GSA 28 Generic, Push-Pull Mounting Kit w/Bracket 011-02952-01

ITEM	GARMIN P/N	QTY	DESCRIPTION
1	231-00037-04	1	COTTER PIN, MS24665-208
2	115-01738-01	1	GSA28 CRANK ARM, LONG
3	211-00090-05	1	AN3-7A BOLT
4	211-00090-16	1	AN3-21A BOLT
5	212-00080-03	2	AN970-3 WASHER
6	212-00035-10	10	AN960-10 WASHER
7	211-00090-01	4	AN3-5A BOLT
8	115-01854-01	1	RV-6 ROLL BRACKET
9	213-00093-02	1	SPACER, .192' x .375" x .600" LNG
10	115-01854-02	1	RV-6 ROLL SUPPORT PLATE
11	211-A0102-02	4	NAS517-2-2 FLAT HEAD SCREW
12	212-00035-08	4	AN960-8 WASHER
13	212-00043-10	1	AN960-10L (THIN) WASHER
14	210-00117-03	6	AN365-1032A LOCK NUT
15	210-00117-02	4	AN365-832A LOCK NUT
16	382-00019-12	2	MALE ROD END BEARING
17	210-00116-03	2	AN315-3R JAM NUT
18	117-00542-06	1	PUSH ROD, 3/8" DIA, 7.50" LNG, TAPPED

NOTES:
1. DIMENSIONS: INCHES
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. GSA28 IS PROVIDED WITH STANDARD CRANK ARM. FOR THE RV-6 ROLL INSTALLATION, THIS PART MUST BE REMOVED AND REPLACED WITH THE LONGER ARM (ITEM 2).
4. CASTLE NUT, 5/16 LOCK WASHER, AND AN960 516L WASHER ARE NOT INCLUDED IN SERVO MOUNTING KIT. THESE PARTS ARE INCLUDED WITH GSA28 AND MUST BE RE-USED.
5. TO INSTALL LONG CRANK ARM: REMOVE COTTER PIN, CASTLE NUT, 5/16 LOCK WASHER, AN960-516L WASHER, AND STANDARD CRANK ARM. INSTALL LONG ARM SUCH THAT HOLE AND SLOT MATE WITH ALIGNMENT PINS ON GSA28 OUPUT HUB. REPLACE CASTLE NUT, LOCK WASHER, AND AN960-516L WASHER. TIGHTEN CASTLE NUT UNTIL LOCK WASHER IS FULLY COMPRESSED, BUT DO NOT TIGHTEN TO MORE THAN 20 IN-LBS. THEN LOOSEN UNTIL ADJACENT CASTELLATION LINES UP WITH HOLE IN OUTPUT SHAFT. INSTALL NEW COTTER PIN (SUPPLIED IN MOUNTING KIT).
6. UNLESS OTHERWISE SPECIFIED, TIGHTEN ALL AN365-1032A NUTS (ITEM 6) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
7. TIGHTEN ALL AN315-3R JAM NUTS (ITEM 17) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).
8. TIGHTEN #4-40 SCREWS USED TO ATTACH STOP BRACKET TO 8 ±1 IN-LBS.
9. TIGHTEN AN365-832A (ITEM 15) LOCK NUTS TO 20±3 IN-LBS.
10. STOP BRACKET SHOULD NOT BE USED AS THE PRIMARY MEANS OF LIMITING MOTION. THE AIRFRAME'S STOPS SHOULD LIMIT MOTION BEFORE THE SERVO CRANK ARM CONTACTS THE STOP BRACKET.
11. THREAD ENGAMENT BETWEEN ROD END BEARINGS (ITEM 16) AND ALUMINUM PUSH ROD (ITEM 18) MUST NOT BE LESS THAN 0.375".
12. AN3-21A BOLT (ITEM 4) ATTACHES PUSH ROD TO CONTROL STICK. SEE SHEET 2 FOR DETAILS.
13. PUSH ROD DIMENSIONS SHOWN IS APPROXIMATE.

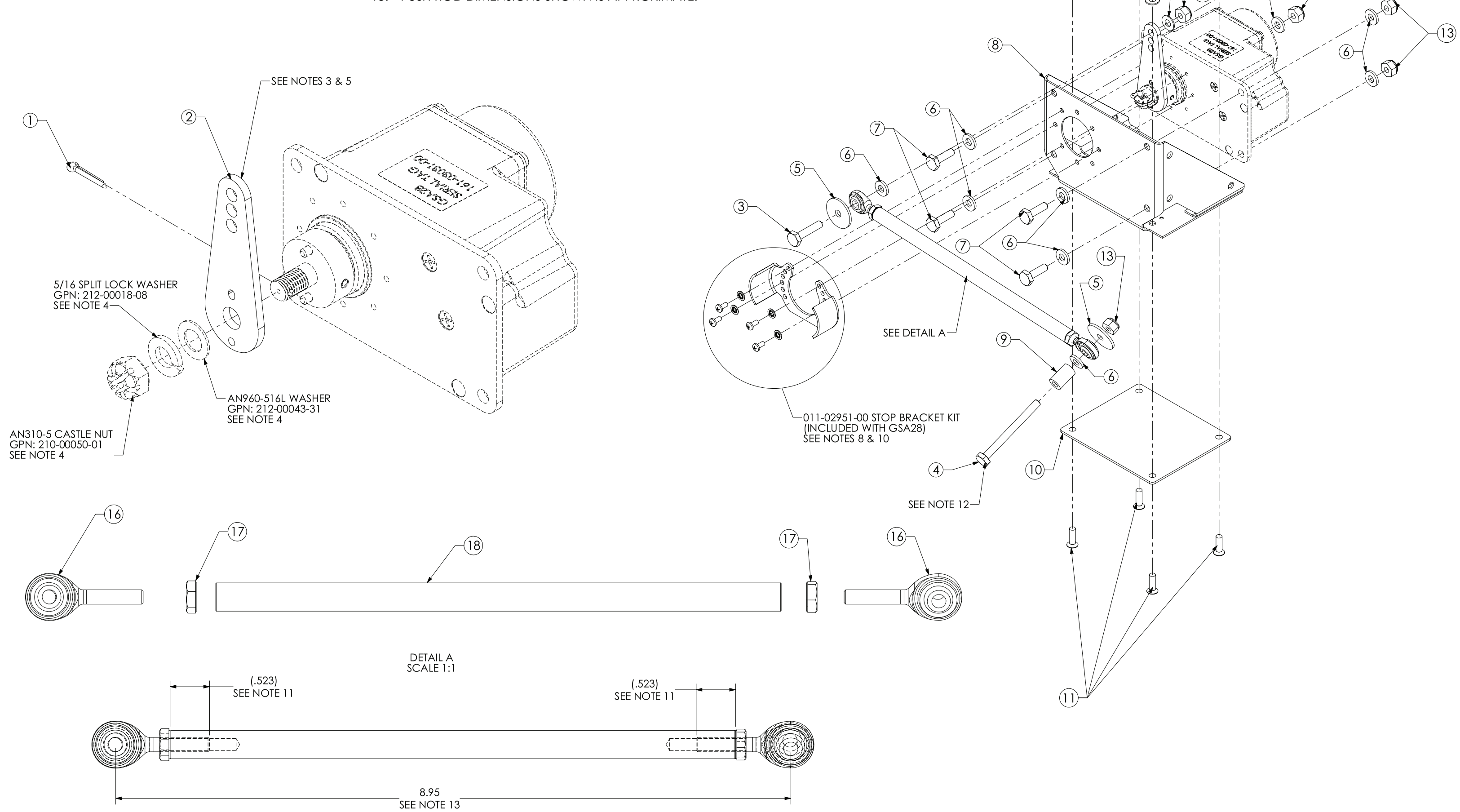


Figure 9-7.1 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 1 of 3)

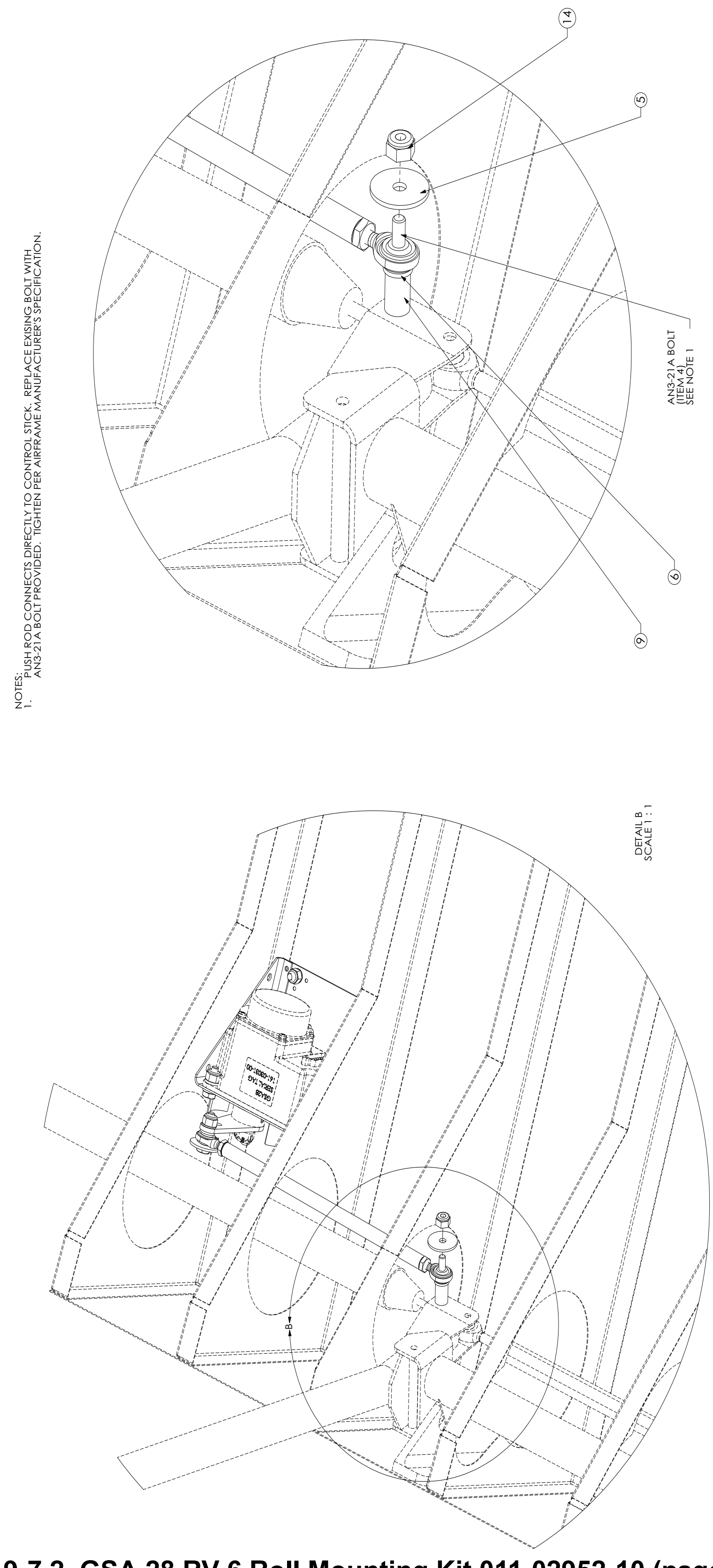


Figure 9-7.2 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 2 of 3)

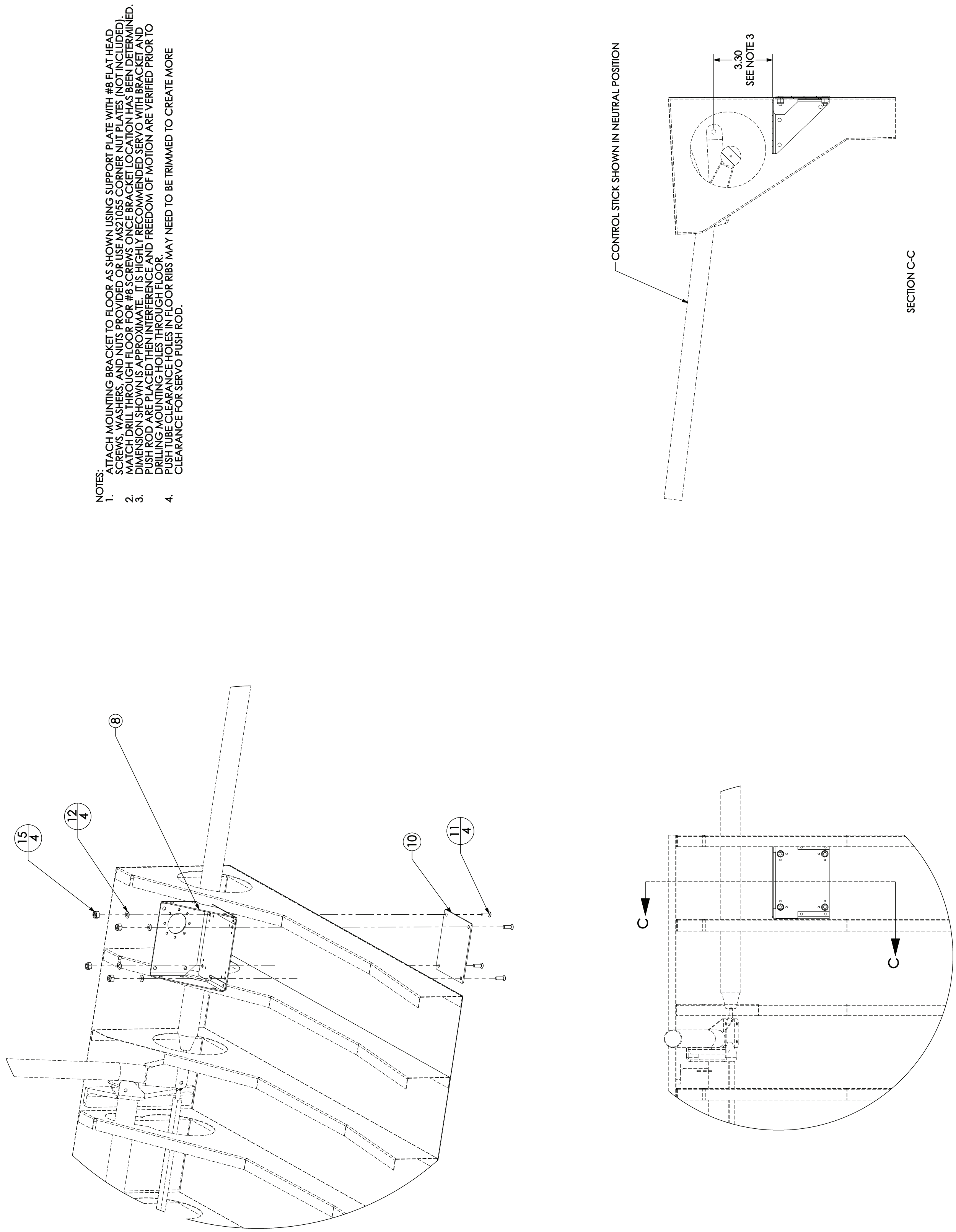


Figure 9-7.3 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 3 of 3)

ITEM	GARMIN P/N	QTY	DESCRIPTION	RV-4 & PRE-SEPT 2006 RV-8	POST-SEPT 2006 RV-8
1	210-00117-03	4	AN365-1032A LOCK NUT	X	X
2	212-00035-10	10	AN960-10 WASHER	X	X
3	211-00090-05	1	AN3-7A BOLT	X	X
4	115-01854-03	1	RV-4/8 PITCH BRACKET, LEFT	X	X
5	211-00090-07	1	AN3-11A BOLT	X	X
6	213-00093-03	1	SPACER, .192x.375x.75 LNG	X	
	213-00093-04	1	SPACER, .192X.375X.875 LNG		X
7	211-00090-01	1	AN3-5A BOLT	X	
	211-00090-06	1	AN3-6A BOLT		X
8	212-00080-03	2	AN970-3 WASHER	X	X
9	115-01854-04	1	RV-4/8 PITCH BRACKET, RIGHT	X	X
10	211-00090-08	1	AN3-14A	X	
	211-00090-09	1	AN3-15A BOLT		X
11	211-00090-13	1	AN4-15A	SEE NOTE 5	X
12	382-00019-02	2	MALE ROD END BEARING	X	X
13	210-00116-03	2	AN315-3R JAM JUT	X	X
14	117-00542-00	1	PUSH ROD, 3/8 DIA, 2.25" LNG, TAPPED	X	X
15	212-00043-10	1	AN960-10L (THIN) WASHER	X	X

NOTES:
1. DIMENSIONS: INCHES.
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. HOLE MUST BE DRILLED THROUGH BELL CRANK TO ATTACH PUSH ROD. SEE SHEET 2 FOR HOLE SIZE AND LOCATION.
4. SINGLE AN960-10 WASHER (ITEM 2) MUST BE PLACED IN-BETWEEN BELL CRANK HALVES CONCENTRIC WITH DRILLED HOLES.
5. AN4-15A BOLT PROVIDED IS TO BE USED WITH POST-SEPT 2006 RV-8 ONLY. FOR RV-4 AND PRE-SEPT 2006 RV-8, USE BOLT PROVIDED WITH AIRFRAME KIT.
6. NUT AND WASHERS FOR AN4 BOLT ARE NOT PROVIDED IN GSA28 MOUNTING KIT. USE PARTS PROVIDED WITH AIRFRAME KIT. TIGHTEN PER AIRFRAME MANUFACTURER'S SPECIFICATION.
7. TIGHTEN ALL AN365-1032A NUTS (ITEM 1) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
8. TIGHTEN ALL AN315-3R JAM NUTS (ITEM 13) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).
9. THREAD ENGAGMENT BETWEEN ROD END BEARINGS (ITEM 12) AND ALUMINUM PUSH ROD (ITEM 14) MUST NOT BE LESS THAN 0.375".

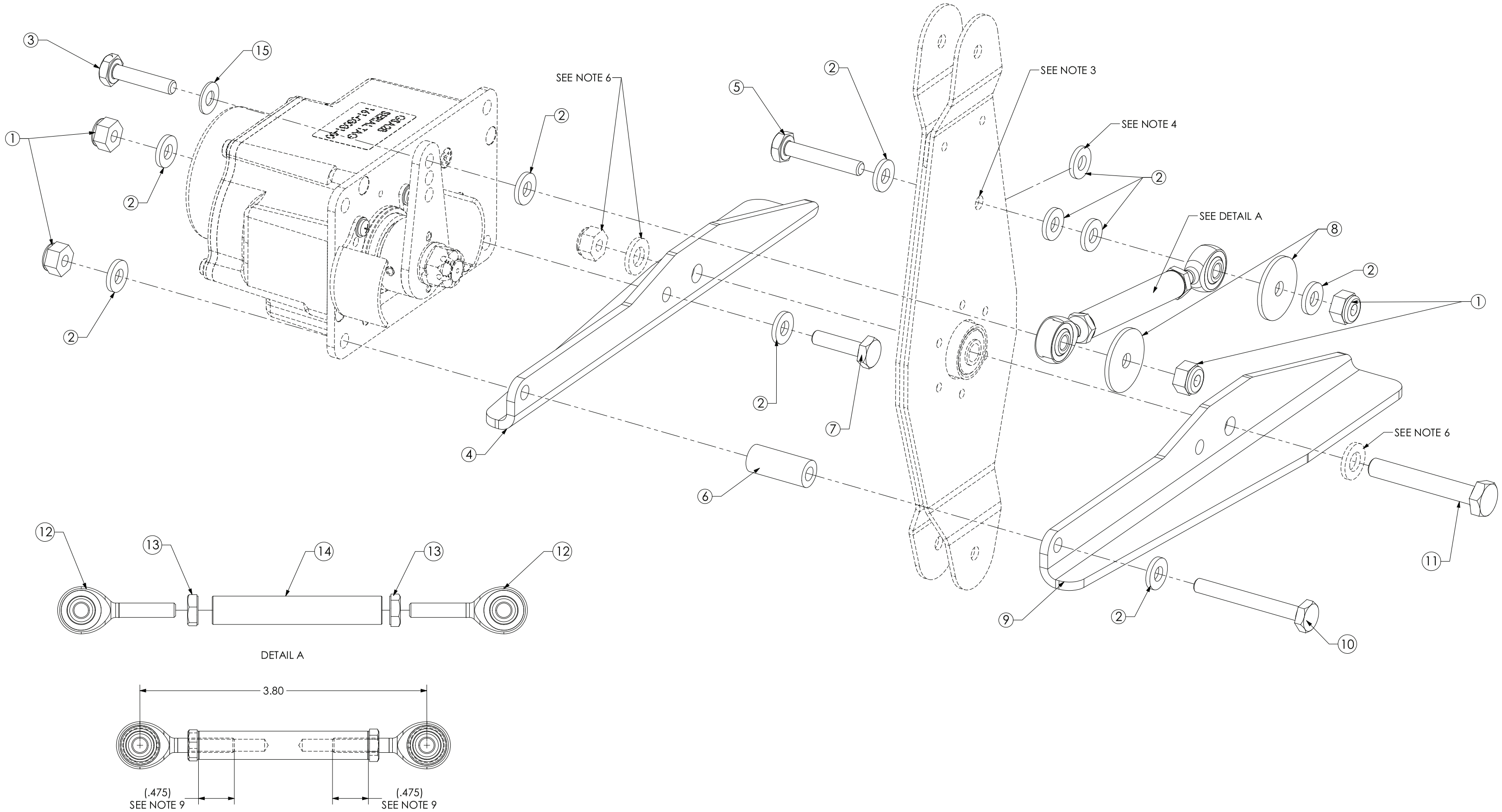
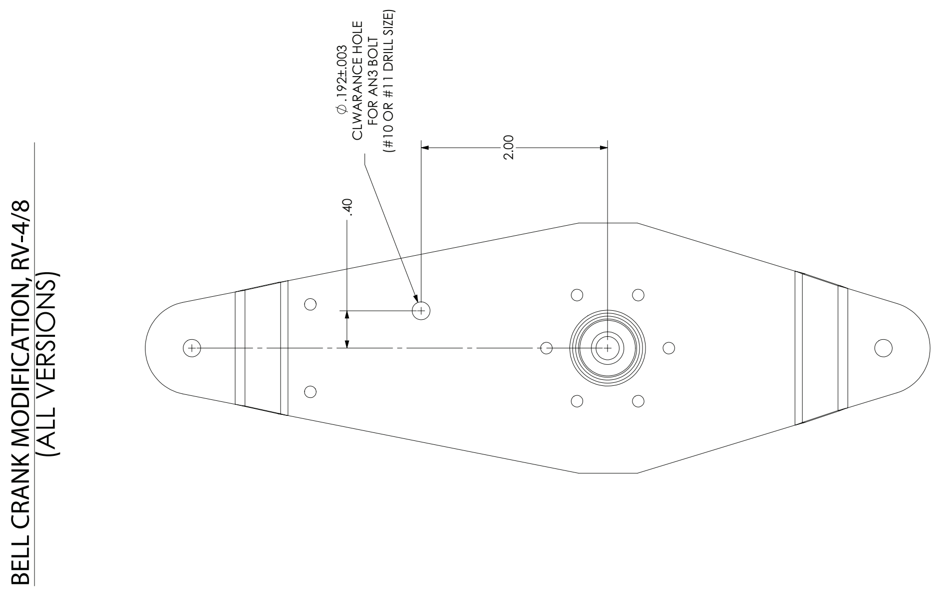


Figure 9-8.1 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 1 of 4)



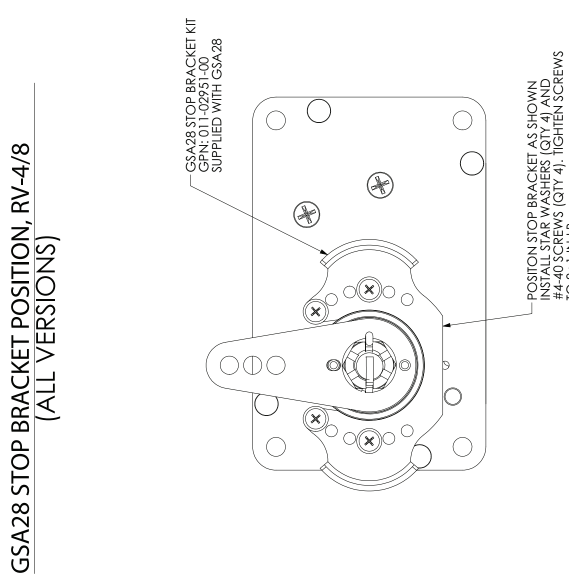
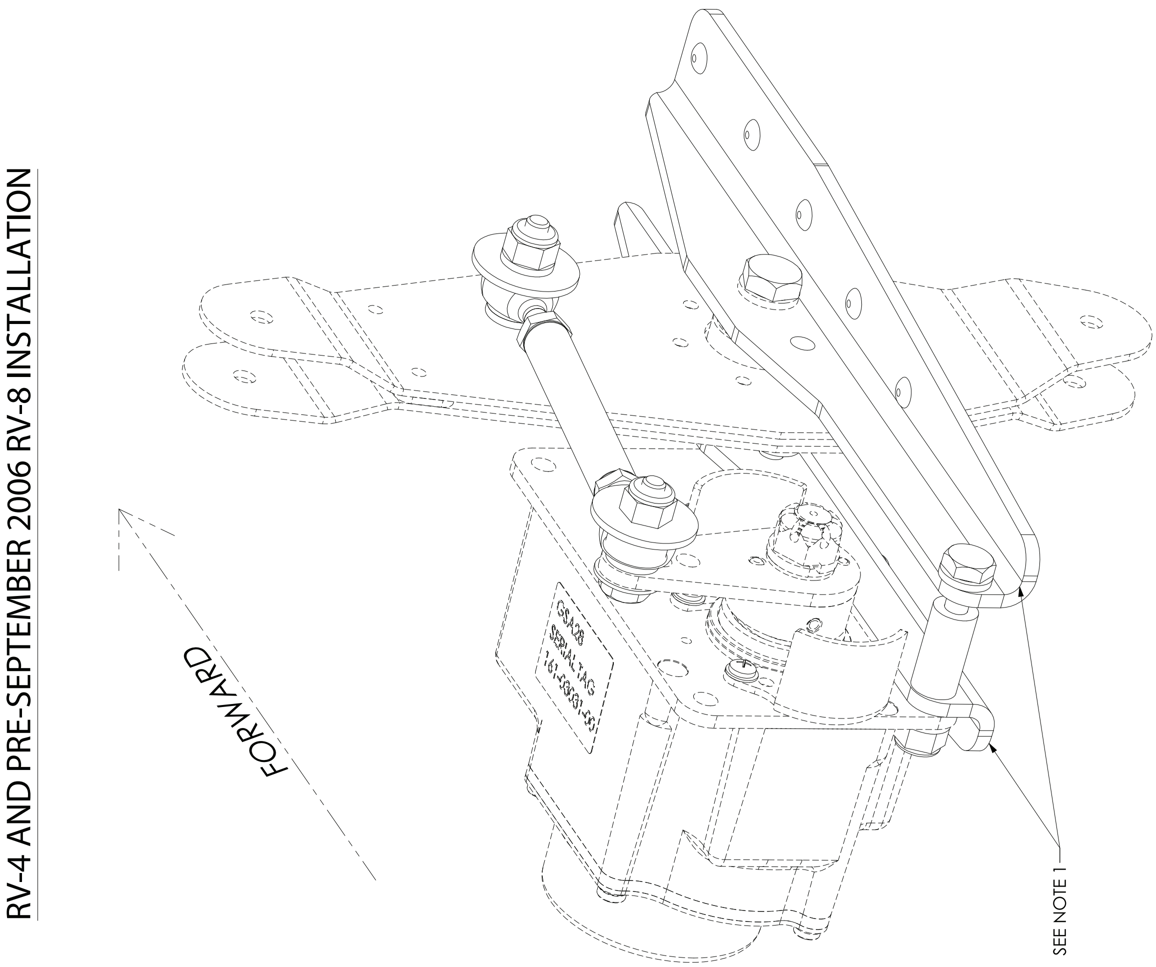


Figure 9-8.2 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 2 of 4)



NOTES:
1. REMOVE EXISTING PITCH BELL CRANK BRACKETS AND REPLACE WITH SERVO MOUNTING BRACKETS (ITEMS 4 AND 9). MATCH-DRILL NEW BRACKETS TO MATCH HOLE PATTERN ON ORIGINAL BRACKET. FASTEN TO AIRFRAME USING ORIGINAL RIVET HOLES. FASTENERS USE FOR MOUNTING THE BRACKETS TO THE AIRFRAME ARE NOT INCLUDED IN MOUNTING KIT.

Figure 9-8.3 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 3 of 4)

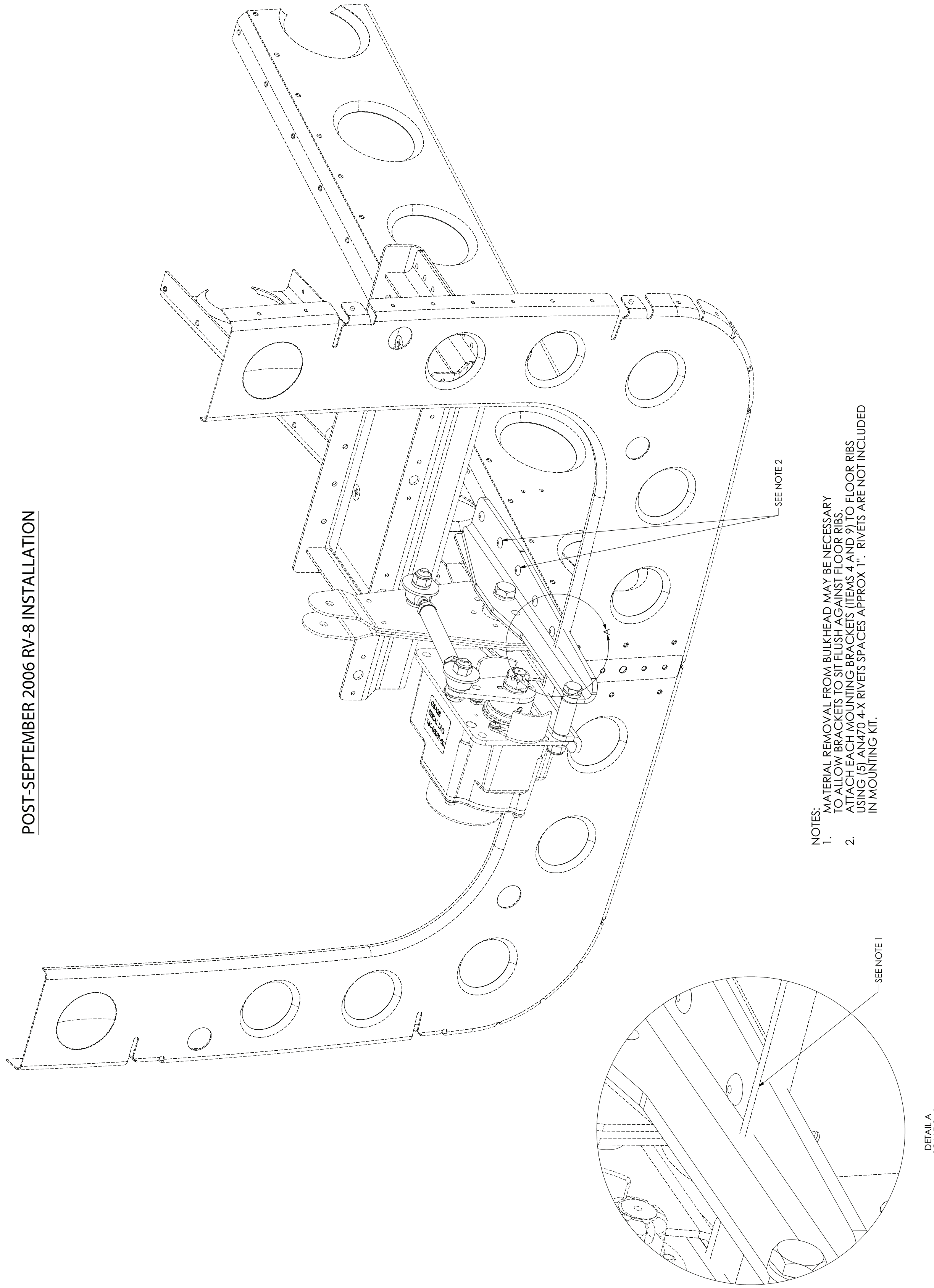
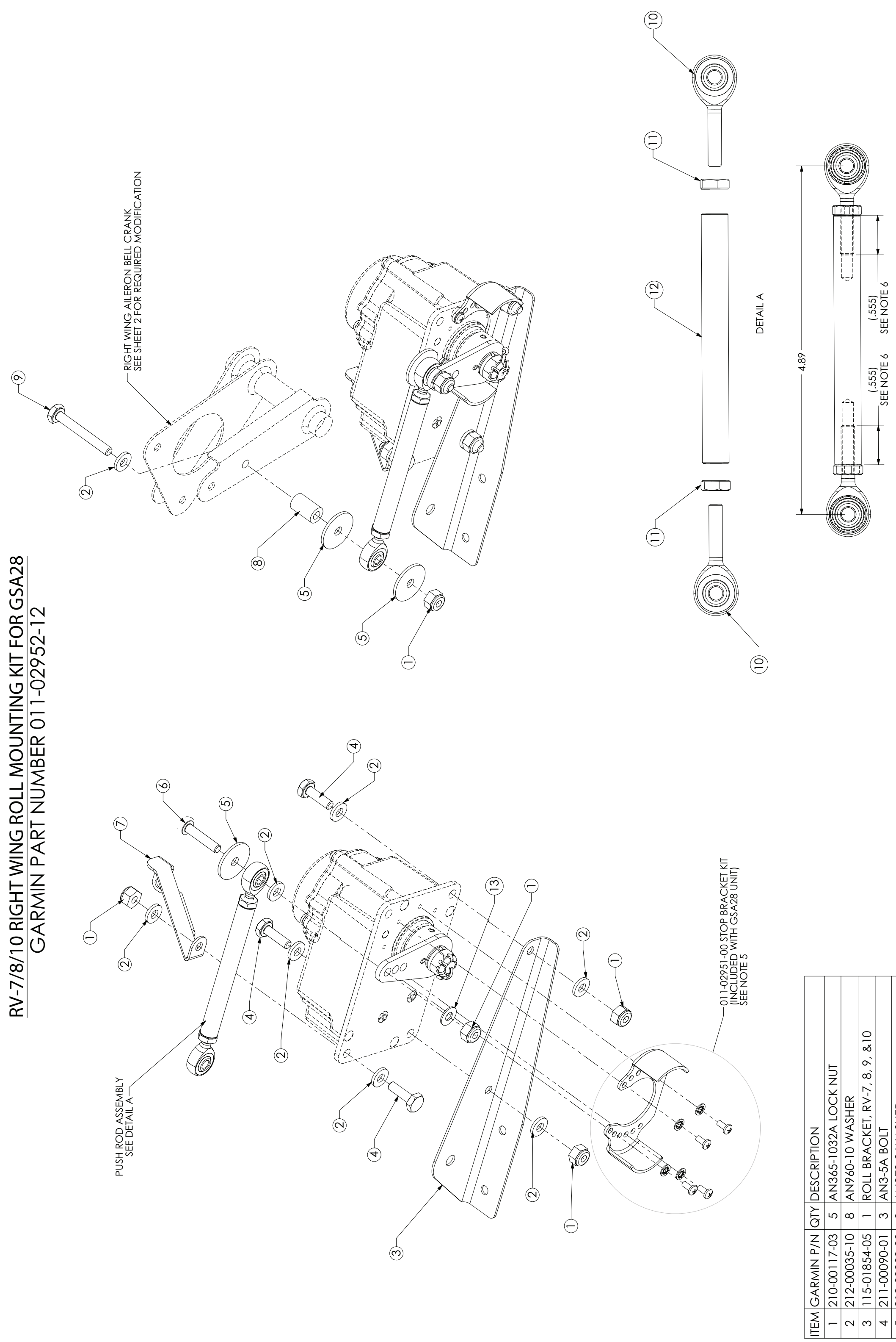


Figure 9-8.4 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 4 of 4)



ITEM	GARMIN P/N	QTY	DESCRIPTION
1	210-00117-03	5	AN365-1032A LOCK NUT
2	212-00035-10	8	AN960-10 WASHER
3	115-01854-05	1	ROLL BRACKET, RV-7, 8, 9, &10
4	211-00090-01	3	AN3-5A BOLT
5	212-00080-03	3	AN970-3 WASHER
6	211-00090-05	1	AN3-7A BOLT
7	115-01854-06	1	ROLL SUPPORT, RV-7, 8, 9, &10
8	213-00093-02	1	SPACER, .192" x .375" x. 600" LNG
9	211-00090-08	1	AN3-14A BOLT
10	382-00019-02	2	MALE ROD END BEARING
11	210-00116-03	2	AN315-3R JAM NUT
12	117-00542-09	1	PUSH ROD, 3/8" DIA, 3.50" LNG, TAPPED
13	212-00043-10	1	AN960-10L (THIN) WASHER

NOTES:
1. DIMENSIONS: INCHES
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. TIGHTEN ALL AN365-1032A LOCK NUTS (ITEM 1) TO 34 - 46 IN-LBS (40 IN-LBS ± 15%).
4. TIGHTEN AN315R JAM NUTS (ITEM 11) TO 14 - 20 IN-LBS (17 ± 3 IN-LBS).
5. TIGHTEN #4-40 SCREWS FOR STOP BRACKET TO 8 ± 1 IN-LBS.
6. THREAD ENGAGMENT BETWEEN ROD END (ITEM 10) AND ALUMINUM PUSH ROD (ITEM 12) MUST NOT BE LESS THAN .375".

Figure 9-9.1 GSA 28 RV-7/8/10 Roll Mounting Kit 011-02952-12 (page 1 of 2)

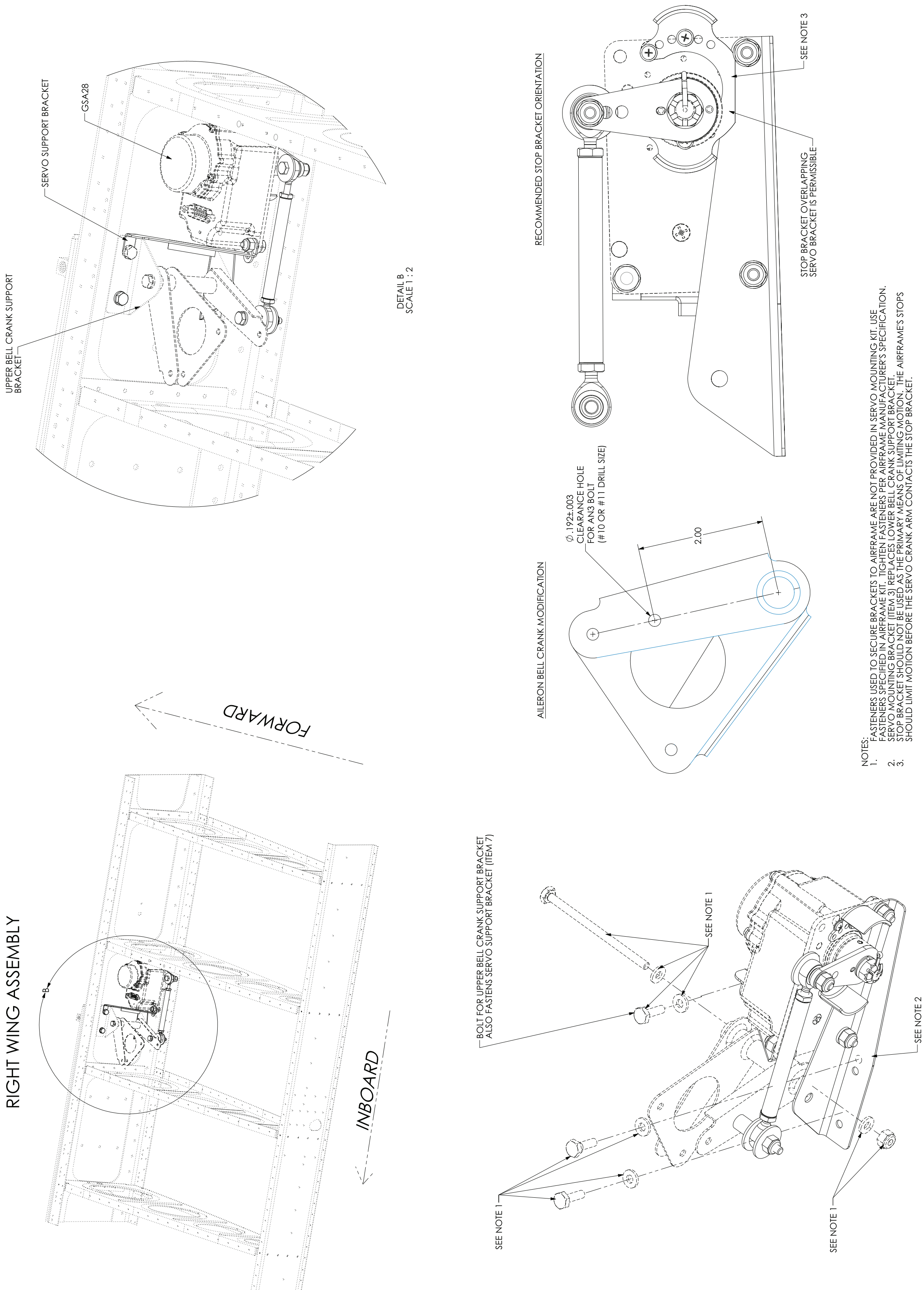
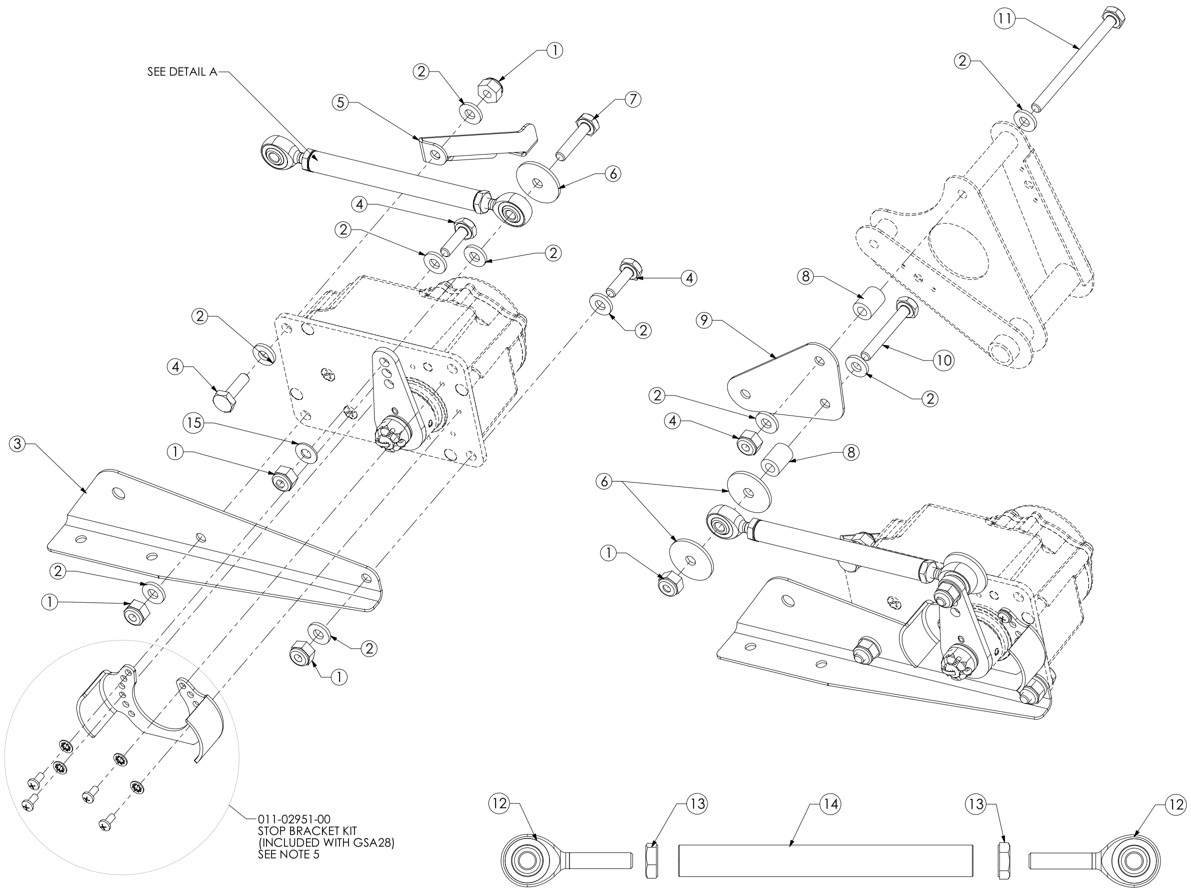


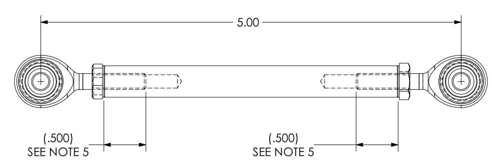
Figure 9-9.2 GSA 28 RV-7/8/10 Roll Mounting Kit 011-02952-12 (page 2 of 2)

RV-9 RIGHT WING ROLL MOUNTING KIT
GARMIN PART NUMBER 011-02952-13



ITEM	GARMIN P/N	QTY	DESCRIPTION
1	210-00117-03	5	AN365-1032A LOCK NUT
2	212-00035-10	10	AN960-10 WASHER
3	115-01854-05	1	ROLL BRACKET, RV-7, 8, 9, &10
4	211-00090-01	3	AN3-5A BOLT
5	115-01854-06	1	ROLL SUPPORT, RV-7, 8, 9, &10
6	212-00080-03	3	AN970-3 WASHER
7	211-00090-05	1	AN3-7A BOLT
8	213-00093-01	2	SPACER, .192" x .375" X .485" LNG
9	115-01854-07	1	ROLL ATTACH PLATE, RV-9
10	211-00090-15	1	AN3-13A BOLT
11	211-00090-12	1	AN3-25A BOLT
12	382-00019-02	2	MALE ROD END BEARING
13	210-00116-03	2	AN315-3R JAM NUT
14	117-00542-09	1	PUSH ROD, 3/8" DIA, 3.50" LNG, TAPPED
15	212-00043-10	1	AN960-10L (THIN) WASHER

DETAIL A



NOTES:
1. DIMENSIONS: INCHES
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. TIGHTEN ALL AN365-1032A LOCK NUTS (ITEM 1) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
4. TIGHTEN AN315R JAM NUTS (ITEM 12) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).
5. TIGHTEN #4-40 SCREWS FOR STOP BRACKET TO 8 ±1 IN-LBS.
6. THREAD ENGAGMENT BETWEEN ROD END (ITEM 12) AND ALUMINUM PUSH ROD (ITEM 14) MUST NOT BE LESS THAN .375".

Figure 9-10.1 GSA 28 RV-9 Roll Mounting Kit 011-02952-13 (page 1 of 2)

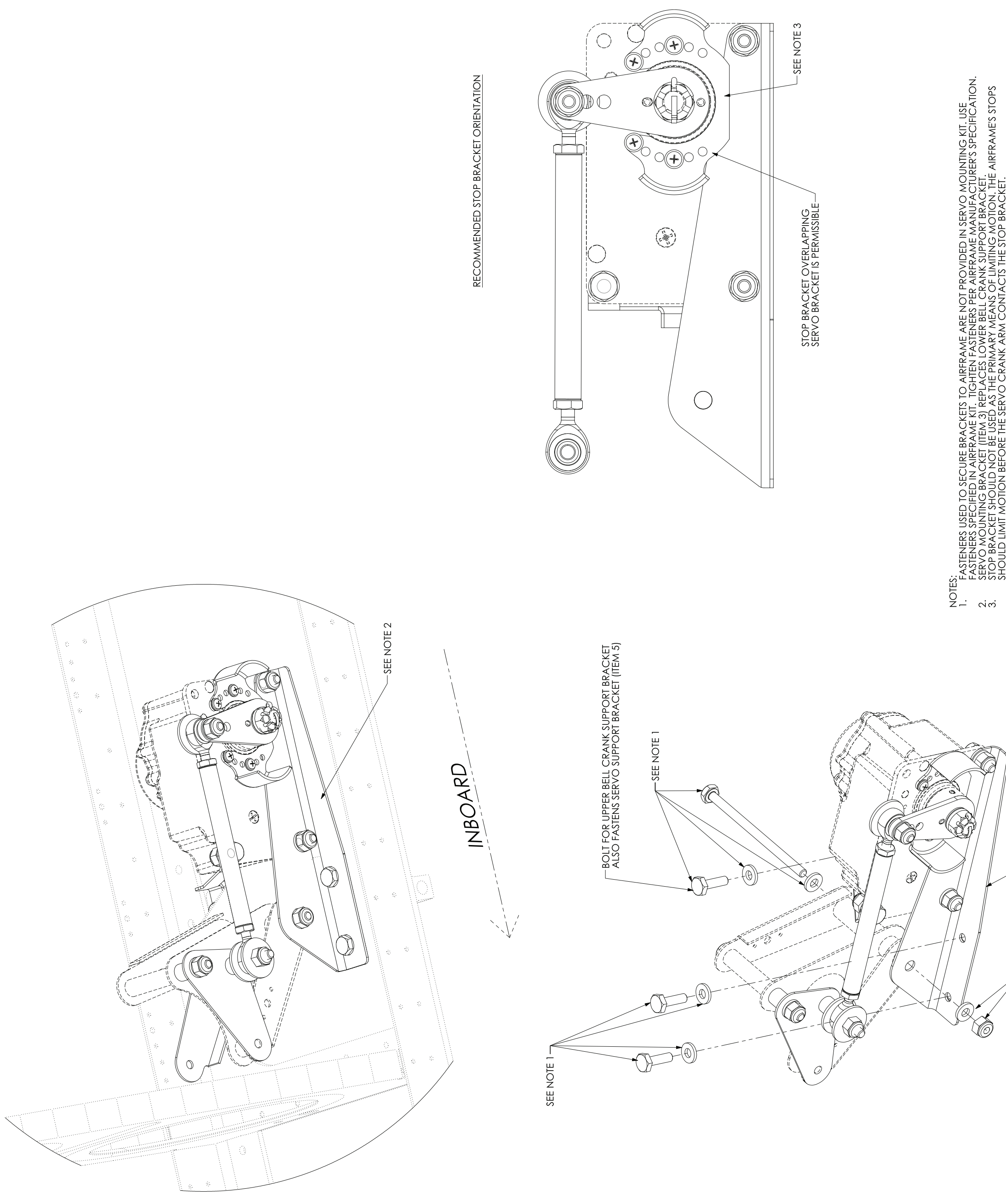
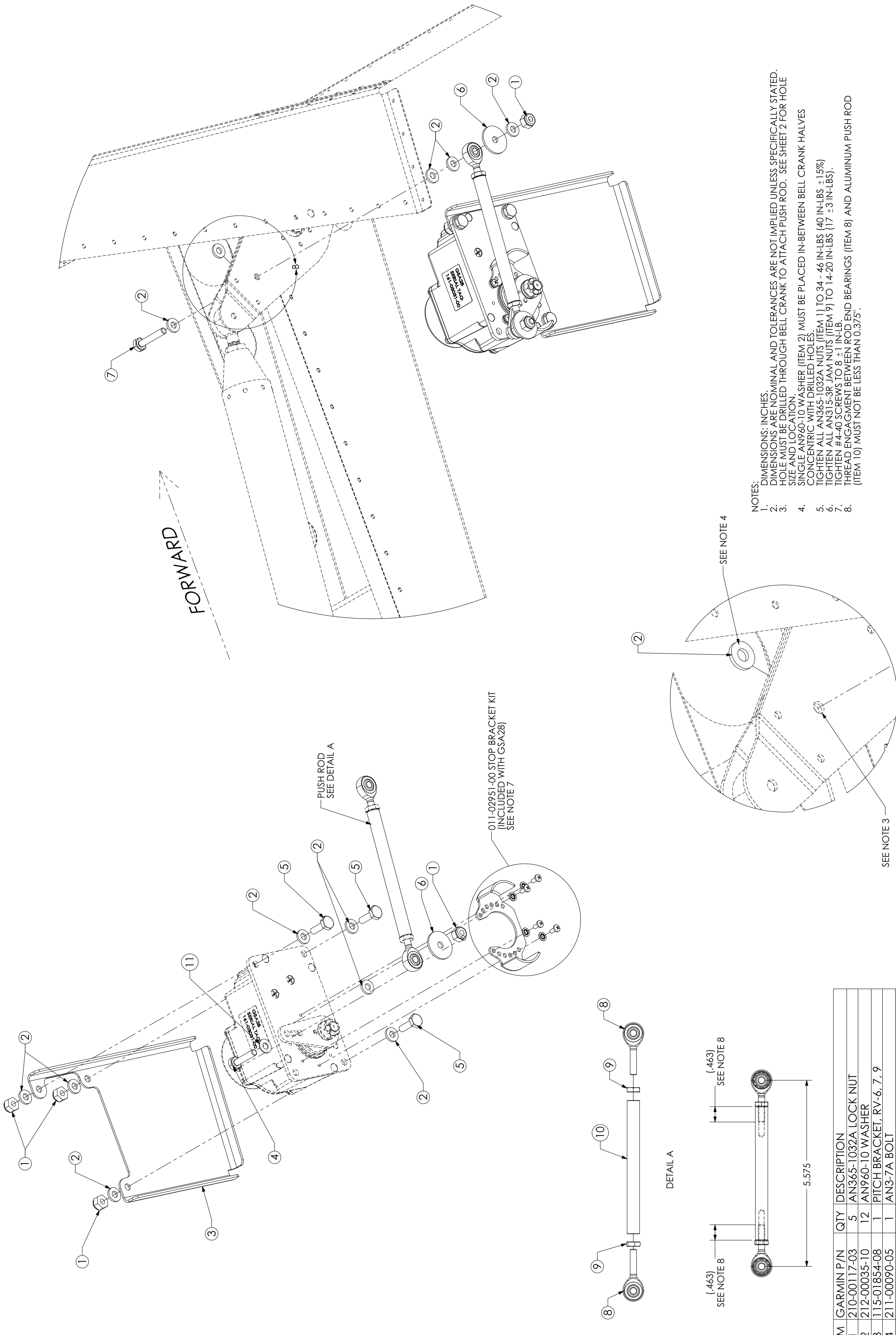


Figure 9-10.2 GSA 28 RV-9 Roll Mounting Kit 011-02952-13 (page 2 of 2)



NOTES:
1. DIMENSIONS: INCHES.
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. HOLE MUST BE DRILLED THROUGH BELL CRANK TO ATTACH PUSH ROD. SEE SHEET 2 FOR HOLE SIZE AND LOCATION.
4. SINGLE AN960-10 WASHER (ITEM 2) MUST BE PLACED IN-BETWEEN BELL CRANK HALVES CONCENTRIC WITH DRILLED HOLES.
5. TIGHTEN ALL AN365-1032A NUTS (ITEM 1) TO 34 - 46 IN-LBS (40 IN-LBS ±15%)
6. TIGHTEN ALL AN315-3R JAM NUTS (ITEM 9) TO 14-20 IN-LBS (17 ±3 IN-LBS).
7. TIGHTEN #4-40 SCREWS TO 8 ±1 IN-LB.
8. THREAD ENGAGMENT BETWEEN ROD END BEARINGS (ITEM 8) AND ALUMINUM PUSH ROD (ITEM 10) MUST NOT BE LESS THAN 0.375".

ITEM	GARMIN P/N	QTY	DESCRIPTION
1	210-00117-03	5	AN365-1032A LOCK NUT
2	212-00035-10	12	AN960-10 WASHER
3	115-01854-08	1	PITCH BRACKET, RV-6, 7, 9
4	211-00090-05	1	AN3-7A BOLT
5	211-00090-01	3	AN3-5A BOLT
6	212-00080-03	2	AN970-3 WASHER
7	211-00090-07	1	AN3-11A BOLT
8	382-00019-02	2	MALE ROD END BEARING
9	210-00116-03	2	AN315-3R JAM NUT
10	117-00542-03	1	PUSH ROD, 3/8" DIA, 4.00" LNG, TAPPED
11	212-00043-10	1	AN690-10L (THIN) WASHER

Figure 9-11.1 GSA 28 RV-6/7/9 Mounting Kit 011-02952-14 (page 1 of 2)

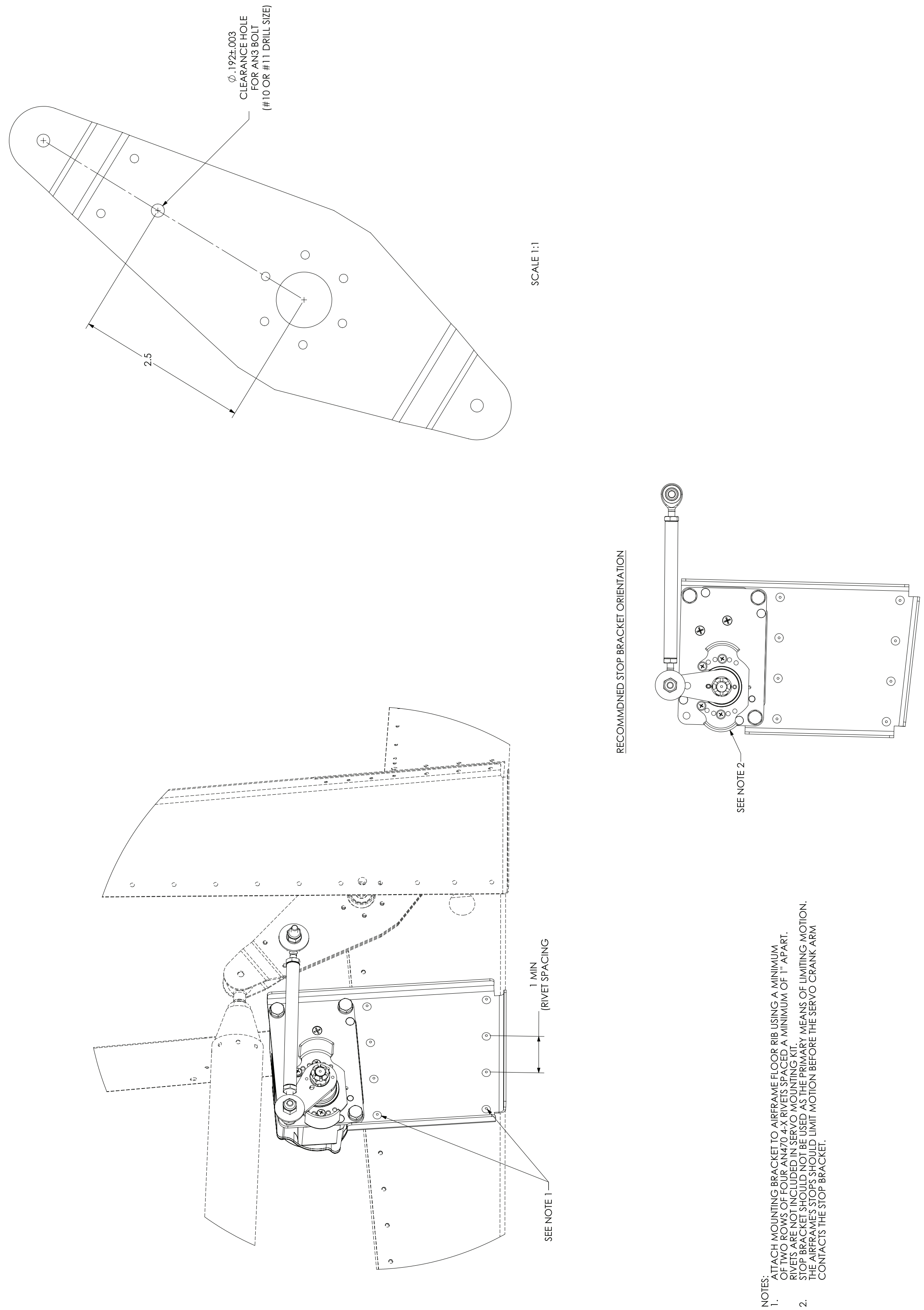
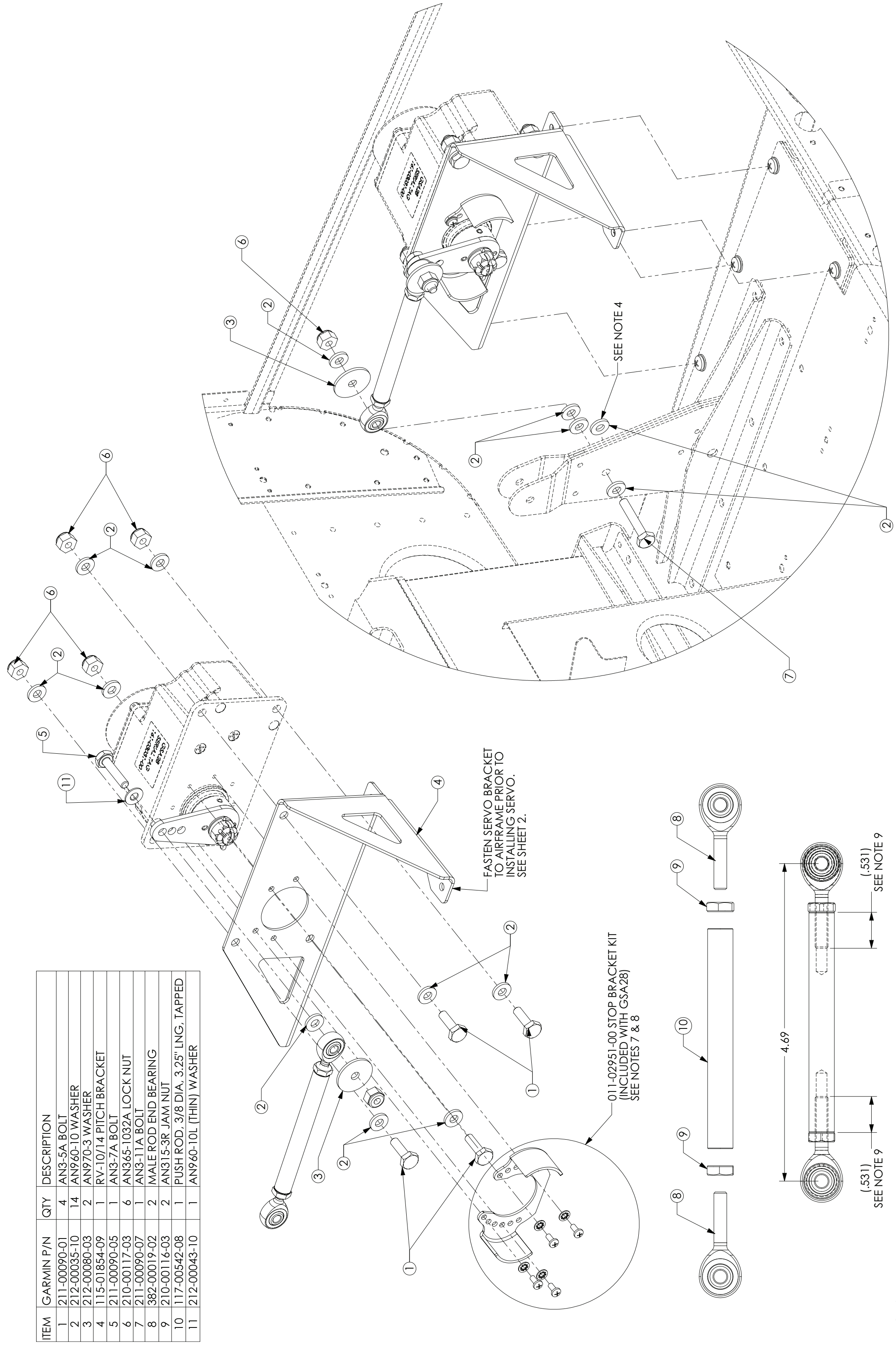


Figure 9-11.2 GSA 28 RV-6/7/9 Pitch Mounting Kit 011-02952-14 (page 2 of 2)



ITEM	GARMIN P/N	QTY	DESCRIPTION
1	211-00090-01	4	AN3-5A BOLT
2	212-00035-10	14	AN960-10 WASHER
3	212-00080-03	2	AN970-3 WASHER
4	115-01854-09	1	RV-10/14 PITCH BRACKET
5	211-00090-05	1	AN3-7A BOLT
6	210-00117-03	6	AN365-1032A LOCK NUT
7	211-00090-07	1	AN3-11A BOLT
8	382-00019-02	2	MALE ROD END BEARING
9	210-00116-03	2	AN315-3R JAM NUT
10	117-00542-08	1	PUSH ROD, 3/8 DIA, 3.25" LNG, TAPPED
11	212-00043-10	1	AN960-10L (THIN) WASHER

NOTES:
1. DIMENSIONS: INCHES
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. HOLE MUST BE DRILLED THORUGH BELL CRANK TO ATTACH PUSH ROD. SEE SHEET 2 FOR HOLE SIZE AND LOCATION.
4. SINGLE AN960-10 WASHER (ITEM 2) MUST BE PLACED IN-BETWEEN BELL CRANK HALVES CONCENTRIC WITH DRILLED HOLES.
5. TIGHTEN ALL AN365-1032A NUTS (ITEM 6) TO 34 - 46 IN-LBS (40 IN-LBS ±15%).
6. TIGHTEN ALL AN315-3R JAM NUTS (ITEM 9) TO 14 - 20 IN-LBS (17 ±3 IN-LBS).
7. TIGHTEN #4-40 SCREWS TO 8 ±1 IN-LBS.
8. STOP BRACKET SHOULD NOT BE USED AS THE PRIMARY MEANS OF LIMITING MOTION. THE AIRFRAME'S STOPS SHOULD LIMIT MOTION BEFORE THE SERVO CRANK ARM CONTACTS THE STOP BRACKET.
9. THREAD ENGAMENT BETWEEN ROD END BEARINGS (ITEM 8) AND ALUMINUM PUSH ROD (ITEM 10) MUST NOT BE LESS THAN 0.375".

Figure 9-12.1 GSA 28 RV-10 Pitch Mounting Kit 011-02952-15 (page 1 of 2)

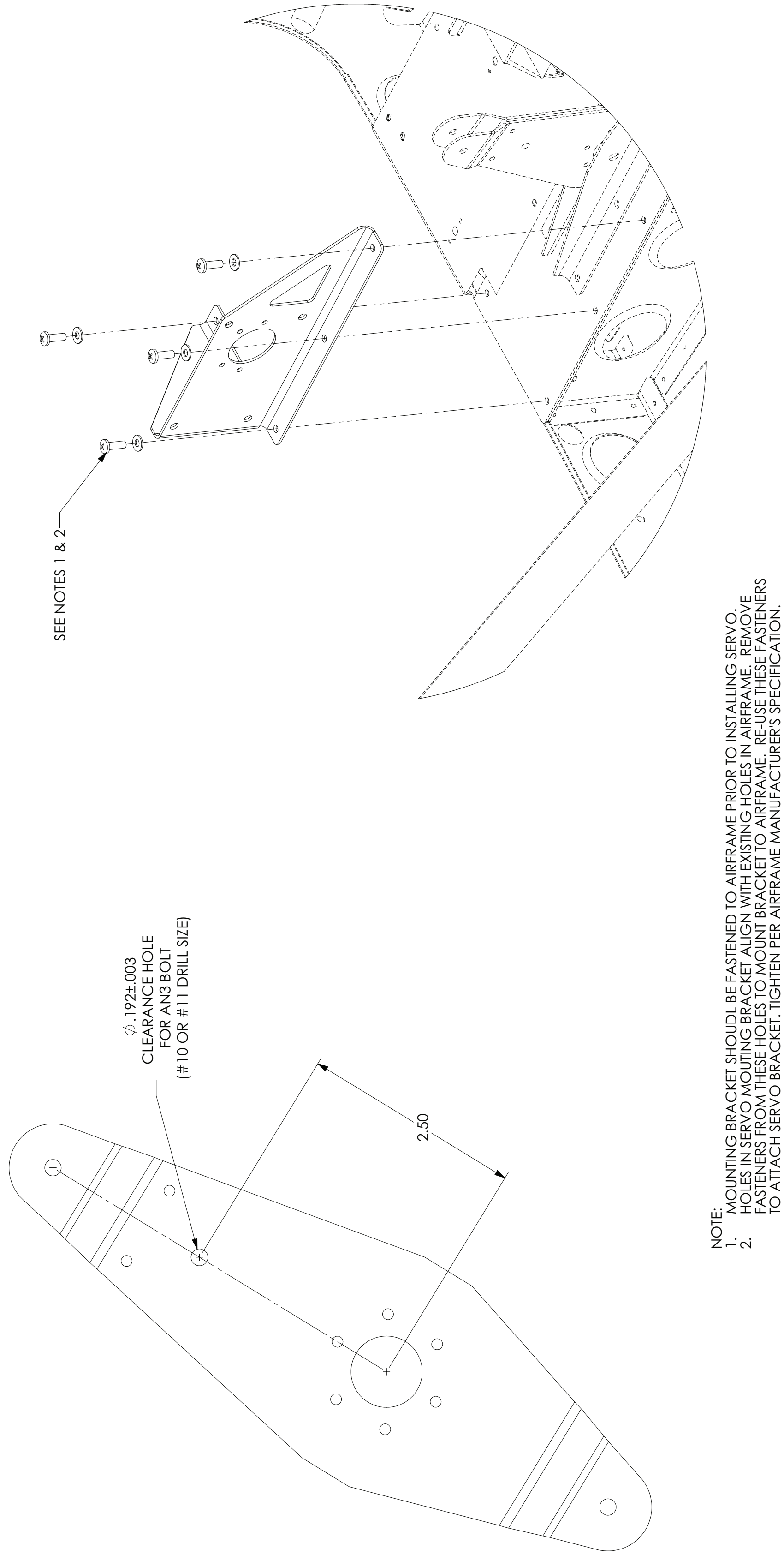


Figure 9-12.2 GSA 28 RV-10 Pitch Mounting Kit 011-02952-15 (page 2 of 2)

9.10 Post Installation Checkout

9.10.1 On Ground Initial Checkout

NOTE

The following post installation checkout must be followed after every completed installation. These steps should be followed when using a Garmin mounting kit or non-Garmin mounting parts to install the GSA 28.

After mounting the GSA 28, please complete the following steps prior to completing the first flight with the GSA 28.

1. Verify that the flight controls can move from stop to stop without binding or interference. Check that the GSA 28 output mechanism and added linkage do not come in contact with any part of the airframe while traveling though its full range of motion.
2. Verify that the travel of the flight controls is being limited by the airplane's primary stops and not the secondary stops provided by the GSA 28 stop bracket.
3. Ensure the structural integrity of the mounting bracket is adequate for the application and well secured to the airframe. Bracket deflection caused by normal servo loading and aircraft acceleration/vibration should be minimal. Also verify there are no cracks or sharp inside corners that could lead to fatigue failures.
4. Verify the fasteners used to mount the servo to the airframe are installed and have been tightened.
5. Make sure the AP DISC wire is correctly wired and tested.
6. If powering the servo through a "pullable" circuit breaker (recommended), ensure the circuit breaker is both accessible and easily identifiable to the pilot.
7. Repeat steps 1-7 for all GSA 28 servos in the aircraft.

9.11 General Autopilot Description (for configuration)

The GSA 28 based autopilot system is a fully integrated, high performance autopilot that can control up to three axes of an aircraft. Each GSA 28 servo is also capable of managing the trim control for its axis. The following four subsections (roll, pitch, yaw, and trim) are provided to aid the pilot/installer in understanding/configuring the Garmin GSA 28 autopilot system.

9.11.1 Roll Servo

All GSA 28 autopilot systems require a servo to control the roll axis of an aircraft. A single axis GSA 28 installation that controls only the roll axis is sometimes referred to as a “wing-leveler”.

The roll servo follows roll steering commands from the G3X display so the airplane will hold a desired roll angle, follow a desired heading, or follow the lateral component of a flight plan.

During the flight test phase of the autopilot checkout, the roll servo aggressiveness will be adjusted to get the desired in-fight performance. The “Roll Servo Gain” setting is used to set the aggressiveness of the roll servo. A larger number will cause the roll servo to more aggressively control the aircraft, and a smaller number will cause the roll servo to less aggressively control the aircraft.

9.11.2 Pitch Servo

Most GSA 28 autopilot systems consist of both a roll and pitch servo allowing for full 2-axis control of the aircraft.

The pitch servo follows vertical guidance commands from the G3X display so the airplane will hold a desired pitch angle, vertical speed, airspeed, or altitude, and also follow the vertical component of a flight plan.

Vertical control of the aircraft is all based on controlling the pitch angle with two additional sub-modes for vertical speed and airspeed. What this means is that the basic pitch mode performance must be properly adjusted before changing settings that adjust the vertical speed and airspeed based modes.

NOTE

Ensure pitch mode functionality is properly adjusted before attempting to adjust vertical speed or airspeed mode performance

During the flight test phase of the autopilot checkout, the pitch servo aggressiveness will be adjusted to get the desired in-fight performance. The “Pitch Servo Gain” setting is used to set the aggressiveness of the pitch servo. A larger number will cause the pitch servo to more aggressively control the aircraft, and a smaller number will cause the pitch servo to less aggressively control the aircraft.

9.11.3 Yaw Damper

The GSA 28 autopilot system can be expanded to support a yaw damper. A yaw damper will control the rudder to try and compensate or remove aircraft body yaw (tail wagging). The yaw damper will also try to null the lateral acceleration (center the ball) over the long term. The ball centering portion of the yaw damper is not a replacement for proper rudder trim.

NOTE

Yaw damper functionality requires a GMC 305 mode control panel.

During the flight test phase, the yaw damper is configured and set up after the basic two axis pitch and roll performance has been properly configured. This is done so the pilot can focus on properly adjusting the performance of each individual component of the autopilot system without trying to tune them all at once.

NOTE

Ensure basic autopilot functionality is properly adjusted before using the yaw damper.

During the flight test phase of the autopilot checkout, the yaw servo aggressiveness will be adjusted to get the desired in-fight performance. The "Yaw Servo Gain" setting is used to set the aggressiveness of the yaw servo. A larger number will cause the yaw servo to more aggressively control the aircraft, and a smaller number will cause the yaw servo to less aggressively control the aircraft.

9.11.4 Trim Control

The GSA28 autopilot servos can be used to control the trim system in an aircraft. When the autopilot is disengaged, the servos can adjust the trim speed based on the current aircraft airspeed. This allows the trim to run slower at high airspeeds and faster at low airspeeds. When the autopilot is engaged, the servos can adjust the trim control to minimize the force on the primary controls. This helps ensure the aircraft will be properly trimmed when the autopilot is later disengaged.

During the flight test phase, the trim system is configured and set up after the primary autopilot performance has been properly configured. This is done so the pilot can focus on properly adjusting the performance of the primary autopilot system without having the auto-trim functionality interfere.

NOTE

Ensure basic autopilot functionality is properly adjusted before enabling trim control for any servo.

9.12 Step by Step On-Ground Setup

9.12.1 Servo Wiring Checkout

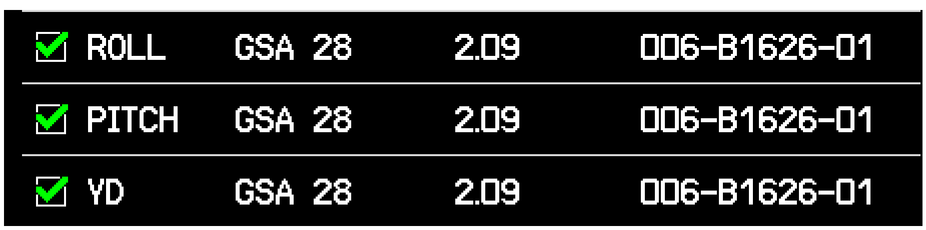
The first phase of setting up the Garmin autopilot system is to verify the proper wiring of the GSA 28 servos while on the ground.

1. If the installation is a 1-axis (roll only) autopilot, use the LRU page in configuration mode on the PFD to configure the "Autopilot Servos" for "Roll Only".

2. If you have installed a 2-axis (pitch and roll) autopilot, use the LRU page in configuration mode on the PFD to configure the "Autopilot Servos" for "Pitch + Roll".

3. If you have installed a 3-axis (pitch, roll, and yaw) autopilot, use the LRU page in configuration mode on the PFD to configure the "Autopilot Servos" for "Pitch + Roll + YD".

4. Go to the Main page in configuration mode and verify the Roll, Pitch, and Yaw servos are properly communicating with the system indicated by a green check box.



5. Go to the Main page in configuration mode and verify the CWS/DISCONNECT INPUT is properly wired for each servo.

   a) The CWS/DISCONNECT input should be LOW when the autopilot disconnect button is pressed.

   b) The CWS/DISCONNECT input should be OPEN when the autopilot disconnect button is NOT pressed.

c) The system will compare the CWS/DISCONNECT INPUT from all servos, press and hold the autopilot disconnect button for at least 5 seconds to verify there are no SYNC faults.

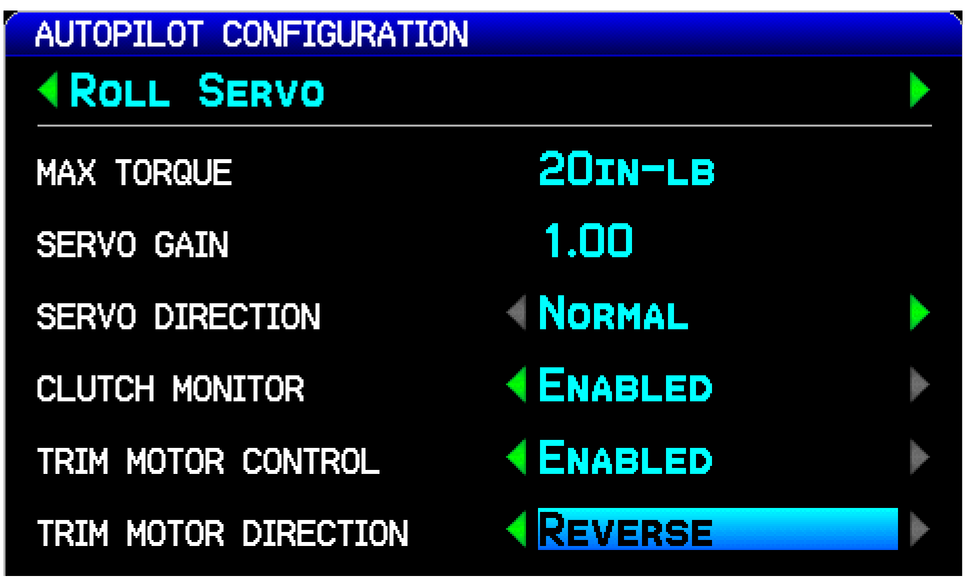
6. Go to the Main page in configuration mode and verify the proper TRIM ACTIVITY if the Roll servo is connected to an auxiliary trim motor.

a) Center the aileron trim switch to input no TRIM command. Verify the aileron trim switch is not moving. Verify the Roll servo is properly indicating no trim activity.

b) Use the aileron trim switch to input a roll right TRIM command. Verify the aileron trim switch properly moves for roll right trim. Verify the Roll servo is properly indicating ROLL RIGHT trim activity.

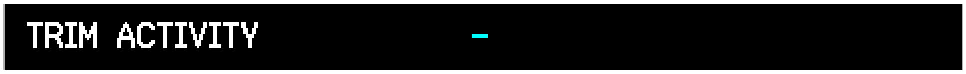
c) Use the aileron trim switch to input a roll left TRIM command. Verify the aileron trim switch properly moves for roll left trim. Verify the Roll servo is properly indicating ROLL LEFT trim activity.

d) If the aileron trim response is reversed, go to the AP CONFIG page and change the roll servo TRIM MOTOR DIRECTION to REVERSE, then repeat step all of step 6.



7. Go to the Main page in configuration mode and verify the proper TRIM ACTIVITY if the Pitch servo is connected to an auxiliary trim motor.

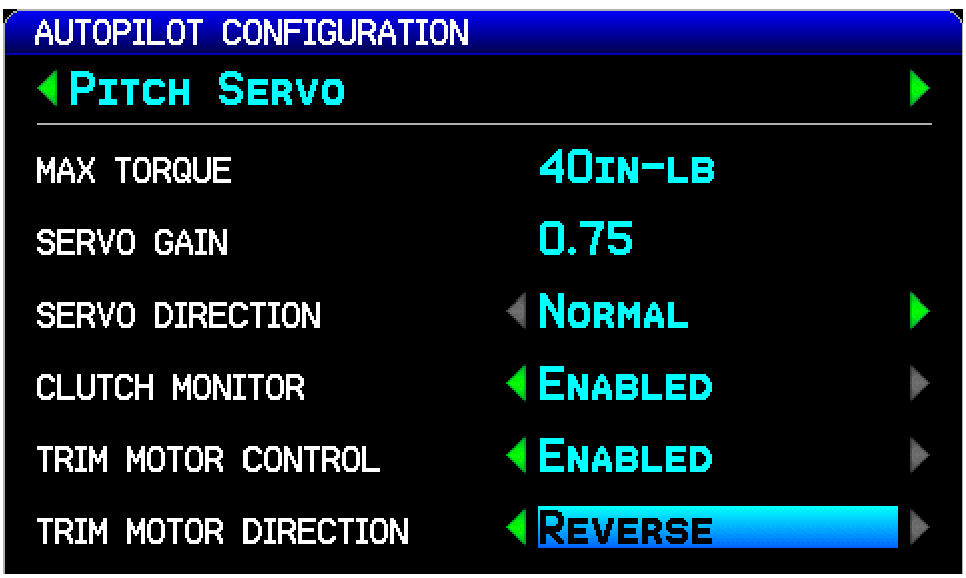
   a) Center the elevator trim switch to input no TRIM command. Verify the elevator trim switch is not moving. Verify the Pitch servo is properly indicating no trim activity.



   b) Use the elevator trim switch to input a nose up TRIM command. Verify the elevator trim switch properly moves for nose up trim. Verify the Pitch servo is properly indicating NOSE UP trim activity.

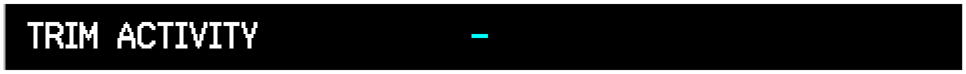
   c) Use the elevator trim switch to input a nose down TRIM command. Verify the elevator trim switch properly moves for nose down trim. Verify the Pitch servo is properly indicating NOSE DOWN trim activity.

   d) If the elevator trim response is reversed, go to the AP CONFIG page and change the pitch servo TRIM MOTOR DIRECTION to REVERSE, then repeat step all of step 7.



8. Go to the Main page in configuration mode and verify the proper TRIM ACTIVITY if the Yaw servo is connected to an auxiliary trim motor.

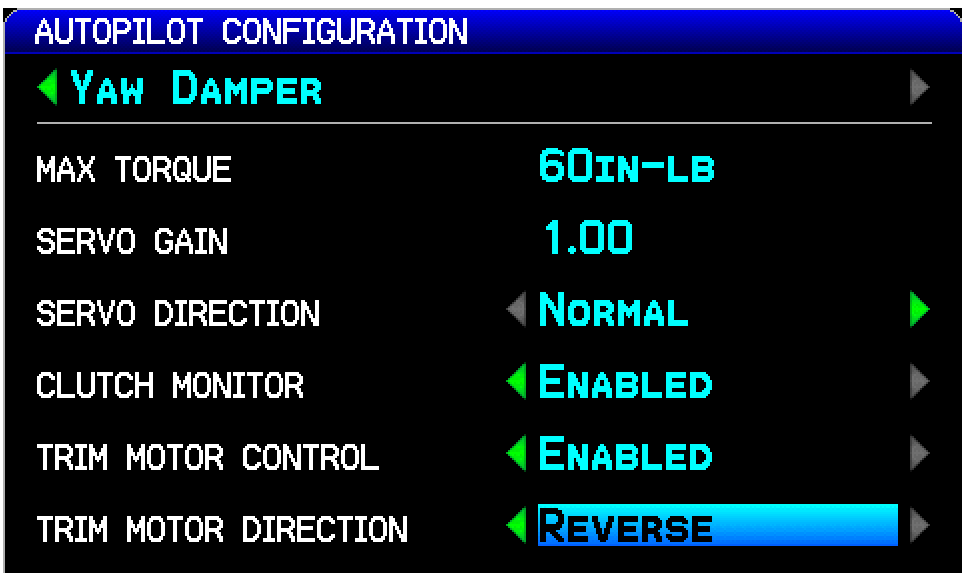
   a) Center the aircraft rudder trim switch to input no TRIM command. Verify the rudder trim switch is not moving. Verify the Yaw servo is properly indicating no trim activity.



   b) Use the rudder trim switch to input a yaw right TRIM command. Verify the rudder trim switch properly moves for yaw left trim. Verify the Yaw servo is properly indicating YAW RIGHT trim activity.

   c) Use the rudder trim switch to input a yaw left TRIM command. Verify the rudder trim switch properly moves for yaw left trim. Verify the Yaw servo is properly indicating YAW LEFT trim activity.

   d) If the rudder trim response is reversed, go to the AP CONFIG page and change the yaw damper TRIM MOTOR DIRECTION to REVERSE, then repeat step all of step 8.



9. Go to the AP page in configuration mode and navigate to the Roll Servo sub-section to configure the servo direction.
   a) The Servo Direction should be set to Normal. The servo arm should move clockwise to cause a bank left aileron movement and the servo arm should move counterclockwise to cause a bank right aileron movement.

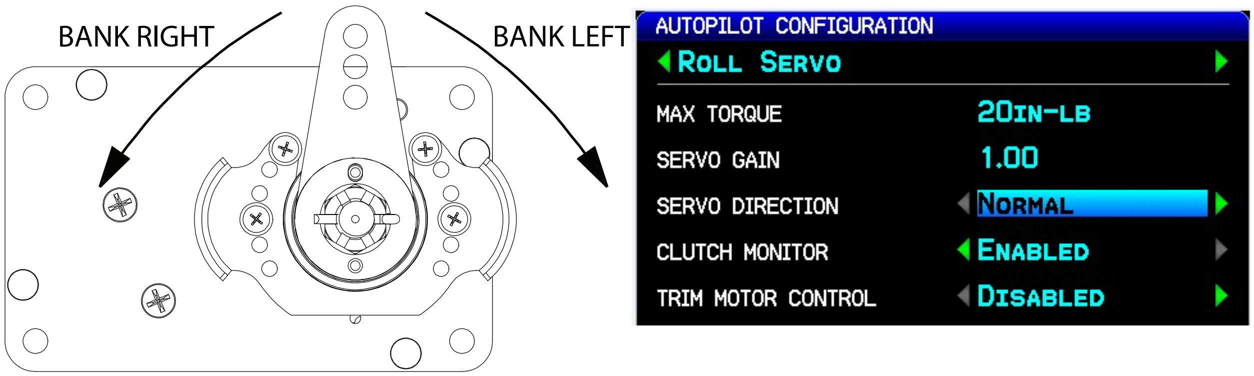


Figure 9-13 Normal Roll Servo Direction

   b) The Servo Direction should be set to Reverse. The servo arm should move clockwise to cause a bank right aileron movement and the servo arm should move counterclockwise to cause a bank left aileron movement.

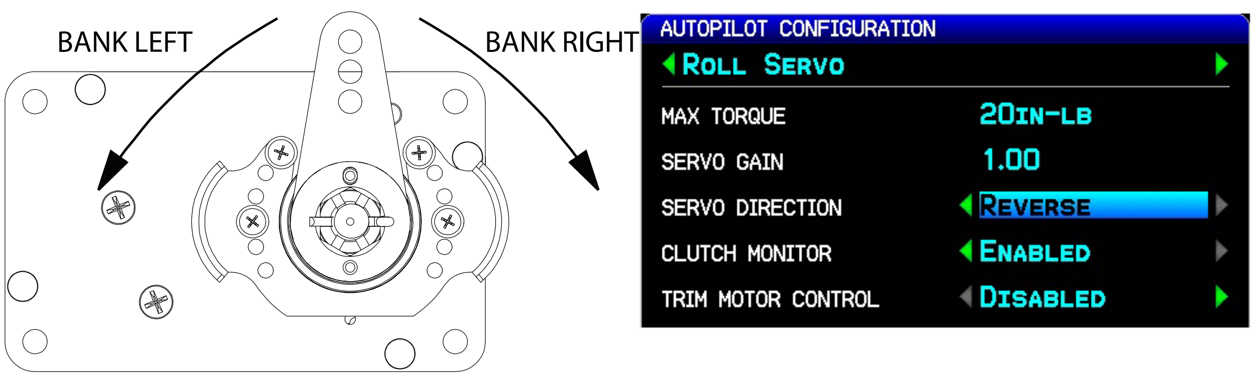


Figure 9-14 Reversed Roll Servo Direction

10. Go to the AP page in configuration mode and navigate to the Pitch Servo sub-section to configure the servo direction.

    a) The Servo Direction should be set to Normal. The servo arm should move clockwise to cause a nose down elevator movement and the servo arm should move counterclockwise to cause a nose up elevator movement.

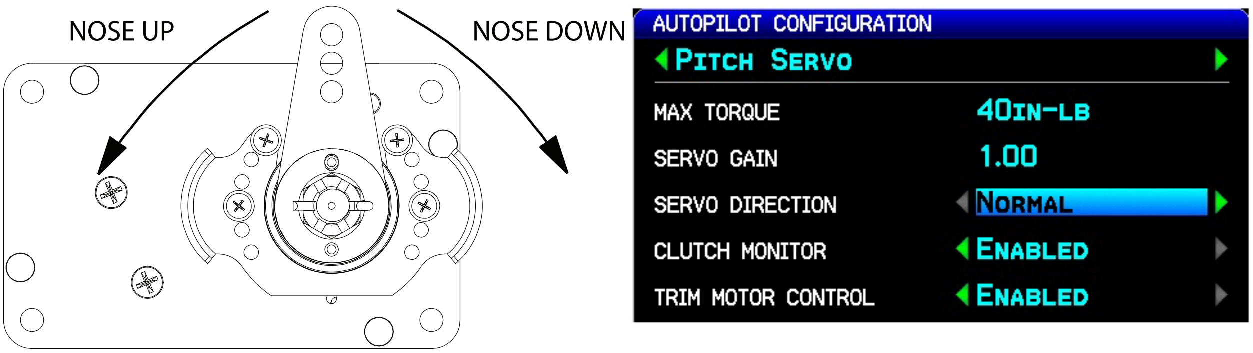


Figure 9-15 Normal Pitch Servo Direction

    b) The Servo Direction should be set to Reverse and the servo arm should move clockwise to cause a nose up elevator movement and the servo arm should move counterclockwise to cause a nose down elevator movement.

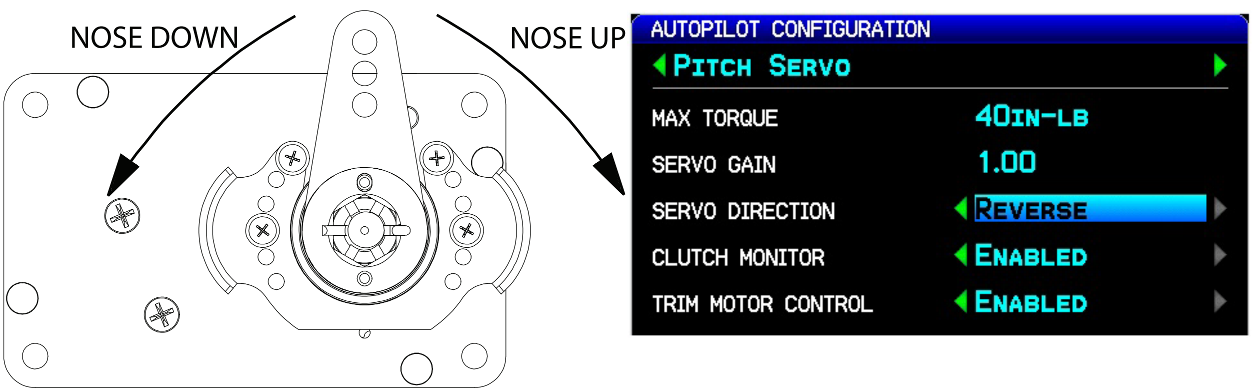


Figure 9-16 Reversed Pitch Servo Direction

11. Go to the AP page in configuration mode and navigate to the Yaw Servo sub-section to configure the servo direction.

    a) The Servo Direction should be set to Normal. The servo arm should move clockwise to cause a nose left rudder movement and servo arm should move counterclockwise to cause a nose right rudder movement.

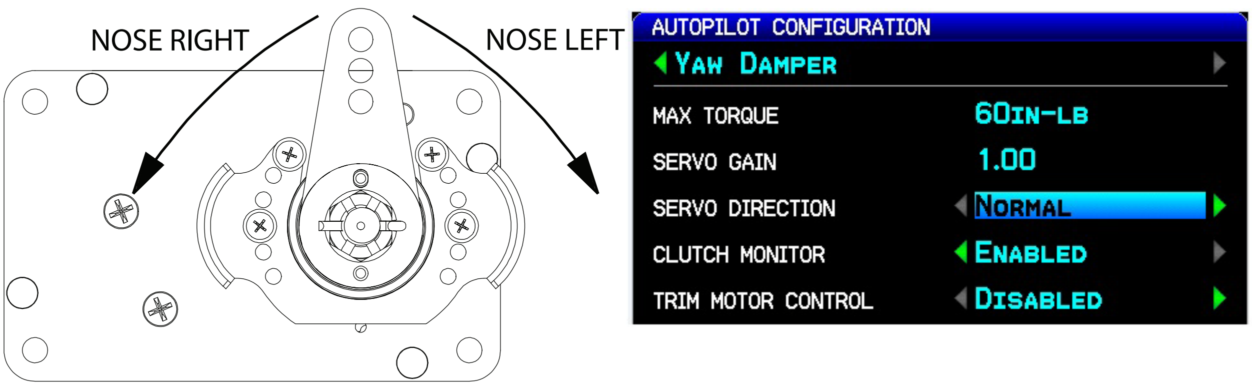


Figure 9-17 Normal Yaw Damper Direction

    b) The Servo Direction should be set to Reverse. The servo arm should move clockwise to cause a nose right rudder movement and the servo arm should move counterclockwise to cause a nose left rudder movement.

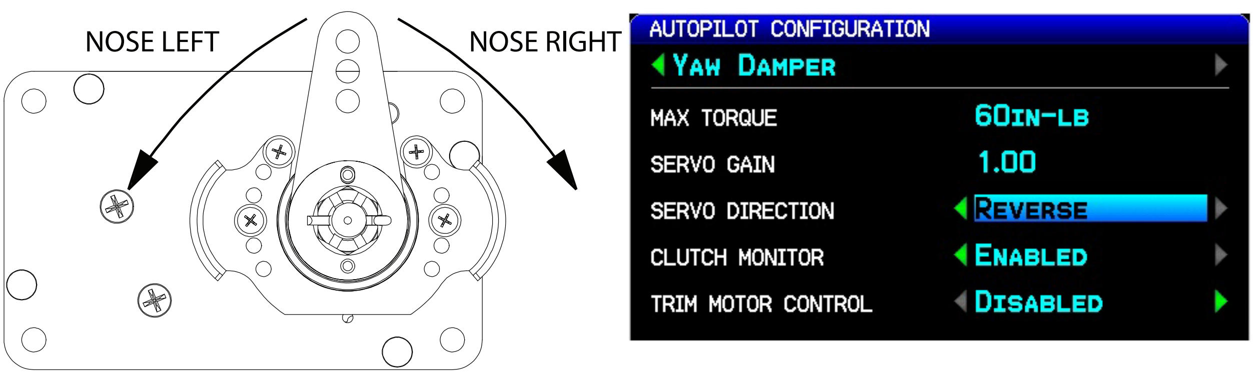
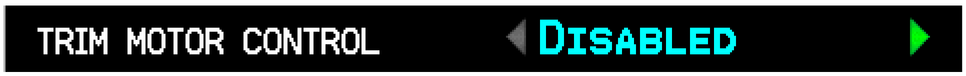


Figure 9-18 Reversed Yaw Damper Direction

12. Go to the AP page in configuration mode and verify the TRIM MOTOR CONTROL is disabled for all servos.

NOTE

Initial autopilot tuning is done with the trim control disabled to avoid the auto-trim function from interfering with the initial autopilot tuning.

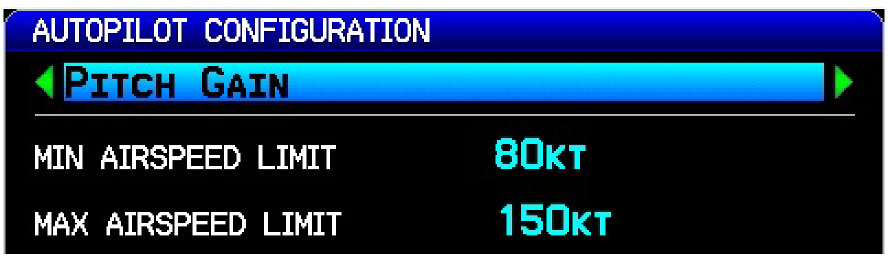


a) By disabling the TRIM MOTOR CONTROL, this will disable auto-trim and airspeed scheduled trim, but the pilot can still control trim in his aircraft using the normal manual electric trim inputs. Auto-trim and airspeed scheduled trim will be setup later in the autopilot setup procedure.

13. Go to the AP gain in configuration mode and set the proper min/max airspeed limits for the pitch servo. The pitch servo will lower or raise the nose of the aircraft to try and keep it inside these airspeed limits.

a) The min airspeed limit should be set above the stall speed of the aircraft with some margin.

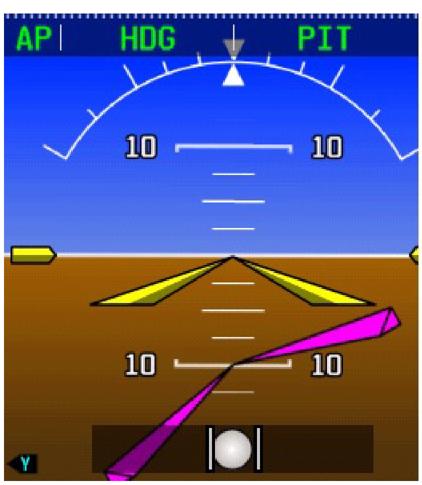
b) The max airspeed limit should be set below the never exceed speed of the aircraft with some margin.

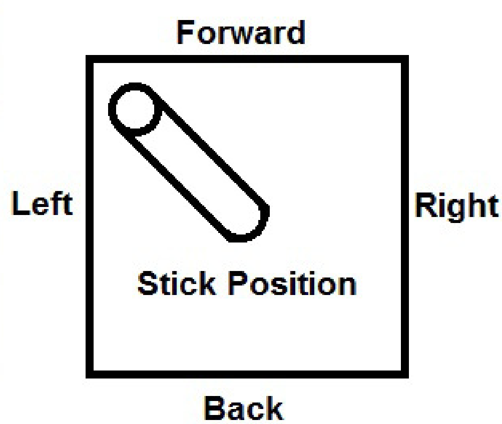


9.13 Autopilot Setup

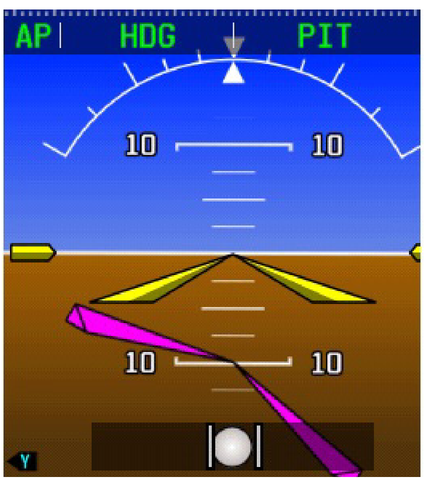
The next phase of setting up the Garmin autopilot system is to verify the proper functionality of the autopilot system on the ground in normal mode. This phase of the checkout requires a valid aircraft heading and pitch output from the ADAHRS. This means the post installation procedures must have already been completed on the ADAHRS before performing the on ground autopilot normal mode checkout.

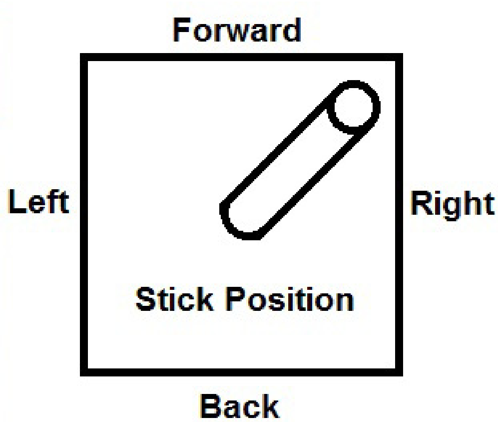
1. Leave the autopilot disengaged and verify the controls can be manipulated smoothly with no control system binding.
2. Engage the autopilot in HDG/PIT mode and command a nose down, left bank.
   a) With no GMC 305 Controller:
      i. Press the HDG/ROLL softkey on the PFD
      ii. Press the AP HDG softkey on the PFD
      iii. Push and hold the joystick to center the HDG bug
      iv. Rotate the joystick counter-clockwise to command a left turn
      v. Bump the joystick down to command a pitch down
   b) With a GMC 305 Controller:
      i. Press the AP button on the GMC 305
      ii. Press the HDG button on the GMC 305
      iii. Push the HDG softkey on the PFD
      iv. Push and hold the joystick on the PFD to center the HDG bug
      v. Rotate the joystick on the PFD counter-clockwise to command a left turn
      vi. Rotate the wheel on the GMC 305 to command a pitch down
3. Verify the stick properly moves in a direction that would cause the aircraft to pitch down and roll to the left smoothly with no control system binding.



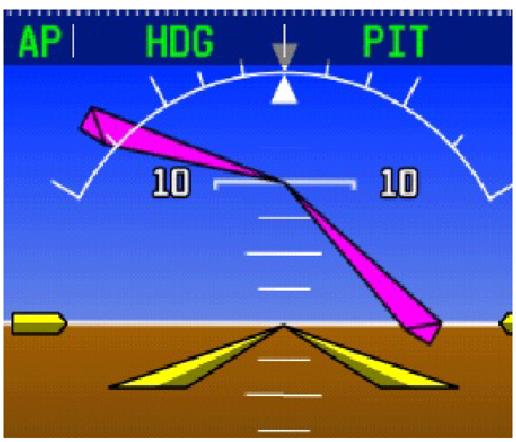


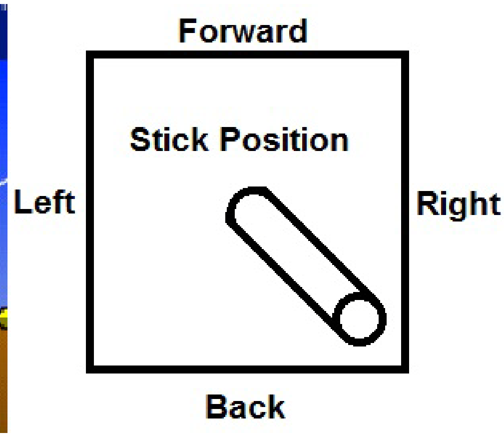
4. Engage the autopilot in HDG/PIT mode and command a nose down, right bank.
   a) With no GMC 305 Controller:
      i. Press the HDG/ROLL softkey on the PFD
      ii. Press the AP HDG softkey on the PFD
      iii. Push the joystick to center the HDG bug
      iv. Rotate the joystick clockwise to command a right turn
      v. Bump the joystick down to command a pitch down
   b) With a GMC 305 Controller:
      i. Press the AP button on the GMC 305
      ii. Press the HDG button on the GMC 305
      iii. Push the HDG softkey on the PFD
      iv. Push the joystick on the PFD to center the HDG bug
      v. Rotate the joystick on the PFD clockwise to command a right turn
      vi. Rotate the wheel on the GMC 305 down to command a pitch down
5. Verify the stick properly moves toward the nose and toward the right wing smoothly with no control system binding.



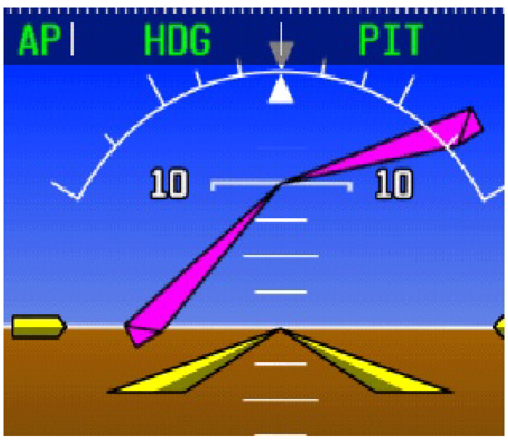


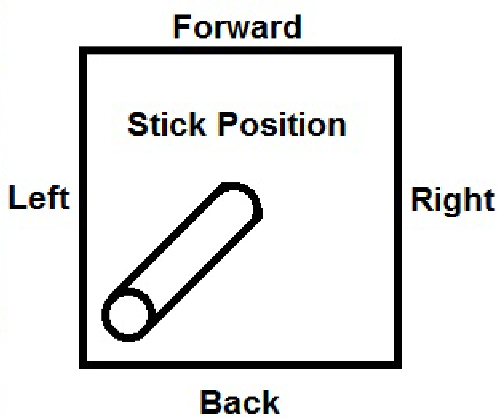
6. Engage the autopilot in HDG/PIT mode and command a nose up, right bank.
   a) With no GMC 305 Controller:
      i. Press the HDG/ROLL softkey on the PFD
      ii. Press the AP HDG softkey on the PFD
      iii. Push the joystick to center the HDG bug
      iv. Rotate the joystick clockwise to command a right turn
      v. Bump the joystick up to command a pitch up
   b) With a GMC 305 Controller:
      i. Press the AP button on the GMC 305
      ii. Press the HDG button on the GMC 305
      iii. Push the HDG softkey on the PFD
      iv. Push the joystick on the PFD to center the HDG bug
      v. Rotate the joystick on the PFD clockwise to command a right turn
      vi. Rotate the wheel on the GMC 305 up to command a pitch up
7. Verify the stick properly moves toward the tail and toward the right wing smoothly with no control system binding.





8. Engage the autopilot in HDG/PIT mode and command a nose up, left bank.
    a) With no GMC 305 Controller:
        i. Press the HDG/ROLL softkey on the PFD
        ii. Press the AP HDG softkey on the PFD
        iii. Push the joystick to center the HDG bug
        iv. Rotate the joystick counter-clockwise to command a left turn
        v. Bump the joystick up to command a pitch up
    b) With a GMC 305 Controller:
        i. Press the AP button on the GMC 305
        ii. Press the HDG button on the GMC 305
        iii. Push the HDG softkey on the PFD
        iv. Push the joystick on the PFD to center the HDG bug
        v. Rotate the joystick on the PFD counter-clockwise to command a left turn
        vi. Rotate the wheel on the GMC 305 up to command a pitch up
9. Verify the stick properly moves toward the tail and toward the left wing smoothly with no control system binding.



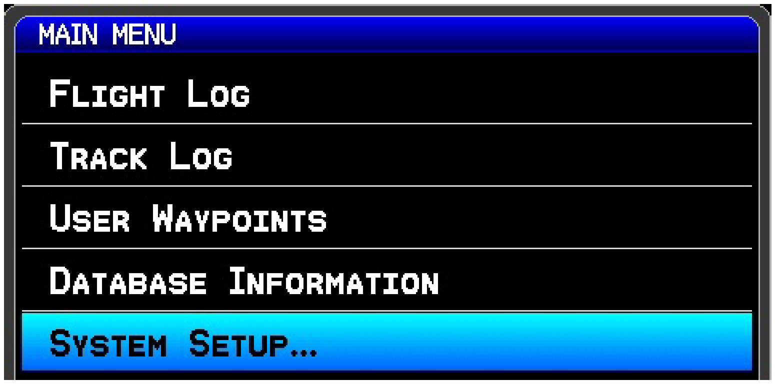


10. If the stick position does not move the correct direction, correct the roll and pitch servo directions documented in Section 9.12.1 Step 9 and Step 10.

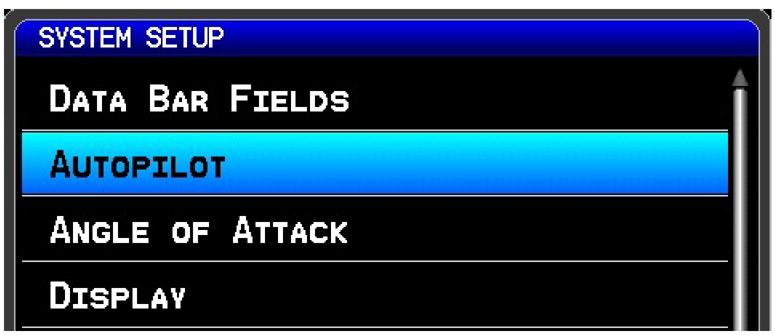
11. Engage the autopilot and verify it can be overpowered in both the pitch and roll axis. If the autopilot cannot be overpowered, use the Autopilot Setup screen to reduce the MAX TORQUE setting for the associated servo.

    a) Press MENU two times on the GDU to enter the MAIN MENU page.

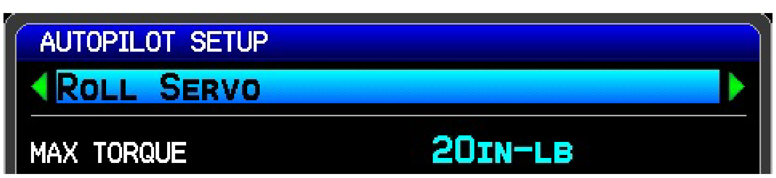
    b) Select the SYSTEM SETUP page.



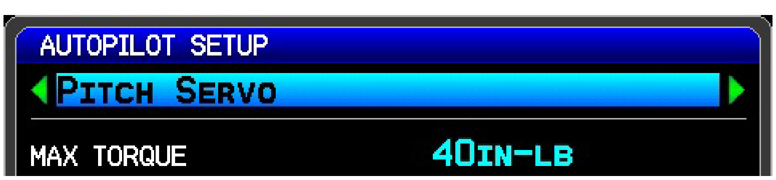
    c) Select the AUTOPILOT page.



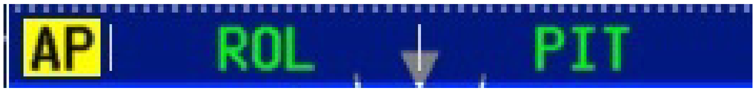
    d) Select ROLL SERVO and set the MAX TORQUE.



    e) Select PITCH SERVO and set the MAX TORQUE.



12. Engage the autopilot and verify that is properly disconnects with a short press and release of the CWS/DISCONNECT button.



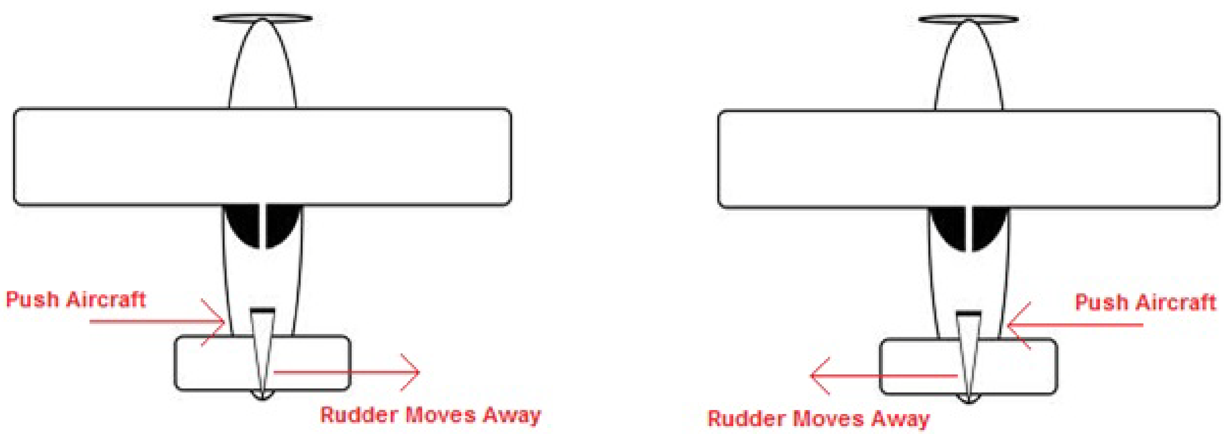
a) If the audio output of the G3X system is connected to the aircraft audio system, verify the pilot hears an autopilot disconnect tone when disconnecting the autopilot.

9.14 Yaw Damper Setup

The next phase of setting up the Garmin autopilot system is to verify the proper functionality of the yaw damper system on the ground in normal mode. This phase of the checkout requires a valid output from the ADAHRS. This means the post installation procedures must have been completed on the ADAHRS before performing the on ground autopilot normal mode checkout.

1. Leave the yaw damper disengaged and verify the rudder pedals can be manipulated smoothly with no control system binding.
2. Engage the autopilot in YD mode.
   a) With no GMC 305 Controller:
      i. YD not supported
   b) With a GMC 305 Controller:
      i. Press the YD button on the GMC 305

3. Verify the rudder properly moves to the correct direction by standing by the tail of the aircraft, facing the vertical stabilizer, and pushing on the fuselage. The rudder should move AWAY from you (the rudder should move in the same direction that the rear fuselage is moving):



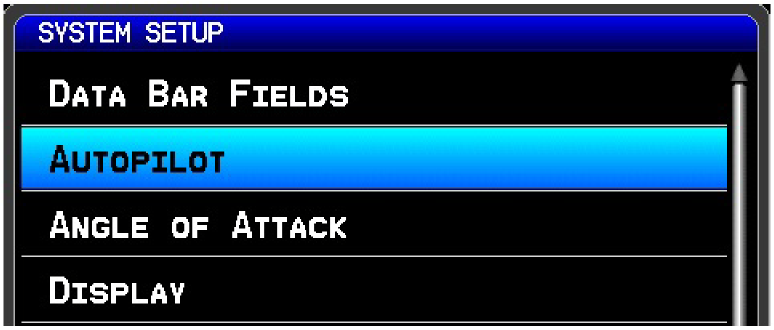
   a) If the rudder does not move the correct direction, correct the yaw servo direction documented in Section 9.14 Step 11.

4. Engage the yaw damper and verify it can be overpowered in yaw axis using rudder pedal inputs. If the autopilot cannot be overpowered, use the Autopilot Setup screen to reduce the MAX TORQUE setting for the yaw damper servo:

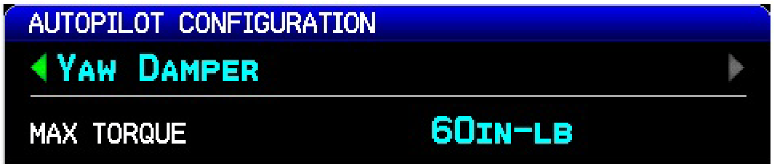
    a) Press MENU two times on the GDU to enter the MAIN MENU page.

    b) Select the SYSTEM SETUP page.

    c) Select the AUTOPILOT page.



    d) Select YAW DAMPER and set the MAX TORQUE.



5. The CWS/DISCONNECT input can optionally be connected to the Yaw Damper. If this connection was made, engage the yaw damper and verify that is properly disconnects with a short press and release of the CWS/DISCONNECT button.

    a) If the audio output of the G3X system is connected to the aircraft audio system, verify the pilot hears an autopilot disconnect tone when disconnecting the autopilot.

9.15 Step By Step In-Air Autopilot Setup

The next phase of setting up the Garmin autopilot system is to verify and tune the proper functionality of the autopilot system in the air.

WARNING

This stage of the flight test involves allowing the GSA28 autopilot servos to manipulate the flight control surfaces of the aircraft. Extreme caution should be used during the initial engagement of the autopilot system. The pilot should always have easy access to the autopilot disconnect button so he can disconnect the autopilot and take control of the aircraft at anytime.

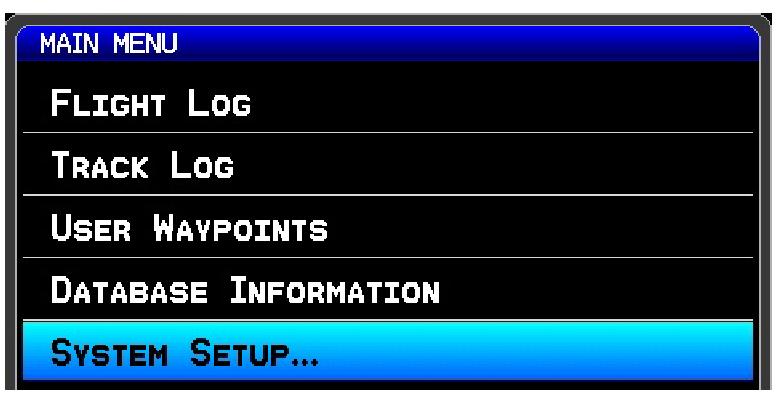
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- Quick access to autopilot disconnect
- Safe altitude above and away from all terrain and obstacles
- No air traffic in the area
- Safe airspeed below maneuvering speed (V_A)

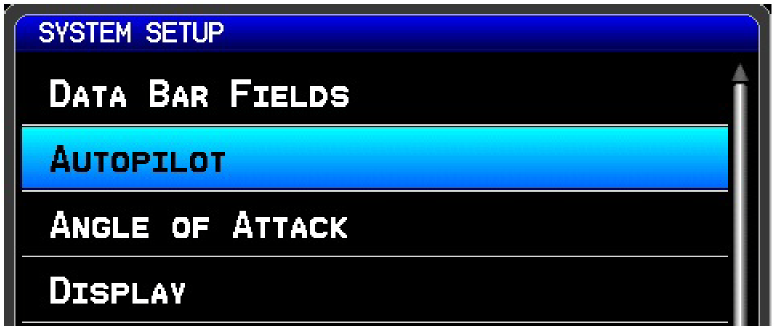
9.15.1 Roll Servo

1. Use the AUTOPILOT SETUP page to adjust the ROLL SERVO gain setting
    a) Engage the autopilot in ROL/PIT mode with the aircraft approximately level
        i. With no GMC 305 Controller:
            1.Press, hold, and release the CWS/DISCONNECT button to engage the AP
        ii. With a GMC305 Controller
            1.Press the AP button on the GMC305 to engage the AP
            2.Press the YD button on the GMC305 to DISENGAGE the YD

    b) Press MENU two times on the GDU to enter the MAIN MENU page.
    c) Select the SYSTEM SETUP page.



d) Select the AUTOPILOT page.



e) Select ROLL SERVO page and highlight the SERVO GAIN entry.

f) Adjust the servo gain so that the aircraft properly responds to the roll guidance from the flight director

i. Overpower the autopilot to fly away from the current flight director commanded roll

ii. Release controls and monitor autopilot response and closure back to commanded roll

iii. Set the SERVO GAIN higher to make the autopilot more aggressive

iv. Set the SERVO GAIN lower to make the autopilot less aggressive

2. The roll servo has additional advanced and expert level settings that can be adjusted to achieve the desired lateral mode performance. These settings are detailed in Section 9.17 below and should only be adjusted after studying the description to properly understand their effect on the roll servo.

9.15.2 Pitch Servo

1. Use the AUTOPILOT SETUP page to adjust the PITCH SERVO gain setting

a) Engage the autopilot in ROL/PIT mode with the aircraft approximately level

i. With no GMC 305 Controller:

1.Press, hold, and release the CWS/DISCONNECT button to engage the AP

ii. With a GMC 305 Controller:

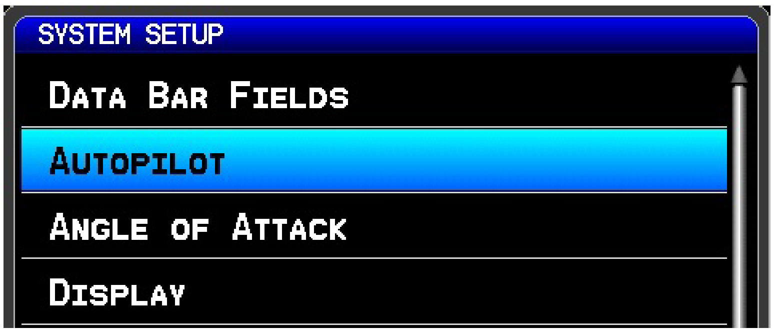
1.Press the AP button on the GMC305 to engage the AP

2.Press the YD button on the GMC305 to DISENGAGE the YD

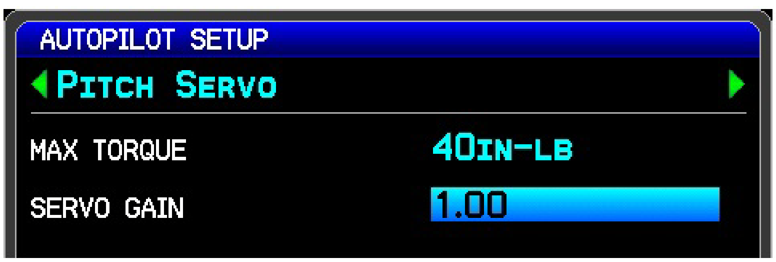
b) Press MENU two times on the GDU to enter the MAIN MENU page.

c) Select the SYSTEM SETUP page.

d) Select the AUTOPILOT page.



e) Select PITCH SERVO page and highlight the SERVO GAIN entry.



f) Adjust the servo gain so that the aircraft properly responds to the pitch guidance from the flight director

i. Overpower the autopilot to fly away from the current flight director commanded pitch

ii. Release controls and monitor autopilot response and closure back to commanded pitch

iii. Set the SERVO GAIN higher to make the autopilot more aggressive

iv. Set the SERVO GAIN lower to make the autopilot less aggressive

2. The pitch servo has additional advanced and expert level settings that can be adjusted to achieve the desired vertical mode performance. These settings are detailed in Section 9.17 below and should only be adjusted after studying the description to properly understand their effect on the roll servo.

9.15.3 Yaw Damper Setup

The next phase of setting up the Garmin yaw damper system is to verify and tune the proper functionality of the yaw damper system in the air.

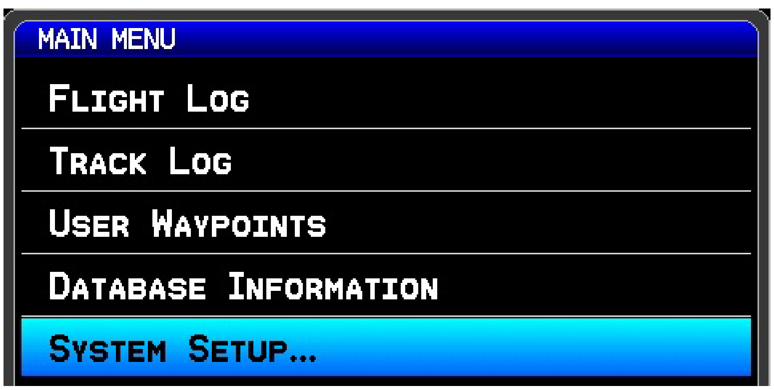
WARNING

This stage of the flight test involves allowing the GSA28 autopilot servos to manipulate the flight control surfaces of the aircraft. Extreme caution should be used during the initial engagement of the autopilot system. The pilot should always have easy access to the autopilot disconnect button so he can disconnect the autopilot and take control of the aircraft at anytime.

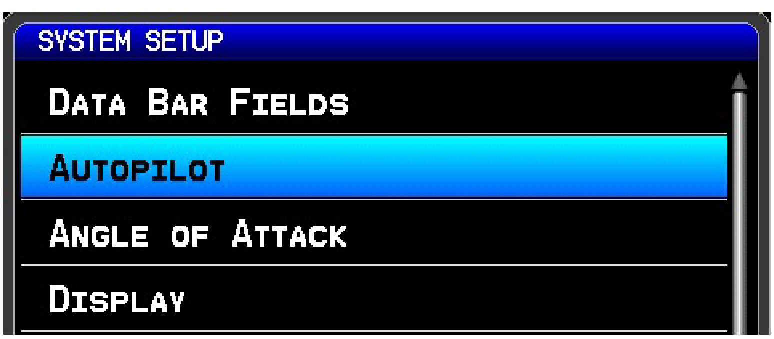
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- Quick access to autopilot disconnect
- Safe altitude above and away from all terrain and obstacles
- No air traffic in the area
- Safe airspeed below maneuvering speed (V_A)

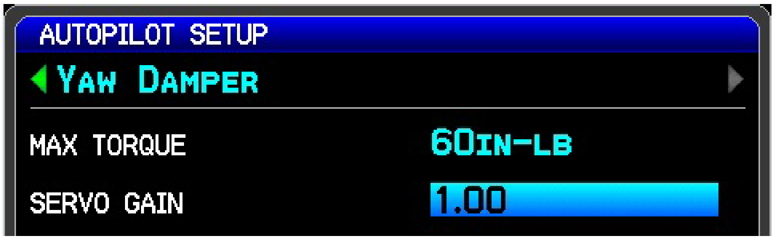
1. Use the AUTOPILOT SETUP page to adjust the YAW DAMPER gain setting
   a) Press MENU two times on the GDU to enter the MAIN MENU page.
   b) Select the SYSTEM SETUP page.



   c) Select the AUTOPILOT page.



d) Select YAW DAMPER page and highlight the SERVO GAIN entry.



e) Adjust the servo gain so that the aircraft properly responds to the yaw body rates (tail wagging)

i. Engage the autopilot in LVL mode with the aircraft approximately level

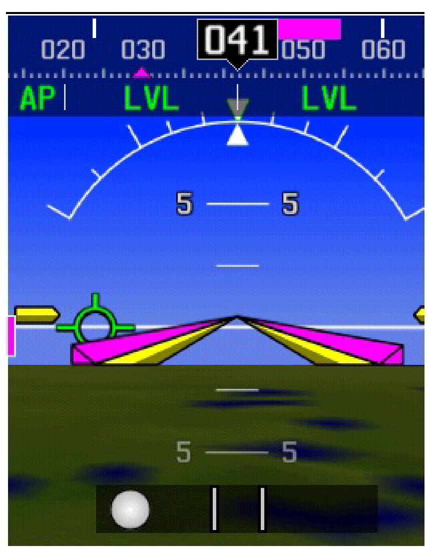
ii. With a GMC 305 Controller

1. Press the LVL button on the GMC 305 to engage the AP in LVL mode

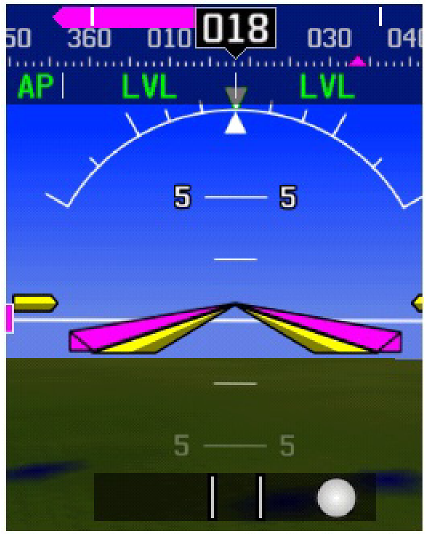
2. Press the YD button on the GMC 305 to disengage the YD

iii. Fly a yaw doublet and engage the YD as the ball swings through the center

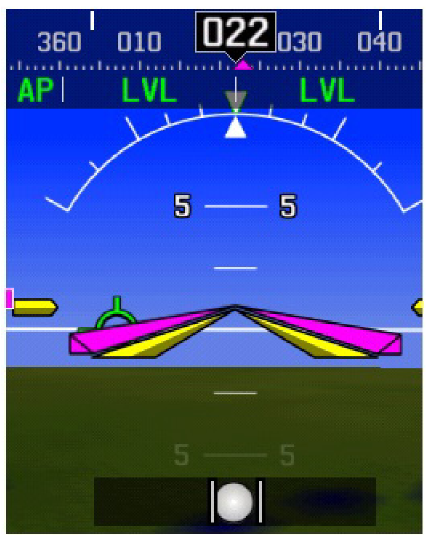
1. Right foot rudder to swing ball left



2.Left foot rudder to swing ball back right



3.Engage YD by pressing the YD button onthe GMC 305 as ball swings through the center



4.Set SERVO GAIN so the established yaw body rate from the yaw doublet is properly dampened out

a.Set the SERVO GAIN higher to make the yaw damper more aggressive

b.Set the SERVO GAIN lower to make the yaw damper less aggressive

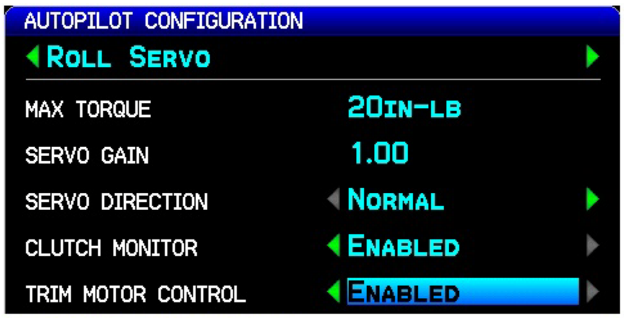
2. The yaw servo has additional advanced and expert level settings that can be adjusted to achieve the desired yaw damping performance. These settings are detailed in Section 9.17 below and should only be adjusted after studying the description to properly understand their effect on the yaw servo.

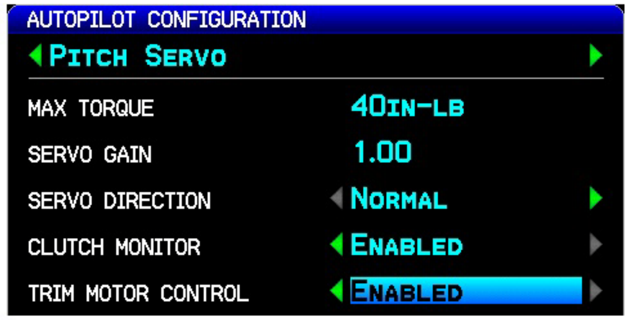
9.16 Step by Step Trim System Setup

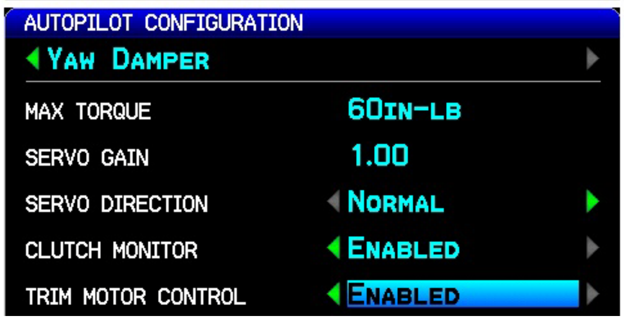
9.16.1 On-ground Setup

After setting up and testing the GSA28 based autopilot and yaw damper systems, the pilot can configure the trim system.

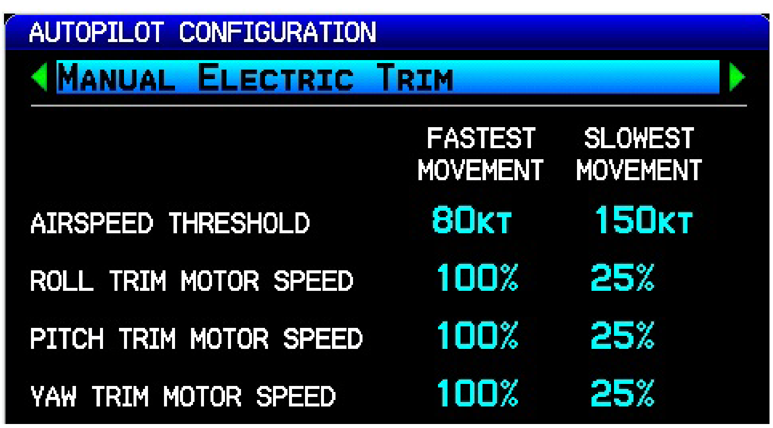
1. Go to the AP pages in configuration mode and enable the TRIM MOTOR CONTROL for all servos that are connected to auxiliary trim motors.







2. Go to the MANUAL ELECTRIC TRIM page and set the airspeed thresholds for fastest and slowest trim movement.
   a) Recommend setting the fastest movement airspeed to the airspeed typically used to fly the normal aircraft landing pattern.
   b) Recommend setting the slowest movement airspeed to the airspeed typically used for cruise flight.
   c) Recommend setting the fastest motor speed 100% (will be adjusted later in flight)
   d) Recommend setting the slowest motor speed to 25% (will be adjusted later in flight)



3. Re-verify proper trim movement in described in Section 9.12.1 Steps 6, 7, & 8.

9.16.2 In Air Setup

The next phase of setting up the Garmin GSA28 based trim control system is to verify and set the proper functionality of the trim system in the air.

WARNING

This stage of the flight test involves allowing the GSA28 autopilot servos to manipulate the flight control surfaces of the aircraft. Extreme caution should be used during this phase of the flight test. The pilot should always have easy access to the autopilot disconnect button so he can disconnect the autopilot and take control of the aircraft at anytime.

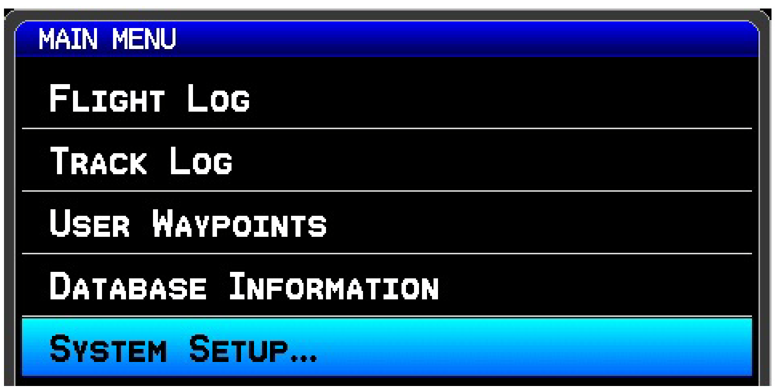
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- Quick access to autopilot disconnect
- Safe altitude above and away from all terrain and obstacles
- No air traffic in the area
- Safe airspeed below maneuvering speed (V_A)

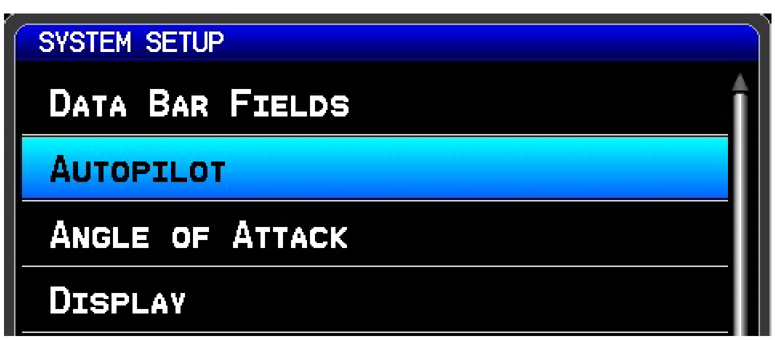
1. Use the AUTOPILOT SETUP page to adjust the TRIM MOTOR SPEED to get the desired manual electric trim response.

   a) Press MENU two times on the GDU to enter the MAIN MENU page.

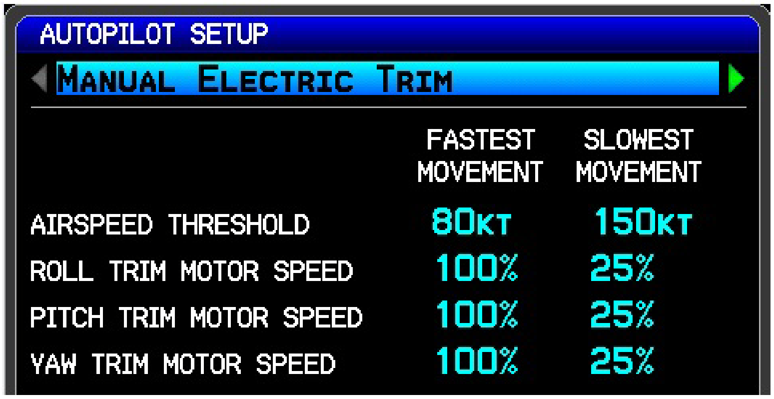
   b) Select the SYSTEM SETUP page.



   c) Select the AUTOPILOT page.



d) Select MANUAL ELECTRIC TRIM page and highlight the various trim motor speeds



e) Adjust the trim motor speeds at the two airspeed thresholds to get a desirable trim response

i. Trim aircraft using manual electric trim inputs

ii. Trim response should not be overly slow

iii. Trim response should not be overly fast

9.17 Detailed Autopilot Configuration Options

The installer needs to make the following autopilot configuration selections when setting up the GSA 28 based autopilot system.

9.17.1 General Configuration Page

These selections are made in configuration mode using the AP CONFIG page.

Table 9-10 General Autopilot Configuration Settings

Configuration Setting	Description
Control Wheel Steering (Configuration mode only)	The CWS/DISCONNECT discrete input to the GSA 28 servos is connected to a momentary pushbutton which can function either as a dedicated Autopilot Disconnect (AP DISC) button, or as a combined Autopilot Disconnect / Control Wheel Steering (AP/CWS) button. Regardless of configuration, a short press and release of the AP DISC or AP/CWS button will disengage the autopilot if it is engaged. If Control Wheel Steering is enabled, the pressing and holding the AP/CWS button places the autopilot into CWS mode. In CWS mode, the servos are temporarily disengaged, allowing hand-flying the aircraft to a new aircraft attitude while continuing to hold the AP/CWS button. When the AP/CWS button is released, the autopilot exits CWS mode and the flight director synchronizes to the current aircraft attitude (if applicable for the current flight director modes). If Control Wheel Steering is disabled, CWS is not supported and the AP button serves as a dedicated AP DISC button only. The AP DISC button will disconnect the autopilot any time it is pressed, regardless of how long it is held.
Engage AP Via CWS Input (Configuration mode only)	If Control Wheel Steering is enabled, the AP/CWS button can optionally be configured to engage the autopilot when pressed and held. If "Engage AP Via CWS Input" is enabled, the autopilot will automatically engage when the AP/CWS button is pressed and held. If "Engage AP Via CWS Input" is disabled, pressing the AP/CWS button while the autopilot is not engaged has no effect. In this state, the autopilot can only be engaged using the GMC 305 AP button or the softkeys on the PFD display.

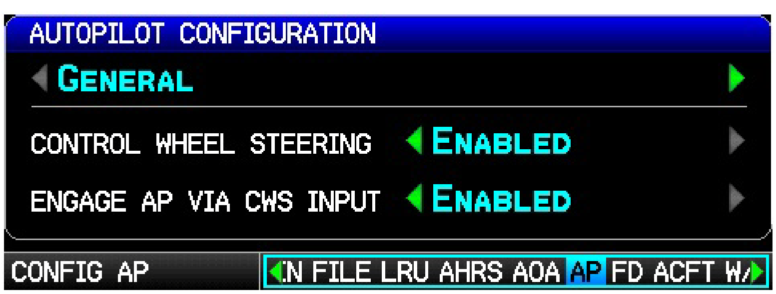


Figure 9-19 General Autopilot Configuration Page

9.17.2 Roll Servo Configuration

The installer needs to make the following roll servo configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode using the AP CONFIG page and the roll servo setup screen in the autopilot setup menu in normal mode.

Table 9-11 Roll Servo Autopilot Configuration Settings

Configuration Setting	Description
Max Torque	The GSA 28 roll servo has a configurable maximum torque setting. This determines how much torque the servo will output before the electronic slip clutch begins to slip. The Max Torque setting should be set high enough to not slip during in flight air loading, but the torque setting should be low enough for the pilot to override the autopilot if required. The Max Torque setting can be adjusted from 10 to 60 inch-pounds in 5 inch-pound steps.
Servo Gain	The GSA 28 roll servo has a configurable servo gain value. This determines how aggressively the roll servo will move the aileron surfaces. The Servo Gain should be set high enough to properly fly the desired roll, heading, and track, but low enough to avoid being overly aggressive in the aileron movements. The servo gain setting can be adjusted from 0.05 to 10.00 in steps of 0.05.
Servo Direction (Configuration mode only)	The GSA 28 roll servo has a configurable servo direction. The Servo Direction should be set to Normal if the servo arm should move clockwise to cause a bank left aileron movement. The Servo Direction should be set to Reverse if the servo arm should move counterclockwise to cause a bank left aileron movement. After selecting the proper servo direction, the installer should engage the autopilot system in normal mode and verify proper aileron response by rotating the heading bug left and right of the current heading.
Clutch Monitor (Configuration mode only)	The GSA 28 roll servo has the ability to monitor itself for a stuck clutch situation. If the servo has a large amount of side loading (typically due to a capstan installation), this can occasionally lead to invalid stuck clutch failures. The Clutch Monitor should be enabled for all control arm installations. The Clutch Monitor can be disabled for capstan installations with larger side loads to prevent invalid stuck clutch failures. Note that the user can reset clutch monitor faults by pressing the RESET softkey on the roll servo configuration page in configuration mode if an invalid stuck clutch failure occurs.
Trim Motor Control (Configuration mode only)	The GSA 28 roll servo has the ability to control an auxiliary roll trim motor. The Trim Motor Control should be enabled if the GSA 28 roll servo was connected to an auxiliary trim motor. The Trim Motor Control should be disabled if the GSA 28 roll servo was not connected to an auxiliary trim motor.

Table 9-11 Roll Servo Autopilot Configuration Settings

Auto Trim Motor Speed	The GSA 28 roll servo has the ability to drive the auxiliary trim motor at various speeds. The Auto Trim Motor Speed should be set so the auxiliary trim motor will move as slowly as possible. The slowest possible movement will ensure that there is no noticeable aircraft response when the auxiliary trim motor is run during auto-trim. The Auto Trim Motor Speed can be adjusted in percent from 5 to 100 in steps of 5.
Fine Adjust Time (Expert Setting)	The GSA 28 roll servo is capable of making very small adjustments to fine tune the aileron position. The Fine Adjust Time is the rate in which these adjustments are made in seconds. Fine Adjust Time is an expert level setting, and should generally be not be changed by the installer, the default value is 0.20. If the installer notices the aircraft doing very small oscillations, the Fine Adjust Time and Fine Adjust Amount can be used to correct this.
Fine Adjust Amount (Expert setting)	The GSA 28 roll servo is capable of making very small adjustments to fine tune the aileron position. The Fine Adjust Amount is the amount in which these adjustments are made. Fine Adjust Amount is an expert level setting, and should generally be not be changed by the installer, the default value is 0. If the installer notices the aircraft doing very small oscillations, the Fine Adjust Time and Fine Adjust Amount can be used to correct this.

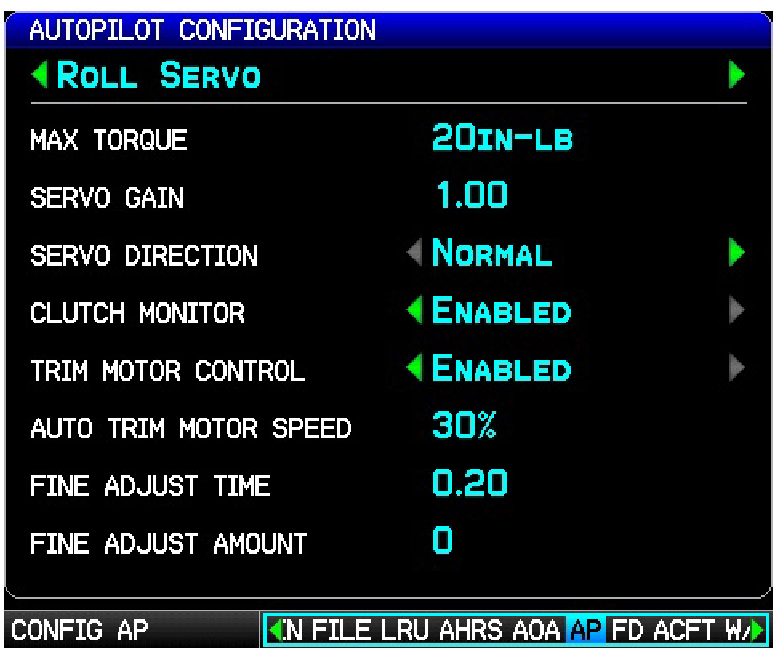


Figure 9-20 Roll Servo Autopilot Configuration Page

9.17.3 Pitch Servo Configuration

The installer needs to make the following pitch servo configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode using the AP CONFIG page and the pitch servo setup screen in the autopilot setup menu in normal mode.

Table 9-12 Pitch Servo Autopilot Configuration Settings

Configuration Setting	Description
Max Torque	The GSA 28 pitch servo has a configurable maximum torque setting. This determines how much torque the servo will output before the electronic slip clutch begins to slip. The Max Torque setting should be set high enough to not slip during in flight air loading, but the torque setting should be low enough for the pilot to override the autopilot if required. The Max Torque setting can be adjusted from 10 to 60 inch-pounds in 5 inch-pound steps.
Servo Gain	The GSA 28 pitch servo has a configurable servo gain value. This determines how aggressively the pitch servo will move the elevator surfaces. The Servo Gain should be set high enough to properly fly the desired pitch, vertical speed, and altitude, but low enough to avoid being overly aggressive in the elevator movements. The servo gain setting can be adjusted from 0.05 to 10.00 in steps of 0.05.
Servo Direction (Configuration mode only)	The GSA 28 pitch servo has a configurable servo direction. The Servo Direction should be set to Normal if the servo arm should move clockwise to cause a nose down elevator movement. The Servo Direction should be set to Reverse if the servo arm should move counterclockwise to cause a nose down elevator movement. After selecting the proper servo direction, the installer should engage the autopilot system in normal mode and verify proper elevator response by rotating the pitch reference up and down from the current pitch.
Clutch Monitor (Configuration mode only)	The GSA 28 pitch servo has the ability to monitor itself for a stuck clutch situation. If the servo has a large amount of side loading (typically due to a capstan installation), this can occasionally lead to invalid stuck clutch failures. The Clutch Monitor should be enabled for all control arm installations. The Clutch Monitor can be disabled for capstan installations with larger side loads to prevent invalid stuck clutch failures. Note that the user can reset clutch monitor faults by pressing the RESET softkey on the pitch servo configuration page in configuration mode if an invalid stuck clutch failure occurs.
Trim Motor Control (Configuration mode only)	The GSA 28 pitch servo has the ability to control an auxiliary pitch trim motor. The Trim Motor Control should be enabled if the GSA 28 pitch servo was connected to an auxiliary trim motor. The Trim Motor Control should be disabled if the GSA 28 pitch servo was not connected to an auxiliary trim motor.

Table 9-12 Pitch Servo Autopilot Configuration Settings

Auto Trim Motor Speed	The GSA 28 pitch servo has the ability to drive the auxiliary trim motor at various speeds. The Auto Trim Motor Speed should be set so the auxiliary trim motor will move as slowly as possible. The slowest possible movement will ensure that there is no noticeable aircraft response when the auxiliary trim motor is run during auto-trim. The Auto Trim Motor Speed can be adjusted in percent from 5 to 100 in steps of 5.
Fine Adjust Time (Expert Setting)	The GSA 28 pitch servo is capable of making very small adjustments to fine tune the aileron position. The Fine Adjust Time is the rate in which these adjustments are made in seconds. Fine Adjust Time is an expert level setting, and should generally be not be changed by the installer, the default value is 0.20. If the installer notices the aircraft doing very small oscillations, the Fine Adjust Time and Fine Adjust Amount can be used to correct this.
Fine Adjust Amount (Expert setting)	The GSA 28 pitch servo is capable of making very small adjustments to fine tune the aileron position. The Fine Adjust Amount is the amount in which these adjustments are made. Fine Adjust Amount is an expert level setting, and should generally be not be changed by the installer, the default value is 0. If the installer notices the aircraft doing very small oscillations, the Fine Adjust Time and Fine Adjust Amount can be used to correct this.

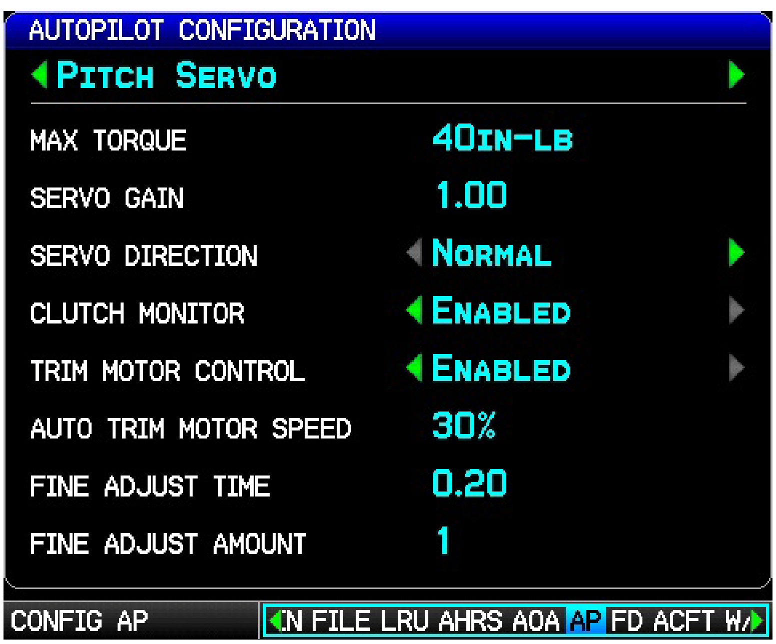


Figure 9-21 Pitch Servo Autopilot Configuration Page

9.17.4 Yaw Damper Configuration

The installer needs to make the following yaw damper configuration selections when setting up the GSA 28 based yaw damper system. These selections are made in configuration mode using the AP CONFIG page and the yaw damper setup screen in the autopilot setup menu in normal mode.

Table 9-13 Yaw Damper Autopilot Configuration Settings

Configuration Setting	Description
Max Torque	The GSA 28 yaw damper has a configurable maximum torque setting. This determines how much torque the servo will output before the electronic slip clutch begins to slip. The Max Torque setting should be set high enough to not slip during in flight air loading, but the torque setting should be low enough for the pilot to override the autopilot if required. The Max Torque setting can be adjusted from 10 to 60 inch-pounds in 5 inch-pound steps.
Servo Gain	The GSA 28 yaw damper has a configurable servo gain value. This determines how aggressively the pitch servo will move the rudder surface. The Servo Gain should be set high enough to properly dampen yaw rates, but low enough to avoid being overly aggressive in the rudder movements. The servo gain setting can be adjusted from 0.05 to 10.00 in steps of 0.05.
Servo Direction (Configuration mode only)	The GSA 28 yaw damper servo has a configurable servo direction. The Servo Direction should be set to Normal if the servo arm should move clockwise to cause a nose left rudder movement. The Servo Direction should be set to Reverse if the servo arm should move counterclockwise to cause a nose left rudder movement. After selecting the proper servo direction, the installer should engage the yaw damper in normal mode and verify proper rudder response pushing the tail of the aircraft back and forth.
Clutch Monitor (Configuration mode only)	The GSA 28 yaw damper has the ability to monitor itself for a stuck clutch situation. If the servo has a large amount of side loading (typically due to a capstan installation), this can occasionally lead to invalid stuck clutch failures. The Clutch Monitor should be enabled for all control arm installations. The Clutch Monitor can be disabled for capstan installations with larger side loads to prevent invalid stuck clutch failures. Note that the user can reset clutch monitor faults by pressing the RESET softkey on the yaw damper configuration page in configuration mode if an invalid stuck clutch failure occurs.
Trim Motor Control (Configuration mode only)	The GSA 28 yaw damper has the ability to control an auxiliary rudder trim motor. The Trim Motor Control should be enabled if the GSA 28 yaw damper servo was connected to an auxiliary trim motor. The Trim Motor Control should be disabled if the GSA28 yaw damper servo was not connected to an auxiliary trim motor.

Table 9-13 Yaw Damper Autopilot Configuration Settings

Auto Trim Motor Speed	The GSA 28 yaw damper has the ability to drive the auxiliary rudder trim motor at various speeds. The Auto Trim Motor Speed should be set so the auxiliary trim motor will move as slowly as possible. The slowest possible movement will ensure that there is no noticeable aircraft response when the auxiliary trim motor is run during auto-trim. The Auto Trim Motor Speed can be adjusted in percent from 5 to 100 in steps of 5.
Ball Centering Gain (Advanced Setting)	The GSA 28 yaw damper is capable of zeroing the aircraft's lateral acceleration or centering the ball as well as dampening aircraft yaw rates. Ball Centering Gain is an advanced level setting and should only be changed by the installer if the yaw damper is not properly zeroing the aircraft's lateral acceleration. Increasing the Ball Centering Gain will cause the yaw damper to more aggressively respond to non-zero lateral acceleration. Decreasing the Ball Centering Gain will cause the yaw damper to respond less aggressively to non-zero lateral acceleration.
Rate Filter Constant (Expert setting)	The GSA 28 yaw damper is capable of damping out yaw body rates to keep the aircraft from shaking its tail. The Rate Filter Constant is used to filter the aircraft yaw body rate. Rate Filter Constant is an expert level setting, and should generally be not be changed by the installer, the default value is 0.08.
Accel Filter Constant (Expert setting)	The GSA 28 yaw damper is capable of zeroing the lateral acceleration of the aircraft. The Accel Filter Constant is used to filter the aircraft lateral acceleration. Accel Filter Constant is an expert level setting, and should generally be not be changed by the installer, the default value is 0.16.

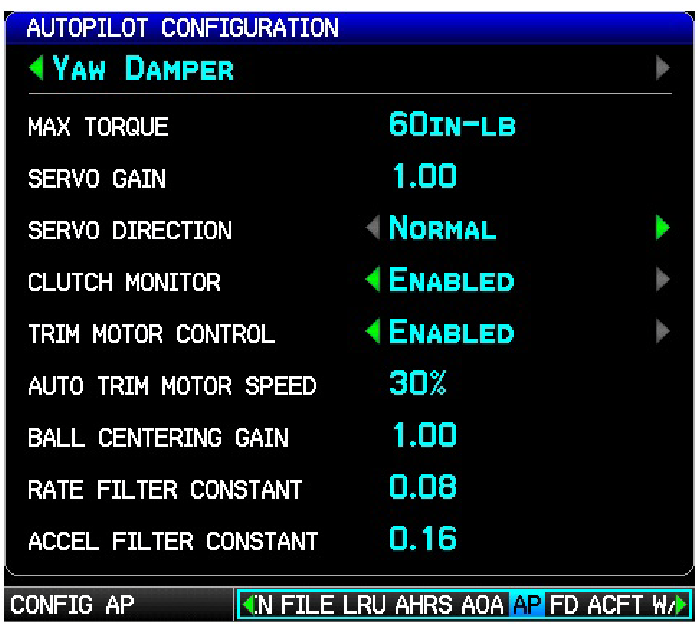


Figure 9-22 Yaw Damper Autopilot Configuration Page

9.17.5 Pitch Gain Configuration

The installer needs to make the following pitch gain configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode on the PFD under the AP tab and the pitch gain setup screen in the autopilot setup menu in normal mode.

Table 9-14 Pitch Gain Autopilot Configuration Settings

Configuration Setting	Description
Min Airspeed Limit	The GSA 28 pitch servo has a configurable minimum airspeed limit. This determines the lowest airspeed the pitch servo will allow the aircraft to fly at. If the speed drops below this limit, the pitch servo will lower the nose of the aircraft to keep the airspeed at or above the Min Airspeed Limit. The Min Airspeed Limit should be set above the aircraft stall speed with some margin.
Max Airspeed Limit	The GSA 28 pitch servo has a configurable maximum airspeed limit. This determines the fastest airspeed the pitch servo will allow the aircraft to fly at. If the speed rises above this limit, the pitch servo will raise the nose of the aircraft to keep the airspeed at or below the Max Airspeed Limit. The Max Airspeed Limit should be set below the aircraft maximum speed with some margin.
Vertical Speed Gain (Advanced setting)	The GSA 28 pitch servo is capable of holding the aircraft at a desired vertical speed. The Vertical Speed Gain should be increased if the aircraft struggles to hold the desired vertical speed target when the flight director is in vertical speed (VS), altitude hold (ALT), or LVL modes. The Vertical Speed Gain should be decreased if the aircraft is overly aggressive when trying to hold the desired vertical speed target.
Vertical Accel Gain (Expert setting)	The GSA 28 pitch servo is capable of holding the aircraft at a desired vertical speed. The Vertical Accel Gain should be increased if the aircraft is overshooting the desired vertical speed target (when the flight director is in vertical speed (VS) mode) when closing on the bug. The Vertical Accel Gain should be increased if the aircraft is appears to back off from the desired vertical speed target when closing on the bug.
Airspeed Gain (Advanced setting)	The GSA 28 pitch servo is capable of holding the aircraft at a desired airspeed. The Airspeed Gain should be increased if the aircraft is lazy and struggles to hold the desired airspeed target when the flight director is in IAS mode. The Airspeed Gain should be decreased if the aircraft is overly aggressive when trying to hold the desired airspeed target.
Airspeed Accel Gain (Expert setting)	The GSA 28 pitch servo is capable of holding the aircraft at a desired airspeed. The Airspeed Accel Gain should be increased if the aircraft is overshooting the desired airspeed target when closing on the bug when the flight director is in IAS mode. The Airspeed Accel Gain should be increased if the aircraft is appears to back off from the desired airspeed target when closing on the bug.

Table 9-14 Pitch Gain Autopilot Configuration Settings

Airspeed Track Gain	The GSA28 pitch servo is capable of holding the aircraft at a desired airspeed. The Airspeed Track Gain should be increased if the aircraft is overly sluggish while tracking airspeed when the airspeed error is less than 5 knots. The Airspeed Track Gain should be decreased if the aircraft is overly aggressive while tracking airspeed when the airspeed error is less than 5 knots.

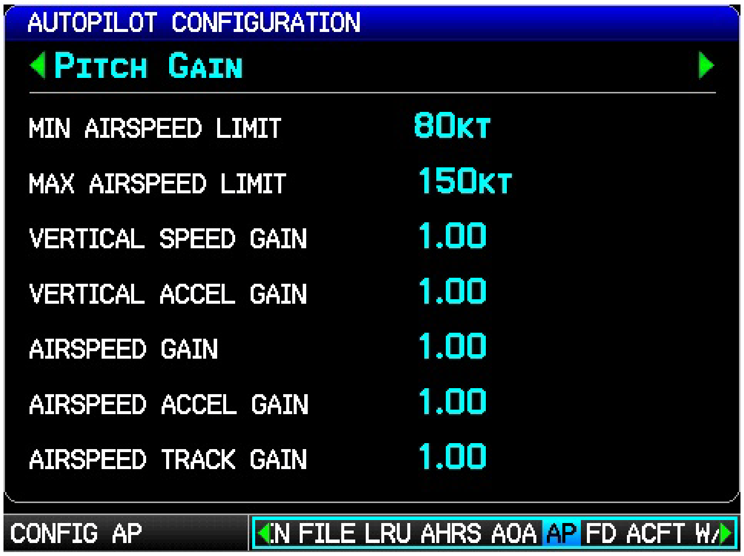


Figure 9-23 Pitch Gain Autopilot Configuration Page

9.17.6 Manual Electric Trim Configuration

The installer needs to make the following manual electric trim configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode on the PFD under the AP tab and the pitch gain setup screen in the autopilot setup menu in normal mode.

Table 9-15 Manual Electric Trim Autopilot Configuration Settings

Configuration Setting	Description
Airspeed Threshold	The GSA 28 servos are capable of airspeed scheduling the aircraft's manual electric trim. The Airspeed Threshold Fastest Movement setting is the airspeed in which the trim motor will be moved at its fastest setting. This should be the lower of the two airspeeds. The Airspeed Threshold Slowest Movement setting is the airspeed in which the trim motor will be moved at its slowest setting. This should be the higher of the two airspeeds.
Roll Trim Motor Speed	The GSA 28 roll servo will control the aileron trim on the aircraft. The Roll Trim Motor Speed percentage for the Fastest Movement is the speed in which the roll servo will run the auxiliary trim motor when at or below the corresponding airspeed. The Roll Trim Motor Speed percentage for the Slowest Movement is the speed in which the roll servo will run the auxiliary trim motor when at or above the corresponding airspeed.
Pitch Trim Motor Speed	The GSA 28 pitch servo will control the elevator trim on the aircraft. The Pitch Trim Motor Speed percentage for the Fastest Movement is the speed in which the pitch servo will run the auxiliary trim motor when at or below the corresponding airspeed. The Pitch Trim Motor Speed percentage for the Slowest Movement is the speed in which the pitch servo will run the auxiliary trim motor when at or above the corresponding airspeed.
Yaw Trim Motor Speed	The GSA 28 yaw servo will control the rudder trim on the aircraft. The Yaw Trim Motor Speed percentage for the Fastest Movement is the speed in which the roll servo will run the auxiliary trim motor when at or below the corresponding airspeed. The Yaw Trim Motor Speed percentage for the Slowest Movement is the speed in which the roll servo will run the auxiliary trim motor when at or above the corresponding airspeed.
Motor Run Time Limit	The GSA 28 servos can limit the maximum continuous run time of the trim motor. This can be used to help prevent the potential for a trim runaway situation. The Motor Run Time Limit is the maximum amount of time the trim servo will be ran continuously when a manual electric trim input is detected. If the maximum time is exceeded, the pilot will need to release the Manual Electric Trim (MET) control and then reassert it to continue running trim.

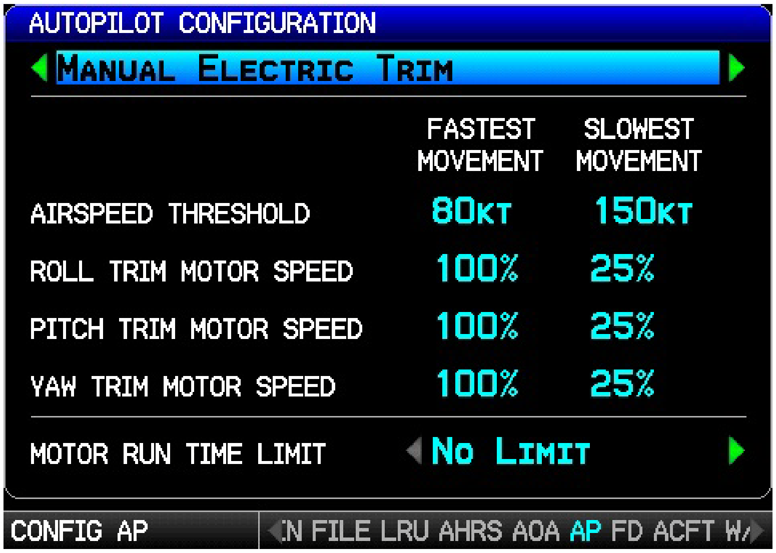


Figure 9-24 Manual Electric Trim Autopilot Configuration Page

10 GSU 25 INSTALLATION (CORE G3X LRU)

The GSU 25 can be installed as part of the G3X system. This section contains general information as well as installation information for the GSU 25. Use this section to mount the GSU 25 unit.

10.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GSU 25.

The GSU 25 is intended for experimental aircraft and LSA (light sport aircraft) markets. The Garmin GSU 25 Sensor Unit is not a TSO-certified product and has received no FAA approval or endorsement. The GSU 25 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 25 is an LRU that provides AHRS and Air Data information in a single mechanical package. The GSU 25 interfaces to a remote mounted GMU 22 for heading information and also computes OAT and TAS from inputs provided by the GTP 59. The GSU 25 does not provide engine/airframe interface, see Section 6 for engine/airframe interface using the GEA 24. Up to three GSU 25 units may be installed to provide redundancy and cross-checking of attitude, heading, and air data.

The GSU 25 provides the following functions:

- Attitude (pitch, roll)
- 3 axis accelerations
- 3 axis angular rates
- Magnetic heading (with input from GMU 22)
- Pressure/density altitude
- Vertical speed
- Indicated/true airspeed
- Angle of attack
- Outside and total air temperature (via GTP 59)

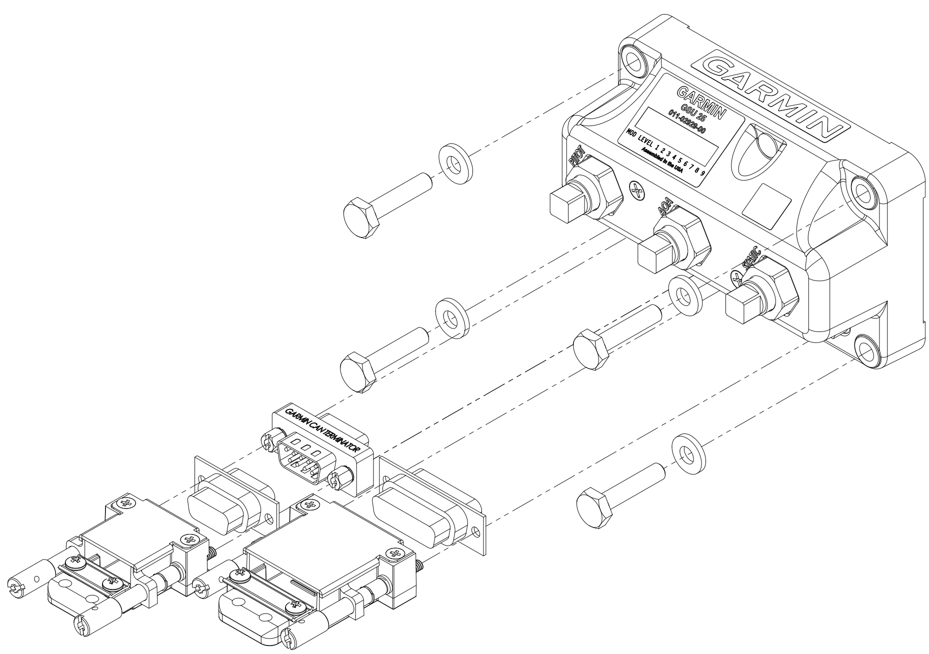


Figure 10-1 GSU 25 Unit View

10.1.1 Status LED

The GSU 25 has an LED on its outer case that indicates its current status. The status indications are:

Table 10-1 Status LED Indications

LED Indication	Status
No Light	No Power
Steady Green	On, but not communicating via CAN Bus
Flashing Green	On and communicating via CAN Bus
Red	Hardware Fault
Alternating Red/Green	CAN bus network error two similar devices are configured with the same unit ID

10.2 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

10.3 Required Equipment

Table 10-2 lists the kits available for the GSU 25.

Table 10-2 GSU 25 Available Equipment

Item	Garmin P/N	Quantity
GSU 25 Unit Assembly	011-02929-00	1
GSU 25 Connector Kit (contains all items in Table 10-3 and Table 10-4)	K10-00181-00	1

Table 10-3 Contents of 9 Pin Connector Kit (011-03002-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 9/15 pin	011-01855-00	1
CAN Termination Kit	011-02887-00	1
D-Sub, Crimp Socket Connector, 09 CKT	330-00625-09	1
Contact Socket, Mil Crimp, Size 20, 20-24 AWG	336-00022-02	9

Table 10-4 Contents of 15 Pin Connector Kit (011-03002-01) contains mounting hardware

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 15/26 pin	011-01855-01	1
AN3-7A, Bolt	211-00090-05	4
AN960, Cad Plate, #10 Washer	212-00035-10	4
D-Sub, Crimp Socket Connector, 15 CKT	330-00652-15	1
Contact Socket, Mil Crimp, Size 20, 20-24 AWG	336-00022-02	15

10.3.1 Additional Equipment Required

- Wiring: The installer will fabricate cables and supply all wire for system connector kits 011-03002-00 and 011-03002-01.
- Air hoses and fittings to connect pitot air, static air, and AOA air to the GSU 25. The GSU 25 uses a female 1/8-27 ANPT fitting for each of these ports. Use appropriate aircraft fittings to connect to pitot, static, and AOA system lines (per Section 10.4.3).

10.4 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices should be used for installation of the GSU 25. Refer to Section 2.3 for wiring considerations, and to Section 15 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 install the jackscrew backshell are located in Section 16.

NOTE

Connection to a GMU 22 and GTP 59 is required for ADAHRS 1 but optional for ADAHRS 2 & 3.

10.4.1 Mounting Requirements

The GSU 25 includes an extremely sensitive strap-down inertial measurement unit, consider the following when selecting a mounting location:

- The GSU 25 can be oriented remotely in any of 16 orientations (Figure B-8.3 and Figure B-8.4), but must satisfy the mounting alignment requirements along the longitudinal/lateral axes of the aircraft. The unit can be mounted in any of the 4 cardinal directions with the connectors pointing up or down can also be mounted on a vertical surface, with the connectors facing up, down, forward, aft, left, or right.
- Mount the GSU 25 with the connectors aligned within 1.0 degree 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 10-2.
- The GSU 25 must be mounted rigidly to the aircraft primary structure through strong structural members capable of supporting substantial loads, see torque specification listed on Figure B-8.2.
- The supporting plate must be rigidly connected.
- The GSU 25 should be mounted within 13 feet (4.0 meters) longitudinally and 6.5 feet (2.0 meters) laterally of the aircraft CG (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 25 forward of the aircraft CG if possible, to enable better acceleration outputs for autopilot use.
- Avoid placing the GSU 25 near sources of vibration or audible noise. Examples locations to be avoided include the engine firewall, near large motors or fans, and audible buzzers and speakers.
- Do not mount the GSU 25 in an enclosed area, it should be mounted in a location that provides adequate airflow.
- Avoid areas that are prone to severe vibration. Excessive vibration may result in degraded accuracy.
- Do not use shock mounting to mount the GSU 25. Shock mounts used for other types of inertial systems are not acceptable for the GSU 25 AHRS. The mounting system must have no resonance with the unit installed. The unit and mounting structure must not have any resonance with respect to the aircraft primary structure.

- The wing is not an optimal location to mount the unit as (in addition to being away from the center of gravity) any amount of wing flex will directly translate into attitude error.
- The GSU 25 must be leveled to within 30.0° of the flight level cruise attitude and an aircraft leveling and offset calibration procedure carried out prior to flight. (This procedure is described in Section 19.3.2.)
- The mounting location for the GSU 25 should be protected from rapid thermal transients, in particular, large heat loads from nearby high-power equipment.
- Avoid placing the GSU 25 within 1 inch of magnetically mounted antennas, speaker magnets, or other strongly magnetic items.

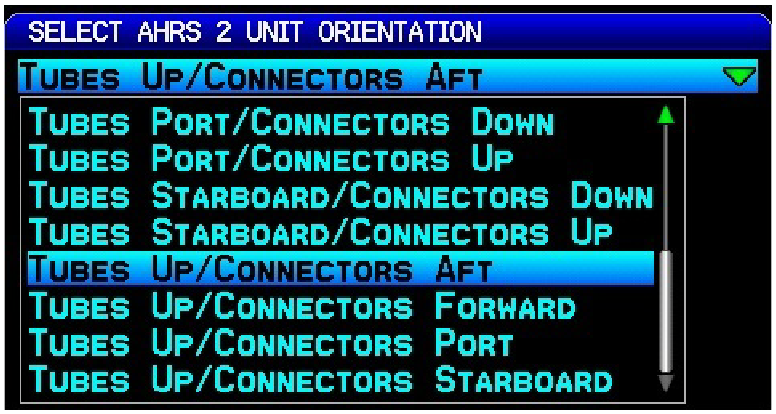


Figure 10-2 AHRS Orientation Selection

10.4.2 Unit Mounting

For final installation and assembly, refer to the outline and installation drawing Figure B-8.1 and Figure B-8.2 of this manual.

1. Mount the unit to a suitable mounting location using the hardware in the connector kit (Table 10-4) per the requirements in Section 10.4.1.
2. Assemble the wiring harness and backshell connectors
3. Assemble the pneumatic hoses and connectors.
4. Connect backshell connector and hoses.
5. Connect CAN terminator to unit if required (see Section 2.3.1.3).

NOTE

When mounting the GSU 25 to the airframe, it is important to ensure that fastening hardware is tight for proper unit operation.

10.4.3 Pneumatic Plumbing

The GSU 25 has three ports that are connected to the aircraft's pitot pressure source, static pressure source, and AOA (Angle Of Attack). The ports are labeled on the unit (Figure 10-3). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

NOTE

The temporary port plugs attached to the pressure ports on a new GSU 25 are not suitable for flight, remove prior to installation of GSU 25 into aircraft.

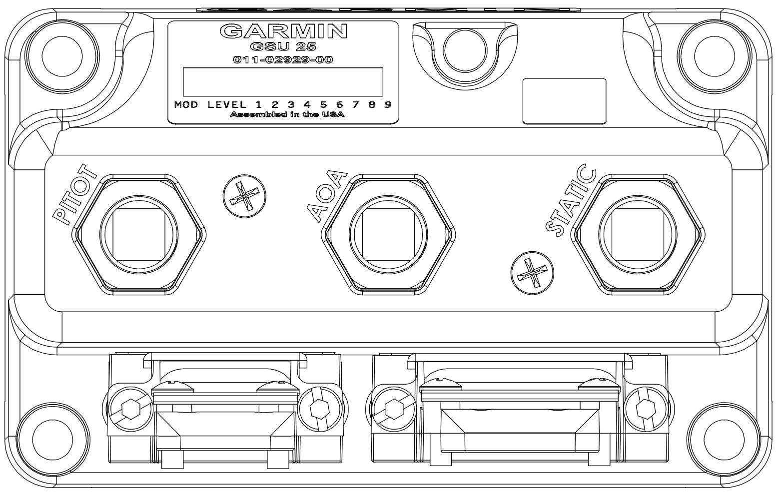


Figure 10-3 GSU 25 Air Hose Fitting Locations

Use appropriate air hoses and fittings to connect the pitot and static lines to the unit. Use colored (or well marked) tubing to avoid confusing pitot, static, and AOA plumbing per Figure C-1.4. Avoid sharp bends and routing near aircraft control cables. The GSU 25 should not be at the low point of the pneumatic 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.

10.4.4 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 25.

NOTE

If the AOA port is unused, connect it to the static port to avoid overpressuring (and causing damage to) the internal AOA sensor.

NOTE

Use of different colored tubing is recommended for static, pitot, and AOA plumbing to avoid plumbing connection errors. Incorrect plumbing connections will result in erroneous air data information calculated by the GSU 25.

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. The AOA port must be plumbed directly to the AOA pressure port or, if unused, directly to the aircraft static 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 pneumatic lines connected to the GSU 25.

The installer must fabricate any additional mounting equipment needed. Use outline and installation drawings Figure B-8.1 and Figure B-8.2 for reference.

10.5 Environmental Specifications

Table 10-5 lists general environmental specifications.

Table 10-5 GSU 25 Environmental Specifications

Characteristic	Specification
Aircraft Pressure Altitude Range	-1,400 feet to 30,000 Feet
Aircraft Vertical Speed Range	-20,000 feet per minute to +20,000 feet per minute
Aircraft Airspeed Range	300 Knots Indicated Airspeed
Aircraft Total Air Temperature Range	-85° C to +85° C
Unit Operating Temperature Range	-45° C to +70° C

10.6 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)
OAT Probe (GTP 59)
Magnetometer (GMU 22) (1 RS-232 TX/ 1 RS-485 RX)

AHRS

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

10.7 Performance Information

The GSU 25 is capable of maneuvers through a range of 360° in bank and pitch. The rotation rate capability is ±500° per second.

Pitch/roll accuracy is +/- 2 degrees, heading accuracy is 3 degrees in straight and level flight.

Pitch/roll accuracy is 3.5 degrees and heading accuracy is +/-5 degrees under normal dynamic maneuvering (bank < 35°, pitch <15°).

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)

10.8 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 25 are not susceptible to these types of errors.

The GSU 25 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 2015 and every five years thereafter, so long as the GSU 25 remains a Garmin –supported product. The IGRF model is automatically updated with a GDU 37X software update. Otherwise maintenance of the GSU 25 is 'on condition' only.

NOTE

If the GSU 25 is moved or replaced, the Post Installation Calibration Procedures (Section 19.3) must be repeated.

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11 GSU 73 INSTALLATION (CORE G3X LRU)

The GSU 73 can be installed as part of the G3X system. This section contains general information as well as installation information for the GSU 73. Use this section to mount the GSU 73 unit.

11.1 Equipment Description

NOTE

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

The GSU 73 is intended for the experimental aircraft and LSA (light sport 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 22 for heading information and also computes OAT and TAS from inputs provided by the GTP 59.

NOTE

In installations using more than one ADAHRS, the GSU 73 will always be designated as ADAHRS 1 and the GSU 25 units will be designated as ADAHRS 2,ADAHRS 3 etc.

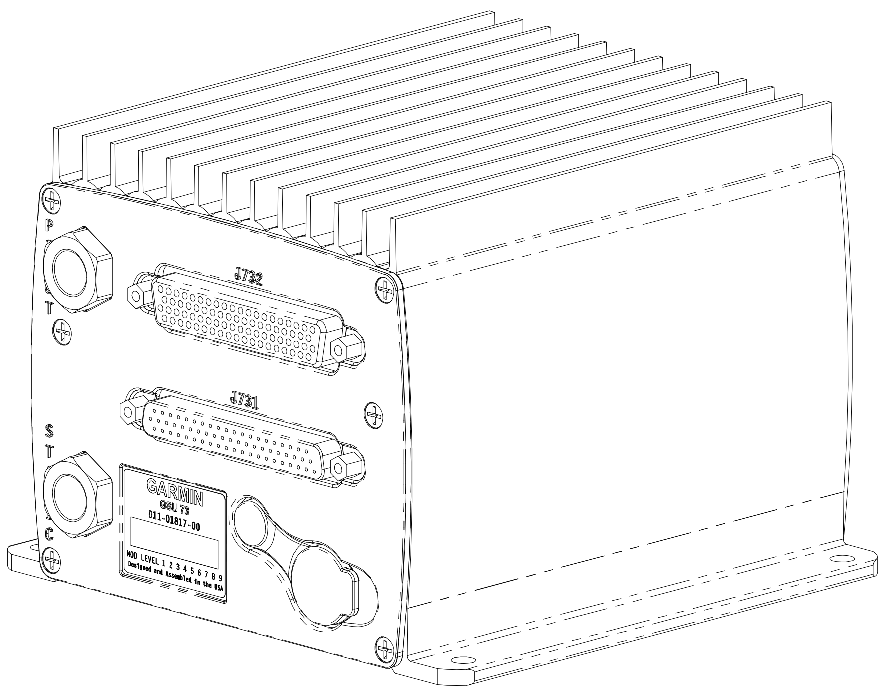


Figure 11-1 GSU 73 Unit View

11.2 General Specifications

See Section 2.2 for power/current specifications, and Section 2.4.1 for dimension/weight specifications.

11.3 Required Equipment

Table 11-1 lists the kits available for the GSU 73.

Table 11-1 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 w/GSU 73 LRU Kit (K10-00016-00)
**Included in G3X w/GSU 73 Installation Kit (K10-00017-00)

Table 11-2 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 w/GSU 73 Installation Kit (K10-00017-00)

Table 11-3 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 w/GSU 73 Installation Kit (K10-00017-00)

11.3.1 GSU 73 Configuration Module

The GSU 73 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.

11.3.2 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.

11.4 Unit Installation

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 2.3 for wiring considerations, and to Section 15 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 Section 16.

11.4.1 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 (Figure 11-2). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

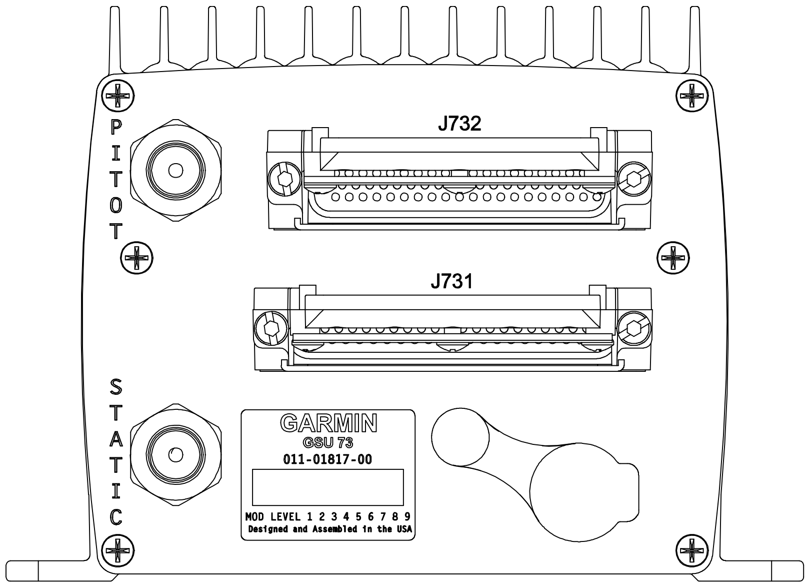


Figure 11-2 GSU 73 Air Hose Fitting Locations

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.

11.4.2 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 drawing Figure B-9.1 for reference.

11.4.3 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 11-3.

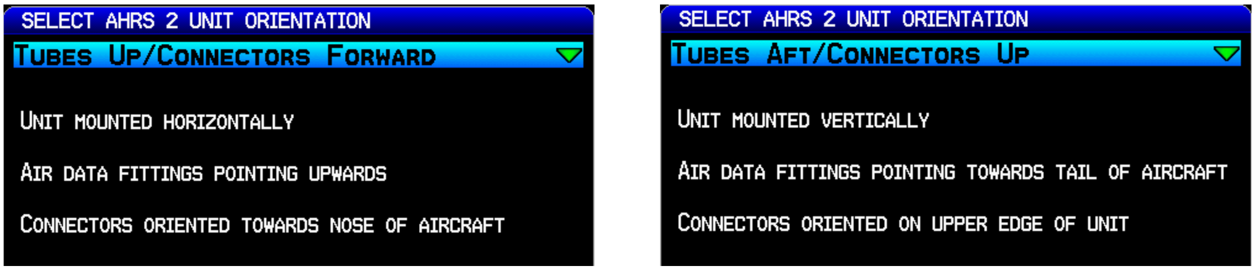


Figure 11-3 AHRS Orientation Selection

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 11.5.

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 19.3.2.)

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

11.4.4 Unit Mounting

For final installation and assembly, refer to the outline and installation drawing Figure B-9.1 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 11.4.3.
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.

11.5 Environmental Specifications

Table 11-4 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 11-4 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

11.6 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 22) (1 RS-232 TX/ 1 RS-485 RX)

AHRS

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

Engine/Airframe

27 Analog Inputs
4 Digital Inputs
4 Discrete Intputs
2 Discrete Outputs

11.7 Performance Information

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)

11.8 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 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. Please contact a local Garmin dealer for more information.

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 2015 and every five years thereafter, so long as the GSU 73 remains a Garmin –supported product. The IGRF model is automatically updated with a GDU 37X software update. Alternatively, 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.

12 GTP 59 INSTALLATION (CORE G3X LRU)

This section contains general information as well as installation information for the GTP 59. Use this section to mount the GTP 59.

NOTE

For installations using more than one ADAHRS, ADAHRS 1 must be connected to a GTP 59, but installing additional GTP 59's for other GSU 25 ADAHRS units is optional. An ADAHRS not connected to a GTP 59 will use temperature data supplied by other ADAHRS as long as both ADAHRS are communicating via the CAN bus.

Figure 12-1. GTP 59

12.1 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 available per the following part number.

Table 12-1 GTP 59 Part Number

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

*Included in G3X w/GSU 73 LRU (K10-00016-00)

Table 12-2 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 12-2 GTP 59 Outside Air Temperature Kit*

Item	Garmin Part Number	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 w/GSU 73 LRU Kit (K10-00016-00)

12.1.1 Additional Equipment Required

- Cables - The installer will supply all system cables.

12.2 General Specifications

See Section B-10.1 for mounting dimensions.

12.3 Unit Installation

NOTE
The following instructions are general guidance.

NOTE
The GTP 59 is a Resistive Temperature Device (RTD) that detects changing temperature by monitoring small changes in resistance. For optimum accuracy, take care to avoid introducing extra resistance, such as loose, dirty, or corroded connections in the wiring path between the ADAHRS and GTP 59.

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

Table 12-3 contains a list of parts needed for the GTP 59 installation and interconnect harness. Reference numbers in the table and following instructions refer to item bubble numbers shown in Figure B-10.1. Refer to Figure B-10.1 GTP 59 O.A.T. Probe Wiring Detail for wiring and mounting instructions.

Table 12-3 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 25/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 25/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.

12.4 TSO/ETSO Compliance

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

Table 12-4 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

12.4.1 TSO/ETSO Deviations

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

Table 12-5 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.

12.4.2 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).

12.5 Maintenance

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

13 GPS/XM ANTENNA INSTALLATION (CORE G3X LRU)

This section contains general information as well as installation information for GPS and XM antennas. Use this section to mount the GPS/XM antenna(s).

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. A minimum of one 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. Additional GPS antennas may be used for redundancy, but are not required. See Section 17.3.13 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.

13.1 Non-Garmin Antennas

Table 13-1 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 25 dB. The GDU 37X supplies power to the antenna at 4.5 V–5V with a maximum current of 50 mA.

Table 13-1 Supported Non-Garmin 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.

13.2 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 outline and installation drawings beginning with Figure B-1.1.

Garmin recommends the antennas shown in Table 13-2. However, any equivalent GPS or XM antenna that meets the specifications listed in Table 13-3 and Table 13-4 should work with the G3X.

Table 13-2 Supported 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 13-3 GPS Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Gain	16 to 25 dB typical, 40 dB 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 13-4   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 13-2. 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.

13.3 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.

13.3.1 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.

13.3.2 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 4a - 4c 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 (Electromagnetic Compatibility) check (Section 19.2) 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 13-1 shows the recommended placement of antennas.

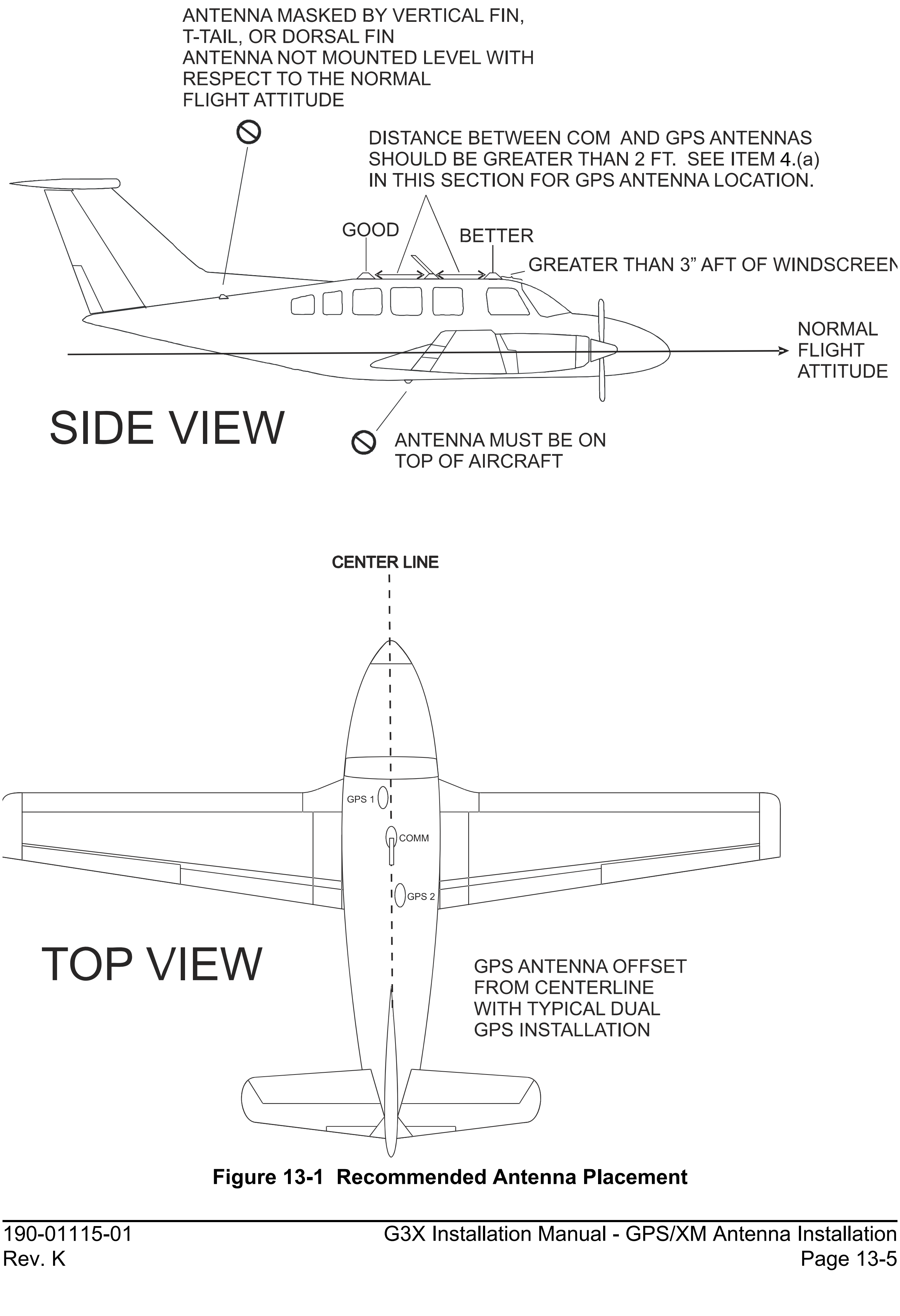


Figure 13-1 Recommended Antenna Placement

13.3.3 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 13.6.2, 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 13-2 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.

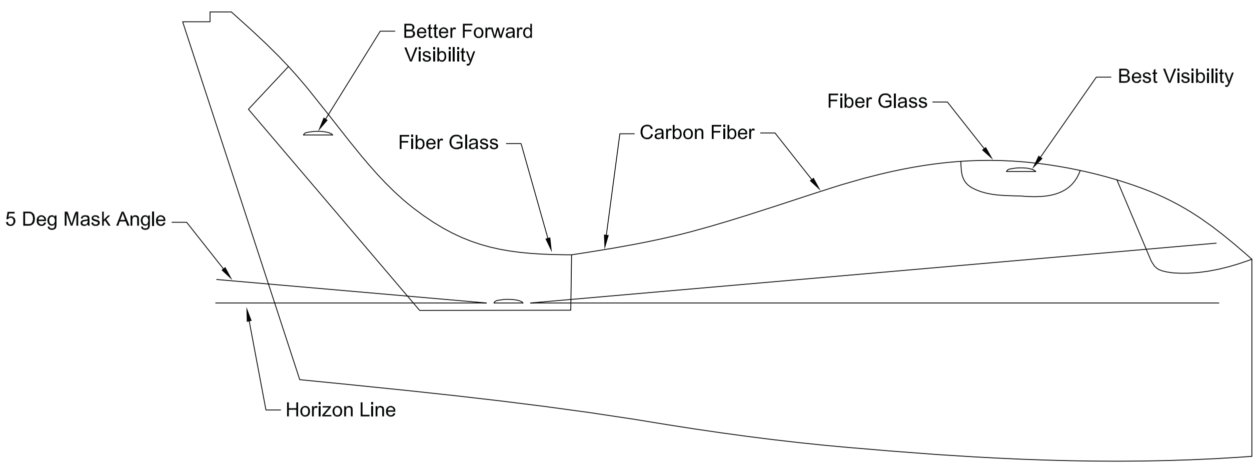


Figure 13-2 Carbon/Glass Buried Antenna Area

Mounting the antenna under the glare shield (Figure 13-3) 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.

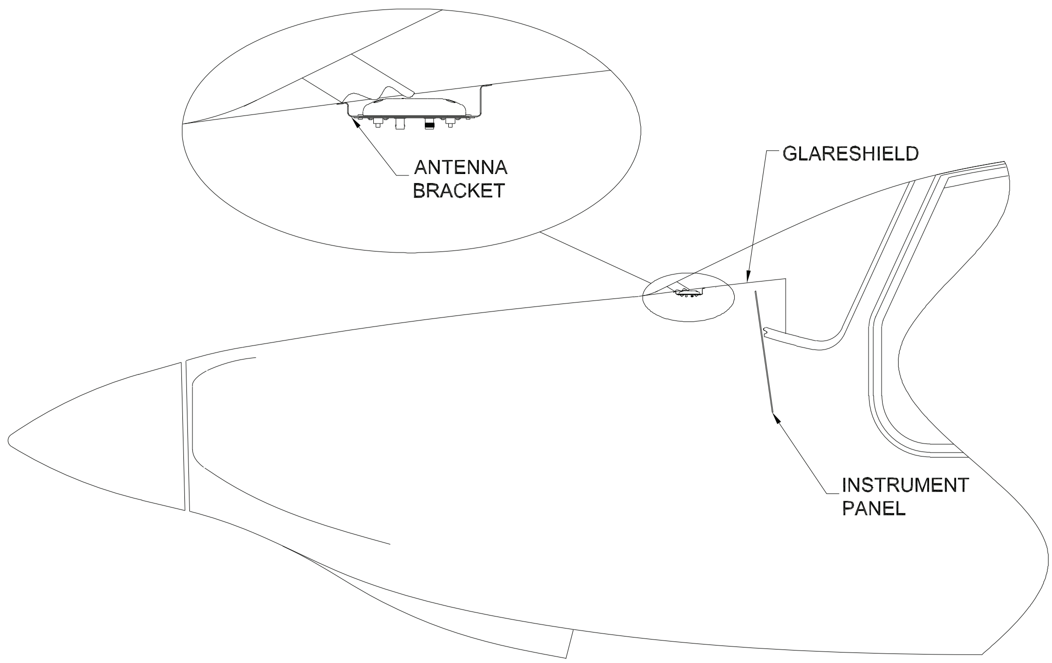


Figure 13-3 Glare Shield Buried Antenna Area

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.

13.3.4 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.

13.3.5 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.

13.3.6 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.

13.4 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 13-4, Figure 13-5, and Figure 13-6), 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 13-5 provides a summary of design and installation details for selecting the appropriate antenna doubler/ backplate.

Figure 13-7 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 13-5 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 13-4	Figure 13-5	Figure 13-6
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 13-8	Figure 13-9	Figure 13-10
Doubler Installation (Figure)	Figure 13-11	Figure 13-12	Figure 13-13

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

Refer to the drawings beginning with Figure B-1.1 for Garmin Antenna installation drawings.

13.4.1 Preparation of Doubler

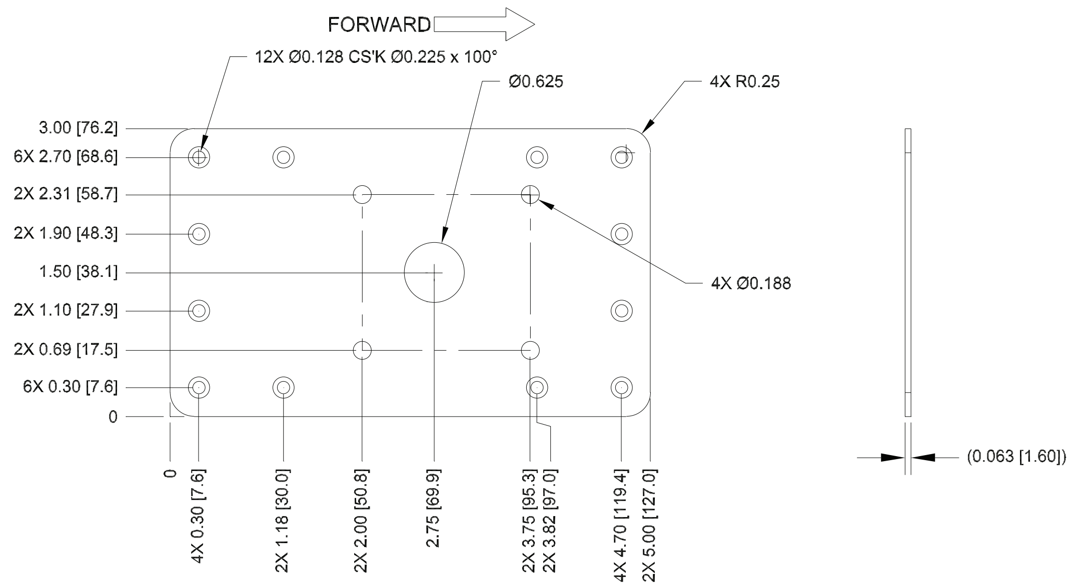
1. Use Garmin P/N: 115-00846-10, or refer to Table 13-5 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063” sheet thickness.
2. For installation in aircraft skins of thickness 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 13-8) and doubler installation (Figure 13-11) are required.

13.4.2 Antenna Installation Instructions

1. Refer to Table 13-5 and the outline and installation drawings beginning with Figure B-1.1 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 13.4.1 for doubler preparation and Table 13-5 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.

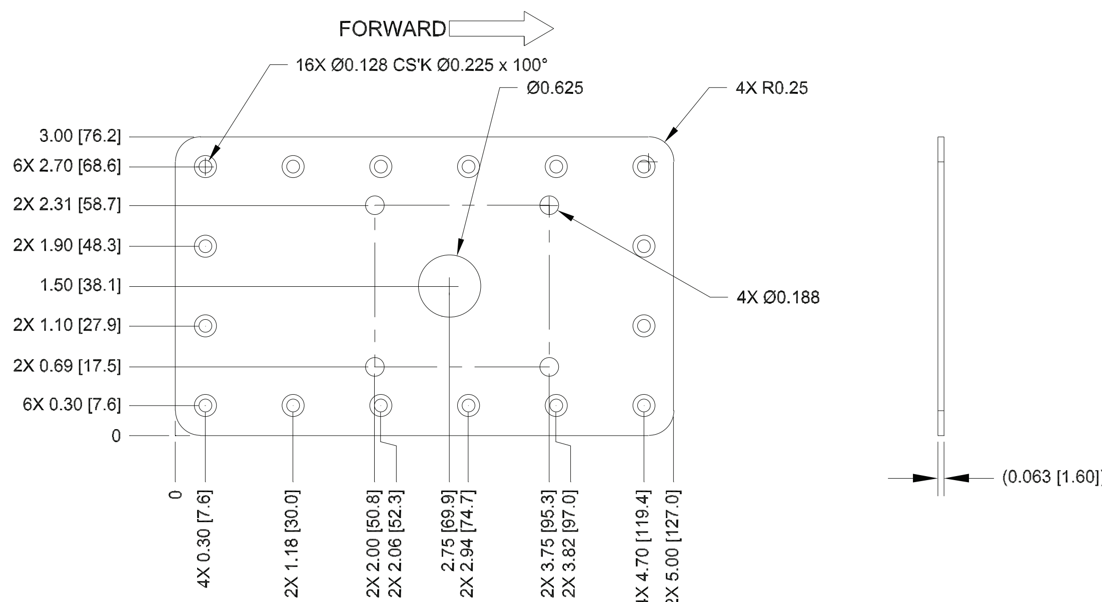
CAUTION
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

13.4.3 Reference Figures



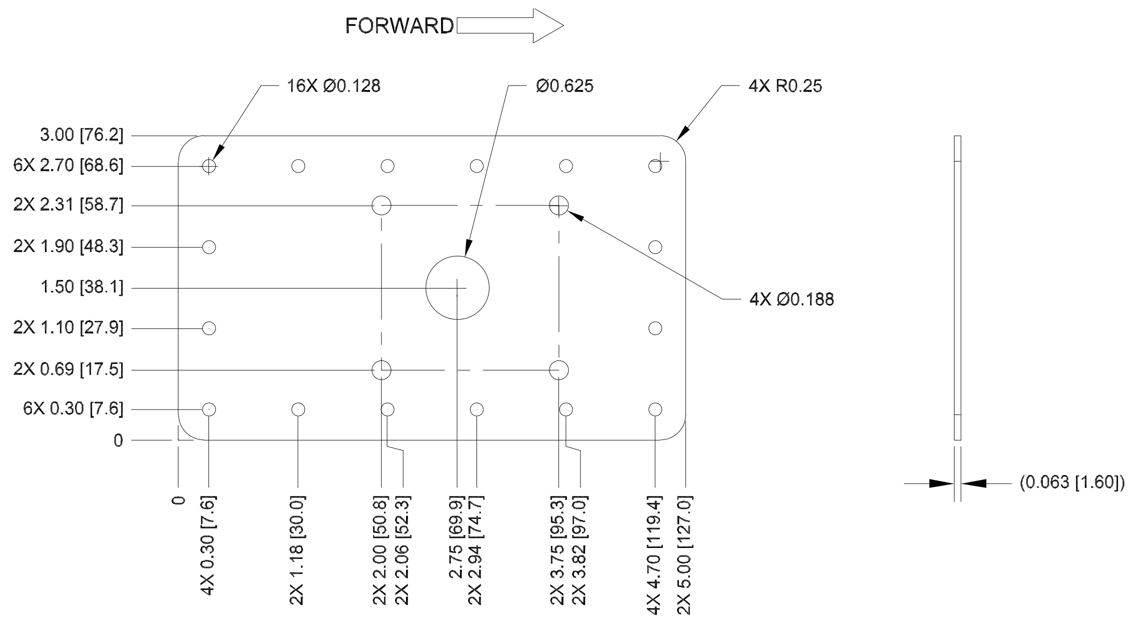
NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 13-4 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 13-5 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 13-6 Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

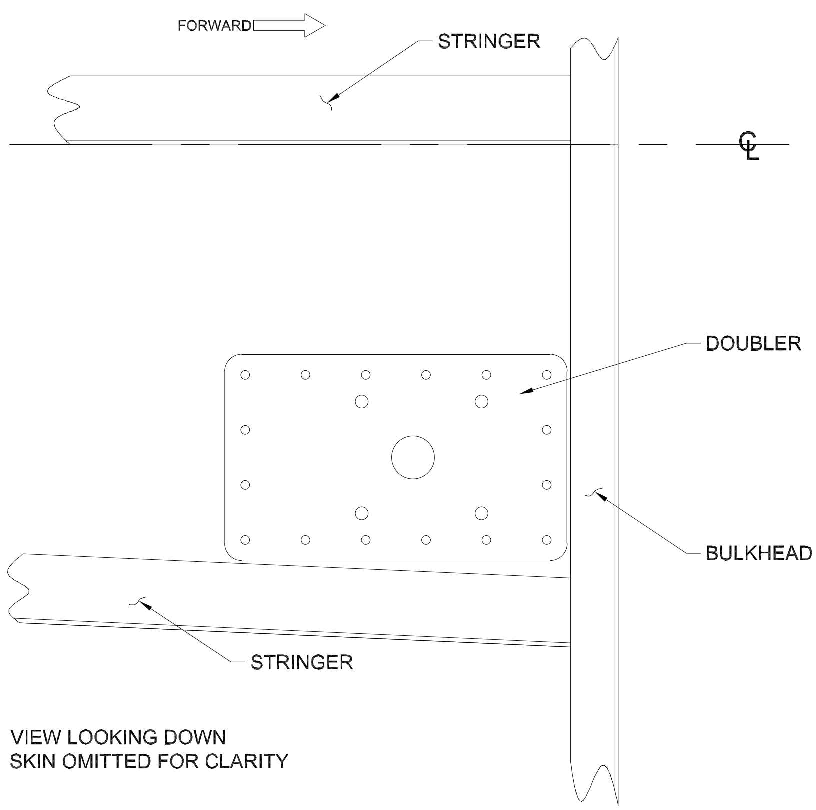
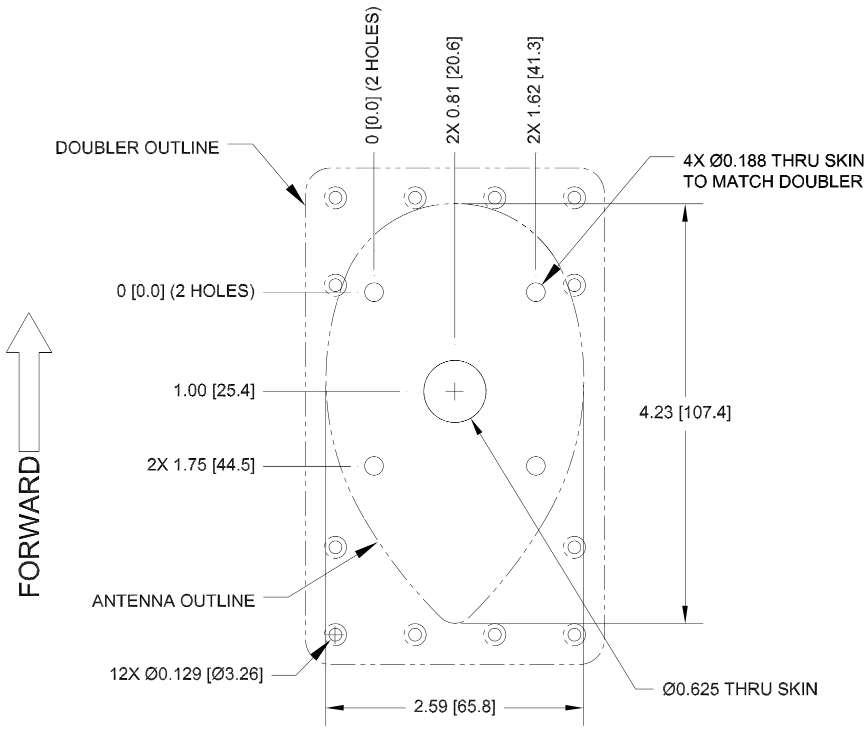
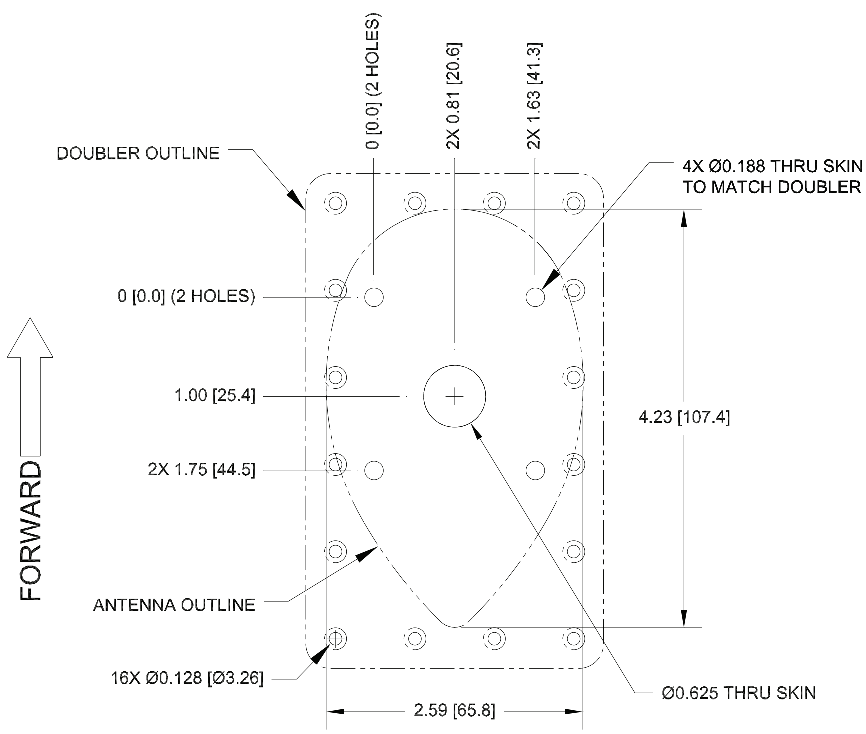


Figure 13-7 Sample Doubler Location, Teardrop Footprint Antenna, Metal Skin Aircraft



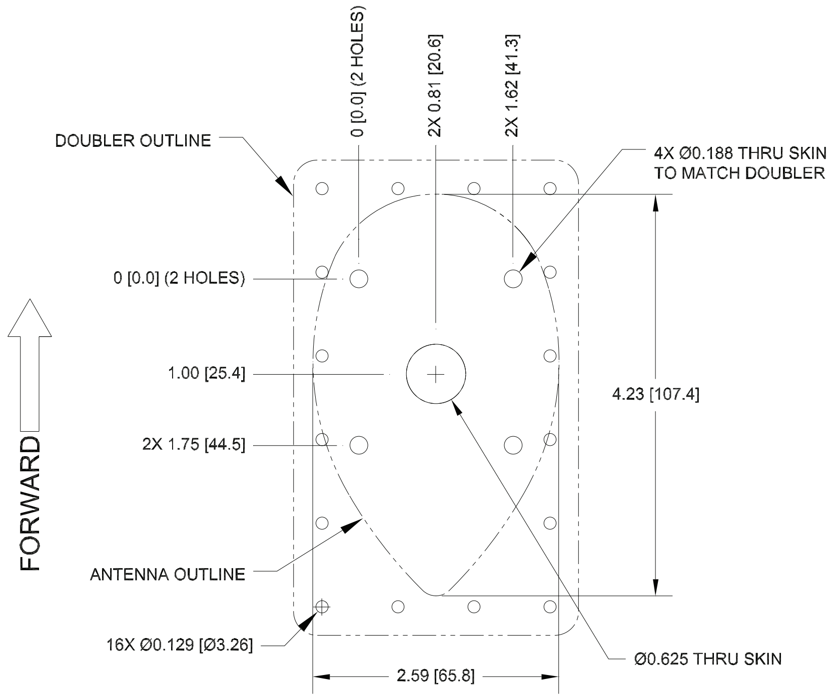
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 13-8 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



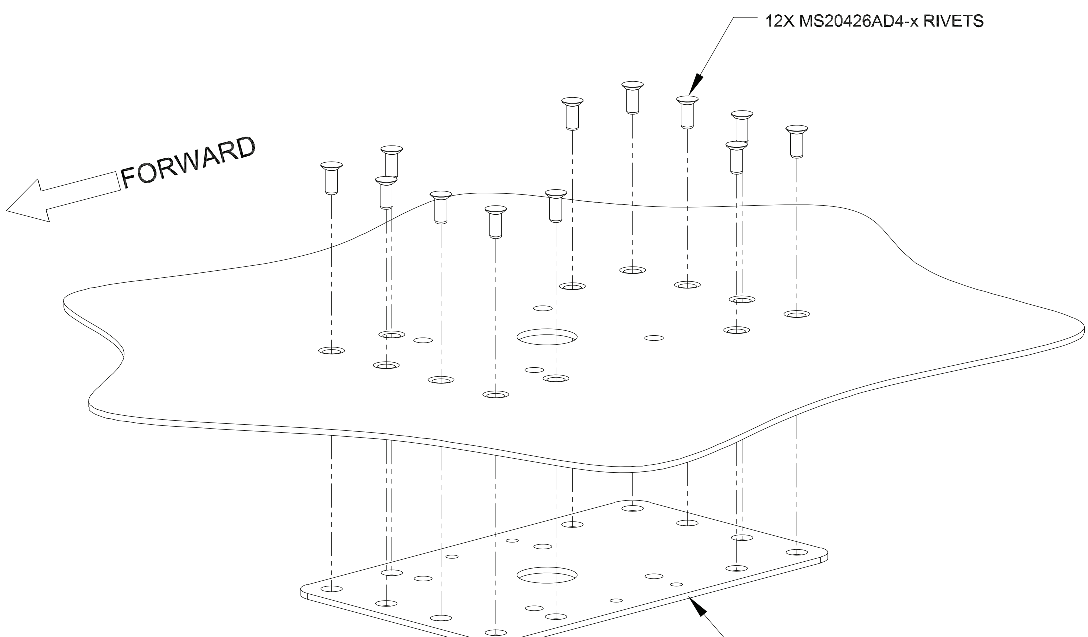
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 13-9 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



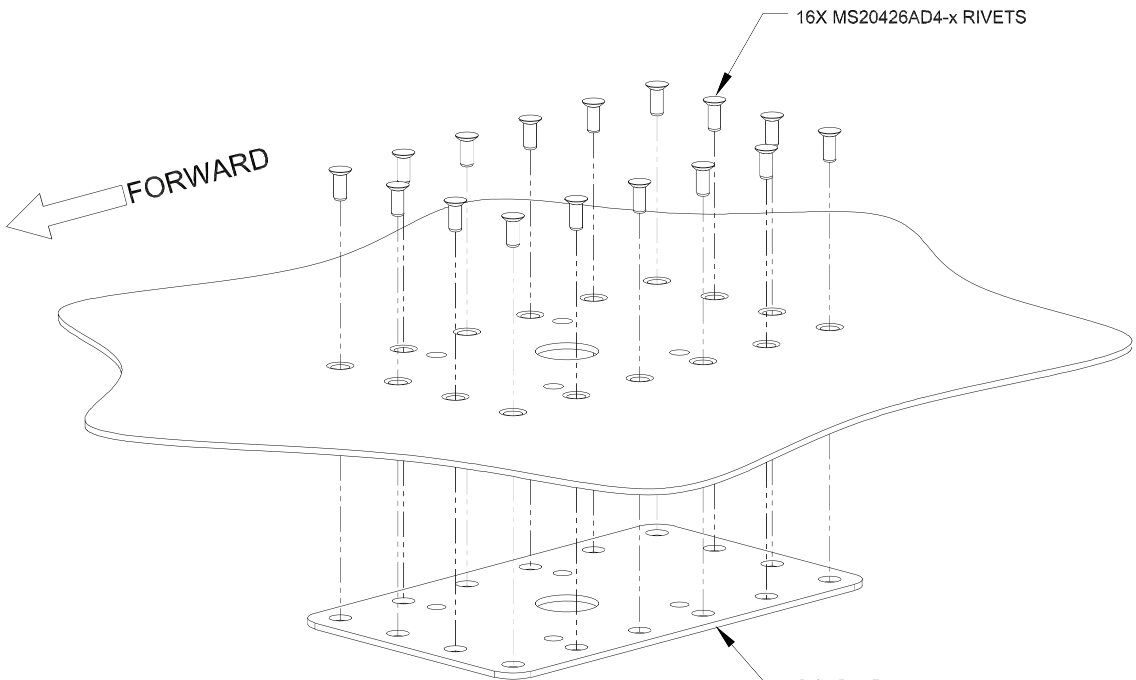
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 13-10 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"



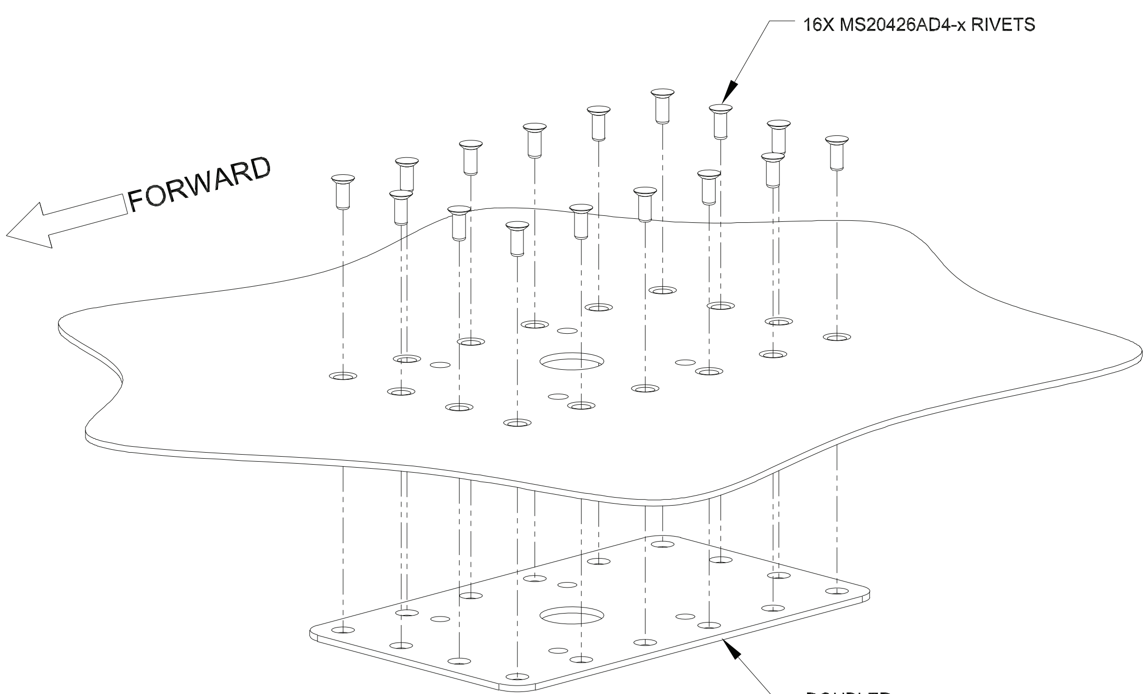
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

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

13.5 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 13-14, Figure 13-15, or Figure 13-16, 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 13-24 shows installation of the ARINC 743 footprint antenna.

Table 13-6 provides a summary of design and installation details for the antenna doubler. Figure 13-17 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 13-6 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 13-14	Figure 13-15	Figure 13-16
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 13-18	Figure 13-19	Figure 13-20
Doubler Installation (Figure)	Figure 13-21	Figure 13-22	Figure 13-23

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

13.5.1 Preparation of Doubler

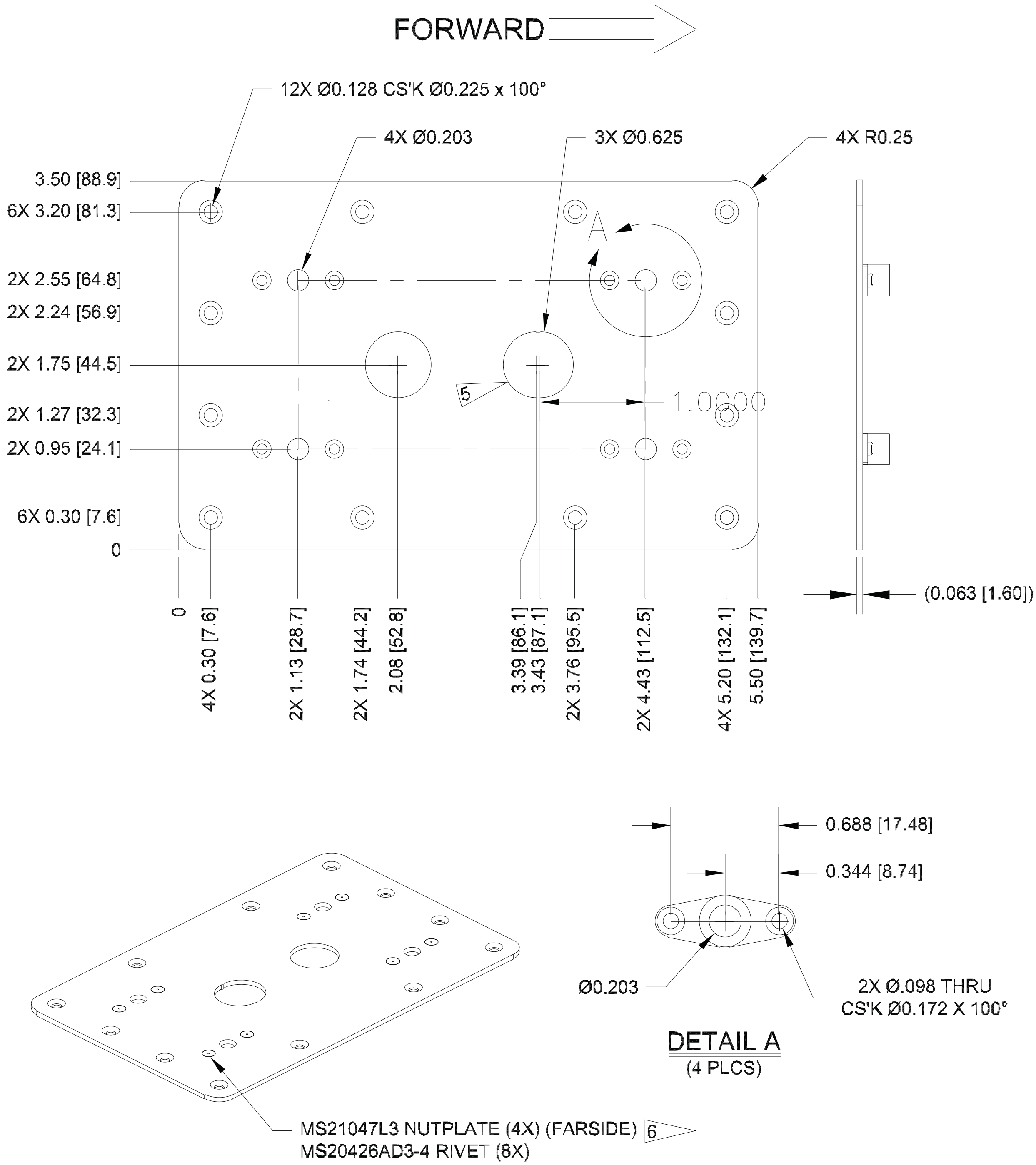
1. Use Garmin P/N: 115-00846-00, or refer to Table 13-6 for guidance on selecting the appropriate doubler drawing based on the thickness of skin at the antenna location. Make the doubler from 2024-T3 Aluminum (AMS-QQ-A-250/5), 0.063" sheet thickness.
2. For installation in aircraft skins of thickness 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 13-18) and doubler installation (Figure 13-21) are required.

13.5.2 Antenna Installation Instructions

1. Refer to Table 13-6 (and the outline and installation drawings beginning with Figure B-1.1) 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 13.5.1 for doubler preparation and Table 13-6 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.

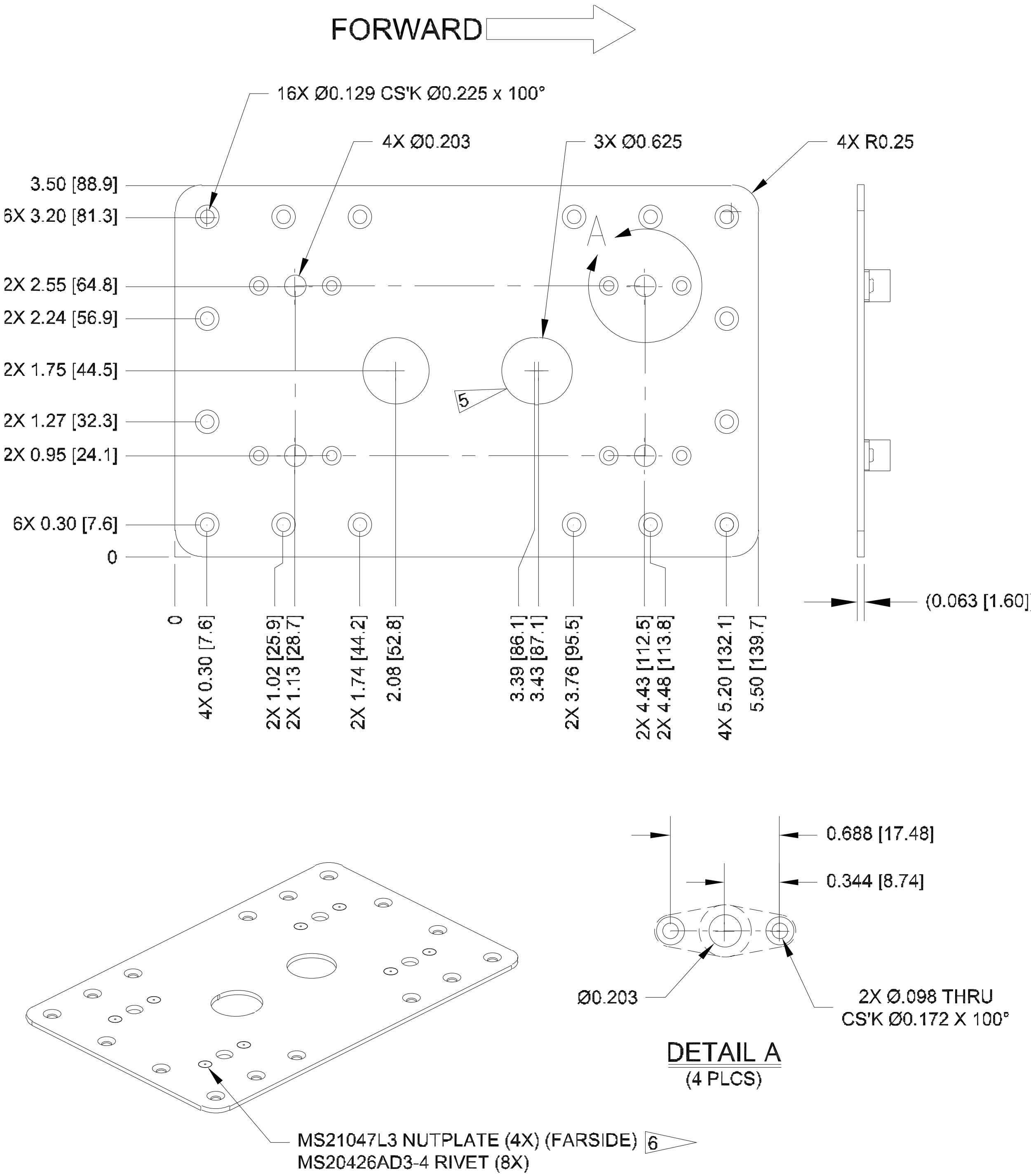
CAUTION
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

13.5.3 Reference Figures



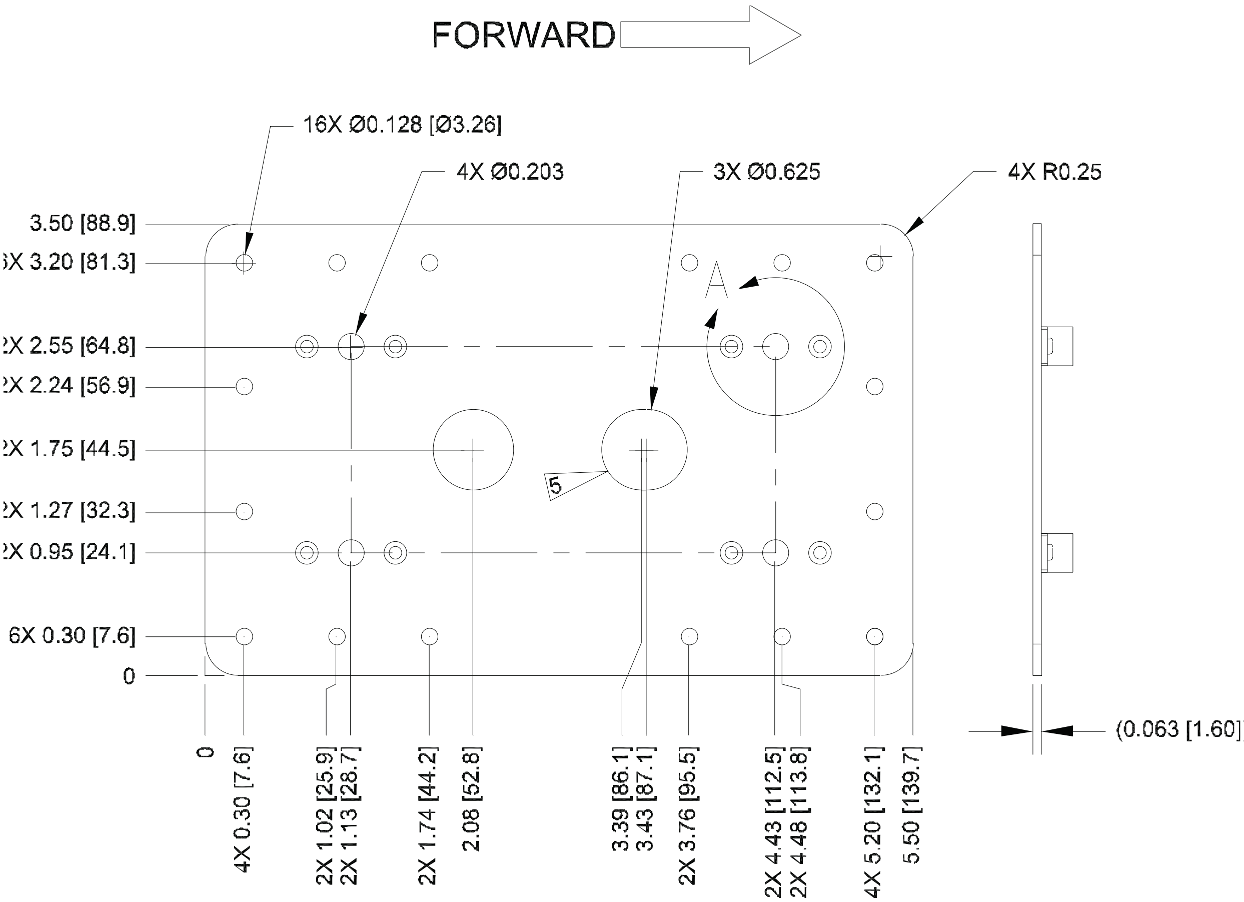
NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

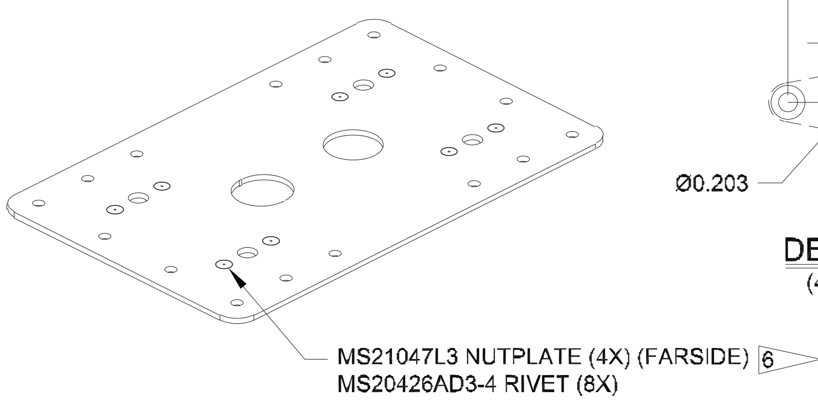
Figure 13-14 Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"

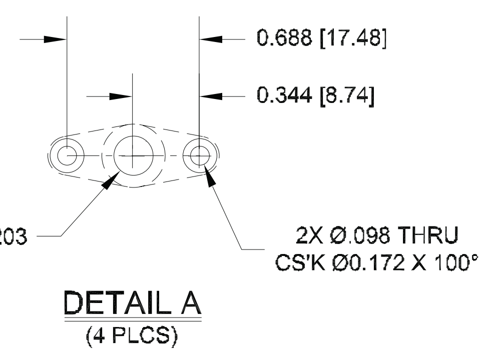


NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL. GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 13-15 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 13-16 Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"

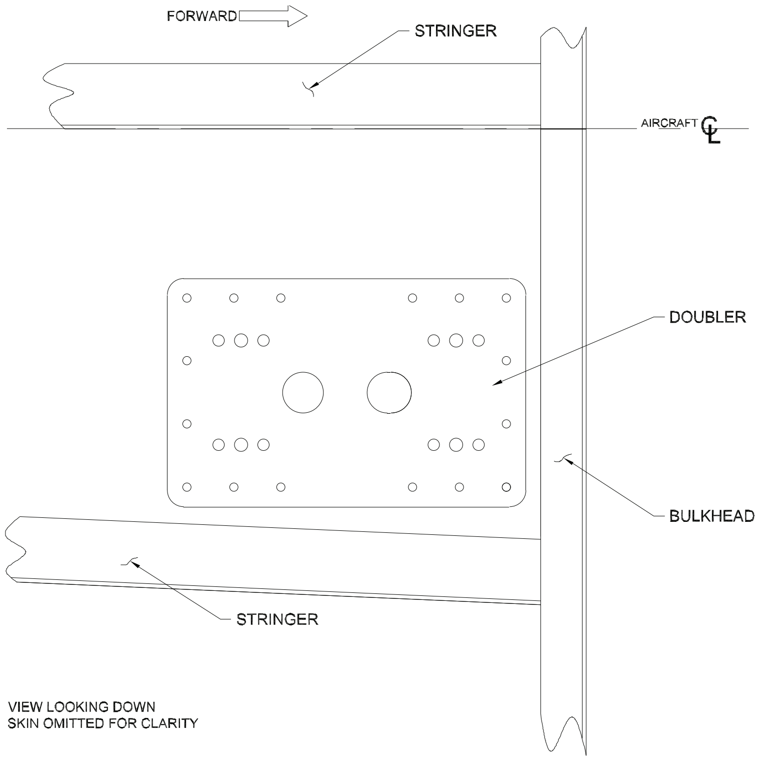
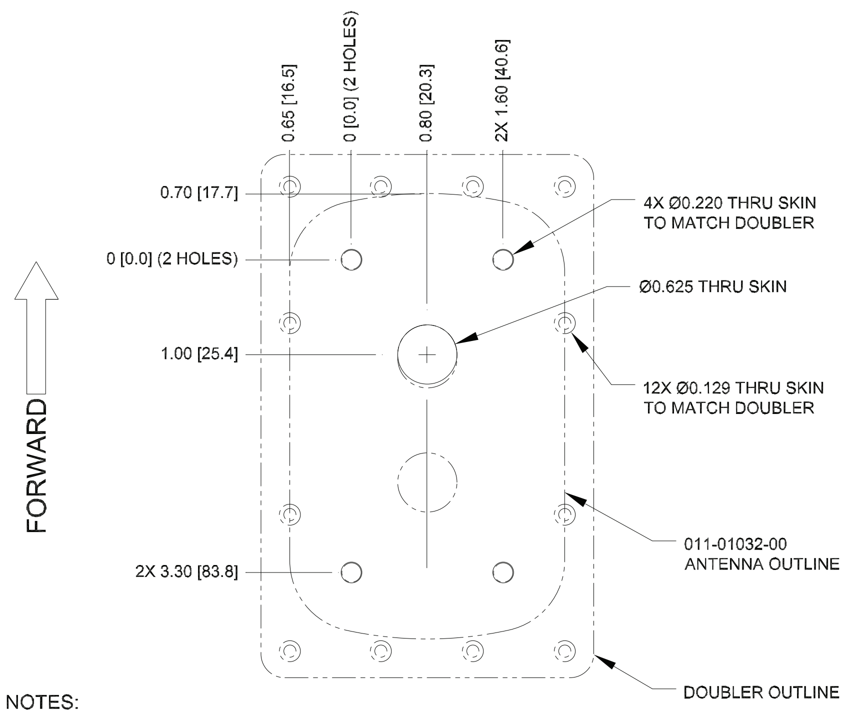
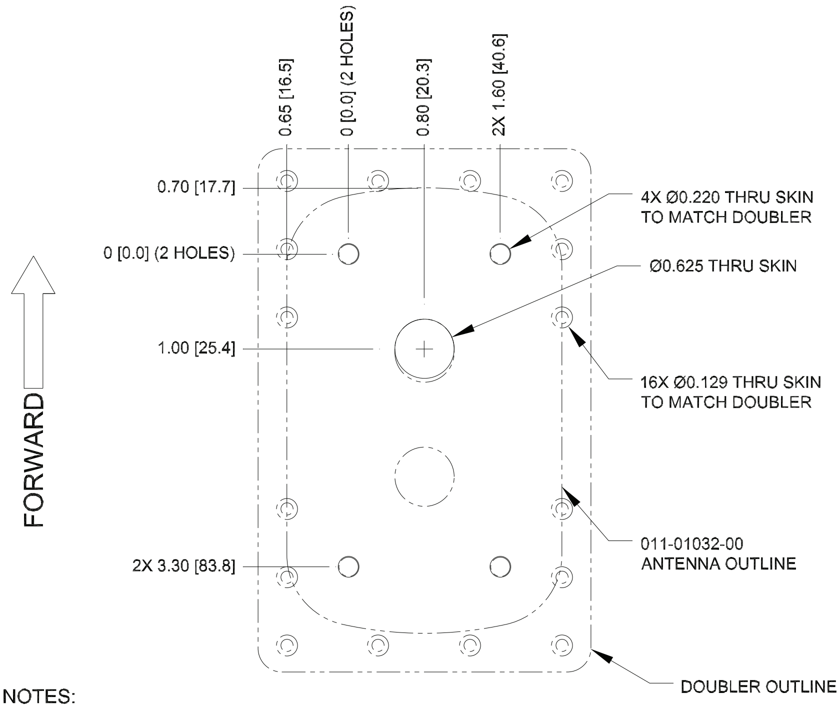


Figure 13-17 Sample Doubler Location, ARINC 743 Antenna, Metal Skin Aircraft



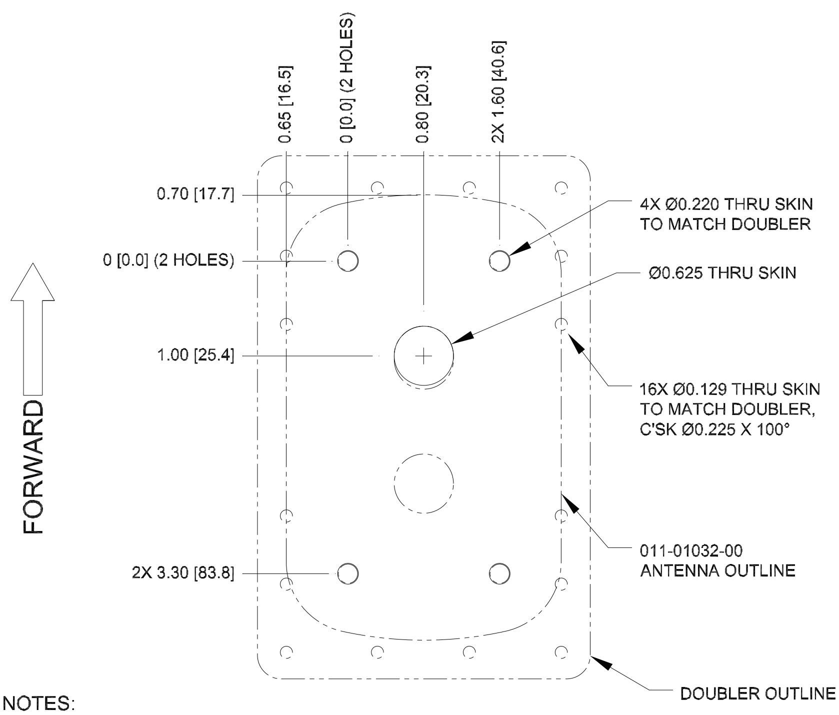
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 13-18 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



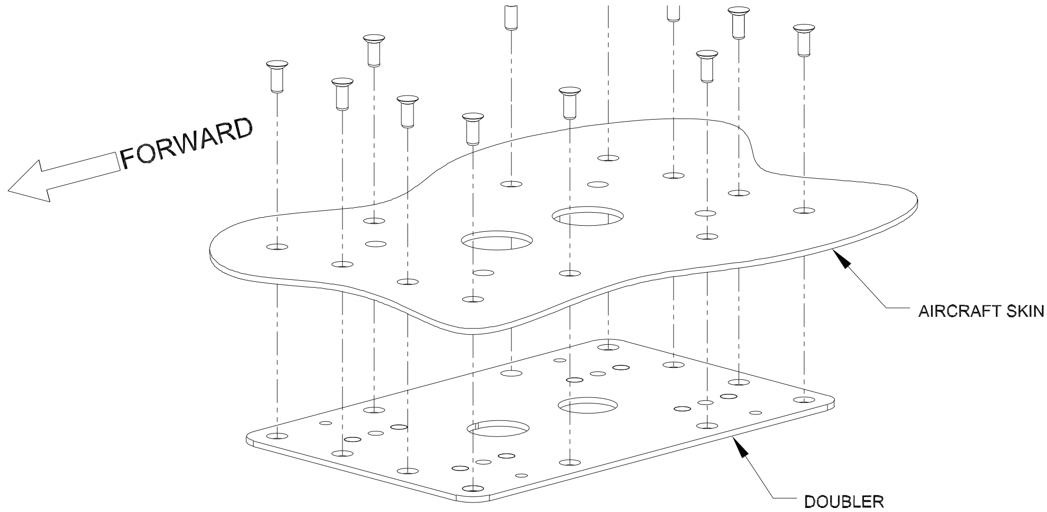
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 13-19 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



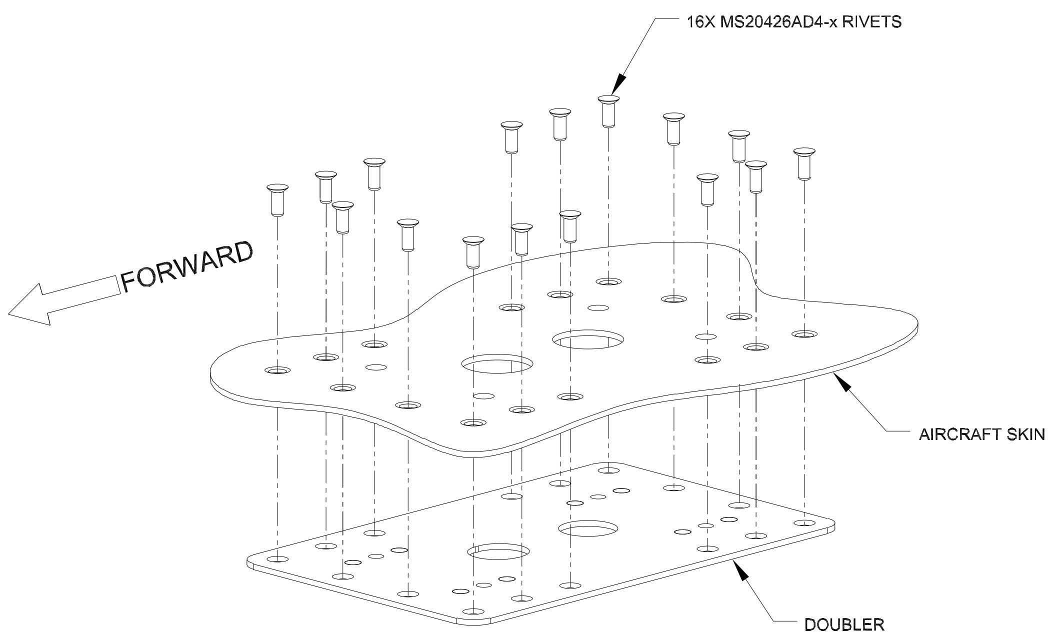
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH RIVETS.

Figure 13-20 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"



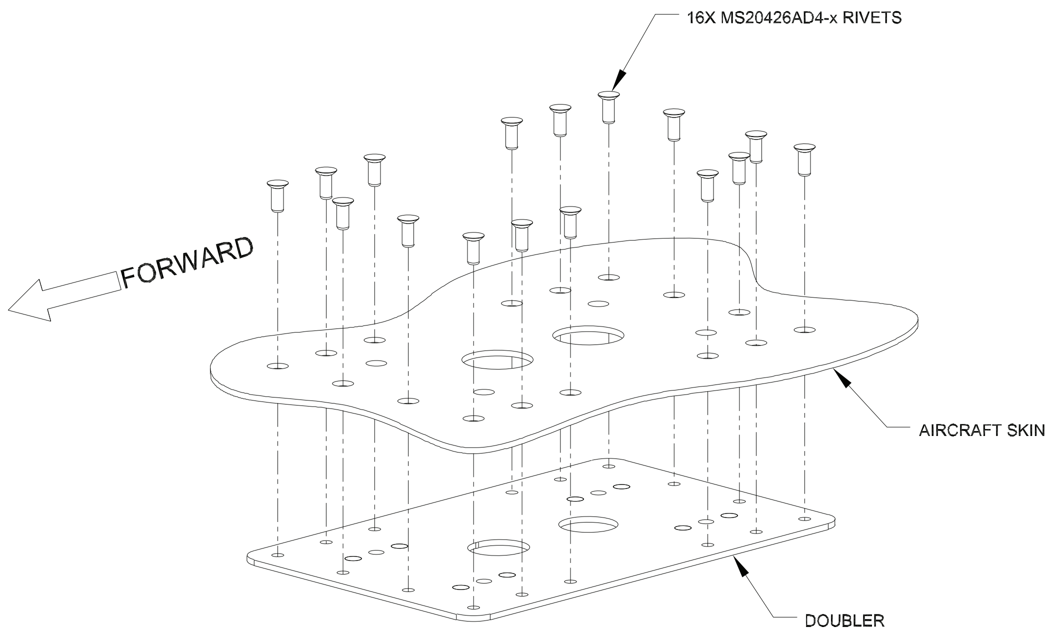
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND
INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN
AC43.13-1B.

Figure 13-21 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 13-22 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 13-23 Doubler Installation, ARINC 743 Footprint, Skin Thickness 0.051" to 0.063"

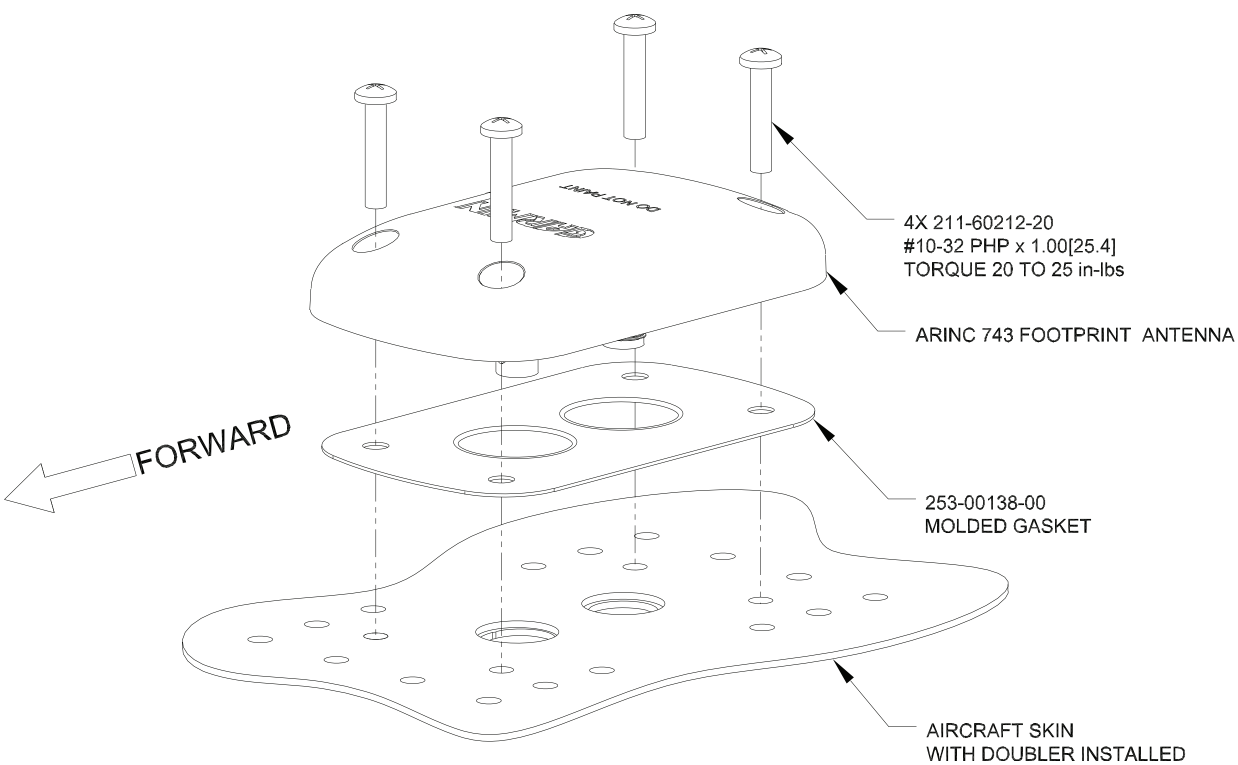


Figure 13-24 Installation of ARINC 743 Footprint Antenna

13.6 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.

13.6.1 Generic Non-structural Antenna Installation

Figure 13-25 shows the generic non-structural installation for the ARINC 743 footprint (GA 55A/GA 57X) antenna. The teardrop footprint antennas (GA 55, GA 56 stud mount) can also be installed in this manner.

For mounting the teardrop style antenna (GA 55 or GA 56), a doubler plate similar to Figure 13-4 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 the outline and installation drawings beginning with Figure B-1.1, 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 13-11, 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.

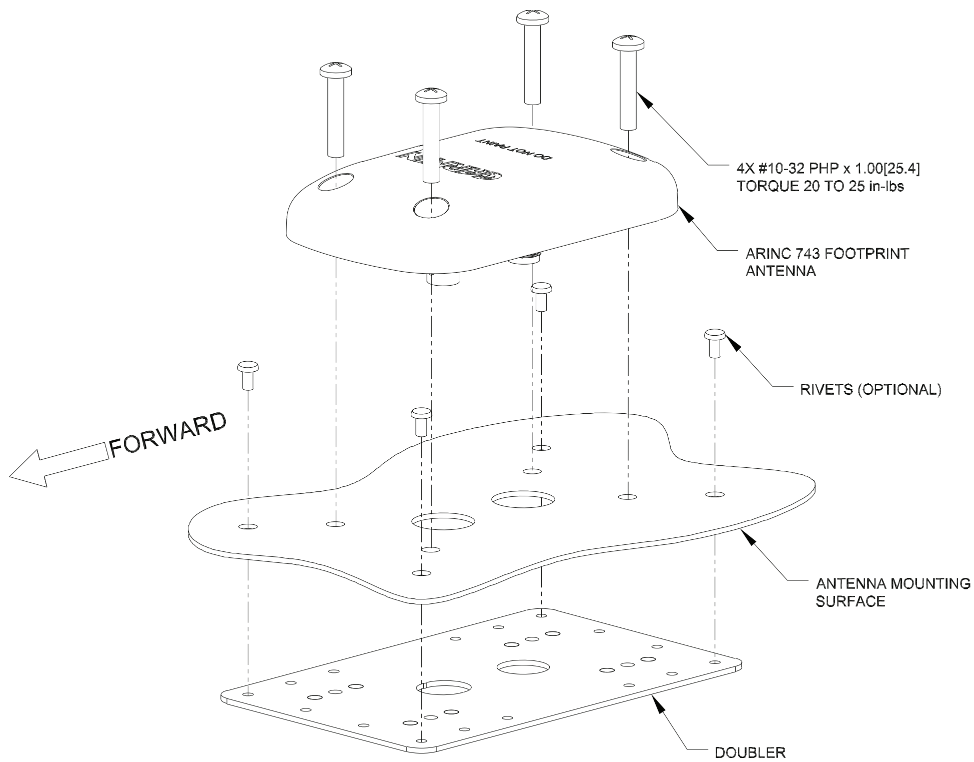


Figure 13-25 Generic Non-structural ARINC 743 Footprint Antenna Installation

13.6.2 Non-Structural Installation to Glareshield

Figure 13-26 shows an example of a bracket created to support an antenna mounted on the underside of the glare shield. Figure 13-27 shows the non-structural mounting of the antenna under the glareshield, with the bracket assembly shown in Figure 13-26.

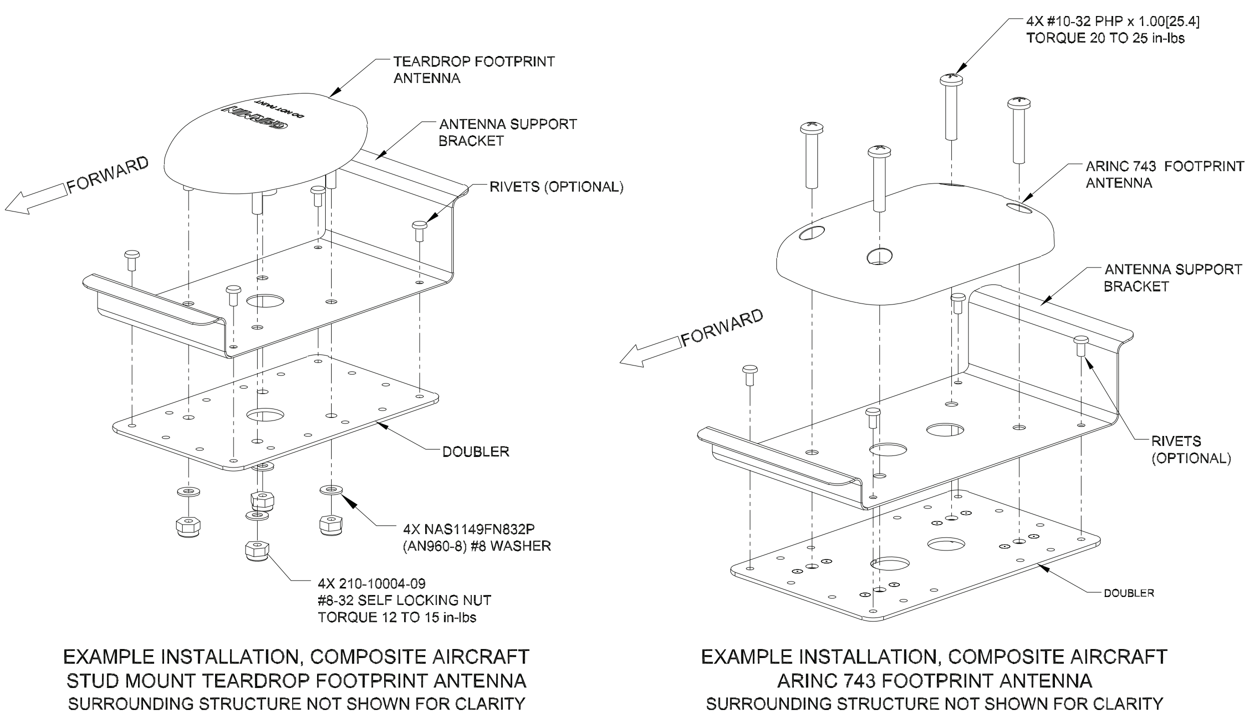


Figure 13-26 Example Bracket Antenna Mounting Under Glareshield

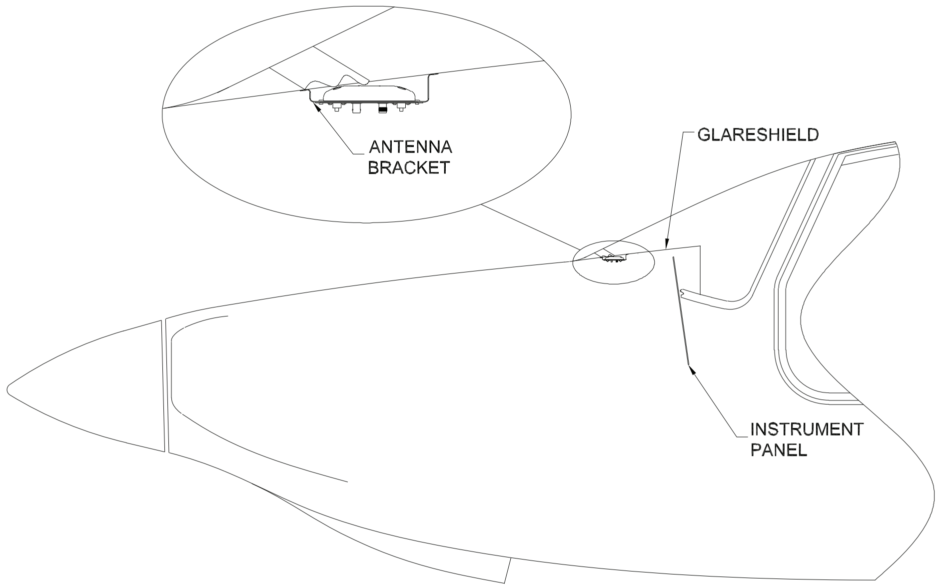


Figure 13-27   Example Non-structural Antenna Mounting Under Glareshield

13.6.3 Non-structural Installation to Airframe

Internal Non-structural Installation

Figure 13-28 and Figure 13-29 show examples of under the fabric skin non-structural mounting of the antenna to the airframe of a tube-and-fabric aircraft.

In Figure 13-28, 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 13.6.1) are used with the bracket as the antenna mounting surface. In Figure 13-29, 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.

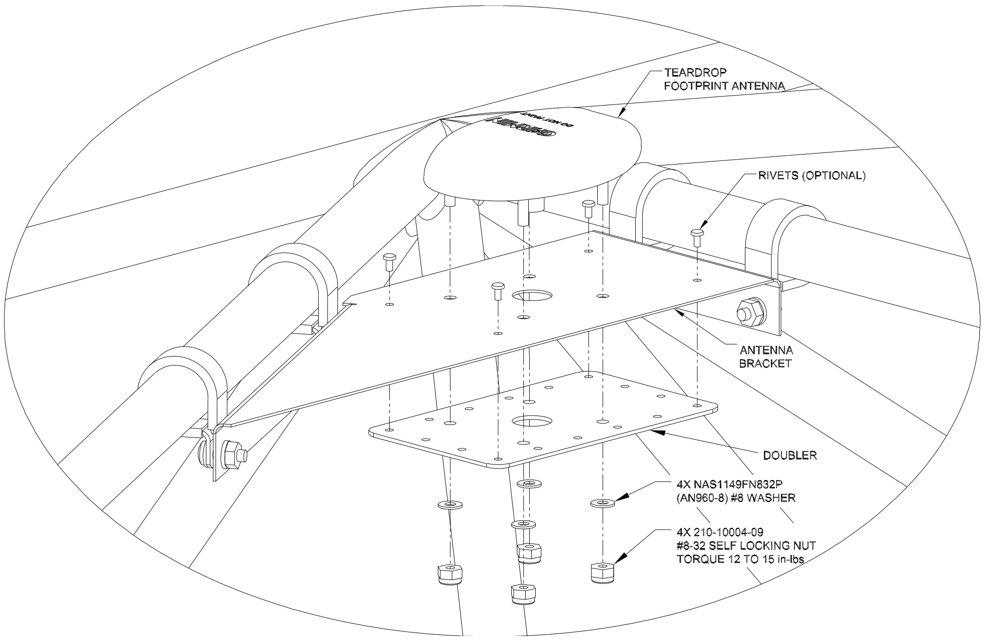


Figure 13-28 Example Teardrop Antenna Installation In Airframe Under Fabric Skin

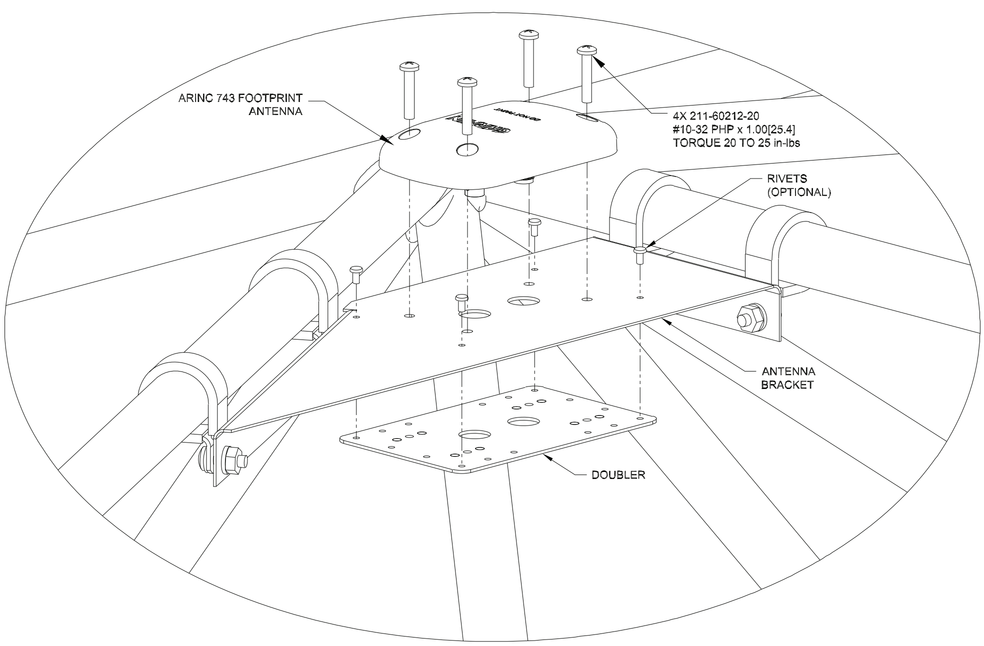


Figure 13-29 Example ARINC 743 Footprint In Airframe Under Fabric Skin

External Non-structural Installation

Figure 13-30 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 13.6.1) antenna is used, with the antenna support bracket as the mounting surface. Follow the applicable gasketing and sealant instructions in Section 13.4.2 (Teardrop style) or Section 13.5.2 (ARINC 743 style).

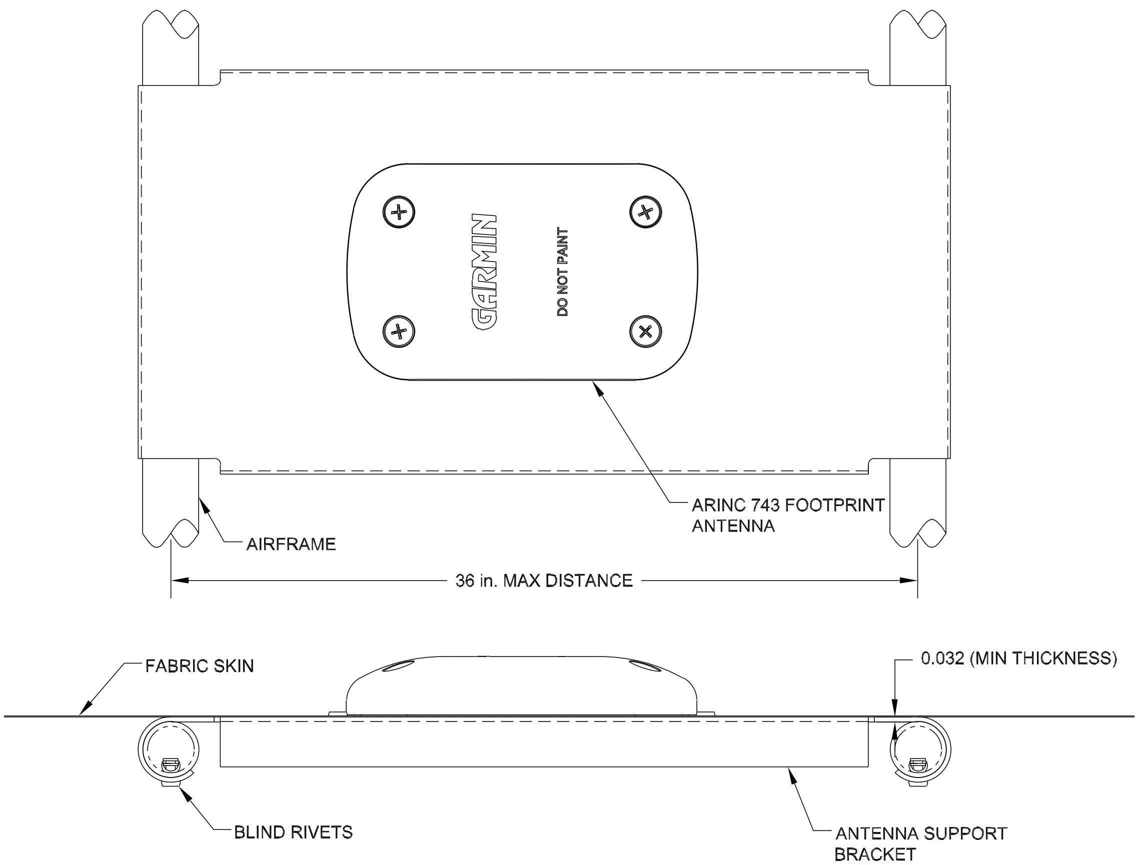


Figure 13-30 Example Non-structural Antenna Mounting On Airframe

Minimum Distance from Metal Tube Structure Requirements

Figure 13-31 shows minimum distance from metal tube structure requirements for internal, non-structural mounting of the antenna. Table 13-7 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 13-31 illustrates the tube diameter (d) and minimum distance (l) references in the Table 13-7.

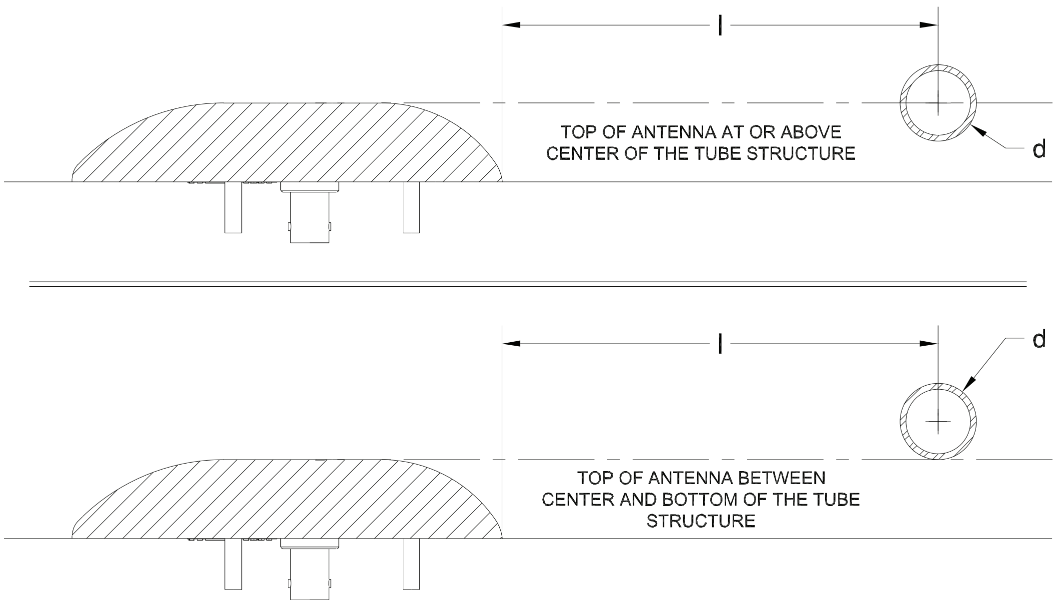


Figure 13-31 Example Teardrop Footprint Antenna Mounting Under Fabric Skin

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Table 13-7 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 13-31, 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 13-31, bottom)	0.625	7.2
	0.75	8.6
	1.00	11.5
	1.25	14.3

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14 ENGINE/AIRFRAME SENSOR INSTALLATION (OPTIONAL)

14.1 Engine/Airframe Sensor Options

Table 14-1 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 14.2). Each of the sensors must be correctly installed and configured (Section 18) prior to use.

Table 14-1 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
	Rotax 966385	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
	Rotax 966385	N/A
	Jabiru (VDO 360-003)	N/A
Oil Pressure	Kavlico P4055-150G-E4A, 0-150 psiG pressure transducer	494-30004-00
	UMA N1EU150G, 0-150 psiG pressure transducer	N/A
	Rotax 956413	N/A
	Rotax 956415	N/A
	Jabiru (VDO 320-021)	N/A
Manifold Pressure	Kavlico P4055-30A-E4A, 0-30 psiA pressure transducer	494-30004-01
	UMA N1EU70A, 0-70 psiA pressure transducer	N/A
	Kavlico P500-30A-E4A 0-30 psiA pressure transducer	N/A

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 14.2), 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

Table 14-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*
Fuel Pressure (Injected)	Kavlico P4055-50G-E4A, 0-50 psiG pressure transducer	494-30004-02
	UMA N1EU70G, 0-70 psiG pressure transducer	N/A
Fuel Pressure (Carbureted)	Kavlico P4055-15G-E4A, 0-15 psiG pressure transducer	494-30004-03
	UMA N1EU07D, 0-7 psi differential pressure transducer	N/A
	UMA N1EU35G, 0-35 psiG pressure transducer	N/A
RPM	UMA 1A3C-2	N/A
	UMA T1A9-1 (Slick Mag)	494-50005-00
	UMA T1A9-2 (Bendix Mag)	494-50005-01
	Electronic Ignition (1, 2, 3, or 4 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	10-29 Vdc 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

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 14.2), 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

Table 14-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*
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
	Rotax 966385	N/A
Position Sensor	Trim servo with integrated position sensor or standalone slide potentiometer (0-5 K Ω variable resistor)	N/A
Auxiliary Temperature	RTD (e.g. UMA 1B3XR series)	N/A
	50-150C Thermistor (e.g. VDO 320-XXX series)	N/A

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 14.2), 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 14-1) and also on the MFD's Engine Page.

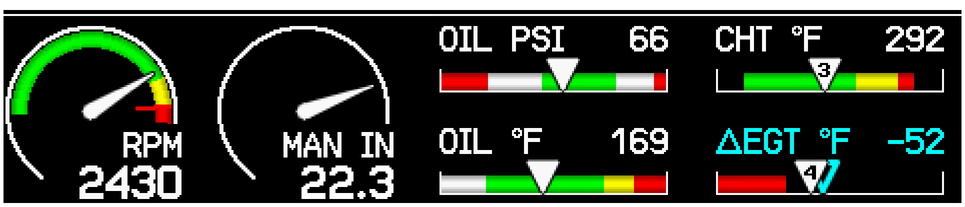

Figure 14-1 EIS Display (Engine Bar)

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 on a pre-defined priority and user selections.

RPM	Oil Temperature	Oil Pressure
Coolant Temperature	Fuel Quantity	

14.2 Garmin G3X Sensor Kits

Table 14-2, Table 14-3, and Table 14-4 list Garmin sensor kits available for G3X installations. Refer to Sensor Interface drawings in Appendix F when installing Sensor Kits K00-00512-00 and K00-00513-00. Refer to Sensor Interface drawings in Appendix G when installing Sensor Kit K00-00514-00.

Table 14-2 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, +/-50 mV, 100 amps, UMA 1C4	909-D0000-00	1

Table 14-3 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, +/-50 mV, 100 Amps, UMA 1C4	909-D0000-00	1

Table 14-4 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, +/-50 mV, 100 Amps, UMA 1C4	909-D0000-00	1

14.3 Engine Sensor Installation

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.

Appendix E, Appendix F, Appendix G, and Appendix H contain interface drawings for sensor installations using the Garmin sensor kits, and for other sensor installations.

14.3.1 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 GEA 24/ GSU 73 ground pin.

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

Rotax 966385 CHT Sensor - See Rotax Guidance for CHT Sensor installation.

14.3.1.1 Lycoming and Continental Engine Sensor Installation

General Installation Guidance – To maintain measurement accuracy, thermocouple (TC) wire must be connected directly to the inputs of the GEA 24/GSU 73. If the supplied sensor wires are not long enough to connect directly to the GEA 24/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. 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.

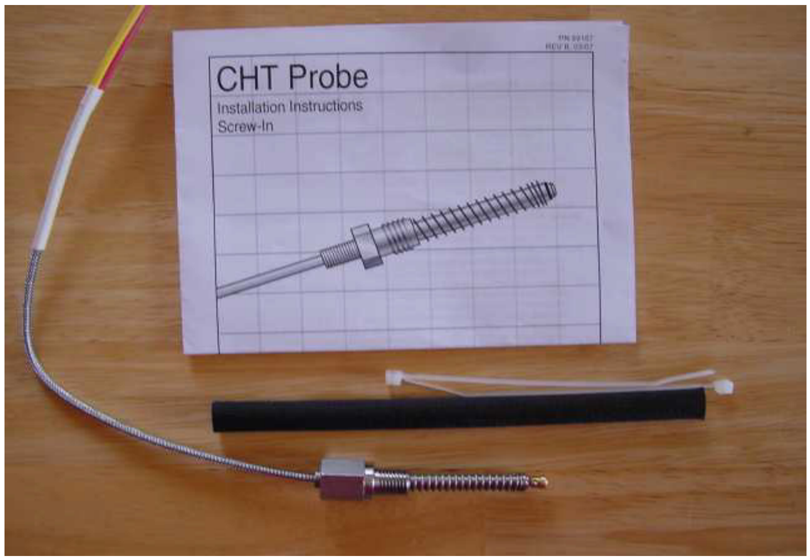

Figure 14-2 CHT Probe Package

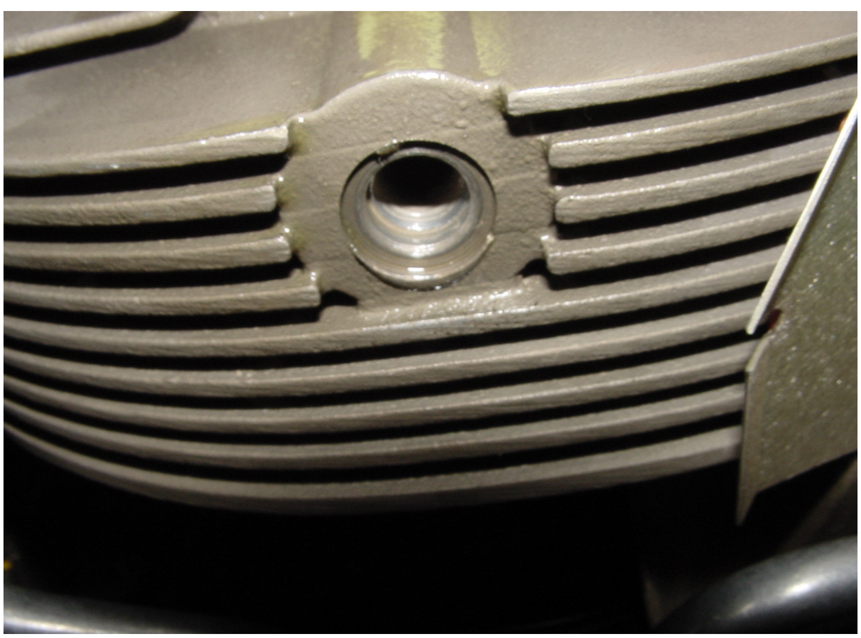

Figure 14-3 CHT Probe Well

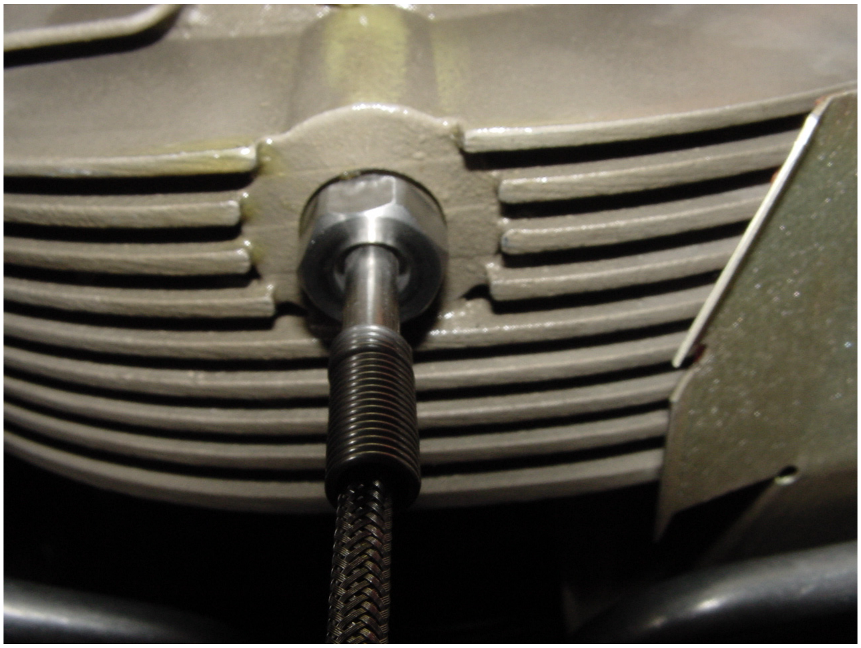

Figure 14-4 One Piece CHT Probe Installed

14.3.2 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 GEA 24/*GSU 73 ground pin.*

14.3.2.1 Engine Sensor 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 GEA 24/GSU 73. If the supplied sensor wires are not long enough to connect directly to the GEA 24/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 Figure 14-5, Figure 14-6, and Figure 14-7 to install an EGT sensor.

1. EGT probes (Figure 14-5) 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 14-6). 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 14-7 for an example of an installed EGT probe.

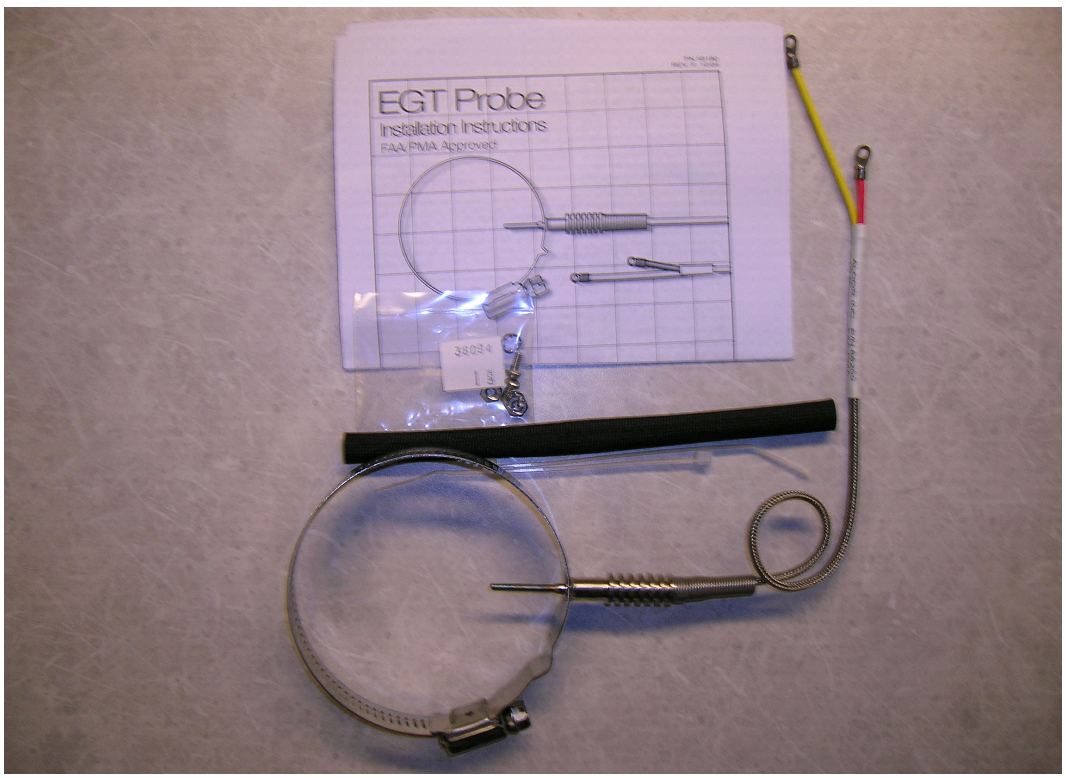

Figure 14-5 EGT Package

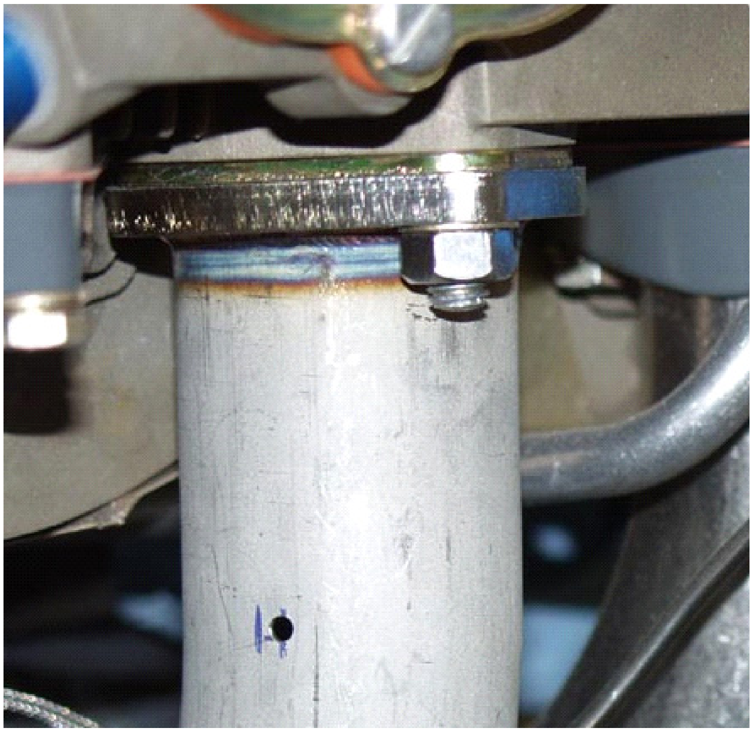

Figure 14-6 Exhaust Pipe Drilled

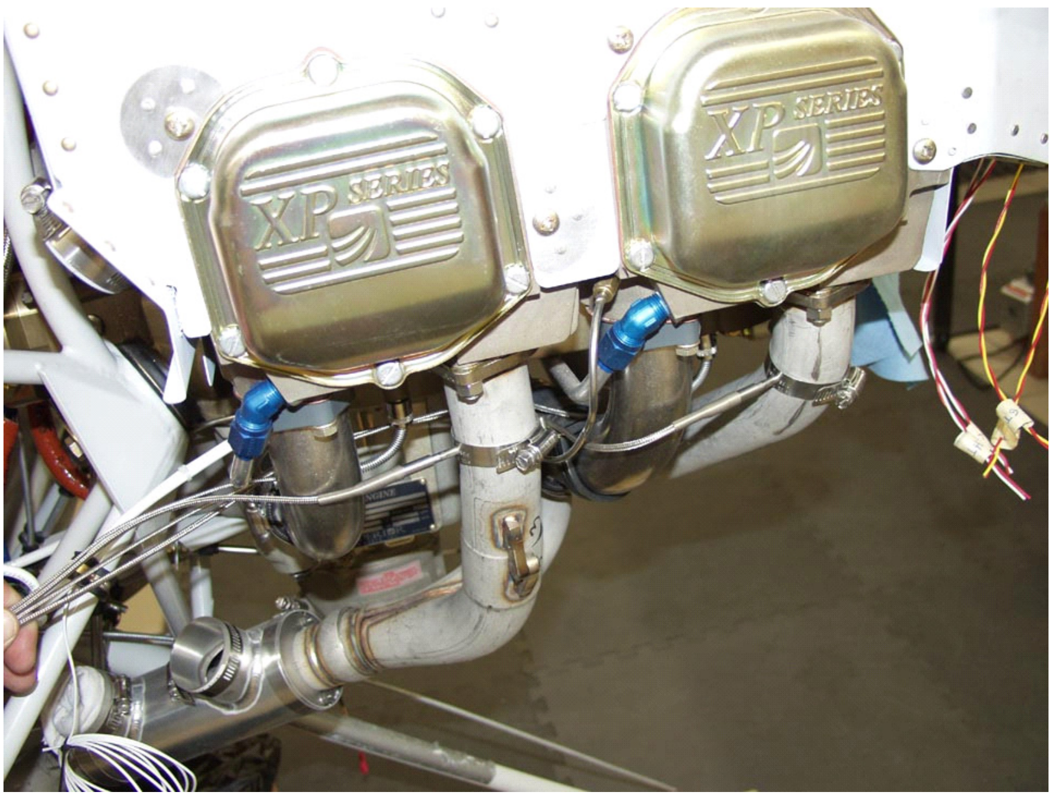

Figure 14-7 Installed EGT Probe Orientation

14.3.3 Oil Temperature

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

Rotax 965531 or Rotax 966385 Oil Temperature Sensor - See Rotax guidance for sensor installation.

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

14.3.3.1 Lycoming and Continental Engine Sensor 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 14-8), 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 GEA 24/GSU 73 as referenced in the G3X interconnects in Appendix F. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

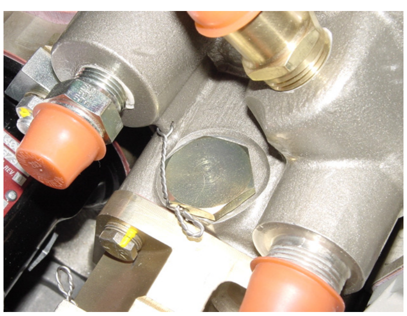

Figure 14-8 Vent Plug

Figure 14-9 Oil Temperature Probe

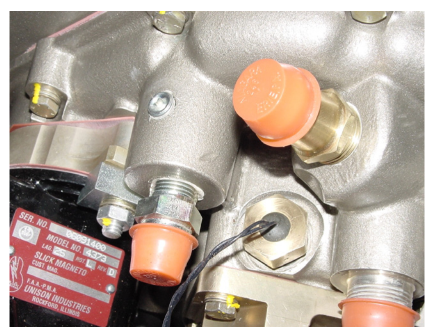

Figure 14-10 Oil Temperature Probe Installed (Crush Gasket Not Shown)

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

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

Figure 14-11 Pressure Transducer Mounting Block

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 GEA 24/GSU 73 as referenced in the Sensor Interface Drawings in Appendices F, G, and H. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

14.3.4.1 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 N1EU07D - 0-7 psiD differential pressure transducer for turbocharged carbureted engines (Rotax 914)

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

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

NOTE
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.

14.3.4.2 Manifold Pressure Sensor

Kavlico P4055-30A-E4A - 0 – 30 psiA pressure transducer.

Kavlico P500-30A-E4A - 0 – 30 psiA pressure transducer.

UMA N1EU70A - 0 – 70 psiA pressure transducer.

14.3.4.3 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. Refer to Rotax Installation Instructions for complete installation details

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

UMA N1EU150G - 0 – 150 psiG pressure transducer.

14.3.4.4 Coolant Pressure Sensor

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

14.3.5 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 1, 2, 3, or 4 pulses per revolution.

Jabiru Alternator - Direct connection to alternator output (6 pulses per revolution)

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

NOTE

Aircraft with dual electronic ignition systems can connect the tachometer signal output from the second ignition to the GEA 24/*GSU 73 RPM2 input (see Figure F-2.1). The value displayed on the RPM gauge will be the higher of the two RPM signals.*

NOTE

Electronic ignition systems with open-collector tachometer signal outputs may require a pull-up resistor between the tachometer signal output and +5VDC or +12VDC.

14.3.5.1 Lycoming and Continental Engine Sensor 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 14-12) 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 14-13).
4. Connect the supplied connector to the appropriate inputs on the GEA 24/GSU 73 as referenced in the G3X interconnects in Appendix F. 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).

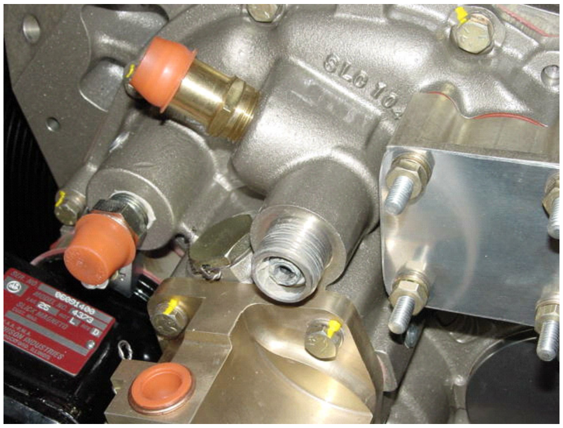

Figure 14-12 Tachometer Drive Output

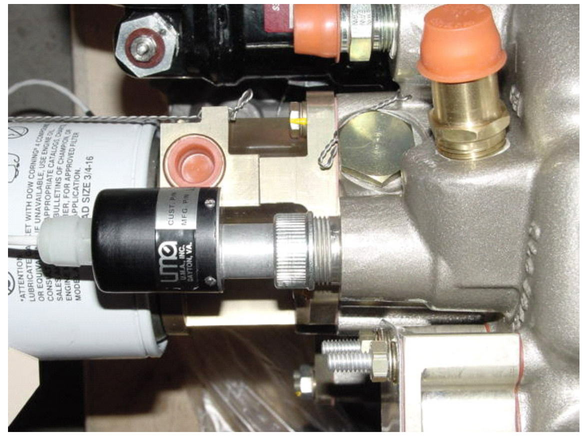

Figure 14-13 Installed Tachometer Sensor

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 14-14).
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 14-16). 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 GEA 24/GSU 73 as referenced in the G3X interconnects in Appendix F. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

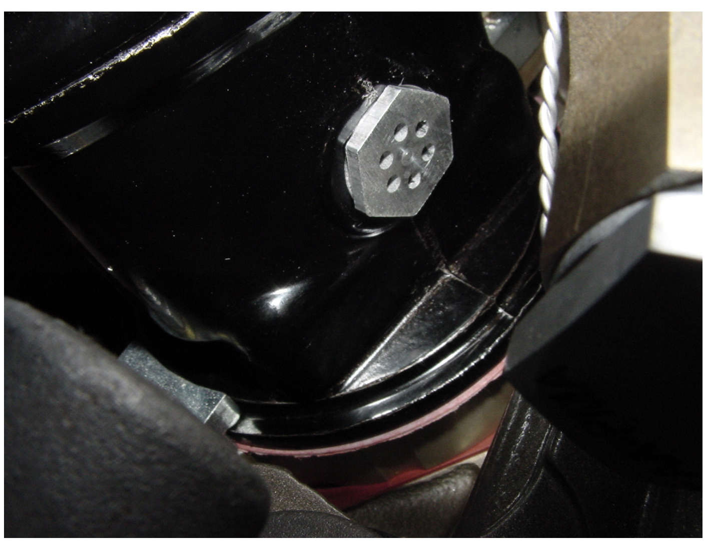

Figure 14-14 Magneto Bleed Port

NOTE

There are two plugs on a Slick/Unison 43xx series magneto where the tach sender could fit. The one closest to the rotating magnet, with the hex-shaped plug, is correct. The one on the opposite side, with a round plug, is incorrect.

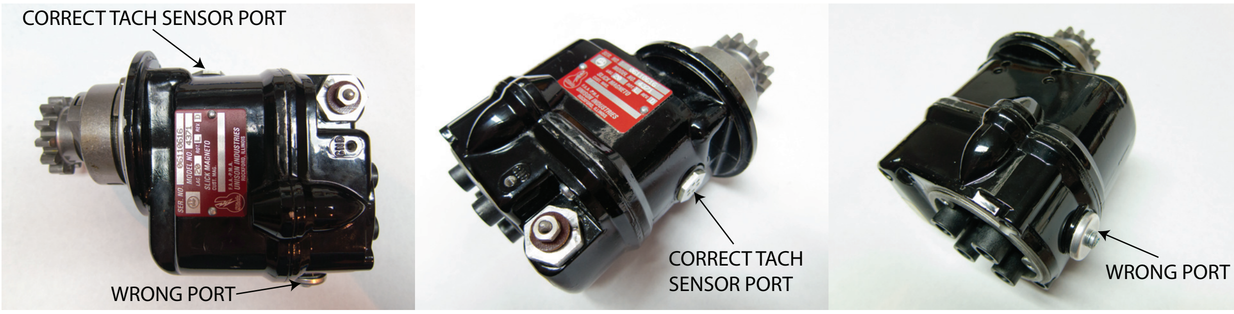

Figure 14-15 Plugs on Slick/Unison 43XX Magneto

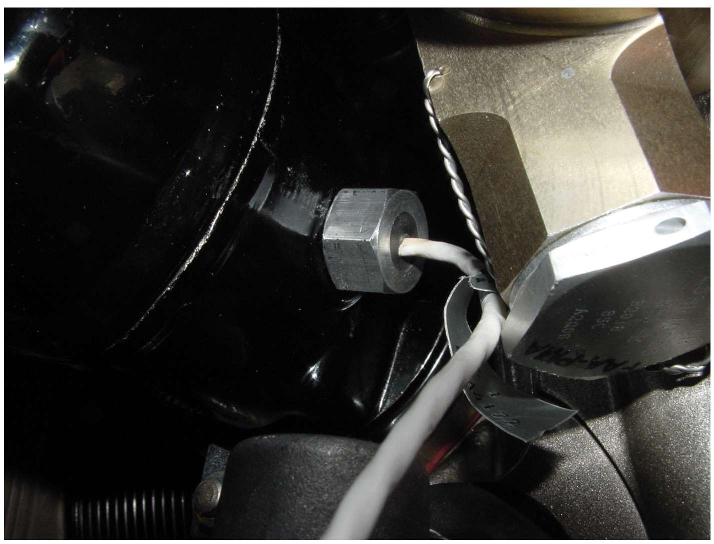

Figure 14-16 Magneto Tach Sensor Installed

14.3.6 Fuel Quantity

14.3.6.1 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 GEA 24/GSU 73 channel being used. Please see Appendices E-H for proper wiring considerations.

14.3.6.2 Capacitive Type Fuel Quantity Sensors

The GSU 73 supports two frequency inputs for fuel quantity, the GEA 24 supports four frequency inputs for fuel quantity.The P-300C receives a +5 V excitation input from the GEA 24/GSU 73 and outputs ±5 V square wave from 600 Hz to 3.8 KHz. See Appendix E for proper wiring considerations.

Capacitive fuel quantity sensors have either frequency or voltage-based ouputs. Capacitive sensors with 5 V or 12 V, 0-50 kHz frequency outputs (including the EI P-300C), are connected to the GEA 24/GSU 73 digital (frequency) fuel quantity inputs (CAP FUEL 1/2). Fuel quantity sensors with 0-5 VDC or 0-12 VDC analog outputs (such as the Skysports or Westach capacitive sensors), are connected to the GEA 24/GSU 73 analog fuel quantity inputs (FUEL 1/2/3/4). See Figure E-2.1 for examples of each type.

NOTE

Vision Microsystems capacitive level senders may require installing a 5 kΩ pull-down resistor at the sensor output.

NOTE

Princeton capacitive converters may require being connected to aircraft power as a voltage source instead of using the 12V transducer power output.

14.3.7 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 GEA 24/GSU 73. If the supplied sensor wires are not long enough to connect directly to the GEA 24/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.

14.3.8 Bus Voltage Monitor

Bus voltage is normally sensed from an external voltage signal connected to a GEA 24/GSU 73 analog input (refer to Appendix E for interface drawings). Optionally, the GEA 24/GSU 73 can be configured to measure bus voltage without requiring an external connection, by sensing the voltage of its power supply inputs. See Section 18.3.2 (Volts 1 and Volts 2 Inputs) for configuration guidance.

14.3.9 Bus Current

14.3.9.1 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.

14.3.9.2 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 14-17). 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.

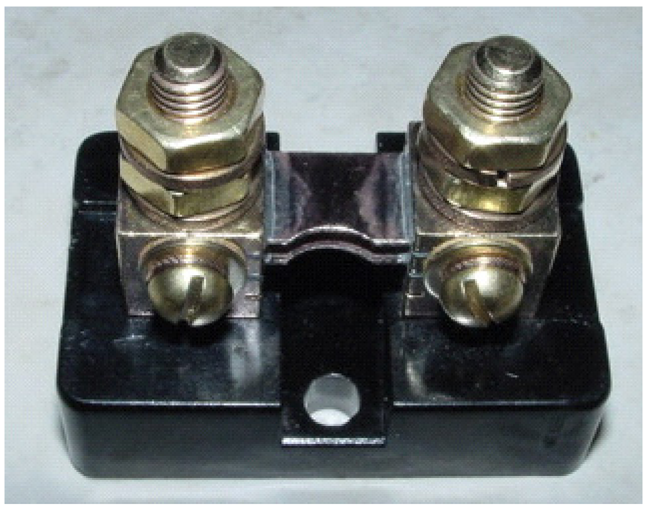

Figure 14-17 Ammeter Shunt

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 GEA 24/GSU 73 inputs to prevent inadvertent damage to the GEA 24/GSU 73. Connect the two sense wires (attached to the #8 terminals) to the appropriate inputs on the GEA 24/GSU 73 as referenced in the G3X interconnects in Appendices E-H . 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.

14.3.10 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).
4. On 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 GEA 24/GSU 73 as referenced in the G3X interconnects in Appendices E-H.

For engines with a fuel return line, a second flow sensor must be used to measure the quantity of unused fuel that is returned from the engine to the fuel tank. Connect the return fuel flow sensor to the GEA 24/ GSU 73 FUEL FLOW 2 input (see Figure E-2.1). The value displayed on the fuel flow gauge will be the difference between the main (supply) fuel flow and secondary (return) fuel flow measurements.

14.3.10.1 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 14-18).

NOTE

If the Floscan tag shown in Figure 14-18 is lost, the serial number of the Floscan sensor can be supplied to Floscan to obtain the calibrated K factor value.

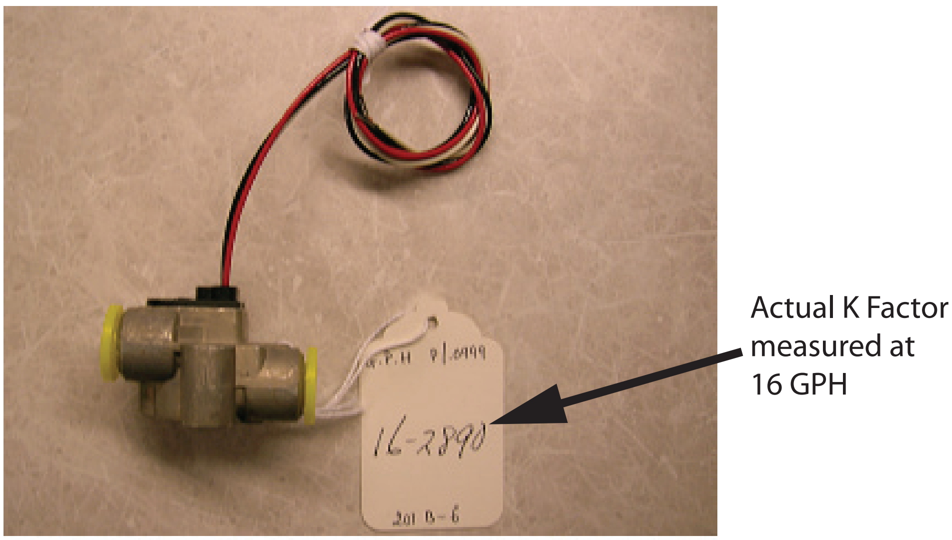

Figure 14-18 Example Floscan Fuel Flow Sensor

The tag shown in Figure 14-18 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 18.3.3. 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.

14.3.10.2 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 18.3.3 for additional information.

14.3.11 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 or Rotax 966385 - This sensor is applicable to all carbureted Rotax engines. Refer to Rotax Installation Instructions for complete installation details.

14.3.11.1 Lycoming and Continental Engine Sensor Installation

General Installation Guidance:

1. Locate and remove the threaded ¼-28 brass plug (Figure 14-19 and Figure 14-20) on the side of the carburetor as shown in Figure 14-19. 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 14-21).
3. Connect the supplied connector to the appropriate inputs of the GEA 24/GSU 73 as referenced in the G3X interconnects in Appendices F and G. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

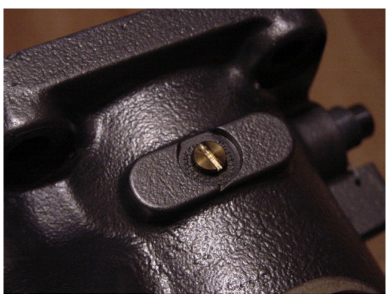

Figure 14-19 Carb Temp Sensor Mounting Location

Figure 14-20 Carb Temp Sensor Mounting Location w/Screw Removed

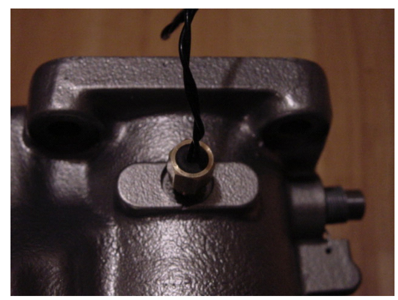

Figure 14-21 Carb Temp Sensor Installed

14.3.12 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 E for proper wiring connections. Section 18.3.2 provides calibration instructions.

14.3.13 Rotax 912iS used as FADEC Interface

The G3X system is capable of monitoring the following engine parameters from the Rotax 912iS FADEC digital interface, when connected via a GEA 24:

- RPM
- Manifold pressure
- Oil pressure
- Oil temperature
- Exhaust gas temperature
- Coolant temperature
- Fuel flow
- ECU bus voltage

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15 LRU PINOUTS

Use the information in this section (along with other applicable sections/appendices in this document) to construct the wiring required for the G3X installation.

Connector references JXXX(X) and PXXX(X) are used throughout this section and in Appendices C through H. The letter "J" or "P" designates the connector (whether on the LRU or wiring harness). "J" (Jack) refers to the connector on the LRU, and "P" (Plug) refers to the connector on the wiring harness. "J" or "P" designate the connector only, regardless of contact type (pin or socket).

15.1 GAD 29

15.1.1 J291 Connector

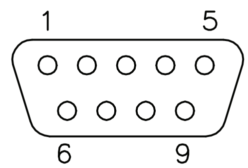

Figure 15-1 J291 on GAD 29, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN HI	I/O
2	CAN LO	I/O
3	RESERVED	--
4	RESERVED	--
5	RESERVED	--
6	GROUND	--
7	AIRCRAFT POWER 1	In
8	AIRCRAFT POWER 2	In
9	GROUND	--

15.1.2 J292 Connector

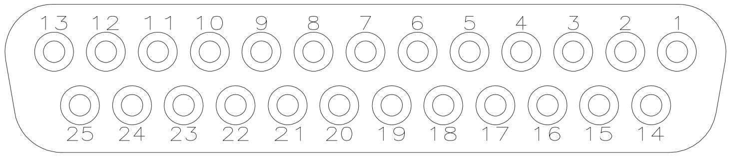

Figure 15-2 J292 on GAD 29, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	RESERVED	--
2	RESERVED	--
3	RESERVED	--
4	ARINC RX 4B	In
5	ARINC RX 3B	In
6	ARINC TX 2B	Out
7		
8	RESERVED	--
9	CAN TERM 1	--
10	ARINC RX 2B	In
11	ARINC RX 1B	In
12	ARINC TX 1B	Out
13		
14	GROUND	--
15	RESERVED	--
16	ARINC RX 4A	In
17	ARINC RX 3A	In
18	ARINC TX 2A	Out
19		
20	GROUND	--
21	CAN TERM 2	--
22	ARINC RX 2A	In
23	ARINC RX 1A	In
24	ARINC TX 1A	Out
25		

15.1.3 Power

This section covers the power input requirements. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode ORed" to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J291	7	In
AIRCRAFT POWER 2	J291	8	In
POWER GROUND	J291	6	--
POWER GROUND	J291	9	--

15.1.4 ARINC 429 RX/TX

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers. Each ARINC 429 Transmitter pin is physically connected to two DSUB pins. When running one transmitter to two receivers use two separate pins to avoid splicing wires. Running one transmitter to more than two receivers will require splicing wires.

Pin	Connector	Pin Name	I/O
23	J292	ARINC RX 1A	In
11	J292	ARINC RX 1B	In
24 25	J292	ARINC TX 1A	Out
12 13	J292	ARINC TX 1B	Out
22	J292	ARINC RX 2A	In
10	J292	ARINC RX 2B	In
18 19	J292	ARINC TX 2A	Out
6 7	J292	ARINC TX 2B	Out
17	J292	ARINC RX 3A	In
5	J292	ARINC RX 3B	In
16	J292	ARINC RX 4A	In
4	J292	ARINC RX 4B	In

15.1.5 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Pins 9 and 21 are used to terminate the CAN bus. To terminate the CAN bus at the GAD 29 short the pins (9 and 21) together. Refer to Section 2.3.1.3 for details on configuring and terminating the CAN bus. The CAN bus on J241 shall be used for communications between G3X LRUs.

Pin Name	Connector	Pin	I/O
CAN HI	J291	1	I/O
CAN LO	J291	2	I/O
CAN TERM 1	J292	9	--
CAN TERM 2	J292	21	--

15.2 GDU 37X

15.2.1 J3701 Connector

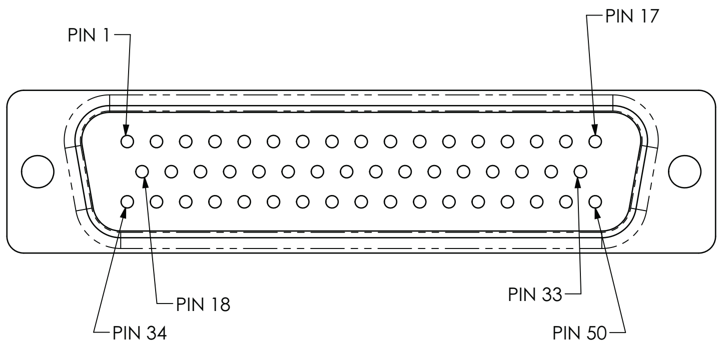

Figure 15-3 J3701 on GDU 37X, as viewed looking at connector on unit

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	--

*Indicates Active Low

Pin	Pin Name	I/O
25	CDU SYSTEM ID PROGRAM* 3	In
26	28V LIGHTING BUS HI	In
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

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.

15.2.2 Aircraft Power

The GDU can operate using power from one or both inputs (AIRCRAFT POWER 1 AND AIRCRAFT POWER 2). The pins are internally connected using diodes to prevent current from flowing between the two power inputs. 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	J3701	32	In
AIRCRAFT POWER 2	J3701	31	In
POWER GROUND	J3701	15	--
POWER GROUND	J3701	16	--

15.2.3 Mode Selections

In a single-display system, configure the display as PFD1. In a two display-system, configure one display as PFD1 and the other display as MFD. In a three-display system, one display is PFD1, one is the MFD, and the third is PFD2.

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, J3701 Pin 10	CDU SYSTEM ID PROGRAM* 2, J3701 Pin 9	GDU Mode
Open	Open	MFD
Ground	Open	PFD1
Open	Ground	PFD2
Ground	Ground	Do Not Use

CDU SYSTEM ID PROGRAM* 3 J3701 Pin 25	GDU Mode
Open	Auto Reversionary
Ground	Forced Reversionary

CDU SYSTEM ID PROGRAM* 4 J3701 Pin 42	GDU Mode
Open	Normal Operation
Ground	Demo Mode

15.2.4 Serial Data

15.2.4.1 RS-232

3 Channels of RS-232 I/O data.

Pin Name	Connector	Pin	I/O
RS-232 IN 1	J3701	47	In
RS-232 OUT 1	J3701	48	Out
RS-232 IN 2	J3701	14	In
RS-232 OUT 2	J3701	30	Out
RS-232 IN 3	J3701	29	In
RS-232 OUT 3	J3701	13	Out

15.2.4.2 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), see Section 2.3.1.3 for details.

Pin Name	Connector	Pin	I/O
CAN BUS HI	J3701	46	I/O
CAN BUS LO	J3701	45	I/O
CAN BUS TERMINATION	J3701	28	--

15.2.4.3 Configuration Module

Connect the configuration module to the PFD1 unit; do not connect a config module to PFD2 or the MFD.

Pin Name	Wire Color	Connector	Pin	I/O
CONFIG MODULE CLOCK	WHITE (WHT)	J3701	33	I/O
CONFIG MODULE DATA	YELLOW (YEL)	J3701	50	I/O
CONFIG MODULE POWER OUT	RED (RED)	J3701	17	Out
CONFIG MODULE GROUND	BLACK (BLK)	J3701	49	--

15.2.5 Lighting

The GDU 37X display brightness 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	J3701	43	In
28V LIGHTING BUS HI	J3701	26	In

15.2.6 Audio

15.2.6.1 Mono Audio

The mono audio output provides audio alerts for connection to an unswitched input on an intercom or audio panel.

Pin Name	Connector	Pin	I/O
MONO AUDIO OUT HI	J3701	1	Out
MONO AUDIO OUT LO	J3701	18	--

15.2.6.2 Stereo Audio

The stereo audio output provides XM audio for connection to an entertainment input on an intercom or audio panel. Audio alerts may optionally be reproduced on the stereo audio output in addition to the mono audio output. See Section 17.3.11 for instructions regarding the sound config page.

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.

Pin Name	Connector	Pin	I/O
STEREO AUDIO OUT LEFT	J3701	3	Out
STEREO AUDIO OUT LO	J3701	20	--
STEREO AUDIO OUT RIGHT	J3701	19	Out
STEREO AUDIO OUT LO	J3701	2	--

15.3 GEA 24

15.3.1 J241 Connector

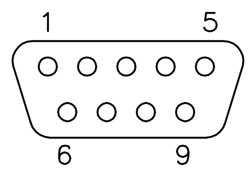

Figure 15-4 J241 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN HI	I/O
2	CAN LO	I/O
3	RESERVED	--
4	RESERVED	--
5	RESERVED	--
6	GROUND	--
7	AIRCRAFT POWER 1	In
8	AIRCRAFT POWER 2	In
9	GROUND	--

15.3.2 J242 Connector

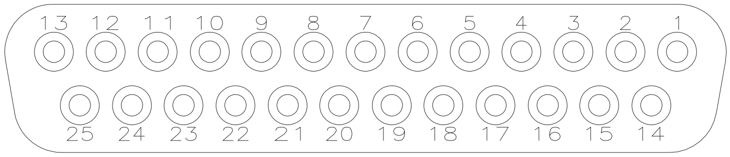

Figure 15-5 J242 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	RESERVED	--
2	CHT6 LO / CHT 2 RESISTIVE LO	In
3	EGT6 LO	In
4	CHT5 LO / CHT 1 RESISTIVE LO	In
5	EGT5 LO	In
6	CHT4 LO	In
7	EGT4 LO	In
8	CHT3 LO	In
9	EGT3 LO	In
10	CHT2 LO	In
11	EGT2 LO	In
12	CHT1 LO	In
13	EGT1 LO	In
14	CHT6 HI / CHT 2 RESISTIVE HI	In
15	EGT6 HI	In
16	CHT5 / CHT 1 RESISTIVE HI	In
17	EGT5 HI	In
18	CHT4 HI	In
19	EGT4 HI	In
20	CHT3 HI	In
21	EGT3 HI	In
22	CHT2 HI	In
23	EGT2 HI	In
24	CHT1 HI	In
25	EGT1 HI	In

15.3.3 J243 Connector

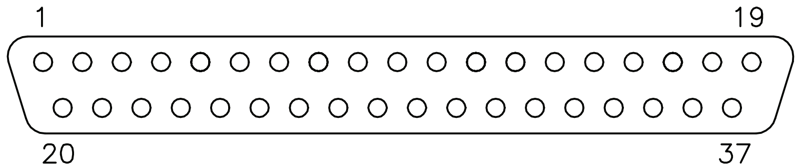

Figure 15-6 J243 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	FUEL PRESS GND	--
2	FUEL PRESS	In
3	FUEL PRESS XDCR +12V	Out
4	FUEL PRESS XDCR +5V	Out
5	RPM XDCR GND_2	--
6	RPM 2	In
7	RPM XDCR GND_1	--
8	RPM 1	In
9	RPM XDCR +12V_1	Out
10	RPM XDCR +12V_2	Out
11	RESERVED / SPARE	In
12	MANIFOLD PRESS GND	--
13	MANIFOLD PRESS	In
14	MANIFOLD PRESS XDCR +12V	Out
15	MANIFOLD PRESS XDCR +5V	Out
16	OIL PRESS GND	--
17	OIL PRESS HI	In
18	OIL PRESS XDCR +12V	Out
19	OIL PRESS XDCR +5V	Out
20	FUEL XDCR GND_1	--
21	FUEL RETURN (shared w/Pin 37, J244 connector)	In
22	FUEL XDCR GND_2	--
23	FUEL FLOW (shared with Pin 36, J244 connector)	In
24	FUEL XDCR +12V_1	Out
25	FUEL XDCR +12V_2	Out
26	GP +5V_1	Out
27	GP GND_1	--
28	POS 7 / TIT 2 / MISC TEMP 2 LO	In
29	POS 7 / TIT 2 / MISC TEMP 2 HI	In

*Indicates Active Low

Pin	Pin Name	I/O
30	POS 6 / TIT 1 / MISC TEMP 1 LO	In
31	POS 6 / TIT 1 / MISC TEMP 1 HI	In
32	OIL TEMP LO	In
33	OIL TEMP HI	In
34	SHUNT 2 LO (shared with Pin 47, J244 connector)	In
35	SHUNT 2 HI (shared with Pin 46, J244 connector)	In
36	SHUNT 1 LO	In
37	SHUNT 1 HI	In

*Indicates Active Low

15.3.4 J244 Connector

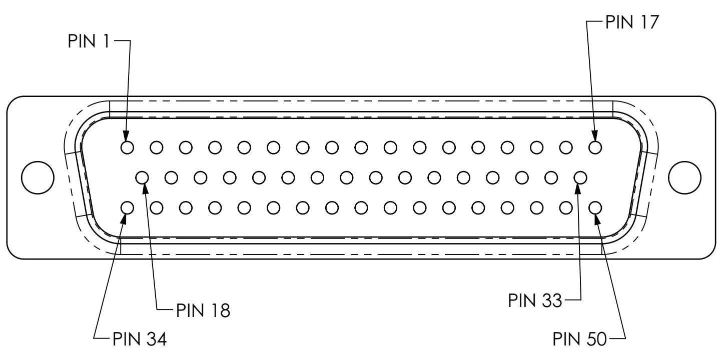

Figure 15-7 J244 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	SYSTEM ID 1A	In
2	SYSTEM ID1B / GND	--
3	SYSTEM ID 2A	In
4	SYSTEM ID 2B / GND	--
5	FUEL QTY +5V_1	Out
6	FUEL QTY 1	In
7	FUEL QTY 1 GND	--
8	FUEL QTY +5V_2	Out
9	FUEL QTY 2	In
10	FUEL QTY 2 GND	--
11	POS 3 HI / +5V_3	Out
12	POS 3 / GP 3 / FUEL QTY 3	In
13	POS 3 LO / GND	--
14	POS 4 HI / +5V_4	Out
15	POS 4 / GP 4 / FUEL QTY 4	In

*Indicates Active Low

Pin	Pin Name	I/O
16	POS 4 LO / GND	--
17	CAN2_H	I/O
18	GP1 HI / +5V	Out
19	GP1 / POS 1	In
20	GP1 LO / GND	--
21	GP2 HI / +5V	Out
22	GP2 / POS 2	In
23	GP2 LO / GND	--
24	GP +5V_2	Out
25	VOLTS 1	In
26	GP GND_2	--
27	GP +5V_3	Out
28	VOLTS 2	In
29	GP GND_3	--
30	POS 5 HI / +5V	Out
31	POS 5 / MISC PRESS	In
32	POS 5 LO / GND	--
33	CAN2_L	I/O
34	FUEL XDCR +12V_3	Out
35	FUEL XDCR +12V_4	Out
36	FUEL FLOW (shared with Pin 23, J243 connector)	In
37	FUEL RETURN (shared with Pin 21, J243 connector)	In
38	FUEL XDCR GND_3	--
39	FUEL XDCR GND_4	--
40	DISCRETE IN** 1	In
41	DISCRETE IN** 2	In
42	DISCRETE IN** 3	In
43	DISCRETE IN** 4	In
44	DISCRETE OUT* 1 / MASTER WARNING	In
45	DISCRETE OUT* 2 / MASTER CAUTION	In
46	SHUNT 2 HI (shared with Pin 35, J243 connector)	In
47	SHUNT 2 LO (shared with Pin 34, J243 connector)	In
48	RESERVED / SPARE 1	In
49	RESERVED / SPARE 2	In
50	GP +12V	Out

*Indicates Active Low
**Can be configured as active high or active low

15.3.5 Aircraft Power

The GEA 24 has two pins for aircraft power inputs of 14/28 Vdc, and can operate using power from one or both inputs (AIRCRAFT POWER 1 AND AIRCRAFT POWER 2). The pins are internally connected using diodes to prevent current from flowing between the two power inputs. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses. The two aircraft power inputs may optionally be used to monitor aircraft bus voltage (see Section 18.3.2.16 for configuration).

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J241	7	In
AIRCRAFT POWER 2	J241	8	In
GROUND	J241	6	--
GROUND	J241	9	--

15.3.6 CAN Bus

Both data buses conform to the BOSCH standard for Controller Area Network 2.0-B. The busses comply with ISO 11898. Refer to Section 2.3.1.3 for details on configuring and terminating the CAN bus. The CAN bus on J241 shall be used for communications between G3X LRUs. The CAN 2 bus on J244 shall be used to communicate with FADEC engine controllers and shall not be connected to other G3X LRUs. The CAN2 bus is not terminated at the unit, refer to the wiring diagrams for how to terminate the second CAN bus if used.

Pin Name	Connector	Pin	I/O
CAN HI	J241	1	I/O
CAN LO	J241	2	I/O
CAN2_HI	J244	17	I/O
CAN2 LO	J244	33	I/O

15.3.7 Digital Inputs

The inputs are capable of sensing frequencies of the range 1 Hz to 100 kHz with a configurable debounce filter. Sensed signals can be either an AC voltage with a peak to peak value of greater than 1 V or an open-collector type input. These inputs are configured by the GDU (refer to Section 18).

NOTE

There are 2 Fuel Flow Input Channels (channels 1 & 2) on J243 and 2 Fuel Flow Input Channels on connector J244. As both channel 1 inputs are connected internally, and both channel 2 inputs are connected internally, the GEA 24 effectively has only 2 two Fuel Flow input channels. Use Channel 1 and/or Channel 2 inputs as desired, but only connect inputs from one connector (either the 37 pin connector or the 50 pin connector) for each channel.

Pin Name	Connector	Pin	I/O
FUEL XDCR +12V_2	J243	25	Out
FUEL FLOW (shared with Pin 36, J244 connector)	J243	23	In
FUEL XDCR GND_2	J243	22	--
FUEL XDCR +12V_1	J243	24	Out
FUEL RETURN (shared w/Pin 37, J244 connector)	J243	21	In
FUEL XDCR GND_1	J243	20	--
FUEL XDCR +12V_3	J244	34	Out
FUEL FLOW (shared with Pin 23, J243 connector)	J244	36	In
FUEL XDCR GND_3	J244	38	--
FUEL XDCR +12V_4	J244	35	Out
FUEL RETURN (shared with Pin 21, J243 connector)	J244	37	In
FUEL XDCR GND_4	J244	39	--
RPM 1	J243	8	In
RPM XDCR GND_1	J243	7	--
RPM 2	J243	6	In
RPM XDCR GND_2	J243	5	--
RPM XDCR +12V_1	J243	9	Out
RPM XDCR +12V_2	J243	10	Out
FUEL QTY +5V_1	J244	5	Out
FUEL QTY 1	J244	6	In
FUEL QTY 1 GND	J244	7	--
FUEL QTY +5V_2	J244	8	Out

*Indicates Active Low

Pin Name	Connector	Pin	I/O
FUEL QTY 2	J244	9	In
FUEL QTY 2 GND	J244	10	--
POS 3 HI / +5V	J244	11	Out
POS 3 / GP 3 / FUEL QTY 3	J244	12	In
FUEL QTY 3 GND	J244	13	--
POS 4 HI / +5V	J244	14	Out
POS 4 / GP 4 / FUEL QTY 4	J244	15	In
FUEL QTY 4 GND	J244	16	--

*Indicates Active Low

15.3.8 Discrete Inputs

The GEA 24 has 4 configurable discrete inputs that can be used as either Active High or Active Low. These inputs are configured by the GDU (refer to Section 18).

When configured as Active Low the inputs conform to the following specification:

a) Low: 0 VDC < Vin < 3.5 VDC, OR Rin < 375 ohms (active)

b) High: 8 VDC < Vin < 36 VDC OR Rin> 100k ohms (inactive)

When configured as Active High the inputs conform to the following specification:

a) Low: 0 VDC < Vin < 3.5 VDC, OR Rin> 100k ohms OR Rin < 375 ohms (inactive)

b) High: 8 VDC < Vin < 36 VDC (active)

Pin Name	Connector	Pin	I/O
DISCRETE IN 1	J244	40	In
DISCRETE IN 2	J244	41	In
DISCRETE IN 3	J244	42	In
DISCRETE IN 4	J244	43	In

15.3.9 Discrete Outputs

The GEA 24 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 E 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 $0 \leq Vout \leq 33$ VDC)

Leakage current in the INACTIVE state is typically ≤ 10 uA to ground

ACTIVE: Vout ≤ 0.5 VDC with ≤ 20 mA sink current

Sink current must be externally limited to 20 mA max

Pin Name	Connector	Pin	I/O
DISCRETE OUT 1 / MASTER WARNING	J244	44	In
DISCRETE OUT 2 / MASTER CAUTION	J244	45	In

15.3.10 Fuel Quantity

Fuel Quantity inputs have an internal pull-up resistor that can be enabled for resistive fuel sensor inputs. The inputs can also support capacitive sensors as either voltage inputs or digital inputs. These inputs are configured by the GDU (refer to Section 18).

Pin Name	Connector	Pin	I/O
FUEL QTY +5V_1	J244	5	Out
FUEL QTY 1	J244	6	In
FUEL QTY 1 GND	J244	7	--
FUEL QTY +5V_2	J244	8	Out
FUEL QTY 2	J244	9	In
FUEL QTY 2 GND	J244	10	--
POS 3 HI / +5V	J244	11	Out
POS 3 / GP 3 / FUEL QTY 3	J244	12	In
FUEL QTY 3 GND	J244	13	--
POS 4 HI / +5V	J244	14	Out
POS 4 / GP 4 / FUEL QTY 4	J244	15	In
FUEL QTY 4 GND	J244	16	--

15.3.11 GP (General Purpose) Inputs

These inputs are configured by the GDU (refer to Section 18) and are capable of reading any voltage up to 40 Vdc. The GEA 24 has 7 position inputs, labeled POS 1 through 7, and 7 general purpose inputs, GP 1 through 7 (to limit the length of pin names, "GPX" is not used on all pins), each of these are paired together.

Potentiometer based sensors can be used by connecting the potentiometer across a +5 V supply and ground and reading back the center tap voltage on GP1-G7/POS1-7. Some General Purpose inputs have multiple functions.

Pin Name	Connector	Pin	I/O
GP1 HI / +5V	J244	18	Out
GP1 / POS 1	J244	19	In
GP1 LO / GND	J244	20	--
GP2 HI / +5V	J244	21	Out
GP2 / POS 2	J244	22	In
GP2 LO / GND	J244	23	--
GP +5V_2	J244	24	Out
GP GND_2	J244	26	--
GP +5V_3	J244	27	Out
GP GND_3	J244	29	--
POS 3 HI / +5V	J244	11	Out
POS 3 / GP 3 / FUEL QTY 3	J244	12	In
POS 4 HI / +5V	J244	14	Out
POS 4 / GP 4 / FUEL QTY 4	J244	15	In
POS 5 HI / +5V	J244	30	Out
POS 5 / GP 5 / MISC PRESS	J244	31	In
POS 5 LO / GP 5 / GND	J244	32	--
GP +12V	J244	50	Out
POS 6 / GP 6 / TIT 1/ MISC TEMP 1 HI	J243	31	In
POS 6 / GP 6 / TIT 1/ MISC TEMP 1 LO	J243	30	In
POS 7 / GP7 / TIT 2/ MISC TEMP 2 HI	J243	29	In
POS 7 / GP 7 / TIT 2/ MISC TEMP 2 LO	J243	28	In
GP +5V	J243	26	Out
GP GND	J243	27	--

15.3.12 Pressure Inputs

All pressure inputs are capable of accepting input voltages of up to 40 Vdc. The oil pressure input can also accommodate resistive and constant current source sensors. These inputs are configured by the GDU (refer to Section 18).

Pin Name	Connector	Pin	I/O
FUEL PRESS GND	J243	1	--
FUEL PRESS	J243	2	In
FUEL PRESS XDCR +12V	J243	3	Out
FUEL PRESS XDCR +5V	J243	4	Out
MANIFOLD PRESS	J243	13	In
MANIFOLD PRESS GND	J243	12	--
MANIFOLD PRESS XDCR +12V	J243	14	Out
MANIFOLD PRESS XDCR +5V	J243	15	Out
OIL PRESS HI	J243	17	In
OIL PRESS GND	J243	16	--
OIL PRESS XDCR +12V	J243	18	Out
OIL PRESS XDCR +5V	J243	19	Out

15.3.13 Voltage Inputs

The two bus voltage inputs are capable of accepting voltages of up to 40 Vdc. These inputs are configured by the GDU (Section 18).

Pin Name	Connector	Pin	I/O
VOLTS 1	J244	25	In
VOLTS 2	J244	28	In

15.3.14 Shunt

Shunt Channel 2, has two inputs (either pin 34 & 35 of the J243 or pin 46 & 47 of the J244) for the single channel. Use the inputs from one connector (J243 or J244) only.

Pin Name	Connector	Pin	I/O
SHUNT 1 HI	J243	37	In
SHUNT 1 LO	J243	36	In
SHUNT 2 HI*	J243	35	In
SHUNT 2 LO*	J243	34	In
SHUNT 2 HI*	J244	46	In
SHUNT 2 LO*	J244	47	In

15.3.15 System ID

Pins 1, 2, 3, and 4 must be left open (floating) for a single GEA 24 installation. When using a GEA 24 and GSU 73 in the same system, pins 1 and 2 should be connected together in order to configure the GEA 24 as the EIS #2 LRU.

Pin Name	Connector	Pin	I/O
SYSTEM ID 1A	J244	1	In
SYSTEM ID 1B / GND	J244	2	--
SYSTEM ID 2A	J244	3	In
SYSTEM ID 2B / GND	J244	4	--

15.3.16 Temperature Inputs

Some thermocouple inputs are multi-purpose capable and have several configuration options. CHT5/CHT6, GP6/GP7, MISC TEMP 1/MISC TEMP 2, and Oil Temp can be used for resistive based temperature sensors. These inputs are configured by the GDU (refer to Section 18).

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 Name	Connector	Pin	I/O
CHT1 HI	J242	24	In
CHT1 LO	J242	12	In
CHT2 HI	J242	22	In
CHT2 LO	J242	10	In
CHT3 HI	J242	20	In
CHT3 LO	J242	8	In
CHT4 HI	J242	18	In
CHT4 LO	J242	6	In
CHT5 HI / CHT 1 RESISTIVE HI	J242	16	In
CHT5 LO / CHT 1 RESISTIVE LO	J242	4	In
CHT6 HI / CHT 2 RESISTIVE HI	J242	14	In
CHT6 LO / CHT 2 RESISTIVE LO	J242	2	In
EGT1 HI	J242	25	In
EGT1 LO	J242	13	In
EGT2 HI	J242	23	In

Pin Name	Connector	Pin	I/O
EGT2 LO	J242	11	In
EGT3 HI	J242	21	In
EGT3 LO	J242	9	In
EGT4 HI	J242	19	In
EGT4 LO	J242	7	In
EGT5 HI	J242	17	In
EGT5 LO	J242	5	In
EGT6 HI	J242	15	In
EGT6 LO	J242	3	In
POS 6 / GP 6 / TIT 1 / MISC TEMP 1 HI	J243	31	In
POS 6 / GP 6 / TIT 1 / MISC TEMP 1 LO	J243	30	In
POS 7 / GP 7 / TIT 2 / MISC TEMP 2 HI	J243	29	In
POS 7 / GP 7 / TIT 2 / MISC TEMP 2 LO	J243	28	In
OIL TEMP HI	J243	33	In
OIL TEMP LO	J243	32	In

NOTE

The pinout of J242 is compatible with 25-pin thermocouple wiring harnesses used in some third-party EIS systems.

15.3.17Transducer Output Power

The GEA 24 supplies output power for engine/airframe sensors that may require supply voltage excitation. The GEA 24 outputs voltage levels of +5 and +12 Vdc. Each output can supply a maximum of 50 mA. If more than 50 mA is needed for a sensor, 3 outputs of the same voltage may be spliced together to allow an output current of up to 100 mA. Transducers that require more current (such as Princeton capacitive fuel quantity converters) must be supplied from aircraft power instead of GEA 24 transducer power output pins.

The transducer output pins are listed in the following table. Additionally, the pins are also listed in the tables for their respective default functionality.

Pin Name	Connector	Pin	I/O
FUEL PRESS XDCR +12V	J243	3	Out
FUEL PRESS XDCR +5V	J243	4	Out
RPM XDCR +12V_1	J243	9	Out
RPM XDCR +12V_2	J243	10	Out
MANIFOLD PRESS XDCR +12V	J243	14	Out
MANIFOLD PRESS XDCR +5V	J243	15	Out
OIL PRESS XDCR +12V	J243	18	Out
OIL PRESS XDCR +5V	J243	19	Out
FUEL XDCR +12V_1	J243	24	Out
FUEL XDCR +12V_2	J243	25	Out
GP +5V_1	J243	26	Out
FUEL QTY +5V_1	J244	5	Out
FUEL QTY +5V_2	J244	8	Out
POS 3 HI / +5V_3	J244	11	Out
POS 4 HI / +5V_4	J244	14	Out
GP1 HI / +5V	J244	18	Out
GP2 HI / +5V	J244	21	Out
GP +5V_2	J244	24	Out
GP +5V_3	J244	27	Out
POS 5 HI / +5V	J244	30	Out
FUEL XDCR +12V_3	J244	34	Out
FUEL XDCR +12V_4	J244	35	Out
GP +12V	J244	50	Out

*Indicates Active Low

15.4 GMC 305

15.4.1 J3051 Connector

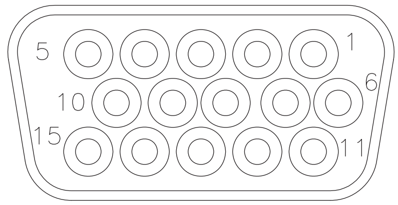

Figure 15-8 J3051 on GMC 305, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	RS-232 OUT 1	Out
2	RS-232 IN 1	In
3	RS-232 OUT 2	Out
4	RS-232 IN 2	In
5	POWER GROUND	--
6	SIGNAL GROUND	--
7	AIRCRAFT POWER 1	In
8	SIGNAL GROUND	--
9	AIRCRAFT POWER 2	In
10	RESERVED	--
11	LIGHTING BUS HI	In
12	LIGHTING BUS LO	In
13	RESERVED	--
14	RESERVED	--
15	POWER GROUND	--

15.4.2 Power

This section covers the power input requirements. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J3051	7	In
AIRCRAFT POWER 2	J3051	9	In
POWER GROUND	J3051	5	--
POWER GROUND	J3051	15	--

15.4.3 Serial Data

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load.

RS-232 channel 1 should be connected to an available RS-232 port on a GDU 37X display. RS-232 channel 2 should be connected to the GSA 28 roll servo RS-232 port in a Garmin autopilot system (see Figure C-1.5).

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	J3051	1	Out
RS-232 IN 1	J3051	2	In
RS-232 OUT 2	J3051	3	Out
RS-232 IN 2	J3051	4	In
SIGNAL GROUND	J3051	6	--
SIGNAL GROUND	J3051	8	--

15.4.4 Lighting

The GMC 305 can track a 14 VDC lighting bus using these inputs. The GMC 305 can also automatically adjust for ambient lighting conditions based on photocell input. If no (0 VDC) voltage is supplied to the lighting bus input (and unit is configured for 14 V supply), the GMC 305 will automatically adjust for ambient lighting conditions using its built-in photocell.

Pin Name	Connector	Pin	I/O
LIGHTING BUS HI	J3051	11	In
LIGHTING BUS LO*	J3051	12	In

15.5 GMU 22

15.5.1 J441 Connector

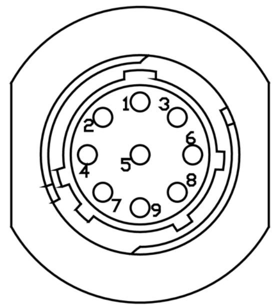

Figure 15-9 J441 on GMU 22, as viewed looking at connector on unit

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

15.5.2 Power Function

Power-input pins accept supply voltage from ADAHRS (GSU 25/73).

Pin Name	Connector	Pin	I/O
+12 VDC POWER, GMU 22	J441	9	In
POWER GROUND, GMU 22	J441	6	--

15.5.3 Serial Data

15.5.3.1 RS-232

The RS-232 input pin accepts data from the ADAHRS (GSU 25/73).

Pin Name	Connector	Pin	I/O
RS-232 IN	J441	8	In

15.5.3.2 RS-485

The RS-485 pins provide data to the ADAHRS (GSU 25/73).

Pin Name	Connector	Pin	I/O
RS-485 OUT A	J441	4	Out
RS-485 OUT B	J441	2	Out

15.6 GSA 28

15.6.1 J281 Connector

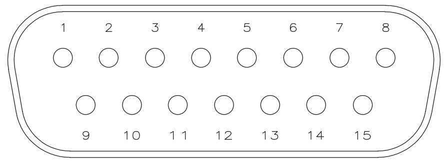

Figure 15-10 J281 on GSA 28, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN_H	I/O
2	CAN_L	I/O
3	CAN_TERM_1	--
4	CAN_TERM_2	--
5	ID_STRAP_1	In
6	ID_STRAP_2	In
7	ID_STRAP_3/(RS-232 TX for Roll Servo Only)	In
8	ID_STRAP_4/(RS-232 RX for Roll Servo Only)	In
9	AIRCRAFT GROUND	--
10	AIRCRAFT POWER	In
11	TRIM_IN_1	In
12	TRIM_IN_2	In
13	TRIM_OUT_1	Out
14	TRIM_OUT_2	Out
15	AP_DISCONNECT	

15.6.2 Power Function

Supply voltage (14/28Vdc) inputs.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER	J281	10	In
AIRCRAFT GROUND	J281	9	--

15.6.3 AP Disconnect

AP Disconnect should be connected to an active low push-button switch that disengages the autopilot, and optionally engages it, if configured. Press and hold the switch to allow for control wheel steering by disengaging the clutch and servo motor. The AP Disconnect input must be connected to both the pitch and the roll servos, and can optionally be connected to the yaw damper servo.

Pin Name	Connector	Pin	I/O
AP_DISCONNECT	J281	15	In

15.6.4 CAN Bus

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. See Section 2.3.1.3 for CAN Bus details.

Pin Name	Connector	Pin	I/O
CAN_H	J281	1	I/O
CAN_L	J281	2	I/O
CAN_TERM_1	J281	3	--
CAN_TERM_2	J281	4	--

15.6.5 ID STRAP

The ID Strap inputs are used to configure the GSA 28 as a roll, pitch, or yaw servo by installing a jumper wire or not installing a jumper wire per the following:

Roll Servo: No jumper wire installed

Pitch Servo: Jumper wire installed from pin 5 to pin 8

Yaw Servo: Jumper wire installed from pin 6 to pin 7

Pin Name	Connector	Pin	I/O
ID_STRAP_1	J281	5	In
ID_STRAP_2	J281	6	In
ID_STRAP_3/(RS-232 TX for Roll Servo Only)	J281	7	In
ID_STRAP_4/(RS-232 RX for Roll Servo Only)	J281	8	In

15.6.6 RS-232

Pins 7 and 8 (TX and RX) connect to the GMC305 RS232 channel 2 on the ROLL SERVO ONLY.

Pin Name	Connector	Pin	I/O
ID_STRAP_3/(RS-232 TX for Roll Servo Only)	J281	7	Out
ID_STRAP_4/(RS-232 RX for Roll Servo Only)	J281	8	In

15.6.7 Trim

The trim inputs should connect to the panel trim switch. The trim outputs should connect to the trim servo, maximum output current of the trim outputs is 1 Amp. If the GSA 28 is not powered, a fail-safe feature causes the trim inputs to connect directly to the trim outputs. If the servo is powered and configured for speed scheduling, the servo drives the trim outputs based on the trim inputs and aircraft speed. If the servo is powered with the autopilot and auto trim feature is enabled, the servo has full control of the trim outputs.

A removal adapter (GPN 011-03158-00) is provided (with each GSA 28 connector kit) that can be used when a GSA 28 is removed. The adapter keeps that node on the CAN bus in the same state as when the servo was connected (either terminated or un-terminated). The adapter also allows trim signals to pass through when the servo is removed.

Pin Name	Connector	Pin	I/O
TRIM_IN_1	J281	11	In
TRIM_IN_2	J281	12	In
TRIM_OUT_1	J281	13	Out
TRIM_OUT_2	J281	14	Out

15.7 GSU 25

15.7.1 J251

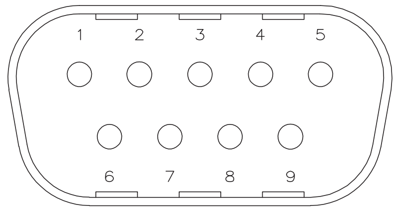

Figure 15-11 J251 on GSU 25, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN H	I/O
2	CAN L	--
3	RESERVED	--
4	RS-232 RX 1	In
5	RS-232 TX 1	Out
6	GROUND	--
7	AIRCRAFT POWER 1	In
8	AIRCRAFT POWER 2	In
9	GROUND	--

15.7.1.1 J252

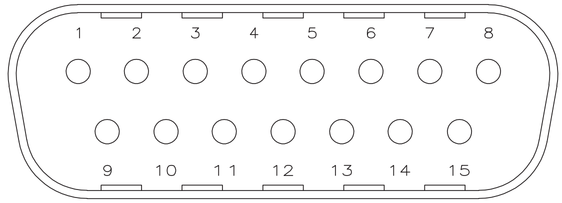

Figure 15-12 J252 on GSU 25, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	OAT POWER	Out
2	OAT HIGH	In
3	OAT LOW	In
4	UNIT ID 1 GROUND	--
5	UNIT ID 1	In
6	+12V MAGNETOMETER POWER	Out
7	MAGNETOMETER GROUND	--
8	RESERVED	--
9	RS-232 TX 3	Out
10	RS-232 RX 3	In
11	GROUND	--
12	RS-485 RX A	In
13	RS-485 RX B	In
14	GROUND	--
15	RS-232 TX 2	Out

15.7.2 Aircraft Power

The GSU 25 can operate using power from one or both inputs (AIRCRAFT POWER 1 AND AIRCRAFT POWER 2). The pins are internally connected using diodes to prevent current from flowing between the two power inputs. 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	J251	7	In
AIRCRAFT POWER 2	J251	8	In
POWER GROUND	J251	6	--
POWER GROUND	J251	9	--

The GSU 25 outputs supply voltage to the GMU 22 via pins 6 & 7.

Pin Name	Connector	Pin	I/O
+12V MAGNETOMETER POWER	J252	6	Out
MAGNETOMETER GROUND	J252	7	--

15.7.3 Serial Data

15.7.3.1 RS-232

2 Channels of RS-232 RX, and 3 Channels of RS-232 TX data.

RS-232 1: Can optionally be connected to a GDU 37X display to provide a redundant path for attitude data. Also used to configure a GSU 25 as ADAHRS #3.

RS-232 2: Transmits data to the GMU 22.

RS-232 3: Connects to a GTX transponder to provide pressure altitude data and remote transponder control. Transponder should only be connected to ADAHRS 1 (not 2 or 3).

Pin Name	Connector	Pin	I/O
RS-232 RX 1	J251	4	In
RS-232 TX 1	J251	5	Out
RS-232 TX 2	J252	15	Out
RS-232 RX 3	J252	10	In
RS-232 TX 3	J252	9	Out

15.7.3.2 RS-485 Input

The GSU 25 contains one channel of RS-485 serial data communications for receiving data from the GMU 22.

Pin Name	Connector	Pin	I/O
RS-485 RX A	J252	1	In
RS-485 RX B	J252	2	In

15.7.3.3 CAN Bus

This data bus conforms to the BOSCH standard for Controller Area Network 2.0-B. This bus complies with ISO 11898. See Section 2.3.1.3 for details.

Pin Name	Connector	Pin	I/O
CAN BUS HI	J251	1	I/O
CAN BUS LOW	J251	2	--

15.7.4 Temperature Inputs

Temperature input is used for Outside Air Temperature (OAT) computations. The temperature input is a three-wire temperature probe interface. OAT Power Out and OAT High are connected internally at the OAT probe. A GTP 59 or other supported temperature probe is required for the ADAHRS (GSU 25/73) installation that is configured as ADAHRS 1. The GTP 59 is a Resistive Temperature Device (RTD). Refer to Figure B-10.1 for the temperature probe interconnect.

Pin Name	Connector	Pin	I/O
OAT POWER	J252	1	Out
OAT HIGH	J252	2	In
OAT LOW	J252	3	In

15.7.5 Unit ID

Refer to Figure C-1.4 for connection drawing.

Pin Name	Connector	Pin	I/O
UNIT ID 1 GROUND	J252	4	--
UNIT ID 1	J252	5	In

Unit ID	Comment
ADAHRS #1	Leave pins 4 and 5 (of J252) unconnected
ADAHRS #2	Connect pin 4 (of J252) to pin 5 (of J252)
ADAHRS #3	Connect pin 4 (of J252) to pin 5 (of J252) and connect RS-232 RX 1 to RS-232 TX 1 (pins 4 and 5 on J251)

15.8 GSU 73

15.8.1 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.

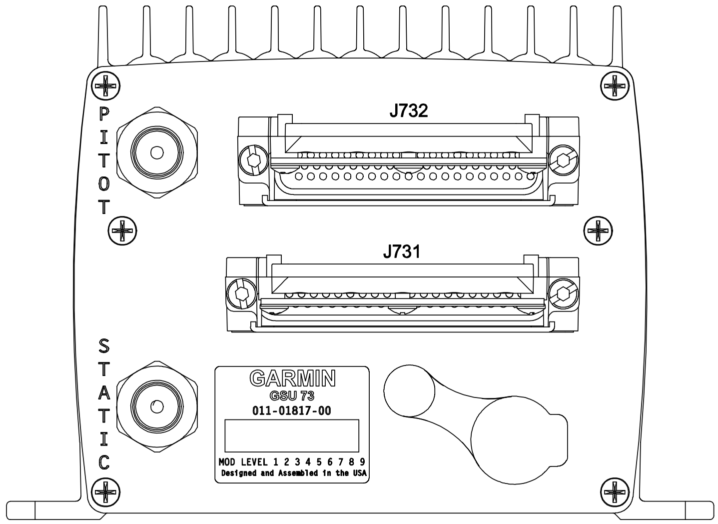

Figure 15-13 Rear View of Connector End Plate

15.8.2 J731 Connector

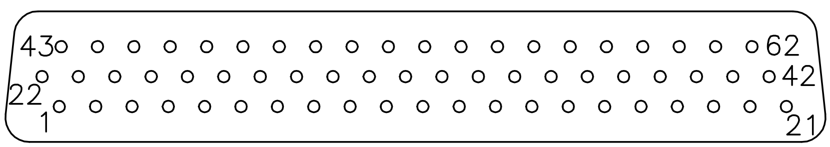

Figure 15-14 J731 on GSU 73, as viewed looking at connector on unit

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	RESERVED	--
5	RESERVED	--
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

*Indicates Active Low

Pin	Pin Name	I/O
13	DISCRETE OUT* 1	Out
14	DISCRETE OUT* 2	Out
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	--

*Indicates Active Low

Pin	Pin Name	I/O
54	SIGNAL GROUND	--
55	SPARE	--
56	SPARE	--
57	SPARE	--
58	SIGNAL GROUND	--
59	POWER GROUND	--
60	SIGNAL GROUND	--
61	POWER GROUND	--
62	SPARE	--

*Indicates Active Low

15.8.2.1 J732 Connector

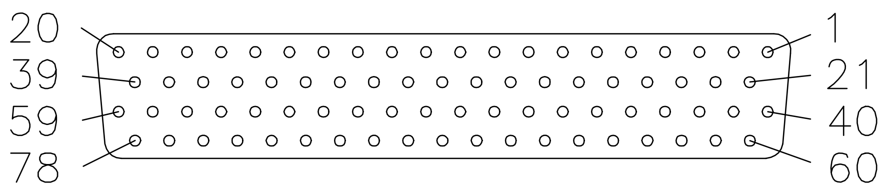

Figure 15-15 J732 on GSU 73, as viewed looking at connector on unit

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

*Indicates Active Low

Pin	Pin Name	I/O
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 / RPM 2	In
37	SIGNAL GROUND	--
38	CAP FUEL 2 / FUEL FLOW 2	In
39	CONFIG MODULE DATA	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)	--

*Indicates Active Low

Pin	Pin Name	I/O
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

15.8.3 Power I/O

15.8.3.1 Aircraft Power

The GSU 73 has four inputs for aircraft power bus inputs of 14/28 Vdc, and can operate using power from one or both inputs (AIRCRAFT POWER 1 AND AIRCRAFT POWER 2). The pins are internally connected using diodes to prevent current from flowing between the two power inputs. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses. The two aircraft power inputs may optionally be used to monitor aircraft bus voltage (see Section 18.3.2.16 for configuration).

Pin	Connector	Pin Name	I/O
47	J731	AIRCRAFT POWER 1	IN
49	J731	AIRCRAFT POWER 2	IN
59	J731	POWER GROUND	--
61	J731	POWER GROUND	--

15.8.3.2 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.

Transducers that require more current (such as Princeton capacitive fuel quantity converters) must be supplied from aircraft power instead of GSU 73 transducer power output pins.

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	J732	+12VDC TRANSDUCER POWER OUT	OUT
56	J732	TRANSDUCER POWER OUT LO (GROUND)	--
58	J732	+10VDC TRANSDUCER POWER OUT	OUT
57	J732	TRANSDUCER POWER OUT LO (GROUND)	--
75	J732	+5VDC TRANSDUCER POWER OUT	OUT
74	J732	TRANSDUCER POWER OUT LO (GROUND)	--

15.8.3.3 Magnetometer Power

The GSU 73 outputs supply voltage to the GMU 22 via pins 38 & 39.

Pin	Connector	Pin Name	I/O
38	J731	MAGNETOMETER POWER OUT	OUT
39	J731	MAGNETOMETER GROUND	--

15.8.4 Serial Data Electrical Characteristics

15.8.4.1 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	J731	ARINC 429 OUT 1A	OUT
21	J731	ARINC 429 OUT 1B	OUT
22	J731	ARINC 429 OUT 2A	OUT
23	J731	ARINC 429 OUT 2B	OUT
25	J731	ARINC 429 IN 1A	IN
26	J731	ARINC 429 IN 1B	IN
27	J731	ARINC 429 IN 2A	IN
28	J731	ARINC 429 IN 2B	IN
30	J731	ARINC 429 IN 3A	IN
31	J731	ARINC 429 IN 3B	IN
32	J731	ARINC 429 IN 4A	IN
33	J731	ARINC 429 IN 4B	IN

15.8.4.2 RS-232 Input/Output

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load. RS-232 OUT 2 is not currently active. RS-232 IN/OUT 3 is used for connection to a transponder (Figure D-2.2 & Figure D-2.3), and is not configurable (always on by default).

Pin	Connector	Pin Name	I/O
15	J731	MAGNETOMETER RS-232 OUT	OUT
16	J731	RS-232 IN 2 (RESERVED)	IN
17	J731	RS-232 OUT 2 (RESERVED)	OUT
18	J731	RS-232 IN 3 (TRANSPONDER)	IN
19	J731	RS-232 OUT 3 (TRANSPONDER)	OUT

15.8.4.3 RS-485 Input

The GSU 73 contains one channel of RS-485 serial data communications for receiving data from the GMU 22.

Pin	Connector	Pin Name	I/O
1	J731	MAGNETOMETER RS-485 IN B	IN
2	J731	MAGNETOMETER RS-485 IN A	IN

15.8.4.4 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 C). See Section 2.3.1.3 for details.

Pin	Connector	Pin Name	I/O
7	J731	CAN BUS HI	I/O
8	J731	CAN BUS LO	I/O
29	J731	CAN BUS TERMINATION	--

15.8.4.5 Configuration Module Interface

Connect the GSU 73 to the configuration module using the 4 pins listed below.

Pin	Connector	Pin Name	Wire Color	I/O
20	J732	CONFIG MODULE CLOCK	WHITE (WHT)	OUT
39	J732	CONFIG MODULE DATA	YELLOW (YEL)	I/O
59	J732	CONFIG MODULE POWER OUT	RED (RED)	OUT
78	J732	CONFIG MODULE GROUND	BLACK (BLK)	--

15.8.5 Discrete I/O

15.8.5.1 Active Low Discrete Inputs

The GSU 73 has 4 configurable discrete inputs conforming to:

Low: 0 VDC < Vin < 3.5 VDC, OR Rin < 375 ohms (active)

High: 8 VDC < Vin < 36 VDC OR Rin> 100k ohms (inactive)

Pin	Connector	Pin Name	I/O
9	J731	DISCRETE IN* 1	IN
10	J731	DISCRETE IN* 2	IN
11	J731	DISCRETE IN* 3	IN
12	J731	DISCRETE IN* 4	IN

*Indicates Active Low

15.8.5.2 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 E 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 ≤ 33 VDC)

Leakage current in the INACTIVE state is typically ≤ 10 uA to ground

ACTIVE: Vout ≤ 0.5 VDC with ≤ 20 mA sink current

Sink current must be externally limited to 20 mA max

Pin	Connector	Pin Name	I/O
13	J731	DISCRETE OUT* 1	OUT
14	J731	DISCRETE OUT* 2	OUT

*Indicates Active Low

15.8.6 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 18).

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	J732	CHT 1 HI	IN
41	J732	CHT 1 LO	IN
21	J732	CHT 2 HI	IN
1	J732	CHT 2 LO	IN
2	J732	CHT 3 HI	IN
22	J732	CHT 3 LO	IN
60	J732	CHT 4 HI	IN
40	J732	CHT 4 LO	IN
73	J732	CHT 5 HI	IN
53	J732	CHT 5 LO	IN
33	J732	CHT 6 HI	IN
13	J732	CHT 6 LO	IN
63	J732	EGT 1 HI	IN
43	J732	EGT 1 LO	IN
23	J732	EGT 2 HI	IN
3	J732	EGT 2 LO	IN
24	J732	EGT 3 HI	IN
4	J732	EGT 3 LO	IN
62	J732	EGT 4 HI	IN
42	J732	EGT 4 LO	IN
30	J732	EGT 5 HI	IN
29	J732	EGT 5 LO	IN
34	J732	OIL TEMP HI	IN
14	J732	OIL TEMP LO	IN
72	J732	POS 5 / MISC TEMP HI	IN
52	J732	POS 5 / MISC TEMP LO	IN
25	J732	FUEL 1 HI	IN
5	J732	FUEL 1 LO	IN

Pin	Connector	Pin Name	I/O
64	J732	FUEL 2 HI	IN
44	J732	FUEL 2 LO	IN
26	J732	FUEL PRESS HI	IN
45	J732	FUEL PRESS LO	IN
65	J732	MAN PRESS HI	IN
6	J732	MAN PRESS LO	IN
71	J732	VOLTS 1 HI	IN
51	J732	VOLTS 1 LO	IN
32	J732	VOLTS 2 HI	IN
12	J732	VOLTS 2 LO	IN
31	J732	EGT 6 / MISC PRESS HI	IN
11	J732	EGT 6 / MISC PRESS LO	IN
69	J732	OIL PRESS HI	IN
49	J732	OIL PRESS LO	IN
47	J732	POS 1 / GP 1 / TIT 1 HI	IN
67	J732	POS 1 / GP 1 / TIT 1 LO	IN
28	J732	POS 2 / GP 2 / TIT 2 HI	IN
8	J732	POS 2 / GP 2 / TIT 2 LO	IN
27	J732	POS 3 / GP 3 / FUEL 3 HI	IN
7	J732	POS 3 / GP 3 / FUEL 3 LO	IN
66	J732	POS 4 / GP 4 / FUEL 4 HI	IN
46	J732	POS 4 / GP 4 / FUEL 4 LO	IN
70	J732	SHUNT 1 HI	IN
50	J732	SHUNT 1 LO	IN
48	J732	SHUNT 2 HI	IN
68	J732	SHUNT 2 LO	IN
10	J732	THERMOCOUPLE REF IN HI	IN
9	J732	THERMOCOUPLE REF IN LO	IN

15.8.7 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 B-10.1 for the temperature probe interconnect.

Pin	Connector	Pin Name	I/O
15	J732	OAT PROBE IN HI	IN
16	J732	OAT PROBE POWER OUT	OUT
35	J732	OAT PROBE IN LO	IN

15.8.8 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 kΩ.

Pin	Connector	Pin Name	I/O
17	J732	RPM	IN
19	J732	FUEL FLOW	IN
36	J732	CAP FUEL 1 / RPM 2	IN
38	J732	CAP FUEL 2 / FUEL FLOW 2	IN

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.

- RPM (Rotax) - Maximum Frequency = 6.5 kHz
- RPM (other) - Maximum Frequency = 4 kHz
- Fuel Flow (Floscan 201-B6) - Maximum Frequency = 500 Hz
- Fuel Flow (EI FT60) - Maximum Frequency = 1.1 kHz
- Fuel Quantity (Capacitive) - Maximum Frequency = 50 kHz

15.8.9 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 +10 V 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 +10 V power through a 1 kΩ resistor, as shown in Appendix E.

Pin	Connector	Pin Name	I/O
76	J732	FUEL SENSOR PULL-UP 2 (FUEL 2)	OUT
77	J732	FUEL SENSOR PULL-UP 1 (FUEL 1)	OUT

15.9 GTX 23

15.9.1 Connector Description

The GTX 23 has one 62-pin connector (J2301) as shown below. All electrical connections are made through J2301 except for the antenna and shield ground.

15.9.2 J2301 Connector

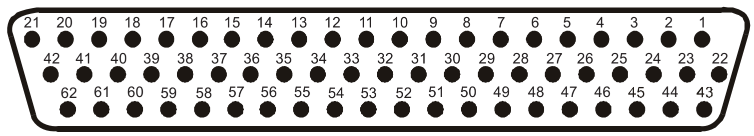

Figure 15-16. J2301 on GTX 23, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	NOT USED	--
2	NOT USED	--
3	NOT USED	--
4	NOT USED	--
5	NOT USED	--
6	NOT USED	--
7	NOT USED	--
8	NOT USED	--
9	NOT USED	--
10	NOT USED	--
11	NOT USED	--
12	EXTERNAL IDENT SELECT*	In
13	EXTERNAL STANDBY SELECT*	In
14	NOT USED	--
15	NOT USED	--
16	NOT USED	--
17	NOT USED	--
18	NOT USED	--
19	NOT USED	--
20	NOT USED	--
21	AIRCRAFT POWER 1	In
22	RS-232 IN 1	In
23	RS-232 OUT 1	Out
24	RS-232 IN 2	In
25	RS-232 OUT 2	Out
26	NOT USED	--
27	NOT USED	--
28	ARINC 429 OUT 2 B	Out
29	NOT USED	--
30	ARINC 429 OUT 2 A	Out

*Denotes active low (ground to activate)

Pin	Pin Name	I/O
31	MUTUAL SUPPRESSION I/O	I/O
32	NOT USED	--
33	NOT USED	--
34	ARINC 429 OUT 1 B	Out
35	NOT USED	--
36	NOT USED	--
37	ARINC 429 OUT 1 A	Out
38	NOT USED	--
39	POWER GROUND	--
40	NOT USED	--
41	NOT USED	--
42	AIRCRAFT POWER 1	In
43	RS-232 GROUND	--
44	NOT USED	--
45	NOT USED	In
46	TIS CONNECT SELECT*	In
47	NOT USED	--
48	NOT USED	--
49	NOT USED	--
50	RS-232 GROUND 2	--
51	NOT USED	--
52	NOT USED	--
53	NOT USED	--
54	NOT USED	--
55	NOT USED	--
56	AIRCRAFT POWER 2	In
57	NOT USED	--
58	POWER GROUND	--
59	NOT USED	--
60	AIRCRAFT POWER 2	In
61	NOT USED	--
62	NOT USED	--

*Denotes active low (ground to activate)

15.9.3 Aircraft Power

Power input requirements are listed in the following tables. The power input pins accept 14/28 Vdc. Refer to Figure C-1 and C-2 for power interconnections. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J2301	21	In
AIRCRAFT POWER 1	J2301	42	In
AIRCRAFT POWER 2	J2301	56	In
AIRCRAFT POWER 2	J2301	60	In
POWER GROUND	J2301	39	--
POWER GROUND	J2301	58	--

15.10 Discrete Functions

15.10.1 Discrete Outputs

External suppression should be connected if a DME or TCAS is installed in the aircraft avionics system. The GTX 23 suppression I/O pulses may not be compatible with all models of DME or TCAS. Known incompatible DME units include the Bendix/King KN 62, KN 64 and KNS 80. These models have an output-only suppression port and can be damaged by the GTX 23 mutual suppression output. In this case, do not connect the GTX 23’s suppression pin to the incompatible unit’s suppression pin; however, do connect the GTX 23’s suppression pin to any other compatible unit’s suppression pin.

Pin Name	Connector	Pin	I/O
EXTERNAL SUPPRESSION I/O (TXP/DME)	J2301	31	I/O

15.10.2Discrete Inputs

Sink current is internally limited to 200 uA max for a grounded input

EXTERNAL IDENT SELECT (remote IDENT) is a momentary input. When grounded, it activates the IDENT pulse for 18 seconds in Mode A replies.

EXTERNAL STANDBY SELECT (remote STANDBY) is not a momentary input. When EXTERNAL STANDBY SELECT is grounded, the GTX 23 operates in standby mode. In this mode, the transponder will not squitter or reply to interrogations.

TIS CONNECT SELECT is a momentary input. When grounded, it toggles whether TIS-A is in standby or operating.

Pin Name	Connector	Pin	I/O
EXTERNAL IDENT SELECT*	J2301	12	In
EXTERNAL STANDBY SELECT*	J2301	13	In
TIS CONNECT SELECT	J2301	46	In

*Inactive State: 10 ≤ Vin ≤ 33 Vdc or Rin ≥100 kΩ, Active State: Vin ≤ 1.9 Vdc with ≥ 75 uA sink current, or Rin ≤ 375 Ω

15.11 Serial Data Electrical Characteristics

15.11.1 RS-232 Input/Output

RS-232 input channel 1 is used to receive pressure altitude and control commands, and to provide status, TIS-A traffic, and other data. RS-232 output channel 1 provides unit status and TIS data. RS-232 channel 1 input and output are also used for software upgrades. RS-232 port channel 1 on the GTX should be connected to the channel 1 RS-232 port on ADAHRS 1.

For installations that enable ADS-B, RS-232 input channel 2 should be connected to a GNS 400W/500W-series WAAS enabled unit or a GTN 6XX/7XX series unit. This connection provides the GTX 23 with GPS data for ADS-B. The RS-232 output channel 2 is unused on the GTX 23.

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load. Refer to figures in Appendix C for the RS-232 serial data interconnect.

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	J2301	23	Out
RS-232 GROUND 1	J2301	43	--
RS-232 IN 1	J2301	22	In
RS-232 OUT 2	J2301	25	Out
RS-232 IN 2	J2301	24	In
RS-232 GROUND 2	J2301	50	--

15.11.2 ARINC 429 Input/Output

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to five standard ARINC 429 receivers.
ARINC 429 Out Channel 1 is configured for low-speed TIS-A data, and ARINC 429 Out Channel 2 is configured for high-speed TIS-A data for a GNS 4XX/5XX unit.

Pin Name	Connector	Pin	I/O
ARINC 429 OUT 1A	J2301	37	Out
ARINC 429 OUT 1B	J2301	34	Out
ARINC 429 OUT 2A	J2301	30	Out
ARINC 429 OUT 2B	J2301	28	Out
SIGNAL GROUND	J2301	51	--
SIGNAL GROUND	J2301	58	--

15.12 RS-232 Input/Output, Software Update Connections

NOTE

GTX 23 software updates can only be performed by a Garmin dealer.

GTX 23 software is updated using the RS-232 #1 interface. When wiring the RS-232 #1 interface to the rest of the system, it may be useful to splice in a pigtail connector that could be plugged into a laptop computer. Also when wiring, consider that the GTX 23 must be turned on (during software update) and the other avionic equipment attached to the RS-232 #1 interface (e.g. GSU or GDU) must be turned off. Instead of turning the other avionic equipment off, a relay can be installed that disconnects the avionic equipment and connects the laptop to the GTX 23. This connector may be useful for updating software to comply with new ADS-B regulation.

The connector can be mounted anywhere convenient for access, such as under the instrument panel, on a remote avionics shelf next to the unit, or in the instrument panel itself. Label the connector "For Software Update". Do not include the Test Mode Select switch in the aircraft. See Figure 15-17 for software update connections.

CAUTION

If the unit is removed from the aircraft and operated, always connect J2302 to an antenna or a 50 Ω, 5-Watt load (Figure 15-17). The GTX 23 transmits Mode S acquisition squitter replies about once per second whether interrogations are received or not. The unit may become damaged if J2302 is not connected to a 50 Ω, 5-Watt load when the unit transmits.

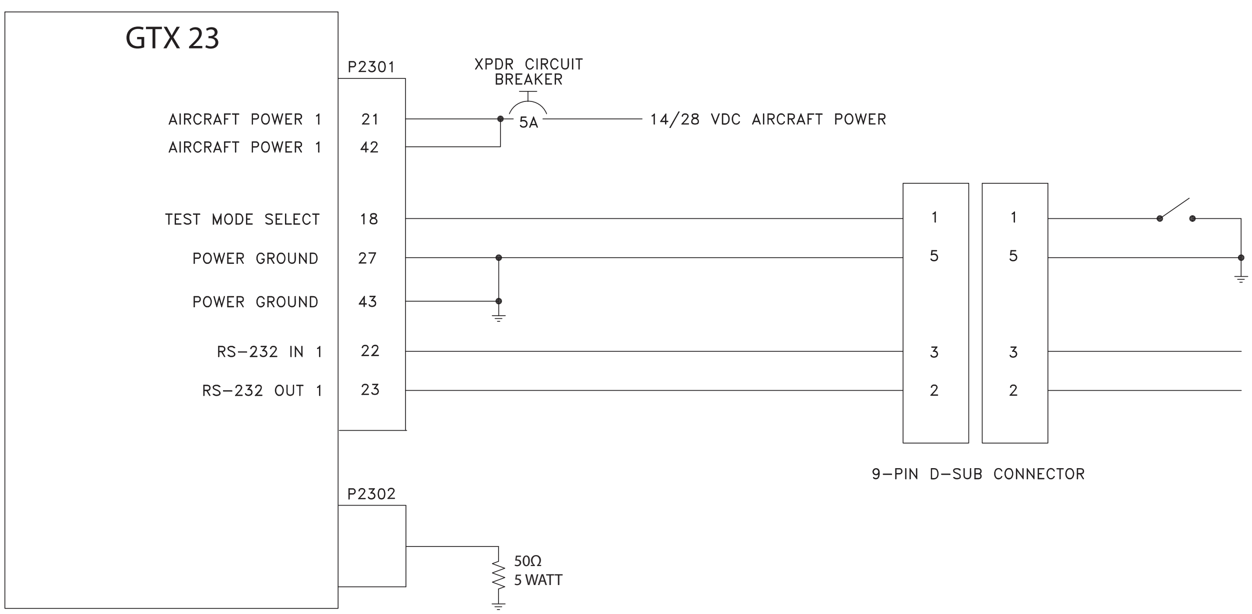

Figure 15-17. GTX 23 Software Update Connections

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16 CONNECTOR INSTALLATION INSTRUCTIONS

16.1 Thermocouple Installation into a Backshell

Table 16-1 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 w/GSU 73Installation Kit (K10-00017-00).

Table 16-1 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 Figure 16-1 and Figure 16-2.

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 16-1.

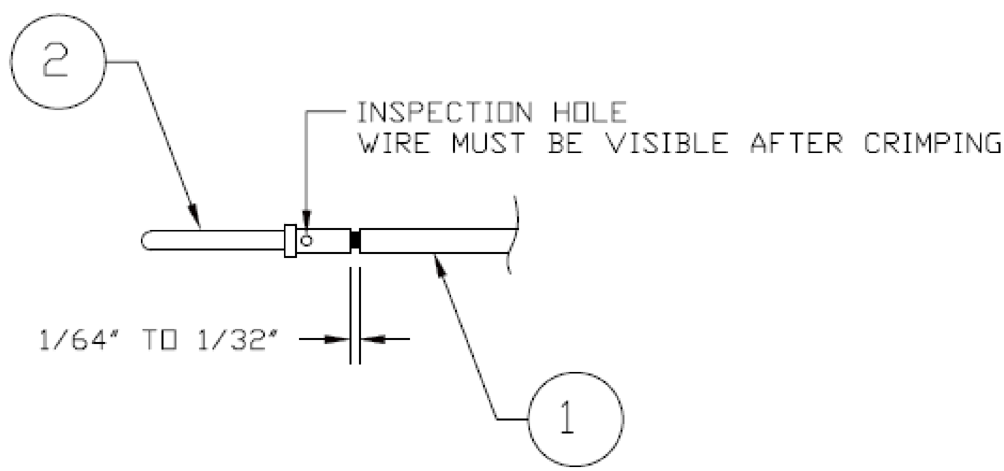


Figure 16-1 Insulation/Contact Clearance

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).

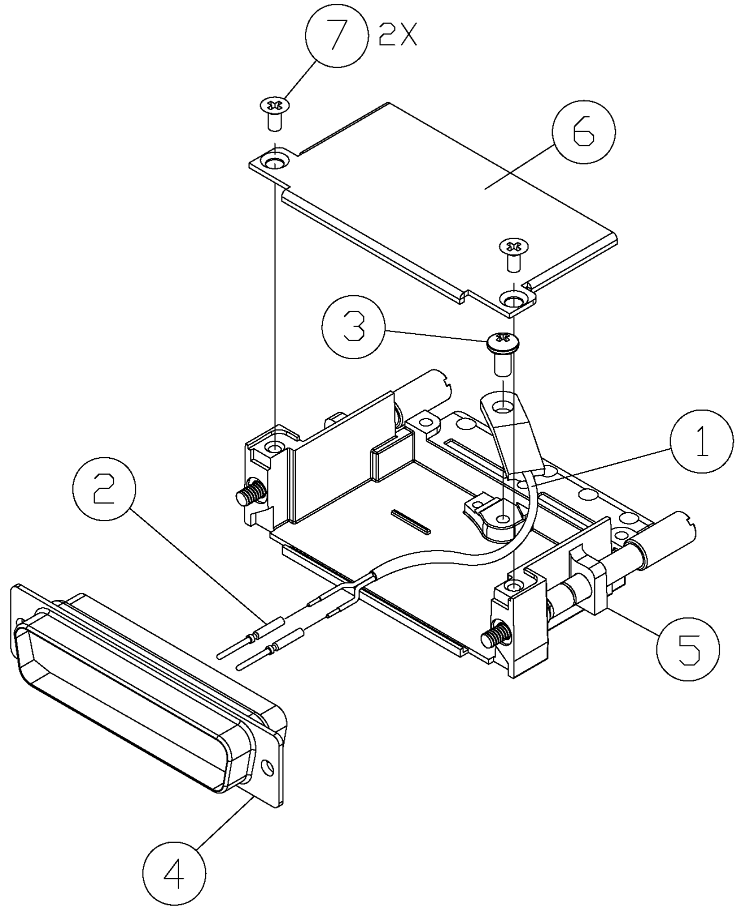


Figure 16-2 Jackscrew Backshell Thermocouple Installation

16.2 Jackscrew Configuration Module Installation into a Jackscrew Backshell

Table 16-2 & Table 16-3 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 w/GSU 73 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 16-2 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 16-3 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 Figure 16-3 & Figure 16-4.

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 16-3.

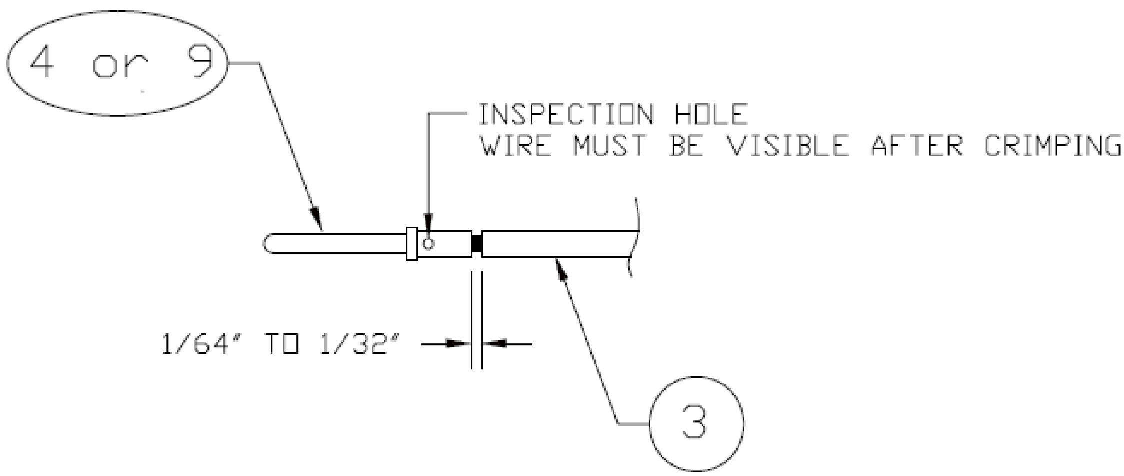


Figure 16-3 Insulation/Contact Clearance

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).

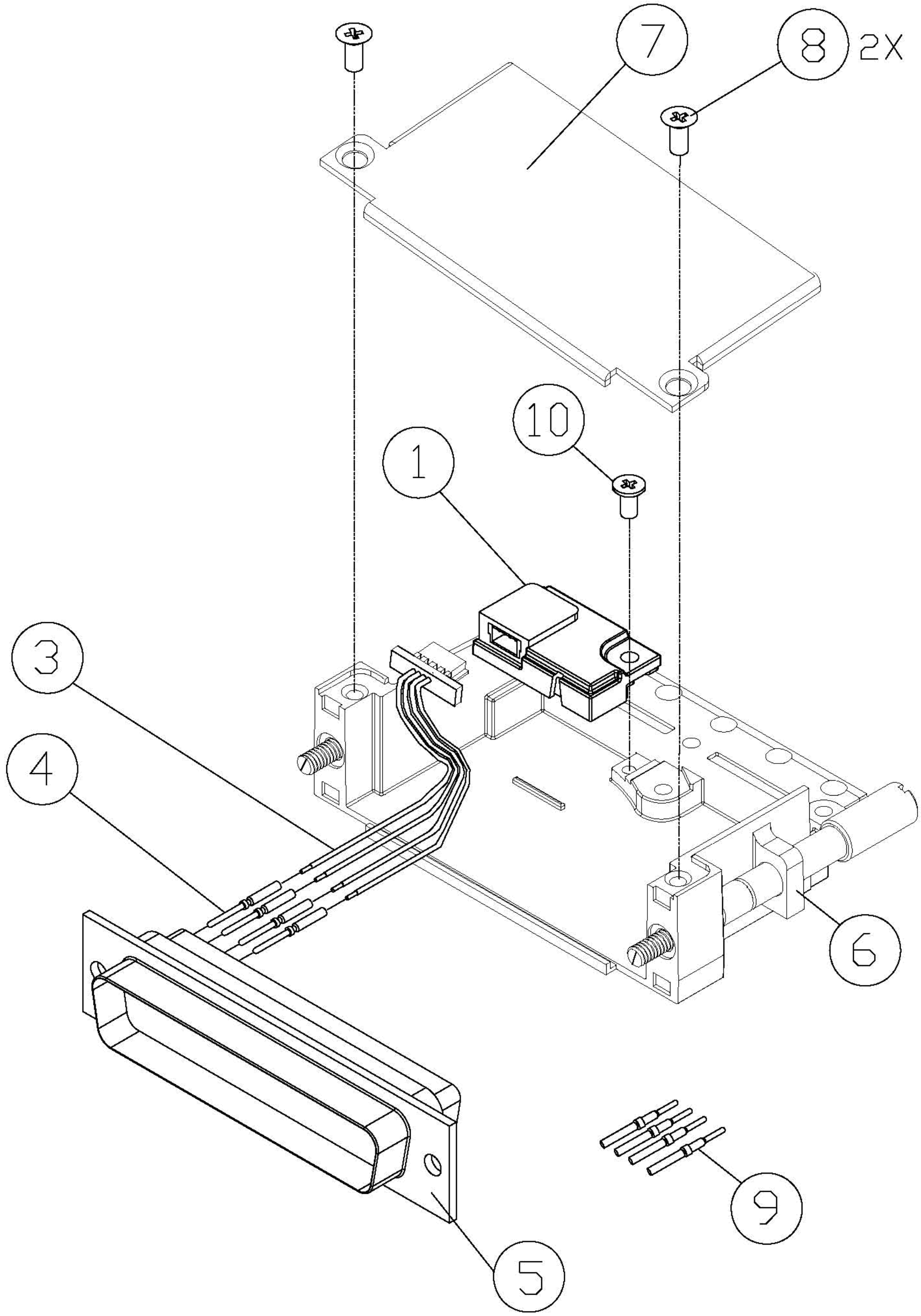


Figure 16-4 Jackscrew Backshell Installation

16.3 Jackscrew Backshell Installation Instructions

16.3.1 Shield Block Installation Parts

Table 16-4 and Table 16-5 list the parts needed to install a Shield Block. Parts listed in Table 16-4 are supplied in the LRU Connector Kits (see Table 1-11). Parts listed in Table 16-5 are to be provided by the installer.

Table 16-4 Parts supplied for a Shield Block Installation (Figure 16-5)

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 16-5 Parts not supplied for a Shield Block Installation (Figure 16-5)

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 16-5, "AR" denotes quantity "As Required" for the particular installation.

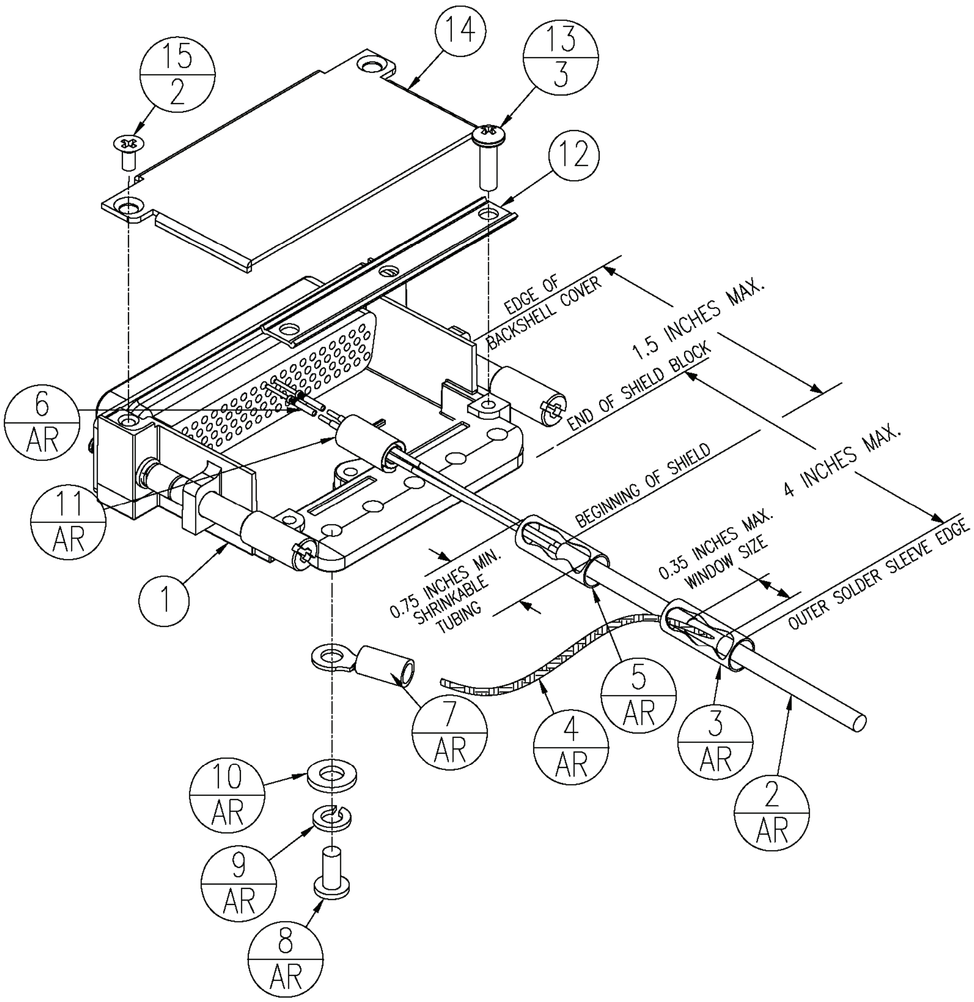


Figure 16-5 Shield Install onto a Jackscrew Backshell (78 pin example)

16.3.2 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.

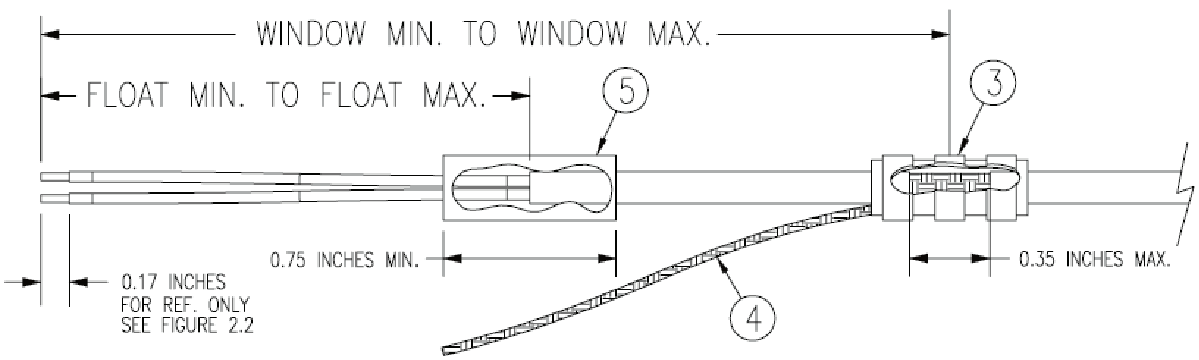


Figure 16-6 Method A.1 for Shield Termination

Table 16-6 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 16-6) and cut a window (max size 0.35”) in the jacket to expose the shield (Figure 16-6). 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 16-6). 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 16-6) length of jacket and shield to expose the insulated center conductors (Figure 16-6). 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 16-7.

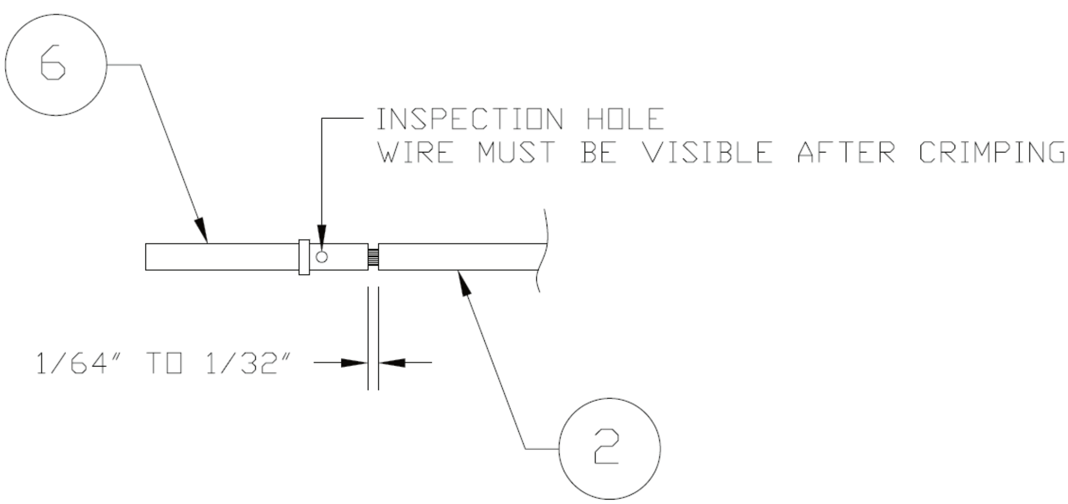


Figure 16-7 Insulation/Contact Clearance

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 16-5). 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).

16.3.3 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 16-8). 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.

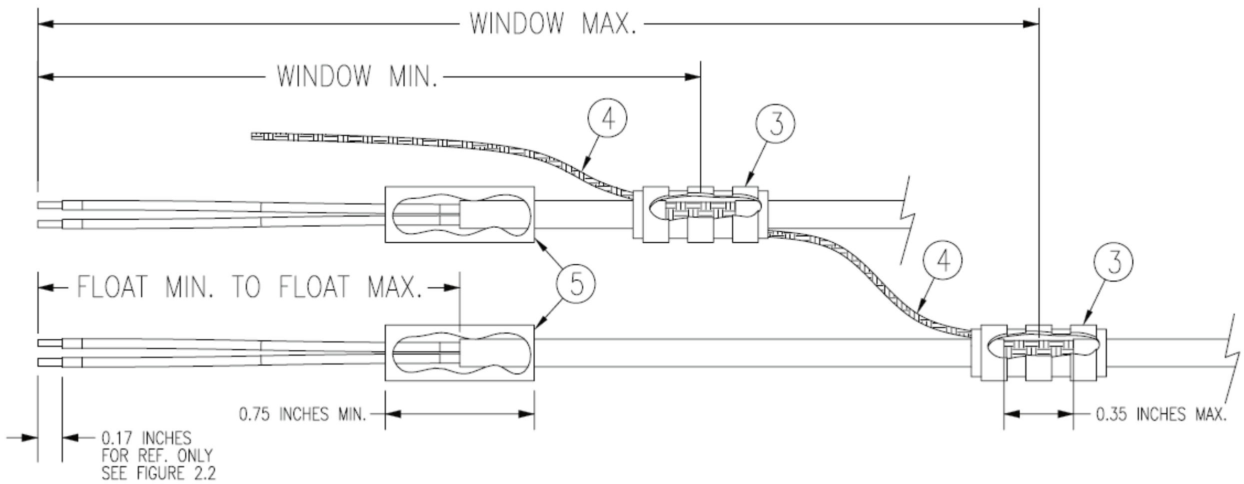


Figure 16-8 Method A.2 (Daisy Chain) for Shield Termination

16.3.4 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 16-9.

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 16.3.2 (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 16-7) 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 16-9). 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 16.3.2 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)

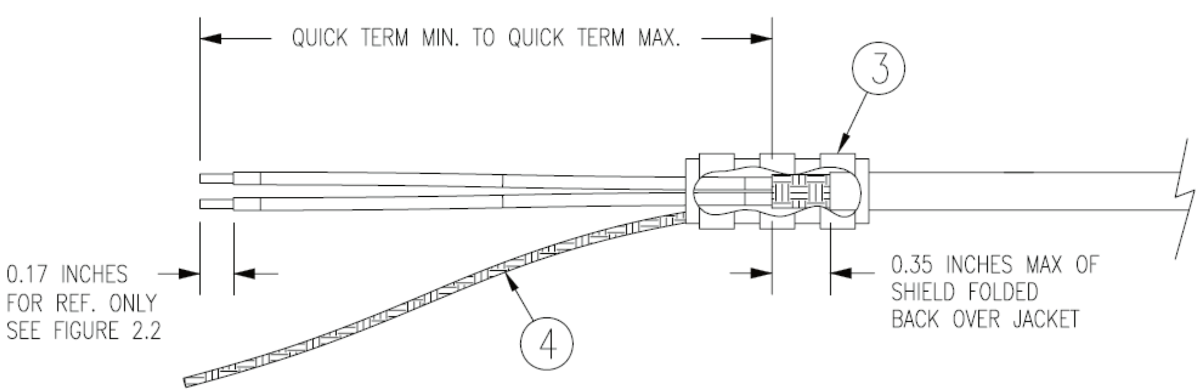


Figure 16-9 Method B.1 (Quick Term) for Shield Termination

Table 16-7 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

16.3.5 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 16-10). 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.

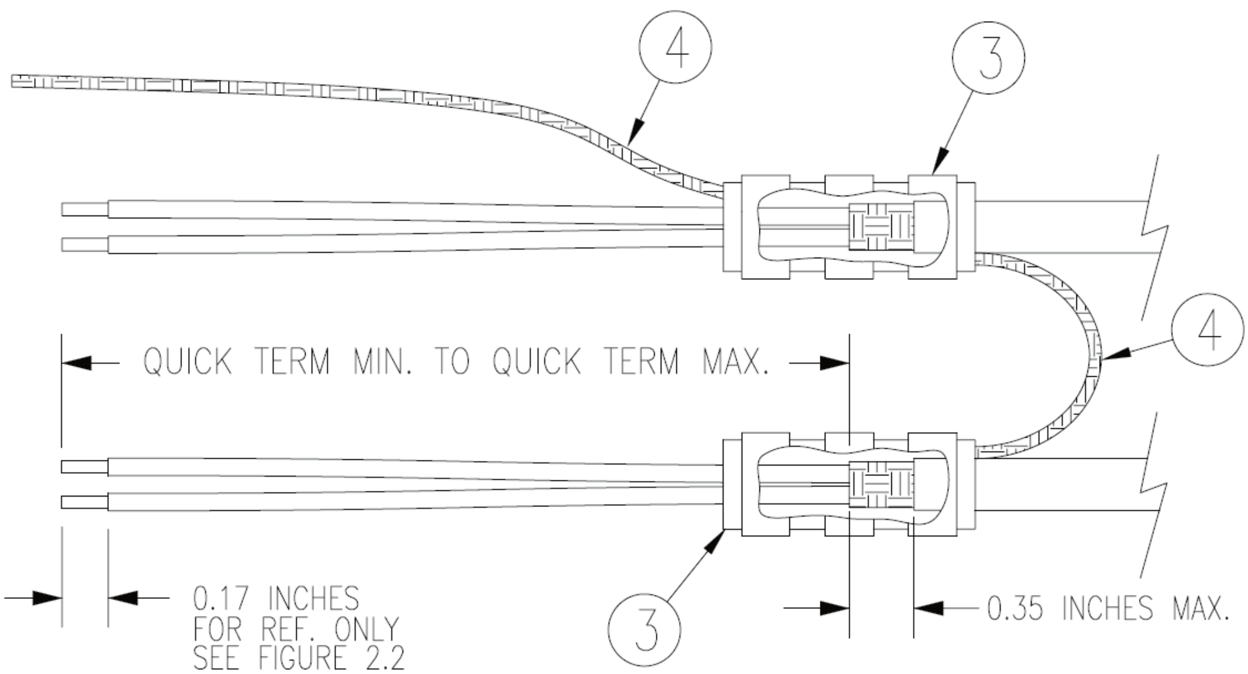


Figure 16-10 Method B.2 (Daisy Chain-Quick Term) for Shield Termination

16.3.6 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 16-11). 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.

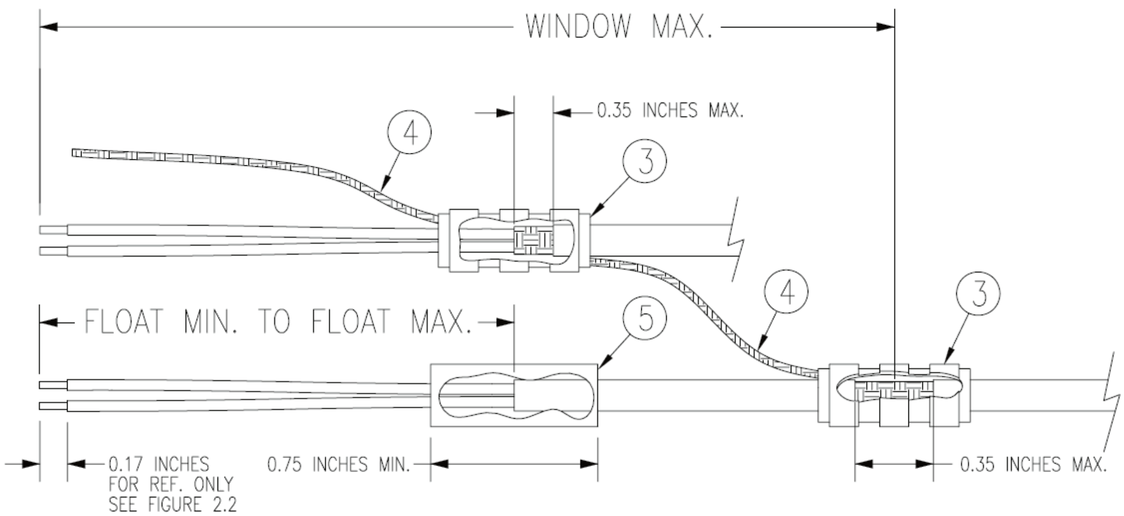


Figure 16-11 Daisy Chain between Methods A and B

16.3.7 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 16-7.
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).

16.3.8 Splicing Signal Wires

NOTE

Figure 16-12 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 16-12 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.

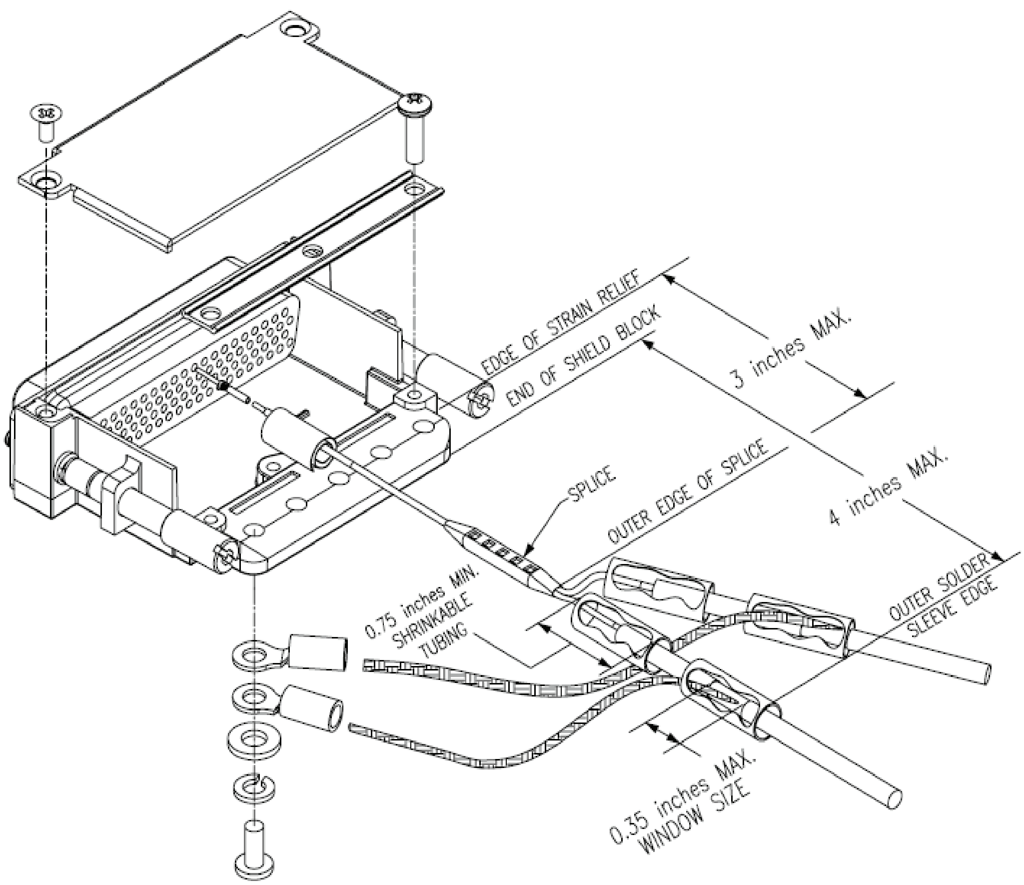
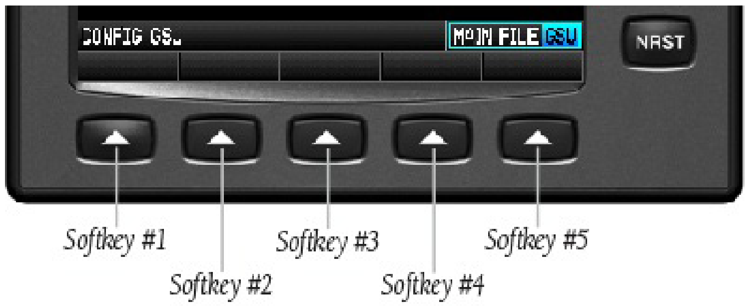


Figure 16-12 D-Sub Spliced Signal Wire illustration

17 CONFIGURATION, SOFTWARE, DATABASES, AND XM ACTIVATION

17.1 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 1 display.



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

17.2 Software Loading Procedure

GDU software loading can be performed in either normal or configuration mode. Section 17.2.1 describes the GDU software load procedures. Section 17.2.2 describes the GDL 39/39R software load procedure

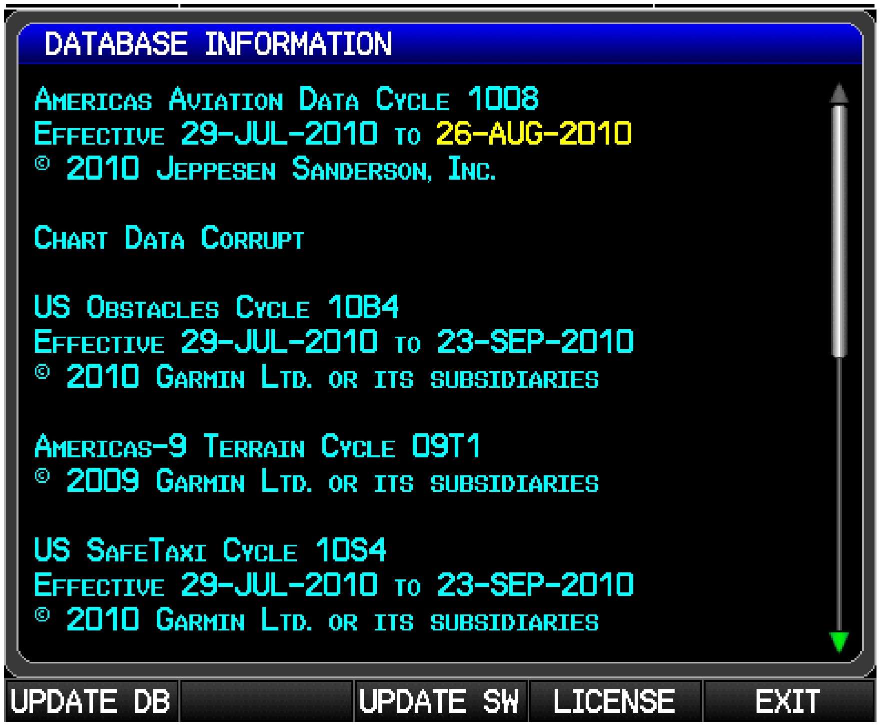
17.2.1 GDU Software Loading Procedure

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.



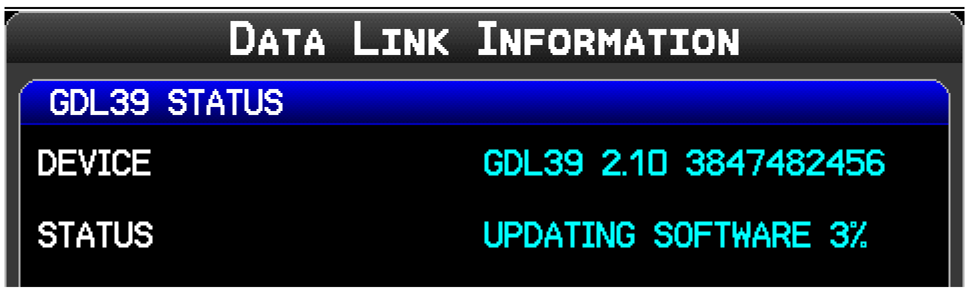
3. The unit will reboot, then GDU software update will begin automatically.
4. Ensure power is not removed while the update is being performed.
5. The unit will reboot after the update is complete.
6. Other connected non-display LRUs will automatically be updated to the correct software version. Software for all CAN LRUs (GSU 25, GSU 73, GEA 24, GSA 28, GAD 29) and also the GDL 39/39R will automatically be loaded by the display with no user action required. In configuration mode, the MAIN Configuration page will display "Updating..." next to any device that is currently performing a software update.
7. Repeat for each GDU in the aircraft.

17.2.2 GDL 39/GDL 39R Software Update

GDL 39/39R software updates are loaded through the GDU. After the steps in Section 17.2.1 have been completed, the GDU will identify the software version currently in use for the GDL 39/39R and compare it to the GDL 39/39R software version stored in internal GDU memory. If the current GDL 39/39R software is different than the GDL 39/39R software stored in GDU memory, the GDU will automatically begin updating the GDL 39/39R9. An "Updating..." indication for the GDL 39/39R (and for any LRU being updated) is displayed on the Main Configuration page. Another indication of the update is found on the Data Link Information Page (normal mode). Allow the update to complete. After the update, the GDL 39/39R will resume normal operation.

CAUTION

It is critical that GDU power is not removed during the software update. An interruption in supplied power or turning the unit off during the SW update may damage the GDL 39/39R causing it to be non-functional.



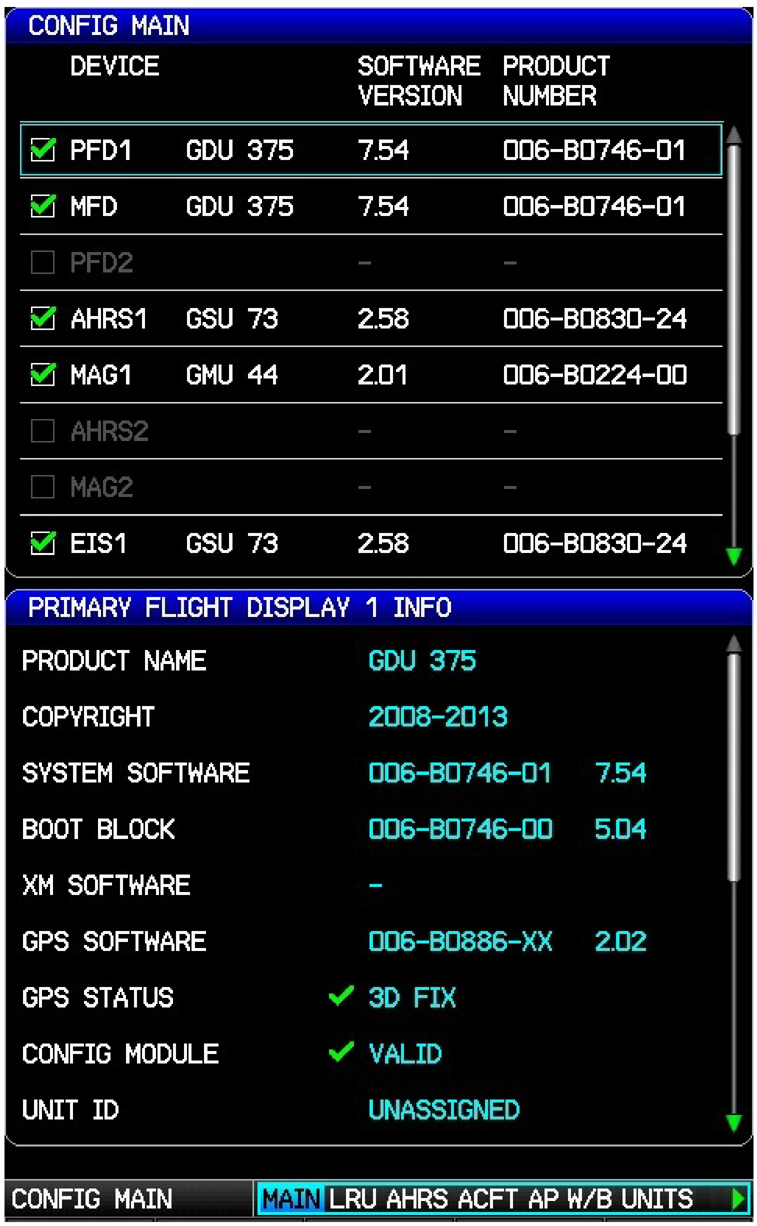
17.3 Configuration Pages

17.3.1 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. Faults are indicated by a Red X next to the affected LRU.

1. In configuration mode (Section 17.1), 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.

2. This page can be used to update the software in the LRUs (highlight the System Software in the INFO box and press the UPDATE softkey), and also test the annunciator outputs on the EIS and GMC 305 LRUs by pressing the ANNUN TEST softkey.



17.3.2 LRU Configuration Page

The LRU configuration page is used to configure which optional LRUs are connected to the system. If a particular LRU is not installed, or a particular LRU function (such as AOA) is not desired, change that setting on the LRU configuration to "Disabled".

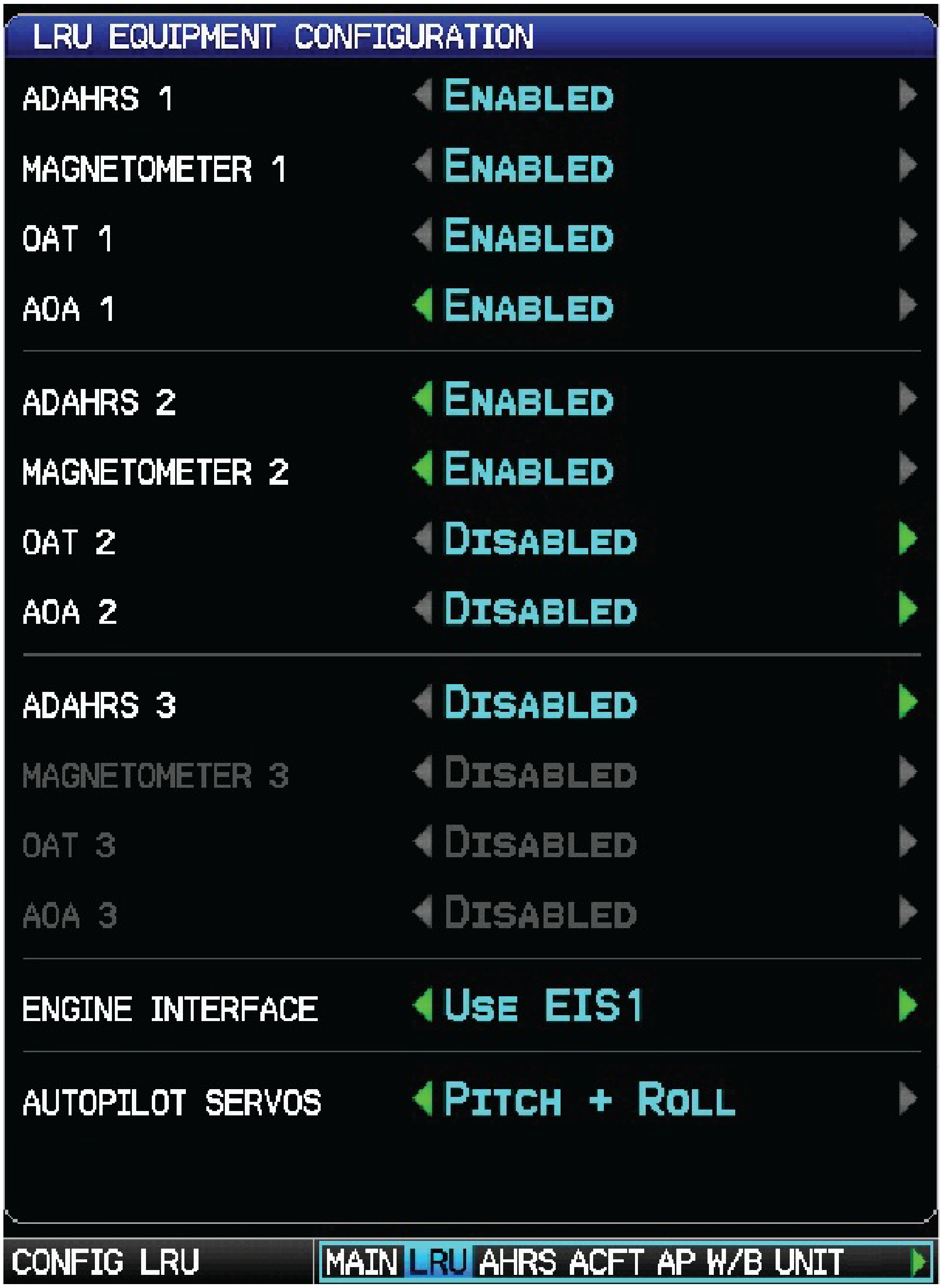
For example, if a GSU 25 is connected as ADAHRS 2 but no GMU 22 or GTP 59 is connected, configure ADAHRS 2 to "Enabled" and Magnetometer 2 and OAT 2 to “Disabled”. Also change any AOA item to “Disabled” if the installed ADAHRS LRU does not support AOA (e.g. the GSU 73) or if the AOA pneumatic connection is not connected to that ADAHRS LRU.

The Engine Interface item is used to configure which numbered EIS LRU should be used. This should be left configured for EIS1 except in the case of a system that includes a GSU 73 and a GEA 24, the latter of which would be wired as EIS2.

The Autopilot Servos item is used to configure how many GSA 28 servos are installed. Select "Roll Only" if a single roll servo is installed, "Pitch + Roll" for a two-axis autopilot servo installation, or "Pitch +Roll+ YD" for a two-axis autopilot installation with a third yaw damper servo.

1. In configuration mode (Section 17.1), use the FMS Joystick to select and view the LRU Page.

2. Use the FMS Joystick to enable or disable the listed LRUs.



17.3.3 AHRS (Attifude/Heading Reference System) Configuration Page

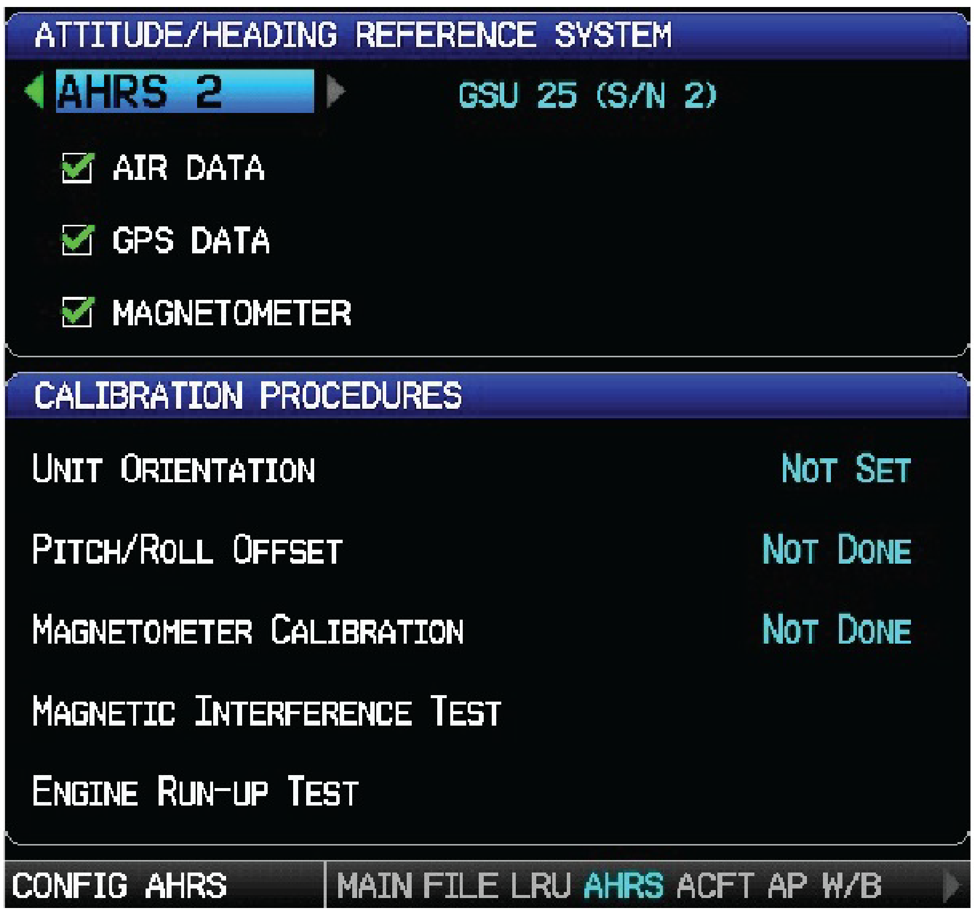
The AHRS Configuration Page is used to perform post-installation calibration for both the GSU 25 and/or GSU 73 (as applicable).

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

Attitude/Heading Reference System–The Air Data, GPS Data, and Magnetometer checkboxes confirm operational status of these LRUs with a green check, no green check indicates no communication with LRU.

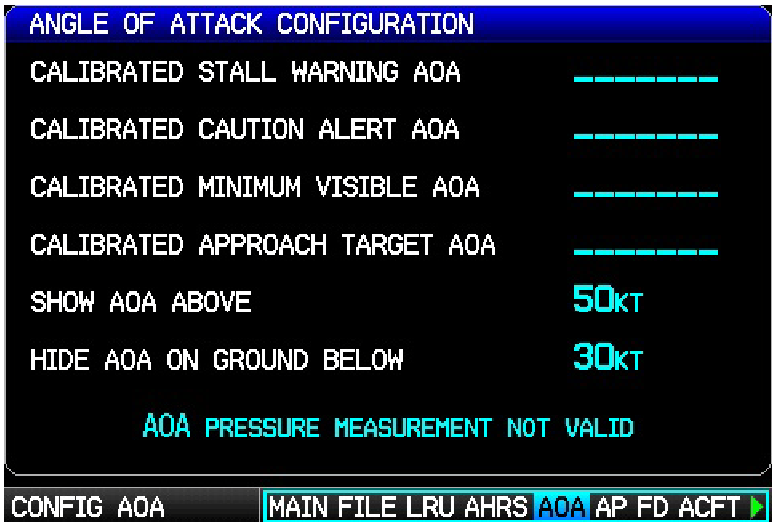
1. Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.

Calibration Procedures–See Section 17.2 (SW loading procedure) , Section 19.3 (GSU 25/73/GMU 22 Post Installation Calibration Procedures), and Section 20.6 (Post Installation Calibration Procedures) for further information regarding the AHRS Configuration Page.



17.3.4 Angle of Attack (AOA)

The AOA Configuration page is accessible only when an AOA input is enabled on the LRU Configuration page (Section 17.3.2). The configuration mode page only allows viewing and deleting the AOA calibration values, the AOA calibration cannot be performed in configuration mode. See Section 19.4 for the AOA Calibration procedure.



17.3.5 AP (Autopilot) Configuration Page

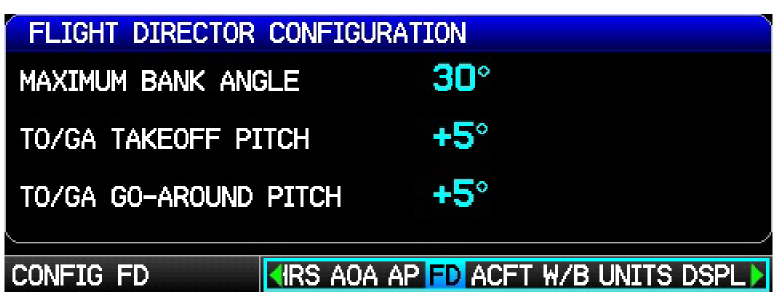
See Section 9.11 through Section 9.17 for autopilot configuration instructions.

17.3.6 FD (Flight Director) Configuration Page

This page allows configuration of certain options for the flight director. It will only appear in installations that include an autopilot.

The Maximum Bank Angle field allows adjustment of the maximum roll angle that will be commanded by the flight director. This setting should not be adjusted from the default of 30 degrees except for very high performance aircraft that have bank angle limitations at high speeds.

If an EIS discrete input is configured for "AFCS TO/GA", fields will appear on the FD config page. These fields allow customization of the pitch attitudes that will be commanded when the flight director is in Takeoff (TO) or Go-Around (GA) mode, to suit the performance characteristics of the aircraft. The default value for both settings is 5 degrees.



17.3.7 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.

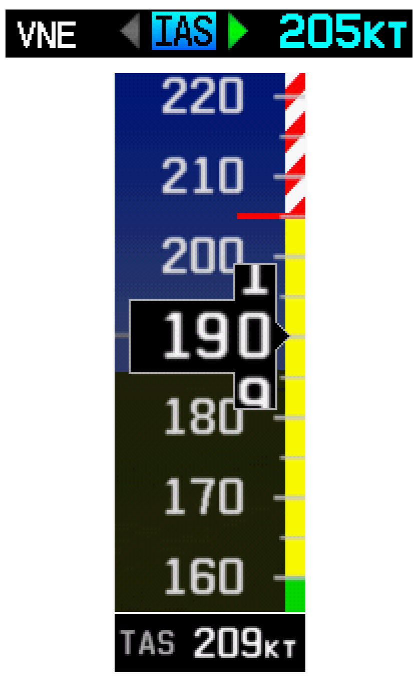
To clear a reference field:

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

To clear a label field:

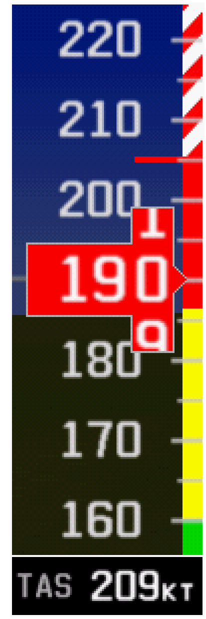
1. Highlight the desired label field.
2. Press the CLR key.

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.

G Meter–The G-Meter fields allow for setting the minimum and maximum G values displayed on the PFD G-meter. The G-meter may be displayed at any time via the PFD Setup page. Not entering any values, or clearing the values, disables the G-Meter entirely. Setting Auto Display to On allows the G-Meter to appear in place of the HSI when G-loads on the aircraft exceed a fixed threshold (setting Auto Display to Off disables Auto Display of the G-Meter).

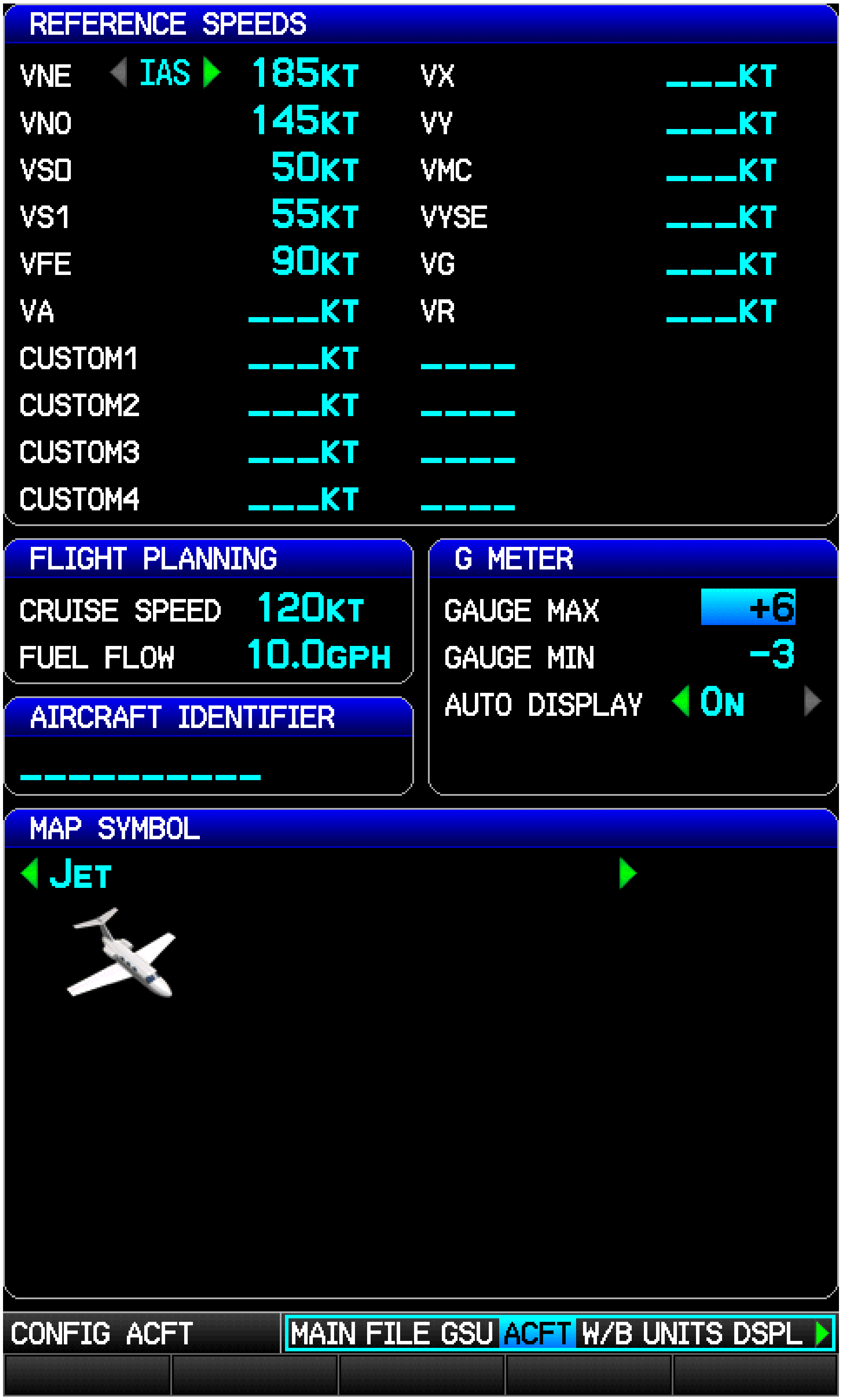
Map Symbol–The aircraft symbol that is displayed on the Map page can be selected from five different vehicles that are stored internally to the unit. Additional vehicles may be downloaded from www.garmin.com/vehicles.

NOTE

The downloaded 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.



17.3.8 W/B (Weight/Balance) Configuration Page

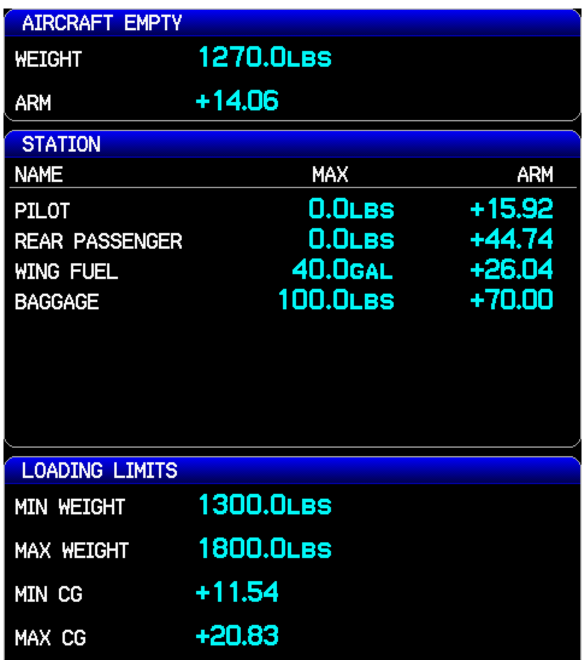
The W/B Configuration Page allows setting the weight and balance parameters for the airplane. These parameters are then used on the Main Menu W/B Page in normal mode. Weight/Balance may be used during pre-flight preparations to verify the weight and balance conditions of the aircraft. By entering the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

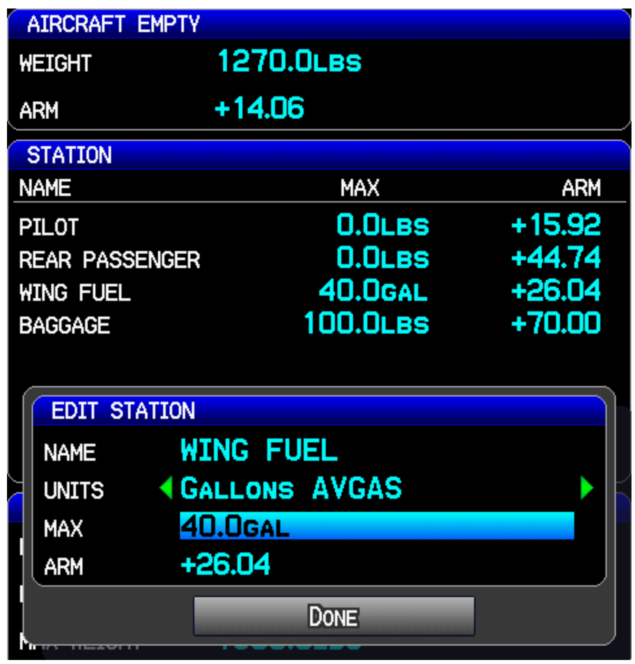
Before entering the various figures, the empty weight of the airplane and the arm (or "station") for each weight should be determined. These figures should be determined using the pilot's operating handbook for the airplane, which also notes the weight limitations and fore/aft CG limits. Compare those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





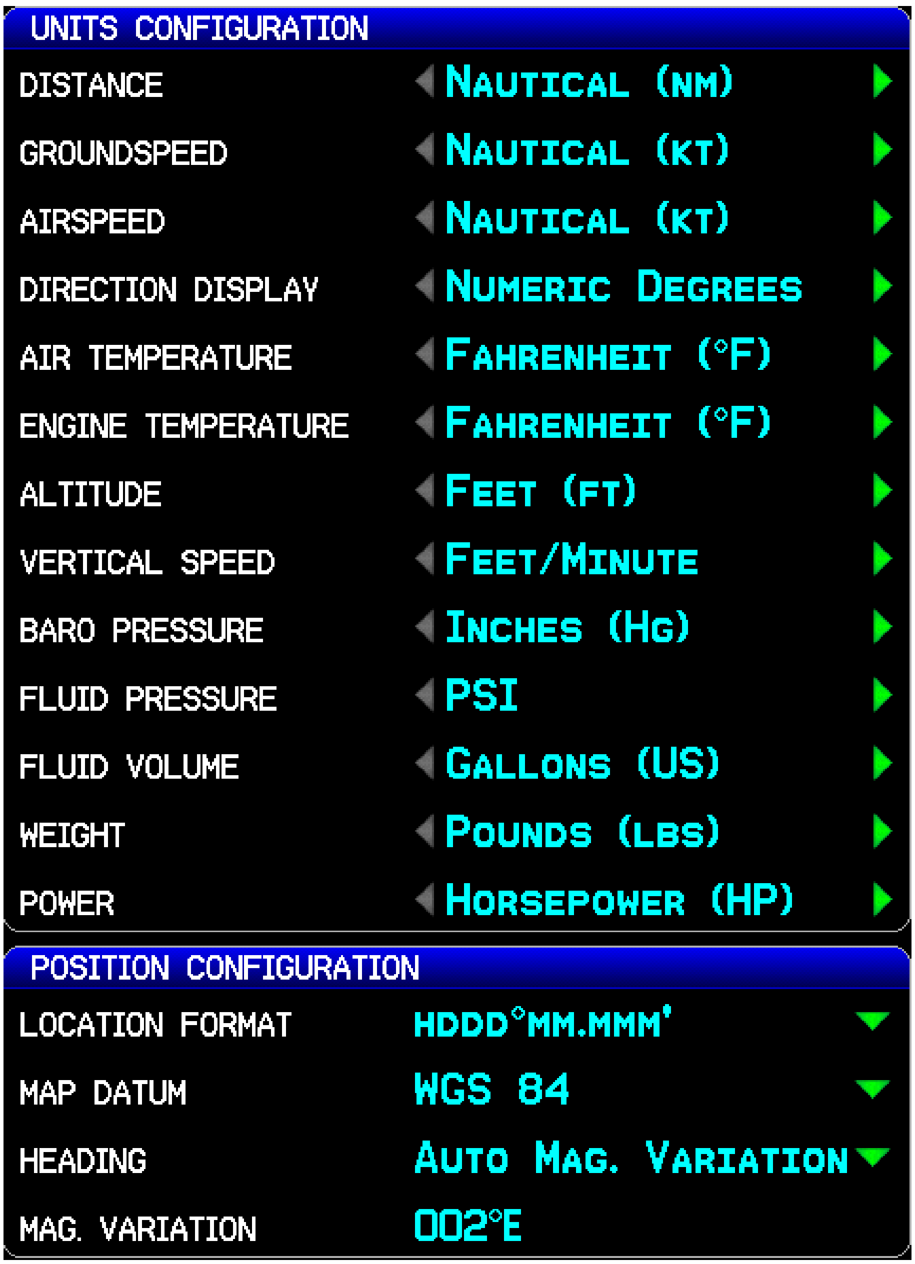
2. Use the FMS Joystick to select the desired configurable item and make the desired change, then press the ENT Key or use the FMS Joystick to select the next item.
3. To create a new station, highlight a blank line (in the Station window), press the ENT key, enter the name, units, max weight, and arm, 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.

17.3.9 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.

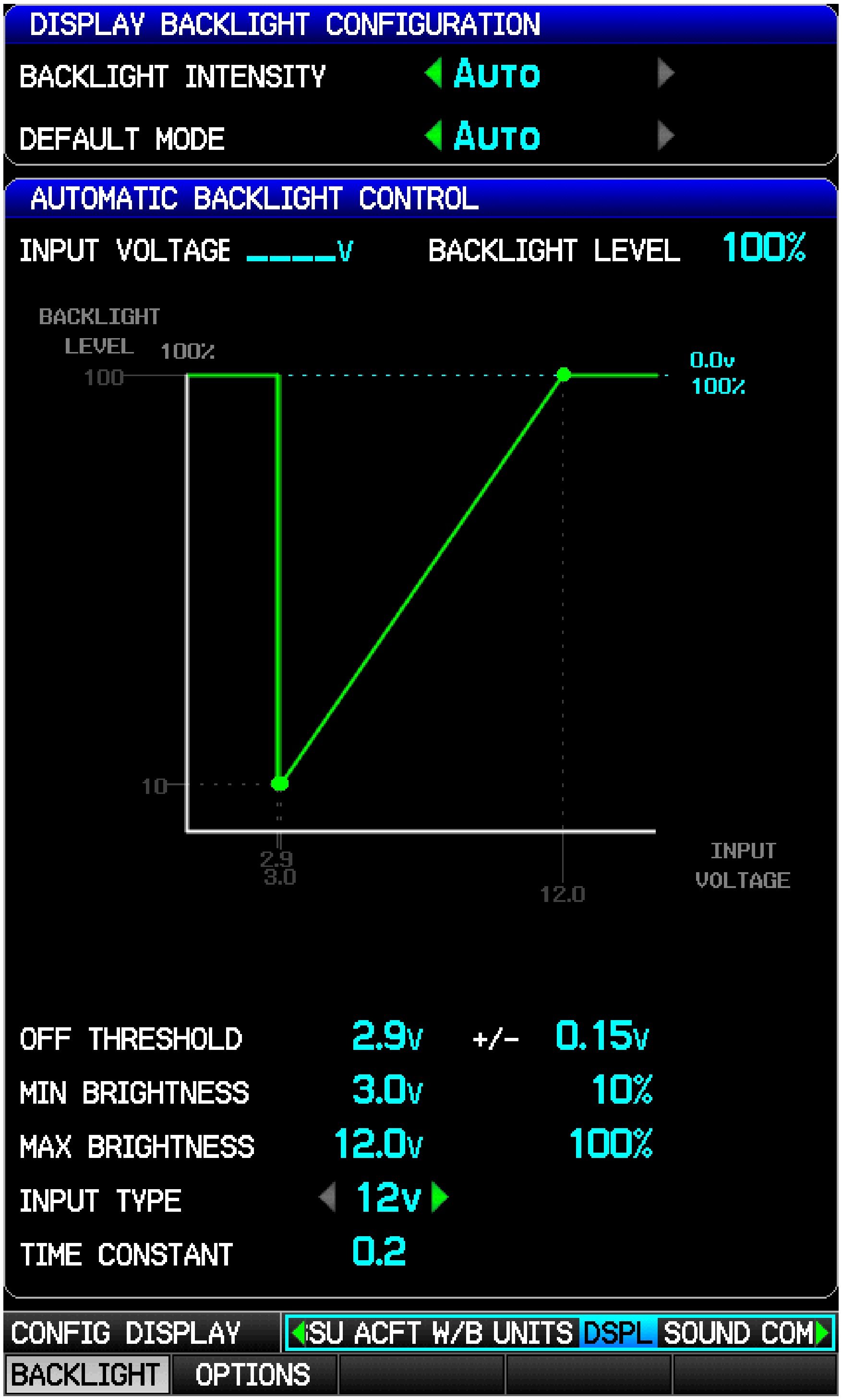
2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



17.3.10 DSPL (Display) Configuration Page

The DSPL Configuration Page allows setting the parameters for display backlight and display options configuration.

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.
3. Press the Options softkey to switch between the Display Configuration Page and the Backlight Configuration Page. Each of these pages are detailed in the following sections.

17.3.10.1 Display Configuration Page

Display Backlight 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 2.9 V & ±0.15 V. If the Off Threshold value is set to 0.0 V, 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.

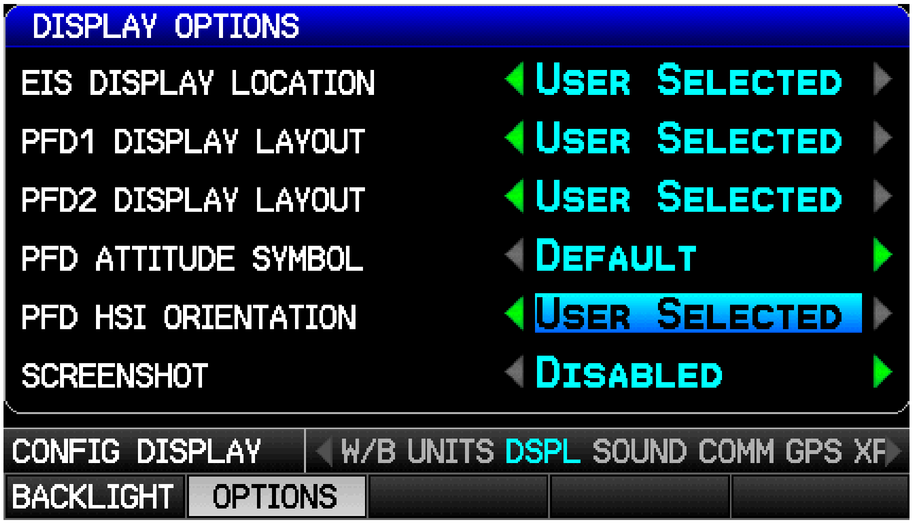
Min Brightness (Voltage and Percentage)–Sets the lower bus voltage required to turn the backlighting on to the percentage of brightness set by the Min % setting. Default values are 3. 0 V and 10%.

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 12.0 V and 100%.

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

17.3.10.2 Display Options Window (press the Options softkey):



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–Controls the screen layout for PFD1.

Auto–PFD1 is a dedicated full-screen PFD display (when in a multi-display system and not in reversionary mode).

Split Screen–PFD1 always remains in split-screen mode.

User Selected-(default setting) Allows changing PFD1 layout in normal mode from the Display Setup page in the main menu.

PFD2 Layout–Controls the screen layout for PFD2 (for 3-display systems only).

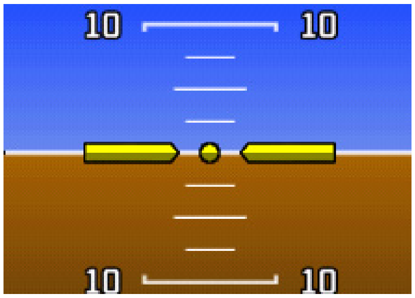
Auto–PFD2 is a dedicated full-screen PFD display (when not in reversionary mode).

Split Screen–PFD2 always remains in split-screen mode.

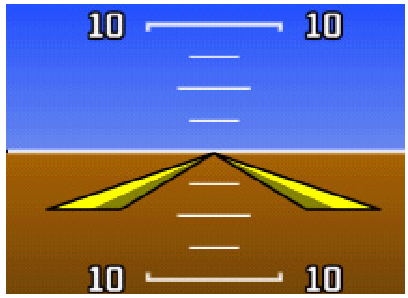
Full PFD/MFD–PFD2 displays a page sequence that includes a full-screen PFD display as well as full-screen MFD pages.

User Selected–(default setting) Allows changing PFD2 Layout in normal mode from the Display Setup page in the main menu.

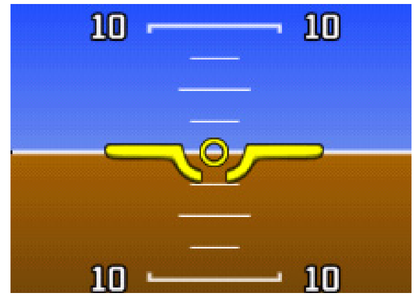
PFD Attitude Symbol–Affects the appearance of the airplane symbol on the PFD attitude display. Options are Default, Alternate 1, and Alternate 2. This option is not selectable if an autopilot is configured. The "Alternate 1 Symbol" shown below will be used if an autopilot (GSA 28 or 3rd party) is configured.



Default Symbol



Alternate 1 Symbol



Alternate 2 Symbol

PFD HSI Orientation–Allows setting the PFD HSI Orientation to either Heading or User Selected (default). The Heading selection displays the HSI (on the PFD) in a heading-up orientation. The User Selected setting enables an HSI Orientation option on the PFD Setup page, see the G3X Pilot's Guide (190-01115-00) for more info.

Screenshot–Allows setting the Screenshot function to either Enabled or Disabled (default). This function allows a 'screenshot' of the current display to be stored to an SD card while in configuration mode. When enabled, with an SD card in the SD card slot, press and hold the Menu key to save a screenshot bitmap file to the SD card (indicated by a screen flash).

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

17.3.11 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

AOA Alert – Enables/disables AOA Alert tone

Altitude Alert – Enables/disables the Altitude Alert tone

Altitude Minimums – Enables/disables the Altitude Minimums tone

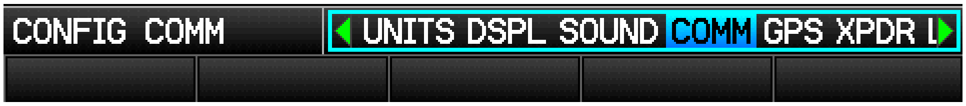
Alert Source – If more than one GDU 37X is installed, an Alert Source field will appear on the SOUND Configuration page. The Alert Source field allows the user to select which GDU will generate the alert sounds. The Alert Source options are: PFD1, PFD2, MFD, or Auto (which will use whichever unit is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

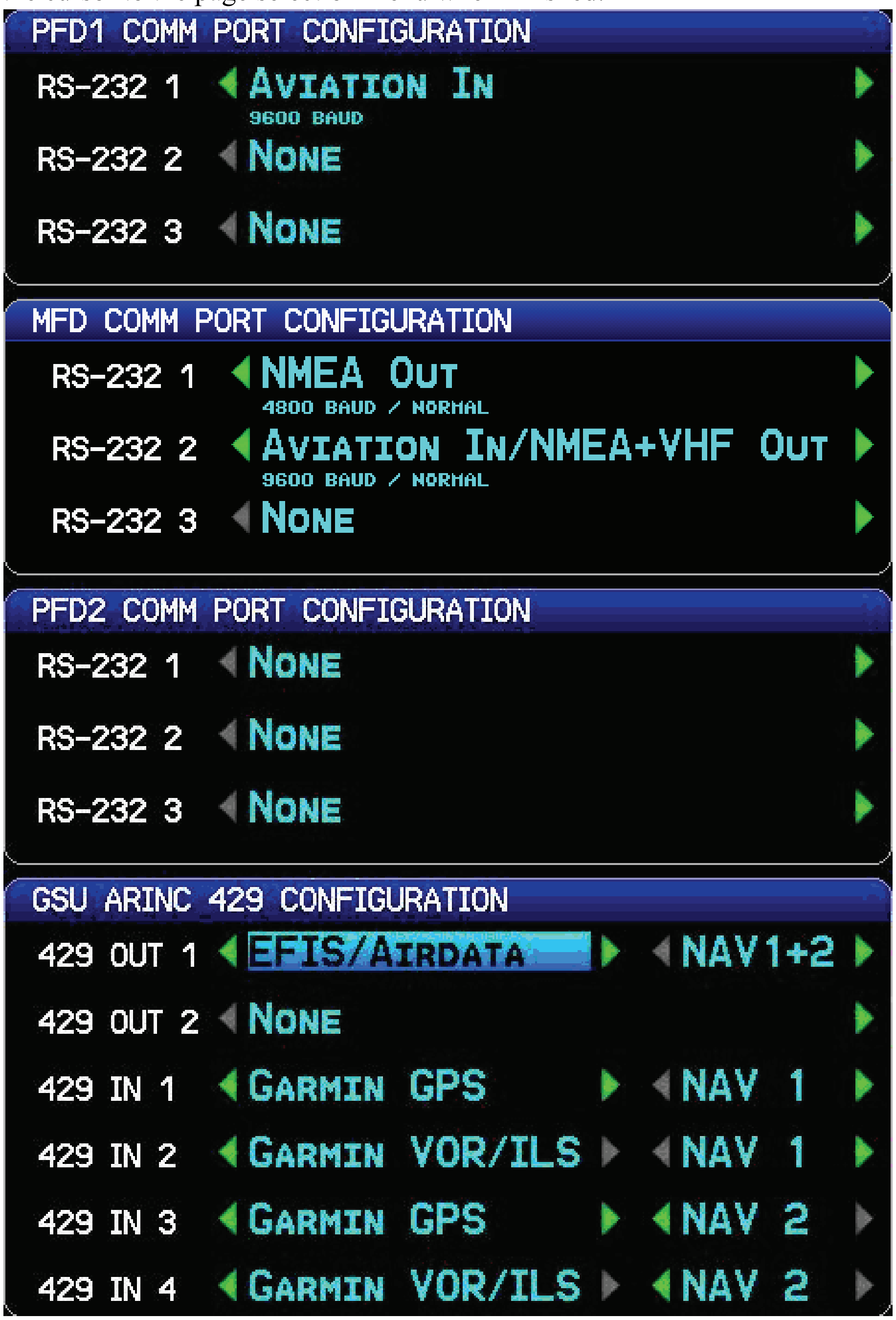
17.3.12 COMM Configuration Page

The COMM Configuration Page allows setting the parameters for the communication ports on the GDU 37X displays, the GSU 73, and the ARINC 429 ports on the GAD 29 or GSU 73.

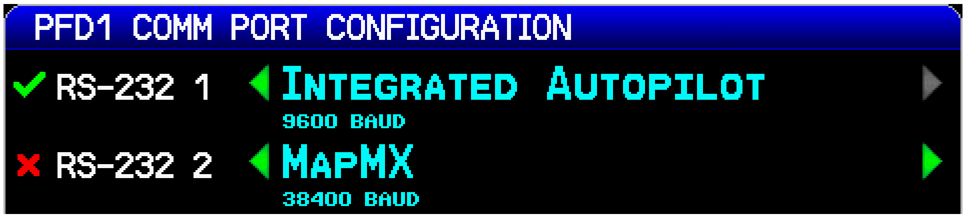
1. In configuration mode, use the FMS Joystick to select the COMM Page.



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 no data has been received after an intial timeout period, or if data has been received and 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.

17.3.12.1 RS-232 (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 or a GDL 39

Garmin Instrument Data - Used for connecting to compatible Garmin LRUs (e.g. GSU 25, GMC 305)

Garmin HSDB - Used for connecting to compatible Garmin LRUs (e.g. GTS 8XX, see Appendix D)

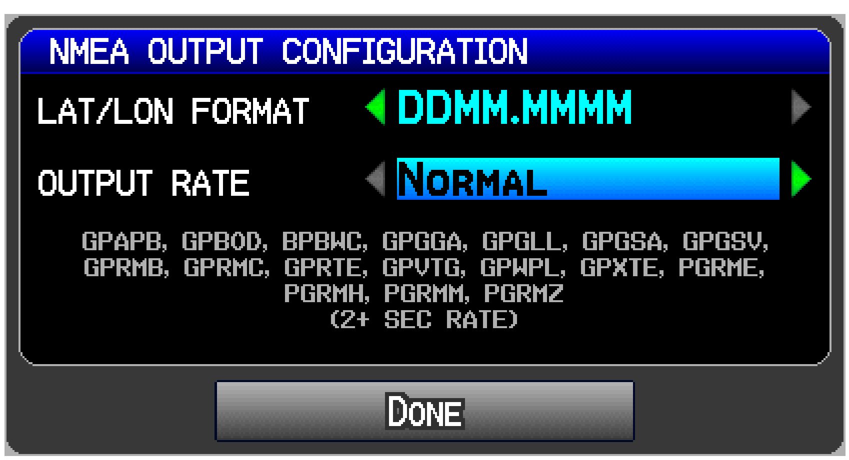
NMEA Out - Supports the output of standard NMEA 0183 version 3.01 data at a baud rate of 4800. The GDU outputs data from the selected GPS source (internal GPS or external GPS1/GPS2) via NMEA sentences.

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.

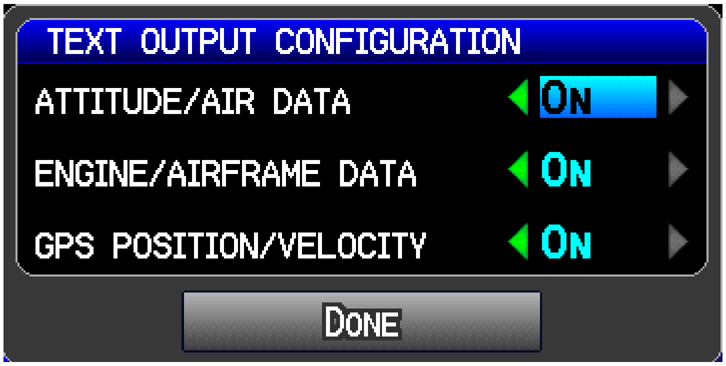
A pop-up window appears which allows the selection of the Lat/Lon format and the output rate. These settings affect all RS-232 ports that are configured to output NMEA data. The selected speed is displayed following the baud rate now for all ports configured for NMEA output. This feature is useful for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



Text Out – Selecting Text Out enables a pop-up menu to appear when the Menu key is pressed (while on the COM Configuration Page). This pop-up menu allows setting three selections (Attitude/Air Data, Engine/Airframe Data, and GPS Position/Velocity) to On or Off. The On setting allows the output of Text Data as described in Appendix I.



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. If the external GPS navigator supports both the Aviation In and MapMX formats, Garmin recommends using the preferred MapMX format.

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-A In - Receives TIS A-data from a Garmin Mode-S panel-mount transponder. If the transponder is connected to the ADAHRS 1 LRU (as shown in Appendix D), it is not necessary to connect its output to a GDU RS-232 port.

TIS-A In/NMEA & VHF Out - Receives TIS-A 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 ADAHRS 1 LRU (as shown in Appendix D), it is not necessary to select TIS-A In, as the transponder data is received via the ADAHRS 1 LRU.

Garmin VHF Nav/Comm - Outputs frequency tuning and radial selection data to an SL30 or GNC 2XX Nav/Comm radio, and receives lateral and vertical NAV deviation signals.

Garmin VHF Comm - Outputs frequency tuning data to an SL40 or GTR 2XX Comm radio.

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 D.

Note the following when configuring the communication settings:

- Each GNS 400/500, GNS 480, 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 ARINC 429 connection(s)). ARINC 429 data input from a GNS 400/500, GNS 480, 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, GNS 480, 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.

Vertical Power – A 3rd party LRU that integrates with the G3X to monitor and control the entire electrical system via the GDU.

17.3.12.2 ARINC 429 Configuration options

The configuration options for the 2 ARINC 429 output and 4 ARINC 429 input ports on the GAD 29 or GSU 73 are detailed in this section.

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, GNS 480, 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,GNS 480, or GTN 600/700 series unit. A second selection is used to determine if the GPS input is from NAV 1 or NAV 2.

17.3.13 GPS Configuration Page

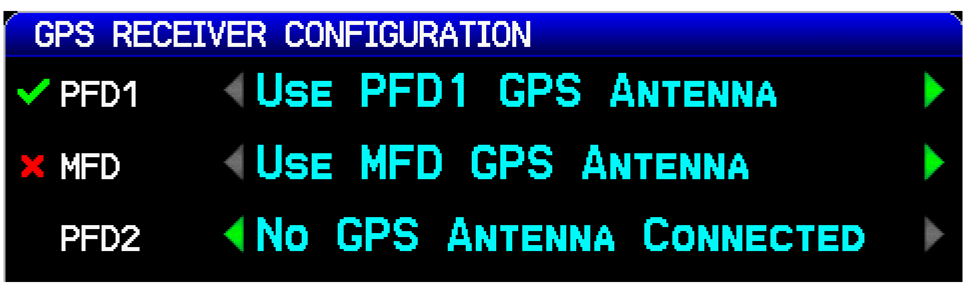
The GPS Configuration Page allows selecting the GPS source for each GDU. Each installed GDU can select either the GPS antenna directly connected to that GDU, or ‘No GPS Antenna Connected’. If ‘No GPS Antenna Connected’ is selected, that GDU will use GPS data from the GDU that is connected to a GPS Antenna. Only one GDU need be connected to a GPS Antenna, that GDU will “share” the GPS info will all other GDUs.

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, GNS 480, or GTN 600/700 series unit, see *Appendix D**). 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.



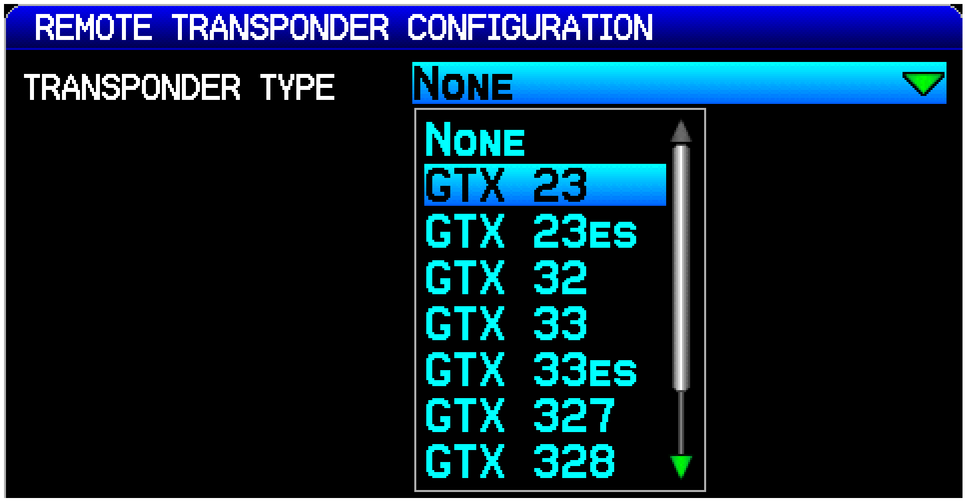
If an external GPS navigator is configured, the GPS config page displays "Select External GPS At Powerup". This setting controls whether the user's choice to use the internal GPS nav source will be retained between power cycles (disabled), or if the system should always return to using the configured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

17.3.14 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.

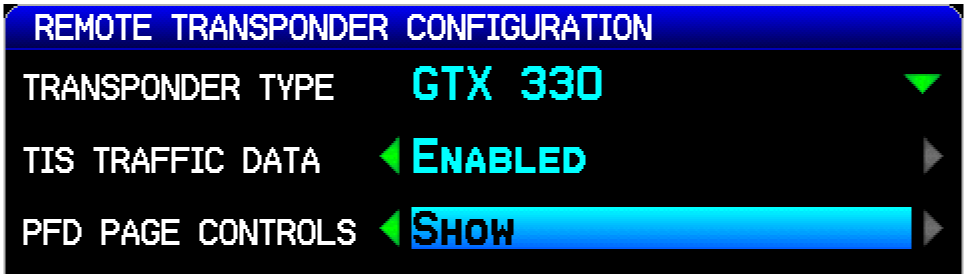
Aircraft Length: Enter Aircraft Length.

Aircraft Width: Enter Aircraft Width.

GPS Antenna Offset: Enter the distance from the nose of the aircraft to the GPS antenna used to provide position data to the transponder.

TIS-A 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.

PFD Page Controls: Can be set to Show or Hide the transponder controls on the PFD as desired for a panel-mounted transponder.



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 (refer to the applicable transponder installation manual for BDS information) 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.

ADS-B UAT In: Set to SUPPORTED if the aircraft is equipped with a receiver that provides ADS-B In capability using the 978 MHz UAT frequency, such as the GDL 39.

ADS-B 1090ES In: Set to SUPPORTED if the aircraft is equipped with a receiver that provides ADS-B In capability using the 1090 MHz frequency, such as the GDL 39.

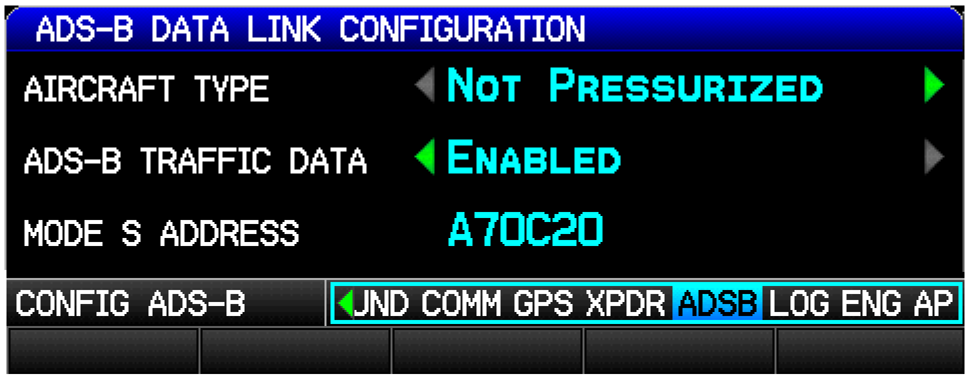
Enhanced Surveil: Sets Enhanced Surveillance (EHS) to DISABLE or ENABLE. ENABLE is the default. When EHS is set to DISABLE the BDS (refer to the applicable transponder installation manual for BDS information) items that are marked “EHS Only” are not active (no enhanced surveillance).

Positions 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. Set to "VFR GPS" if no TSO WAAS GPS input is connected to the transponder. 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.

17.3.15 ADS-B Configuration Page

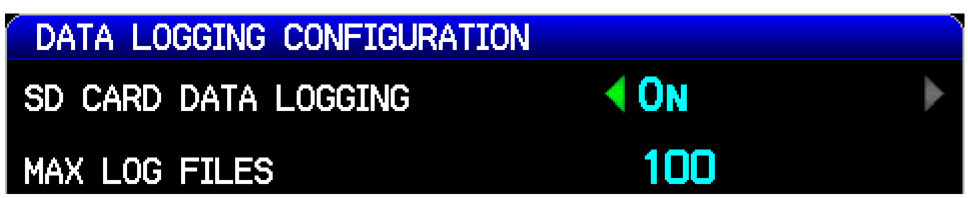
The ADS-B Data Link Configuration Page is only displayed when the unit is configured to communicate with and has successfully communicated with a GDL 39 (see Appendix D for interface and configuration info). Aircraft Type should be set to "Not Pressurized". The Mode S Address field is displayed (and is editable) if configured for a Mode S Transponder or not configured for any transponder. The Mode S Address field is not displayed if configured for a non-Mode S Transponder, such as a GTX 327.



17.3.16 LOG Configuration Page

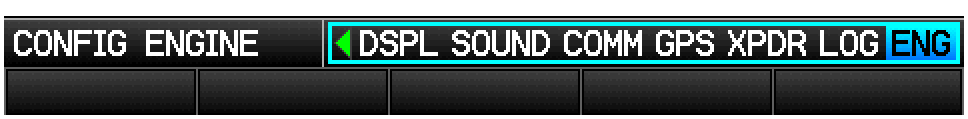
The Data Logging Configuration page enables the storage of flight data as .csv files to the "data_log" folder on an SD card. If data logging is enabled, the files are automatically written to the SD card after it is inserted into the card slot. These files can be opened in Excel, or imported into Google 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.



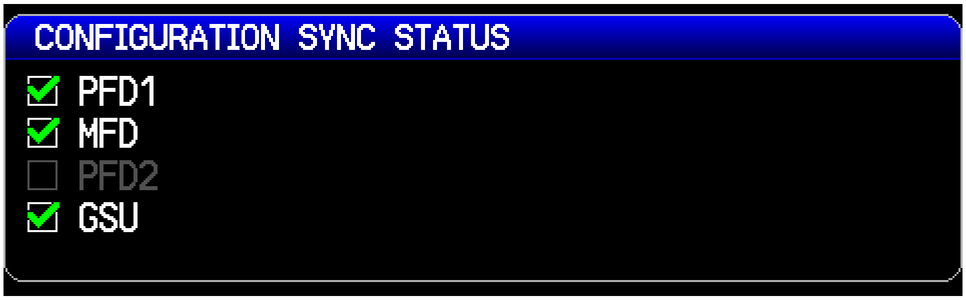
17.3.17 ENG Configuration Page

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 18 Engine/Airframe Sensor Configuration, for configuring items listed in the Engine/Airframe Input Configuration section of the Engine Configuration page.



17.3.18 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.



17.4 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.

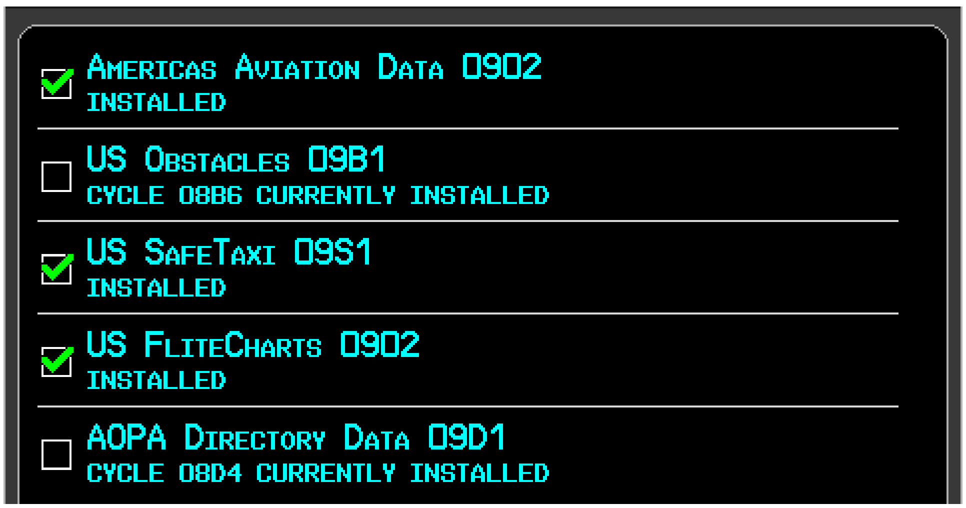
17.4.1 Updating Garmin Databases

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)

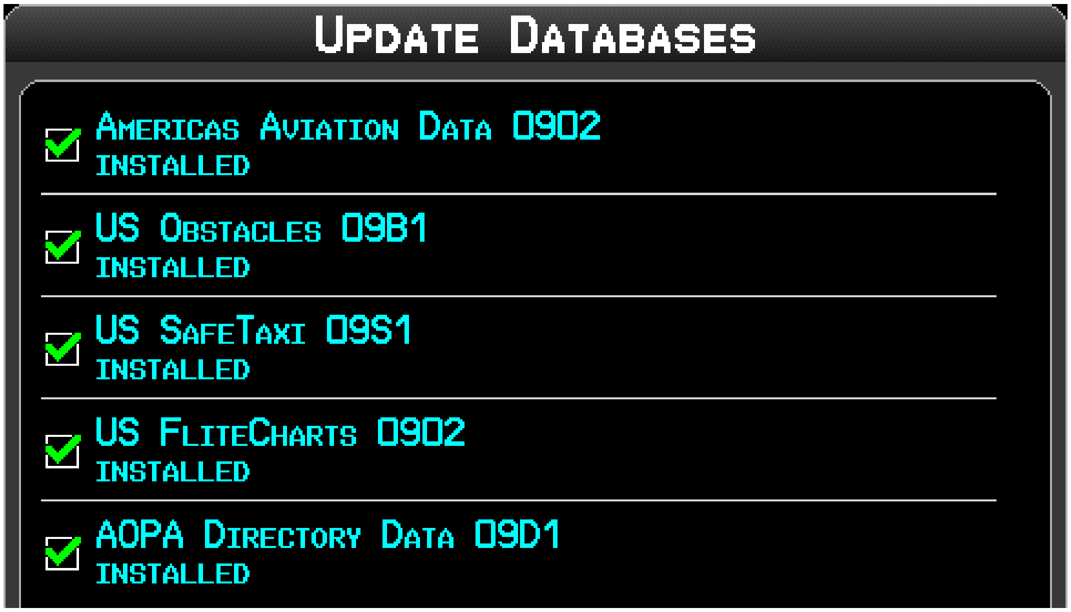
After the data has been copied to the SD card, perform the following steps:

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.

17.4.2 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.

17.5 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.

17.6 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

17.7 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

18 ENGINE/AIRFRAME SENSOR CONFIGURATION

18.1 Engine/Airframe Sensors

Each of the sensors must be correctly installed (Section 14) and configured prior to use. The Engine inputs being monitored are displayed as gauges on the EIS display (Figure 18-1) and also on the MFD's Engine Page.

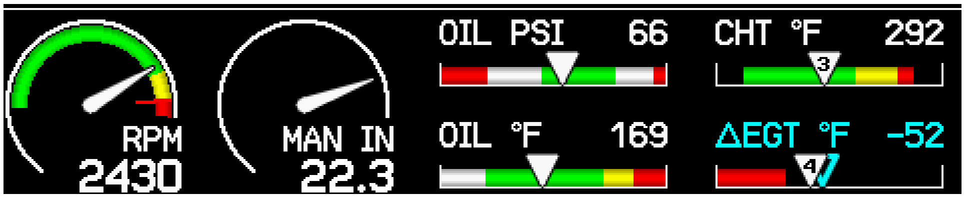


Figure 18-1 EIS Display (Engine Bar)

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 on a pre-defined priority and user selections.

RPM	Oil Temperature	Oil Pressure	Fuel Quantity

18.2 Engine Sensor Installation

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 E through H contain interface drawings for sensor installations using the Garmin sensor kits, and for other sensor installations.

18.3 Engine/Airframe Input Configuration

The Engine/Airframe Input Configuration section of the Engine Configuration Page allows selection of the engine/airframe inputs that are connected to the GEA 24 or GSU 73, and for customizing the displayed resulting information on the EIS display and the MFD Engine Page. A list of analog, digital, and discrete inputs appropriate for the connected EIS LRU type (GEA 24, Figure 18-2 or GSU 73, Figure 18-3) will be displayed.

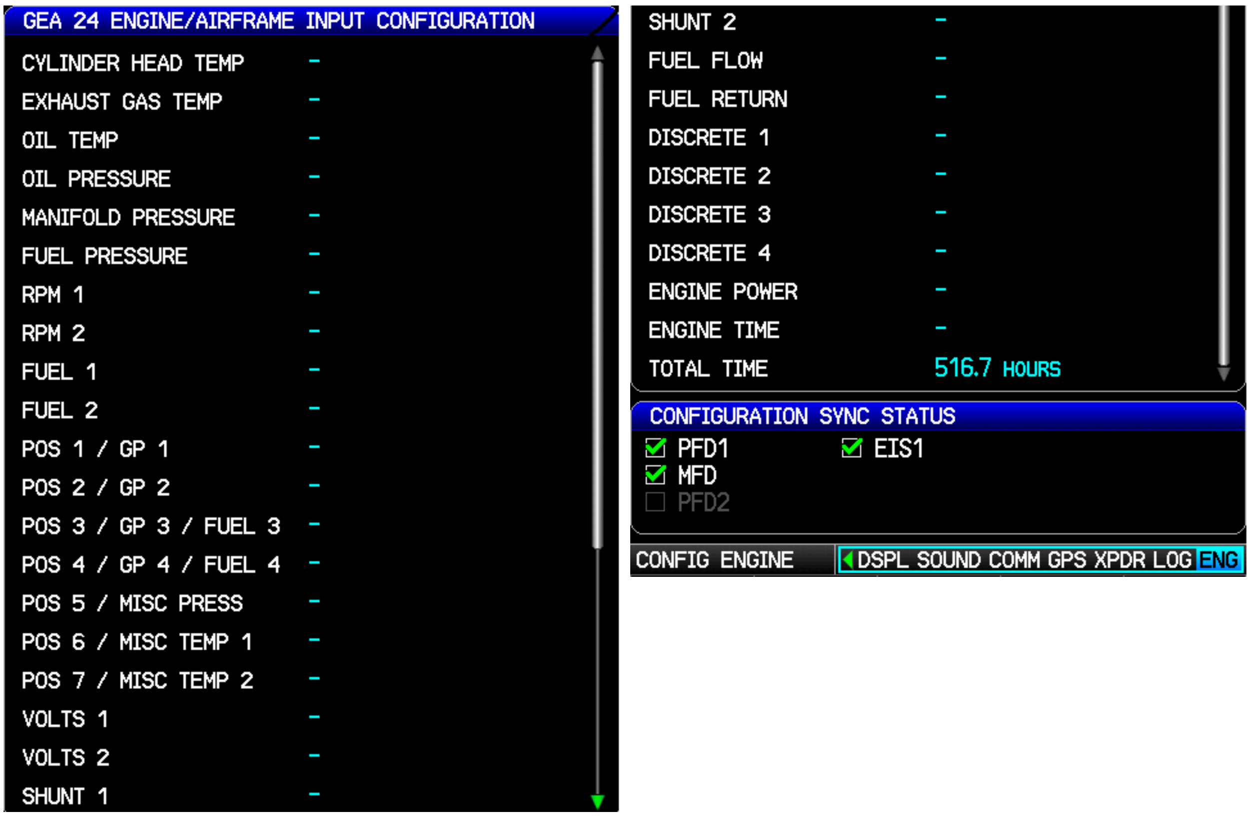


Figure 18-2 GEA 24 Engine/Airframe Input Configuration Page

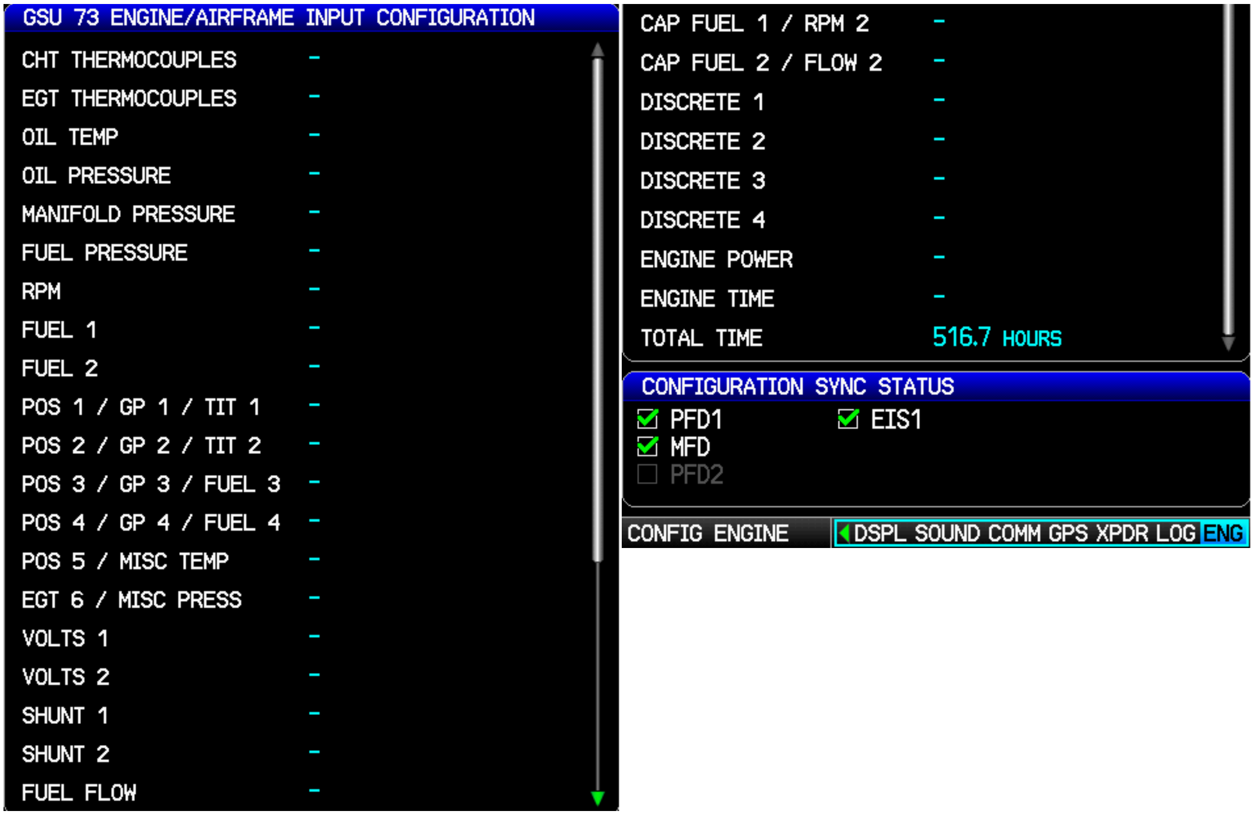
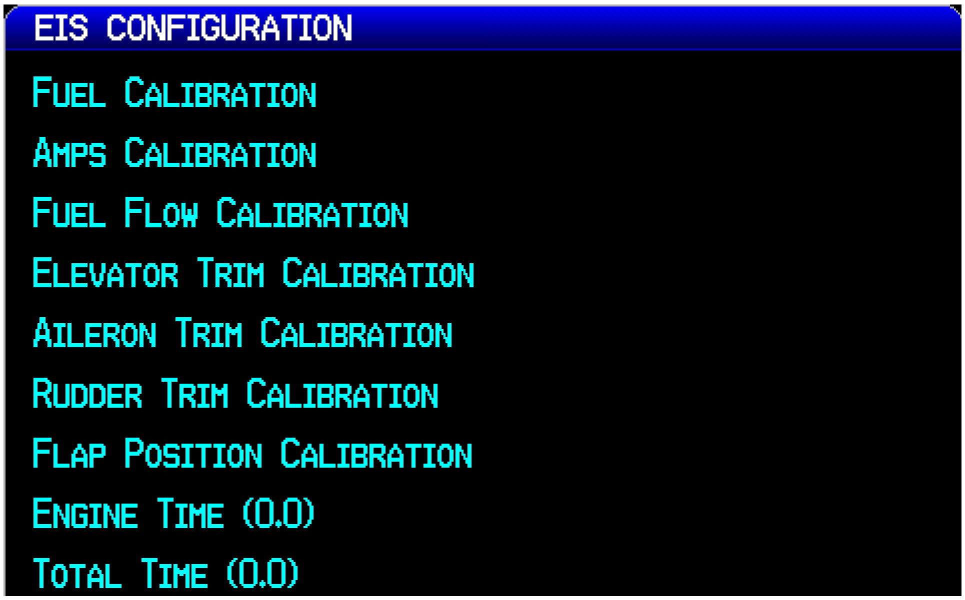


Figure 18-3 GSU 73 Engine/Airframe Input Configuration Page

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 18.3.3 for calibration information, Section 18.3.2.23 for Engine Time, and Section 18.3.2.24 Total Time information.



Refer to Section 17.1 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) (Section 18.1, including 18.3.1 - 18.3.3.).
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.

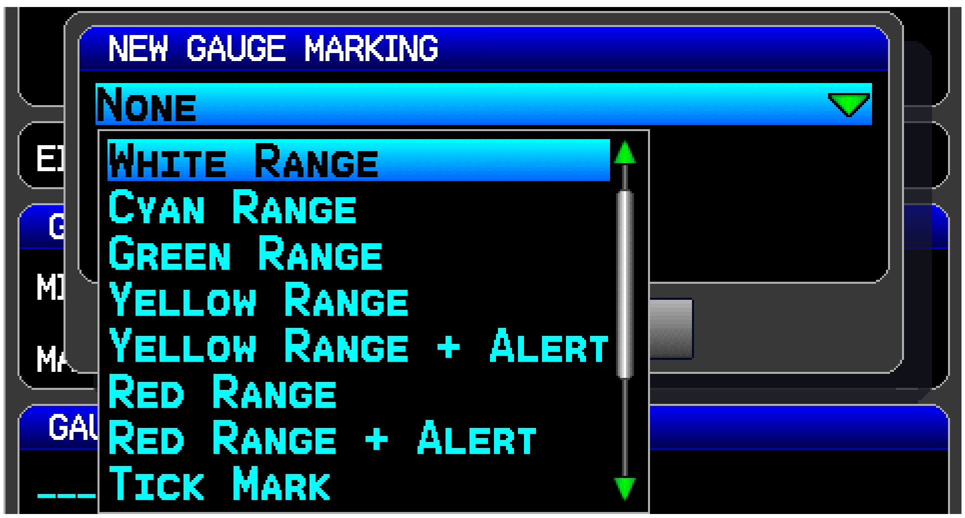
18.3.1 Common Configuration Options

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.

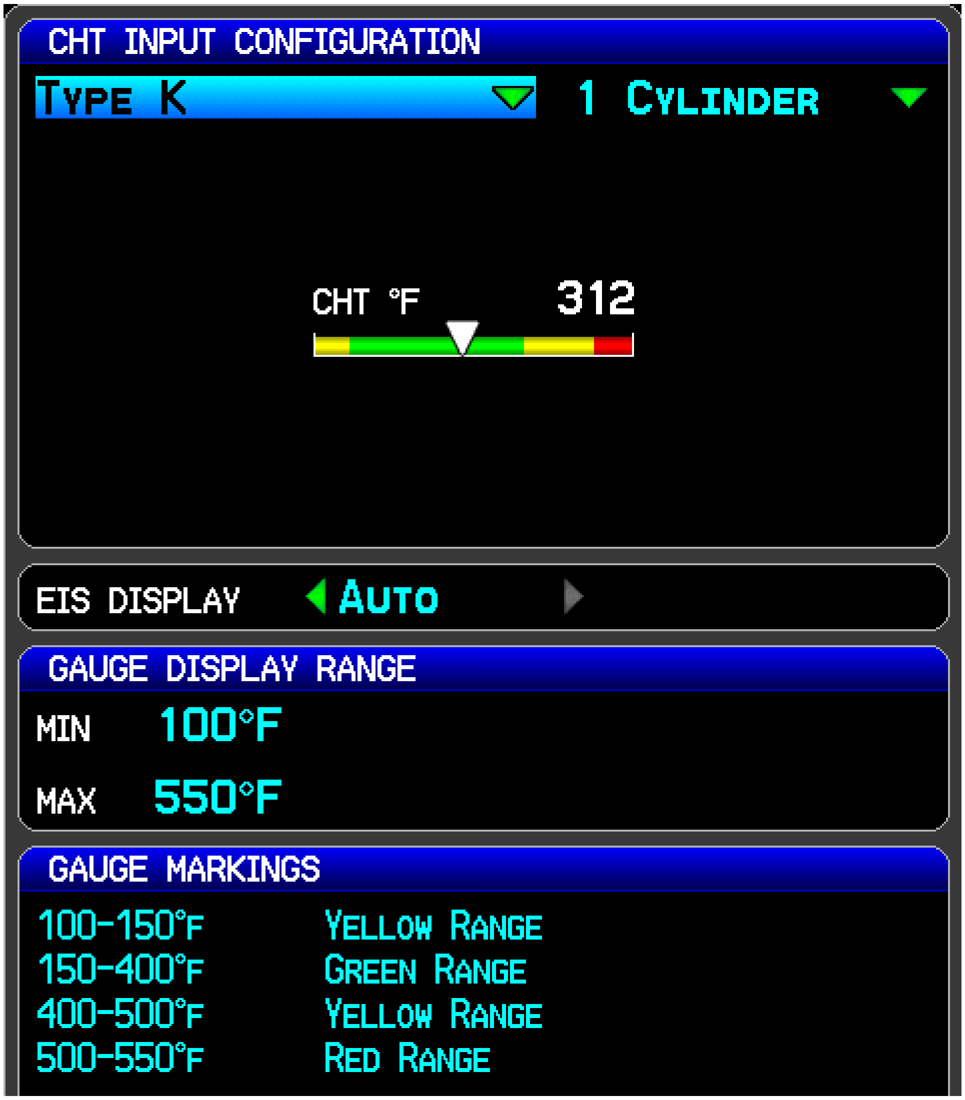
Gauge Markings – Used to select the desired color displayed on the applicable gauge. The Yellow Range + Alert and Red Range + Alert settings will issue a CAS (Crew Alerting System) on-screen alert anytime the value is within that range. The Red Range + Alert settings will issue a CAS audible and on-screen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



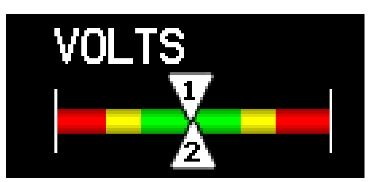
Gauge Display Range – The Gauge Display Range allows for setting the minimum and maximum values of each gauge.

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.

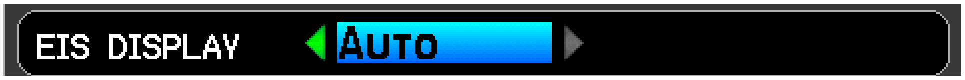


Dual Gauge

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	Oil Temperature	Oil Pressure	Fuel Quantity

18.3.2 Engine/Airframe Input Configuration Items

This section briefly describes how to configure the engine/airframe inputs for each supported sensor type, using the Engine Configuration page. Where applicable, differences between the GEA 24 and GSU 73 are noted. Refer to appendices C through H for wiring guidance.

18.3.2.1 CHT (Cylinder Head Temperature)

Thermocouples: Up to six thermocouples can be connected to the CHT thermocouple inputs on the GEA 24 or GSU 73. Both J-type and K-type thermocouples are supported. Select 1, 2, 4, or 6 cylinders of CHT thermocouple monitoring.

Rotax CHT sensors: Rotax CHT sensor part numbers 965531 and 966385 are supported. For the GEA 24, Rotax CHT sensors are configured using the same CHT input page but are connected to different GEA 24 input pins (Appendix G.1). For the GSU 73, Rotax CHT sensors are connected and configured using the GSU 73 general purpose (GP) inputs (Appendix G.2).

18.3.2.2 Exhaust Gas Temperature (EGT)

Thermocouples: Up to six Type-K thermocouples can be connected to the EGT thermocouple inputs on the GEA 24 or GSU 73. Select 1, 2, 4, or 6 cylinders of EGT thermocouple monitoring. If Lean Assist using EGT is desired, change the Lean Assist setting to "Enabled". (see Section 18.3.2.20 for more information).

Rotax 912iS: For the GEA 24, select "Rotax FADEC" as the EGT configuration to use EGT data from the Rotax 912iS FADEC interface.

NOTE

The EGT 6/MISC PRESS input on the GSU 73 has multiple functions. If the GSU 73 EGT 6/MISC PRESS input has been configured for a sensor that is not an EGT thermocouple, only four EGT thermocouples can be configured.

18.3.2.3 Turbine Inlet Temperature (TIT)

One or two Type K thermocouples can be connected for turbine inlet temperature monitoring, using the TIT 1 and TIT 2 inputs on the GEA 24 or GSU 73. If Lean Assist using TIT is desired, change the Lean Assist setting to "Enabled". (see Section 18.3.2.20 for more information).

18.3.2.4 RPM

The following sensors can be configured for the RPM 1 input on the GEA 24, or the RPM input on the GSU 73:

- UMA 1A3C Mechanical RPM Sender
- UMA T1A9 Magneto Port RPM Sender (4- or 6-cylinder)
- Electronic Ignition Tachometer Signal (1, 2, 3, or 4 pulses per revolution - Lycoming and Continental electronic ignitions typically output 2 pulses/revolution for 4-cylinder engines and 3 pulses/revolution for 6-cylinder engines)
- Rotax Trigger Coil RPM
- Jabiru Alternator RPM (6 pulses per revolution)

Rotax 912iS: For the GEA 24, select "Rotax FADEC" as the RPM configuration to use engine speed data from the Rotax 912iS FADEC interface.

NOTE

External components are required when using the Rotax Trigger Coil configuration with the GSU 73 (see Figure G-3.1).

18.3.2.5 RPM 2

A second RPM input is provided (RPM 2 input on the GEA 24, CAP FUEL 1 / RPM 2 on the GSU 73). If both RPM inputs are configured, the highest of the two valid RPM values will be displayed. This configuration is useful for aircraft equipped with dual electronic ignitions, where the tach signal ceases to function during a pre-takeoff ignition check.

18.3.2.6 Manifold Pressure

The following sensors can be configured for the Manifold Pressure input on the GEA 24 or GSU 73:

- Kavlico P4055-30A
- Kavlico P500-30A
- UMA N1EU70A

Rotax 912iS: For the GEA 24, select "Rotax FADEC" for the manifold pressure configuration to use manifold pressure data from the Rotax 912iS FADEC interface.

18.3.2.7 Oil Pressure

The following sensors can be configured for the Oil Pressure input on the GEA 24 or GSU 73:

- Kavlico P4055-150G
- UMA N1EU150G

Rotax/Jabiru oil pressure sensors: Rotax oil pressure sensor part numbers 956413 and 956415, and Jabiru / VDO oil pressure sensor part number 360-003 (or similar VDO 0-5 Bar pressure sensor) are supported. For the GEA 24, these sensors connect to the Oil Pressure Input and are configured using the same page. For the GSU 73, these sensors connect to a general purpose (GP) input.

Rotax 912iS: For the GEA 24, select "Rotax FADEC" to use oil pressure data from the Rotax 912iS FADEC interface.

NOTE

The Rotax 956413 oil pressure sensor requires an external resistor for proper functioning (see Figure G-2.2 for GEA 24 and Figure G-3.1 for GSU 73).

18.3.2.8 Oil Temperature

The following sensors can be configured for the Oil Temperature input on the GEA 24 or GSU 73:

- UMA 1B3-2.5R
- Rotax 965531
- Rotax 966385
- Jabiru / VDO 320-021 (or similar VDO 50-150°C thermistor sensor)

Rotax 912iS: For the GEA 24, select "Rotax FADEC" to use oil temperature data from the Rotax 912iS FADEC interface.

18.3.2.9 Fuel Pressure

The following sensors can be configured for the Fuel Pressure input on the GEA 24 or GSU 73:

- Kavlico P4055-15G (0-15 PSI, for most carbureted engines)
- Kavlico P4055-50G (0-50 PSI, for most fuel-injected engines)
- UMA NAEU07D (0-7 PSI differential, for some turbocharged carbureted engines such as the Rotax 914)
- UMA N1EU35G (0-35 PSI, for most carbureted engines)
- UMA N1EU705G (0-70 PSI, for most fuel-injected engines)

18.3.2.10 Carburetor Temperature

The following sensors can be configured to monitor carburetor temperature on the GEA 24 or GSU 73 MISC TEMP 1 inputs, or the GEA 24 MISC TEMP 2 input:

- UMA 1B10R
- Rotax 965531
- Rotax 966385

18.3.2.11 Coolant Pressure

The Kavlico P4055-50G sensor can be configured to monitor engine coolant pressure on the GEA 24 or GSU 73 MISC PRESS input.

18.3.2.12 Coolant Temperature

The following sensors can be configured to monitor engine coolant temperature on the GEA 24 or GSU 73 MISC TEMP 1 inputs, or the GEA 24 MISC TEMP 2 input:

- UMA 1B10R (or any Pt100-type RTD sensor)
- Rotax 965531 (or any similar VDO 50-150°C thermistor sensor)
- Rotax 966385

Rotax 912iS: For the GEA 24, select "Rotax Coolant Temp (FADEC)" for the MISC TEMP 1 input to use coolant temperature data from the Rotax 912iS FADEC interface.

18.3.2.13 Miscellaneous Temperature

The following sensors can be configured to monitor a single miscellaneous (AUX) temperature using the GEA 24 or GSU 73 MISC TEMP 1 inputs, or the GEA 24 MISC TEMP 2 input:

- Thermistor (any 50-150°C thermistor such as the Rotax 965531 or the VDO 320-xxx series)
- UMA 1BxR-C (or any Pt100-type RTD sensor)

18.3.2.14 Fuel Quantity

The GEA 24 and GSU 73 support fuel quantity inputs from both analog (resistance or voltage) and digital (frequency) sensors. "Float" type resistive fuel quantity sensors are analog devices. Capacitive fuel quantity sensors may be analog or digital devices, depending on whether they output a voltage (analog) or a frequency (digital).

The GEA 24 supports four fuel quantity inputs (FUEL 1 through 4), any of which can be used with an analog or digital fuel quantity sensor.

The GSU 73 supports four analog fuel quantity inputs (FUEL 1 through 4) and two digital fuel quantity inputs (CAP FUEL 1 and 2). Of these inputs, up four can be configured at any one time.

For both the GEA 24 and GSU 73, up to four fuel quantity measurements may be configured, using one item 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

Analog and digital fuel quantity inputs may be configured interchangeably for the above listed Groups 1-4. The "Fuel Quantity" and "Main Fuel" configurations are functionally the same, only the displayed text differs.

NOTE

The GSU 73 FUEL 3 and 4 analog inputs require an external pull-up resistor when used with a resistive analog fuel quantity sensor (see Figure E-3.1).

The analog and digital fuel quantity inputs require calibration (see Section 18.3.3).

NOTE

Note: After performing fuel quantity calibration, it is advised to back up the calibration data to an SD card (see Section 18.3.3). Changing the configuration for a fuel quantity input may reset calibration data.

18.3.2.15 Position

The GEA 24 and GSU 73 each have multiple POS inputs. Each POS input can be used with a resistive (potentiometer) sensor to monitor the following position measurements:

- Elevator Trim
- Aileron Trim
- Rudder Trim
- Flap Position

These inputs require calibration (see section Section 18.3.3).

Vertical Power: When using a Vertical Power unit, trim and flap positions will automatically be displayed. Connecting, configuring, and calibrating the POS inputs is not required when the position sensors are connected to a Vertical Power unit.

18.3.2.16 Voltage

The GEA 24 and GSU 73 have provisions to monitor bus voltage from two different sources. Bus voltage can be connected to the physical input pins, measured internally by the LRU, or communicated from another data source.

Voltage inputs: The VOLTS 1 and VOLTS 2 input pins on the GEA 24 and GSU 73 can be configured to monitor a directly connected bus voltage. VOLTS 1 can be configured either as "Bus 1" or "Main Bus", and VOLTS 2 can be configured either as "Bus 2" or "Aux Bus". The only difference is the text labels used to display the voltage gauges in the EIS display and Engine Page.

EIS power input: Instead of monitoring a voltage on a physical input pin, the GEA 24 and GSU 73 can monitor the voltage applied to their AIRCRAFT POWER pins. Configure the VOLTS 1 input to "EIS Power Input 1 Volts" to monitor AIRCRAFT POWER 1, and configure the VOLTS 2 input to "EIS Power Input 2 Volts" to monitor AIRCRAFT POWER 2.

Vertical Power: When using a Vertical Power unit, configure VOLTS 1 to "Vertical Power Main Batt Volts" or "Vertical Power Bus 1 Volts" to use primary battery/bus voltage data from the Vertical Power unit. Configure VOLTS 2 to "Vertical Power Aux Batt Volts" or "Vertical Power Bus 2 Volts" to use secondary battery/bus voltage data from the Vertical Power unit.

Rotax 912iS: For the GEA 24, configure the VOLTS 1 input to "Rotax FADEC ECU Bus A Volts" to use power supply voltage data from Lane A of the Rotax 912iS ECU. Configure the VOLTS 2 input to "Rotax FADEC ECU Bus B Volts" to power supply voltage data from ECU Lane B.

18.3.2.17 Current

The GEA 24 and GSU 73 have provisions to monitor bus current from two different sources. Current can be measured either using a shunt resistor such as the UMA 1C4 (50mV/100A type) or a Hall effect sensor such as the Amploc KEY100 series.

Shunt sensors: Shunt sensors are connected to the SHUNT 1 and SHUNT 2 inputs on the GEA 24 and GSU 73 (see Figure E-2.2 and Figure E-3.2). The SHUNT 1 input can be configured to display either "Bus 1 Amps" or "Main Bus Amps". The SHUNT 2 input can be configured to display either "Bus 2 Amps" or "Essential Bus Amps".

Hall effect sensors: Hall effect current sensors are connected to the GEA 24 or GSU 73 general purpose (GP) inputs (see Figure E-2.2 and Figure E-3.2). Hall effect sensors can optionally be calibrated to adjust for installation differences (see Section 18.3.3). The supported configurations for Hall effect current sensors on GP inputs are similar to those supported for shunt current sensors:

- Bus 1 Amps (Hall)
- Bus 2 Amps (Hall)
- Main Bus Amps (Hall)
- Essential Bus Amps (Hall)

Vertical Power: When using a Vertical Power unit, configure SHUNT 1 to "Vertical Power Main Bus Amps" or "Vertical Power Bus 1 Amps" to use primary bus current data from the Vertical Power unit. Configure Shunt 2 to "Vertical Power Bus 2 Amps" to use secondary bus current data from the Vertical Power unit.

18.3.2.18 Fuel Flow

The following sensors can be configured for the Fuel Flow input on the GEA 24 or GSU 73:

- Electronics International FT-60
- Floscan 201B-6

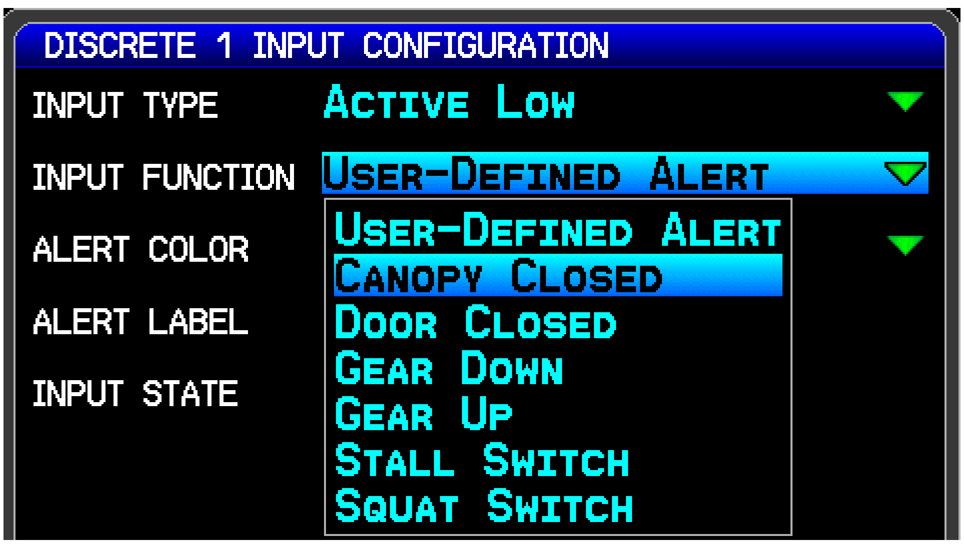
The fuel flow input requires calibration (see Section 18.3.3).

Rotax 912iS: For the GEA 24, configure the FUEL FLOW input to "Rotax FADEC" to use fuel flow data from the Rotax 912 FADEC interface.

The GEA 24 and GSU 73 also have provisions for a second fuel flow input (FUEL FLOW 2) to use in aircraft that require a second fuel flow sensor for differential fuel flow measurement. If both fuel flow inputs are configured, the displayed fuel flow will be FUEL FLOW 1 (feed) minus FUEL FLOW 2 (return).

18.3.2.19 Discrete Inputs

The GEA 24 and GSU 73 support up to four discrete inputs (DISCRETE 1 through 4) which can be connected to a variety of external switches or voltage signals and used to generate system alerts or control other system functions. For instance, a discrete input could be configured to generate an audible alert and a CAS (Crew Alerting System) message on the PFD display when an external switch is closed.



To configure a discrete input, first select whether the input should be Active Low or Active High. An Active High input will be considered active when the input voltage is above an upper threshold, and inactive when the input voltage is below a lower threshold. An Active Low input will be considered active when the input voltage is below a certain threshold, and inactive when the input voltage is above a certain threshold, or if the input is floating (not connected). In general, most switch-type inputs that are either open or connected to ground should be configured as Active Low. See Section 15.3.8 and Section 15.8.5.1 for the specific voltage levels used for discrete input sensing on the GEA 24 and GSU 73.

After a discrete input is configured for either Active Low or Active High, it is assigned to a specific function. The following discrete input functions are supported:

- 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.
- AFCS TO/GA - Used in conjunction with the automatic flight control system (AFCS) flight director to activate Takeoff or Go-Around mode. This input should be connected to a momentary pushbutton located near the pilot's throttle control.
- User-Defined Alert - Used to display a custom alert on the PFD when the discrete input is active. Both the message text and the message color can be entered. A yellow alert will generate an audible caution tone, and a red alert will generate an audible warning tone.

18.3.2.20 Lean Assist

Lean Assist is a feature that monitors and detects peak temperatures for EGT or TIT as the pilot leans the engine's air/fuel mixture. When configuring EGT or TIT inputs, Lean Assist can be enabled or disabled. If Lean Assist is enabled, the LEAN softkey will appear on the ENG page in normal mode. Lean Assist should be disabled for engines that do not have pilot-controllable air/fuel mixture.

18.3.2.21 Annunciator Outputs

The GEA 24 and GSU 73 have two discrete output pins, which can be used to drive external indicator lamps. These outputs are optional and do not require any configuration.

DISCRETE OUT 1 acts as a Master Warning annunciator, and is active (pulled low) any time a warning-level (red) alert is displayed on the PFD.

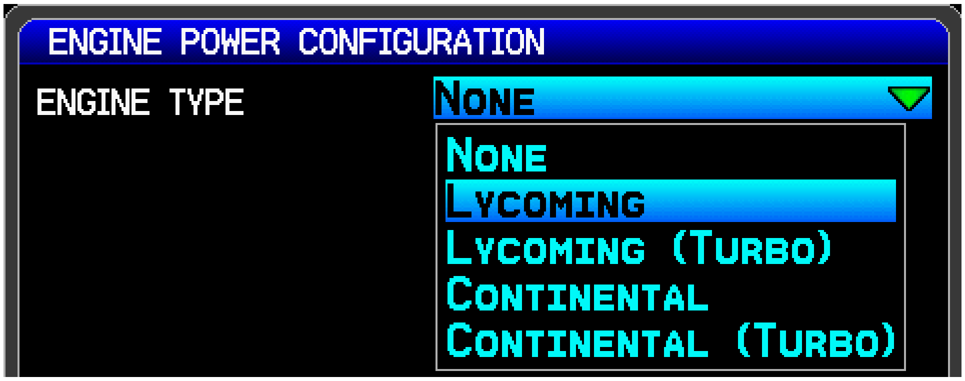
DISCRETE OUT 2 acts as a Master Caution annunciator, and is active (pulled low) any time a caution-level (yellow) alert is displayed on the PFD.

See Figure E-2.2 and Figure E-3.2 for guidance on wiring indicator lamps to the annunciator output pins.

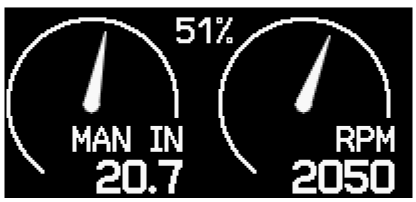
18.3.2.22 Engine Power

Estimated engine power can be calculated for Lycoming and Continental engines, using inputs from RPM, manifold pressure, and fuel flow sensors (all three all required for engine power calculation).

On the Engine Power Configuration page, select the appropriate engine type (Lycoming or Continental, turbocharged or normally-aspirated). Then enter the engine's maximum rated power and RPM (for example, 180 horsepower at 2750 RPM). For a turbocharged engine, enter the manifold pressure for maximum rated power. Configuring maximum manifold pressure is not required for a normally-aspirated engine, as it is assumed to produce maximum power at sea level pressure.



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



NOTE

The Engine Power item is disabled when a FADEC engine is configured. For FADEC configurations, engine power or other related status information from the FADEC data interface (for example, an Economy mode indication) will be displayed if available.

18.3.2.23 Engine Time

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 (below).

NOTE

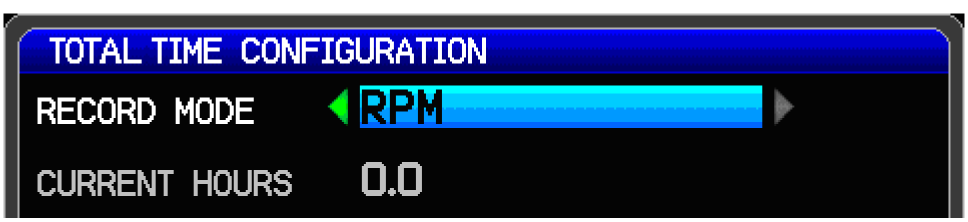
The Engine Time item is disabled when a FADEC engine is configured. For FADEC configurations engine hours from the FADEC data interface will be displayed.

18.3.2.24 Total Time

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 (softkeys are numbered consecutively left-right, see Section 17.1), then using the FMS Joystick to highlight the Current Hours field. The Record Mode selections are listed in Table 18-1.

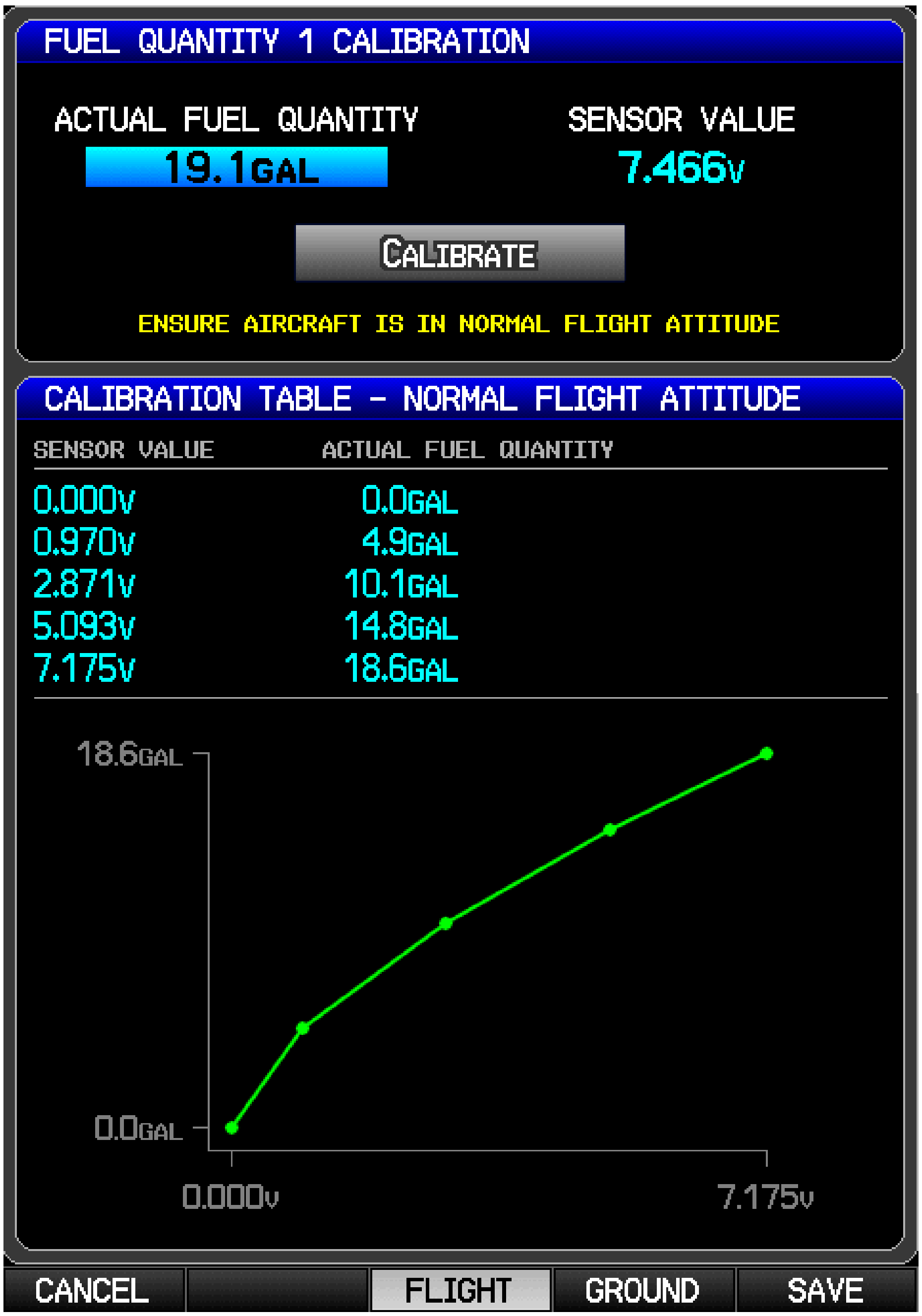
Table 18-1 Record Mode Selections

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



18.3.3 Input Configuration Items Requiring Calibration

Fuel Input 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.

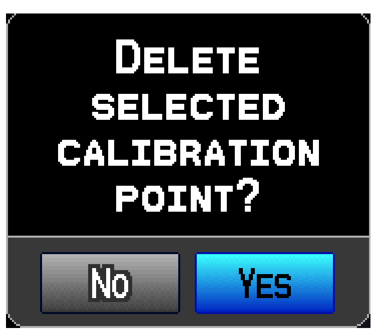
To perform the Fuel Quantity calibration:

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 Digital (frequency) 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.

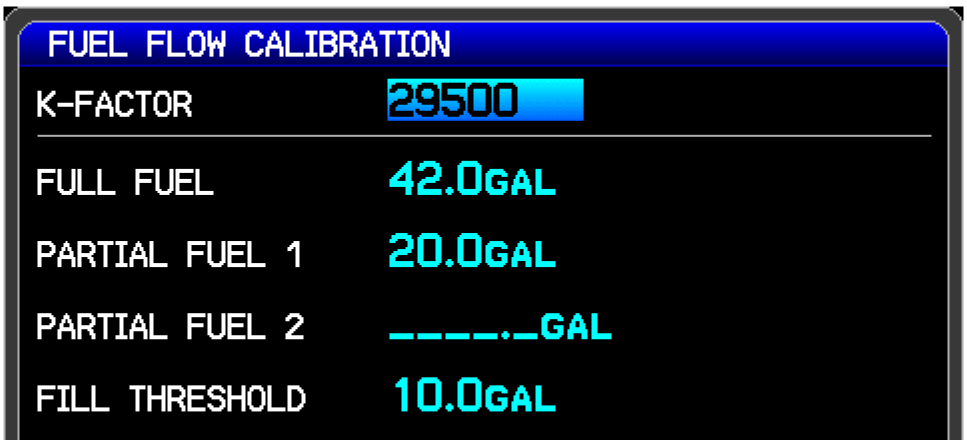


Fuel Quantity Calibration Data Backup – This option allows the user to back up fuel calibration data to an SD card placed in the SD card slot of the PFD. Access the Read/Write Calibration File menu by pressing the Menu key when displaying the Fuel Quantity Calibration Page

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 14.3.10.1).

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.

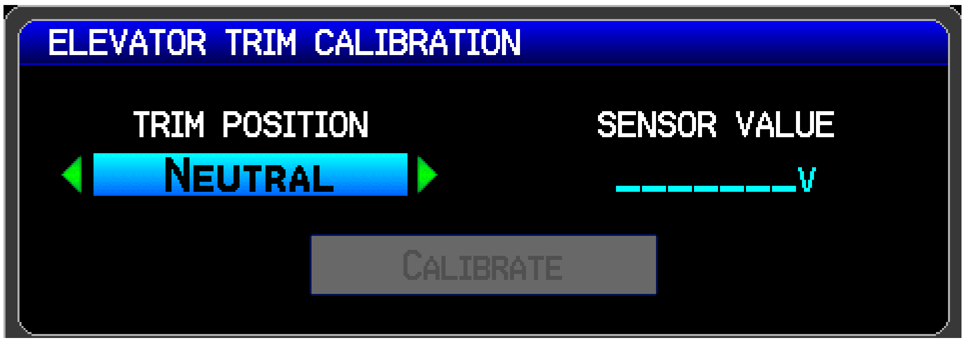
Corrected K-Factor = ([G3X reported fuel used] x [previous K-factor]) / [actual fuel used].

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.

Fill Threshold – This setting is used to determine if the fuel quantity should be confirmed upon system power up. During power up, the sytem compares the current fuel quantity to the fuel quantity recorded when the system was last shut down. If the current fuel quantity exceeds the previous fuel quantity by more than the fill threshold amount (10 gallons shown in previous figure) the system will assume that fuel has been added and will pop up a reminder page prompting the pilot to confirm the quantity of fuel on board.

Trim/Flap Position Input Calibration – The POS 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.

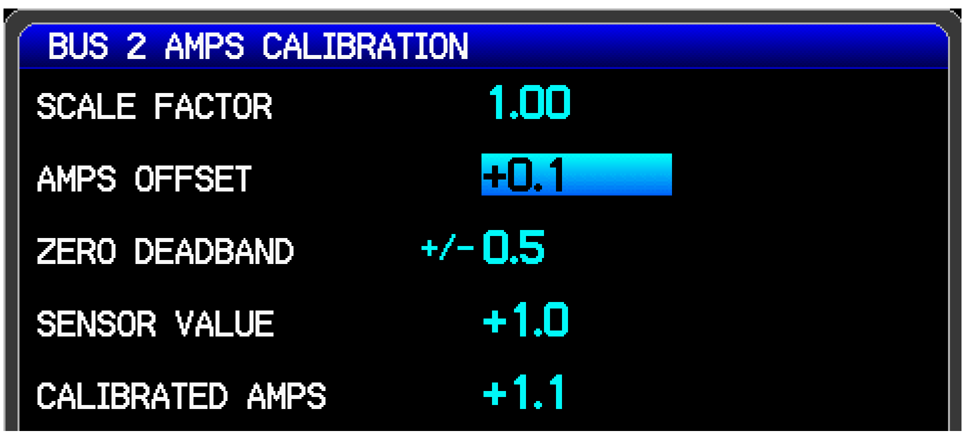
Scale Factor – For most installations, the scale factor will remain set to the default (1.00) value. A typical use for the scale factor is for a Hall Effect current sensor that has the current-carrying conductor looped through the sensor twice; in that case the scale factor should be set to 0.50 to give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



19 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 PFD 1 while powering on the unit.

The calibration procedures (Section 19.3.1 – Section 19.3.5) may require that certain status boxes on the GSU Page (configuration mode) indicate a positive state (green check marks) before starting the procedure.
Table 19-2 and Table 19-3 list the status box requirements for each calibration procedure.

NOTE
Some procedures in this section require that the GPS receiver is receiving sufficient satellite signal to compute a present position (Table 19-2). This requires outdoor line-of-site to GPS satellite signals or a GPS indoor repeater.

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.

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

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.

19.1 Recommended Test Equipment

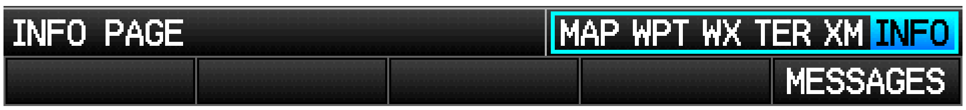
The following test equipment is recommended to conduct and complete all post installation checkout procedures in this section: (All test equipment should have current calibration records)

- 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-sight to GPS satellite signals or GPS indoor repeater
- Digital Level or equivalent

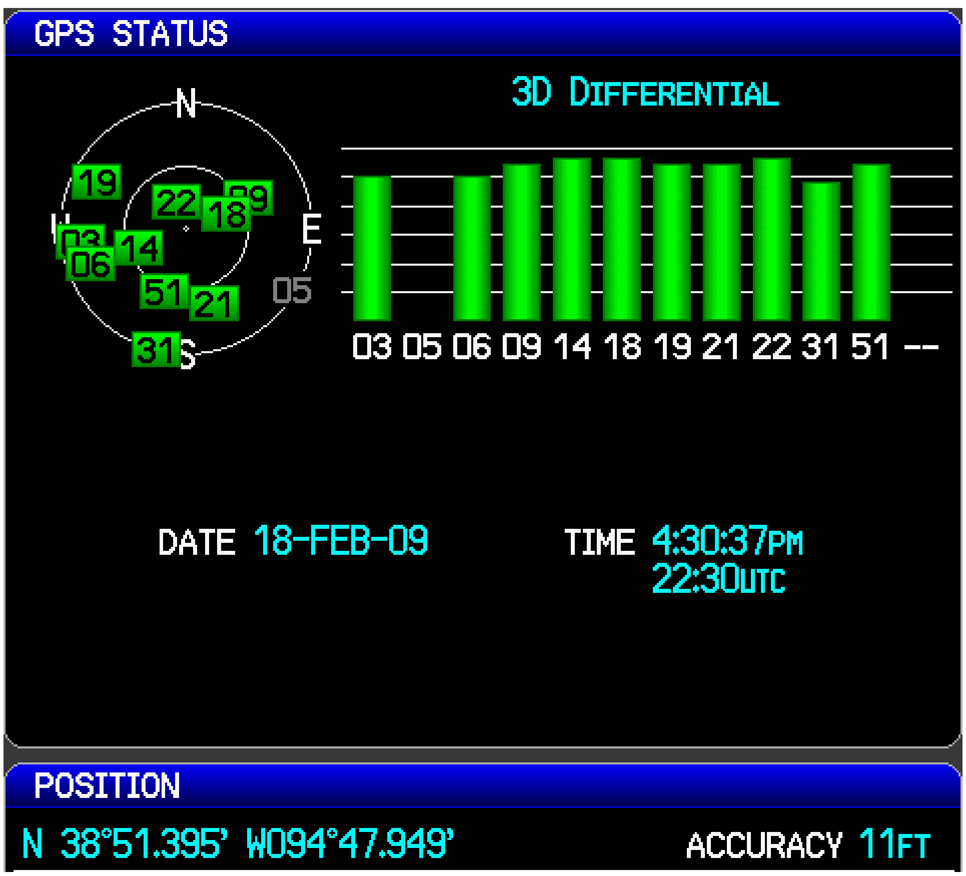
19.2 GDU 37X Test Procedure

Test the GPS Receiver:

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



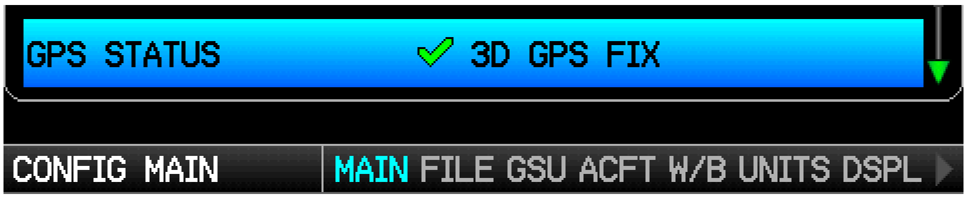
2. Verify that the GPS receiver is functional and able to calculate its present position.



Test the GPS Receiver for COM Interference:

This test must be conducted outside, as the use of a GPS repeater inside a hangar may result in a failed test. Once the signal acquisition test from Section 13.2 has been completed successfully, perform the following steps:

1. Power on the unit in configuration mode and use the FMS Joystick (scroll down) to view GPS Status on the Main Page.

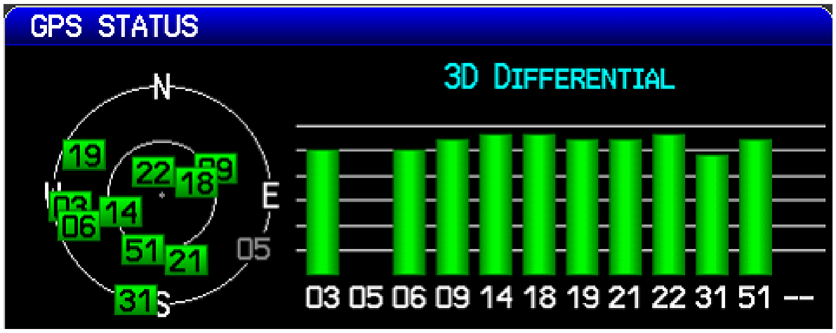


2. Monitor GPS status on the Main Page. Possible GPS status indications include:
   - NO ANTENNA
   - AUTOLOCATE
   - LOST GPS FIX
   - 2D GPS FIX
   - 3D GPS FIX*
   - SEARCHING THE SKY
   - ACQUIRING
   - NO GPS FIX
   - 2D DIFFERENTIAL FIX
   - 3D DIFFERENTIAL FIX*

   *Indicates valid GPS position fix for this test
3. Select 121.150 MHz on the COM transceiver.
4. Transmit for a period of 30 seconds while monitoring GPS status.
5. During the transmit period, verify that GPS status does not lose a valid GPS position fix on the Main Page in configuration mode.
6. Repeat steps 3 through 5 for the following frequencies:121.175 MHz, 121.200 MHz, 131.250 MHz, 131.275 MHz, and 131.300 MHz.
7. Repeat steps 3 through 6 for other installed COM transceivers (if applicable).
8. If an installed COM supports 8.33 MHz channel spacing, repeat steps 3 through 5 (while transmitting for a period of 35 seconds), for the following frequencies: 121.185 MHz, 121.190 MHz, 130.285 MHz, and 131.290 MHz .
9. Repeat step 8 for other installed COM transceivers supporting 8.33 MHz channel spacing (if applicable).
10. This COM interference test should be repeated for each installed GDU 37X with a connected antenna.

NOTE

GPS Status may also be monitored on the Info page in normal mode. The signal strength bars are a real-time representation of GPS signal strength, which may be useful for troubleshooting a failed COM interference test.



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 17.5 for XM Activation Instructions if needed.

19.3 GSU 25/GSU 73/GMU 22 Post-Installation Calibration Procedures

After mechanical and electrical installation of the GSU 25/GSU 73 AHRS and GMU 22 magnetometer have been completed, prior to operation, a set of post-installation calibration procedures must be carried out.

Table 19-1 describes the calibration procedures:

Table 19-1 Post-Installation Calibration Procedure Summary

Calibration Procedure	Procedure Name	Procedure Description	Installations Requiring Procedure
A	AHRS Orientation	Validate GSU 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 22	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 22 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 22 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 22. 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 22 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 22 unit, or degaussing of the area near the GMU 22 location.
E	Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Procedure E is required for all installations

For each Calibration Procedure, Table 19-2 lists the LRU's that require valid calibration data.

Table 19-2 Data Validity Requirements for AHRS Calibration Procedures

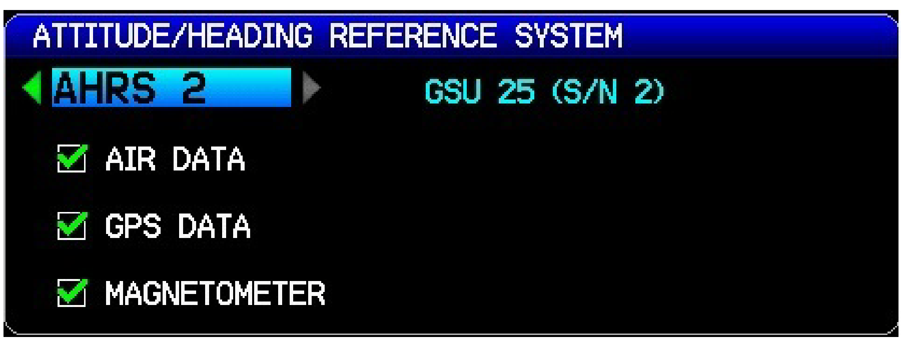
AHRS Calibration Procedure	Valid Status Required for GSU 25 Calibrations	Valid Status Required for GSU 73 Calibrations
AHRS Mounting Orientation Identification	None	None
Pitch/Roll Offset	None	GPS or Air Data
Magnetometer Calibration	GPS and Magnetometer	Air Data, GPS, and Magnetometer
Engine Run-Up	None	GPS or Air Data
Magnetometer Interference Test	Magnetometer	GPS or Air Data. Magnetometer always required.

Table 19-3 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table 19-2.

Table 19-3 Configuration Mode AHRS 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

The AHRS Configuration Page status boxes referred to in Table 19-2 and Table 19-3 are shown in the following figure.



If removal and replacement of a GMU 22 unit is required after post-installation calibration has been completed, the GMU 22 mounting rack must not be moved. If the mounting screws that secure the GSU 25/GSU 73 unit or the GMU 22 mounting rack are loosened for any reason, post-installation calibration procedure, A, B, D and E must be repeated before the aircraft can be returned to service.

Any GMU 22 removal or replacement requires repeating the magnetometer calibration.

A repeat of the pitch/roll offset procedure (Procedure B) requires a repeat of the magnetometer calibration procedure (Procedure D).

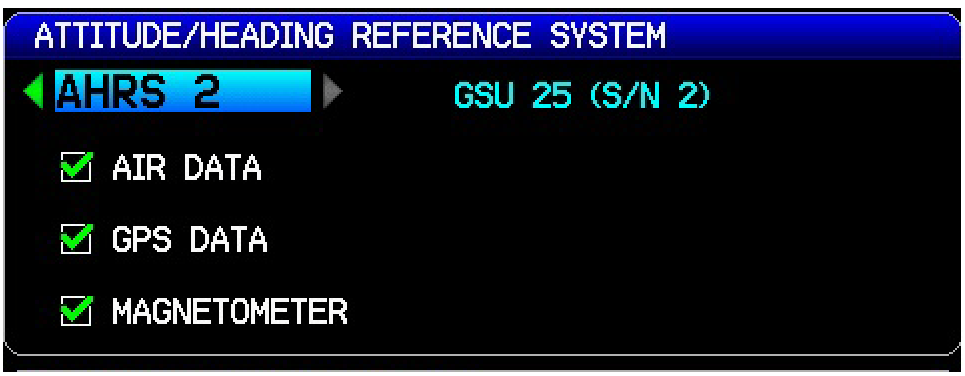
The addition, removal, or modification of components that are ferrous, or otherwise magnetic, within 10.0 feet of the GMU 22 magnetometer location after the magnetometer interference test or magnetometer calibration procedure were completed requires a repeat of both procedures.

Furthermore, electrical changes to the installation that affect components within 10.0 feet of the GMU 22 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 22 is a good example of such a change.

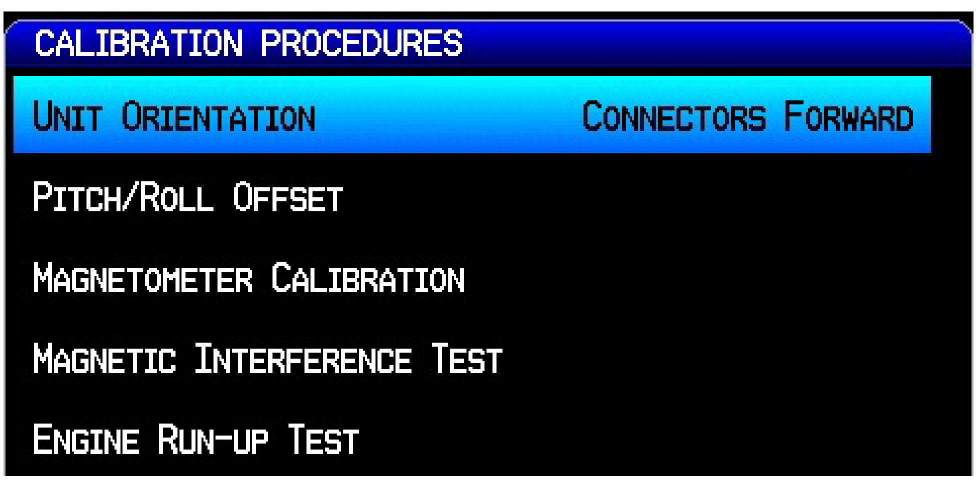
19.3.1 Calibration Procedure A: AHRS ORIENTATION

1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display.
2. Use the FMS Joystick to select the AHRS Page.

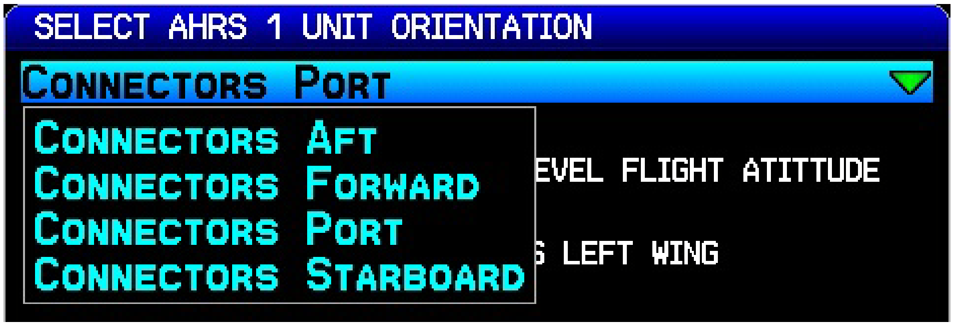
3. Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.



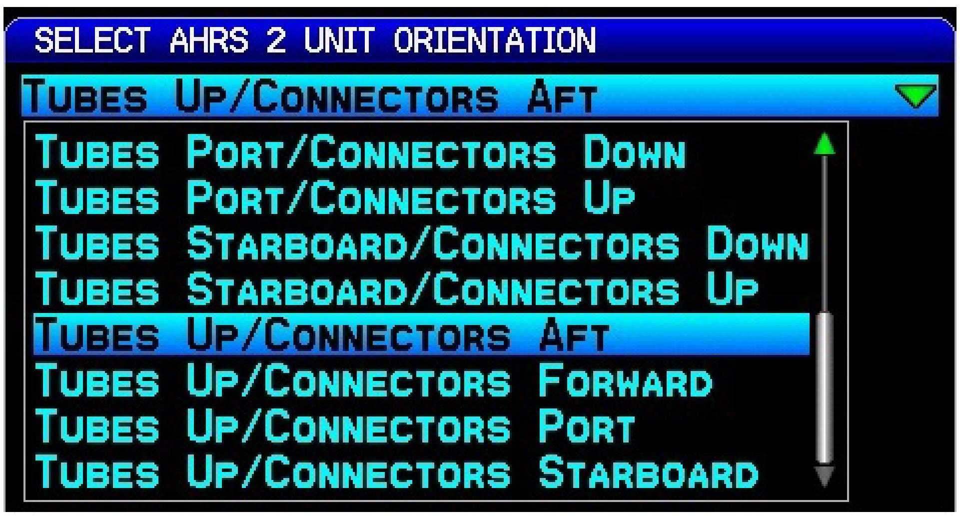
4. Use the FMS Joystick to select Unit Orientation and press the ENT key.



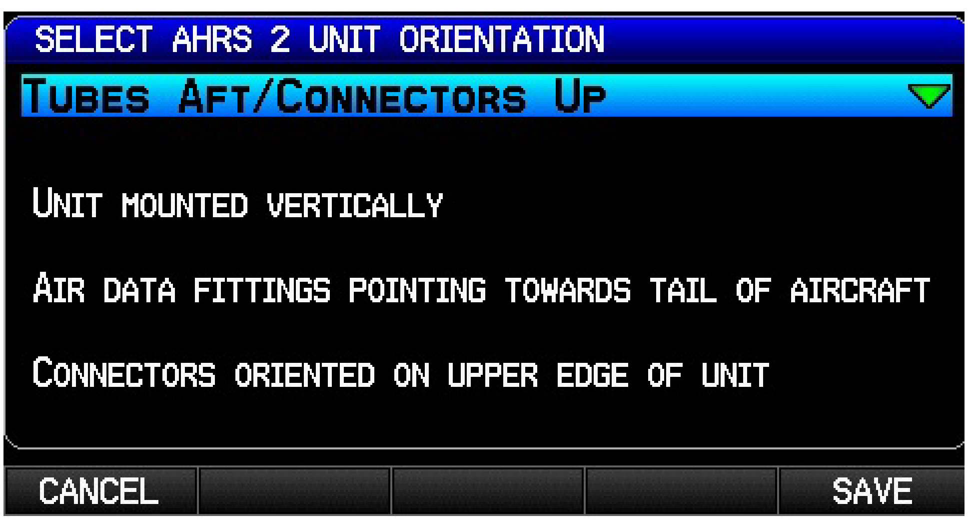
5. For a GSU 73, refer to Figure B-9.2 to determine the correct LRU orientation. Select the correct orientation from the pull-down list, then press the ENT key. For a GSU 25, proceed to the next step (6).



6. For a GSU 25, refer to Figure B-8.3 and Figure B-8.4 to determine the correct LRU orientation, then select that orientation from the pull-down list.



7. Read the description of the selected orientation to ensure the proper orientation has been selected, then press the Save softkey to store the orientation.



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

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.

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).

NOTE

The GSU 25 must be leveled within 30.0 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).

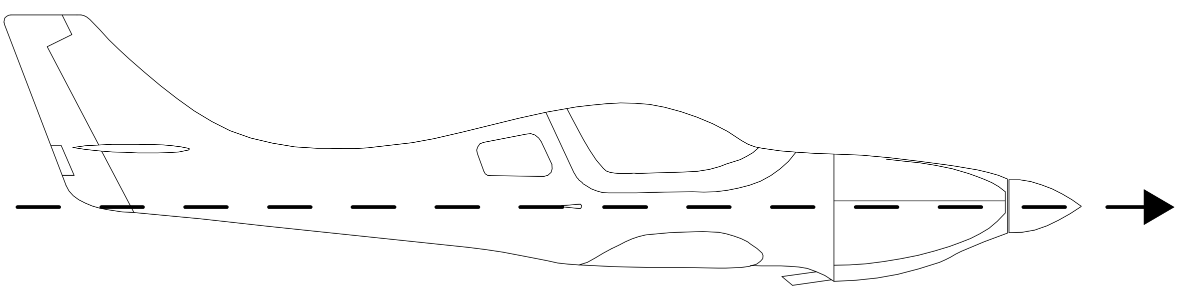
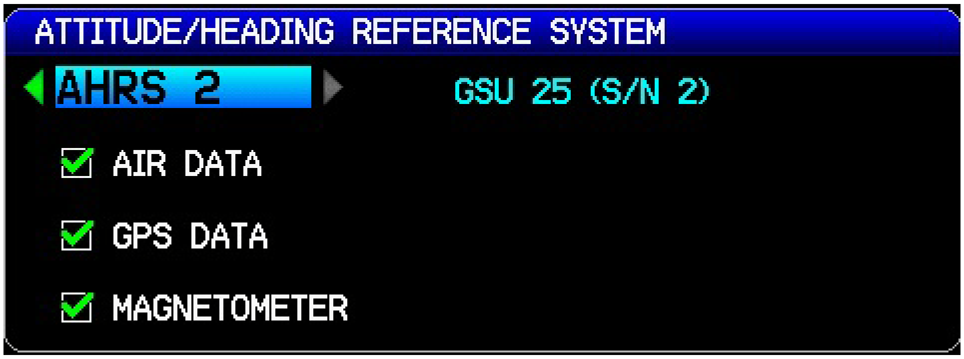


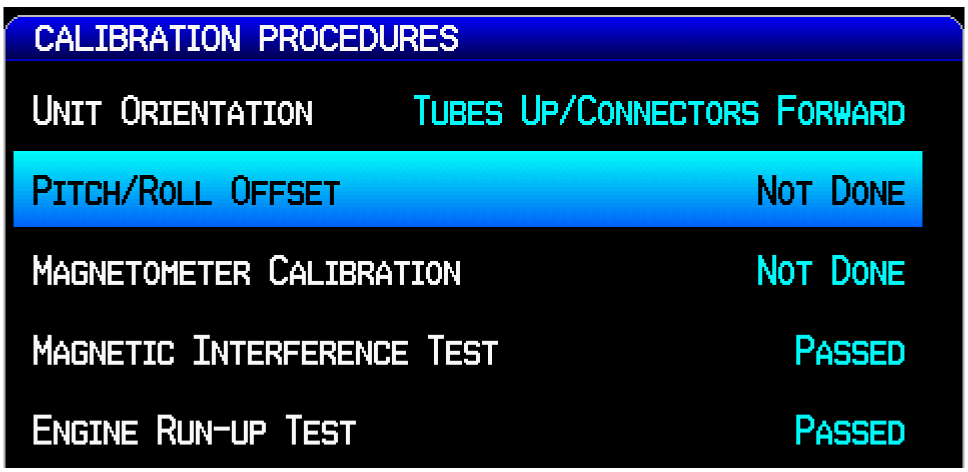
Figure 19-1 Flight Level Cruise Attitude

1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the AHRS Page (if needed).

3. Ensure that all the required status boxes are checked (Table 19-2 and Table 19-3). Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.



4. Use the FMS Joystick to select PITCH/ROLL OFFSET, press the ENT key.



5. Ensure that aircraft and AHRS comply with all on-screen instructions, press the START softkey.

NOTE

Per the following figure, GSU 73 units must have the AHRS pitch and roll within 3 degrees of level, GSU 25 units must have the AHRS pitch and roll within 30 degrees of level.

6. “Pitch/Roll Offset Calibration in Progress” appears on the display along with calibration information. The GSU 73 pitch/roll offset procedure completes in a few seconds. The GSU 25 pitch/roll offset procedure has a 30 second countdown timer that resets when the aircraft moves.

7. When the calibration has completed “Success” or “Failure” will be displayed, press the DONE softkey to return to the AHRS Configuration screen.

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

NOTE

The pilot may adjust the displayed pitch attitude in normal mode by using the PFD Setup page (see G3X Pilot’s Guide,190-01115-00). The maximum amount of pitch display adjustment available in Normal Mode is +/- 2.5°. This feature should not be used to compensate for a non-conforming GSU 25/GSU 73 installation that does not meet the requirements of Calibration Procedure Pitch/Roll Offset Compensation.

NOTE

If the installation has multiple AHRS and the pitch/roll offset procedure is performed for one AHRS, it should be performed on all other AHRS before moving the aircraft.

19.3.3 Calibration Procedure C: Magnetometer Interference Test

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 22 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 22 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU 22. 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 22 unit. This procedure validates that no electronic device is interfering with the operation of the GMU 22 magnetometer which directly impacts the determination of attitude and heading by the GSU 25/GSU 73 AHRS. Calibration Procedures A and B are not required prior to this execution of this procedure.

CAUTION

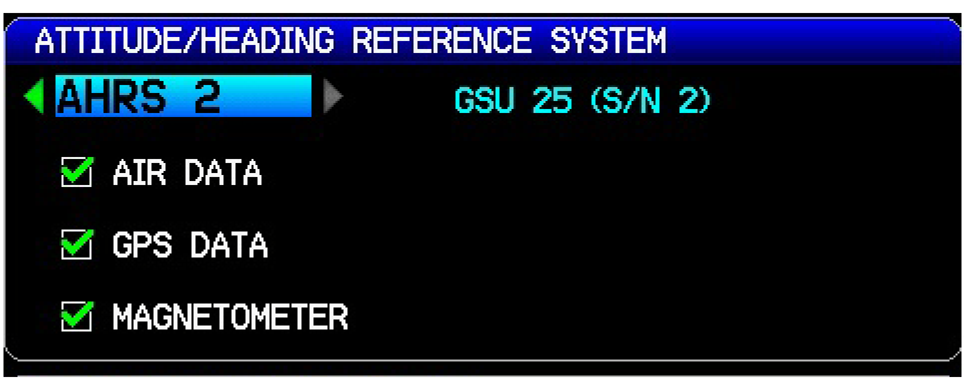
The real time readout displayed during the interference test is only valid for the location of the GMU when the test was initiated. If using this procedure to evaluate multiple mounting locations, the test must be started over for each location, failure to do so could provide incorrect test results.

NOTE

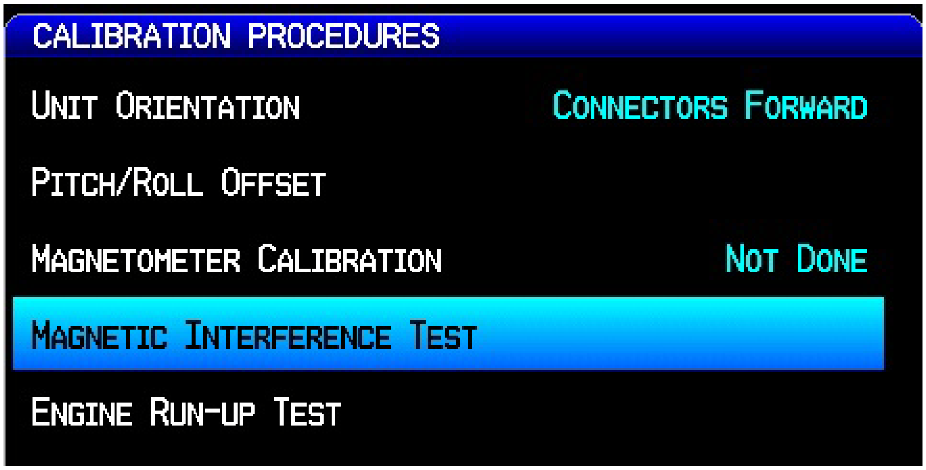
Garmin recommends this test be performed at least once every 12 months.

1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the AHRS Page (if needed).

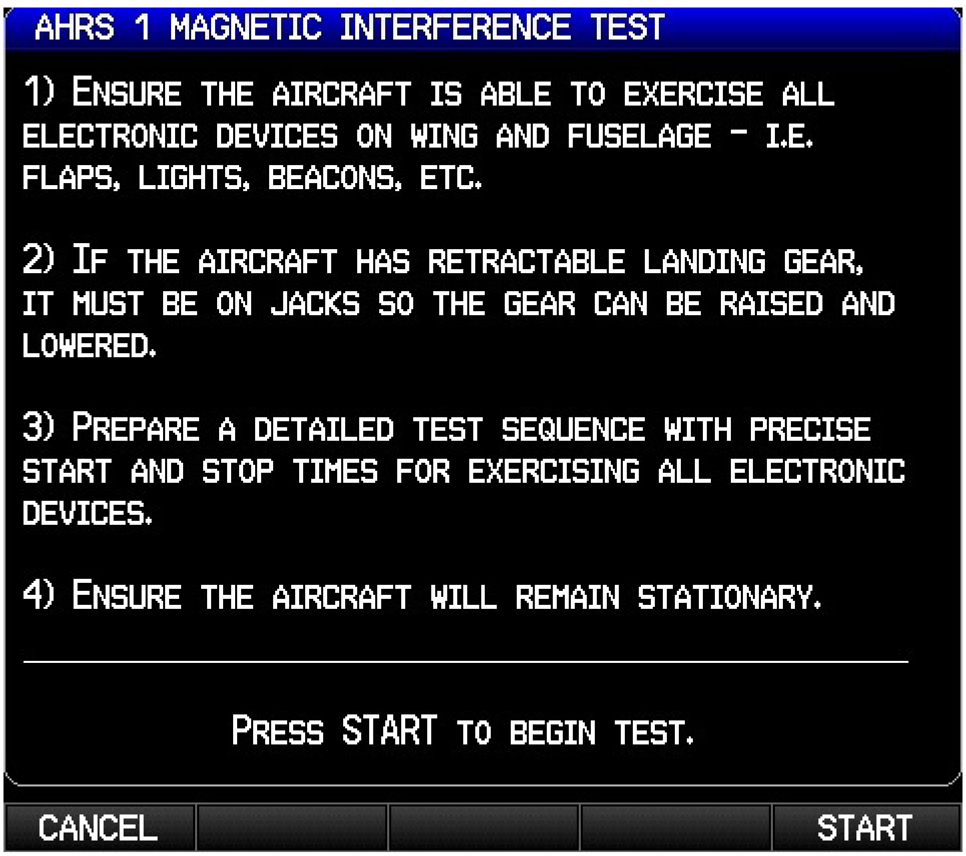
3. Ensure that all the required status boxes are checked (Table 19-2 and Table 19-3). Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.



4. Use the FMS Joystick to select Magnetic Interference Test and press the ENT key.



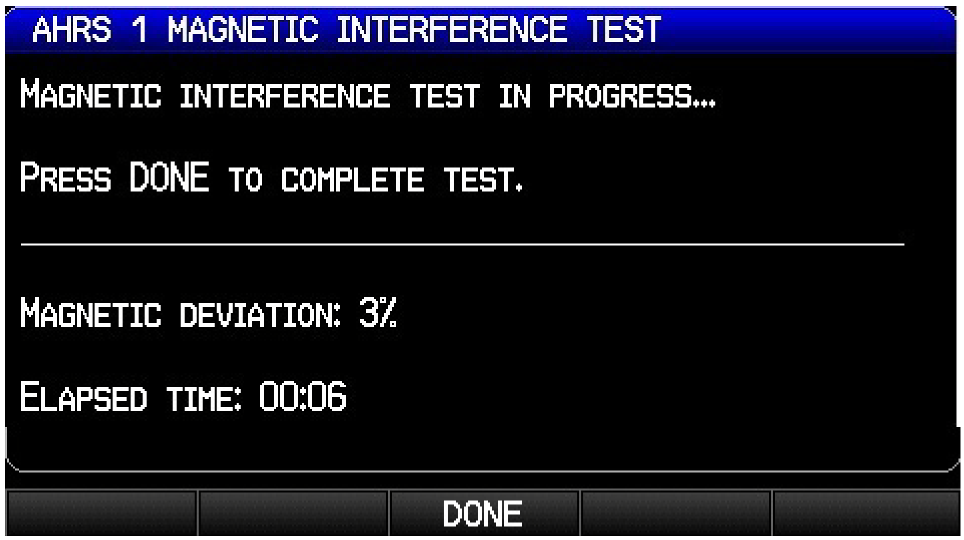
5. Ensure that the aircraft has been properly prepared per the on-screen instructions. See Table 19-4 for a sample test sequence. Press the Start softkey to begin the test.



6. 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.



7. After completing the prepared test sequence, press the Done softkey. Ensure that a PASSED message appears on the display. The magnetic deviation value is displayed to indicate the pass or fail margin of the test. Press the Done softkey to return to the AHRS Page.

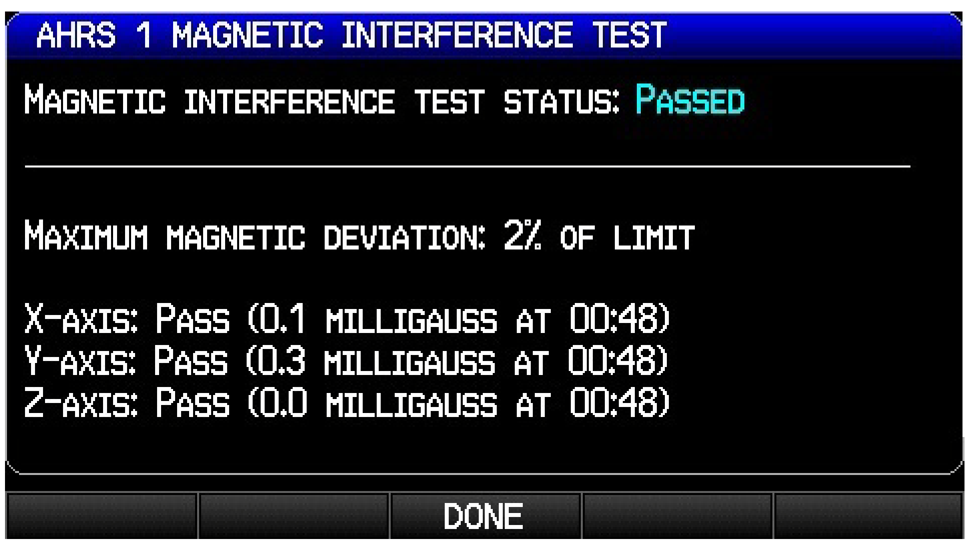


Table 19-4 Magnetometer Interference Test Sequence Example

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
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 100% of the total limit in any 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.

NOTE

Two common reasons for a failed magnetometer interference test are:
1) New equipment is installed in close proximity to the GMU 22 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.

19.3.4 Calibration Procedure D: Magnetometer Calibration

NOTE

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

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 19.5.

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 19-2.

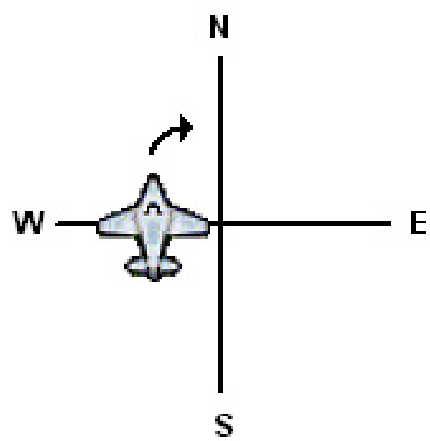
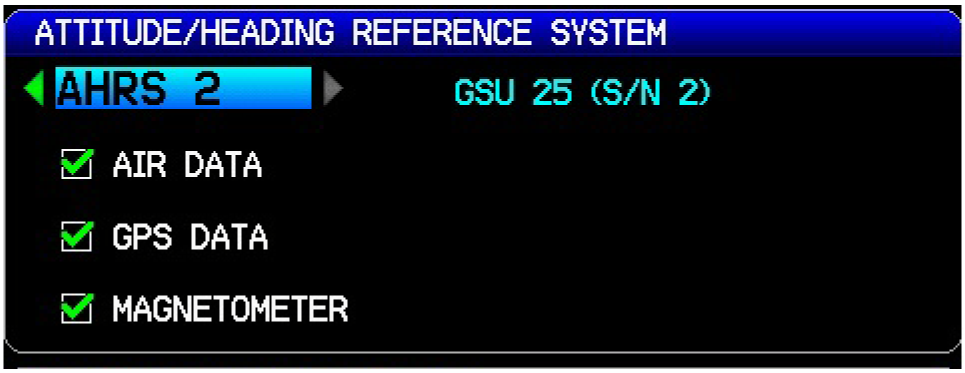


Figure 19-2 Aircraft Alignment

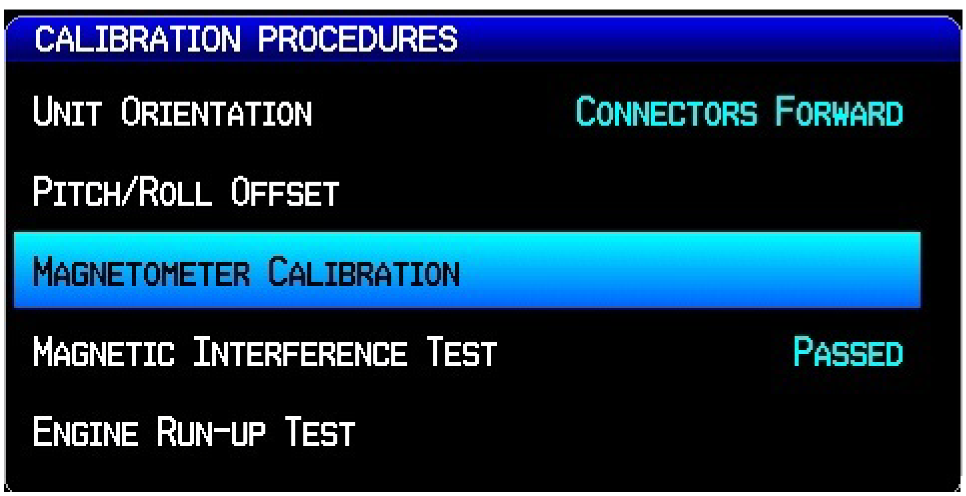
With the aircraft stationary, initiate the GSU 25/GSU 73 AHRS magnetometer calibration procedure as follows:

1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the AHRS Page (if needed).

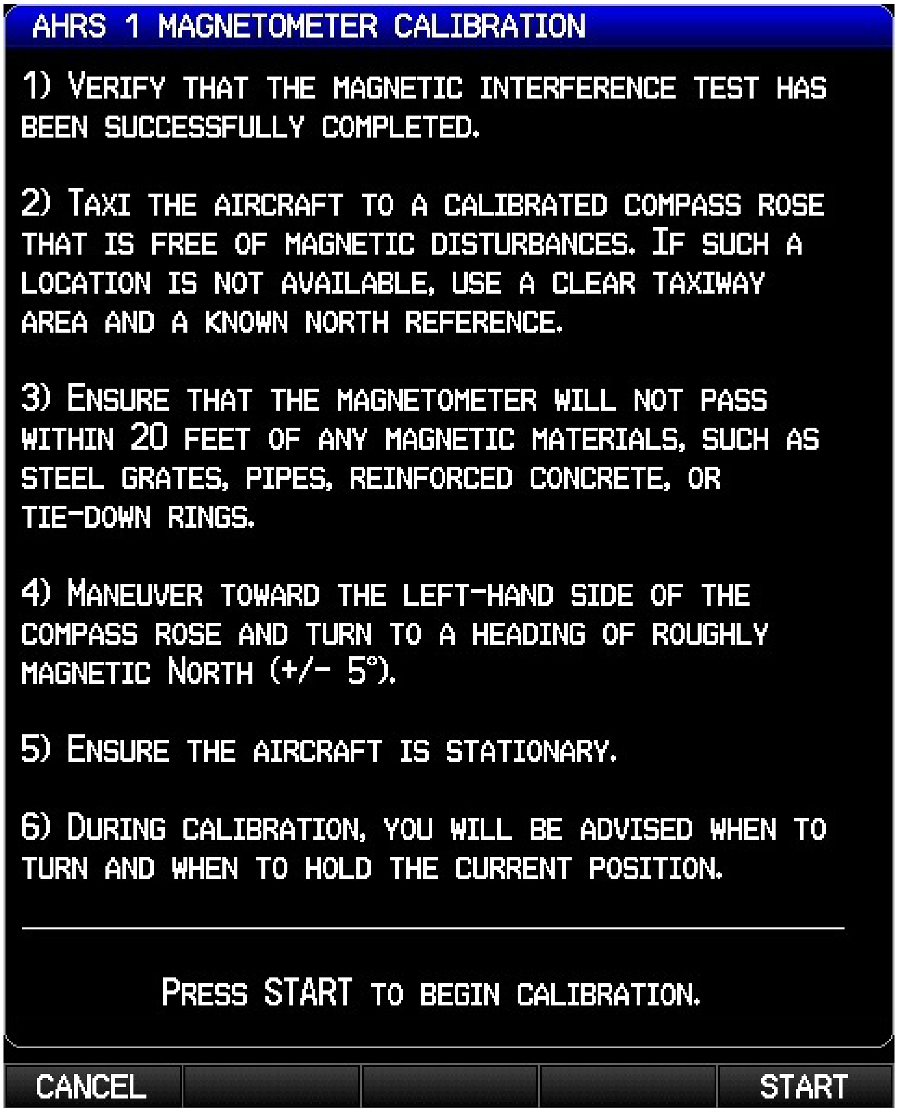
3. Ensure that all the required status boxes are checked (Table 19-2 and Table 19-3). Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.



4. On the AHRS page, use the FMS Joystick to select Magnetometer Calibration and press the ENT key.



5. Ensure that all on-screen instructions have been complied with, then press the Start softkey to begin the calibration.



6. Follow the on-screen instructions, the dots at the end of the text will be removed as the test progresses.

7. Follow the on-screen instructions by slowly turning the aircraft to the right, the dots at the end of the text will be removed as the aircraft rotates 30 degrees. When all of the dots have been removed, and the text changes to ‘Hold Position’, stop turning the aircraft, and wait for further instructions.

8. Continue following the on-screen instructions until the calibration is completed. The calibration will go through 12 cycles of holding, then turning to the right before completing a full circle.
9. When the calibration is finished, ensure that a Calibration Status of “Success” is displayed, press the Done softkey to return to the AHRS Configuration Page.

NOTE

If more than one magnetometer is installed, it is recommended to perform the Magnetic Calibration Procedure for both magnetometers consecutively, one procedure immediately followed by the next. This is especially important if something about the airplane has been changed that required a repeat of the Magnetic Calibration Procedure.

19.3.5 Calibration Procedure E: Engine Run-Up Vibration Test

NOTE

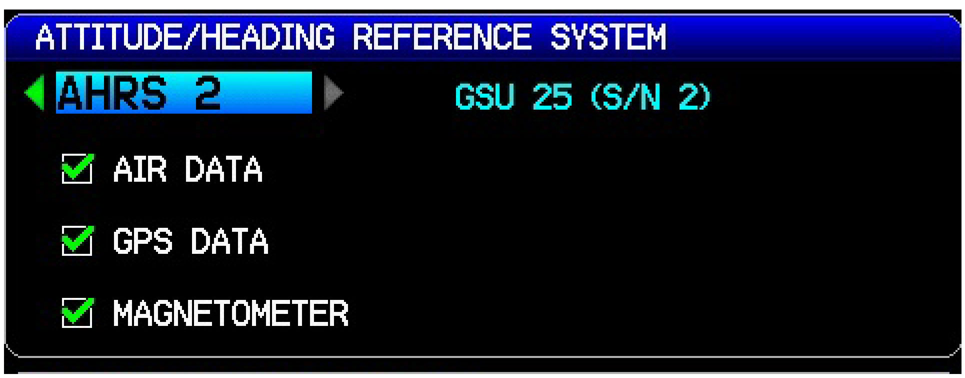
Calibration Procedure E is required for all installations to validate the vibration characteristics of the installation. Calibration Procedures B through D are not required prior to this procedure.

NOTE

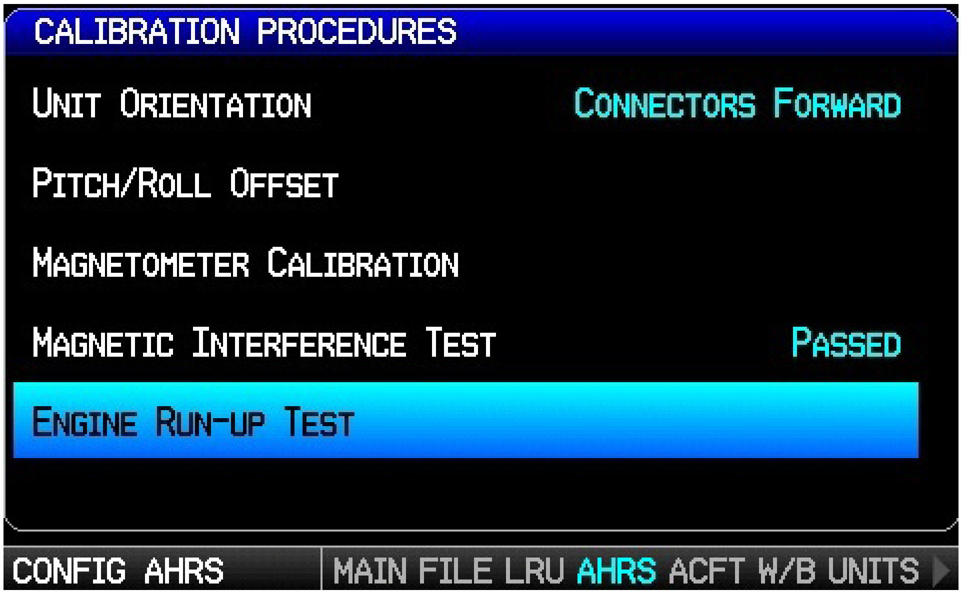
Passing the Engine Run-Up Vibration test does not remove the requirement to rigidly mount the GSU 25/GSU 73 to the aircraft primary structure. The Engine Run-Up Vibration Test is intended to help discover mounting issues but successful completion of the test does not validate the mounting of the GSU 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 PFD 1 display (if needed).
2. Use the FMS Joystick to select the AHRS Page (if needed).

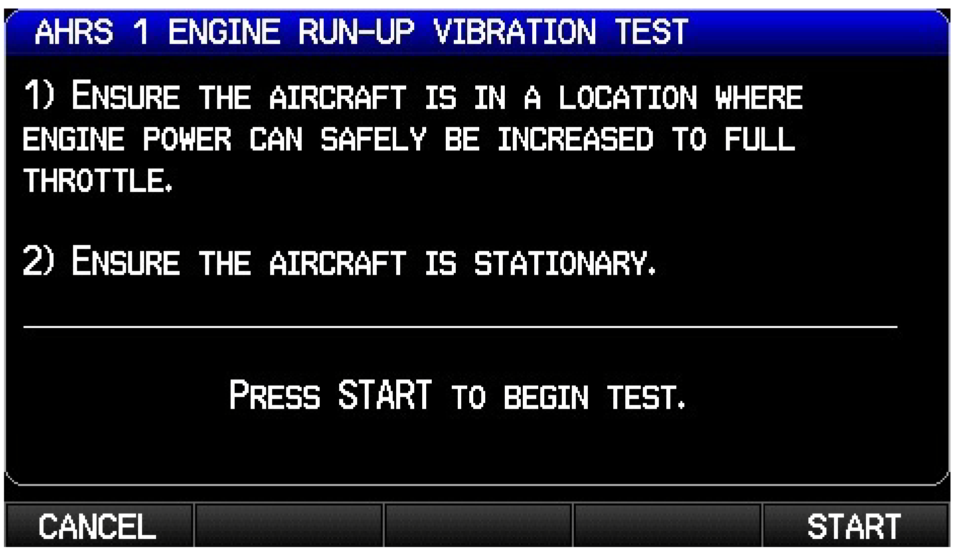
3. Ensure that all the required status boxes are checked (Table 19-2 and Table 19-3). Use the FMS Joystick to select which AHRS (1, 2 or 3) is being configured.



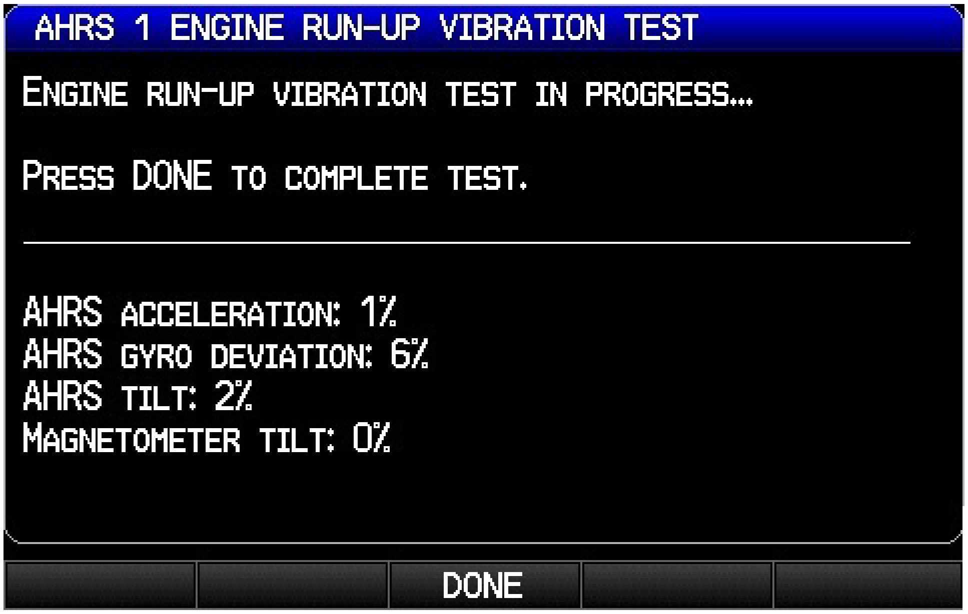
4. Use the FMS Joystick to select ENGINE RUN-UP TEST and press the ENT key.



5. Ensure that the aircraft has been properly positioned per the on-screen instructions, then press the Start softkey to begin the test.



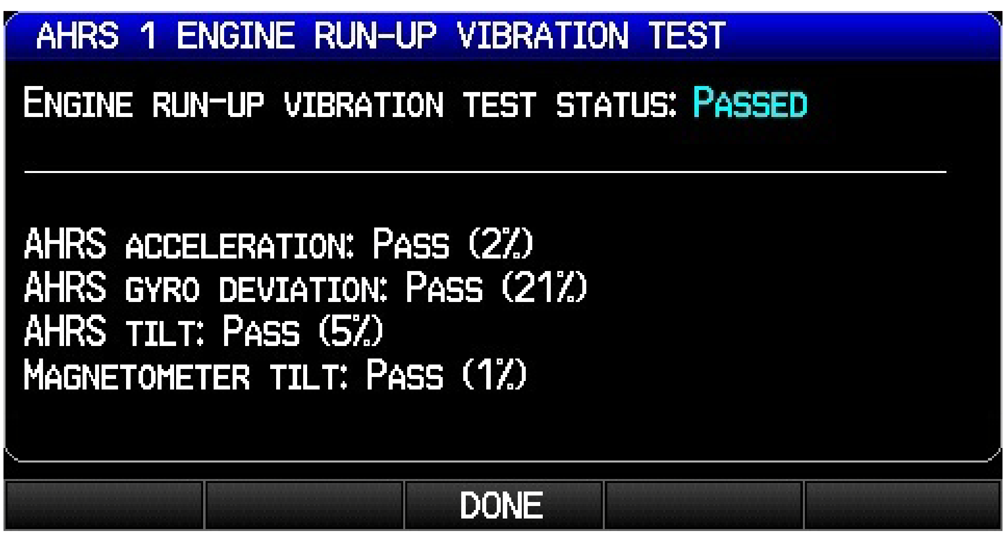
6. Gradually increase power from idle to full throttle and back to idle over the course of 1-2 minutes, the test data is displayed as the test progresses.



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.

7. Press the Done softkey when engine runup has been completed, the test results will be displayed. Ensure that test results indicate Passed, then press the Done softkey to return to the AHRS page.



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

a) Excessive flexing of GSU 25/GSU 73 and/or GMU 22 mechanical mounting with respect to airframe (see Section 10, Section 11, and Section 8 for applicable mounting requirements and instructions).

b) Vibration or motion of GSU 25/GSU 73 and/or GMU 22 caused by neighboring equipment and/or supports.

c) Mounting of GSU 25/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 25/GSU 73 and/or GMU 22 not firmly attached.

e) Absence of recommended mounting supports.

f) GSU 25/GSU 73 connector not firmly attached to unit.

g) Cabling leading to GSU 25/GSU 73 or GMU 22 not firmly secured to supporting structure.

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

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.

19.4 AOA (Angle of Attack) Calibration (Performed In-flight)

Installations that include a GAP 26 and which have Angle of Attack (AOA) enabled require that an AOA calibration be performed to enable AOA functionality. The AOA calibration is used to determine the four AOA settings shown in Figure 19-3. This calibration must be done while in flight. The AOA Setup page (Figure 19-5) on PFD 1 is used for the AOA cal procedure, and is accessed in normal mode (requires that an AOA input is enabled on the LRU Configuration page, see Section 17.3.2).

WARNING

AOA calibration involves flying the aircraft at low airspeeds and angles of attack at or near the stall point. Do not perform AOA calibration until the aircraft's stall recovery characteristics are well-understood. Before AOA calibration, ensure that the aircraft is clear of all traffic and at a safe altitude for stall recovery.

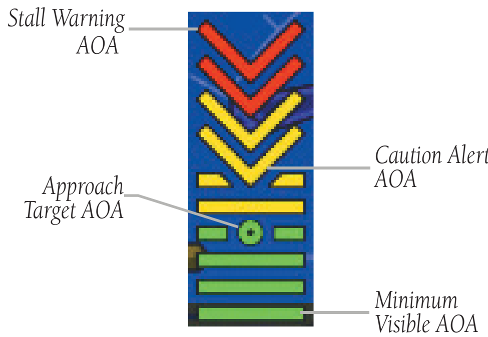


Figure 19-3 Angle of Attack (AOA) Display

AOA is the angle between the aircraft's wing and the oncoming airflow (see Figure 19-4). As AOA increases, eventually it will reach a critical value (determined by the physical characteristics of the wing), whereupon the airflow will separate, the wing will stop producing lift, and the aircraft will stall. The primary purpose of an AOA system is to monitor the wing's angle of attack and provide feedback to the pilot when the aircraft is approaching the critical AOA.

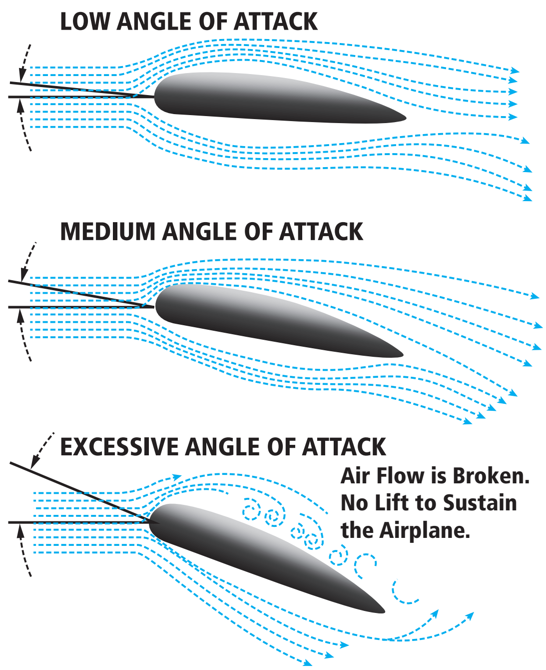


Figure 19-4 Angle of Attack (AOA) Illustration

19.4.1 AOA Calibration Procedure

Perform the procedure steps in Section 19.4.1, Section 19.4.1.1, Section 19.4.1.2, Section 19.4.1.3, and Section 19.4.1.4. Any of the calibration procedures can be repeated to fine-tune the behavior of the AOA gauge and audio alerting.

NOTE

For best results, perform all AOA calibration in smooth air. Turbulence or rough air can affect the calibration.

NOTE

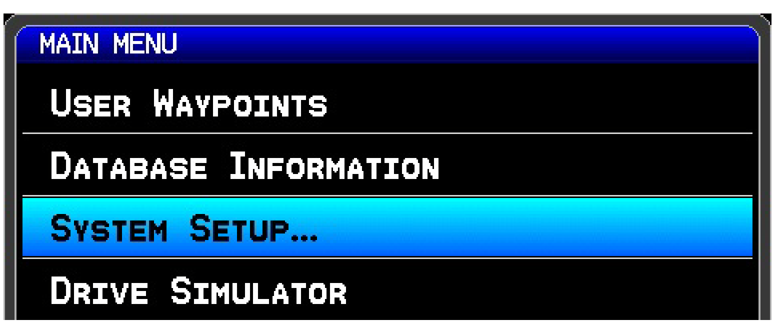
The calibration values displayed for the AOA calibration points are proportional to actual AOA (the greater the calibration value, the greater the AOA) but are not otherwise representative of any specific unit of measure.

For the calibration to be valid:

- The stall warning AOA calibration value (resultant from the calibration procedure) must be greater than the minimum visible AOA calibration value (see Figure 19-5).
- The caution alert AOA calibration value (resultant from the calibration procedure) must be greater than the minimum visible AOA calibration value and less than the stall warning AOA calibration value (see Figure 19-5).

Figure 19-5 Angle of Attack Setup Page

1. In normal mode on PFD 1, press the MENU Key twice to display the Main Menu.
2. Use the FMS Joystick to select System Setup.

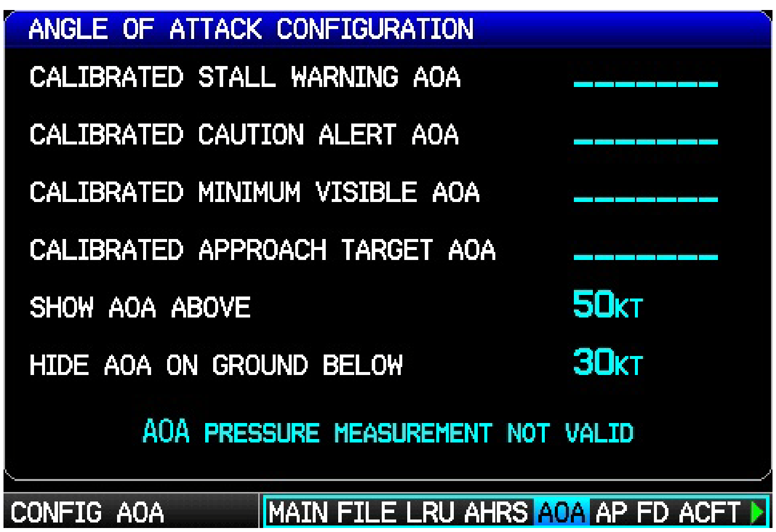


3. Press the ENT Key to display the System Setup page, use the FMS Joystick to select Angle of Attack.

4. Press the ENT Key to display the Angle of Attack Setup page.
5. If AOA calibration has not yet been performed, the calibration fields will be blank. "AOA Pressure Measurement Not Valid" will be displayed if an air pressure sensor is not connected, or if the aircraft is on the ground. To delete an existing AOA calibration, highlight the calibration field, then press the CLR key.

NOTE

The following Angle Of Attack Setup page is also accessible in configuration mode. The configuration mode page only allows viewing and deleting the AOA calibration values, the AOA calibration cannot be performed in configuration mode.



6. Perform the 3 required calibration points (minimum visible AOA, caution alert AOA, and stall warning AOA), plus 1 optional calibration point (approach target AOA, if desired) in the following recommended order.

19.4.1.1 Minimum Visible AOA Calibration

This procedure sets the AOA value for the bottom of the AOA gauge green arc (Figure 19-6), which is also the AOA value at which the gauge will first appear on the PFD. Perform this calibration while flying the aircraft at an AOA somewhat higher than a normal cruise flight (1.5 x stall speed is suggested) to avoid nuisance frequent appearances of the AOA gauge.

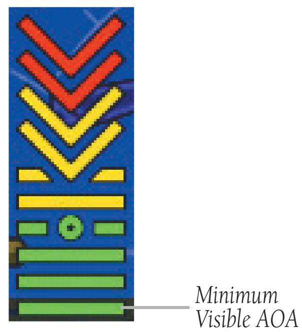
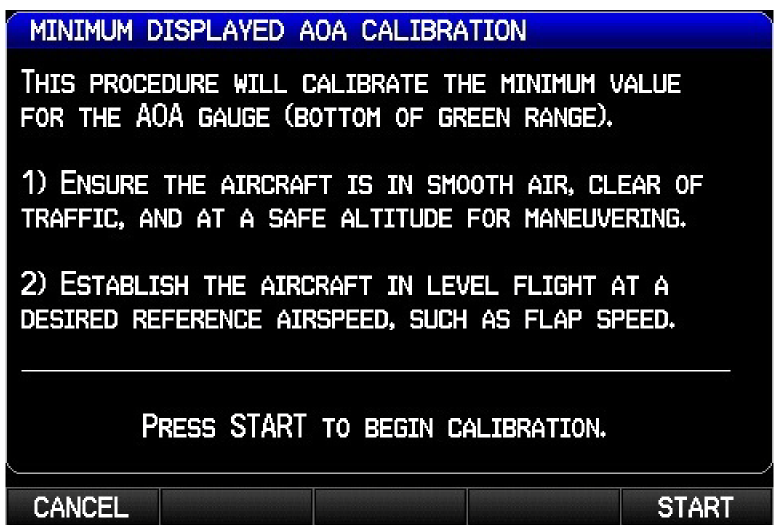
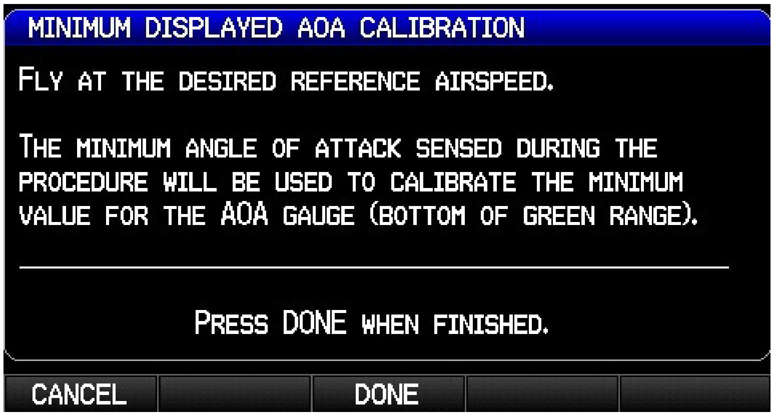


Figure 19-6 Minimum Visible AOA

1. Use the FMS Joystick to select the Calibrated Minimum Visible AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Follow the onscreen instructions, then press the Done softkey when finished.



4. Verify that the calibration is successful, then press the Done softkey when finished.

5. Proceed to Section 19.4.1.2.

NOTE

After calibrating all required AOA points, if the AOA gauge appears too frequently or not frequently enough, the Minimum Visible AOA calibration step can be repeated to set a new value.

19.4.1.2 Caution Alert AOA Calibration

This procedure sets the AOA value for the bottom of the yellow "chevron" section of the AOA gauge (Figure 19-7), which is also the AOA value at which the audible stall warning sound will begin to intermittently play. Perform this calibration while flying the aircraft at an AOA below the aircraft's stall AOA (1.1 x stall speed is suggested).

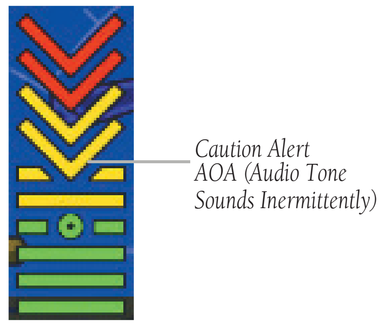
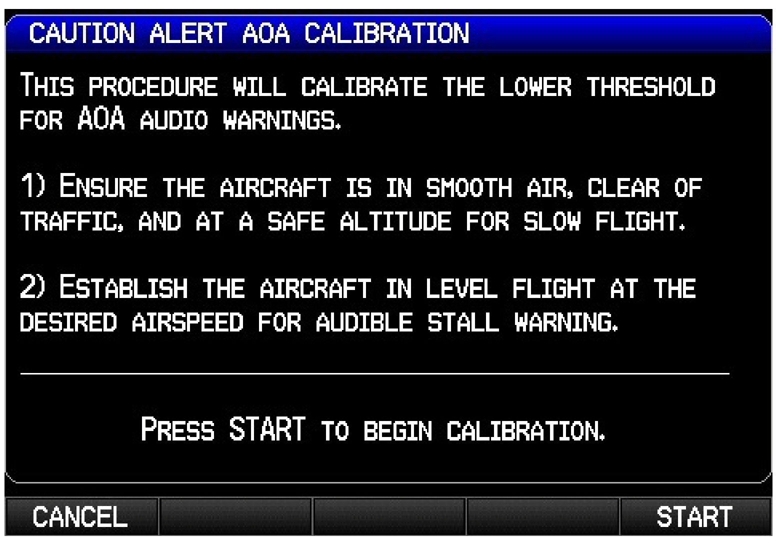
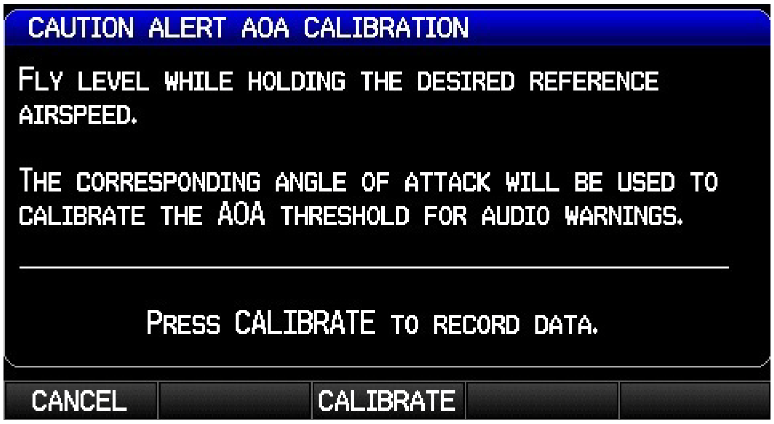


Figure 19-7 Caution Alert AOA

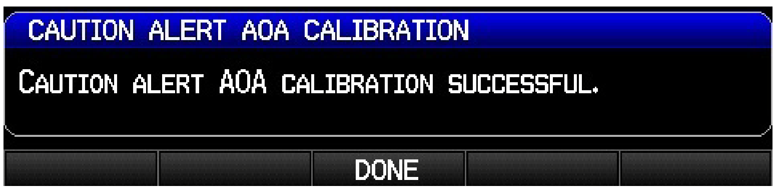
1. Use the FMS Joystick to select the Calibrated Caution Alert AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify that the calibration is successful, then press the Done softkey when finished.



5. Proceed to Section 19.4.1.3.

NOTE

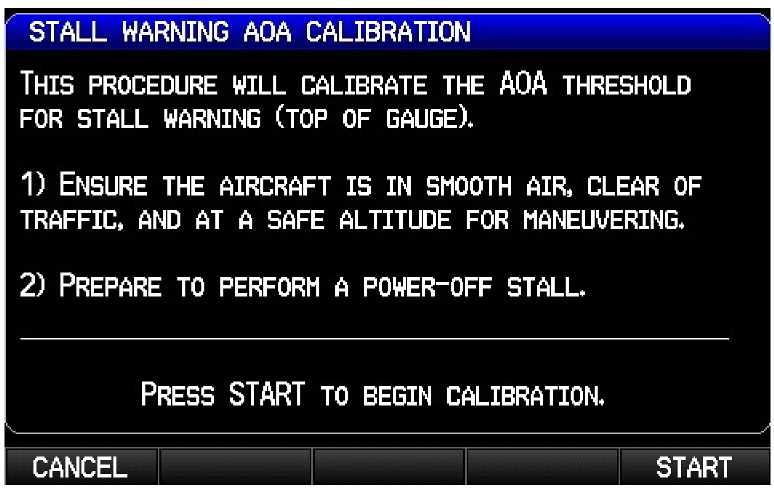
After calibrating all required AOA points, if the AOA caution alert and audio warning occur too frequently or not frequently enough, the Caution Alert AOA calibration step can be repeated to set a new value.

19.4.1.3 Stall Warning AOA Calibration

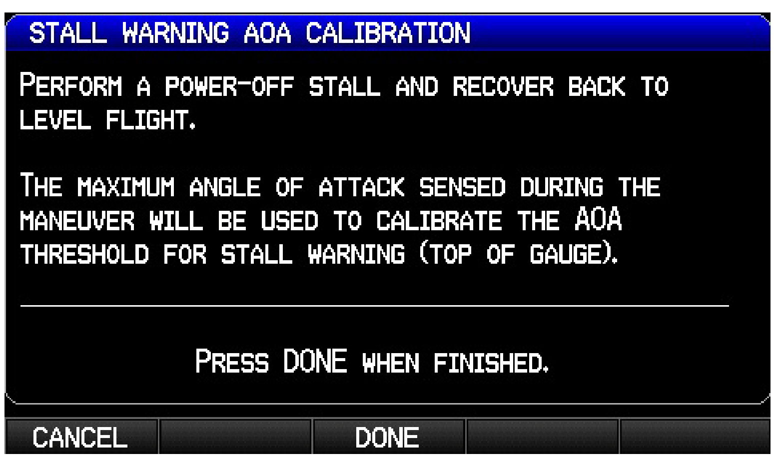
This procedure sets the AOA value for the top of the red "chevron" section of the AOA gauge (Figure 19-8), which is also the AOA value at which the audible stall warning sound will play continuously (just before stall break is suggested).

Figure 19-8 Stall Warning AOA

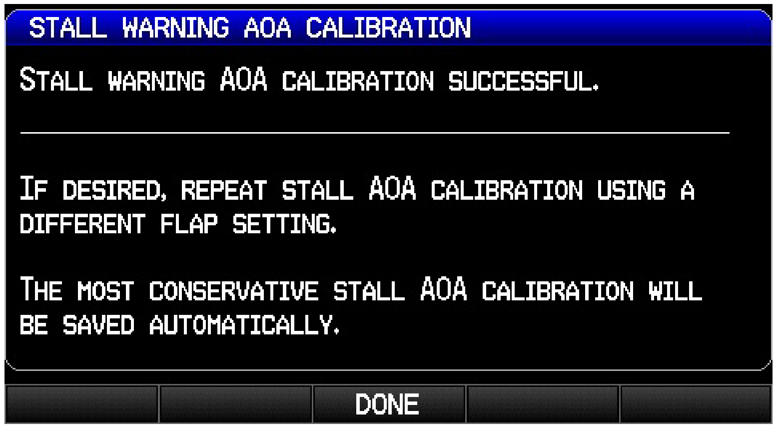
1. Use the FMS Joystick to select the Calibrated Stall Warning AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify that the calibration is successful, then press the Done softkey when finished.



5. If desired, repeat the Stall Warning AOA calibration using a different flap setting.
6. If desired, proceed to Section 19.4.1.4. If the Approach Target AOA Calibration procedure is not desired, the AOA Calibration Procedure is complete.

19.4.1.4 Approach Target AOA Calibration (Optional)

This procedure sets a specific point (1.3 x stall speed is suggested) on the AOA gauge to use as the ideal target AOA for an approach, glide, short-field landing, etc. If calibrated, the approach target AOA will display as a green circle on the AOA gauge (Figure 19-9). To be valid, the approach target AOA must be between the minimum visible (green) and caution alert (yellow chevron) AOA points.

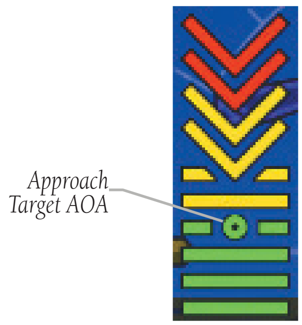
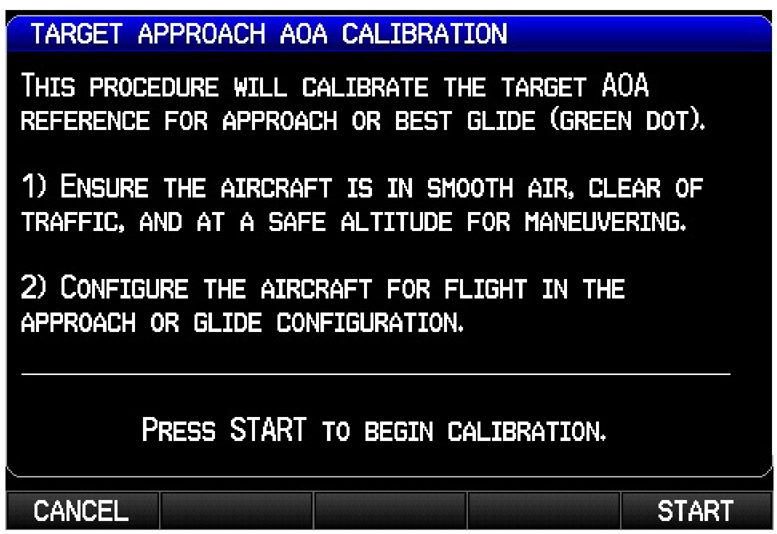
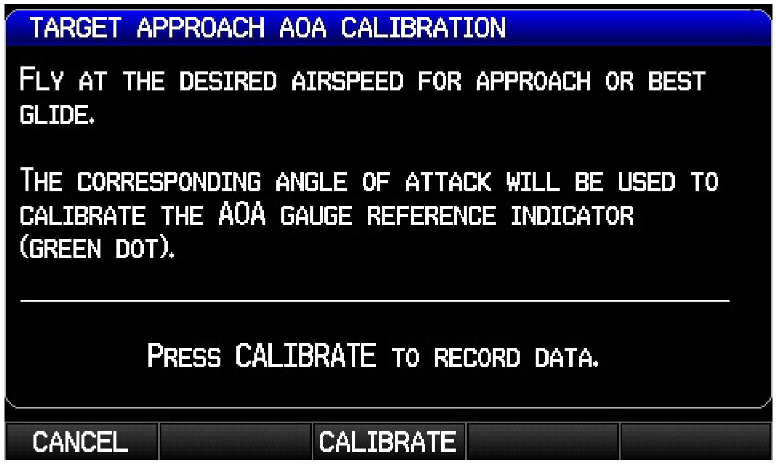


Figure 19-9 Approach Target AOA

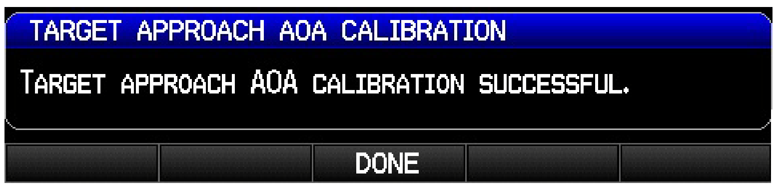
1. Use the FMS Joystick to select the Calibrated Approach Target AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify that the calibration is successful, then press the Done softkey when finished.



5. This completes the AOA calibration procedure.

19.5 External Interface Configuration (Garmin units only)

Refer to Appendix D for wiring the interface connections between GDU 37X LRUs and any external Garmin units such as the GNS 4XX/5XX, GNS 480, GTN 6XX/7XX, and GTX transponder products. See the Configuration Guidance instructions on the drawings in Appendix D 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).

19.5.1 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

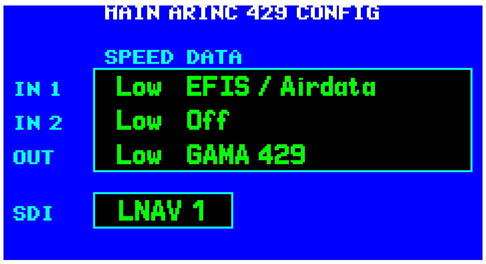
Make configuration changes only as described in this section, changing other configuration settings is not recommended and may significantly alter the unit's operation. Garmin recommends recording all configuration settings (before making any changes) for reference.

Changing data on the displayed configuration pages:

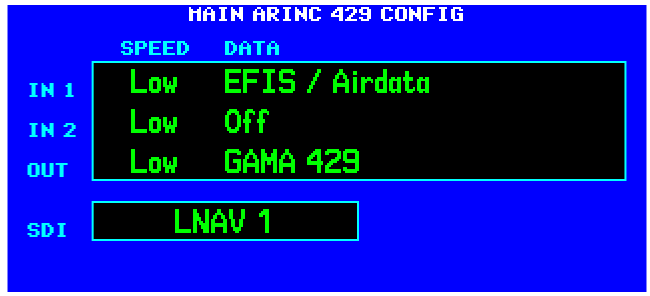
1. Press the small right knob to turn on the cursor.
2. Turn the large right knob to change between data fields.
3. Turn the large or small right knob to change data in the selected field.
4. Press the ENT key to accept the entry.
5. Turn unit off and then back on to return to normal operation.

Installation Configuration Pages

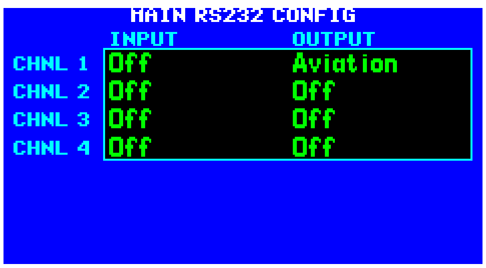
The configuration pages are in the order found when rotating the right small knob clockwise starting at the MAIN ARINC 429 CONFIG page. Follow the preceding procedures to enter configuration mode and to select the desired configuration settings (the following figures are for reference only and may vary from actual screens/settings, refer to instructions on the drawings in Appendix D).



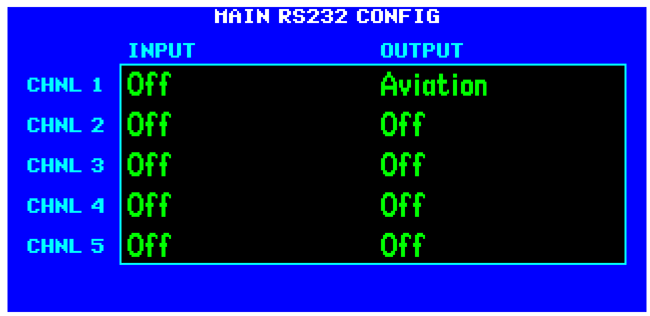
4XX Main ARINC 429 Config Page



5XX Main ARINC 429 Config Page



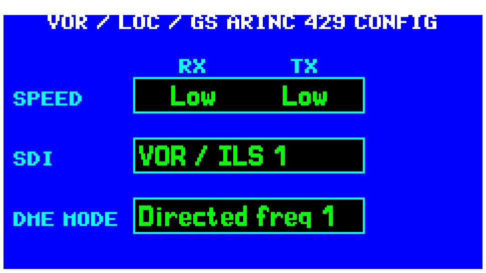
4XX Main RS232 Config Page



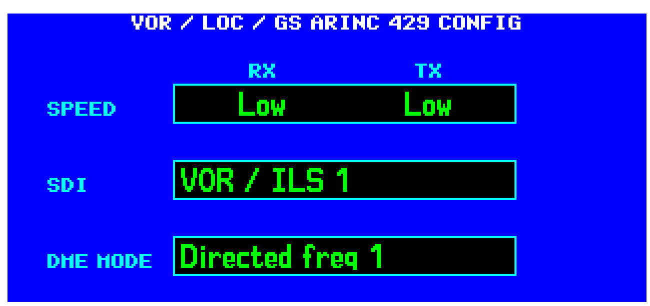
5XX Main RS232 Config Page

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.

19.5.2 GTX 23/33/327/328/330 Transponder

Refer to the applicable transponder (GTX 23/33/327/328/330) installation manual for configuration mode instructions. The configuration settings are detailed in Appendix D of this document.

NOTE

Make configuration changes only as described in Appendix D, 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.

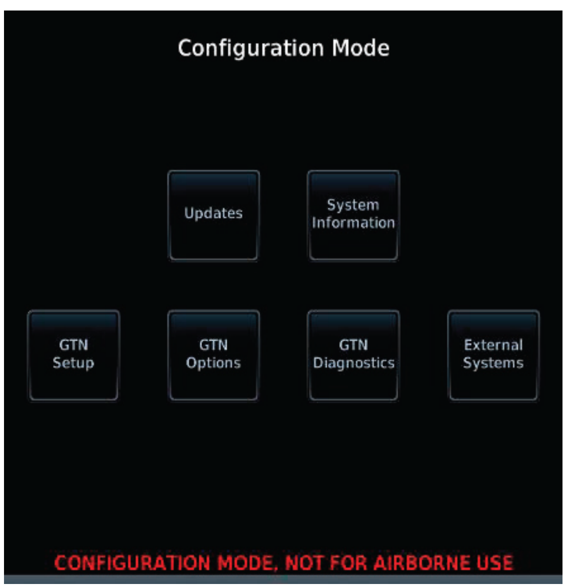
19.5.3 GTN 625/635/650/725/750 Unit

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 (the following figures are for reference only and may vary from actual screen/settings, refer to instructions on the drawings in Appendix D).
4. Touch the GTN Setup key.



GTN 7XX Configuration Mode Home Page

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

GTN 6XX GTN Setup Page

GTN 7XX GTN Setup Page

20 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

Any advisory or warning message indicated on the Info Page whlie on-ground should be investigated and resolved before flight.

NOTE

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

20.1 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 affected LRU.
2. Check that the connectors are fully seated, and that the jack screw connectors are fully tightened on both sides of the affected LRU's 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 affected LRU is mounted securely. Use a screwdriver to check the tightness of the four mounting screws.
5. Look in the vicinity of the affected LRU for any heavy objects that may not be fastened tight to the structure and induce GSU 25/GSU 73 vibration.
6. Look for evidence of water or fluid contamination in the area around the affected LRU.
7. Unplug the affected LRU's 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 and email the logs back to Garmin to help determine if the condition is caused by a G3X LRU or in the aircraft.

20.1.1 Status LED

The GAD 29, GEA 24, GSA 28, and GSU 25 units have an LED on their outer cases that indicates the LRUs current status. The status indications are:

Table 20-1 Status LED Indications

LED Indication	Description
No Light	No Power
Steady Green	On, but not communicating via CAN Bus
Flashing Green	On and communicating via CAN Bus
Red	Hardware Fault
Alternating Red/Green	CAN bus network error two similar devices are configured with the same unit ID

20.2 GDU 37X

20.2.1 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).

20.2.2 Unit Communication Error Messages (Two or Three GDU Systems)

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. Unit communication error related messages are as follows:

- GDU Software Version Mismatch - Indicates that two or more GDU displays are using incompatible software versions. All GDUs in the aircraft must be updated to use the same software version.
- Network Fault - Duplicate GDU Detected - Indicates that more than one GDU is configured to be the same unit type (e.g. two displays are configured as PFD1). See section Section 15.2.3 for information on GDU mode pin connections.
- Network Address Changed - Indicates that the state of a GDU's mode pins was detected. Check for loose connections and see Section 15.2.3 for information on GDU mode pin connections.
- Navigation/Terrain/Obstacle Database Missing - Indicates that a required database is missing on the specified GDU display. A database update is required.
- Navigation/Terrain/Obstacle Database Mismatch - Indicates that two or more GDU displays have different versions of the specified database. Update the databases in all GDU displays to the same cycle number.

20.3 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 20-1):

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 20-1 No info for TAS & OAT

If the Airspeed and/or Altitude is failed and shows a Red-X condition as shown in Figure 20-2:

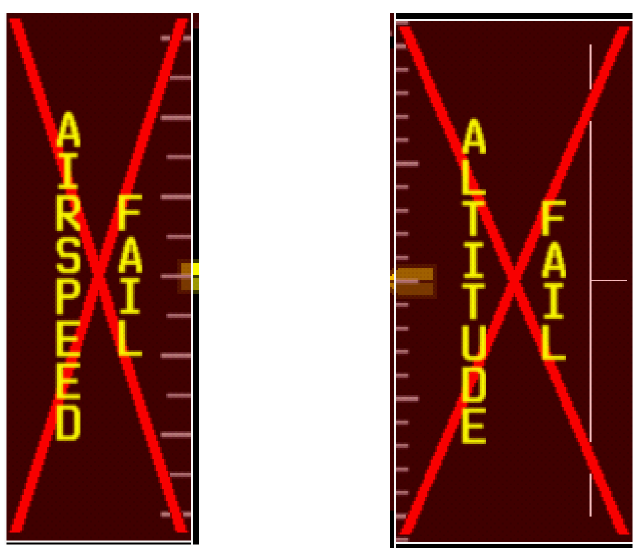


Figure 20-2 Airspeed and Altitude Failure Indications

1. Inspect GSU 73 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.

20.4 Engine Indication Troubleshooting

To troubleshoot an Engine Indication failure (Figure 20-3), 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.

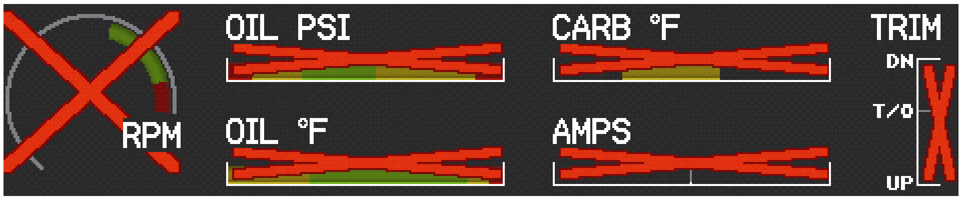


Figure 20-3 Engine/Airframe Failure Indications (Reversionary or Split-Screen PFD)

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 +5 VDC 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.

20.5 AHRS Troubleshooting

20.5.1 Heading Red-X

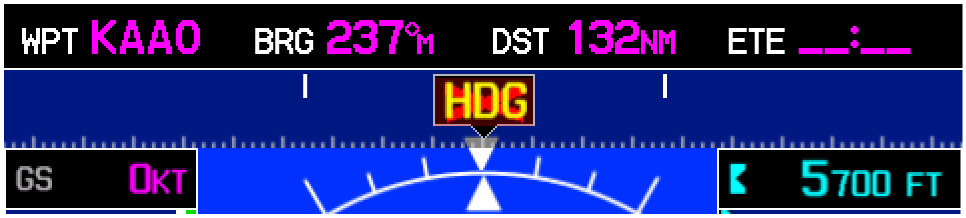


Figure 20-4 Heading Failure Indication (Full-Screen PFD)

If a Red-X (steady or intermittent) is displayed on the heading (Figure 20-4), 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 22 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 8-4 for minimum distances for installed equipment from the GMU 22 to prevent interference.

If the GMU 22 heading is not present on the GDU 37X, there may be a problem with the RS-232 or RS-485 line between the GSU 25/73 and GMU 22. Troubleshoot any possible wiring/connector issues before replacing either unit.

20.5.2 Attitude/Heading Failure Troubleshooting

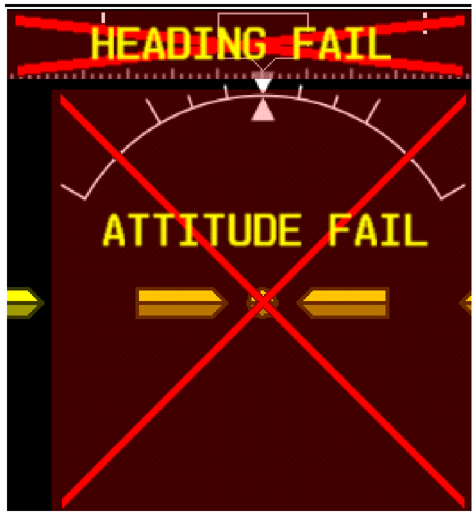


Figure 20-5 Attitude and Heading Failure Indications (Reversionary or Split-Screen PFD)

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 25/73 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 25/73 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 25/73 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 25/73 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.

20.6 Post Installation Calibration Procedures

The calibration procedures in Section 19.3.3 and Section 19.3.5 may be performed during troubleshooting. Table 19-2 and Table 19-3 list the status box requirements for each calibration procedure. The Magnetometer Interference Test may be used to determine if the location of the GMU 22 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 22 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

20.7 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.

20.7.1 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.

20.7.2 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.

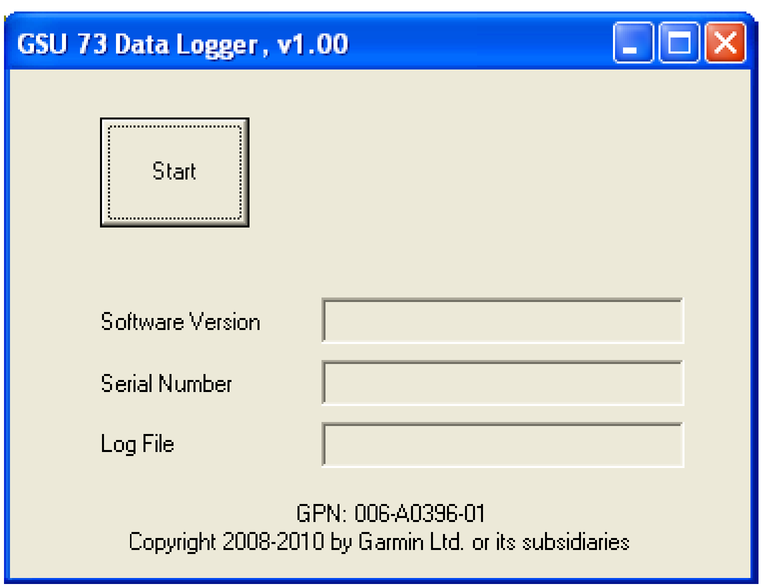


Figure 20-6 Data Logger, Start Screen

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.

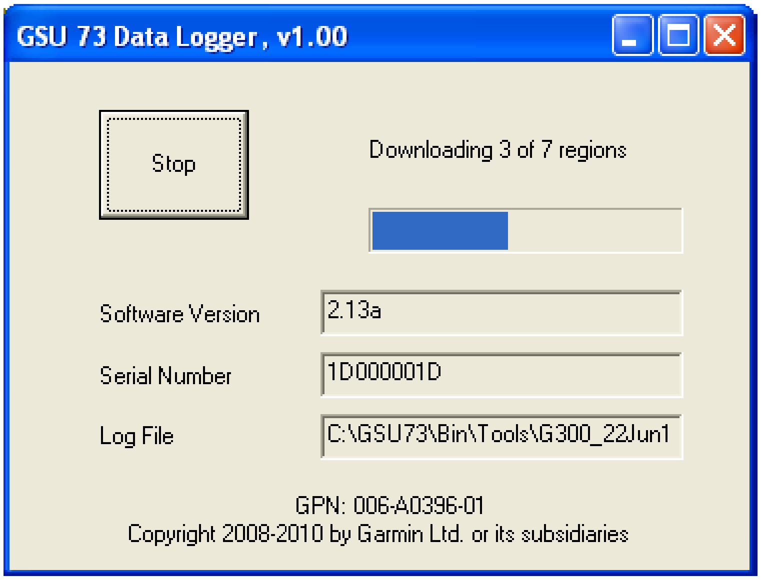


Figure 20-7 Data Logger, Download Screen

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.

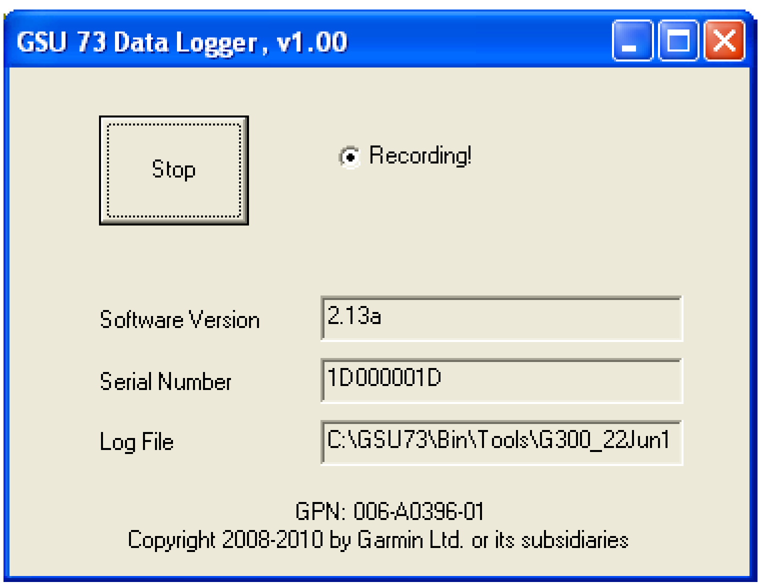


Figure 20-8 Data Logger, Recording Screen

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.

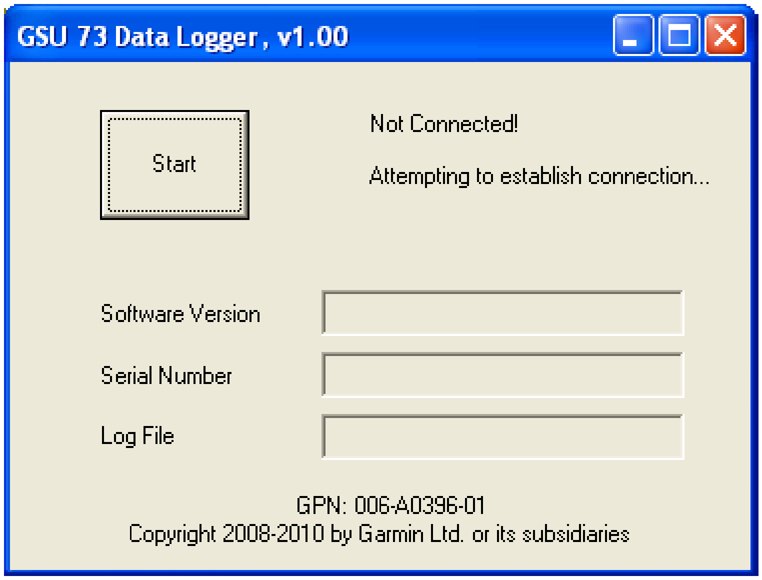


Figure 20-9 Data Logger, Connection Screen

20.7.3 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.

21 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.

21.1 GDU 37X

21.1.1 Original GDU 37X is Reinstalled

No software or configuration loading is required if the original GDU 37X is reinstalled. Continue to Section 21.2.

21.1.2 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 21.2.

21.1.3 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 21.2.

21.1.4 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 17).

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.

21.2 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.

21.2.1 Original GSU 73 is Reinstalled

No software or configuration loading is required if the original GSU 73 is reinstalled in its original mounting location. Continue to Section 21.4.

21.2.2 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. The correct GSU 73 software version will automatically be loaded from the GDU. If the configuration module is operational, no software configuration is required. Continue to Section 21.4.

21.3 GSU 25

21.3.1 Original GSU 25 is Reinstalled

No software or calibration is required if the original GSU 25 is reinstalled in its original mounting location. Continue to Section 21.4.

21.3.2 New GSU 25 is Installed

Any time a new GSU 25 is installed, or an existing GSU 25 is moved to a different mounting location, the AHRS unit orientation (Section 19.3.1), pitch/roll offset (Section 19.3.2), and magnetometer calibration procedures (Section 19.3.4) must be performed. The correct GSU 25 software version will automatically be loaded from the GDU.

21.4 GMU 22

NOTE

If the GMU 22 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.

21.4.1 GMU 22 is Reinstalled

Any time a GMU 22 is reinstalled, a new magnetometer calibration is required (Section 19.3.4). Continue to Section 21.4.2

21.4.2 New GMU 22 Installed

If a new GMU 22 is installed (new serial number), a new magnetometer calibration (Section 19.3.4) and verification of the correct software version (Section 17.2) is required. If the correct software version is not installed, load the GMU 22 software contained in the G3X system software which is loaded to the displays (Section 17.2). Following a successful magnetometer calibration, and software verification the Return to Service Procedure is complete.

21.5 GEA 24

No additional action is required when a GEA 24 is reinstalled or replaced. The correct GEA 24 software version and EIS configuration will automatically be loaded from the GDU.

21.6 GSA 28

21.6.1 GSA 28 is removed

No additional action is required when a GSA 28 is reinstalled or replaced. The correct GSA 28 software version and autopilot configuration settings will automatically be loaded from the GDU.

21.7 GAD 29

No additional action is required when a GAD 29 is reinstalled or replaced. The correct GAD 29 software version and ARINC 429 configuration will automatically be loaded from the GDU.

21.8 GMC 305

No additional action is required when a GMC 305 is reinstalled or replaced.

APPENDIX A AIRFRAME SPECIFIC INSTALLATION GUIDANCE

A.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 22 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 when choosing an appropriate mounting location for the GMU 22. In addition to reviewing the guidance provided in Section , the installer should use the Garmin GMU Site Survey Tool to conduct a GMU 22 site evaluation prior to permanent installation of the GMU 22 mounting bracket. The GMU Site Survey Tool and the AHRS/Magnetometer Installation Considerations document (which contains instructions) can be downloaded from the Dealer Resource Center portion of the Garmin website www.garmin.com. Please contact your G3X dealer for additional information on setup and use of the GMU Site Survey Tool.

NOTE

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.

NOTE

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.

A.1.1 GMU 22

The integrity and reliability of the G3X heading and attitude information is entirely dependent upon the installation quality of the GMU 22 Magnetometer. Garmin strongly recommends the purchase of the pre-fabricated parts indicated in Table . 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 22 installation, if the installer chooses to follow the typical installation guidance.

Table A-1 GMU 22 Mount Kits

Airframe	GMU 22 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

A.2 Van's Aircraft

A.2.1 RV-7/9

A.2.1.1 GMU 22 Mounting Bracket

An RV-7/9 GMU 22 Mounting Bracket Kit is available under Garmin part number 011-01796-00, see Figure A-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.

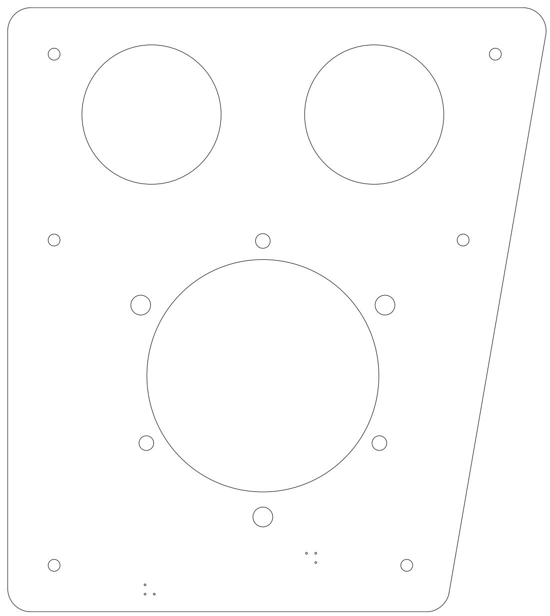


Figure A-1 RV-7/9 GMU 22 Mounting Bracket (115-01027-00)

A.2.1.1.1 GMU 22 Mounting Bracket Installation Guidance

The RV-7/9 GMU 22 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 22 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 B-4.1, the mounting plate should be attached to the bracket with the supplied AN426AD5-6 rivets.

NOTE

The GMU 22 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 22 mounting bracket.

NOTE

After the GMU 22 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 22 mounting bracket on the F-714 aft deck (see Figure A-2).
3. Slide the GMU 22 mounting bracket forward, ensuring the front edge is against the vertical portion of the F-714 aft deck (see Figure A-2).

NOTE

It is vital that the front edge be squarely positioned against the flange. The GMU 22 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).

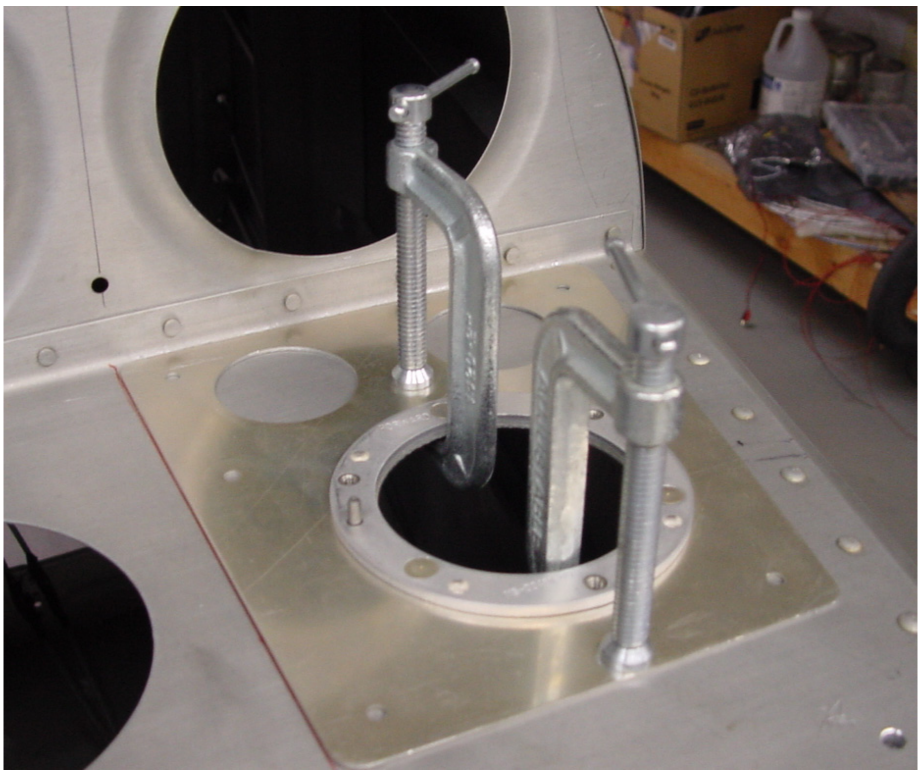


Figure A-2 RV-7/9 GMU 22 Mounting Bracket on the F714 Aft Deck

A.3 Lancair Aircraft

A.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 22.

A.3.1.1 GMU 22 Mounting Bracket

The Lancair IV/IV-P GMU 22 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.

A.3.1.1.1 GMU 22 Mount Installation Guidance

One possible mounting location for the GMU 22 is in the right wingtip (refer to Figure A-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.

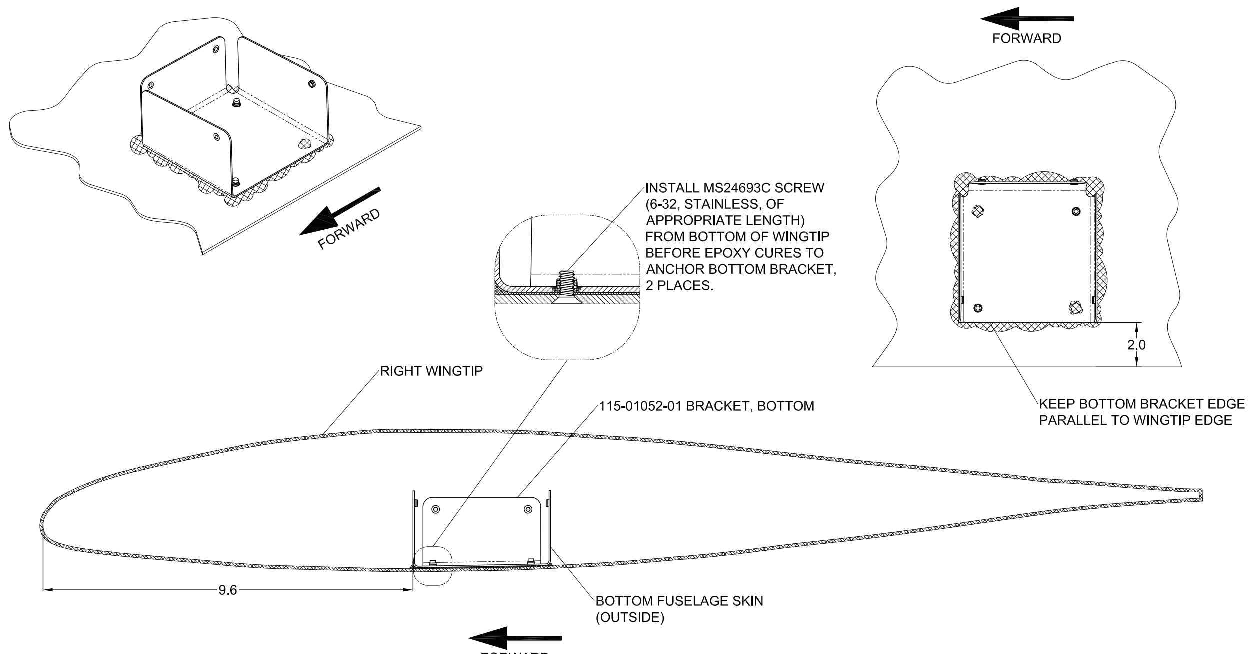


Figure A-3 Lancair IV/IV-P Right Wingtip GMU 22 Installation

1. Rivet the GMU 22 Installation Rack (115-00481-00) to the Top Bracket Assembly (115-01052-00) as shown in Figure A-4.

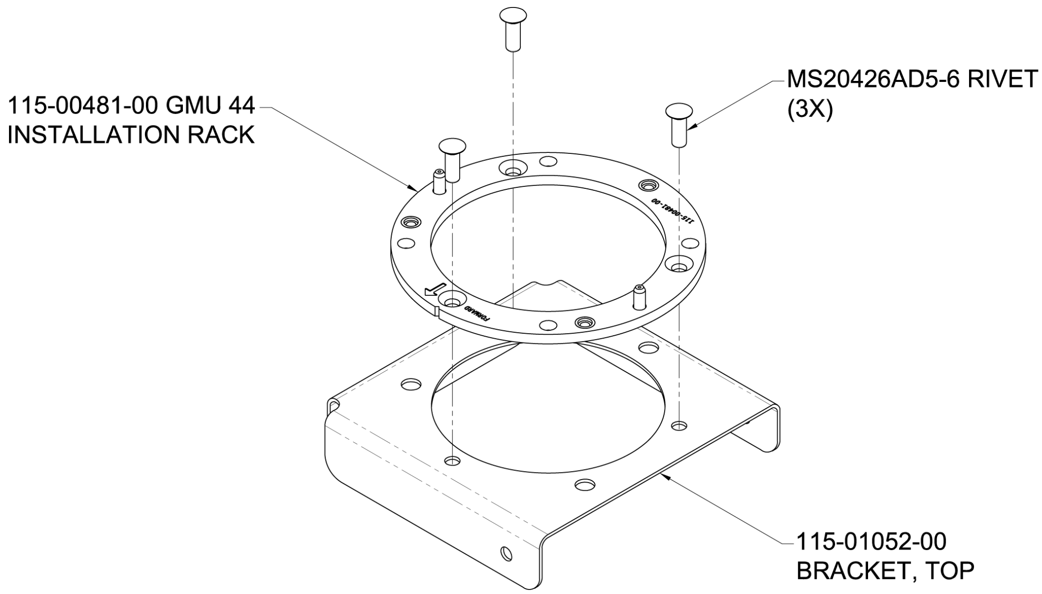


Figure A-4 Lancair IV/IV-P GMU 22 Mounting Bracket

2. Attach the GMU 22 to the Top Bracket Assembly (115-01052-00) using screws (211-60037-08) as shown in Figure A-5.

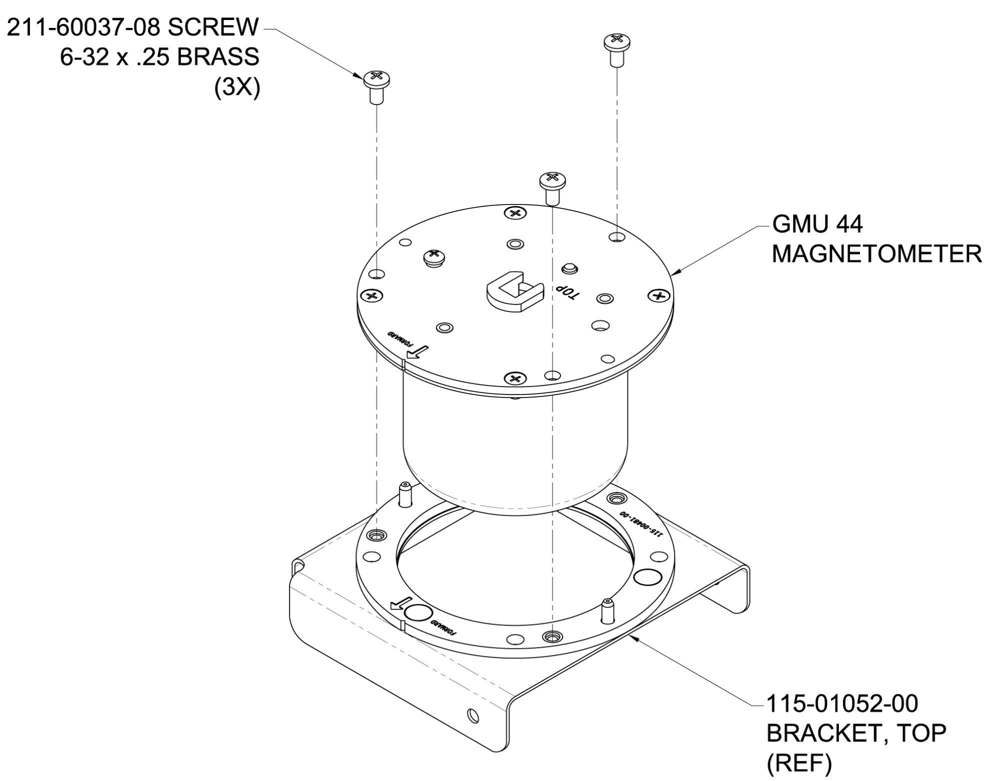


Figure A-5 Lancair IV/IV-P GMU 2222 Mounting Bracket

3. Attach the Top Bracket Assembly (115-01052-00) to the Bottom Bracket Assembly (115-01052-01) as shown in Figure A-6.

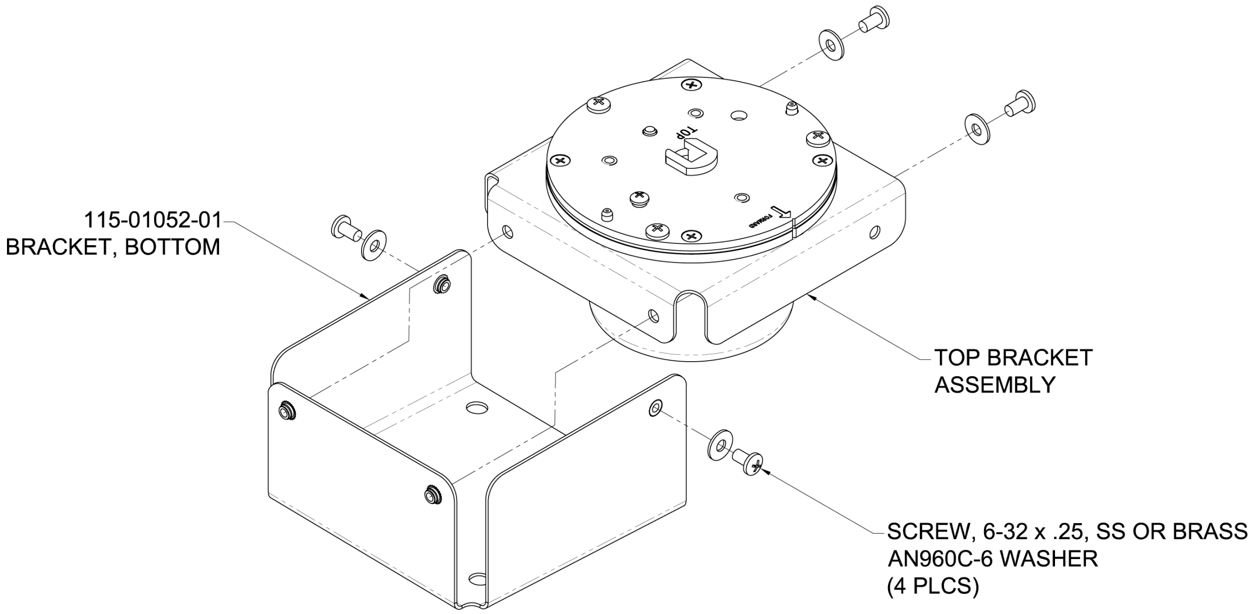


Figure A-6 Lancair IV/IV-P GMU 22 Mounting Bracket

4. After the installation, the pigtail of the GMU 22 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 22 and all surfaces of the wingtip that may come in contact with the pigtail.
   - When routing the GMU 22 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 22.
5. Refrain from installing any ferrous metals near the GMU 22, including the mounting screws and nut plates used to attach the wingtip. Stainless steel fasteners are recommended.

A.3.2 Lancair ES/ES-P

A.3.2.1 GMU 22 Mounting Bracket

The Lancair ES/ES-P uses the G3X generic GMU 22 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 22 mounting plate. The set is purchased as a sub-assembly kit under Garmin part number 011-01779-00.

A.3.2.1.1 GMU 22 Mount Installation Guidance

One possible mounting location for the GMU 22 is the last wing rib in the right wingtip (refer to Figure A-7). The wing tip should be removable to gain proper access to the GMU 22. At a minimum, a removable access panel under the wingtip is required.

The GMU 22 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 22 bracket attachments and wingtip attachments should be made to ensure access to the GMU 22.

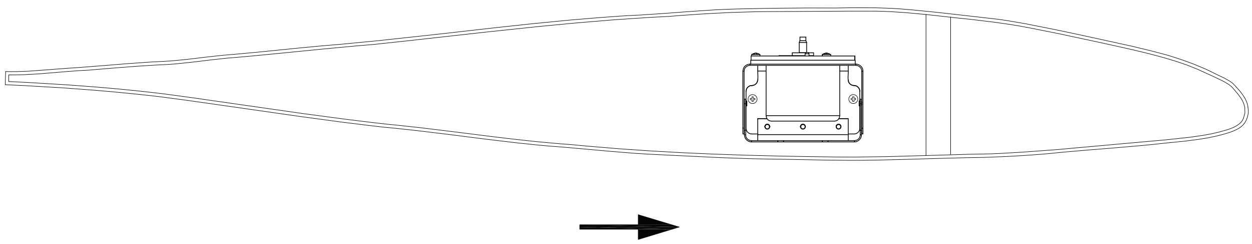


Figure A-7 Right Wingtip GMU 22 Installation

- The GMU 22 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 22 installation will be in alignment with the Lancair ES/ES-P aircraft heading.
- The GMU 22 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 22 bracket and a "V" cut into the GMU 22 Installation Rack. Temporarily placing a drill bit in this hole will aid in making a perfectly parallel alignment of the GMU 22.

1. Clamp the GMU 22 Installation Rack (Figure A-8) in place and match drill the GMU 22 Bracket through three countersunk mounting holes.
2. Mark the center of the three mounting screw holes.
3. Remove the GMU 22 mounting plate.
4. Drill the clearance holes in the GMU 22 Mounting Bracket.

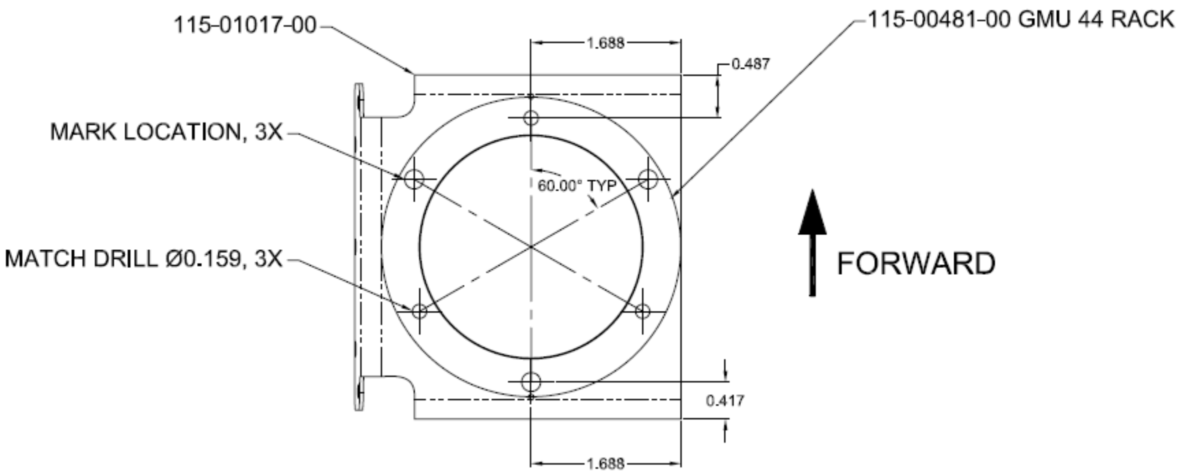


Figure A-8 GMU 22 Installation Rack (ES / ES-P)

5. Rivet the GMU 22 Installation Rack (115-00481-00) to the Top Bracket Assembly (115-01017-00) as shown in Figure A-9.

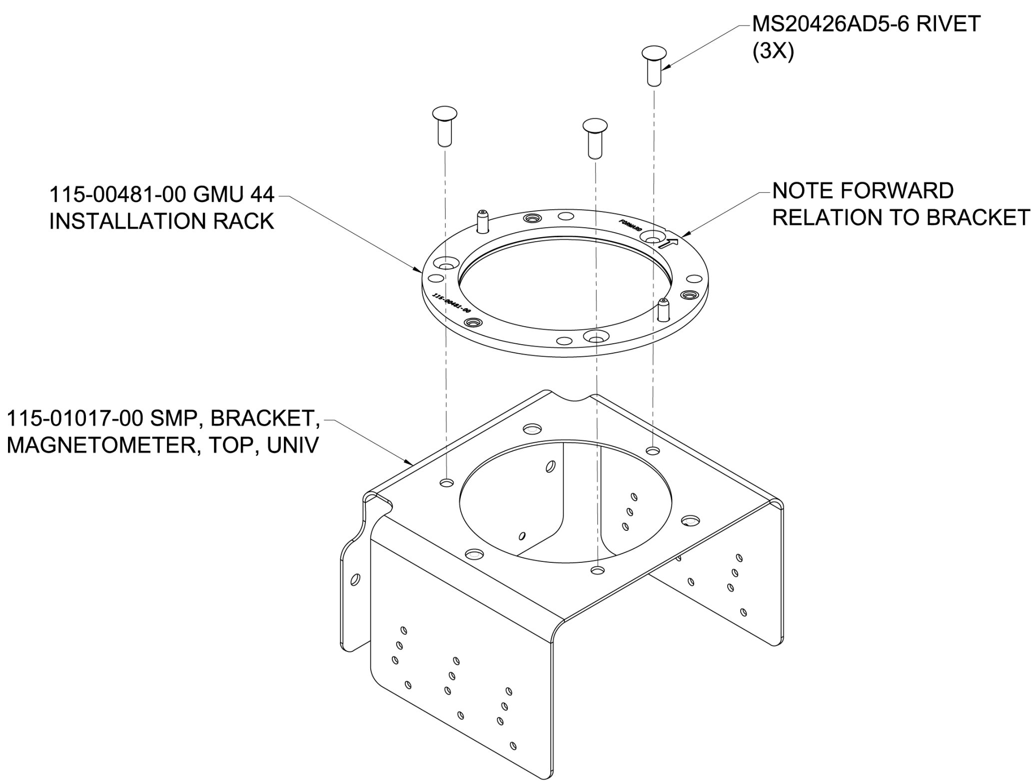


Figure A-9 GMU 22 Installation Rack (ES/ES-P)

6. Rivet the Top Bracket Assembly (115-01017-00) to the Universal Bracket Assembly (115-00939-00) as shown in Figure A-10 and Figure A-11.

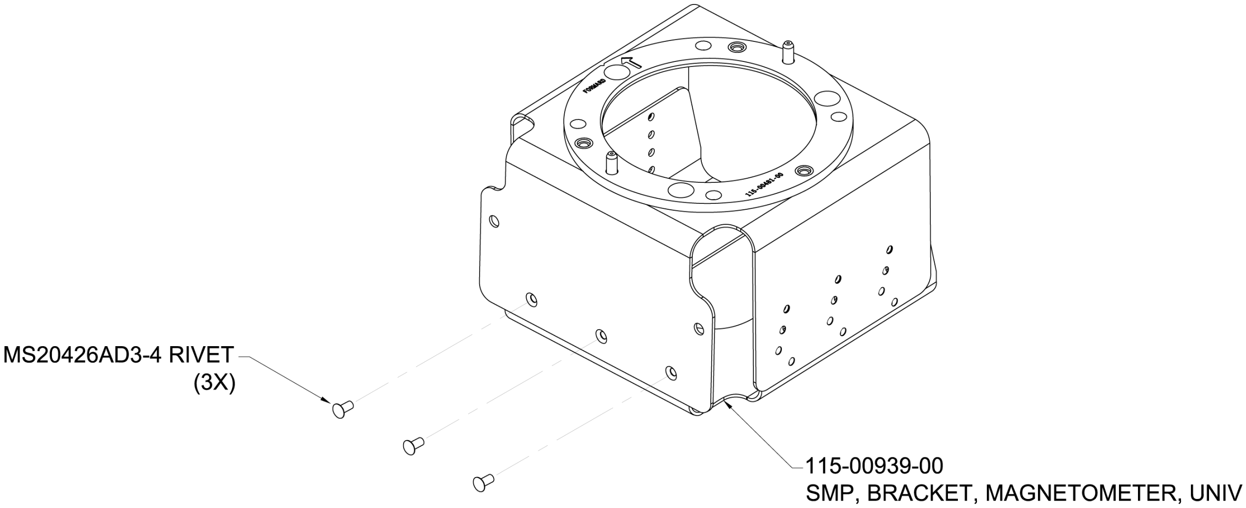


Figure A-10 Lancair IV/IV-P GMU 22 Mounting Bracket Assembly

NOTE

The assembled bracket can be shifted to accommodate for wing dihedral. Figure A-11 illustrates the offset rivet holes which may be utilized to tilt the GMU 22 up (plus) from the mounting surface or down (minus) from the mounting surface.

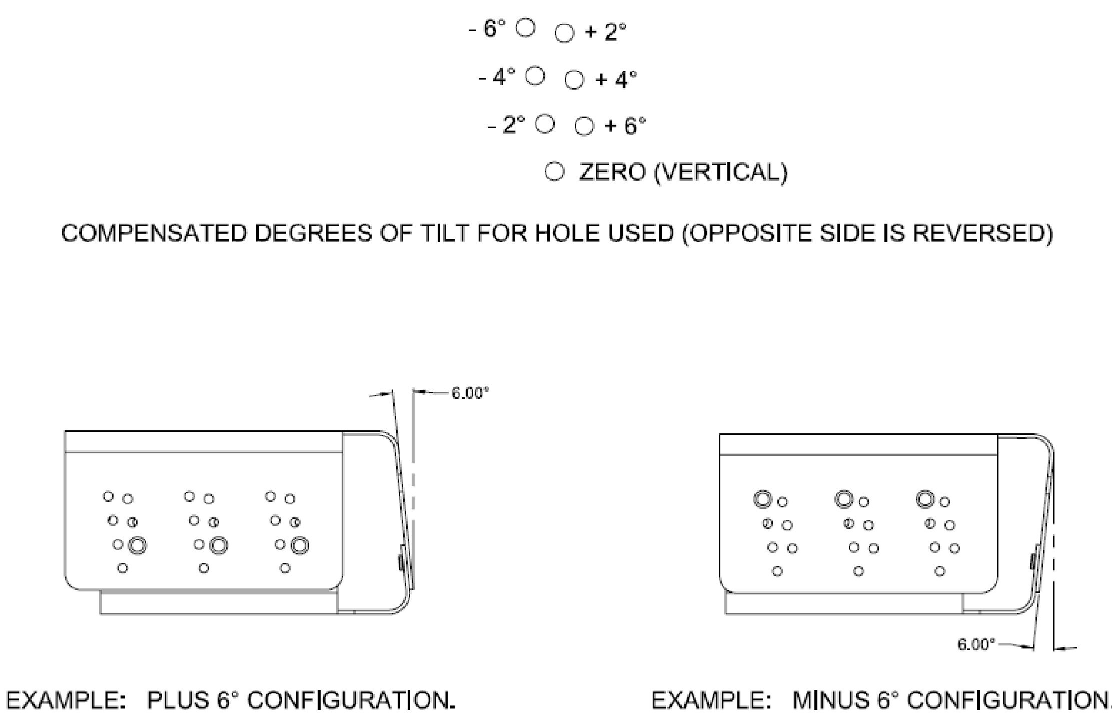


Figure A-11 Adjusting for Wing Dihedral

7. With the GMU 22 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 A-12.

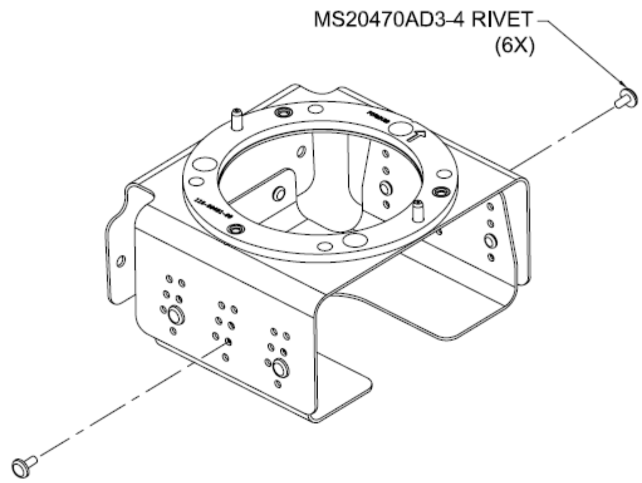


Figure A-12 Rivet shifted Magnetometer Mount

8. Attach the GMU 22 to the GMU 22 Mounting Bracket as illustrated in Figure A-13 using brass screws.

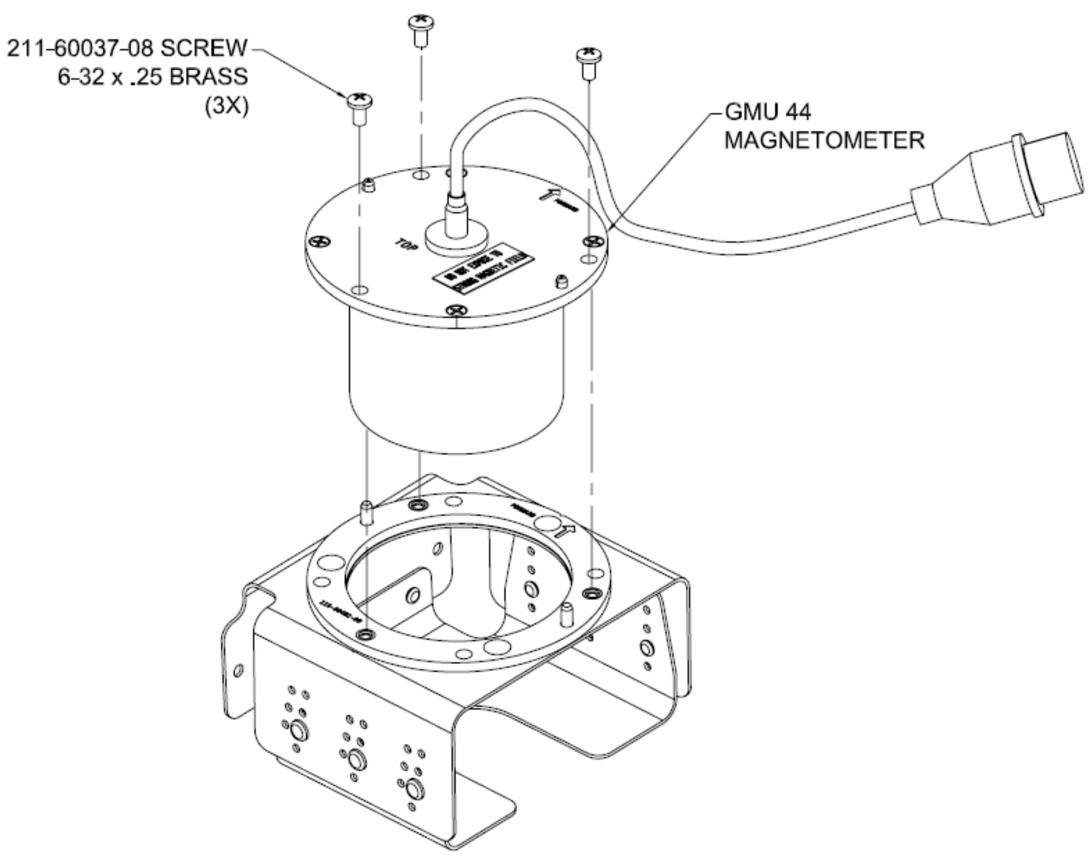


Figure A-13 Secure GMU 22 to the Mounting Bracket Assembly

9. Fabricate two disks from 2 BID sheet to the dimensions shown in Figure A-14.

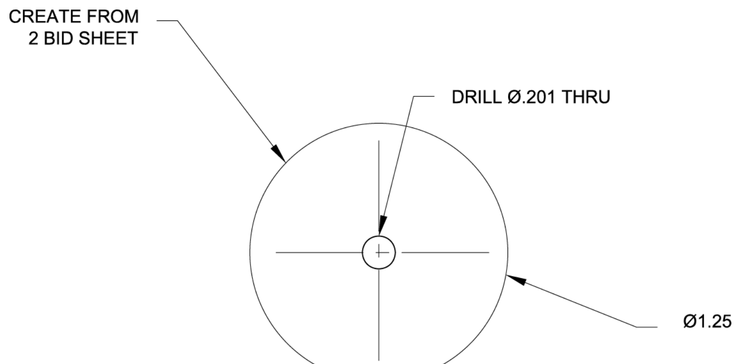


Figure A-14 2 BID Sheet Disk

10. Align one <u>*stainless steel*</u> 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 A-15.

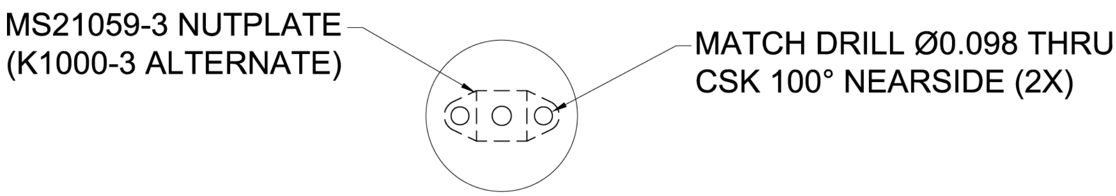


Figure A-15 Aligned Nutplate And Disk

11. Rivet nutplate to disk with MS20426AD3-4 rivets as shown in Figure A-16.

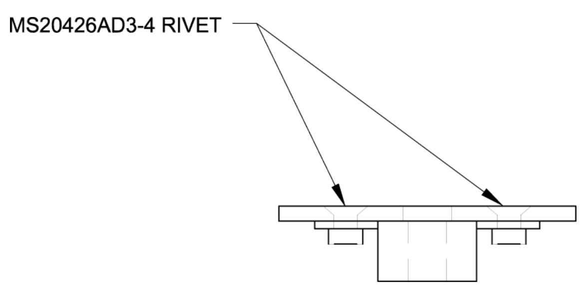


Figure A-16 Riveted Nutplate And Disk

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 A-17.

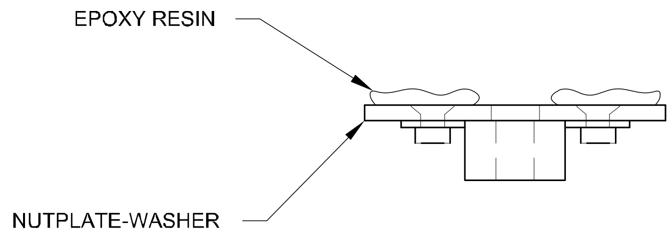


Figure A-17 Nutplate Washers

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 A-18.

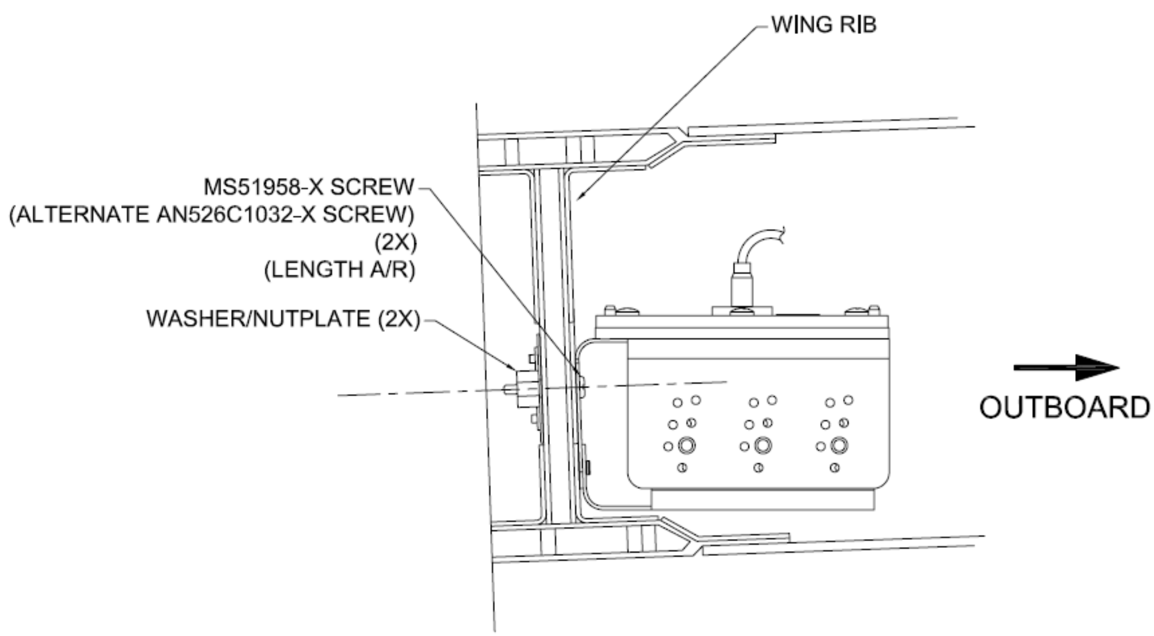


Figure A-18 Magnetometer Assembly attached to Wing Rib

NOTE

Stainless steel hardware (nutplates and screws) must be used to attach the GMU 22 bracket to the wing.

NOTE

The wing tip should also be attached with stainless steel hardware (nutplates and screws).

NOTE

Never use a magnetic screwdriver to remove or install wingtip hardware.

A.3.3 Lancair Legacy

A.3.3.1 GMU 22 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 A-19.

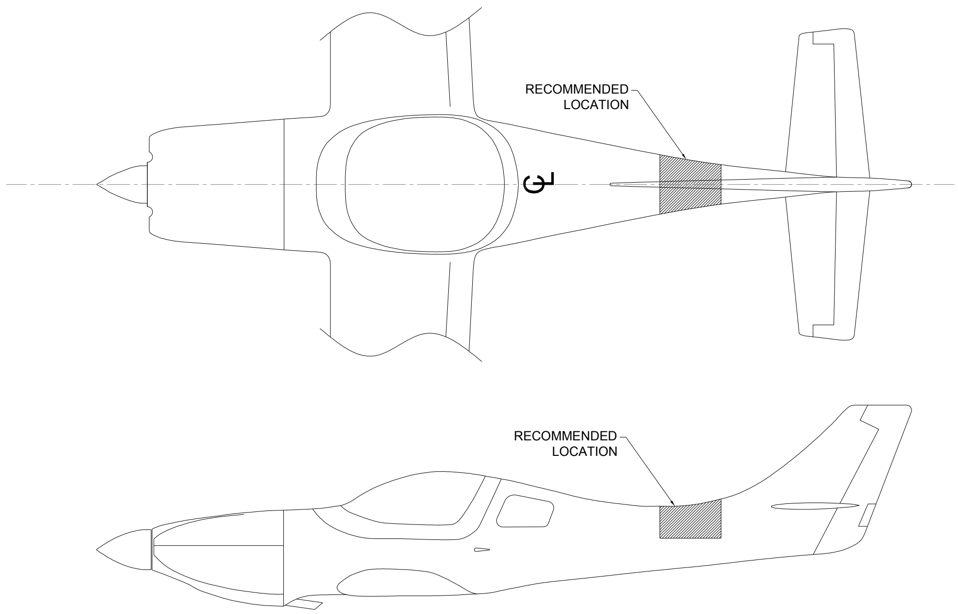


Figure A-19 Lancair Legacy Magnetometer Location

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 shown in Figure A-20.

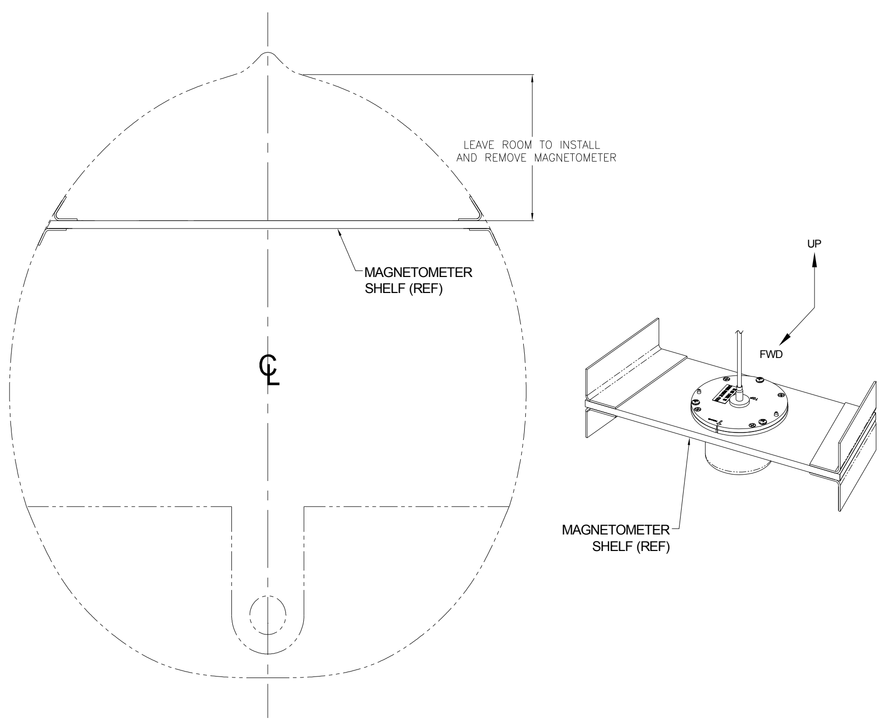


Figure A-20 View Looking AFT At Recommended Magnetometer Location

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 shown in Figure A-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 22 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.

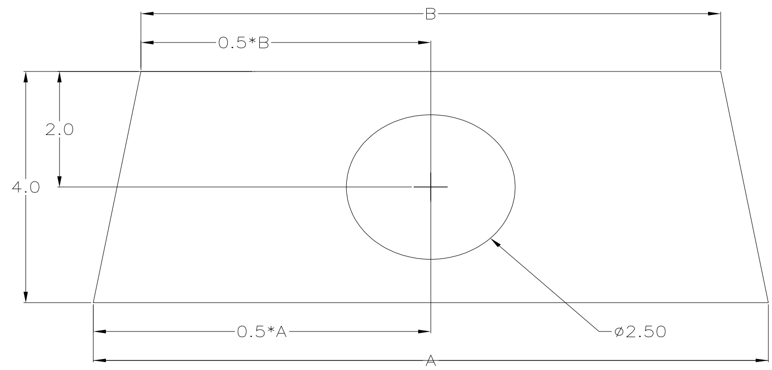


Figure A-21 Example Magnetometer Shelf

4. Fill gap between sides of fuselage and shelf with epoxy/flox mixture. Be sure to make a radius at the corners as shown in Figure A-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.

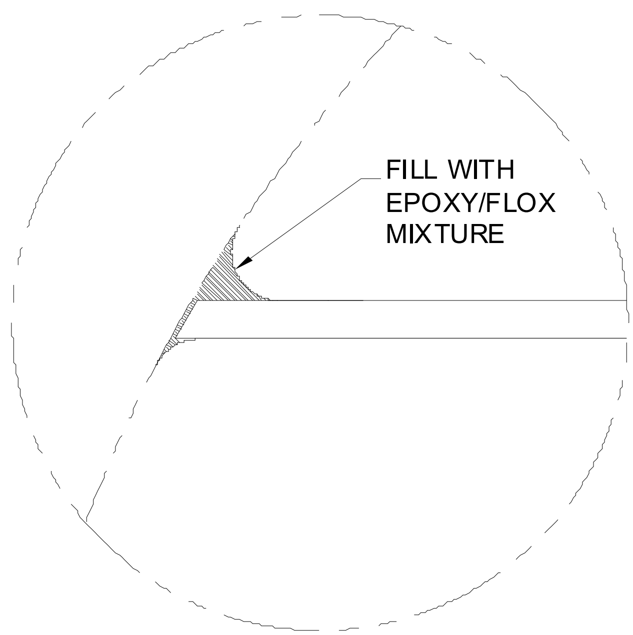


Figure A-22 Fill Detail For Corner Radii And Magnetometer Shelf

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 A-23.

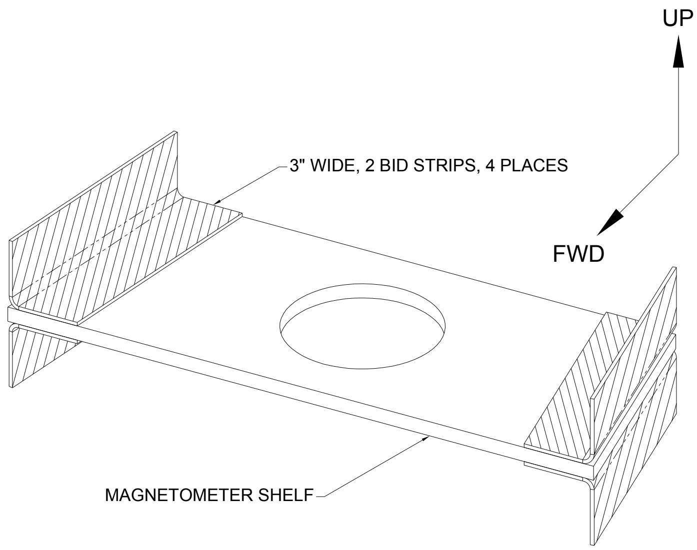


Figure A-23 Magnetometer Shelf With Lay up

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 shown in Figure A-24. The alignment of the magnetometer is critical and needs to be within 0.5° of the aircraft's forward direction.

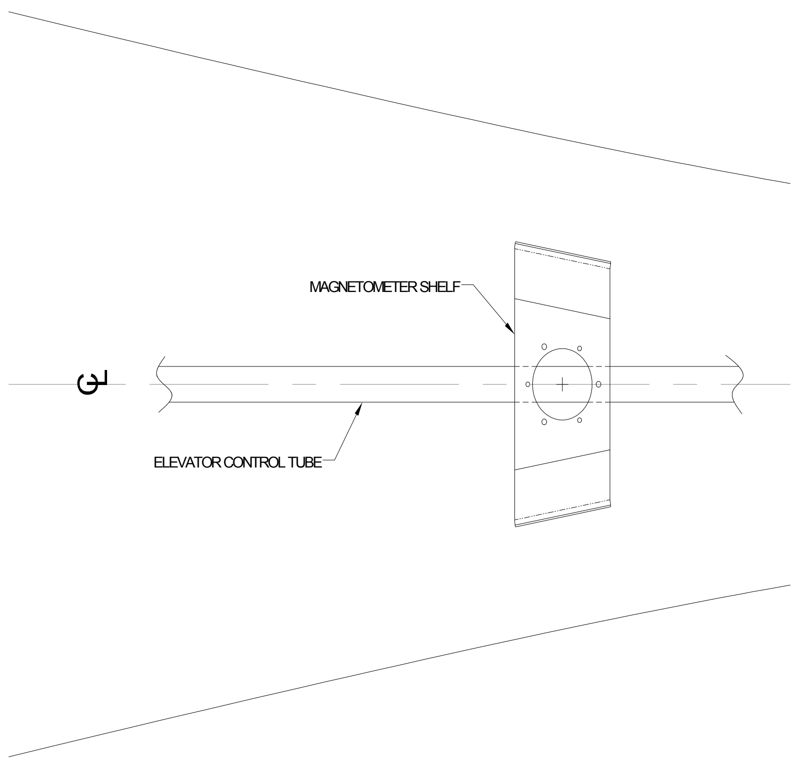


Figure A-24 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction

Alternately, if the 2.50 in. diameter hole is drilled off of centerline as shown in Figure A-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.

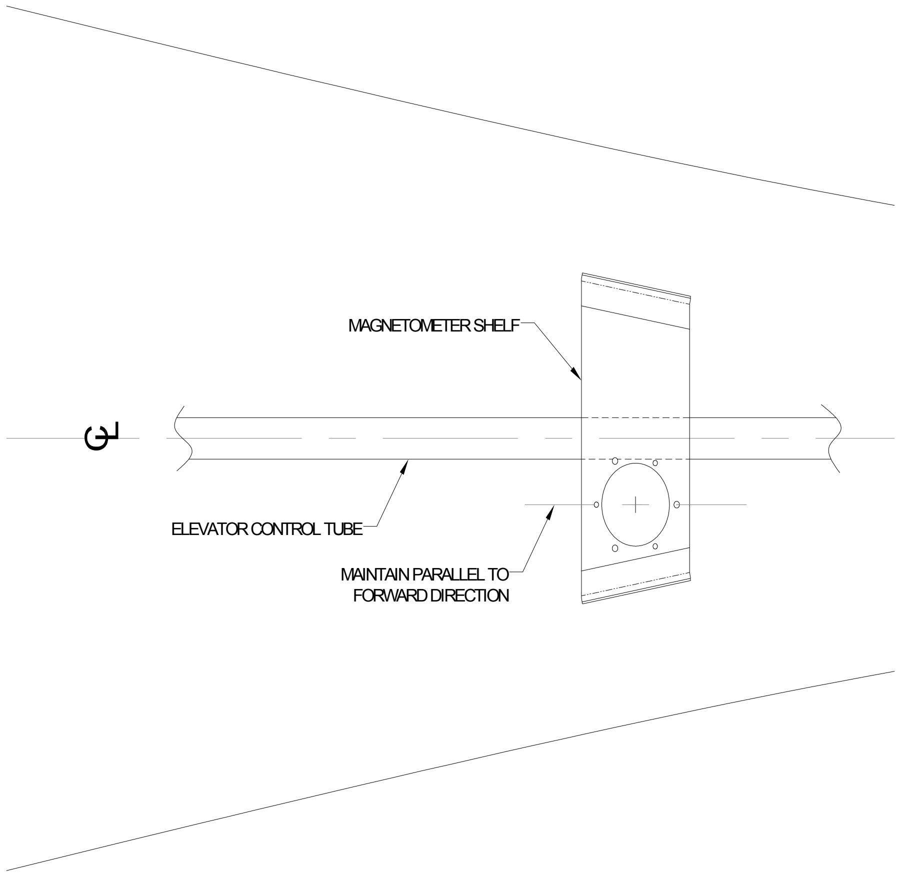


Figure A-25 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction With Offset Magnetometer Cutout

Clamp the GMU 22 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 22 Installation Rack to be concentric with the circular cutout in the magnetometer shelf. Align the notch on the GMU 22 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 A-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 22 Installation Rack and drill the three marked locations to 0.203 in. diameter, as these are clearance holes for the GMU 22 Magnetometer unit installation.

NOTE

The GMU 22 Installation Rack must be set, drilled, and installed after the shelf has been mounted in the aircraft and cured.

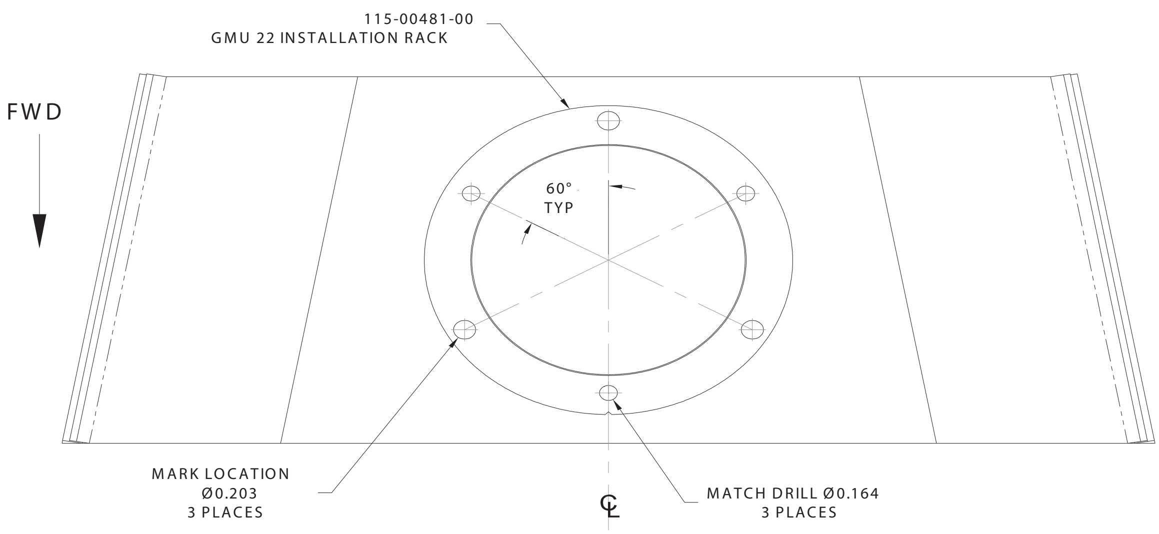


Figure A-26 Magnetometer Shelf With Hole Pattern For GMU 22 Installation Rack

7. Assemble the GMU 22 Installation Rack to the magnetometer shelf as shown in Figure A-27.

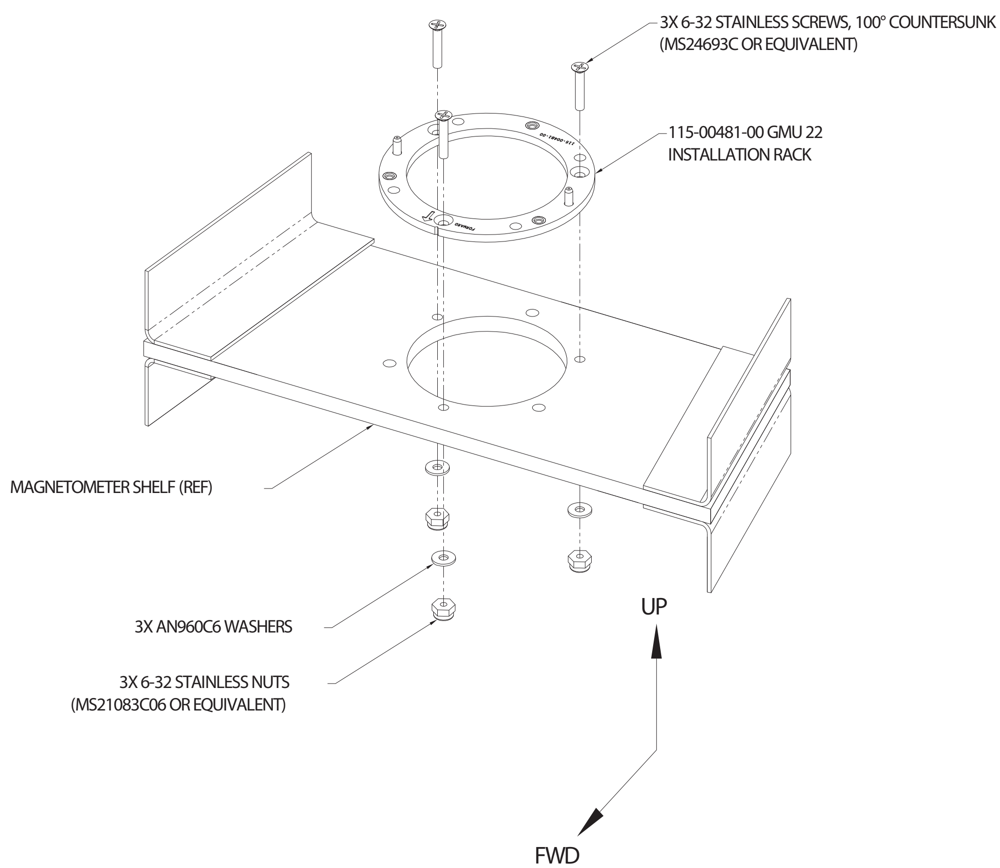


Figure A-27   Assembly Of GMU 22 Installation Rack To Magnetometer Shelf

8. Install the GMU 22 Magnetometer in the installation rack with the hardware provided as shown in Figure A-28.

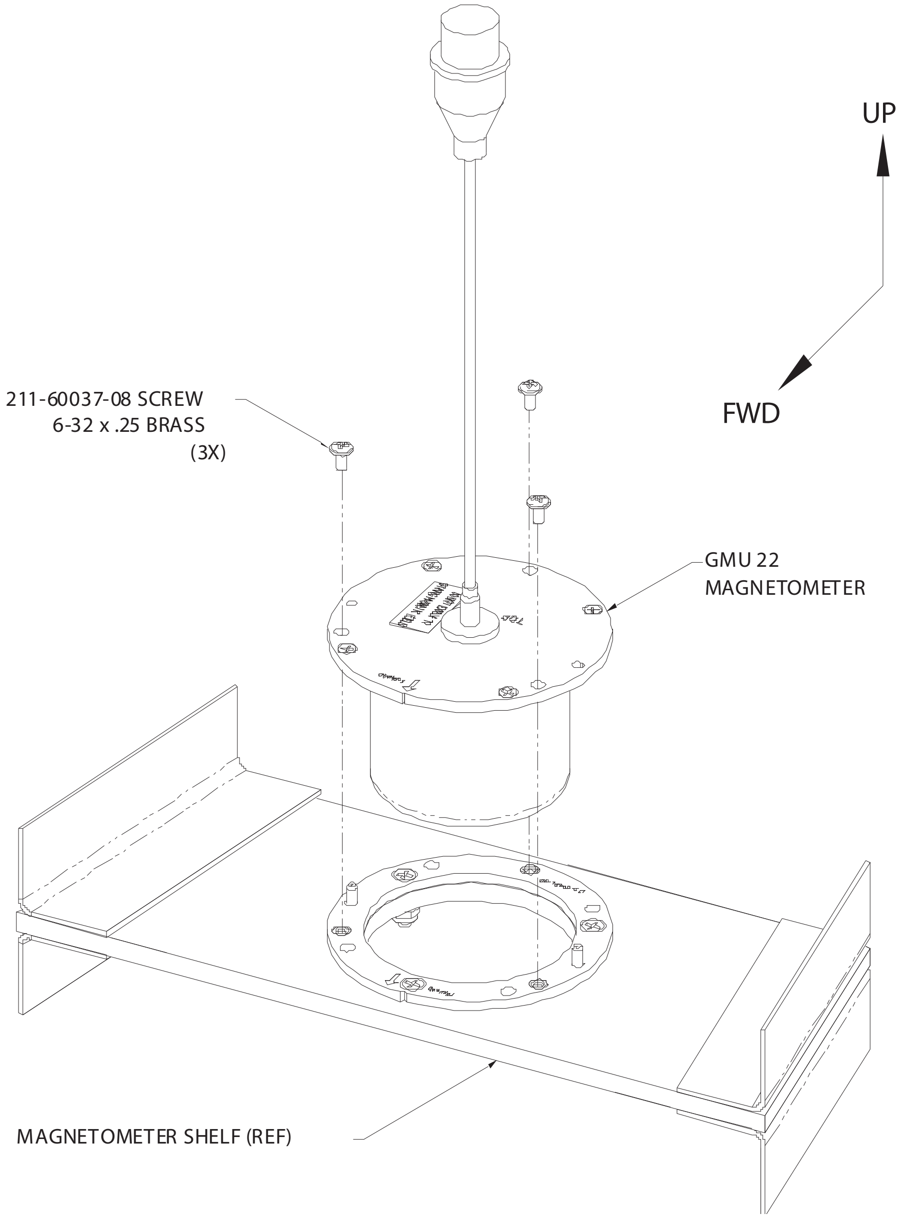


Figure A-28 Installation Of GMU 22 Magnetometer

APPENDIX B OUTLINE & INSTALLATION DRAWINGS

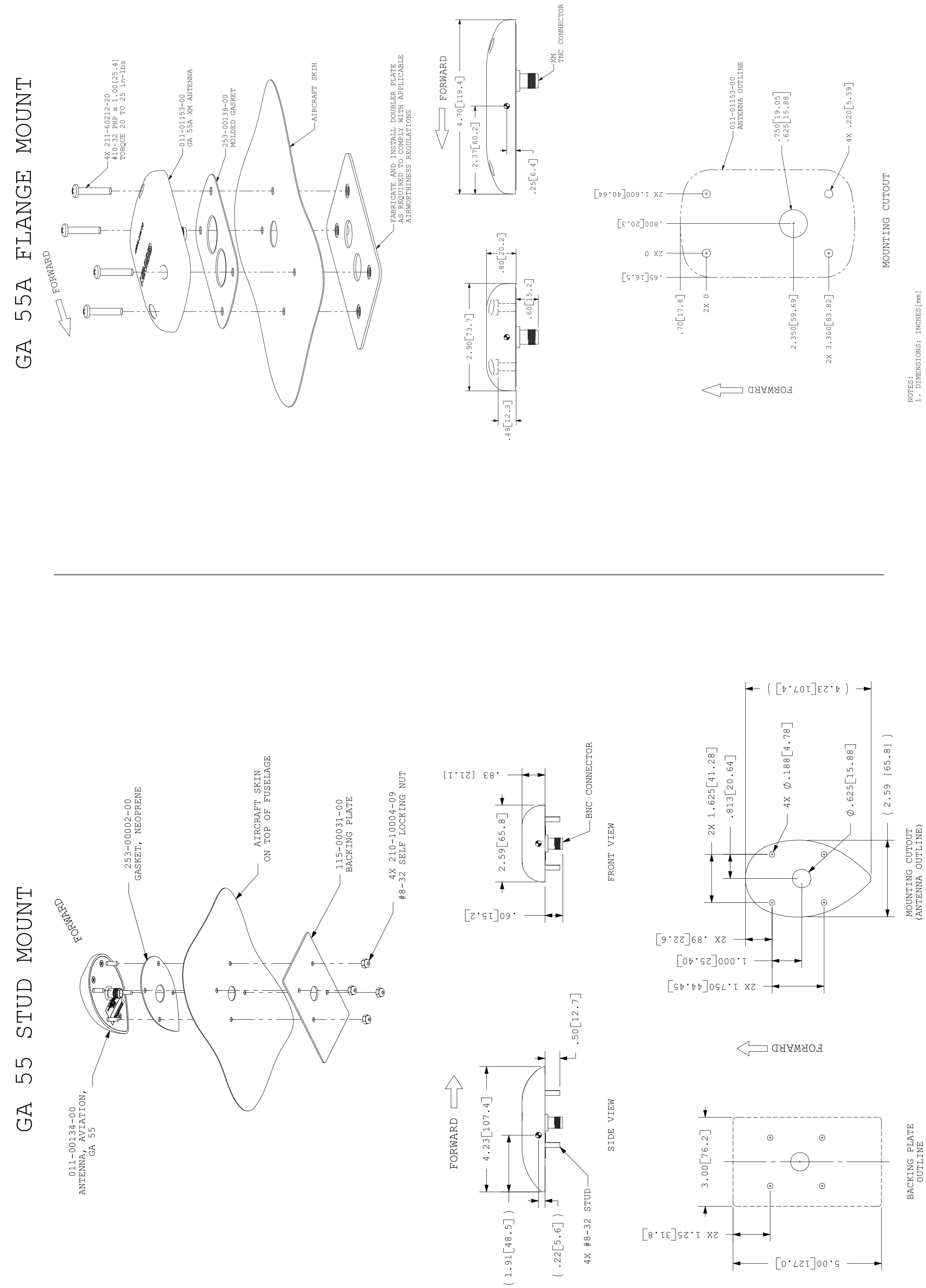


Figure B-1.1 GA 55/55A Installation Drawing

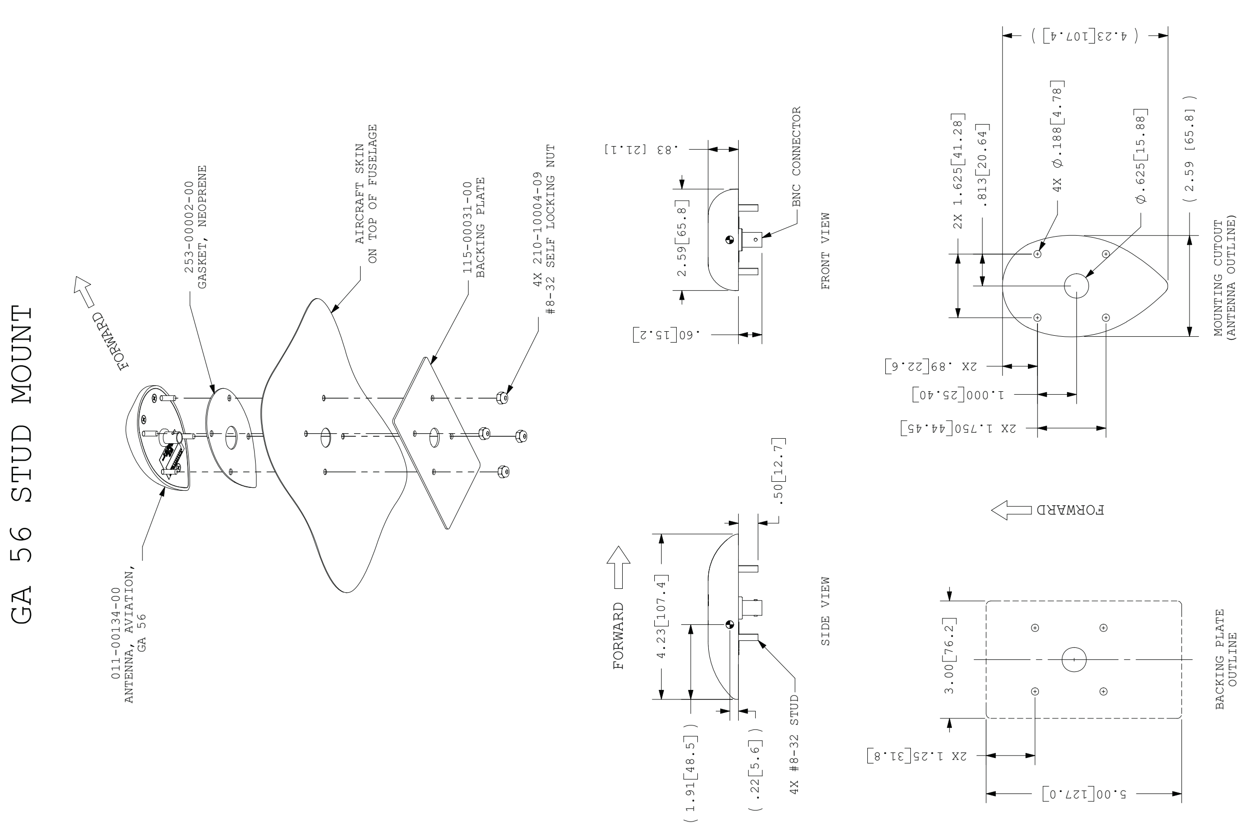


Figure B-1.2 GA 56 Installation Drawing

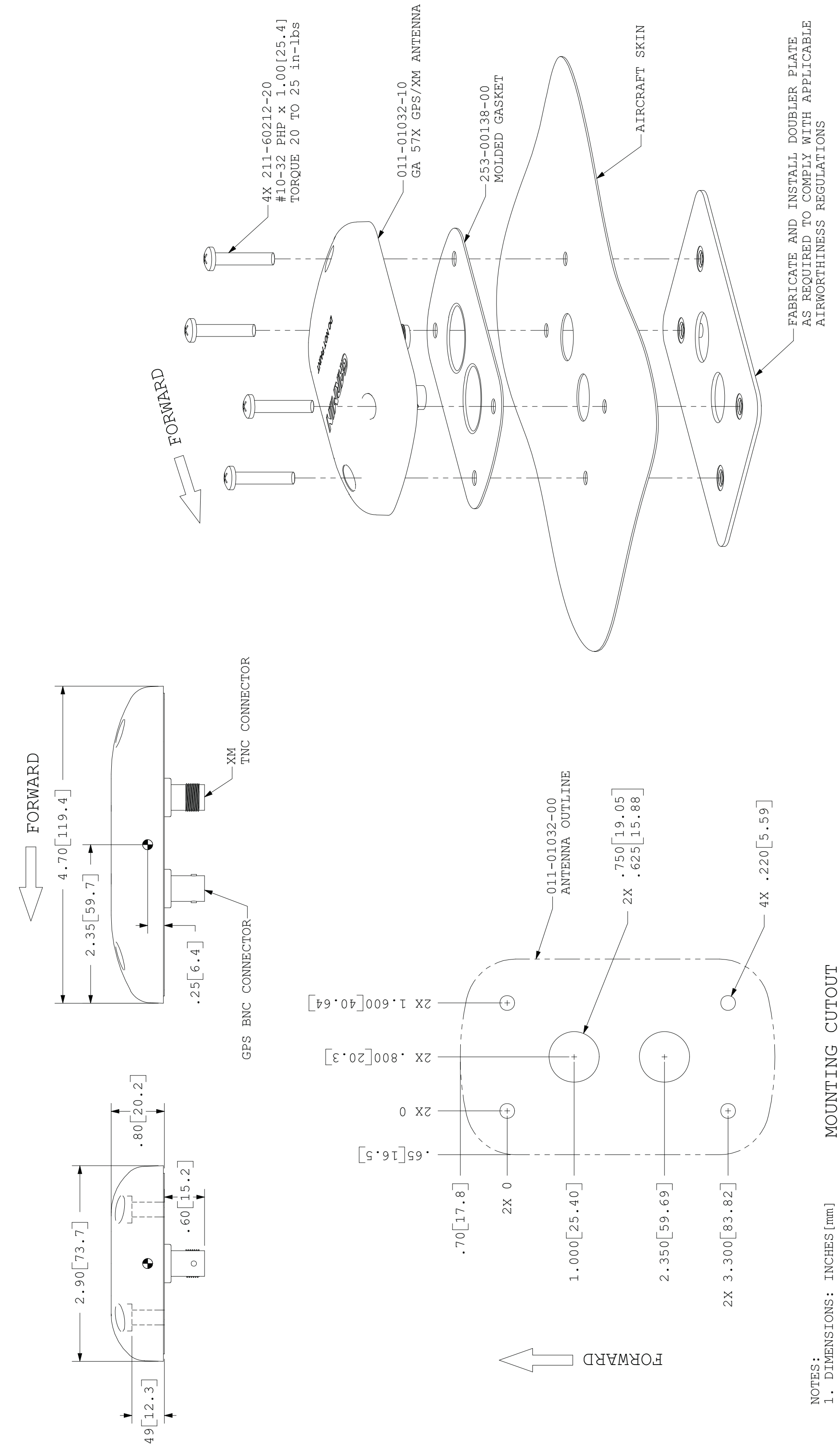


Figure B-1.3 GA 57X Installation Drawing

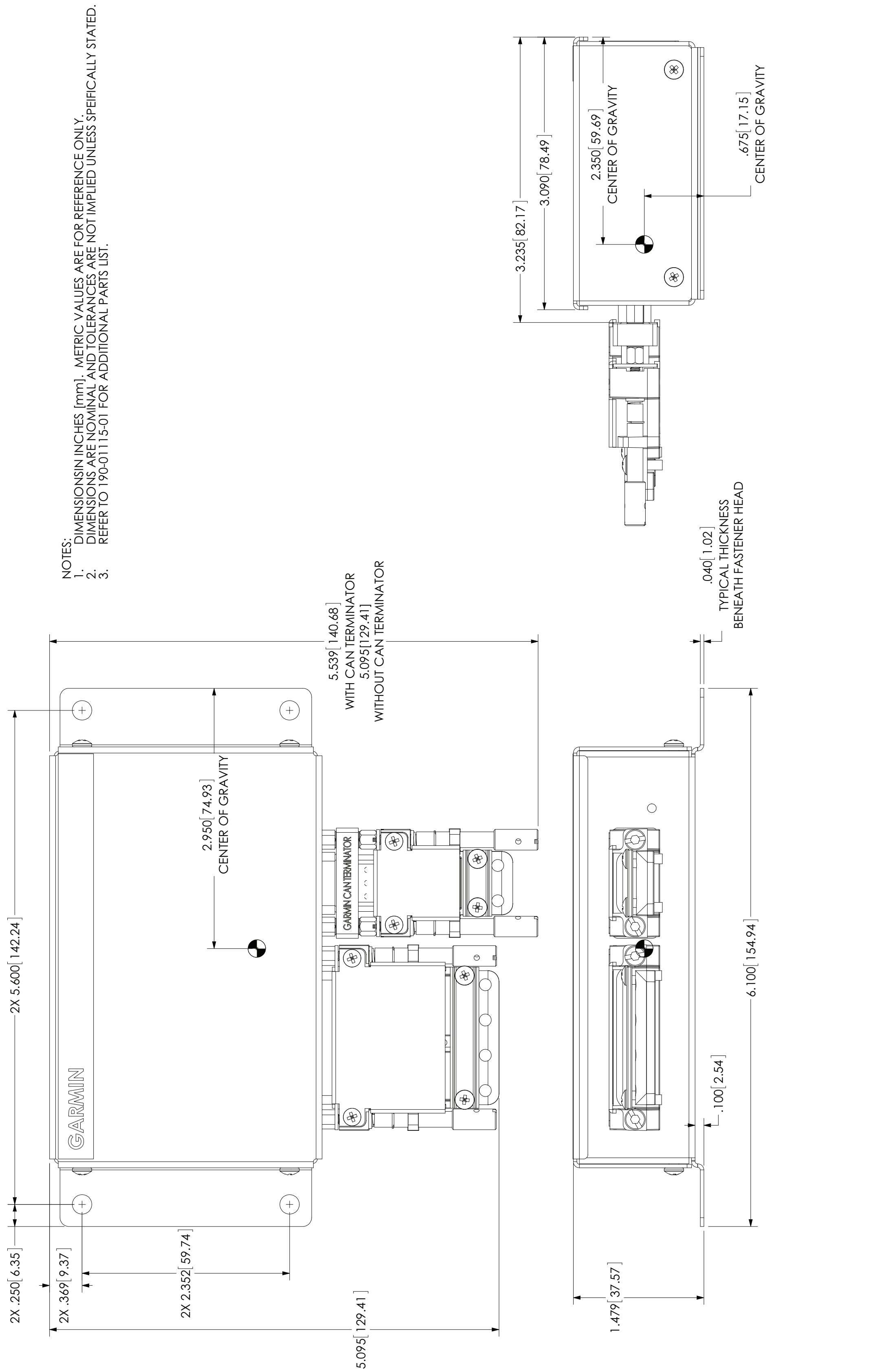


Figure B-2.1 GAD 29 Outline Drawing

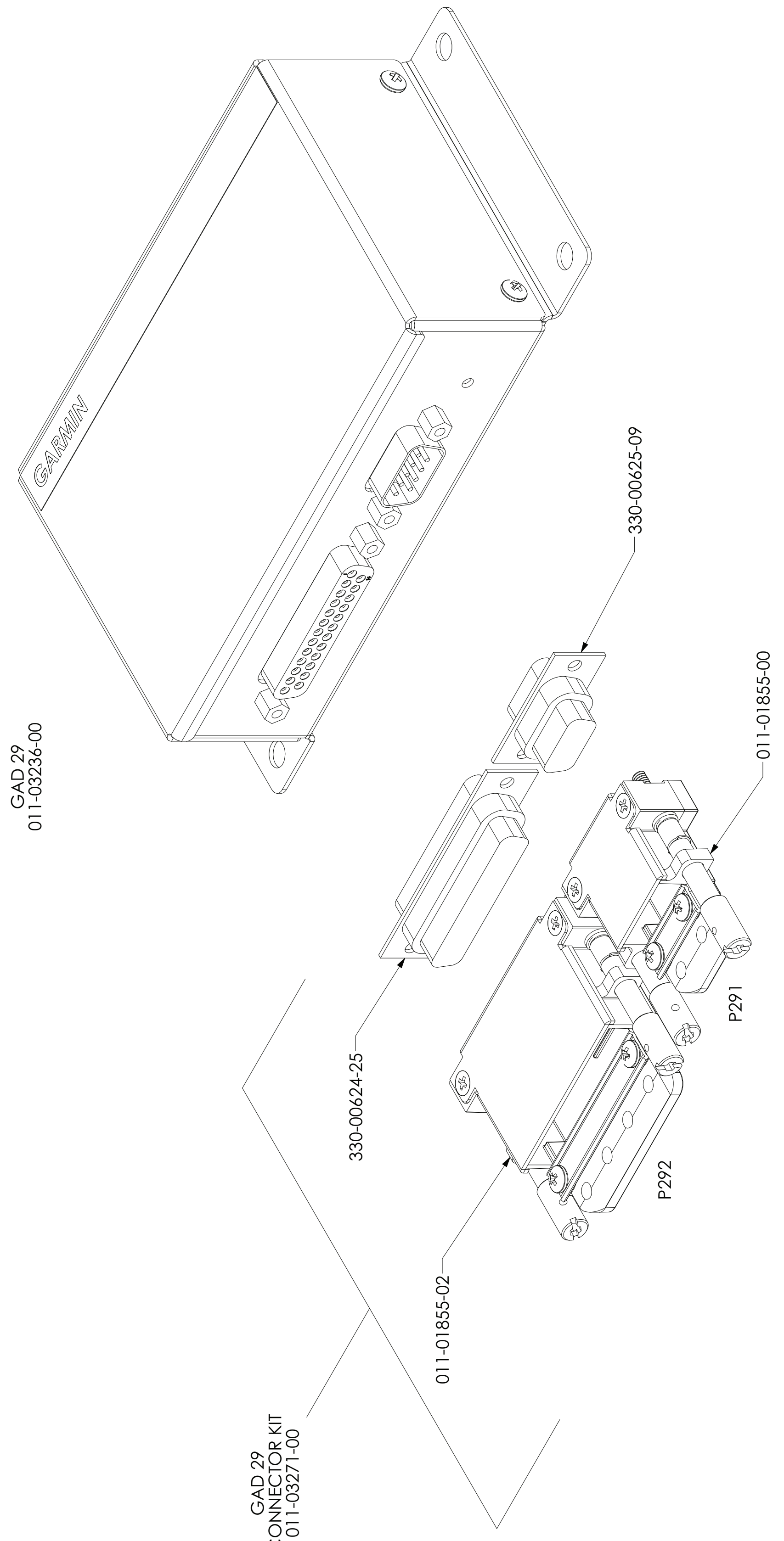


Figure B-2.2 GAD 29 Installation Drawing (no CAN terminator)

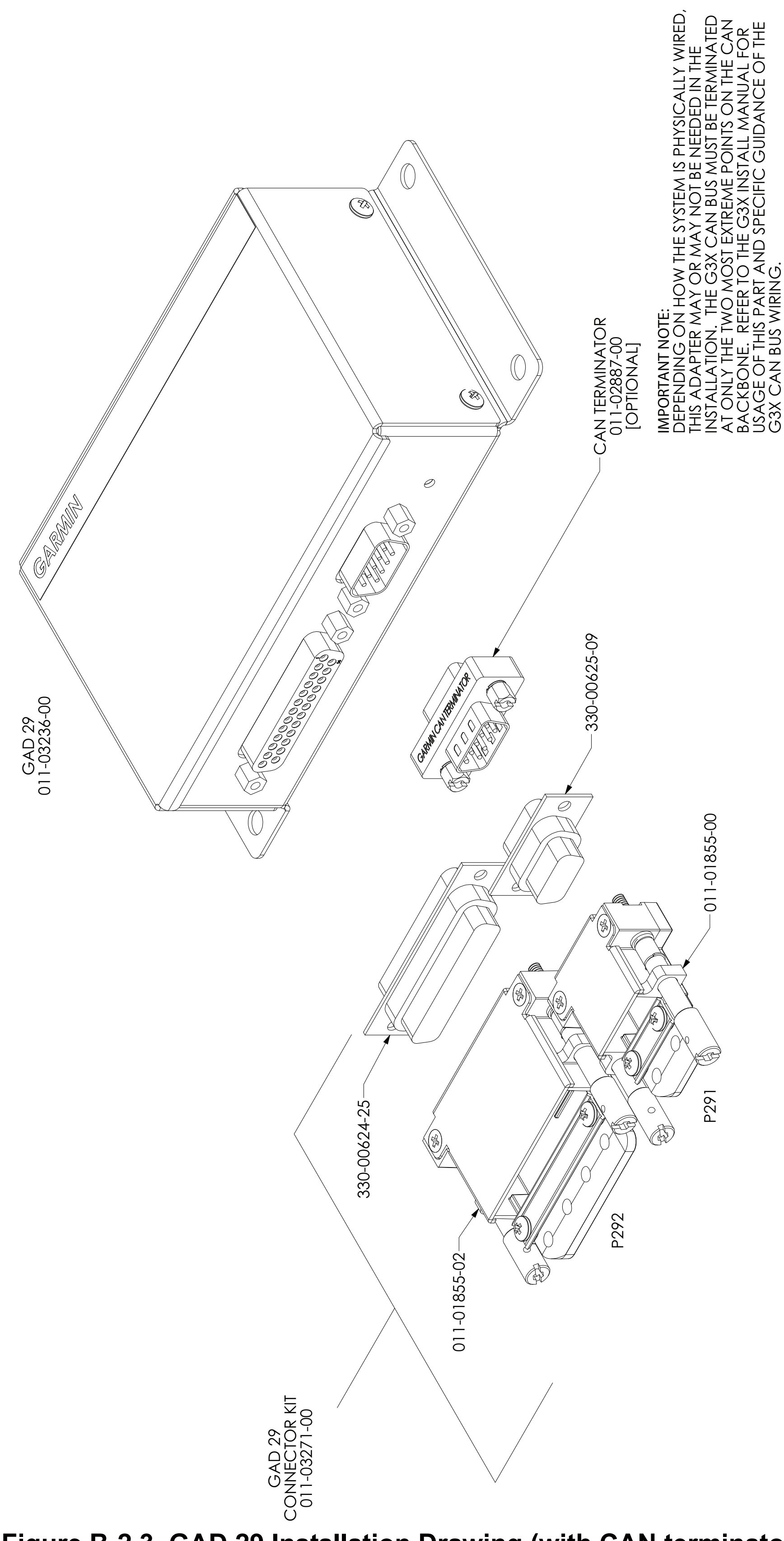


Figure B-2.3 GAD 29 Installation Drawing (with CAN terminator)

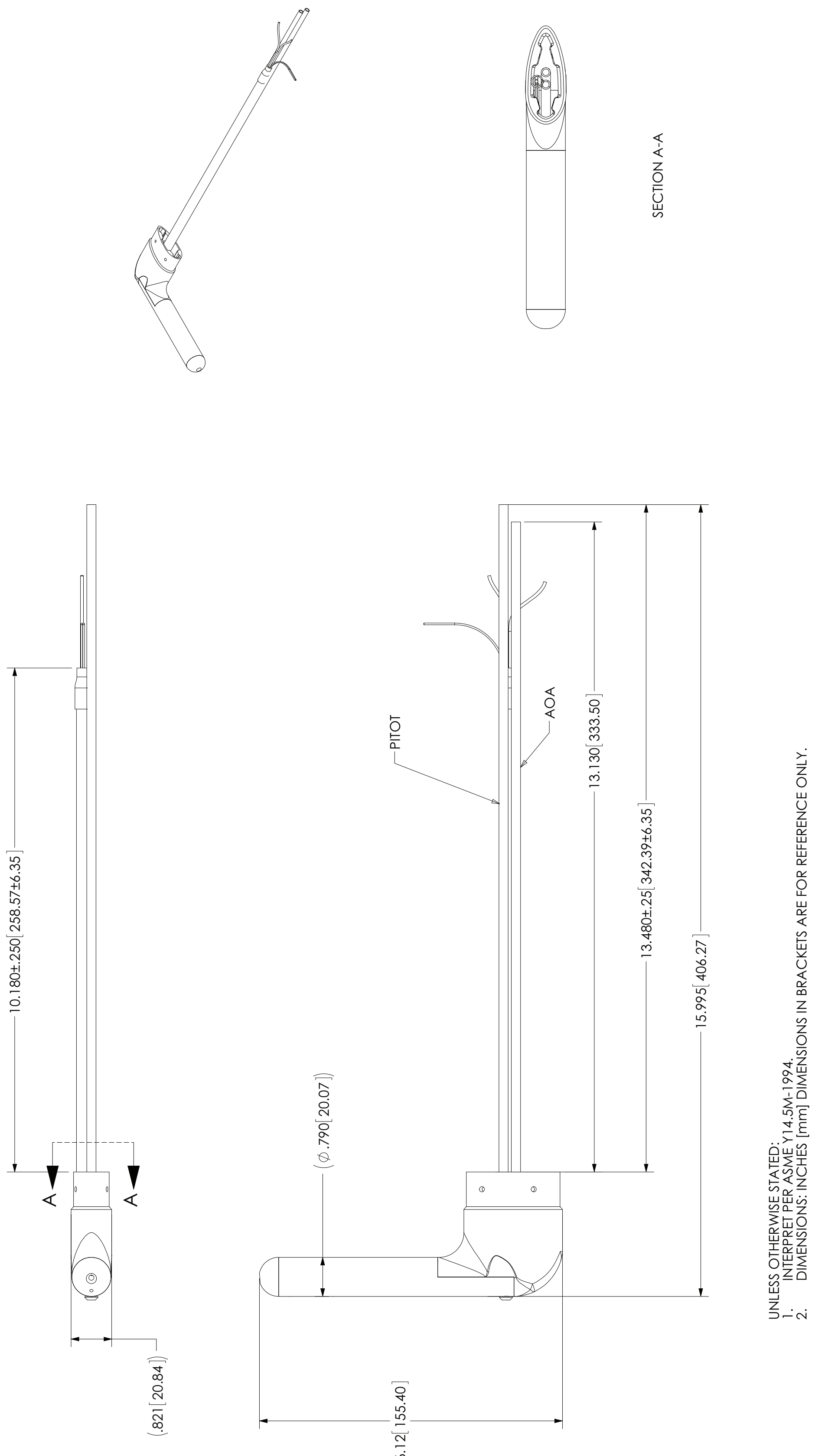


Figure B-3.1 GAP 26 Outline Drawing

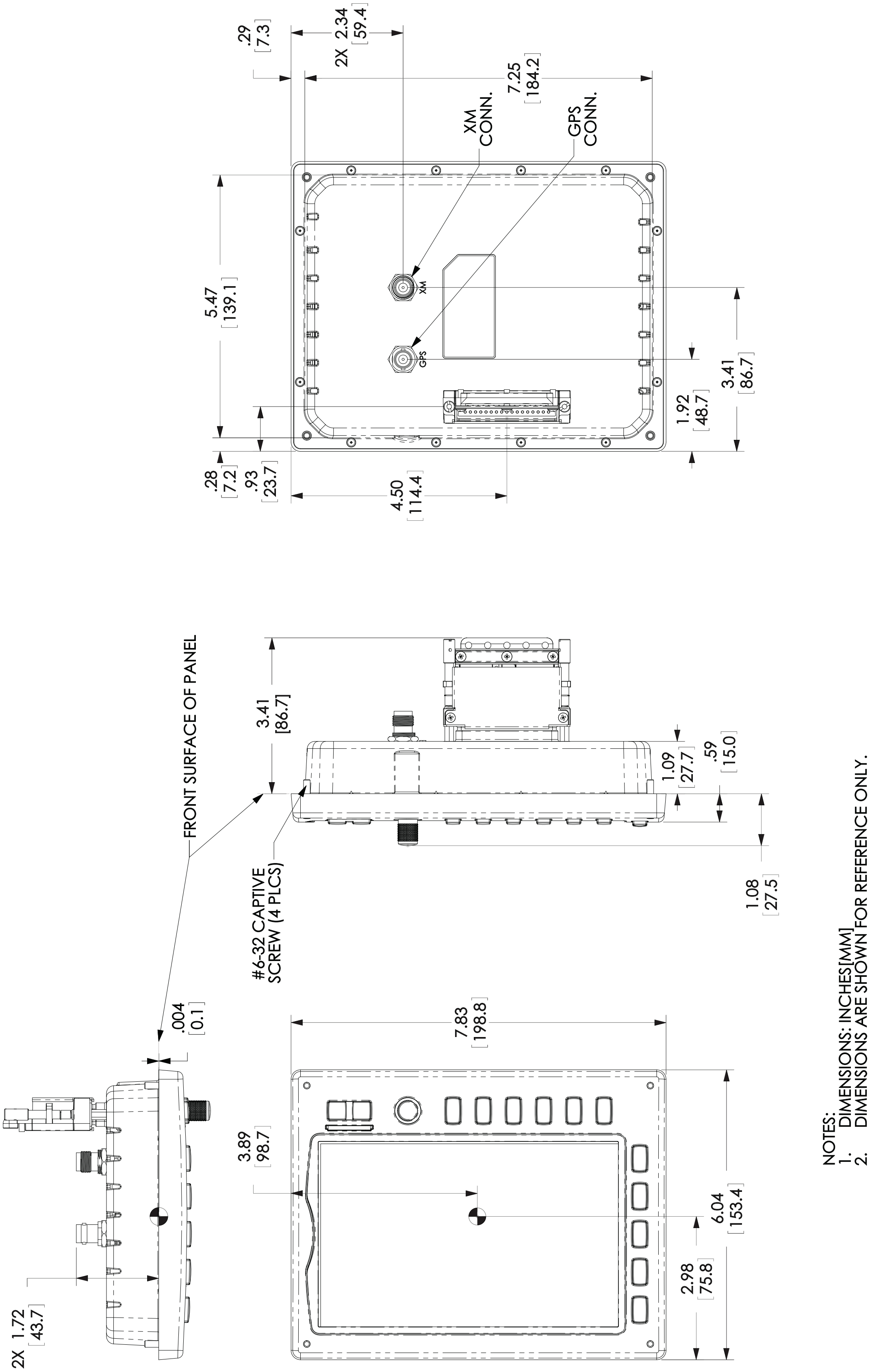


Figure B-4.1 GDU 37X Outline Drawing

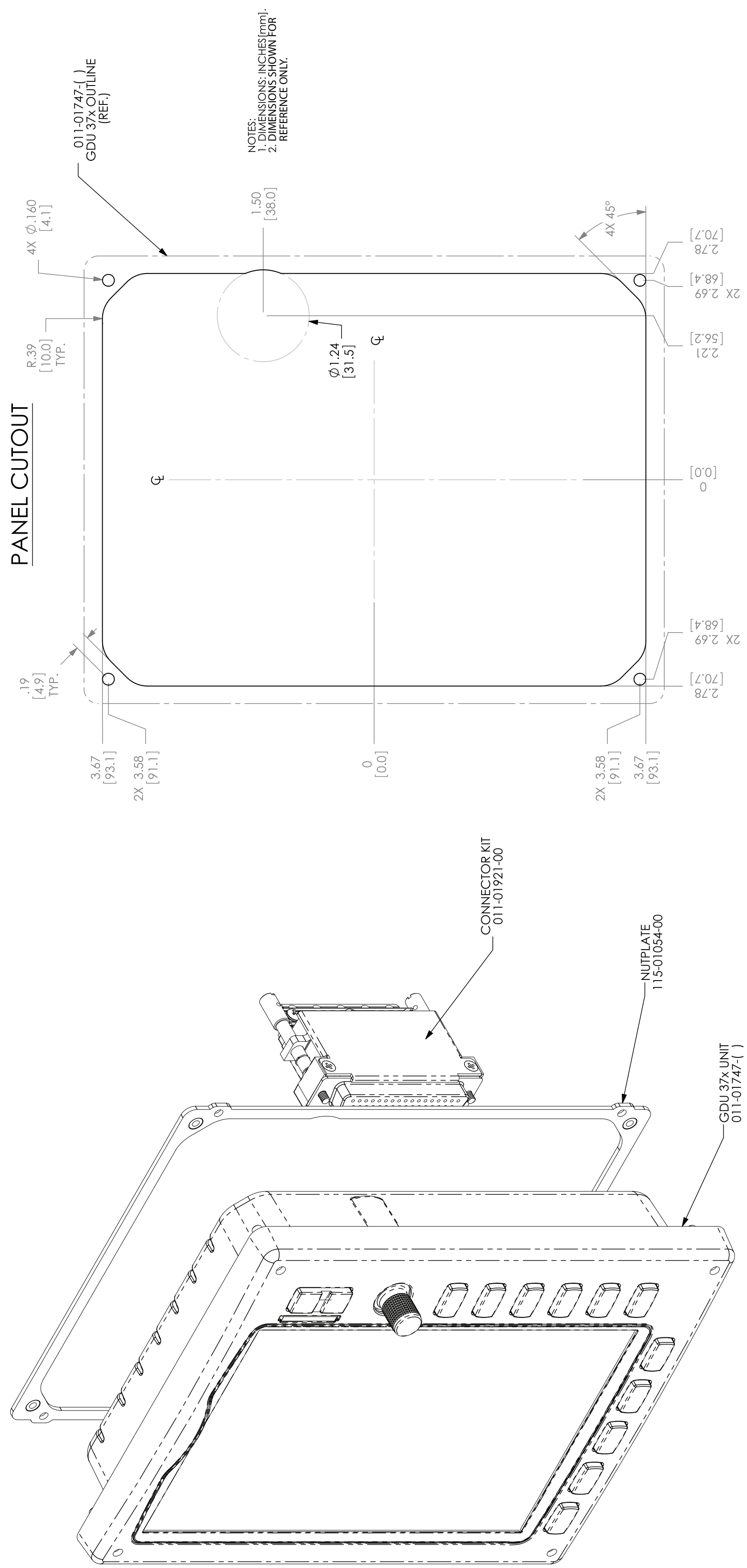


Figure B-4.2 GDU 37X Outline Drawing

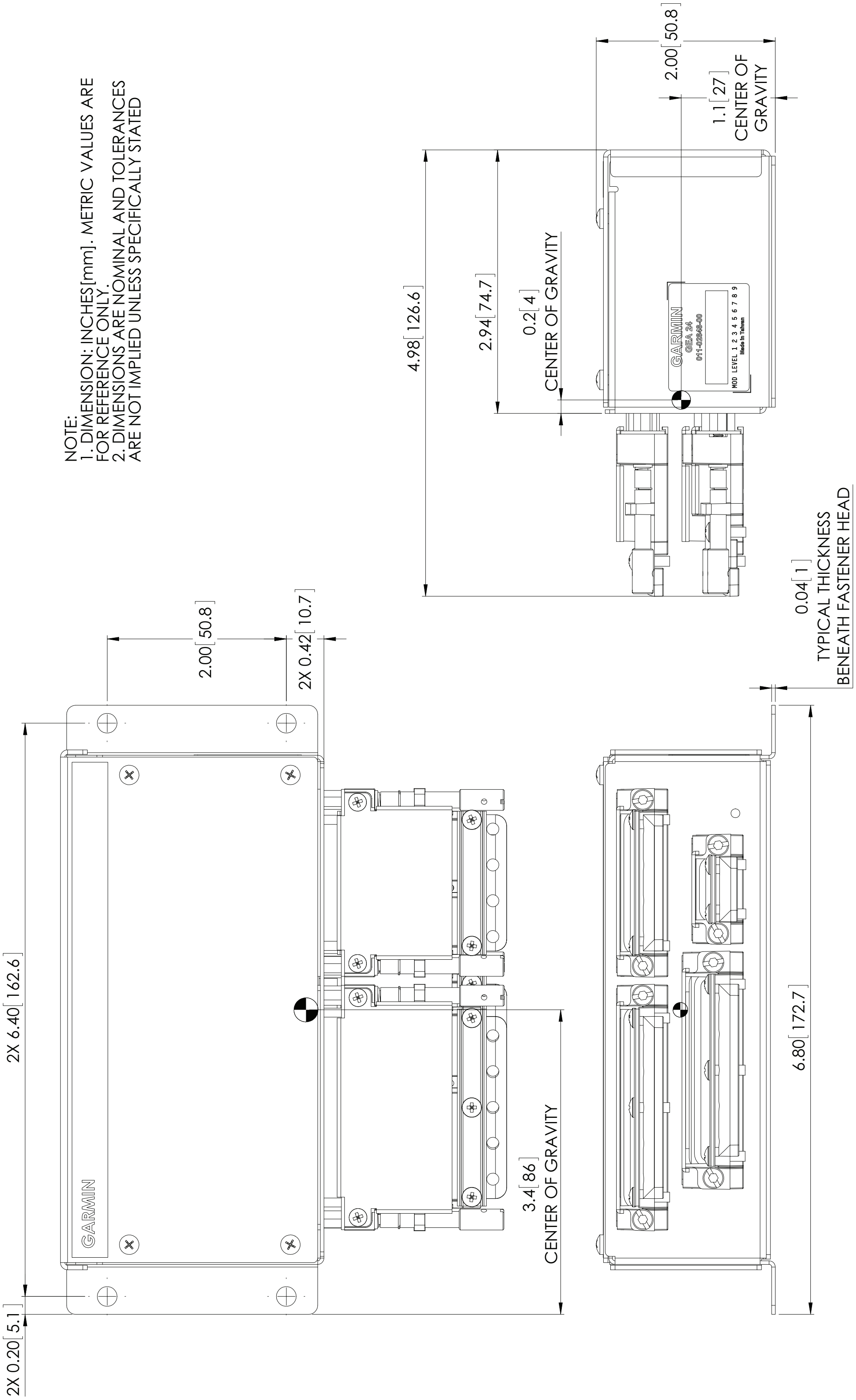


Figure B-5.1 GEA 24 Outline Drawing

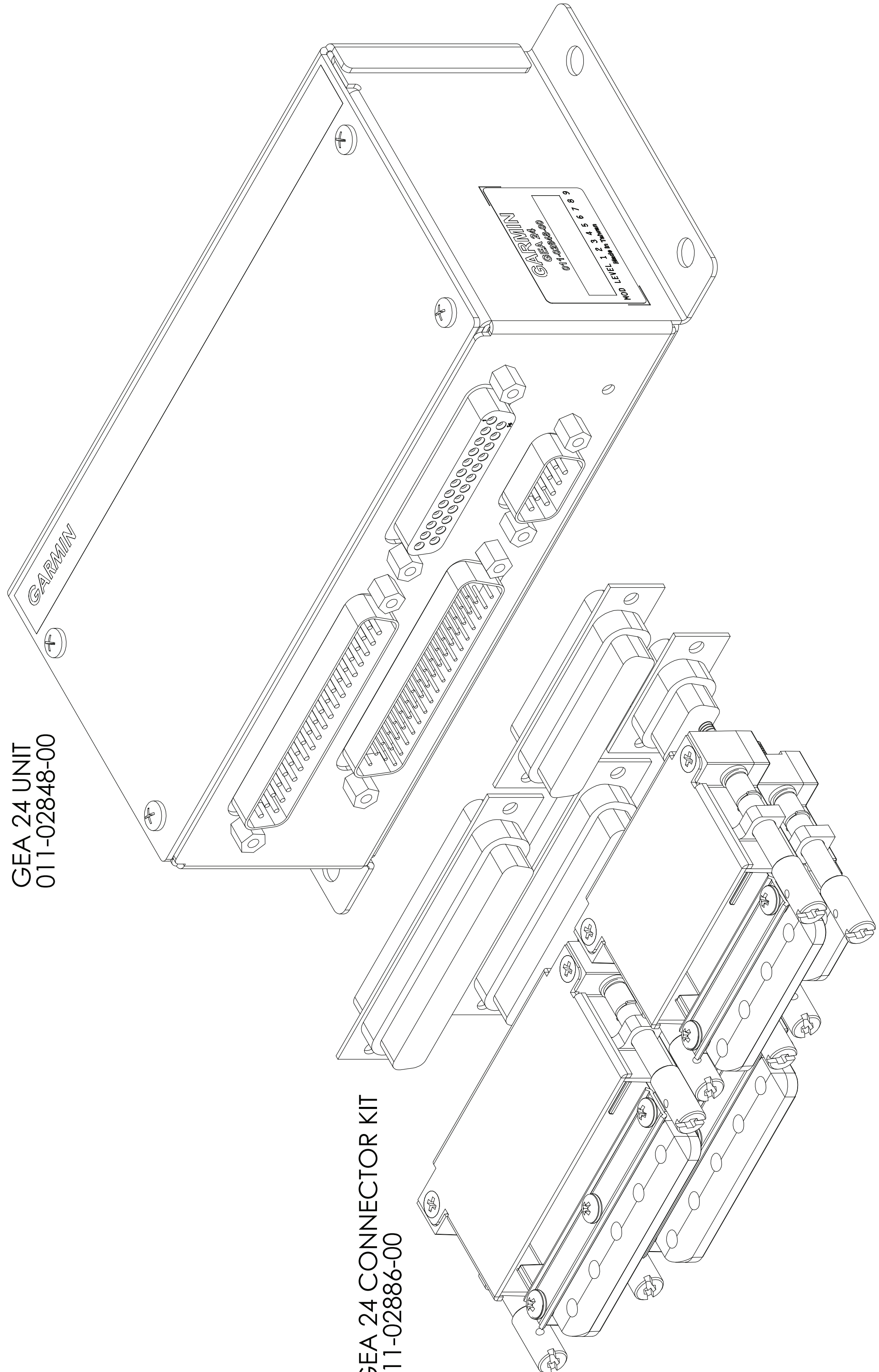


Figure B-5.2 GEA 24 Assembly Drawing (no CAN terminator)

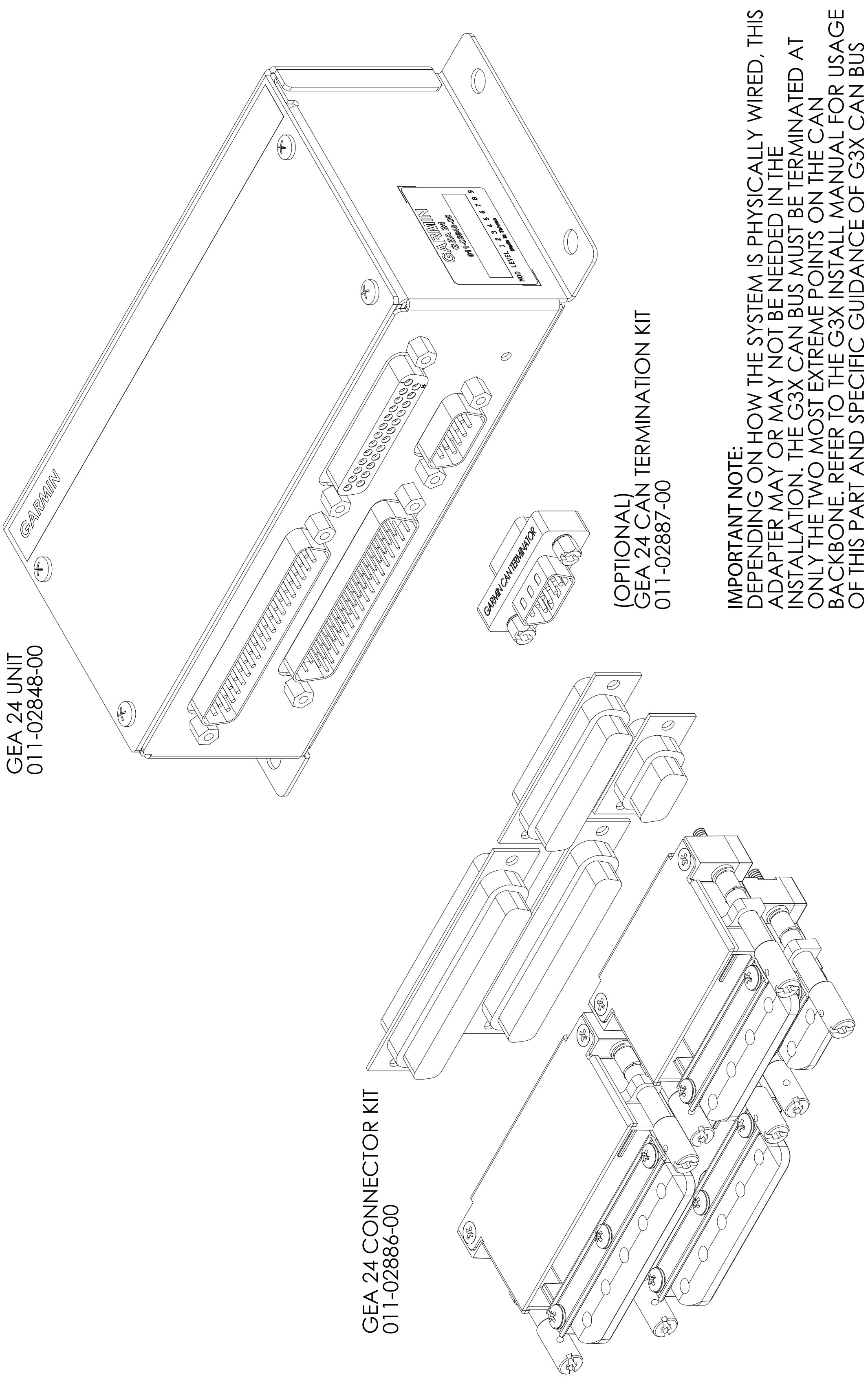


Figure B-5.3 GEA 24 Assembly Drawing (with CAN terminator)

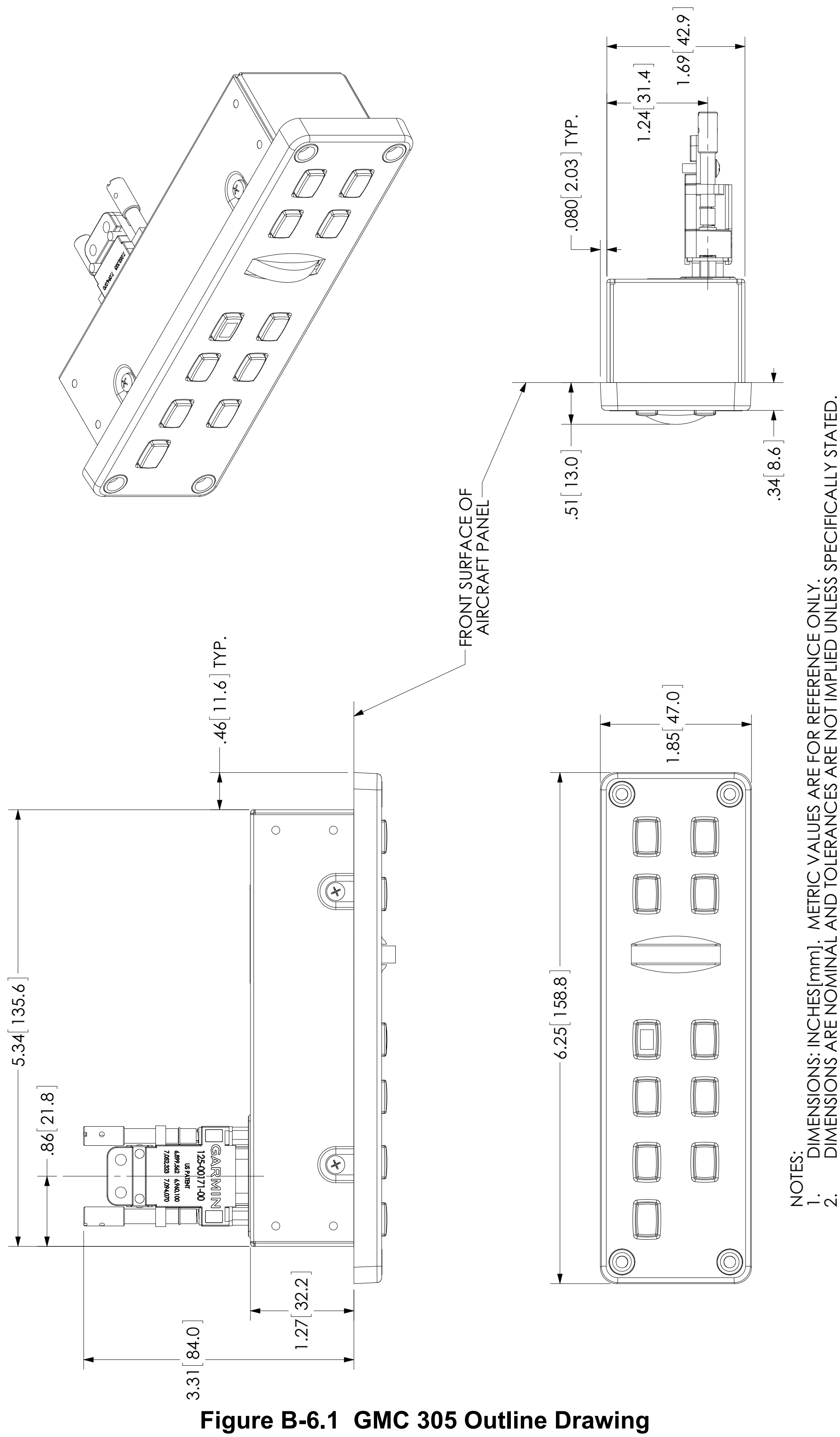


Figure B-6.1 GMC 305 Outline Drawing

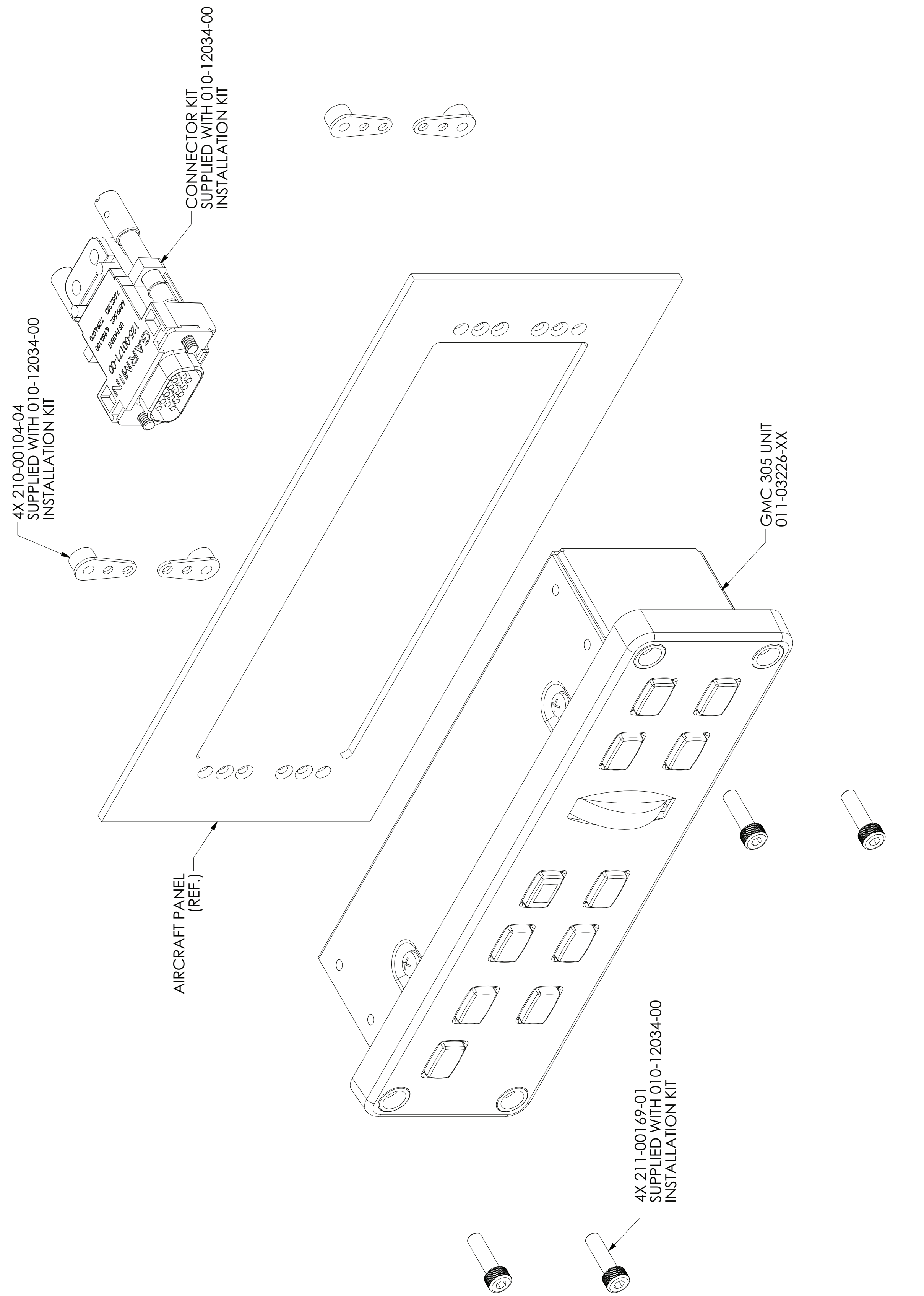


Figure B-6.2 GMC 305 Installation Drawing

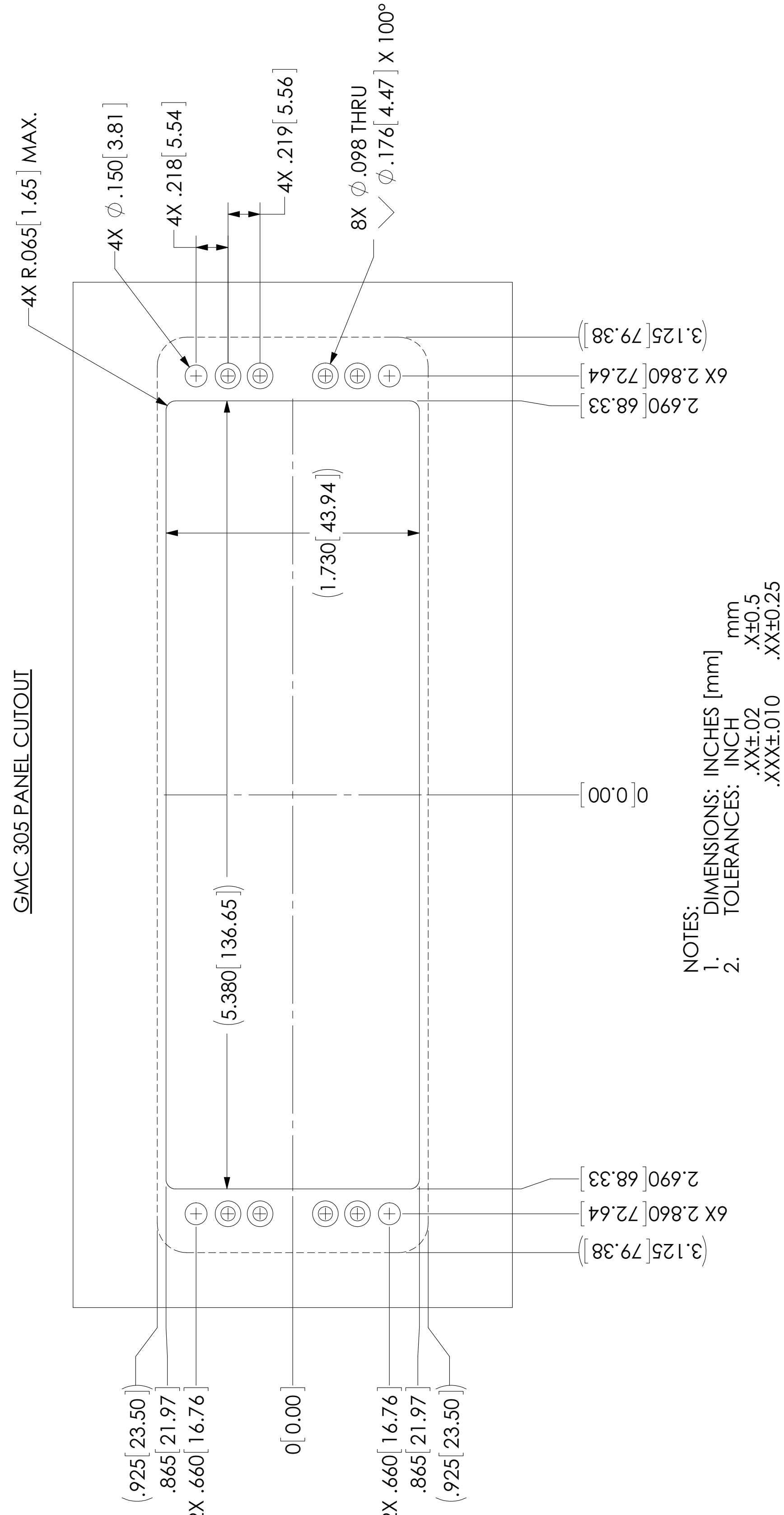


Figure B-6.3 GMC 305 Cutout Drawing (Not to Scale)

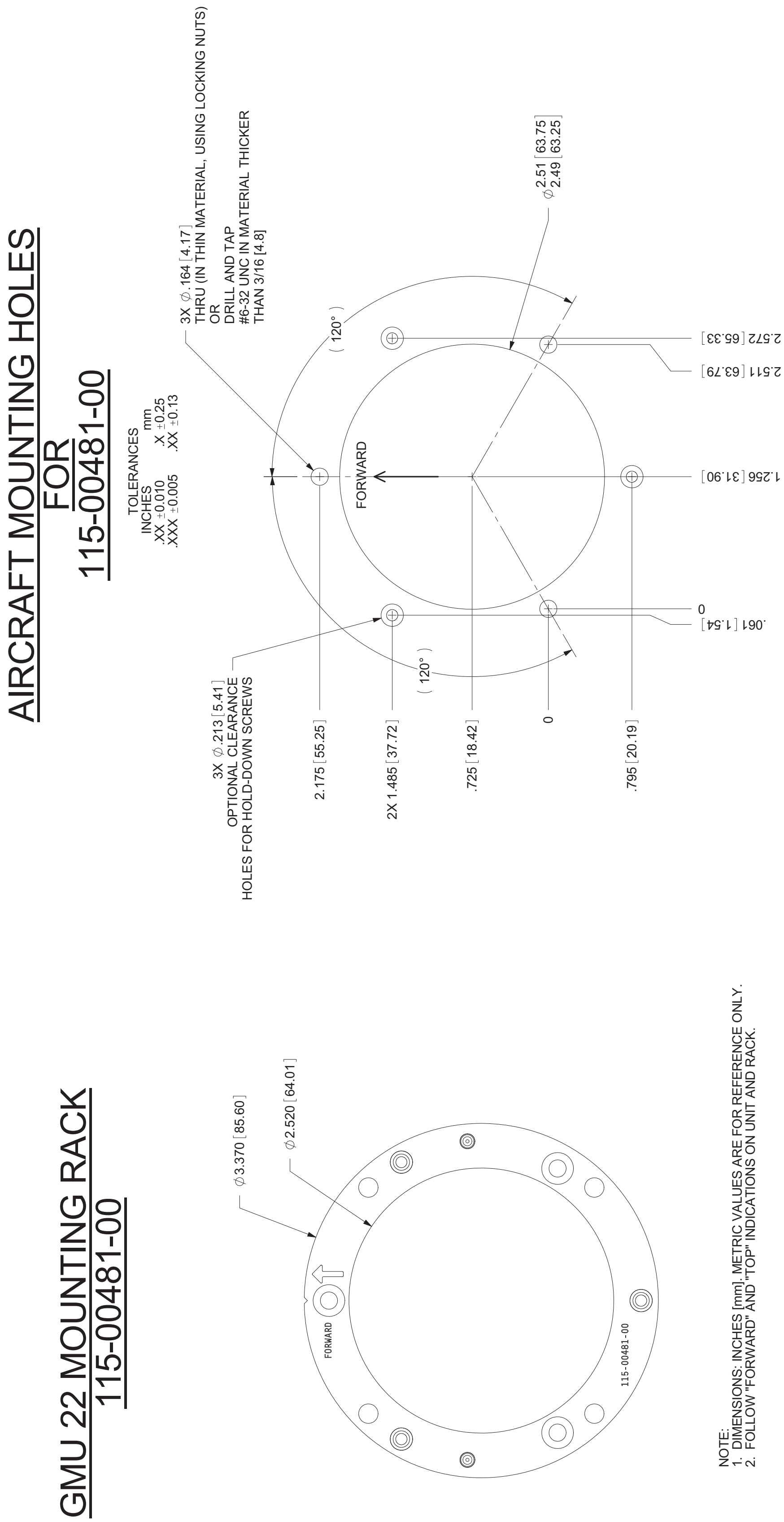


Figure B-7.1 GMU 22 Mounting Rack

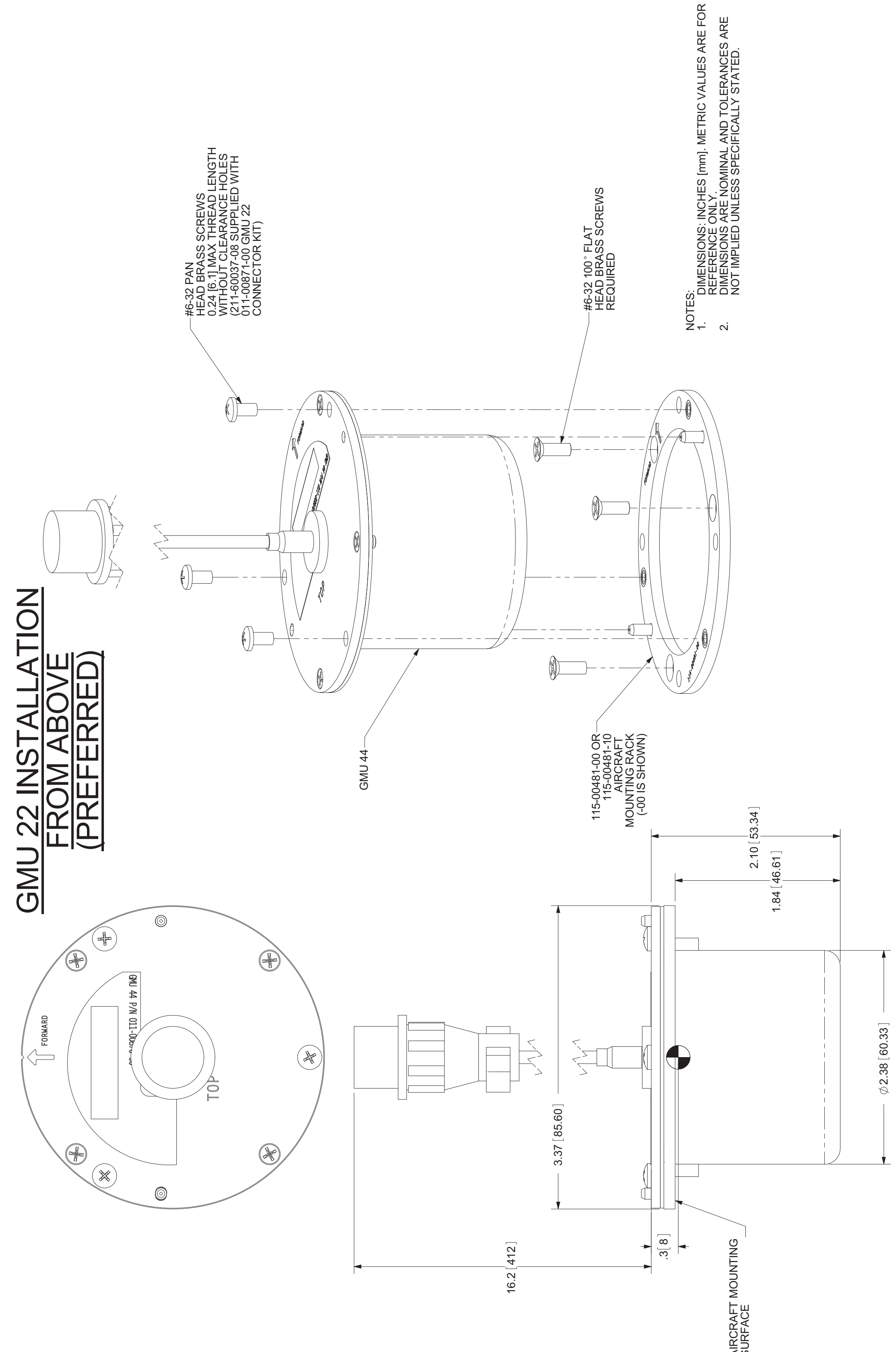


Figure B-7.2 GMU 22 Top Mounted Installation

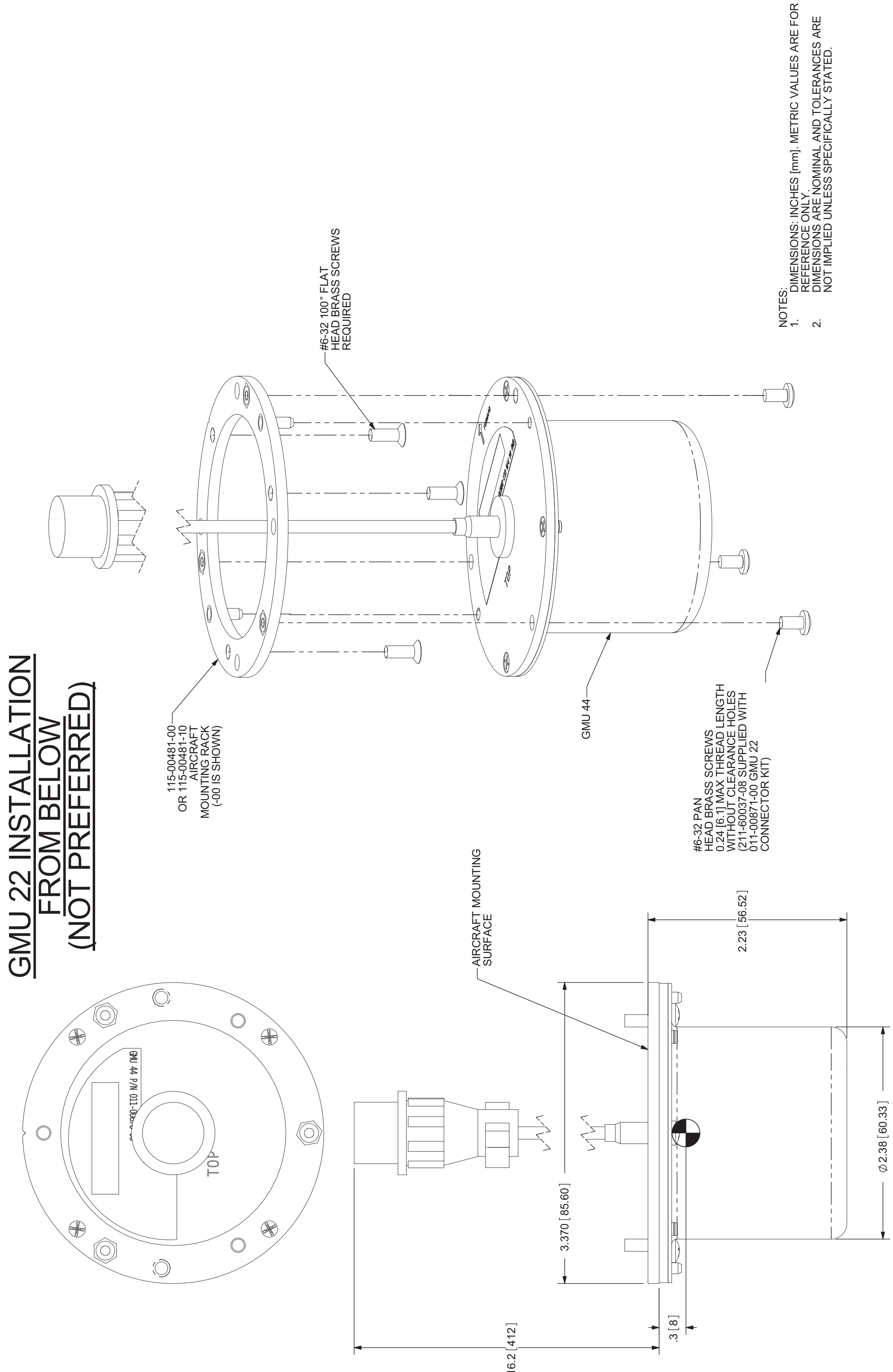


Figure B-7.3 GMU 22 Bottom Mounted Installation

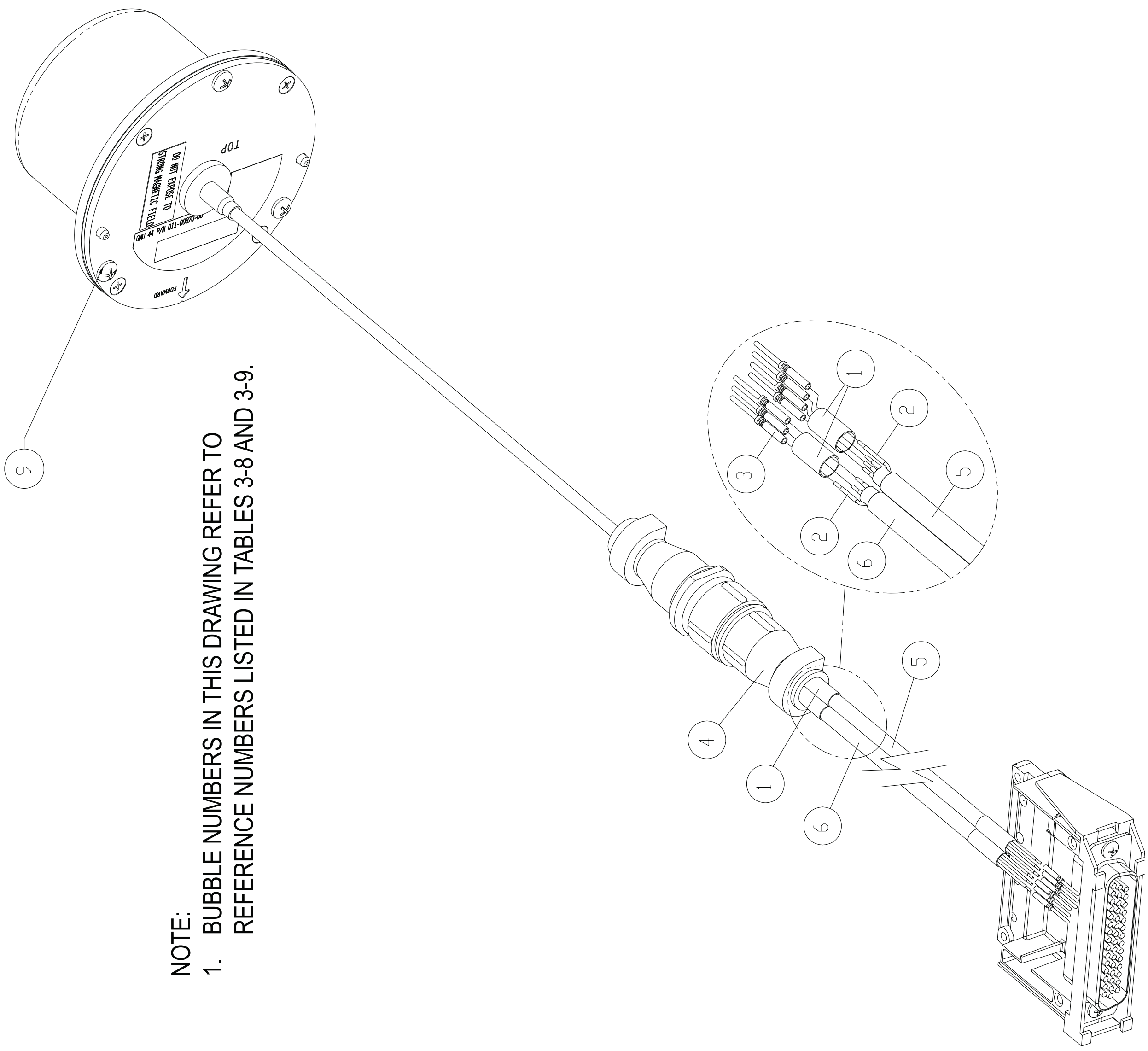


Figure B-7.4 GMU 22 Wiring Details

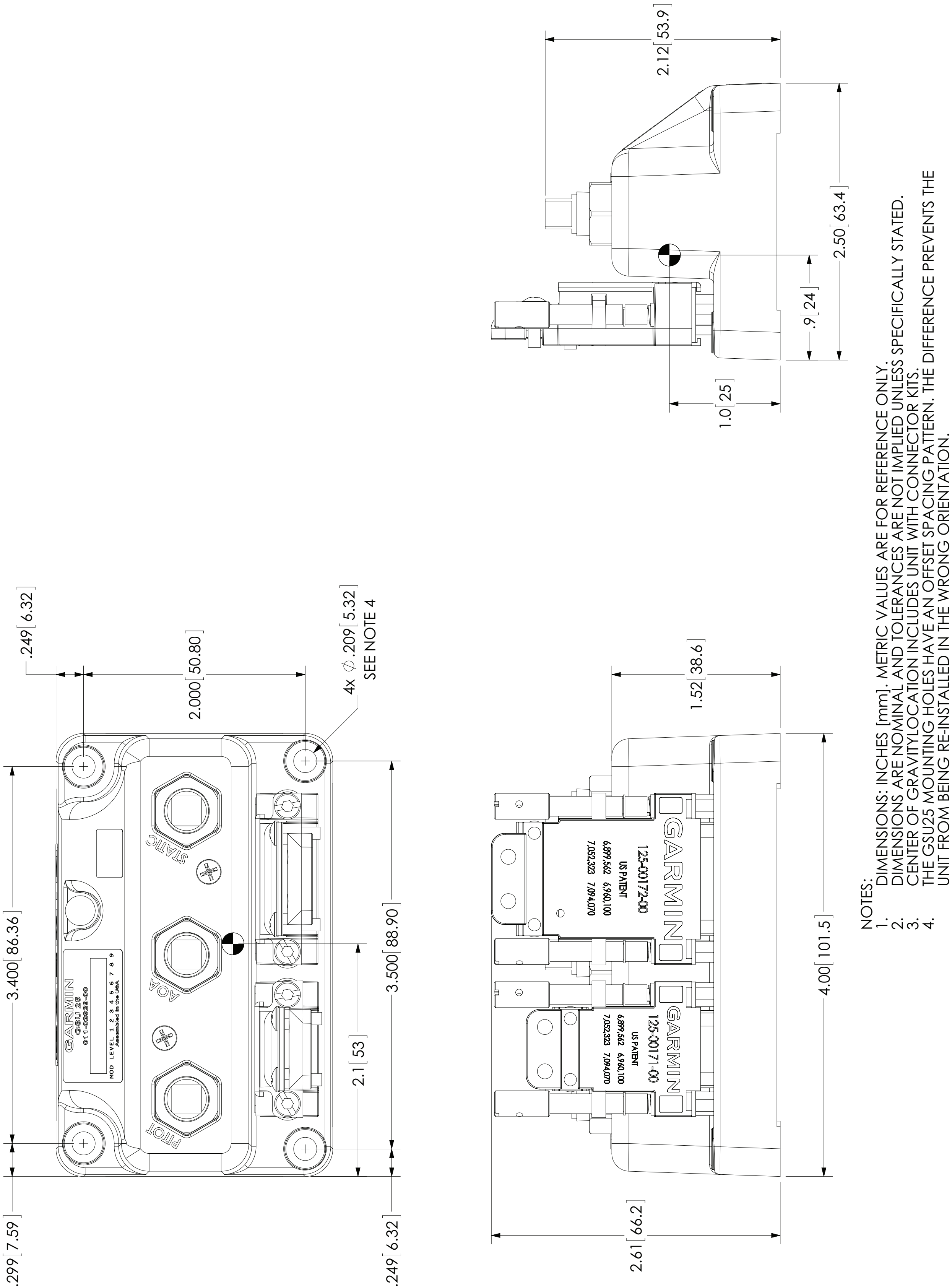


Figure B-8.1 GSU 25 Outline Drawing

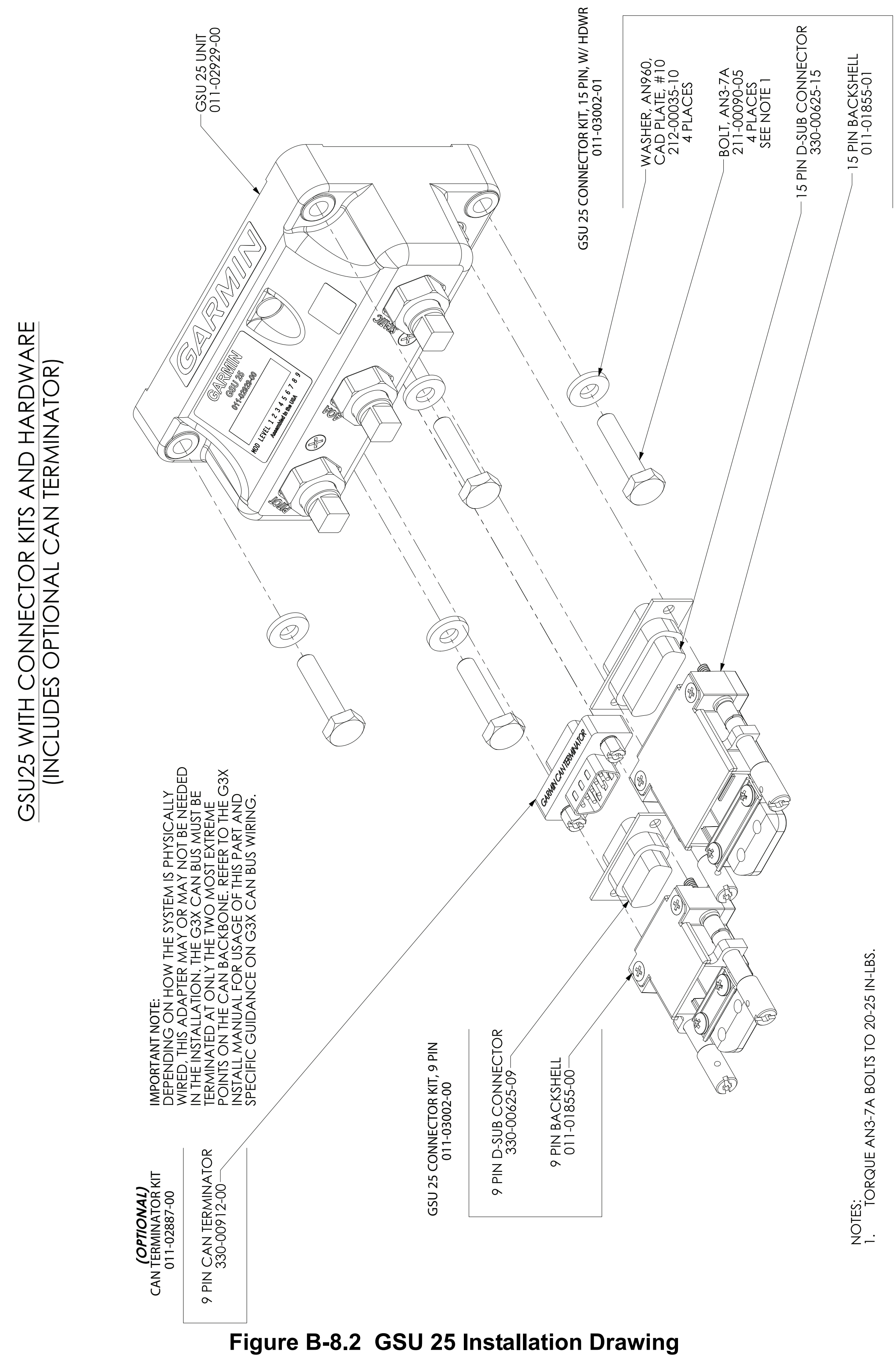


Figure B-8.2 GSU 25 Installation Drawing

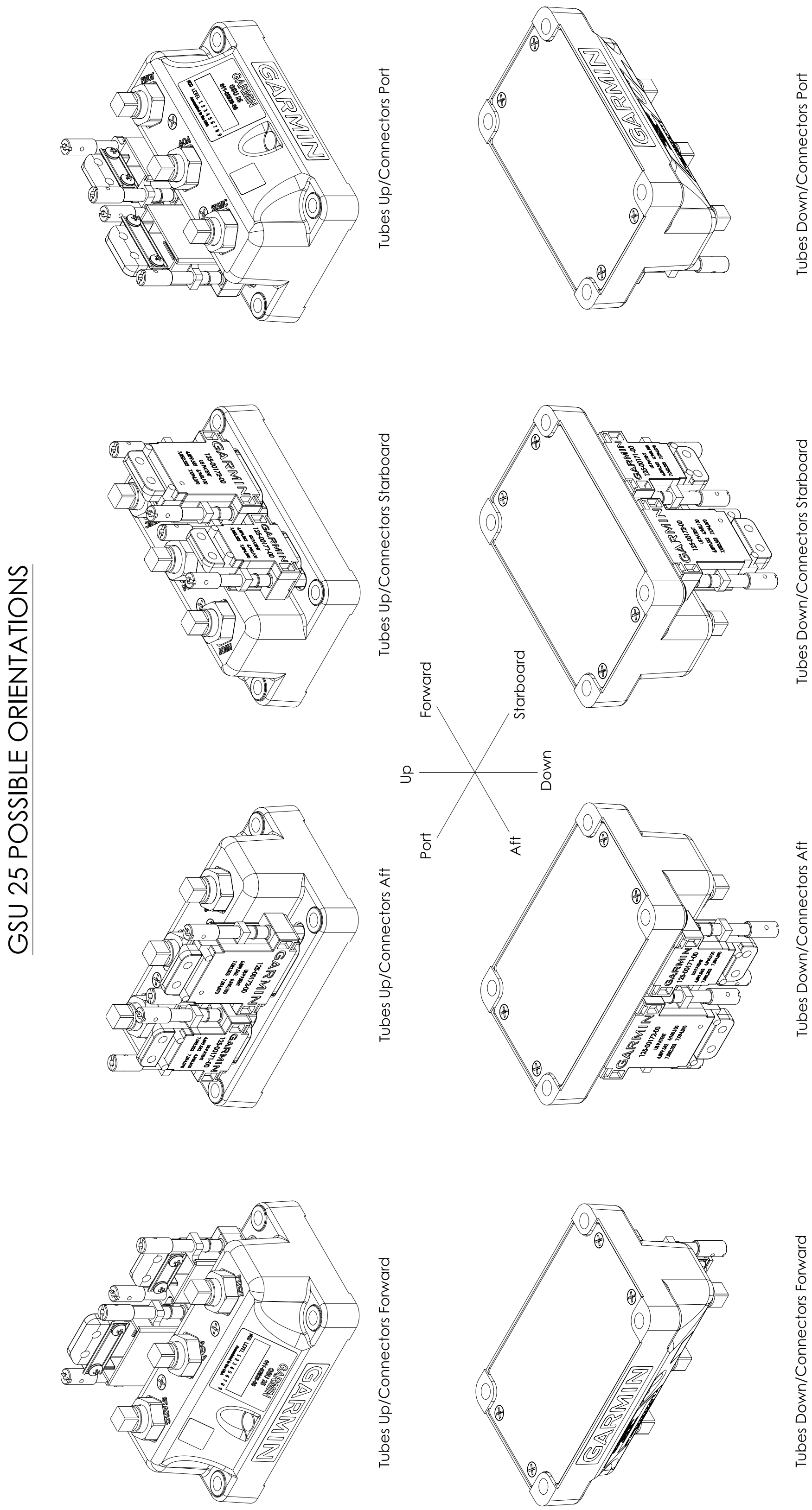


Figure B-8.3 GSU 25 Orientation Drawings (page 1 of 2)

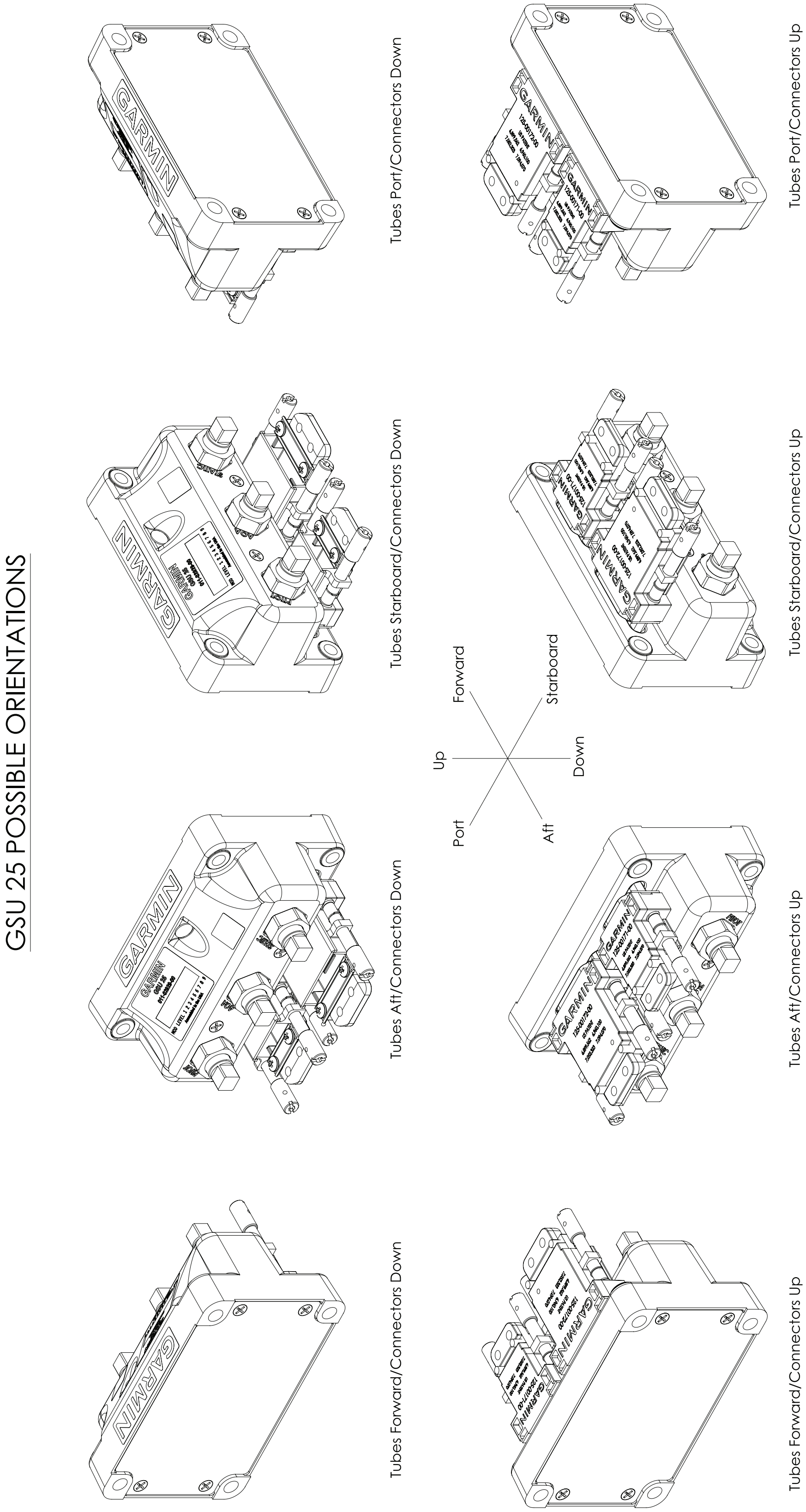


Figure B-8.4 GSU 25 Orientation Drawings (page 2 of 2)

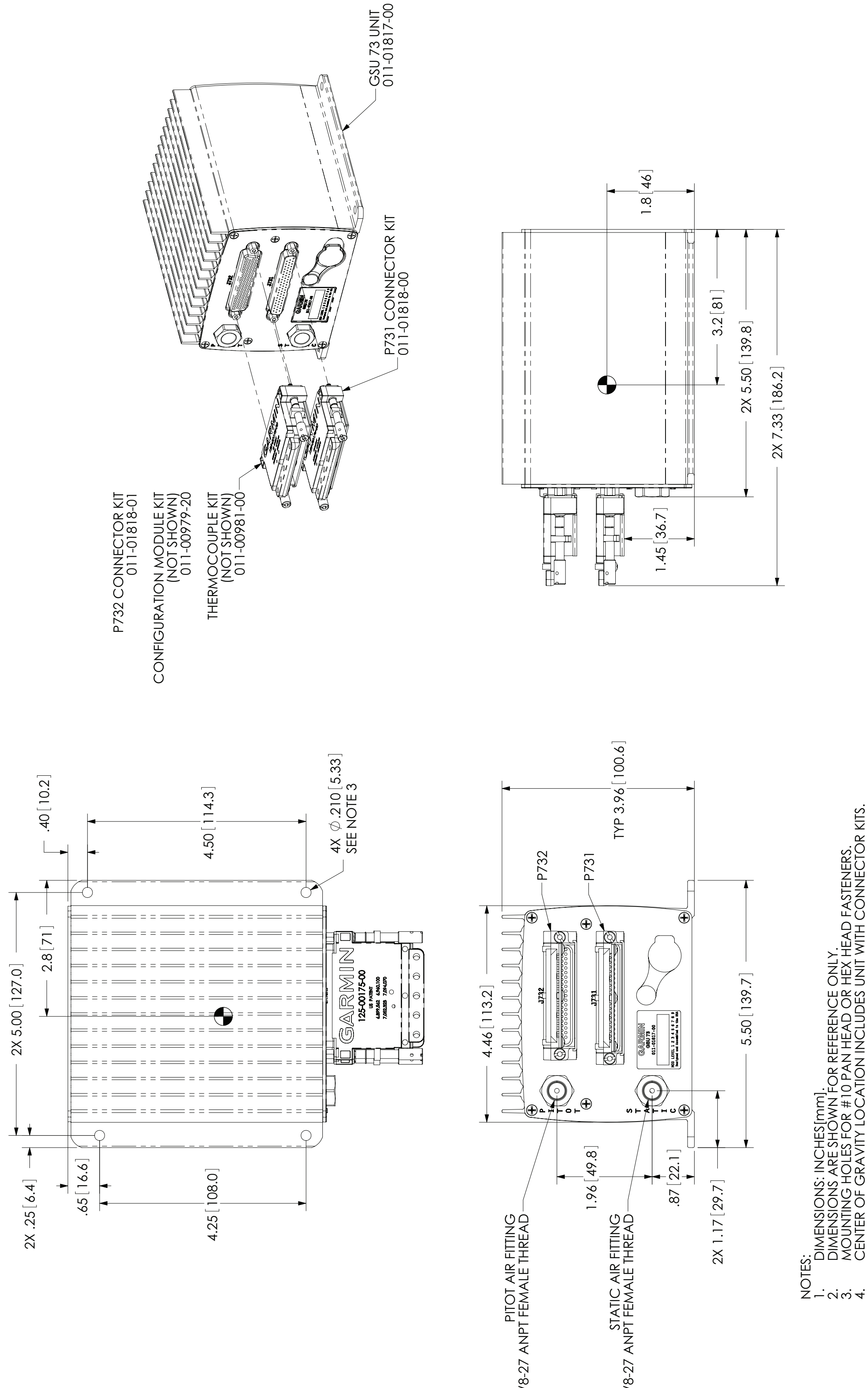


Figure B-9.1 GSU 73 Outline Drawing

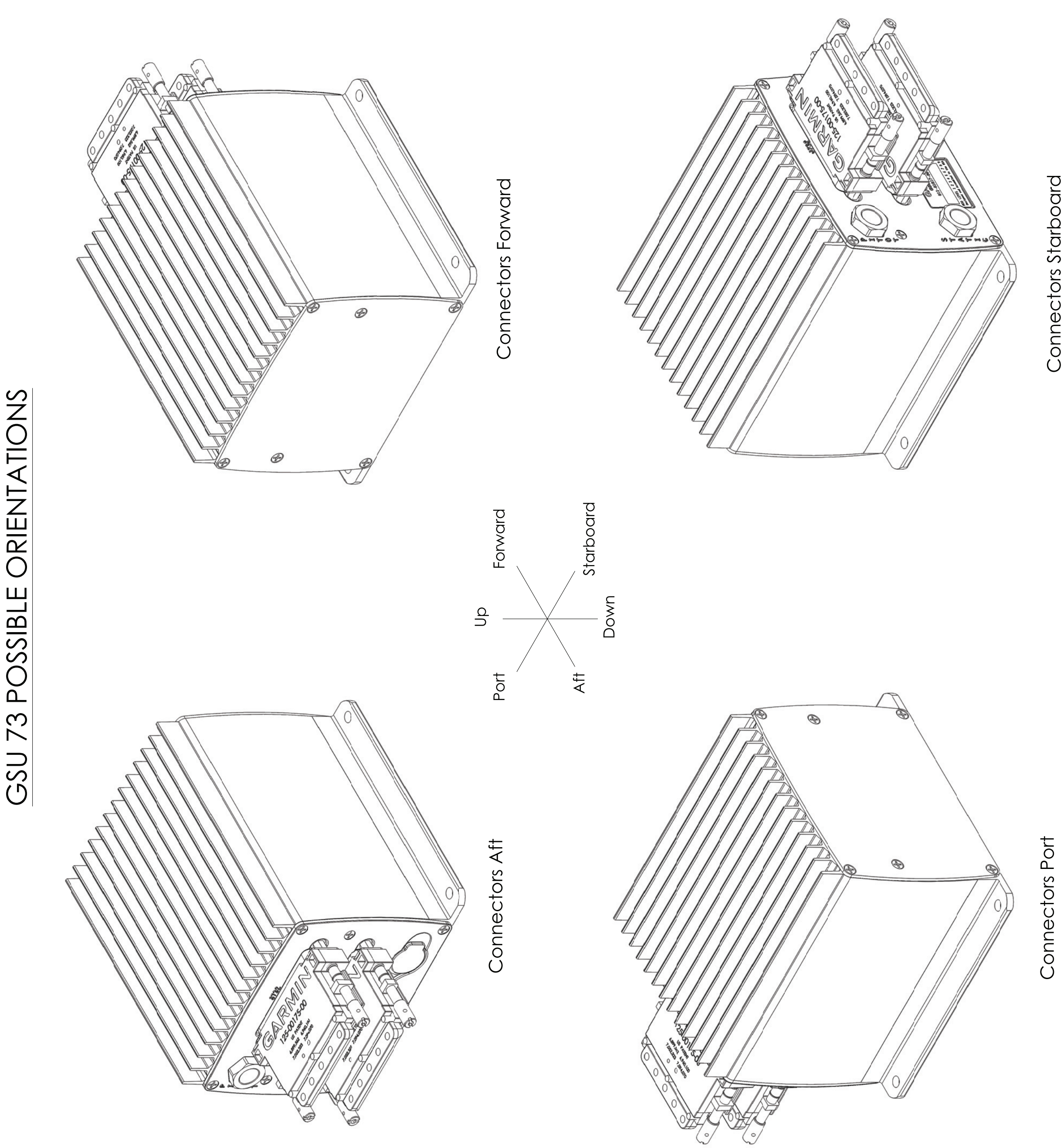


Figure B-9.2 GSU 73 Orientation Drawings

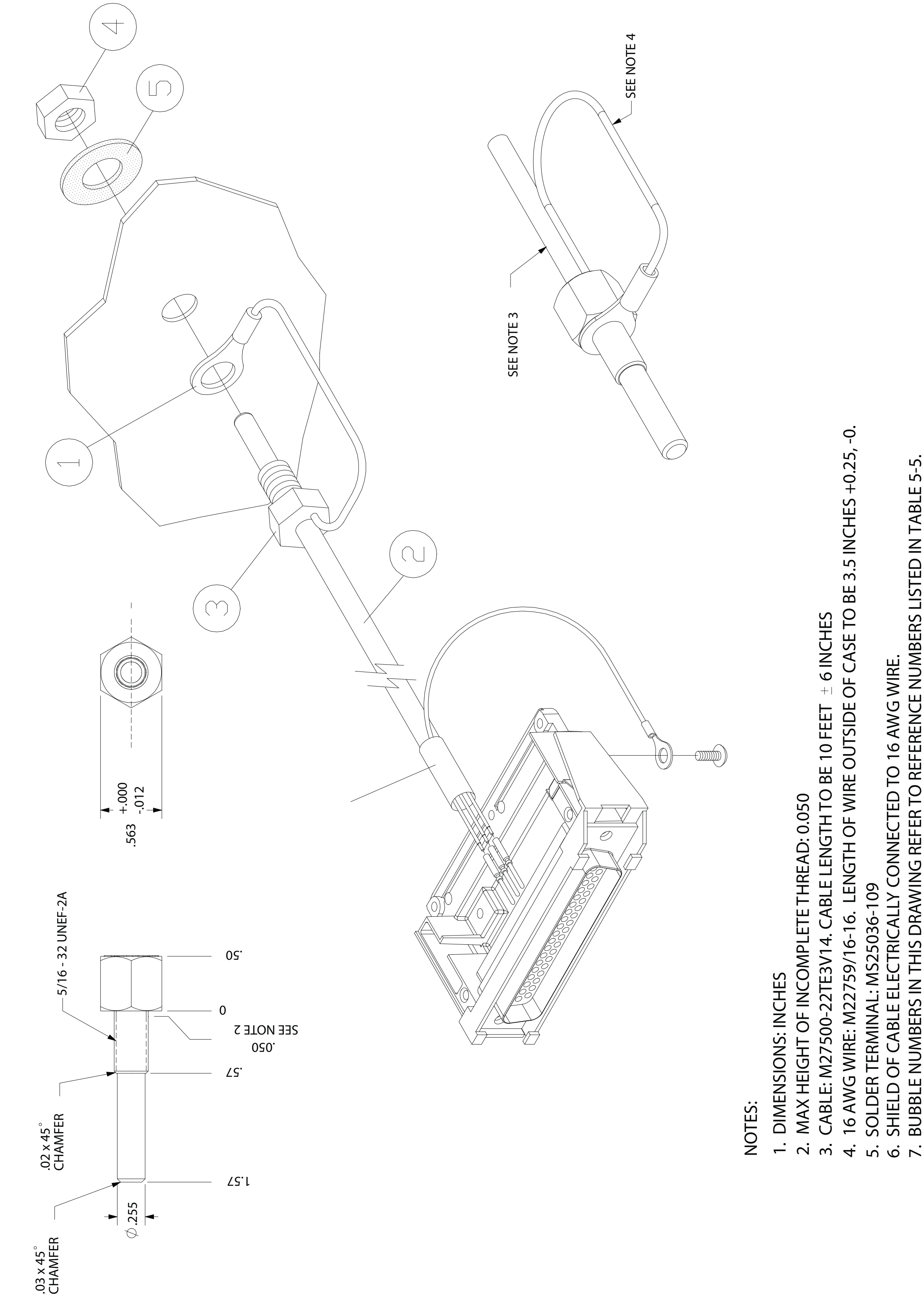


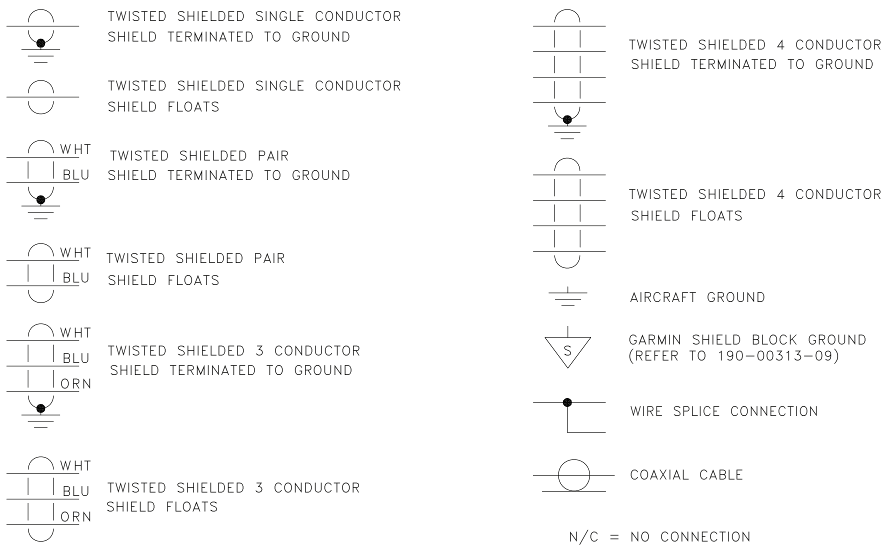
Figure B-10.1 GTP 59 O.A. T. Probe Installation Drawing

APPENDIX C G3X W/GSU 25 AND/OR GAD 29 INTERCONNECT DRAWINGS

C.1 Core Interconnect Drawings w/GSU 25 and/or GAD 29

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. WIRE COLORS ARE NOTED FOR ADVISORY PURPOSES ONLY, EXCEPT FOR THE CONFIG MODULE AND GTP 59.
7. N/A
8. INSTALLATION INFORMATION IS PROVIDED FOR CONFIGURATION MODULES AND THERMOCOUPLES IN SECTION 2, FOR GMU 22 IN SECTION 8, AND FOR THE GTP 59 IN SECTION 12.
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 SECTION 17 FOR CONFIGURATION).
12. ONLY ONE GDU 37X GPS ANTENNA CONNECTION IS REQUIRED FOR THE G3X SYSTEM. ADDITIONAL ANTENNAS CAN BE ADDED FOR REDUNDANCY IF DESIRED, SEE SECTION 17 FOR GPS CONFIGURAITON INFORMATION.
13. IN A 2 DISPLAY SYSTEM WHERE A GDU IS USED AS A CAN BUS TERMINATION, THE CAN BUS SHOULD ONLY BE TERMINATED AT ONE GDU 37X.
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 STABILIZED 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 BBS CAN BE WIRED TO A DISCRETE INPUT ON THE GEA 24 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 GEA 24 DISCRETE INPUTS.

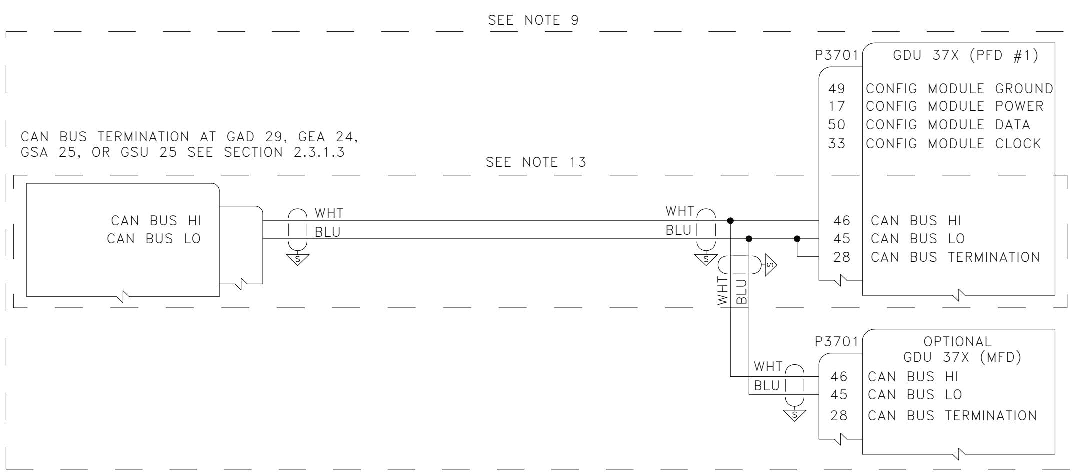


Figure C-1.1 Core Interconnect Notes and 2 Display CAN Bus Interconnect Drawing

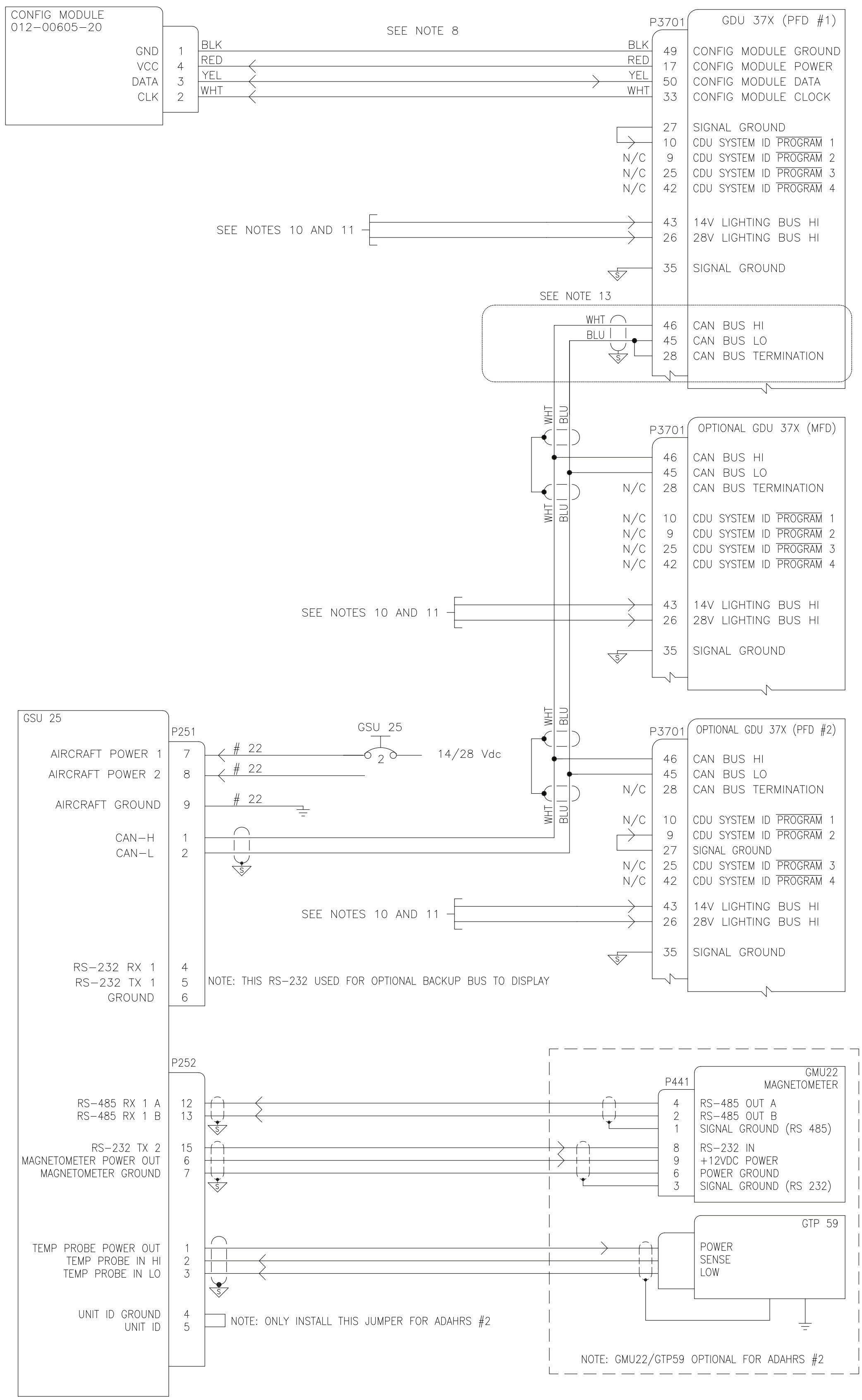


Figure C-1.2 GDU 37X/GMU 22/GSU 25 Interconnect Drawing

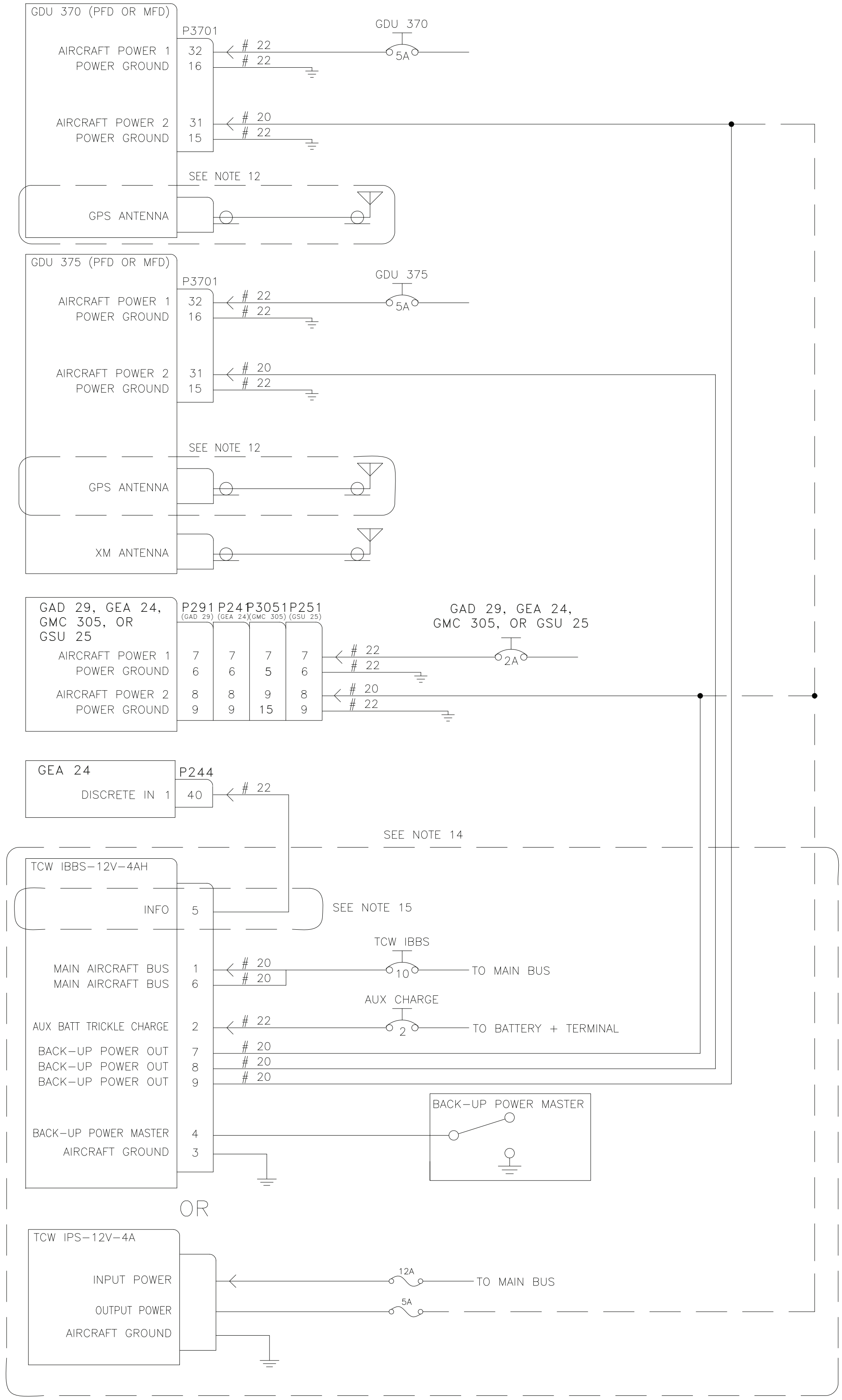
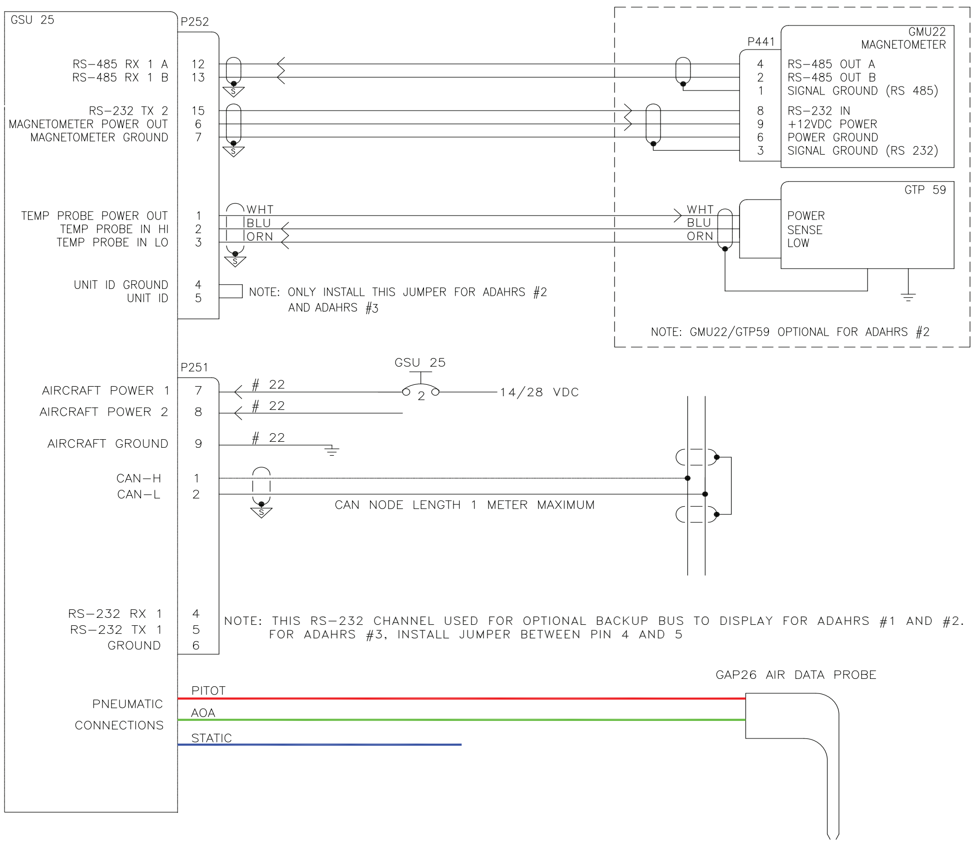


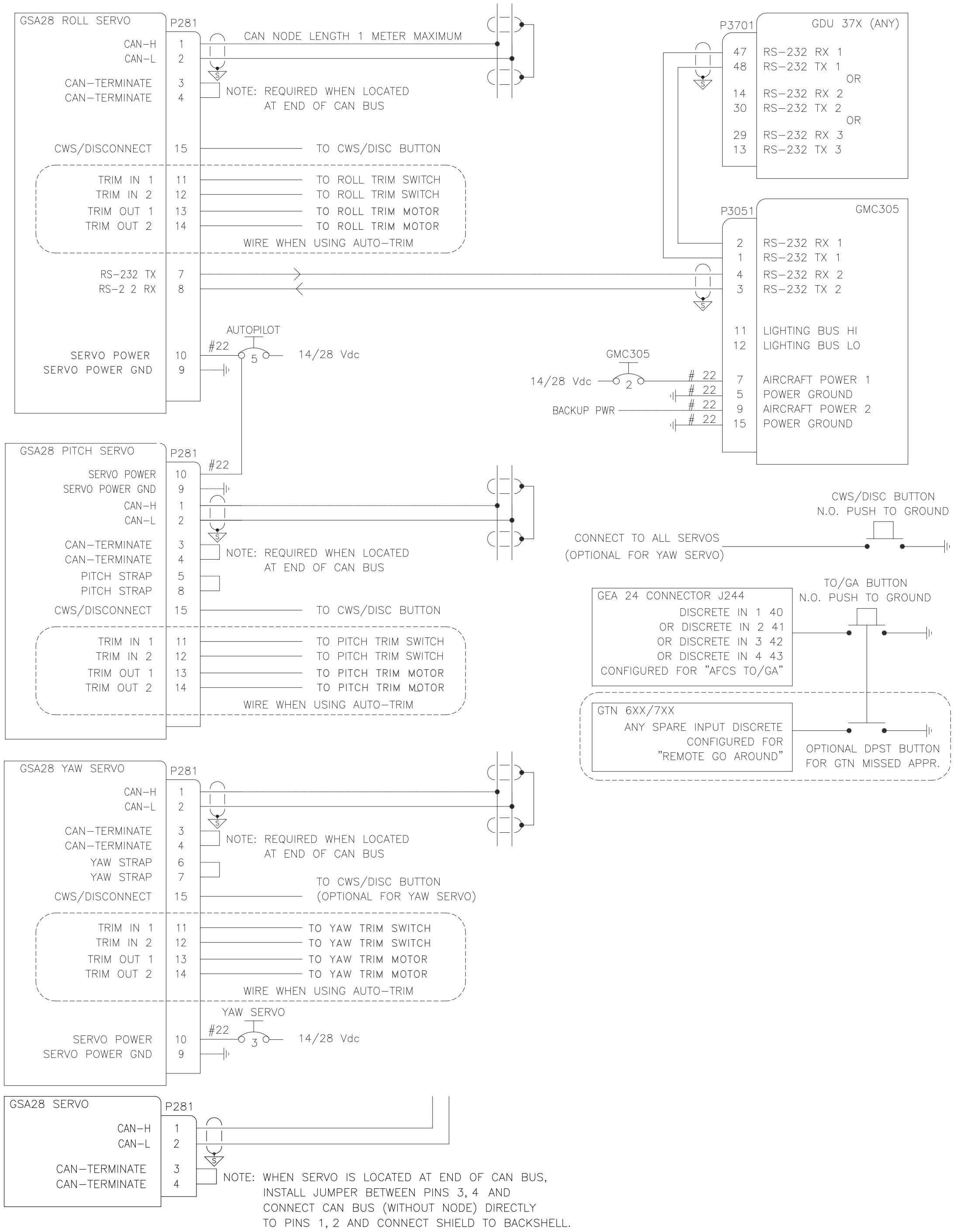
Figure C-1.3 Power, Backup Power, and Antennas Interconnect Drawing



CONFIGURATION GUIDANCE

1. G3X
   A. ON THE GDU 37X CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE
      - ENABLE ADAHRS 1, 2, OR 3 AS APPROPRIATE FOR THIS UNIT
      - ENABLE MAGNETOMETER FOR THIS UNIT IF CONNECTED
      - ENABLE OAT PROBE FOR THIS UNIT IF CONNECTED
      - ENABLE AOA FOR THIS UNIT IF CONNECTED TO GAP 26 PROBE

Figure C-1.4 GMU 22/GSU 25/GTP 59 Interconnect Drawing



CONFIGURATION GUIDANCE

1. G3X
   - A. ON THE GDU 37X CONFIG MODE COM PORT CONFIGURATION PAGE
     SET COM PORT CONNECTED TO GMC 305 TO "GARMIN INSTRUMENT DATA"
   - B. ON THE GDU 37X CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE
     SET AUTOPILOT SERVOS TO ONE OF THE FOLLOWING:
     "ROLL ONLY", "PITCH + ROLL", OR "PITCH + YAW"

Figure C-1.5 GMC 305/GSA 28 Interconnect Drawing

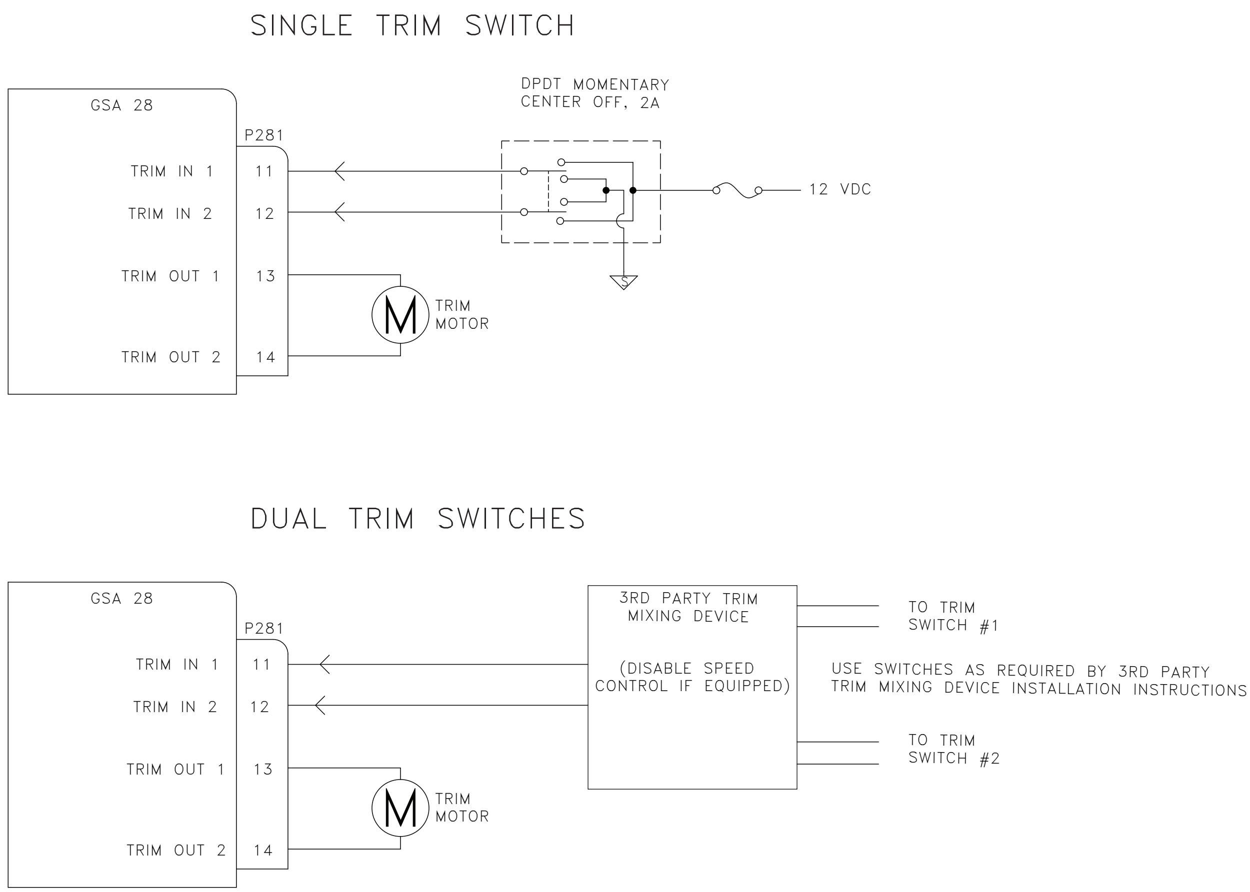
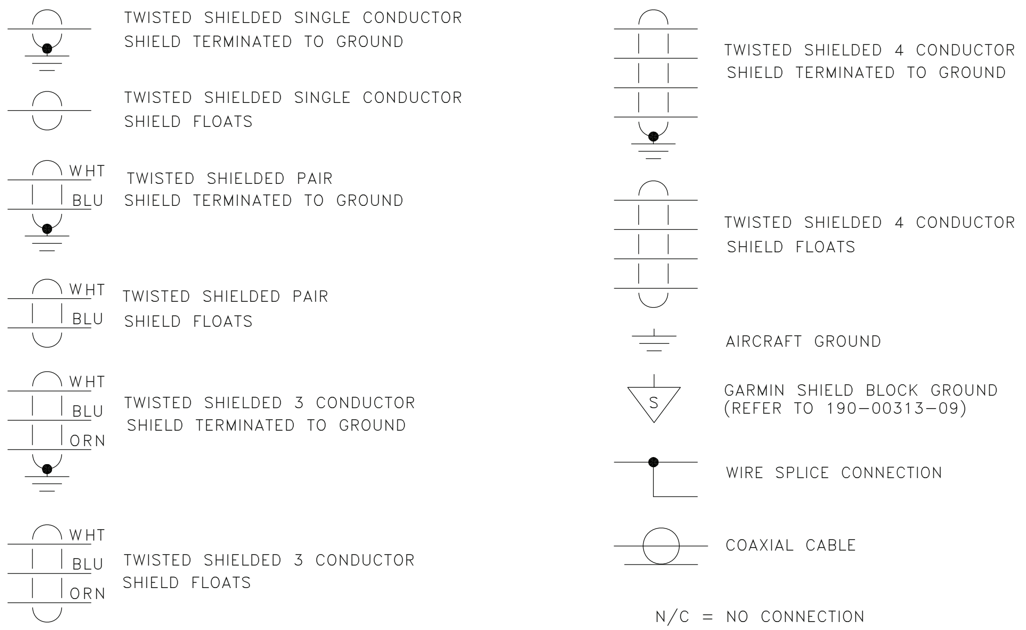


Figure C-1.6 GSA 28 - Trim Switch Interconnect Drawing

C.2 External Interconnect Drawings w/GSU 25

NOTES:

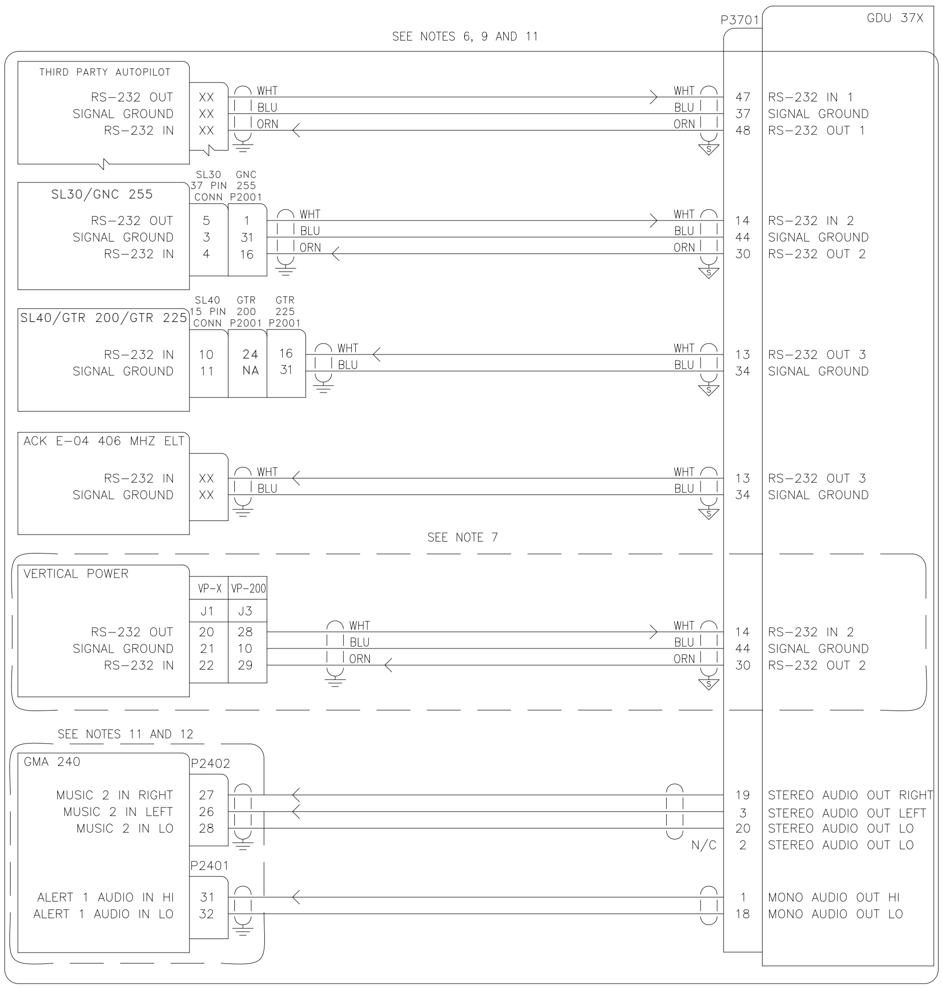
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM
4. SYMBOL DESIGNATIONS:



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. N/A
8. CONNECTIONS FOR THIRD PARTY AUTOPILOT SERVOS, AP DISCONNECT, AND OTHER AUTOPILOT FUNCTIONALITY NOT SHOWN. CONSULT AUTOPILOT VENDOR DOCUMENTATION FOR ADDITIONAL DETAILS.
9. REFER TO FIG. C-2.11 FOR MORE DETAILED INFORMATION ON CONNECTION OF THIRD PARTY AUTOPILOTS.
10. THE GSU 25 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 OUTPUS.
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. A 14 CFR 91.227 CFR COMPLIANT INSTALLATION REQUIRES 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 SOFTWARE VERSION 3.00 (OR LATER) TO SUPPORT ADS-B TRANSMISSIONS. FOR VFR AIRCRAFT, NON-COMPLIANT ADS-B OUT IS PROVIDED BY THE VFR GPS DATA SENT AUTOMATICALLY TO THE GTX 23ES. IF ADS-B TRANSMISSION FROM THE GTX 23ES IS NOT REQUIRED, THIS CONNECTION IS NOT REQUIRED.
16. THE GTN 6XX/7XX UNITS RECEIVE ALTITUDE ENCODER DATA FROM THE GAD 29 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 GAD 29 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 C-2.1 External Interconnect Drawing Notes

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF AN SL30 OR SL40. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GDU 37X TO SL40, GTR 200, OR GTR 225
   A. ON THE GDU 37X COMM CONFIG MODE PAGE
      - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "GARMIN VHF COMM"
   B. NO GTR 200 OR SL40 CONFIGURATION REQUIRED
   C. CONFIGURE GTR 225 RS-232 FORMAT TO "NMEA"

2. GDU 37X TO SL30 OR GNC 255
   A. ON THE GDU 37X COMM CONFIG MODE PAGE
      - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "GARMIN VHF COMM"
   B. NO SL30 CONFIGURATION REQUIRED
   C. CONFIGURE GNC 255 RS-232 FORMAT TO "NMEA"

3. GDU 37X TO VERTICAL POWER VP-X OR VP-200
   A. ON THE GDU 37X COMM CONFIG MODE PAGE
      - SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "VERTICAL POWER"
   B. ON THE GDU 37X EIS CONFIG MODE PAGE
      - SET THE "VOLTS 1" AND "VOLTS 2" INPUTS TO ONE OF THE FOLLOWING BASED ON WHAT INPUTS HAVE BEEN CONNECTED TO THE VP-X OR VP-200:

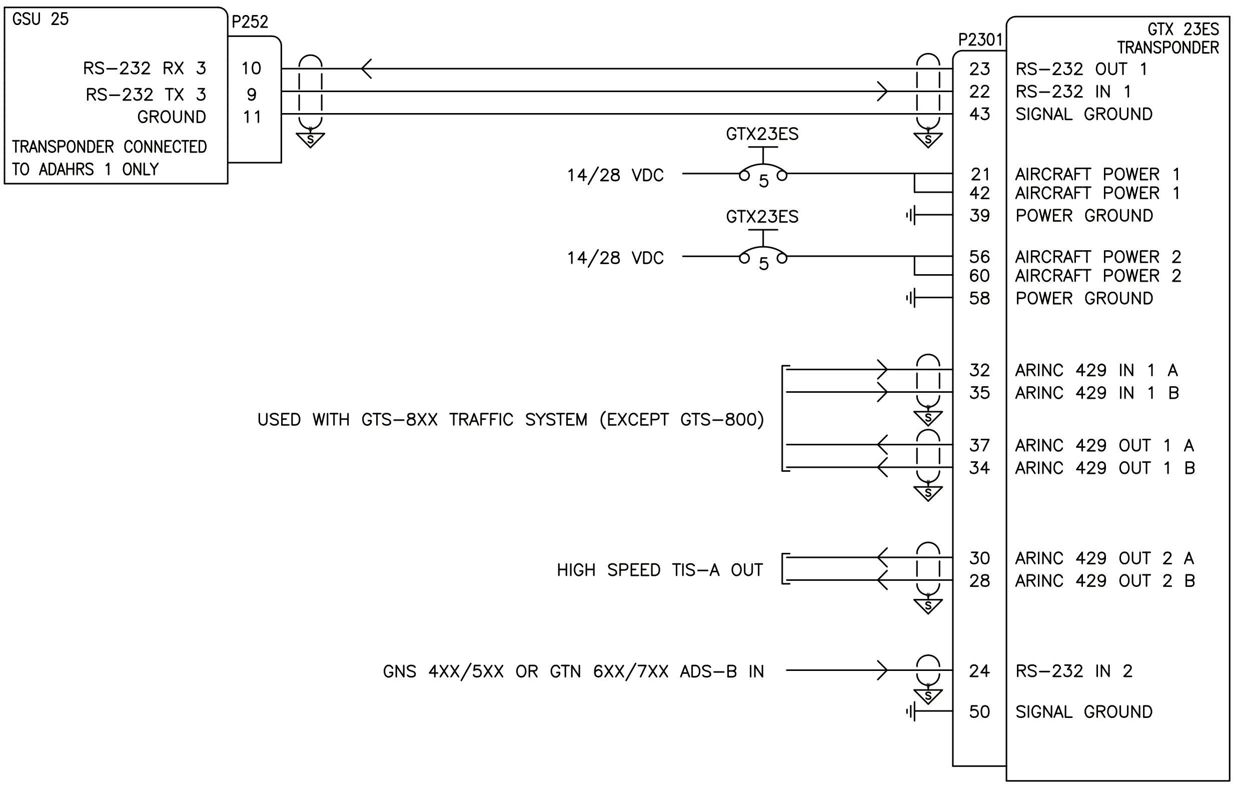
NONE	VERTICAL POWER MAIN BATT VOLTS
VERTICAL POWER AUX BATT VOLTS	VERTICAL POWER BUS 1 VOLTS
VERTICAL POWER BUS 2 VOLTS	

      - SET THE "SHUNT 1" AND "SHUNT 2" INPUTS TO ONE OF THE FOLLOWING BASED ON WHAT INPUTS HAVE BEEN CONNECTED TO THE VP-X OR VP-200:

NONE	VERTICAL POWER MAIN BUS AMPS
VERTICAL POWER BUS 1 AMPS	VERTICAL POWER BUS 2 AMPS

   C. REFERENCE VERTICAL POWER DOCUMENTATION FOR ADDITIONAL INSTALLATION AND CONFIGURATION GUIDANCE

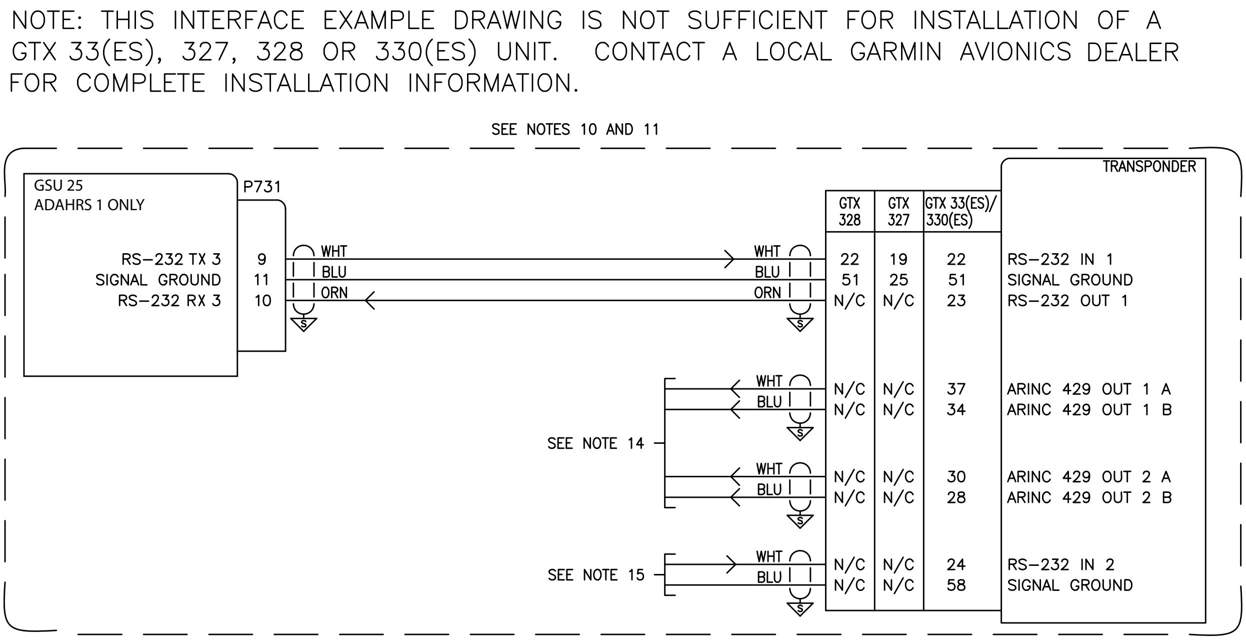
Figure C-2.2 GDU 37X - External LRU Interconnect Examples



CONFIGURATION GUIDANCE

1. GNS 4XX/5XX OR GTN 6XX/7XX PROVIDING ADS-B POSITION SOURCE DATA (OPTIONAL)
   A. ON THE GNS OR GTN UNIT, CONFIGURE THE RS-232 OUTPUT PROVIDING THIS DATA TO "ADS-B OUT" ("ADS-B OUT+ IF AVAILABLE)

Figure C-2.3 GSU 25 - GTX 23ES Transponder Interconnect/Configuration Example



CONFIGURATION GUIDANCE

1. GTX 327/328/330(ES)

A. ON THE GTX 327/328/330(ES) RS-232 CONFIG MODE PAGE FOR RS-232 CHANNEL 1
- SET CONNECTED GTX 327/328/330(ES) RS-232 CHANNEL 1 INPUT FORMAT TO "REMOTE"
- SET CONNECTED GTX 330(ES) RS-232 CHANNEL 1 OUTPUT FORMAT TO "REMOTE+TIS"

B. ON THE GTX 330(ES) RS-232 CONFIG MODE PAGE FOR RS-232 CHANNEL 2
- SET RS-232 CHANNEL 2 INPUT FORMAT TO “REMOTE”

C. ON THE GTX 327/328/330(ES) SQUAT SWITCH CONFIG MODE PAGE
- SET THE SQUAT SWITCH FIELD TO "NO"

D. 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 328" OR "GTX 330" OR "GTX 330ES" OR "GTX 33" AS APPROPRIATE

E. NO GSU 25 CONFIGURATION REQUIRED

2. GTX 33(ES)

A. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 33" OR "GTX 33ES" AS APPROPRIATE

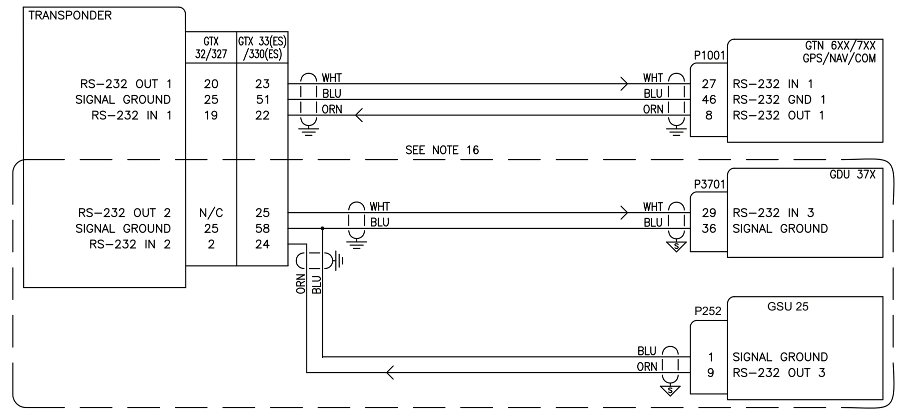
B. NO GSU 25 CONFIGURATION REQUIRED

3. GTN 6XX/7XX, GNS 4XXW/5XXW (WHEN ADS-B OUT IS BEING PROVIDED TO ES TRANSPONDER)

A. ON THE GTN/GNS RS-232 CONFIG MODE PAGE
- SET RS-232 OUTPUT FORMAT TO ADS-B OUT(+) (FOR RS-232 PORT CONNECTED TO TRANSPONDER RS-232 IN CHANNEL 2)

Figure C-2.4 GSU 25 - Transponder Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 32, 327, 33(ES), OR 330(ES) UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE (IN THIS CONFIGURATION THE TRANSPONDER IS CONTROLLED BY THE GTN 6XX/7XX UNIT (NOT CONTROLLED BY THE G3X DISPLAY)

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. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

D. NO GDU 37X OR GSU 25 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. ON THE GDU 37X XPDR CONFIG PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

D. NO GSU 25 CONFIGURATION REQUIRED

3. GTX 33(ES)

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 PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS_A IN" IF TIS-A TRAFFIC DATA IS DESIRED.

D. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

E. NO GSU 25 CONFIGURATION REQUIRED

4. GTX 330(ES)

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 PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS_A IN" IF TIS-A TRAFFIC DATA IS DESIRED.

D. ON THE GDU 37X XPDR CONFIG PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

E. NO GSU 25 CONFIGURATION REQUIRED

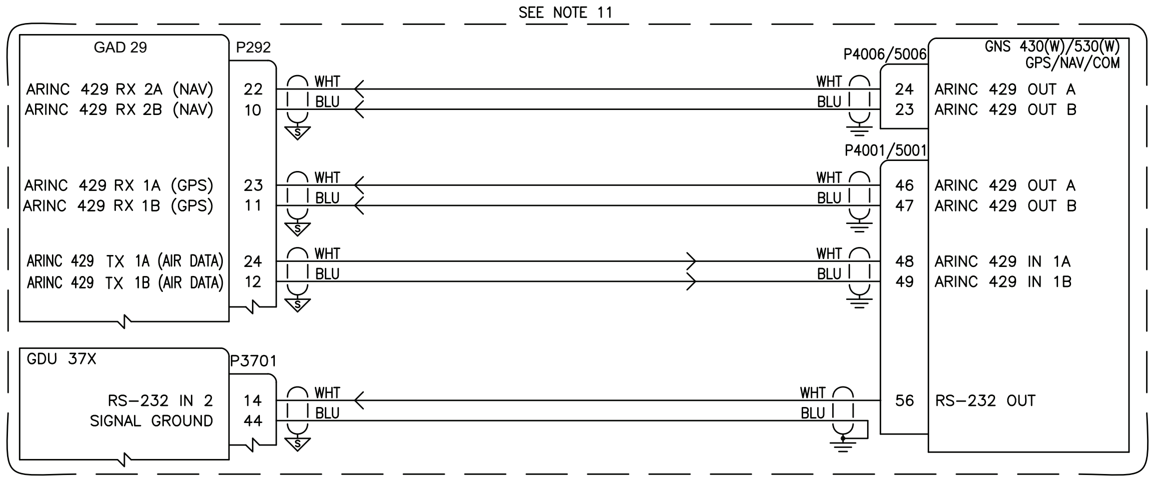
5. GTX 23ES

A. THE GTX 23ES MUST BE CONNECTED AS SHOWN IN FIG C-2.3

B. CONTROL OF GTX 23ES FROM THE GTN 6XX/7XX IS NOT SUPPORTED

Figure C-2.5 GTN 6XX/7XX Transponder Interconnect/Configuration 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

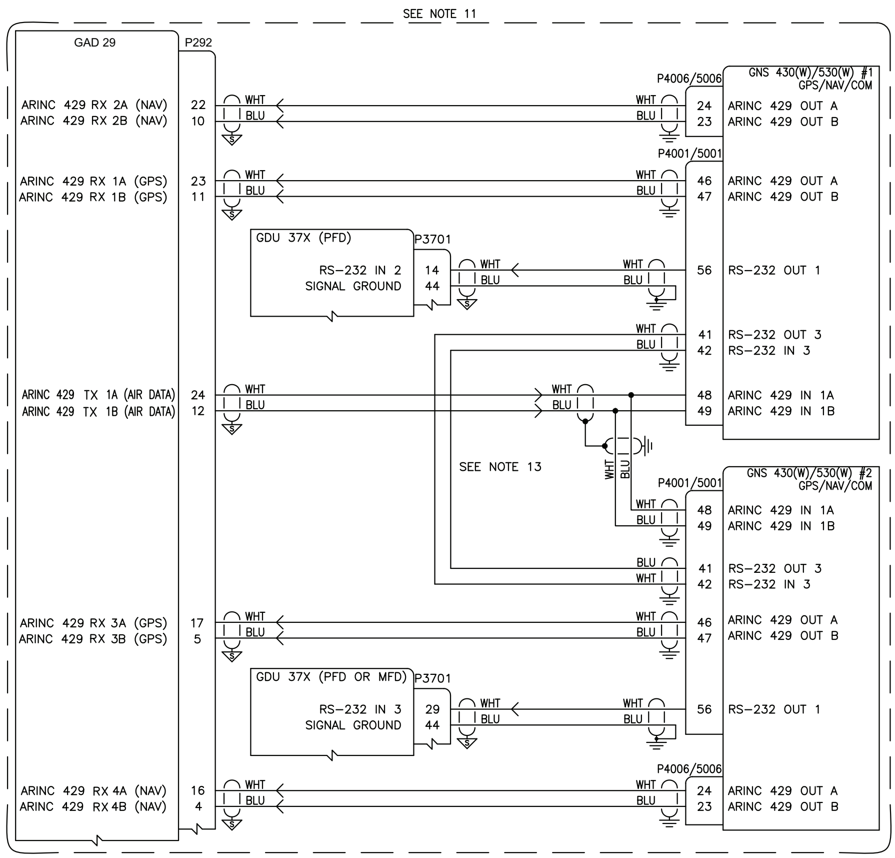
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET RX AND TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure C-2.6 Single GNS 430(W)/530(W) Interconnect/Configuration 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

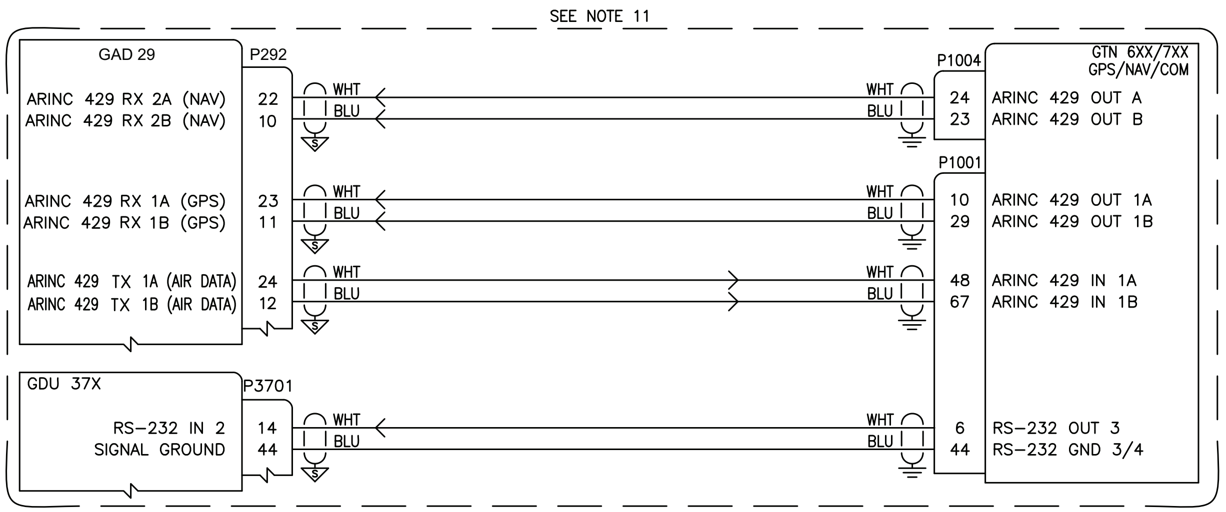
2. G3X

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET 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 C-2.7 Dual GNS 430(W)/530(W) Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX 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"

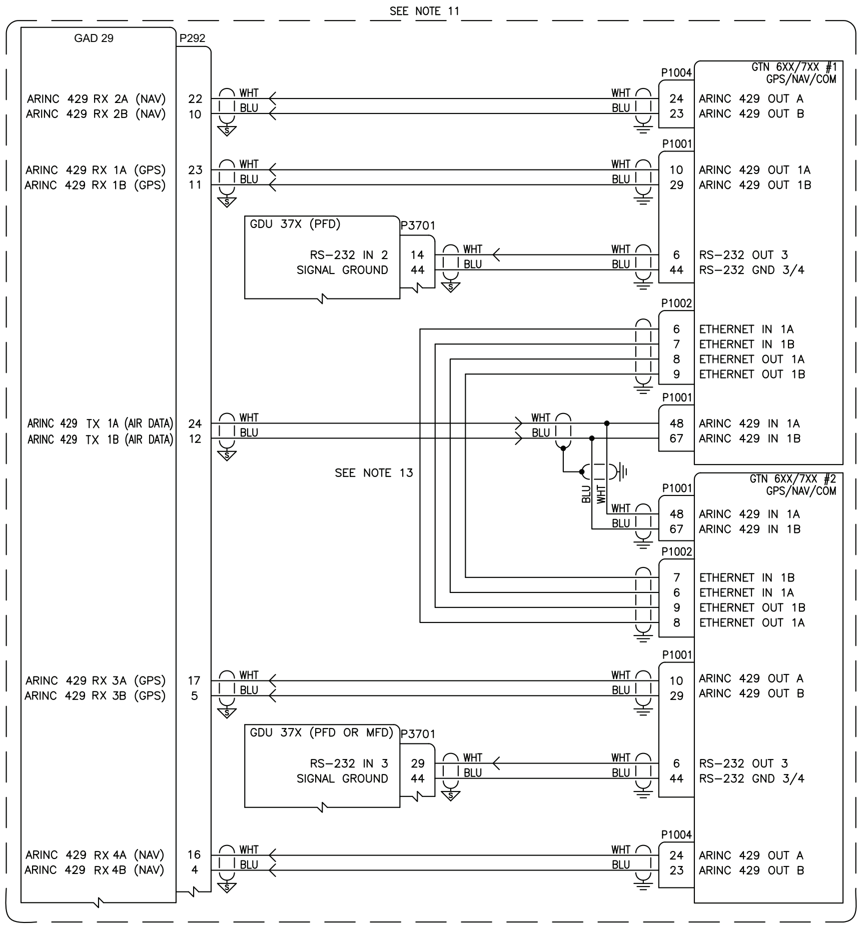
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET NAV RADIO TO "ENABLED"
- SET TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure C-2.8 Single GTN 6XX/7XX Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX 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"

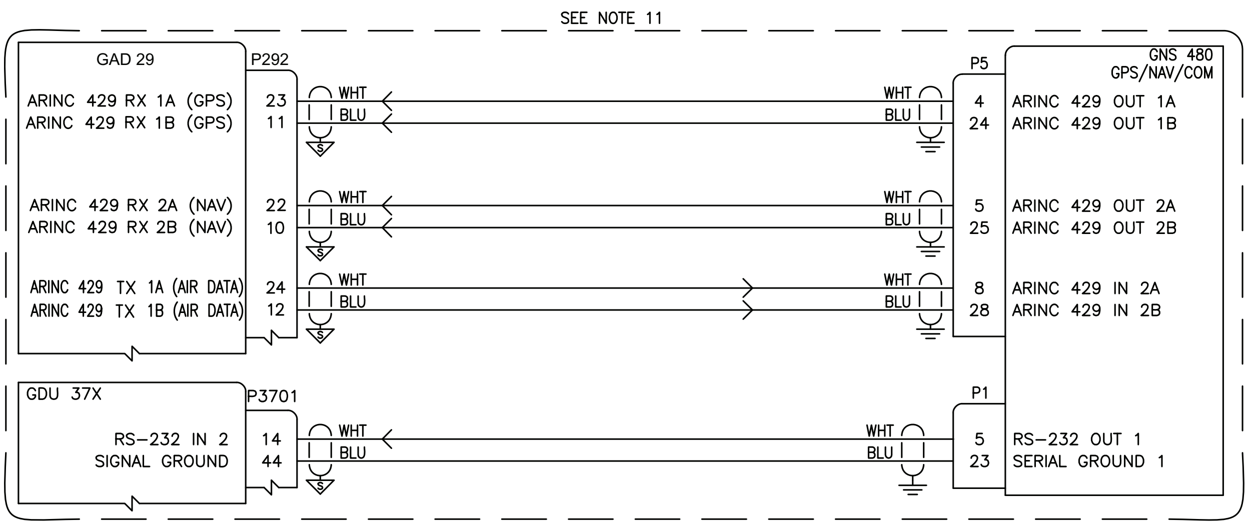
2. G3X

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET 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 C-2.9 Dual GTN 6XX/7XX Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 480 UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GNS 480

A. ON THE MAIN ARINC 429 SETUP PAGE
- SET IN 2 SEL TO "EFIS"
- SET IN 2 SPEED TO "LOW"
- SET IN 2 SDI TO "SYS1"
- SET OUT 1 SEL TO "GAMA 429"
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 SDI TO "SYS1"
- SET OUT 2 SEL TO "VOR/ILS"
- SET OUT 2 SPEED TO "LOW"
- SET OUT 2 SDI TO "SYS1"

B. ON THE SERIAL SETUP PAGE
- SET CHNL 1 OUTPUT TO "MAPMX"

C. ON THE RESOLVER INTERFACE PAGE SET RESOLVER TO "NOT INSTALLED"

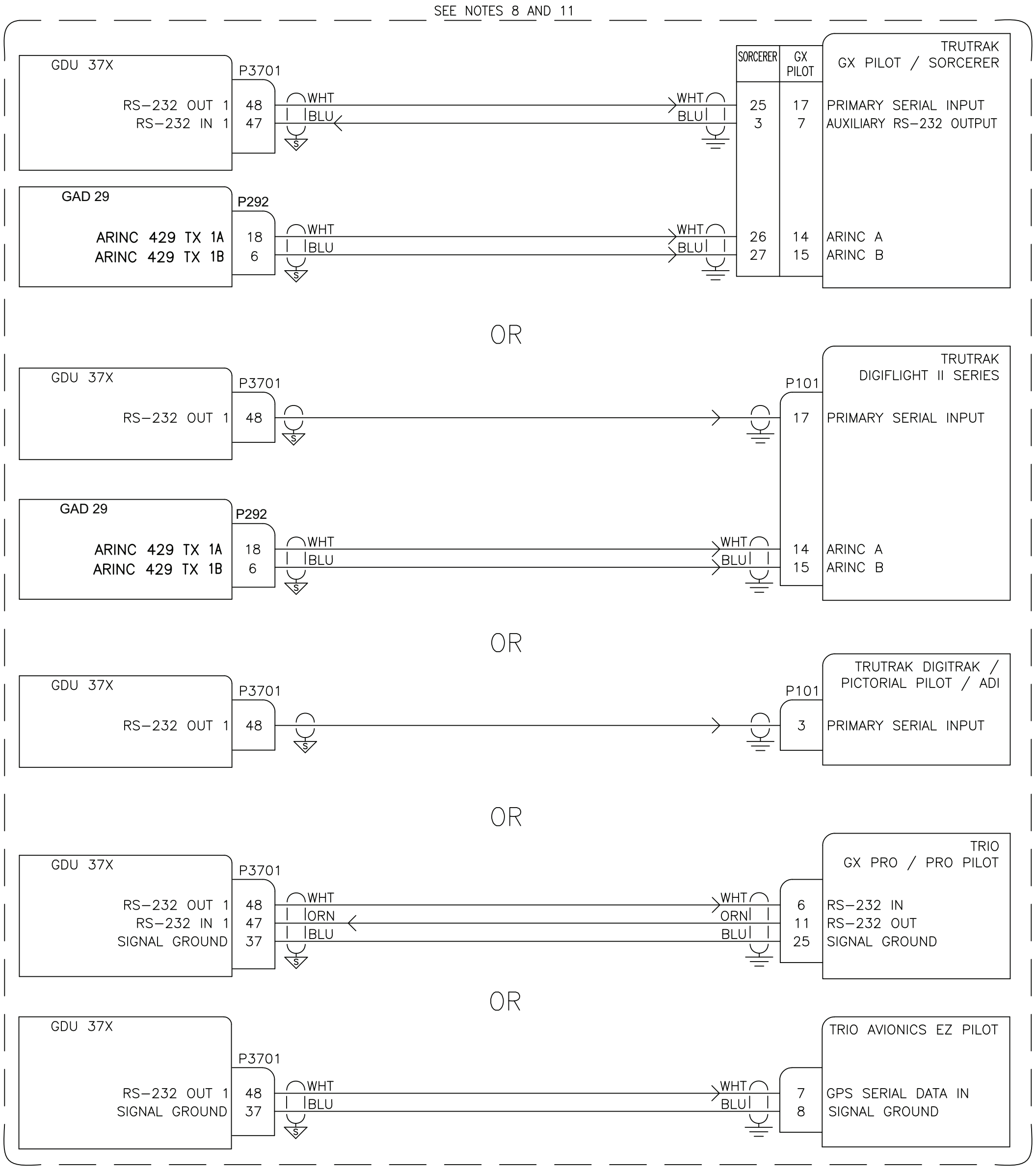
D. ON THE MISCELLANEOUS SETUP PAGE SET CDI SELECT TO "USE"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure C-2.10 GNS 480 Interconnect/Configuration Example

NON-GARMIN AUTOPILOT INTERCONNECTS SHOWN FOR REFERENCE ONLY. AUTOPILOT VENDOR DOCUMENTATION SHOULD BE CONSULTED FOR PROPER PIN CONNECTIONS.



CONFIGURATION GUIDANCE

1. TRUTRAK GX PILOT / SORCERER

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"
- SET ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

2. TRUTRAK DIGIFLIGHT II SERIES

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
- SET ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

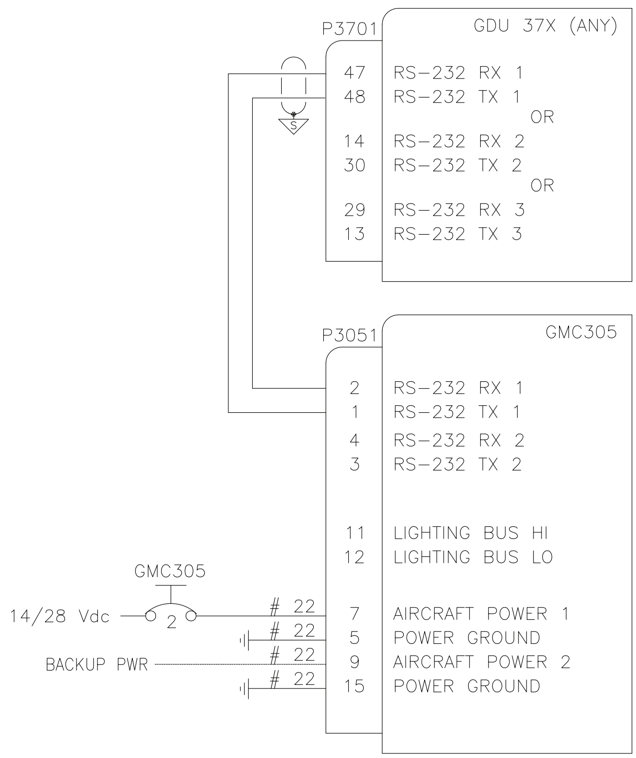
3. TRUTRAK DIGITRAK / PICTORIAL PILOT / ADI OR TRIO AVIONICS EZ PILOT

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"

4. TRIO GX PRO / PROPILOT

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"

Figure C-2.11 Non-Garmin Auto Pilot Interconnect/Configuration Example



THIS DRAWING IS ONLY APPLICABLE TO "INTEGRATED" AUTOPILOTS SHOWN IN FIGURE C-2.11

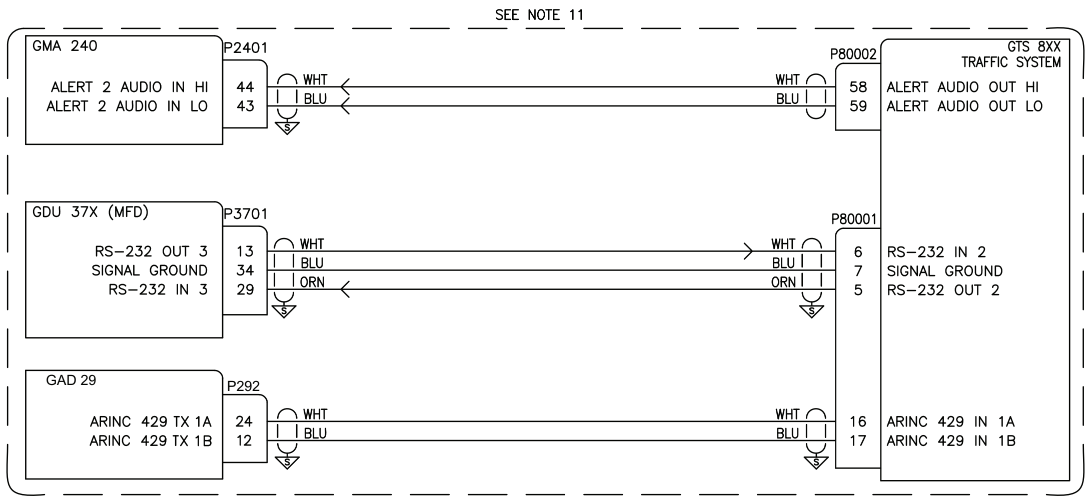
CONFIGURATION GUIDANCE

1. G3X

A. ON THE GDU 37X CONFIG MODE COMM PORT CONFIGURATION PAGE
- SET COM PORT CONNECTED TO GMC 305 TO "GARMIN INSTRUMENT DATA"

Figure C-2.12 Non-Garmin Auto Pilot Interconnect/Configuration Example w/GMC 305

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTS 8XX TRAFFIC SYSTEM. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



REFER TO THE GTS 8XX INSTALLATION MANUAL FOR ADDITIONAL WIRING INFORMATION SUCH AS POWER, USB, AND TRANSPONDER CONNECTIONS AS WELL AS CONFIGURATION GUIDANCE. DO NOT USE RS-232 PORT 1 ON THE GTS 8XX UNIT.

CONFIGURATION GUIDANCE

1. GTS 8XX

A. USE GTS 8XX SOFTWARE VERSION 2.02 OR HIGHER

B. CONFIGURE "TRAFFIC DISPLAY DESTINATION" TO THE APPROPRIATE RS-232 PORT

C. CONFIGURE "BAROMETRIC ALTITUDE SOURCE" AND "MAGNETIC HEADING SOURCE" TO THE APPROPRIATE A429 INPUT PORT, AND UNCHECK THE ASSOCIATED "HIGH" SPEED CHECKBOXES

2. GDU 37X

A. ON THE GDU 37X COMM CONFIG MODE PAGE

- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "GARMIN HSDB"
- SET THE APPROPRIATE ARINC 429 OUT FORMAT TO "EFIS/AIRDATA"
- CONFIGURE THE "NAV 1/2" SETTING AS REQUIRED FOR THE EXTERNAL GPS NAVIGATOR(S), IF APPLICABLE

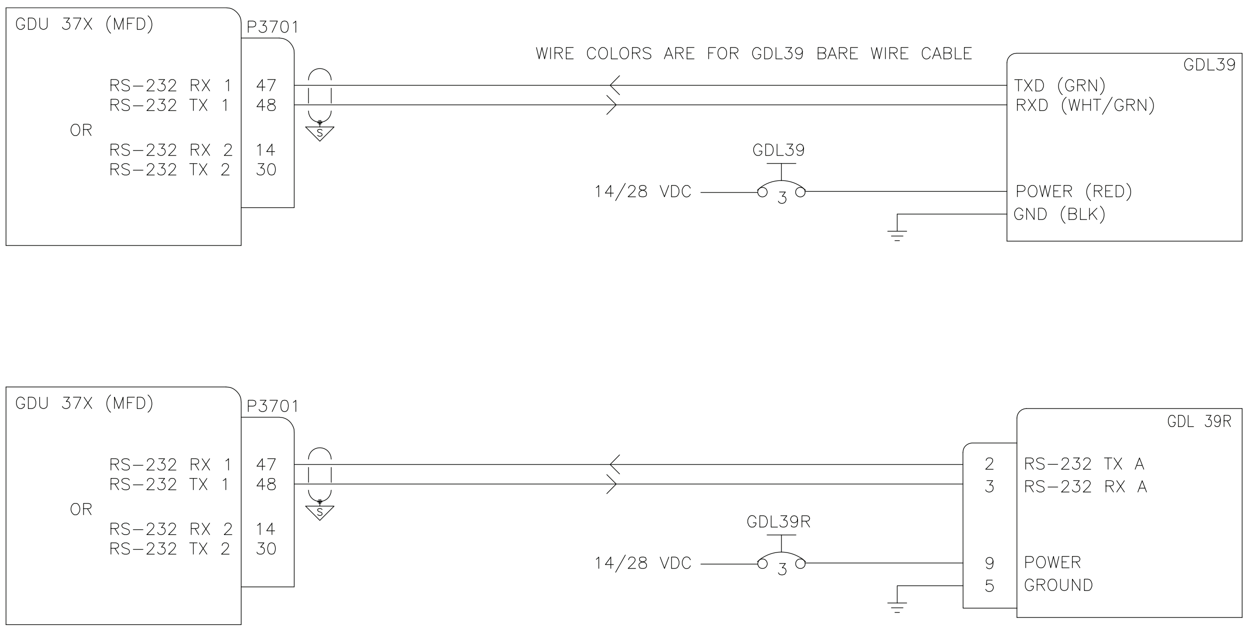
B. ON THE GDU 37X XPDR CONFIG MODE PAGE

- IF A REMOTE TRANSPONDER IS CONFIGURED, SET "TIS-A TRAFFIC DATA" TO "DISABLED"

C. ON THE GDU 37X SOUND CONFIG MODE PAGE

- SET "TRAFFIC AUDIO" AND "TRAFFIC N/A ALERT" TO "OFF"

Figure C-2.13 GTS 8XX Interconnect/Configuration Example



CONFIGURATION GUIDANCE

1. G3X

A. THE GDL39/GDL39R MUST BE CONNECTED TO GDU 37X RS-232 PORT 1 OR PORT 2

B. ON THE GDU 37X CONFIG MODE COMM PORT CONFIGURATION PAGE

- SET COMM PORT CONNECTED TO GDL39/GDL39R TO "GARMIN DATA TRANSFER"
- A GREEN CHECK MARK WILL APPEAR BESIDE THIS COMM PORT WHEN COMMUNICATION IS ESTABLISHED WITH THE GDL39/GDL39R.
- IN NORMAL MODE, THE GDU WILL AUTOMATICALLY ADD A DATA LINK STATUS PAGE (PRESS MENU KEY TWICE TO VIEW) AND A TRAFFIC PAGE.

C. ON THE GDU 37X CONFIG MODE ADS-B DATA LINK CONFIGURATION PAGE

- VERIFY THAT THE AIRCRAFT TYPE IS CORRECTLY SET TO "PRESSURIZED" OR "NOT PRESSURIZED" AS APPROPRIATE FOR THE AIRCRAFT.

Figure C-2.14 GDL 39/GDL 39R Interconnect/Configuration Example

APPENDIX D G3X W/GSU 73 INTERCONNECT DRAWINGS

D.1 Core Interconnect Drawings

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.

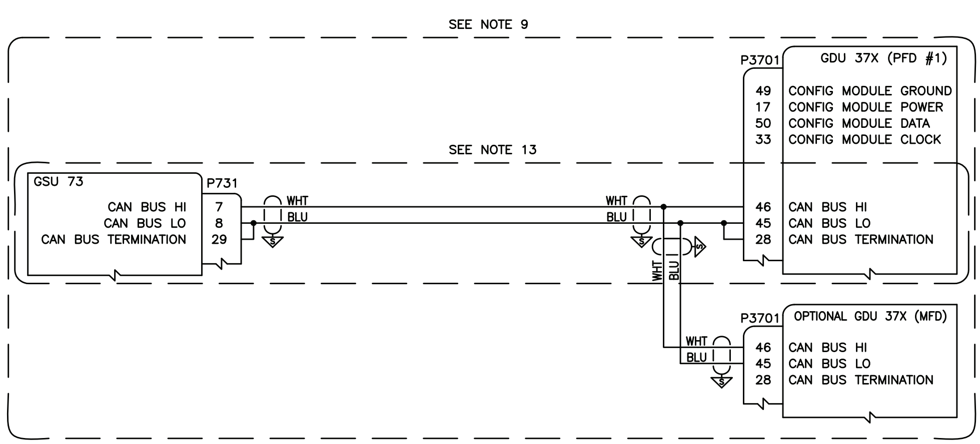


Figure D-1.1 Core (w/GSU 73) Interconnect Notes and 2 Display CAN Bus Interconnect Drawing

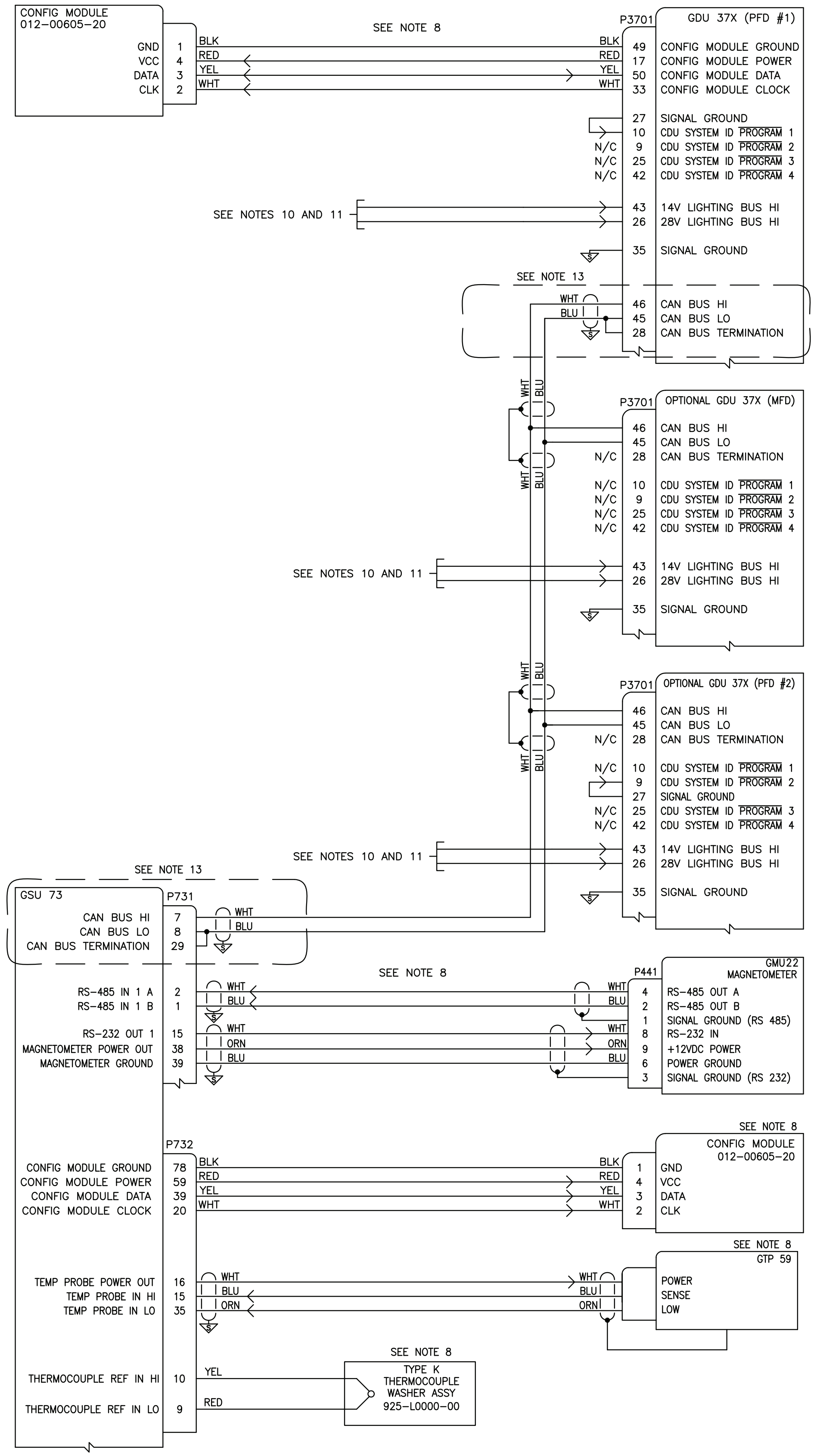


Figure D-1.2 GDU 37X/GMU 22/GSU 73 Interconnect Drawing

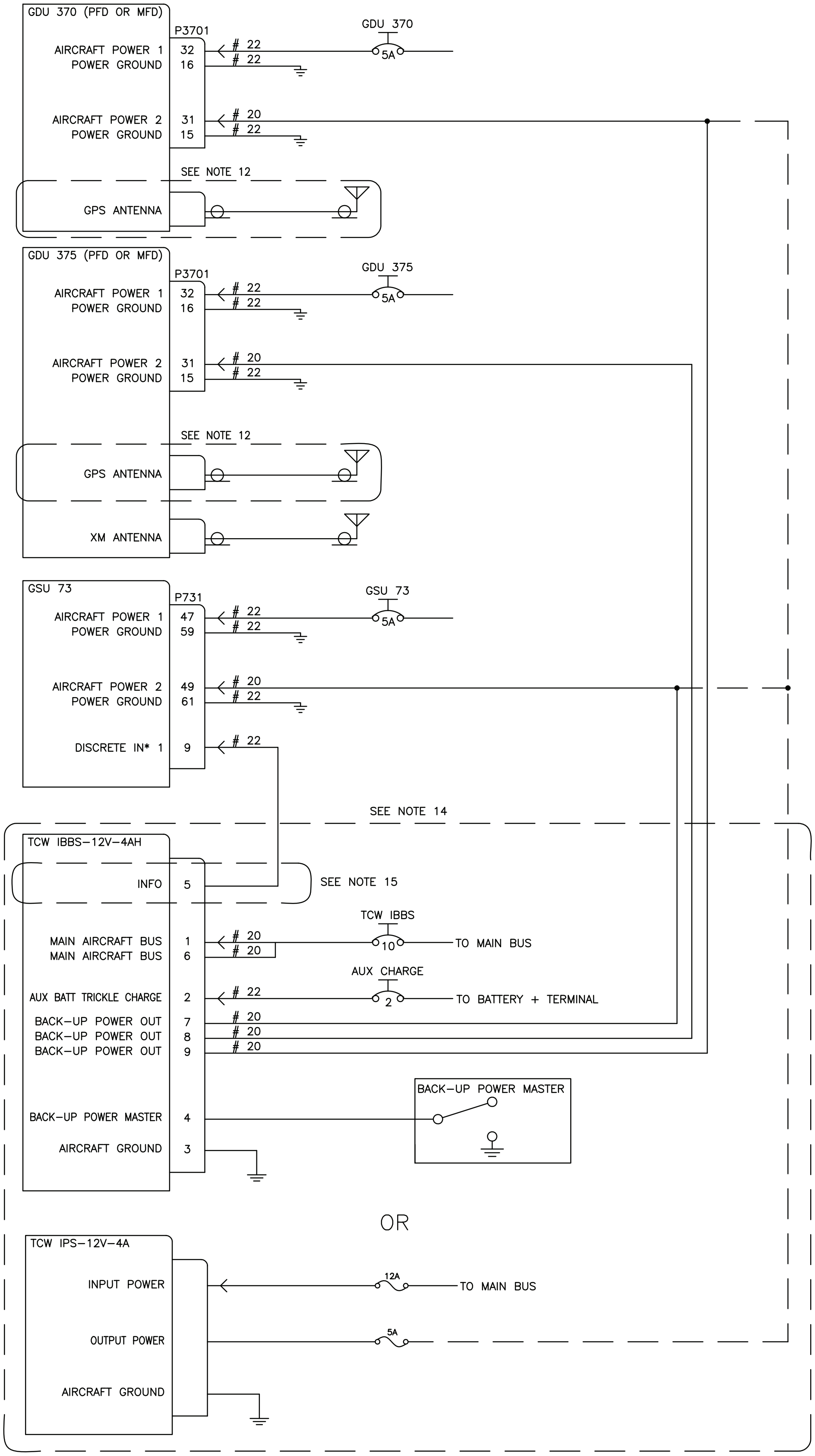
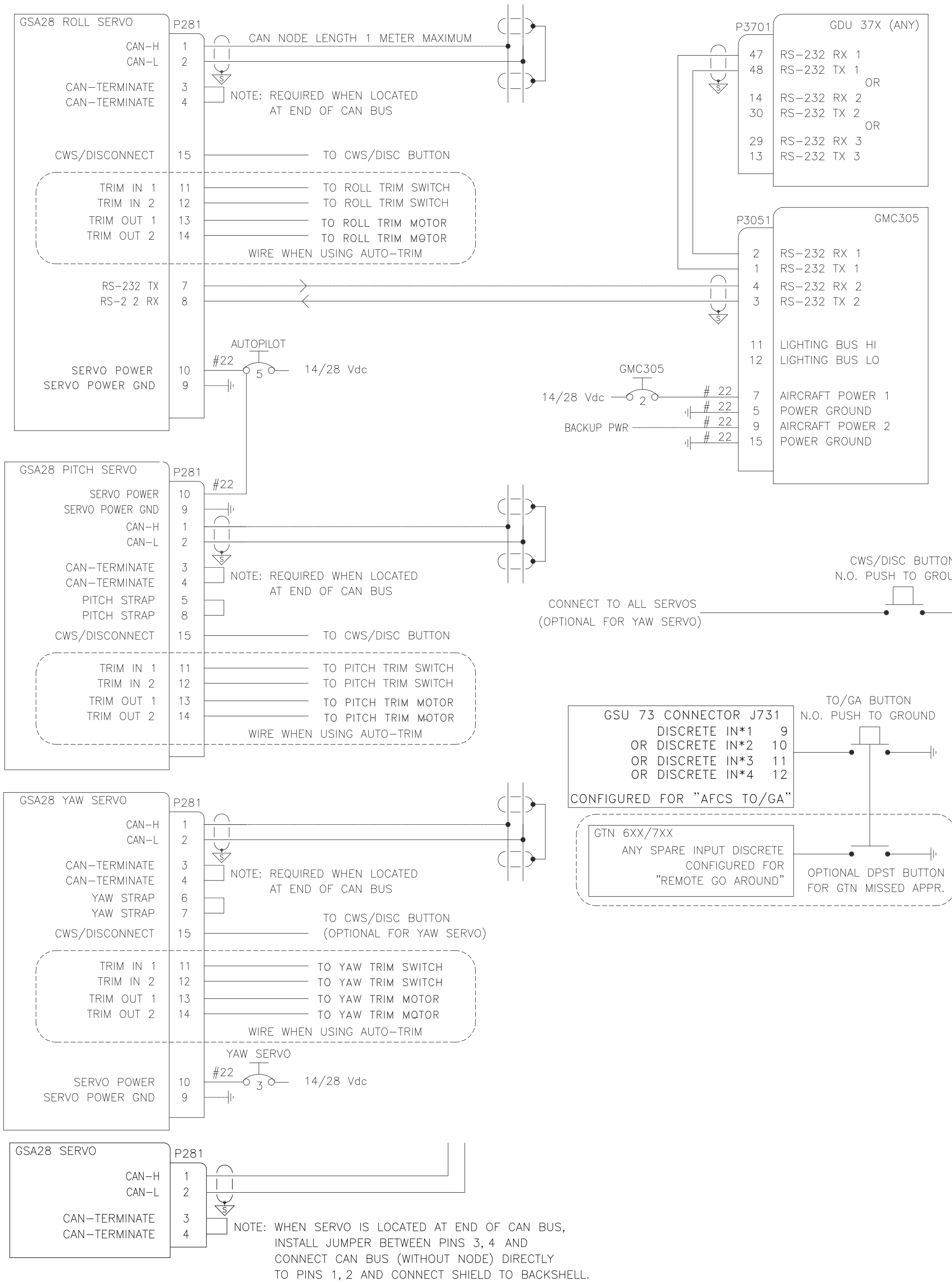


Figure D-1.3 Power, Backup Power, and Antennas Interconnect Drawing w/GSU 73



CONFIGURATION GUIDANCE

1. G3X
   A. ON THE GDU 37X CONFIG MODE COM PORT CONFIGURATION PAGE
      - SET COM PORT CONNECTED TO GMC 305 TO "GARMIN INSTRUMENT DATA"
   B. ON THE GDU 37X CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE
      - SET AUTOPILOT SERVOS TO ONE OF THE FOLLOWING: "ROLL ONLY", "PITCH + ROLL", OR "PITCH + YAW"

Figure D-1.4 GMC 305/GSA 28 Interconnect Drawing w/GSU 73

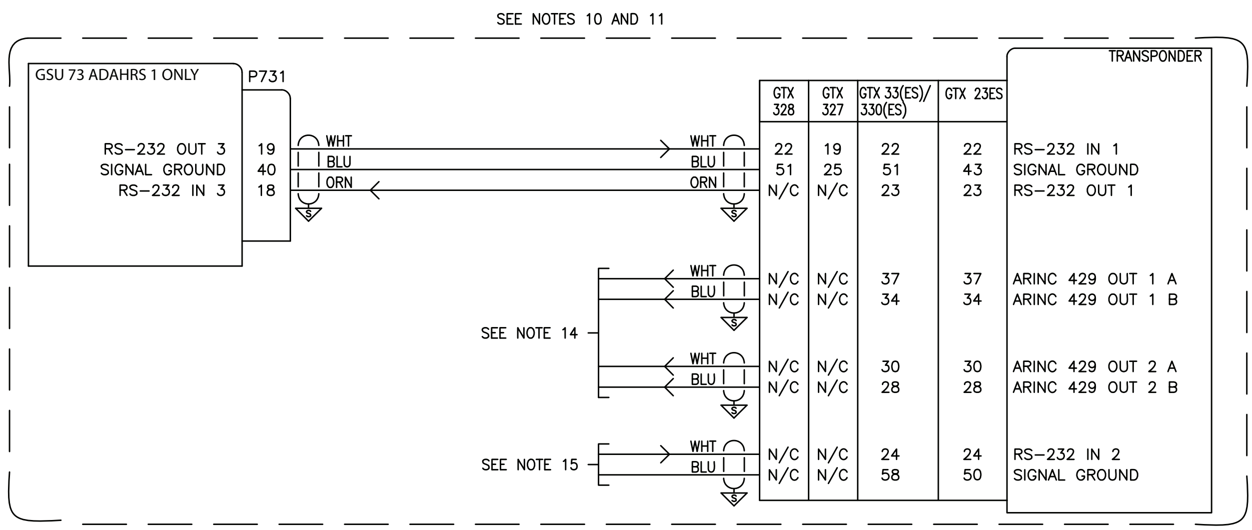
D.2 External Interconnect Drawings w/GSU 73

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. 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 FIG D-2.9 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. A 14 CFR 91.227 COMPLIANT INSTALLATION REQUIRES 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 SOFTWARE VERSION 3.00 (OR LATER) TO SUPPORT ADS-B TRANSMISSIONS. FOR VFR AIRCRAFT, NON-COMPLIANT ADS-B OUT IS PROVIDED BY THE VFR GPS DATA SENT AUTOMATICALLY TO THE GTX 23ES. IF ADS-B TRANSMISSION FROM THE GTX 23ES 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 D-2.1 External Interconnect w/GSU 73 Drawing Notes

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 33(ES), 327, 328 OR 330(ES) UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GTX 327/328/330(ES)

A. ON THE GTX 327/328/330(ES) RS-232 CONFIG MODE PAGE FOR RS-232 CHANNEL 1
- SET CONNECTED GTX 327/328/330(ES) RS-232 CHANNEL 1 INPUT FORMAT TO "REMOTE"
- SET CONNECTED GTX 330(ES) RS-232 CHANNEL 1 OUTPUT FORMAT TO "REMOTE+TIS"

B. ON THE GTX 330(ES) RS-232 CONFIG MODE PAGE FOR RS-232 CHANNEL 2
- SET RS-232 CHANNEL 2 INPUT FORMAT TO “REMOTE”

C. ON THE GTX 327/328/330(ES) SQUAT SWITCH CONFIG MODE PAGE
- SET THE SQUAT SWITCH FIELD TO "NO"

D. 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 328" OR "GTX 330" OR "GTX 330ES" OR "GTX 33" AS APPROPRIATE

E. NO GSU 73 CONFIGURATION REQUIRED

2. GTX 33(ES)

A. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 33" OR "GTX 33ES" AS APPROPRIATE

B. NO GSU 73 CONFIGURATION REQUIRED

3. GTX 23ES

A. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 23ES"

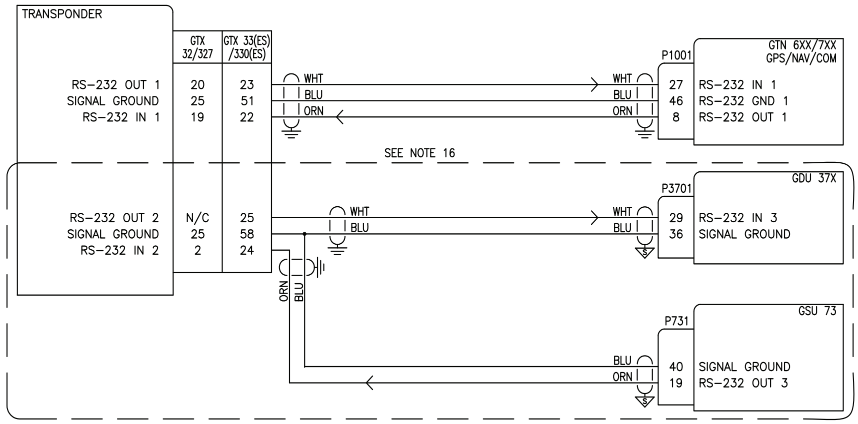
B. NO GSU 73 CONFIGURATION REQUIRED

4. GTN 6XX/7XX, GNS 4XXW/5XXW (WHEN ADS-B OUT IS BEING PROVIDED TO ES TRANSPONDER)

A. ON THE GTN/GNS RS-232 CONFIG MODE PAGE
- SET RS-232 OUTPUT FORMAT TO ADS-B OUT(+) (FOR RS-232 PORT CONNECTED TO TRANSPONDER RS-232 IN CHANNEL 2)

Figure D-2.2 G3X w/GSU 73 - Transponders Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 32, 327, 33(ES), OR 330(ES) 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. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

D. 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. ON THE GDU 37X XPDR CONFIG PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

D. NO GSU 73 CONFIGURATION REQUIRED

3. GTX 33(ES)

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 PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS-A IN" IF TIS-A TRAFFIC IS DESIRED

D. ON THE GDU 37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

E. NO GSU 73 CONFIGURATION REQUIRED

4. GTX 330(ES)

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 PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS-A IN" IF TIS-A TRAFFIC IS DESIRED

D. ON THE GDU 37X XPDR CONFIG PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

E. NO GSU 73 CONFIGURATION REQUIRED

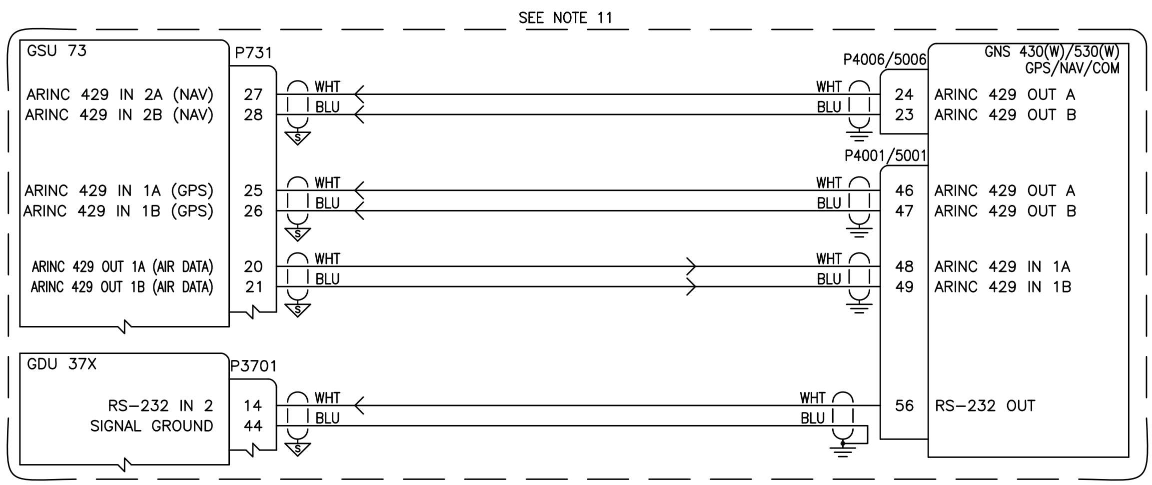
5. GTX 23ES

A. THE GTX 23ES MUST BE CONNECTED AS SHOWN IN FIG D-2.2

B. CONTROL OF GTX 23ES FROM THE GTN 6XX/7XX IS NOT SUPPORTED

Figure D-2.3 GTN 6XX/7XX - Transponder Interconnect/Configuration Example w/GSU 73

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

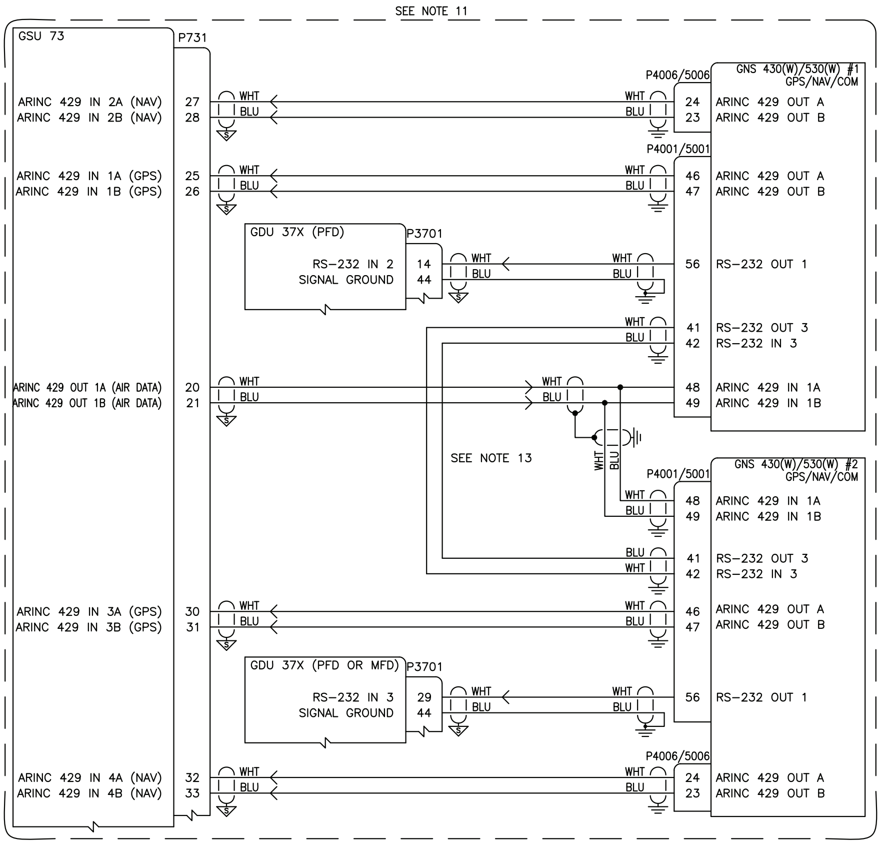
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET RX AND TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure D-2.4 Single GNS 430(W)/530(W) Interconnect/Configuration Example w/GSU 73

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

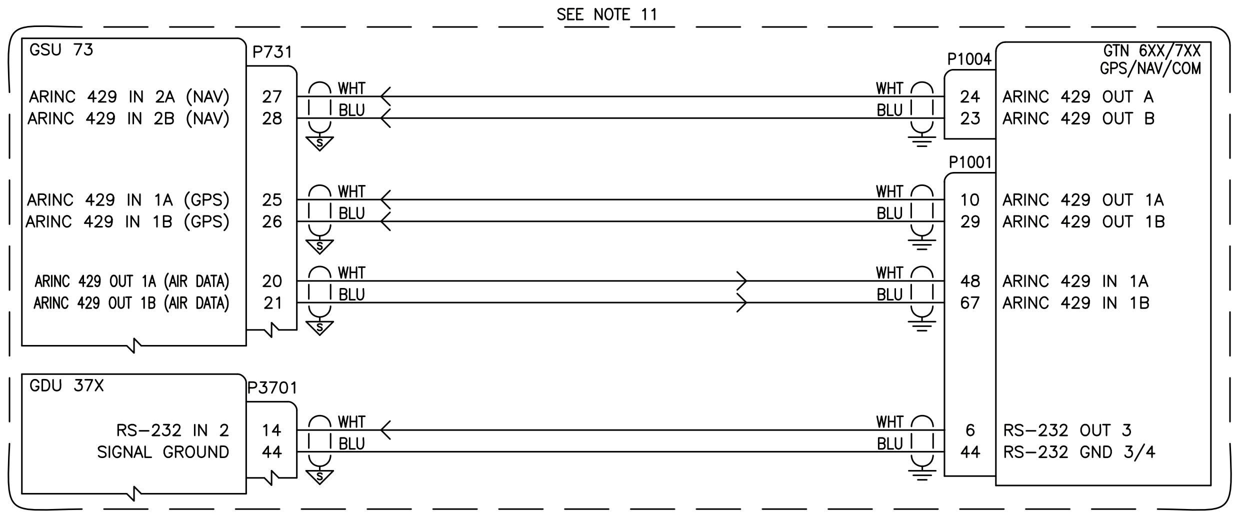
2. G3X

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET 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 D-2.5 Dual GNS 430(W)/530(W) Interconnect/Configuration Example w/GSU 73

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX 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"

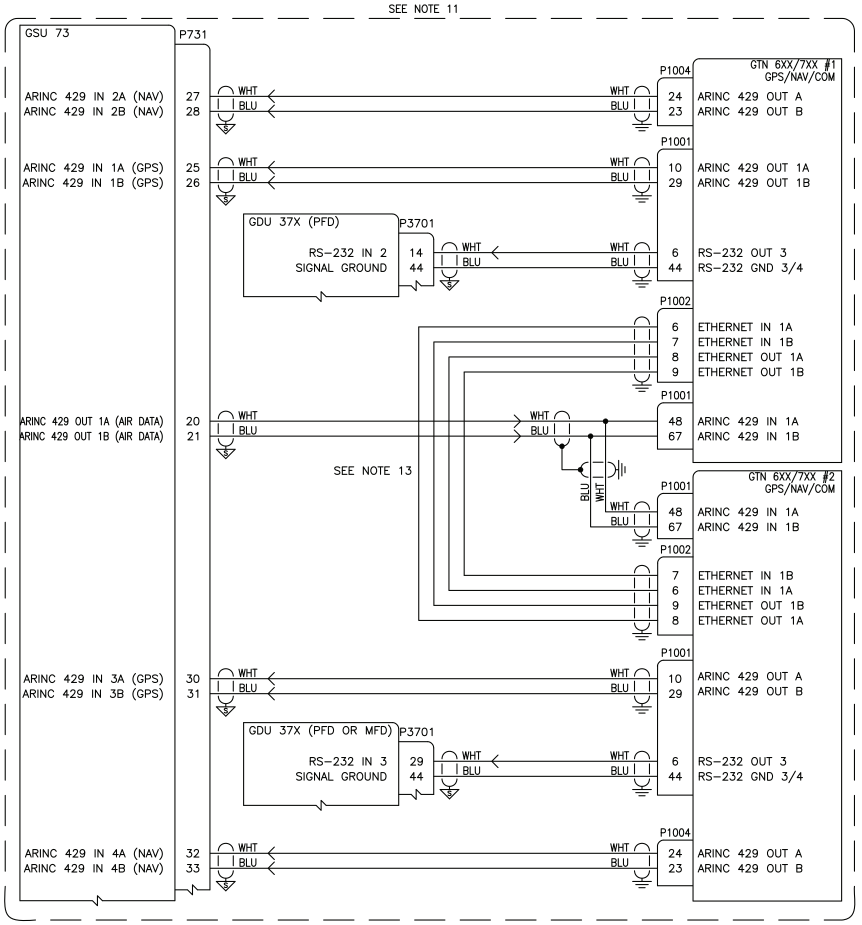
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE
- SET NAV RADIO TO "ENABLED"
- SET TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure D-2.6 Single GTN 6XX/7XX Interconnect/Configuration Example w/GSU 73

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX 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"

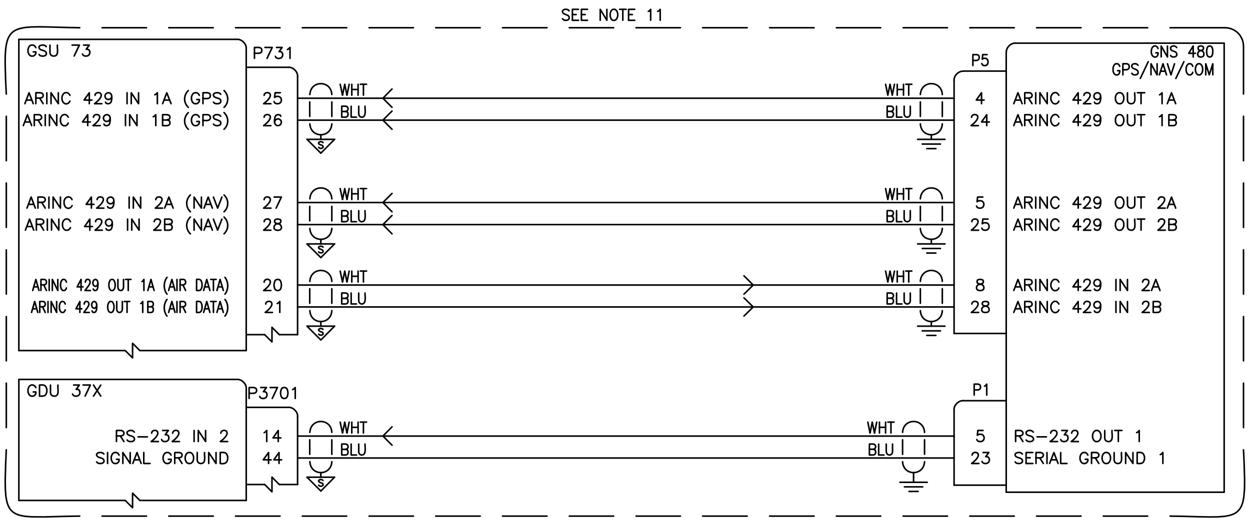
2. G3X

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 ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET 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 D-2.7 Dual GTN 6XX/7XX Interconnect/Configuration Example w/GSU 73

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 480 UNIT. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



CONFIGURATION GUIDANCE

1. GNS 480

A. ON THE MAIN ARINC 429 SETUP PAGE
- SET IN 2 SEL TO "EFIS"
- SET IN 2 SPEED TO "LOW"
- SET IN 2 SDI TO "SYS1"
- SET OUT 1 SEL TO "GAMA 429"
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 SDI TO "SYS1"
- SET OUT 2 SEL TO "VOR/ILS"
- SET OUT 2 SPEED TO "LOW"
- SET OUT 2 SDI TO "SYS1"

B. ON THE SERIAL SETUP PAGE
- SET CHNL 1 OUTPUT TO "MAPMX"

C. ON THE RESOLVER INTERFACE PAGE SET RESOLVER TO "NOT INSTALLED"

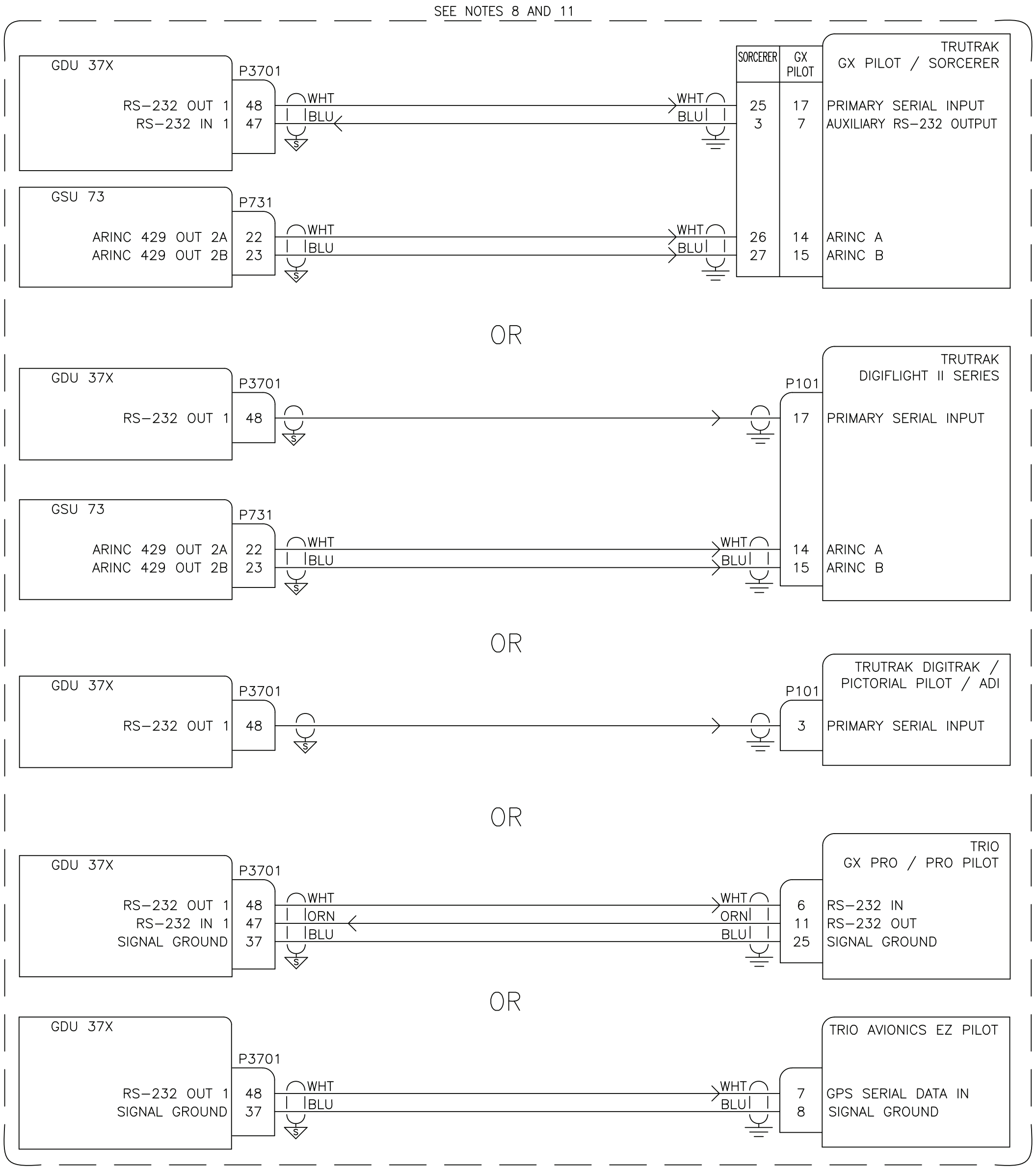
D. ON THE MISCELLANEOUS SETUP PAGE SET CDI SELECT TO "USE"

2. G3X

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET THE CONNECTED GDU 37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure D-2.8 GNS 480 Interconnect/Configuration Example w/GSU 73

NON-GARMIN AUTOPILOT INTERCONNECTS SHOWN FOR REFERENCE ONLY. AUTOPILOT VENDOR DOCUMENTATION SHOULD BE CONSULTED FOR PROPER PIN CONNECTIONS.



CONFIGURATION GUIDANCE

1. TRUTRAK GX PILOT / SORCERER

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"
- SET ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

2. TRUTRAK DIGIFLIGHT II SERIES

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
- SET ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

3. TRUTRAK DIGITRAK / PICTORIAL PILOT / ADI OR TRIO AVIONICS EZ PILOT

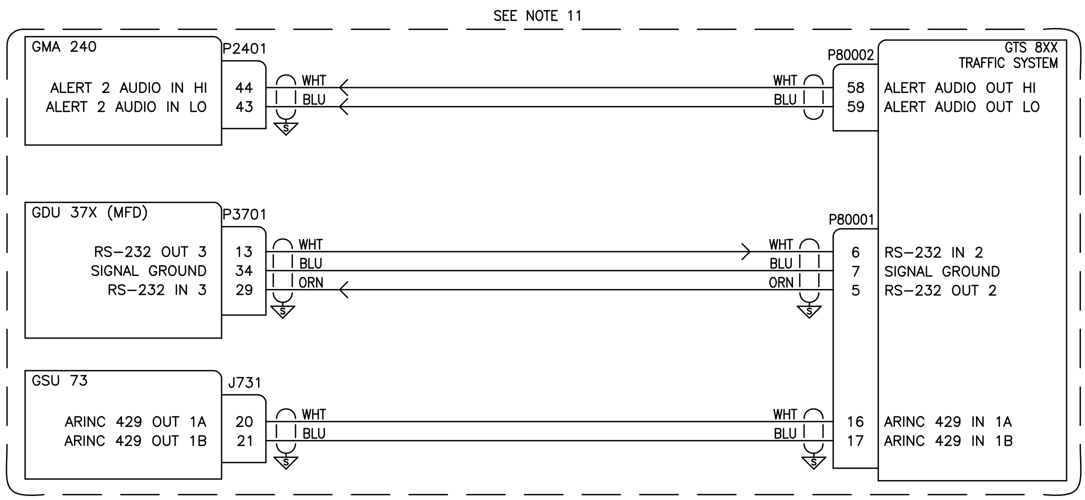
A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "NMEA OUT"

4. TRIO GX PRO / PROPILOT

A. ON THE GDU 37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"

Figure D-2.9 Non-Garmin Auto Pilot Interconnect/Configuration Example w/GSU 73

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTS 8XX TRAFFIC SYSTEM. CONTACT A LOCAL GARMIN AVIONICS DEALER FOR COMPLETE INSTALLATION INFORMATION.



REFER TO THE GTS 8XX INSTALLATION MANUAL FOR ADDITIONAL WIRING INFORMATION SUCH AS POWER, USB, AND TRANSPONDER CONNECTIONS AS WELL AS CONFIGURATION GUIDANCE. DO NOT USE RS-232 PORT 1 ON THE GTS 8XX UNIT.

CONFIGURATION GUIDANCE

1. GTS 8XX

A. USE GTS 8XX SOFTWARE VERSION 2.02 OR HIGHER

B. CONFIGURE "TRAFFIC DISPLAY DESTINATION" TO THE APPROPRIATE RS-232 PORT

C. CONFIGURE "BAROMETRIC ALTITUDE SOURCE" AND "MAGNETIC HEADING SOURCE" TO THE APPROPRIATE A429 INPUT PORT, AND UNCHECK THE ASSOCIATED "HIGH" SPEED CHECKBOXES

2. GDU 37X

A. ON THE GDU 37X COMM CONFIG MODE PAGE

- SET CONNECTED GDU 37X RS-232 CHANNEL FORMAT TO "GARMIN HSDB"
- SET THE APPROPRIATE ARINC 429 OUT FORMAT TO "EFIS/AIRDATA"
- CONFIGURE THE "NAV 1/2" SETTING AS REQUIRED FOR THE EXTERNAL GPS NAVIGATOR(S), IF APPLICABLE

B. ON THE GDU 37X XPDR CONFIG MODE PAGE

- IF A REMOTE TRANSPONDER IS CONFIGURED, SET "TIS-A TRAFFIC DATA" TO "DISABLED"

C. ON THE GDU 37X SOUND CONFIG MODE PAGE

- SET "TRAFFIC AUDIO" AND "TRAFFIC N/A ALERT" TO "OFF"

Figure D-2.10 G3X w/GSU 73 - GTS 8XX Interconnect/Configuration Example

APPENDIX E SENSOR WIRING 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

   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. 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 SECTION 18 FOR ADDITIONAL GUIDANCE ON FUEL QUANTITY GAUGE CONFIGURATION.
7. CAPACITANCE TO FREQUENCY CONVERTERS CAN BE USED FOR MEASUREMENT OF CAPACITIVE FUEL QUANTITY.
8. THIS NOTE IS NO LONGER APPLICABLE AND HAS BEEN REMOVED.
9. FOR GSU 73 ONLY: 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. FOR GSU 73 ONLY: 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. FOR GSU 73 ONLY: THE USE OF "XX" AS A GROUND CONNECTION PIN NUMBER 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 E-1.1 Notes for Sensor Wiring Example Drawings (for all Appdx E drawings)

E.1 Sensor Wiring Examples w/GEA 24

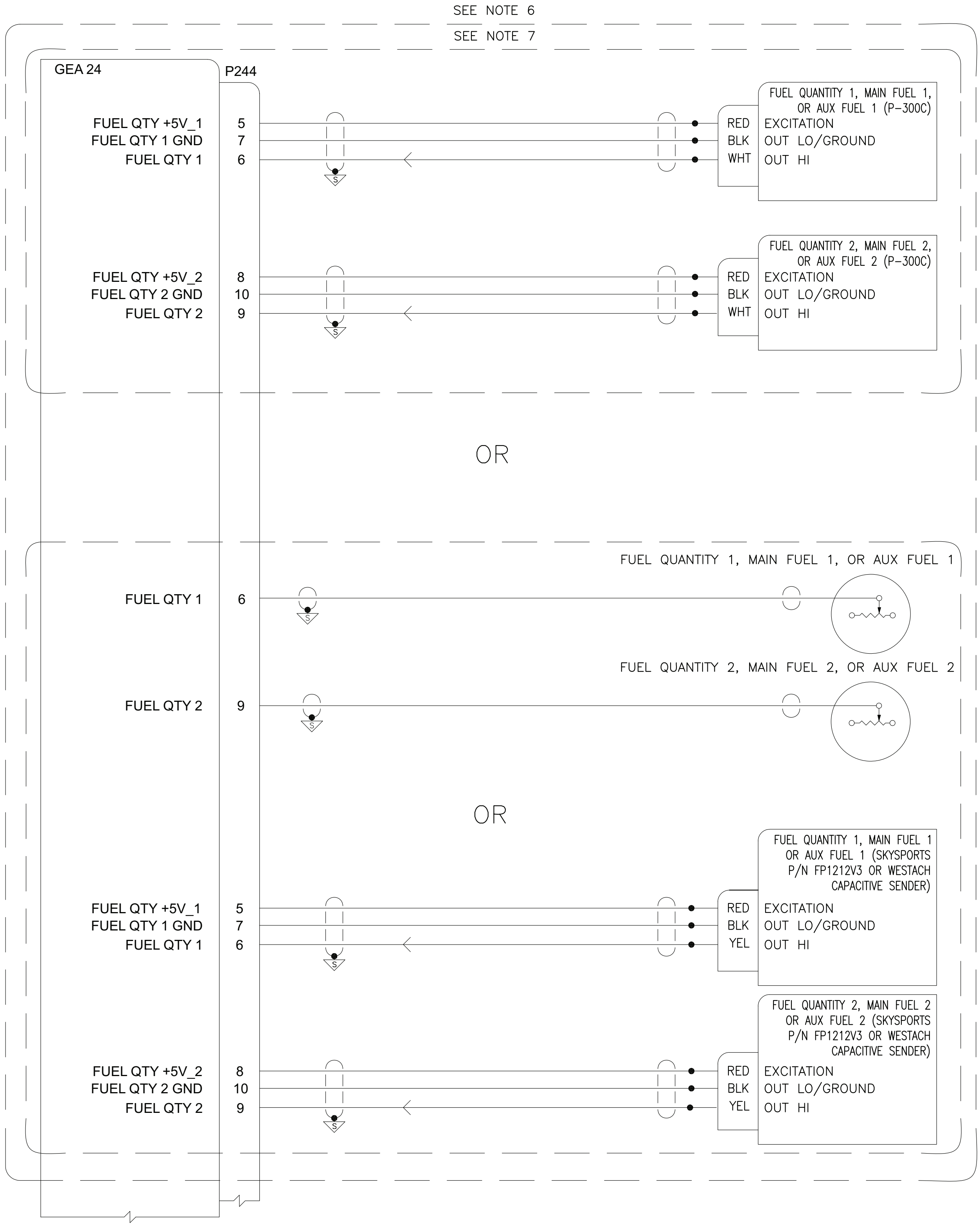


Figure E-2.1 Page 1 of 2 Fuel Quantity and Fuel Flow Examples (w/GEA 24)

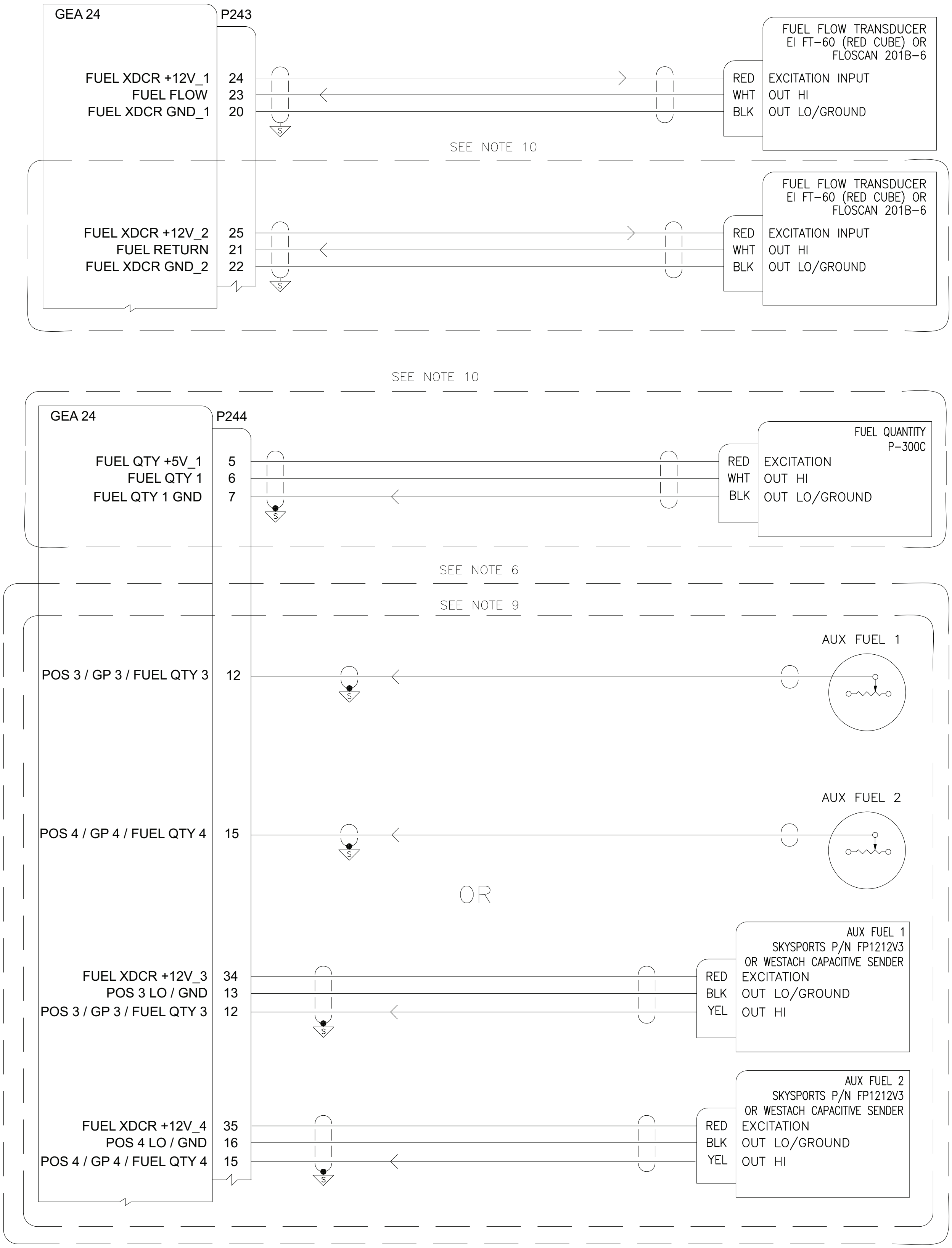


Figure E-2.1 Page 2 of 2 Fuel Quantity and Fuel Flow Examples (w/GEA 24)

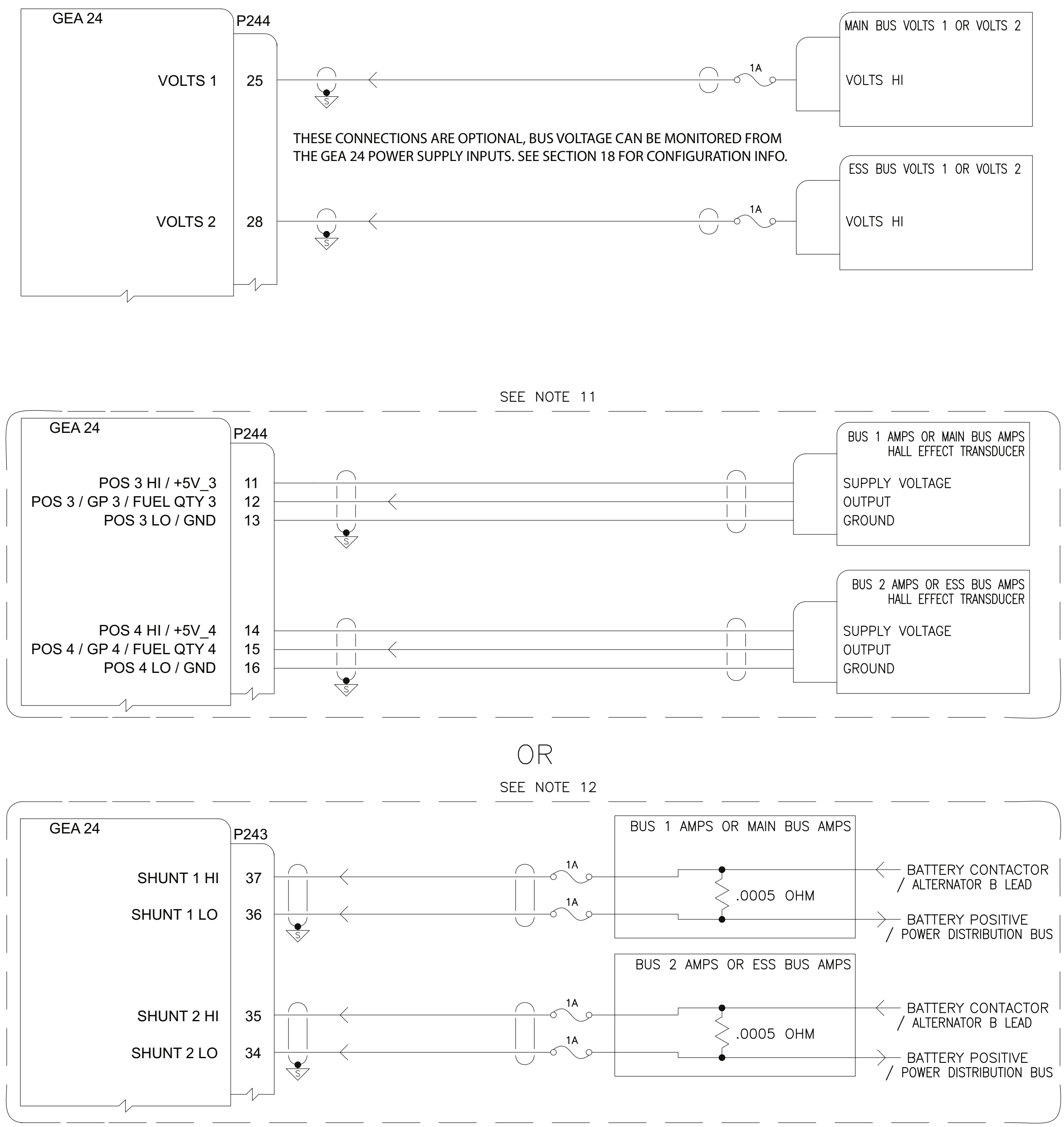


Figure E-2.2 Page 1 of 2 Electrical and Discrete Input/Output Examples (w/GEA 24)

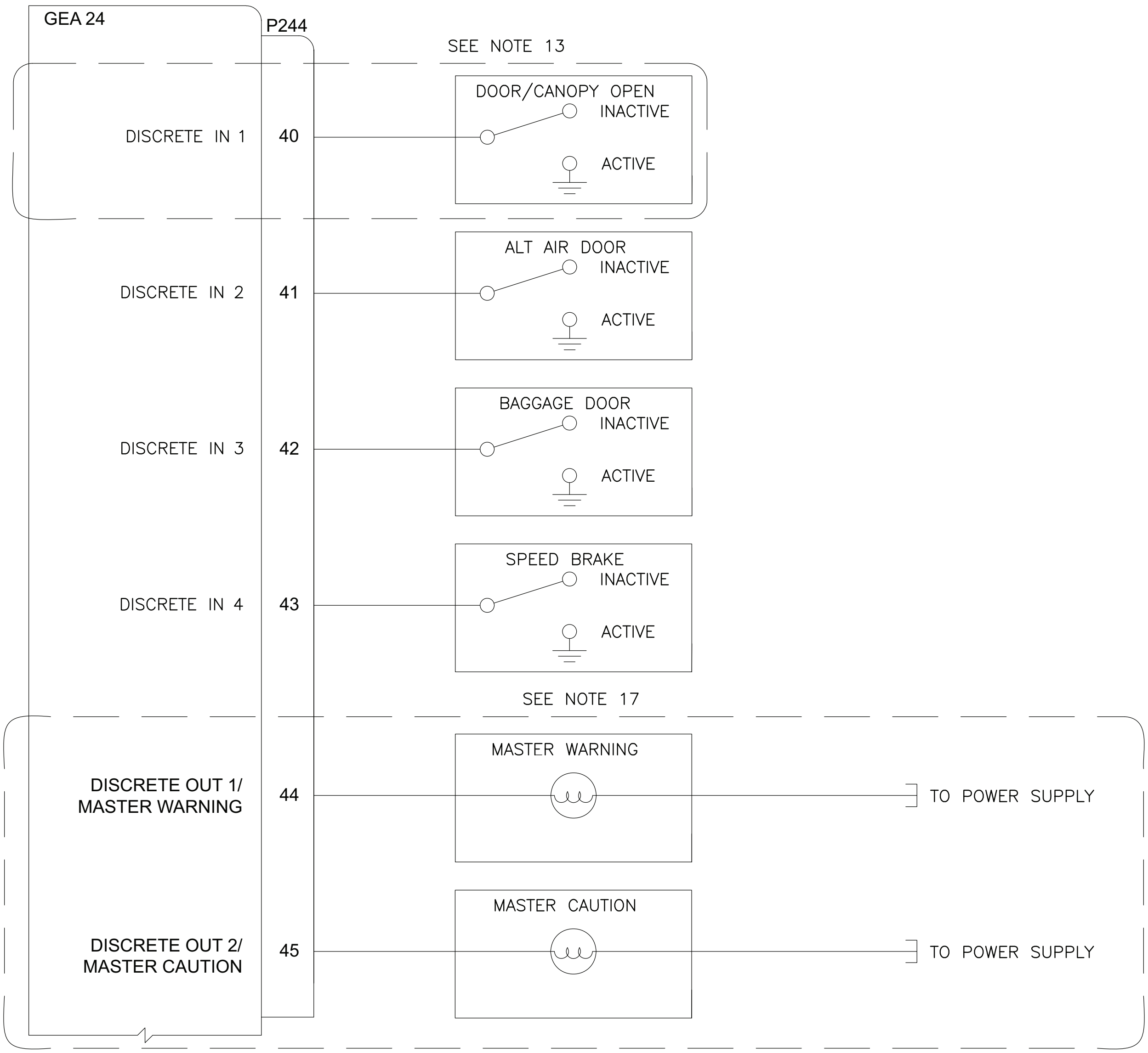


Figure E-2.2 Page 2 of 2 Electrical and Discrete Input/Output Examples (w/GEA 24)

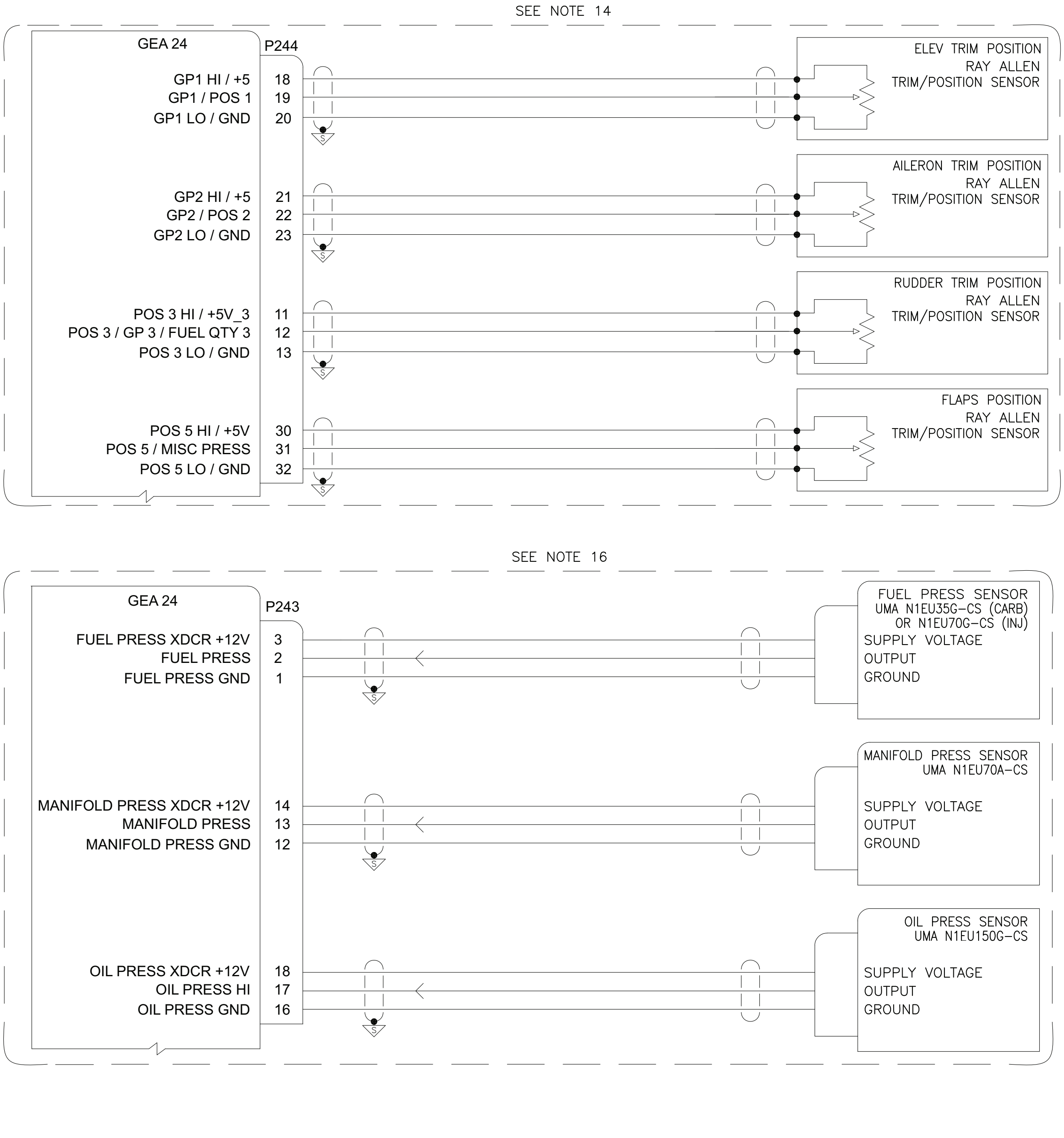


Figure E-2.3 Flaps/Trim and UMA Pressure Transducer Examples (w/GEA 24)

E.2 Sensor Wiring Examples w/GSU 73

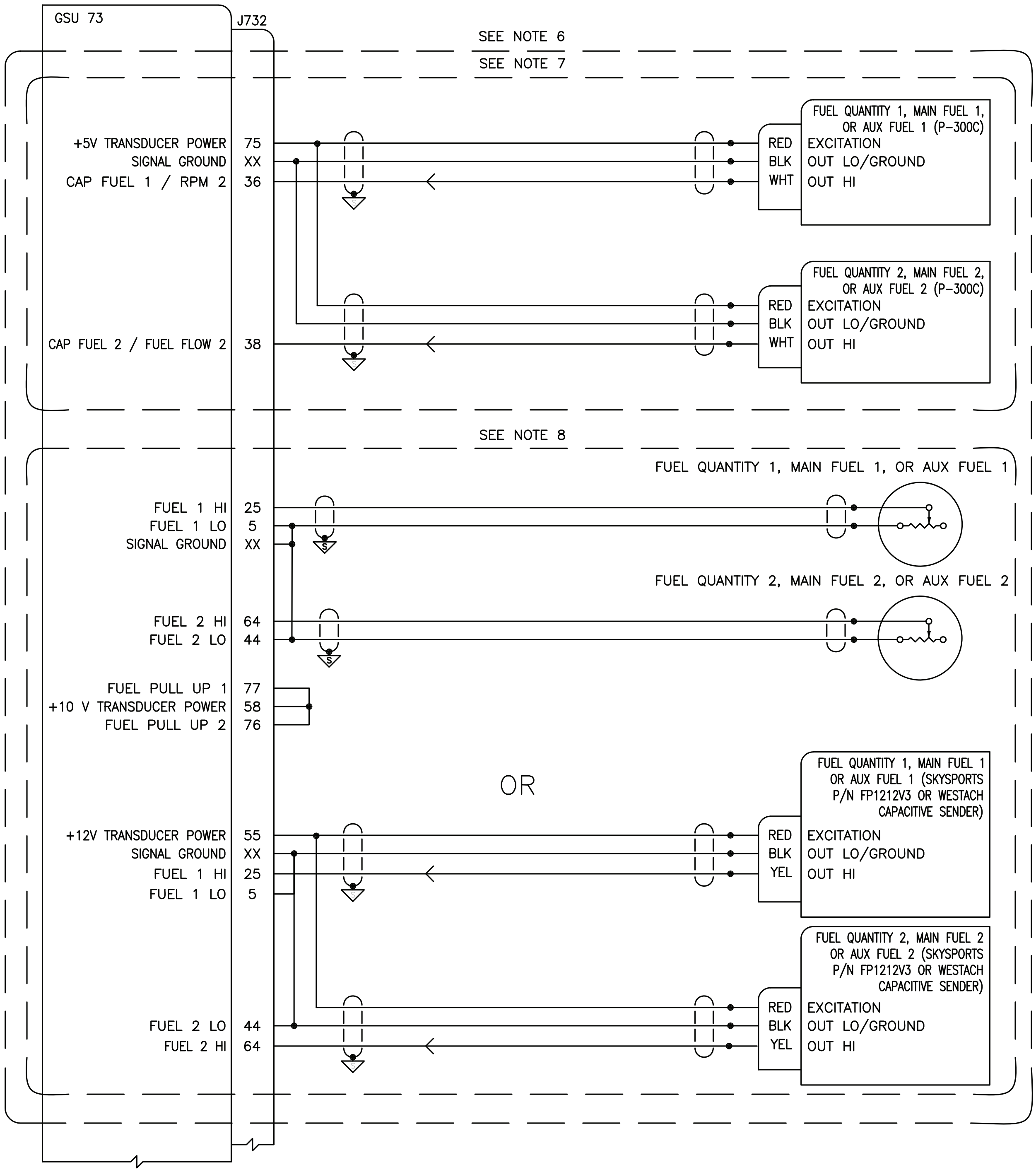


Figure E-3.1 Page 1 of 2 Fuel Quantity and Fuel Flow Examples (w/GSU 73)

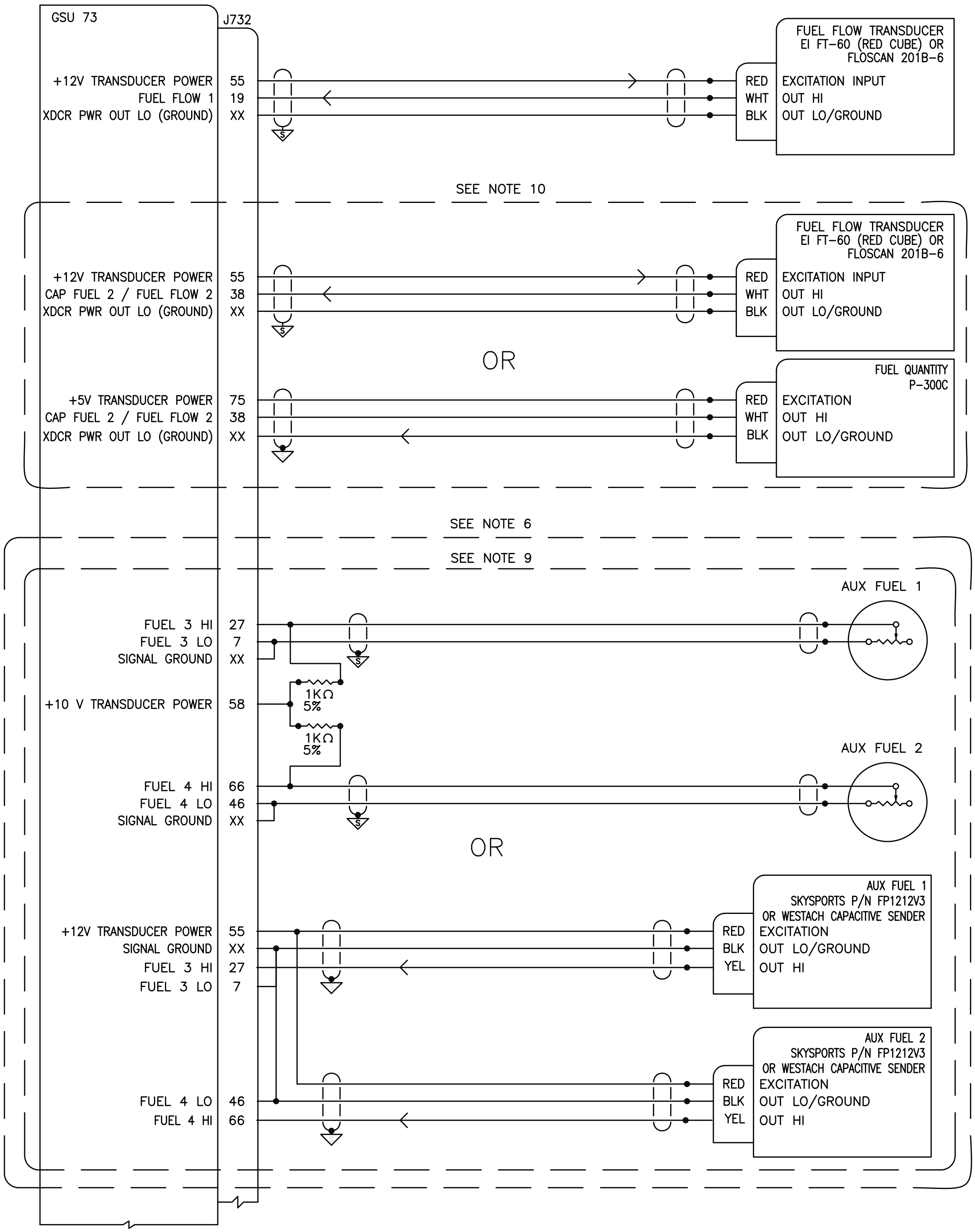


Figure E-3.1 Page 2 of 2 Fuel Quantity and Fuel Flow Examples (w/GSU 73)

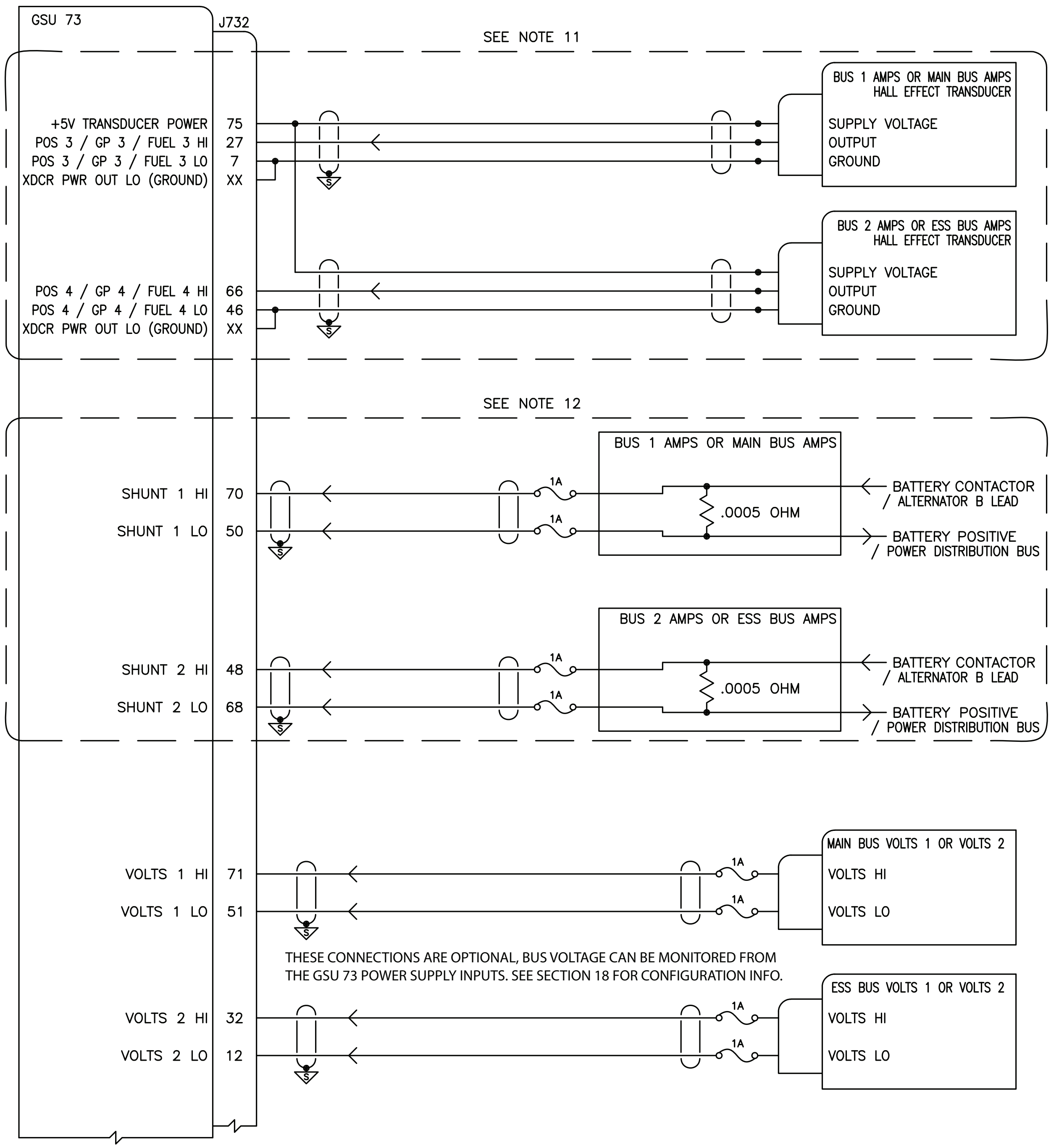


Figure E-3.2 Page 1 of 2 Electrical and Discrete Input/Output Examples (w/GSU 73)

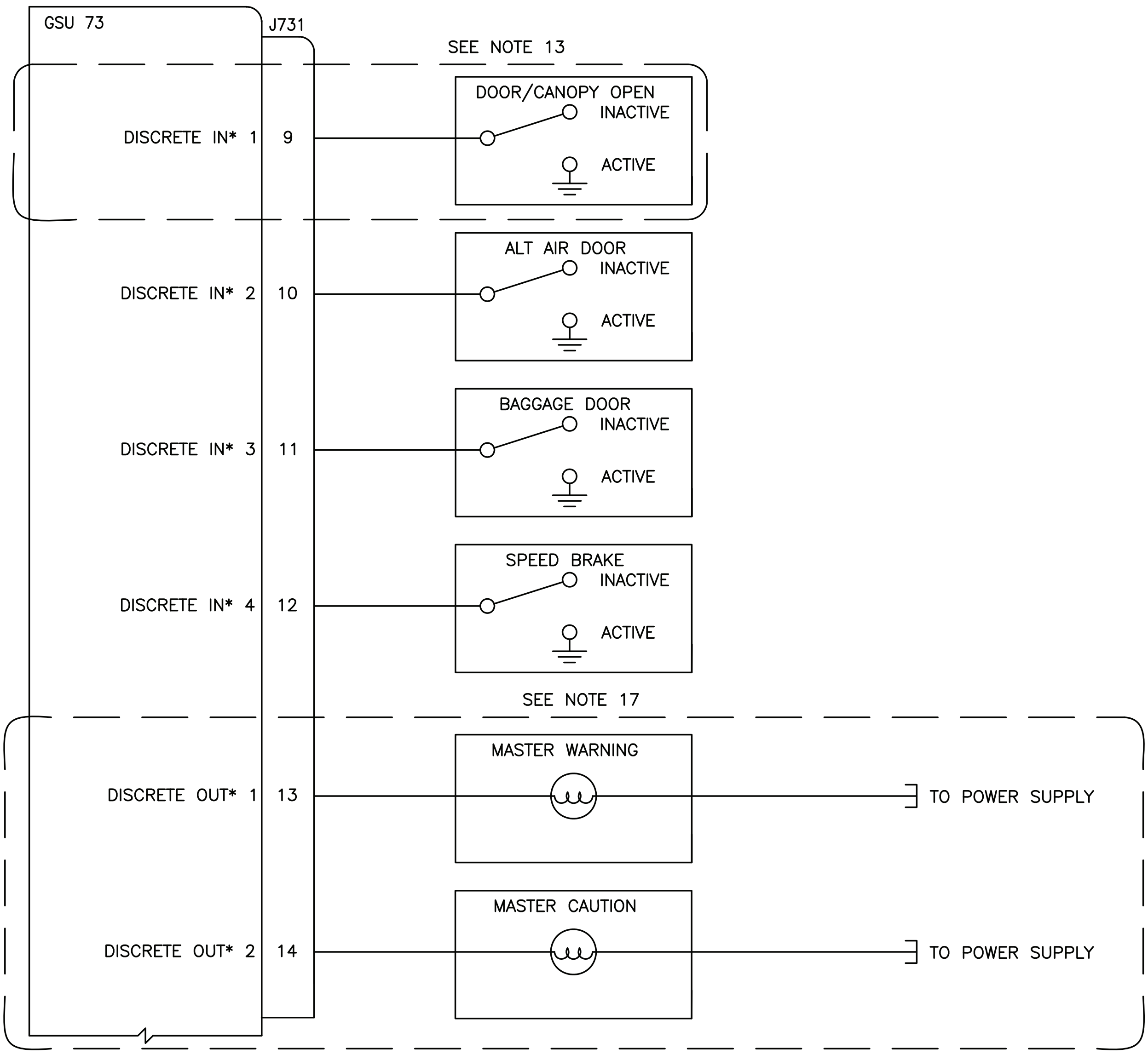


Figure E-3.2 Page 2 of 2 Electrical and Discrete Input/Output Examples (w/GSU 73)

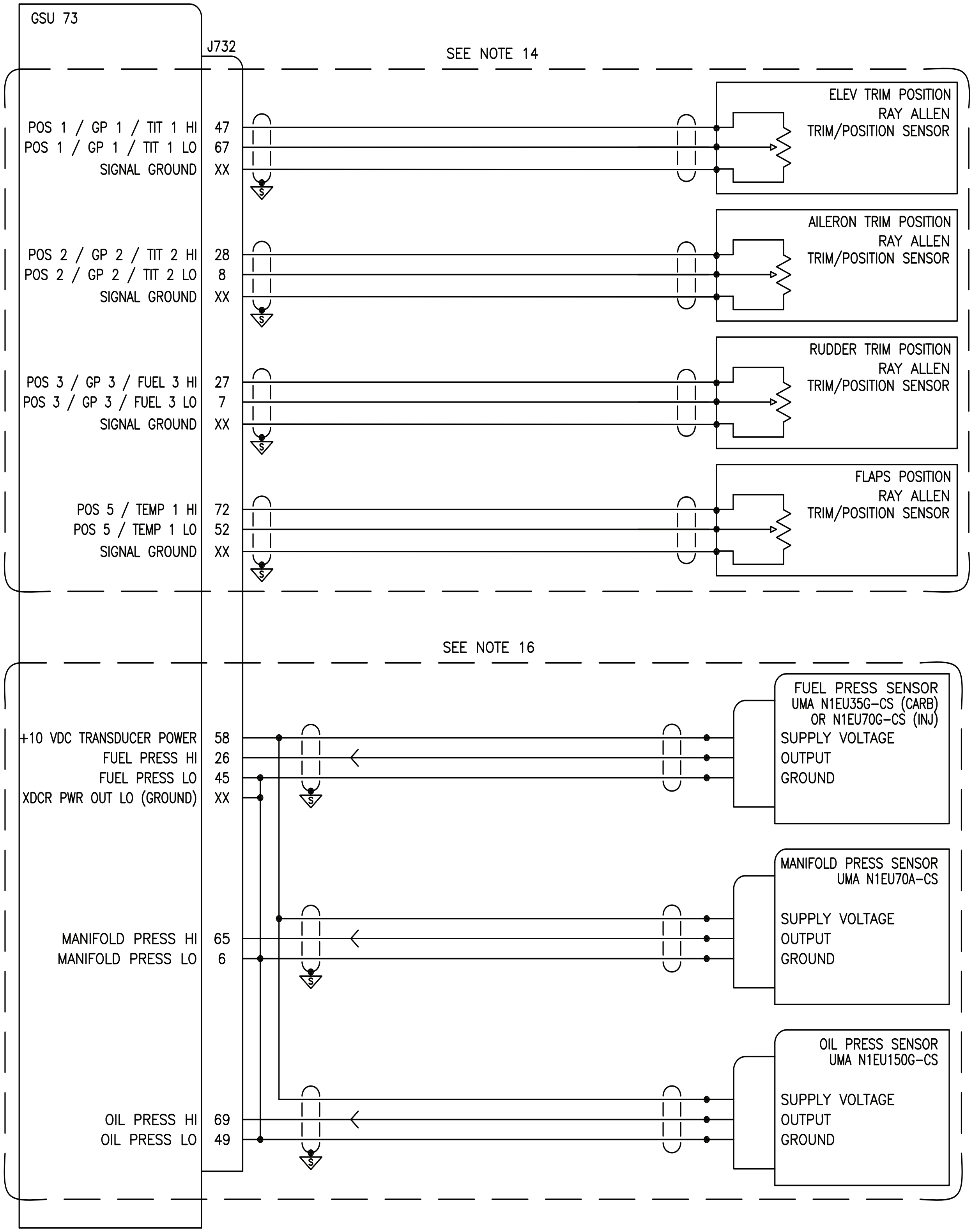


Figure E-3.3 Flaps/Trim and UMA Pressure Transducer Examples (w/GSU 73)

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APPENDIX F LYCOMING/CONTINENTAL SENSOR WIRING 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
   - 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. THE RPM CHANNEL CAN BE CONFIGURED FOR UMA TACH SENDERS SHOWN OR 4 OR 6 CYLINDER ELECTRONIC IGNITION INPUTS.
7. GROUNDING METHODS FOR ELECTRONIC 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 (GSU 73) OR RPM 2 (GEA 24) 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. WIRE COLORS ARE SHOWN FOR REFERENCE ONLY, ALWAYS CONFIRM CORRECT SENSOR CONNECTIONS USING SENSOR MANUFACTURER DOCUMENTATION BEFORE CONNECTING WIRES.
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 F-1.1 Notes for Lycoming/Continental Sensor Drawings (for all Appdx F drawings)

F.1 GEA 24 - Lycoming/Continental Sensor Drawings

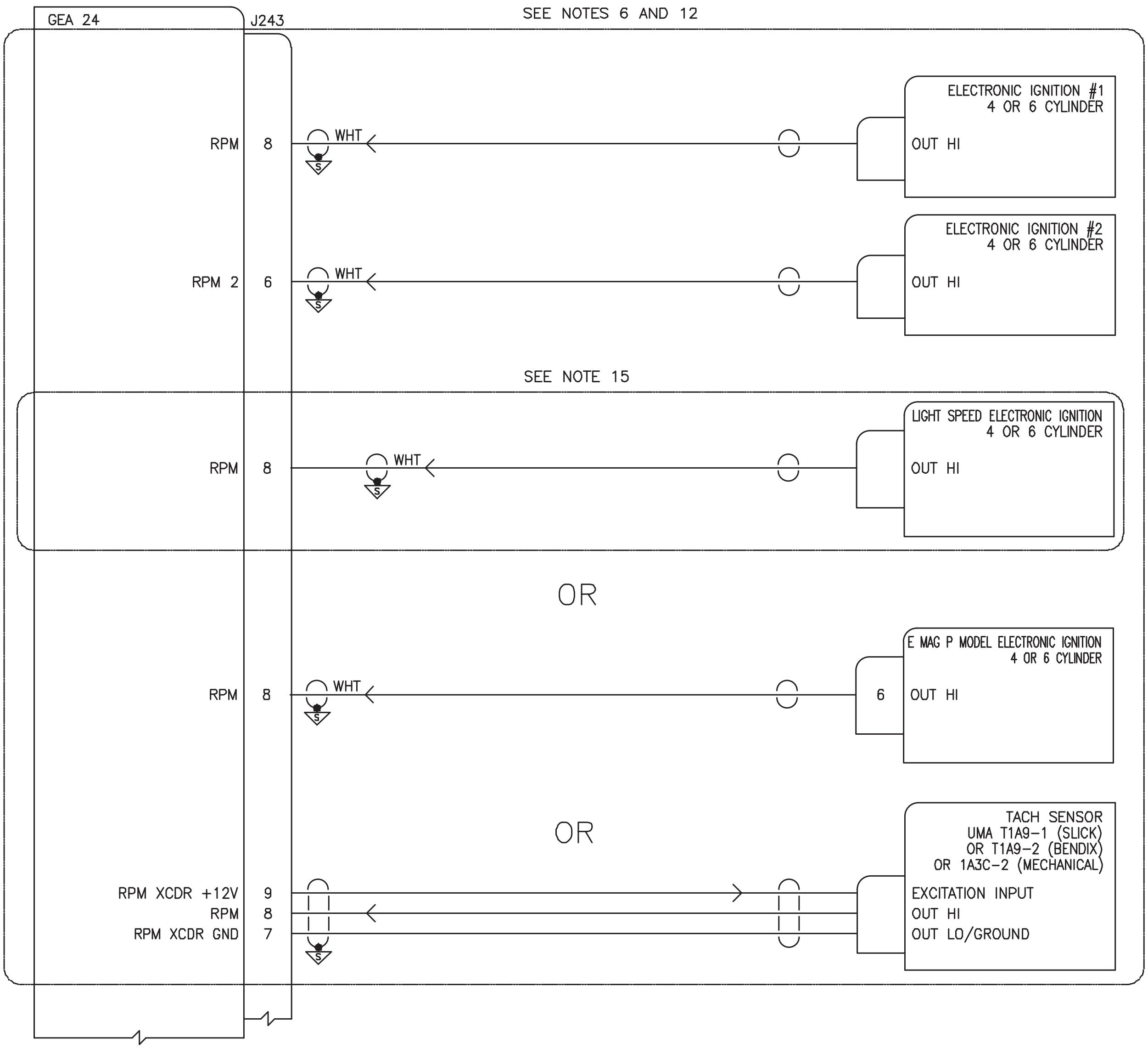

Figure F-2.1 GEA 24 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 1 of 3

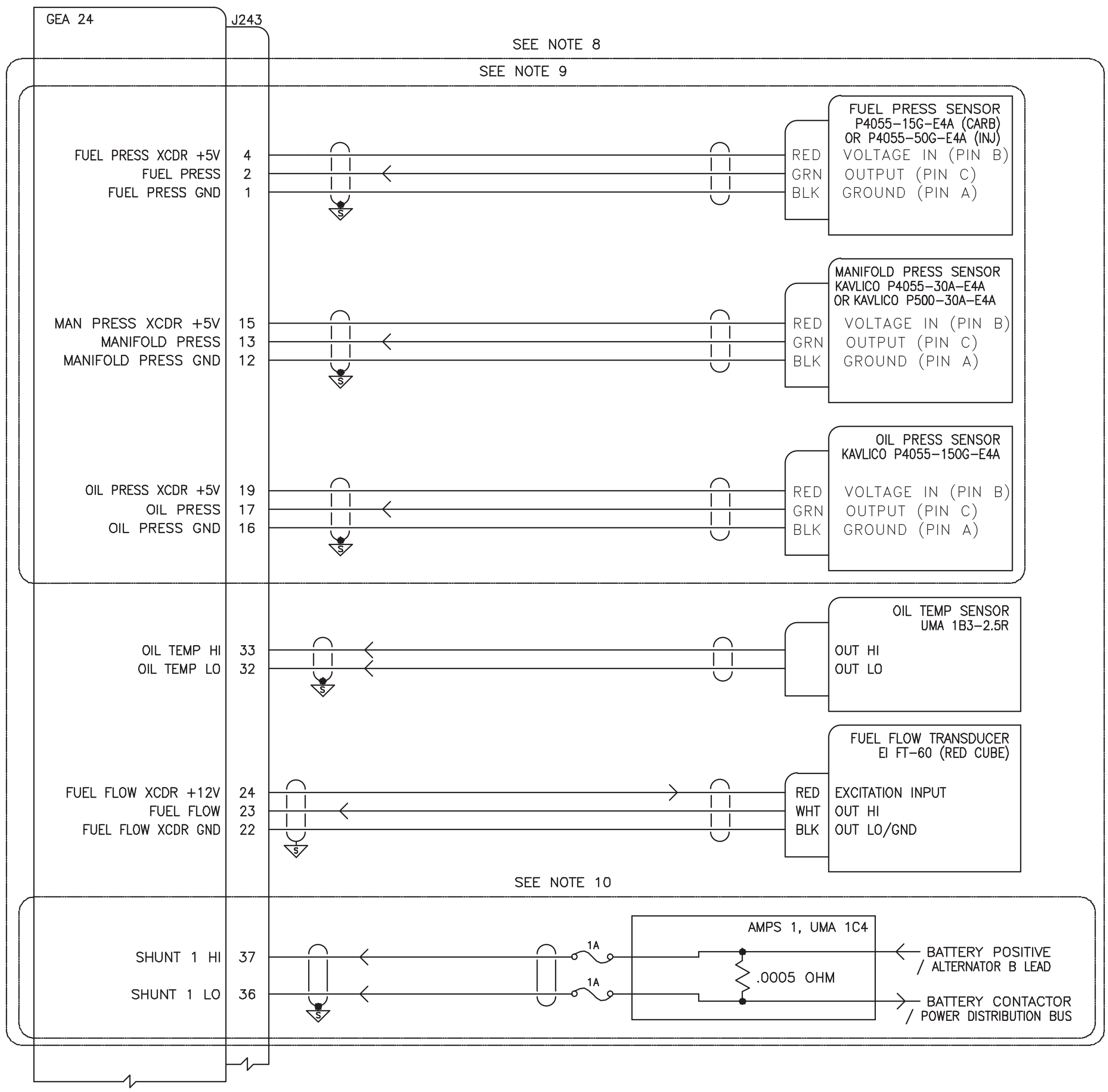

Figure F-2.1 GEA 24 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 2 of 3

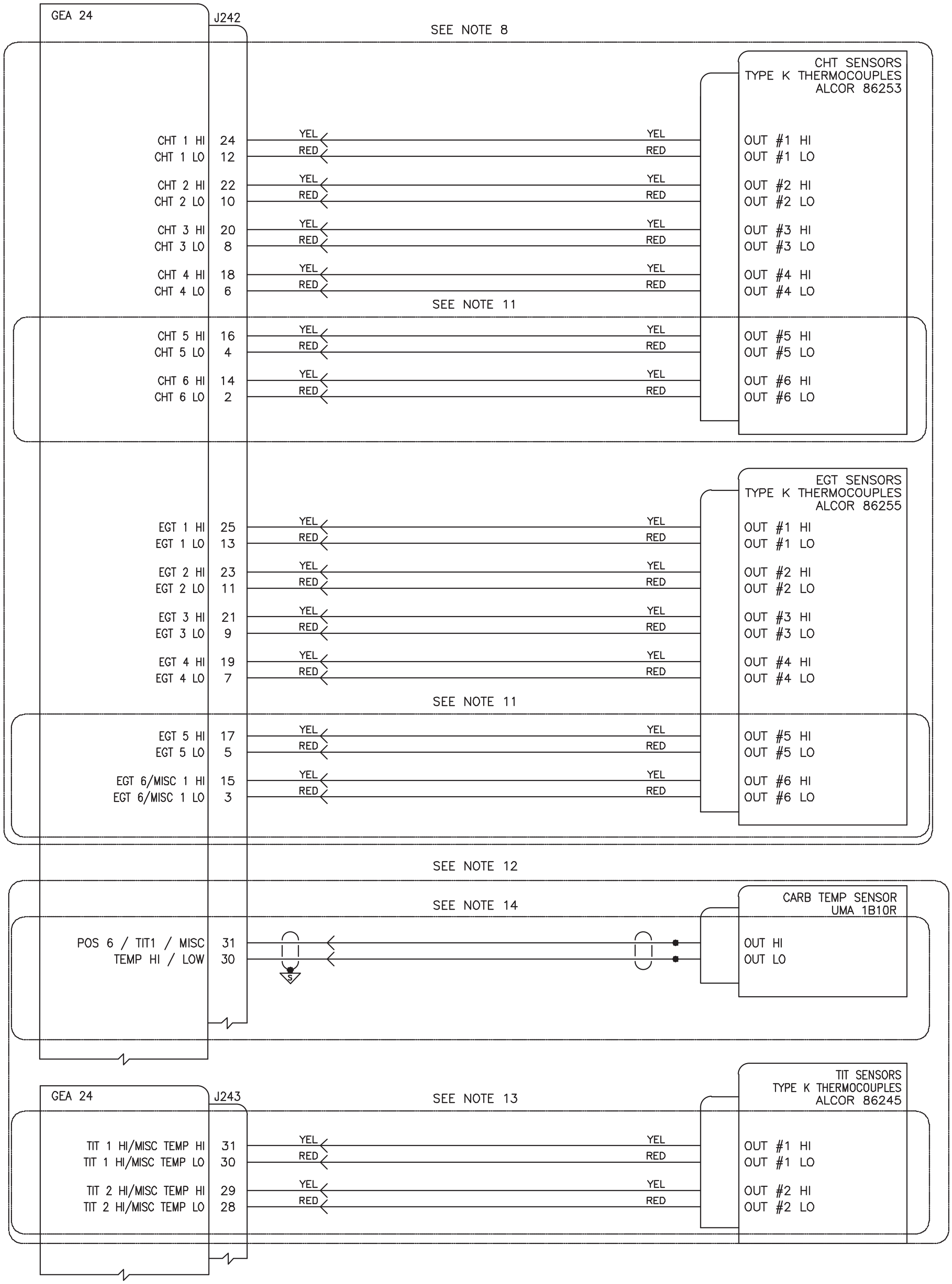

Figure F-2.1 GEA 24 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 3 of 3

F.2 GSU 73 - Lycoming/Continental Sensor Drawings

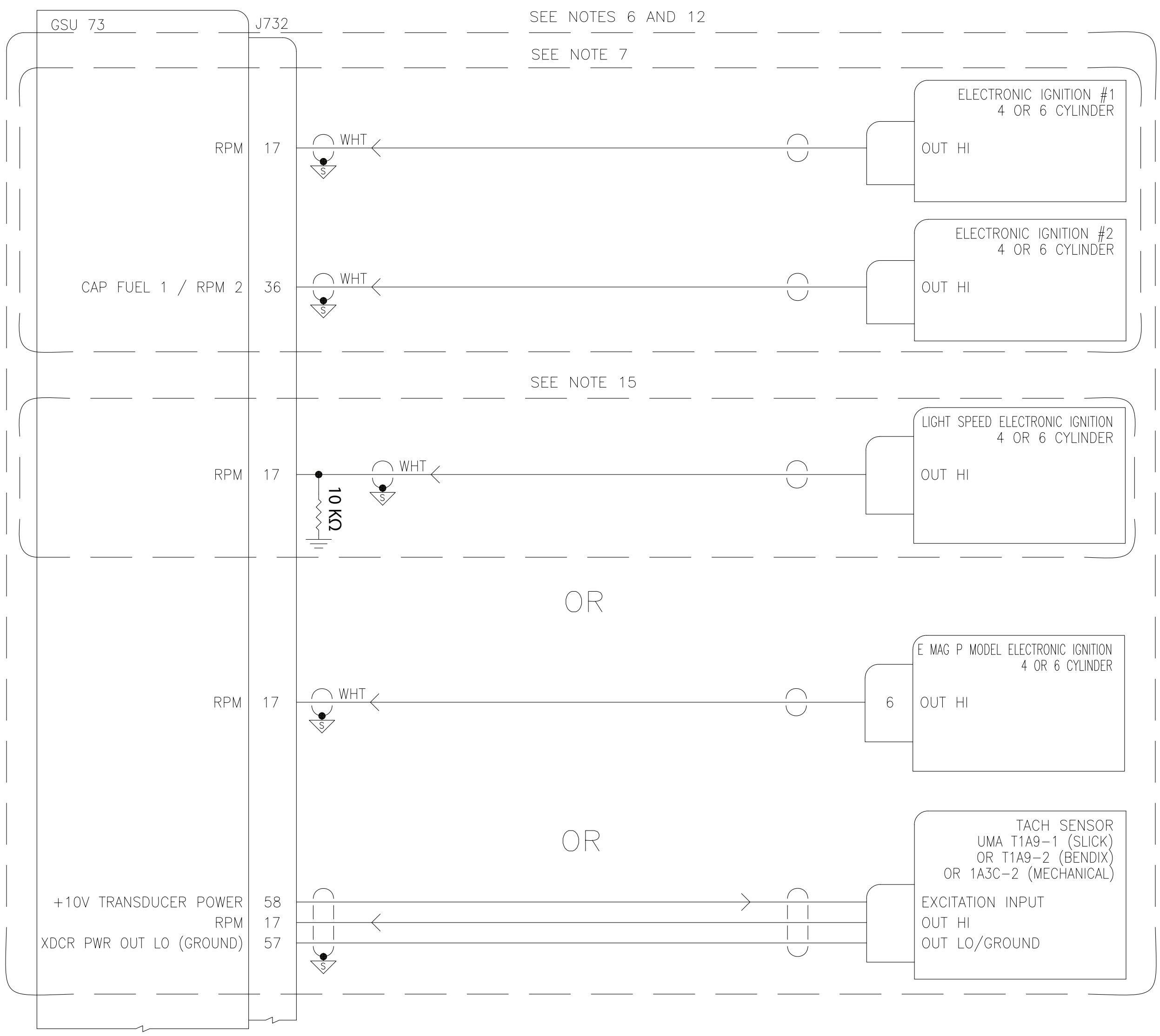

Figure F-3.1 GSU 73 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 1 of 3

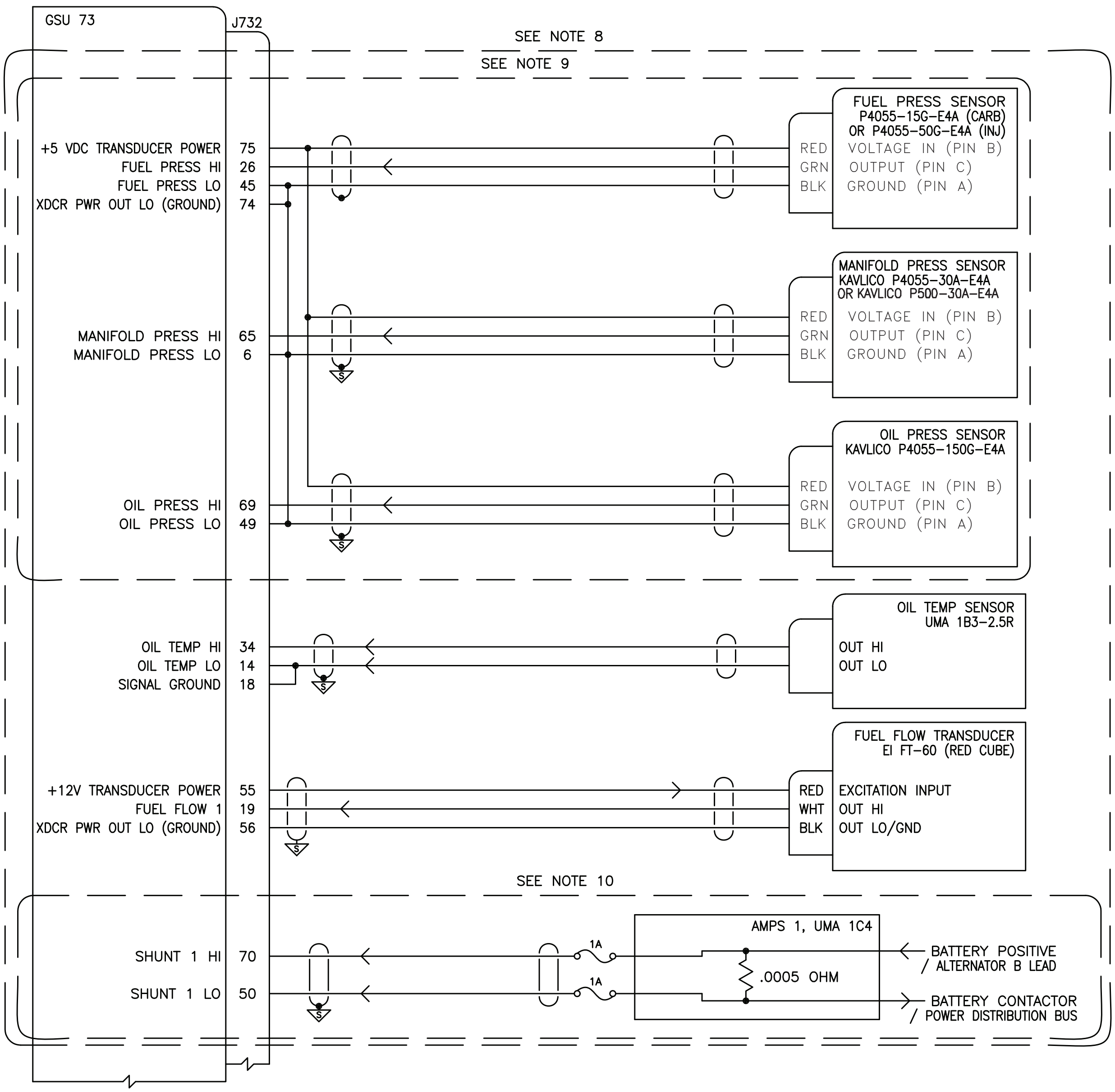

Figure F-3.1 GSU 73 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 2 of 3

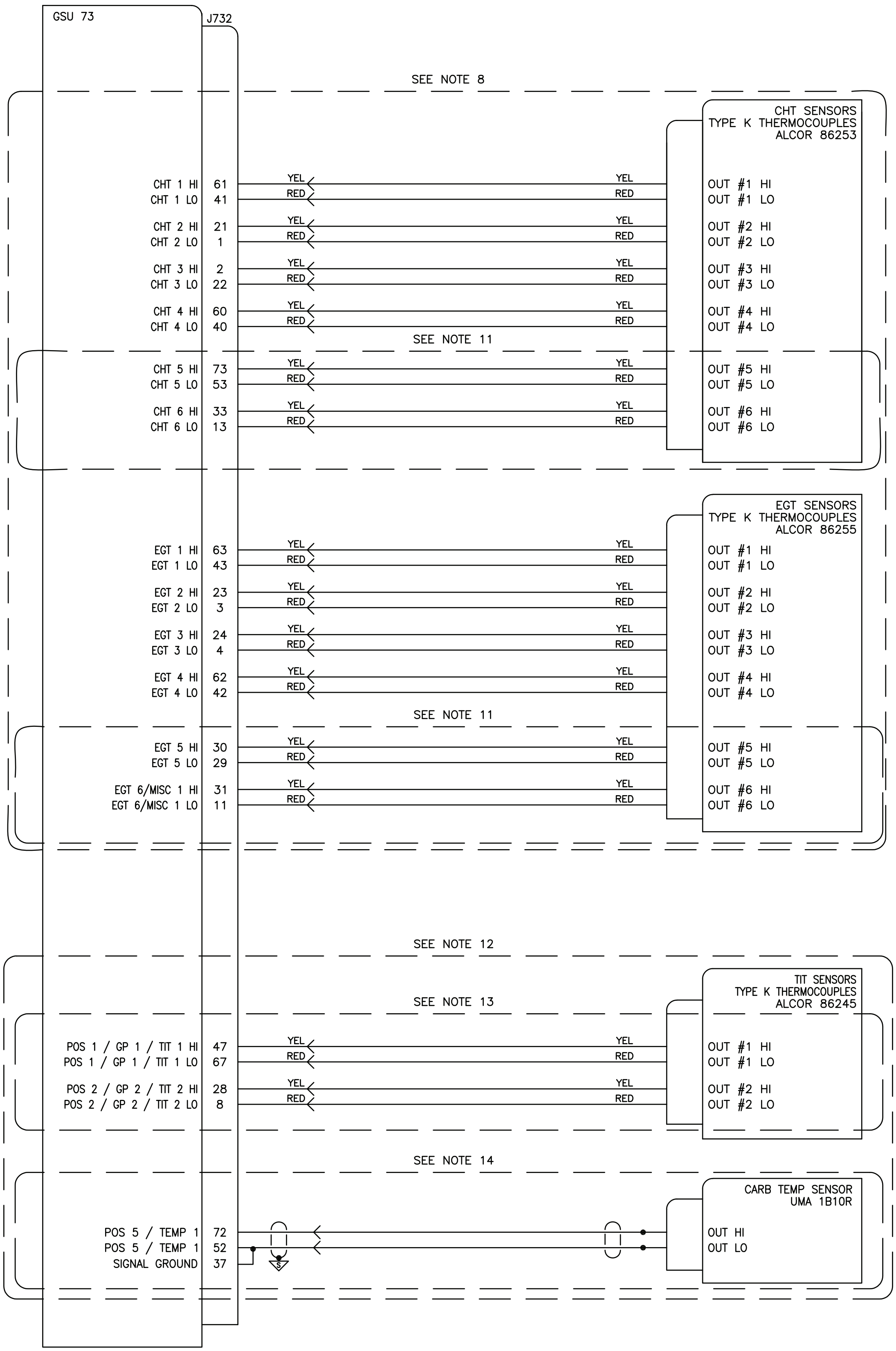

Figure F-3.1 GSU 73 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 3 of 3

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APPENDIX G ROTAX SENSOR WIRING 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:

TWISTED SHIELDED SINGLE CONDUCTOR SHIELD TERMINATED TO GROUND

TWISTED SHIELDED SINGLE CONDUCTOR SHIELD FLOATS

WHT BLU TWISTED SHIELDED PAIR SHIELD TERMINATED TO GROUND

WHT BLU TWISTED SHIELDED PAIR SHIELD FLOATS

WHT BLU ORN TWISTED SHIELDED 3 CONDUCTOR SHIELD TERMINATED TO GROUND

WHT BLU ORN TWISTED SHIELDED 3 CONDUCTOR SHIELD FLOATS

TWISTED SHIELDED 4 CONDUCTOR SHIELD TERMINATED TO GROUND

TWISTED SHIELDED 4 CONDUCTOR SHIELD FLOATS

AIRCRAFT GROUND

S GARMIN SHIELD BLOCK GROUND (REFER TO 190-00313-09)

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. SENSOR 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. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS. WIRE COLORS ARE SHOWN FOR REFERENCE ONLY, ALWAYS CONFIRM CORRECT SENSOR CONNECTIONS USING SENSOR MANUFACTURER DOCUMENTATION BEFORE CONNECTING WIRES.
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. 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.
12. USE GARMIN P/N 682-00011-00 BI-DIRECTIONAL DIODE ON RPM 1 INPUT AND 300 Ω RESISTOR BETWEEN PINS 7 AND 8 AS SHOWN IN FIGURE G-2.2.
13. USE THE KAVLICO P4055-15G FUEL PRESSURE SENSOR WITH THE ROTAX 912 ENGINE. USE THE UMA N1EU07D FUEL PRESSURE SENSOR WITH THE ROTAX 914 ENGINE

Figure G-1.1 Notes for Rotax 912/914 Sensor Drawings (for all Appdx G drawings)

G.1 GEA 24 - Rotax Sensor Drawings

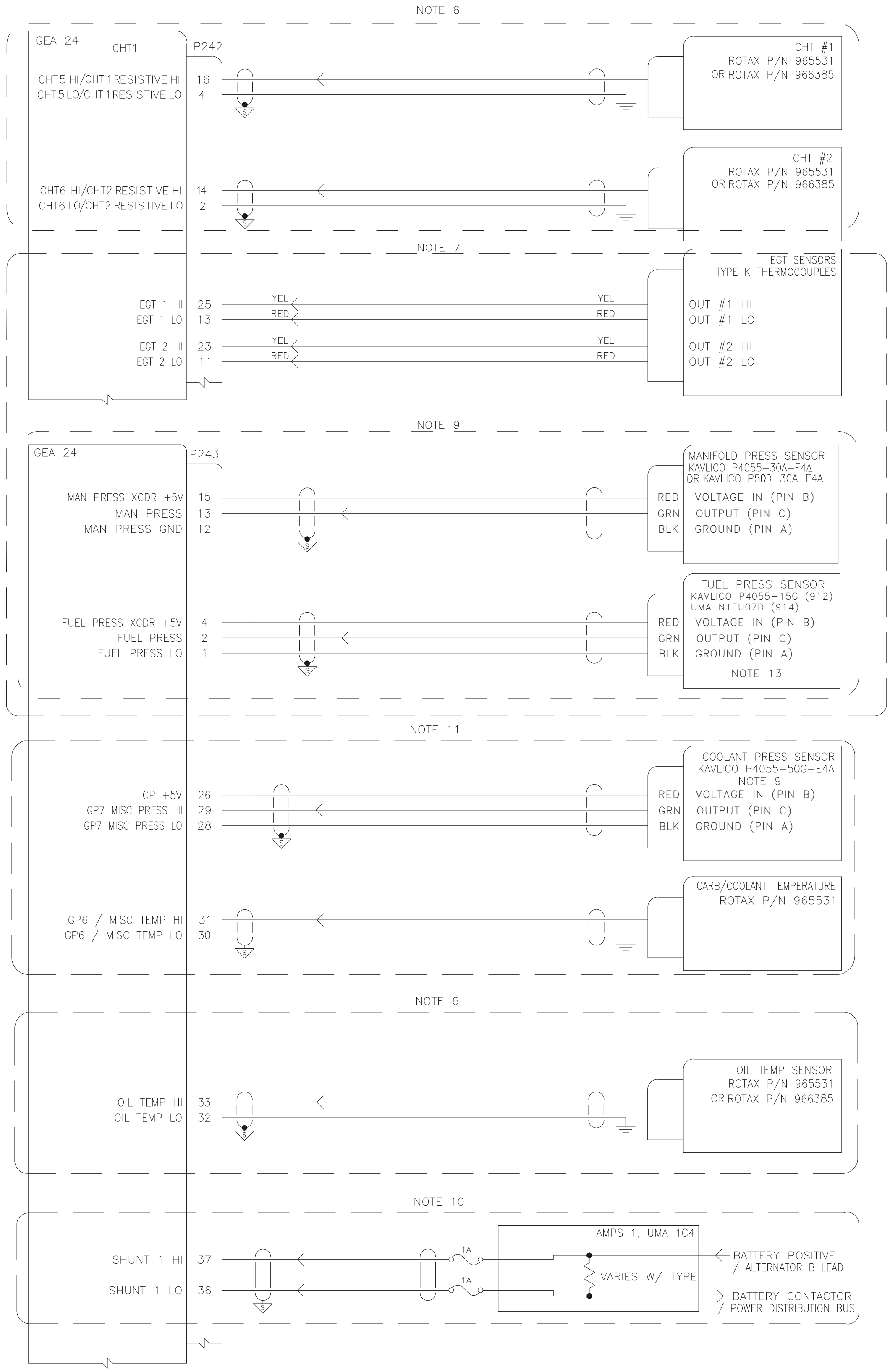

Figure G-2.1 GEA 24 - Rotax 912/914 Sensor Wiring Examples, Page 1 of 2

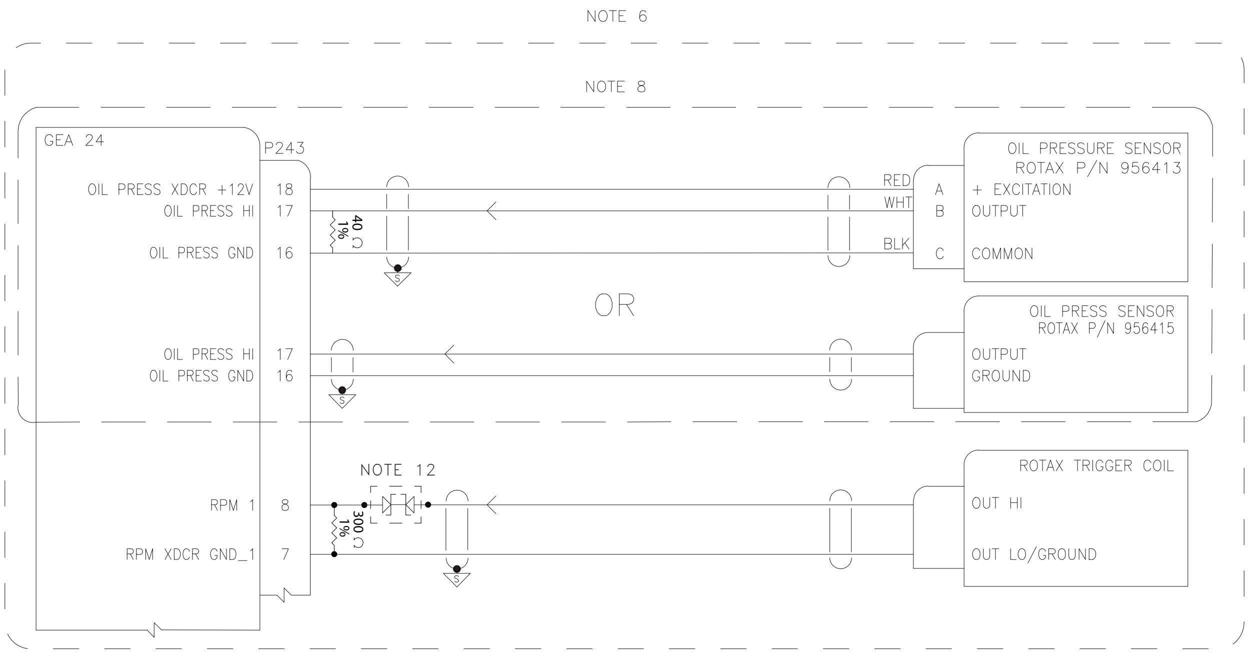

Figure G-2.2 GEA 24 - Rotax 912/914 Sensor Wiring Examples, Page 2 of 2

G.2 GSU 73 - Rotax Sensor Drawings

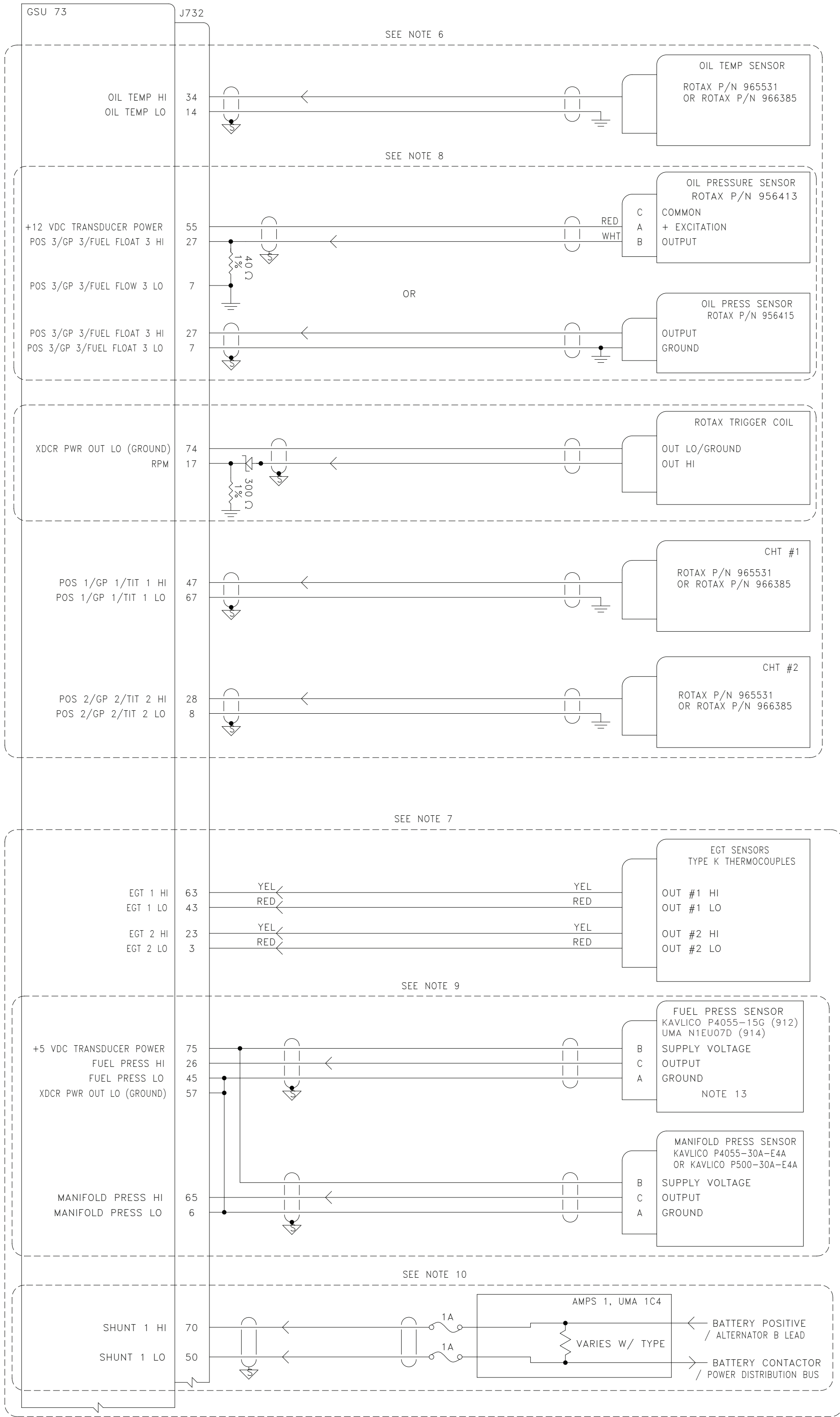

Figure G-3.1 GSU 73 - Rotax 912/914 Sensor Wiring Examples, Page 1 of 2

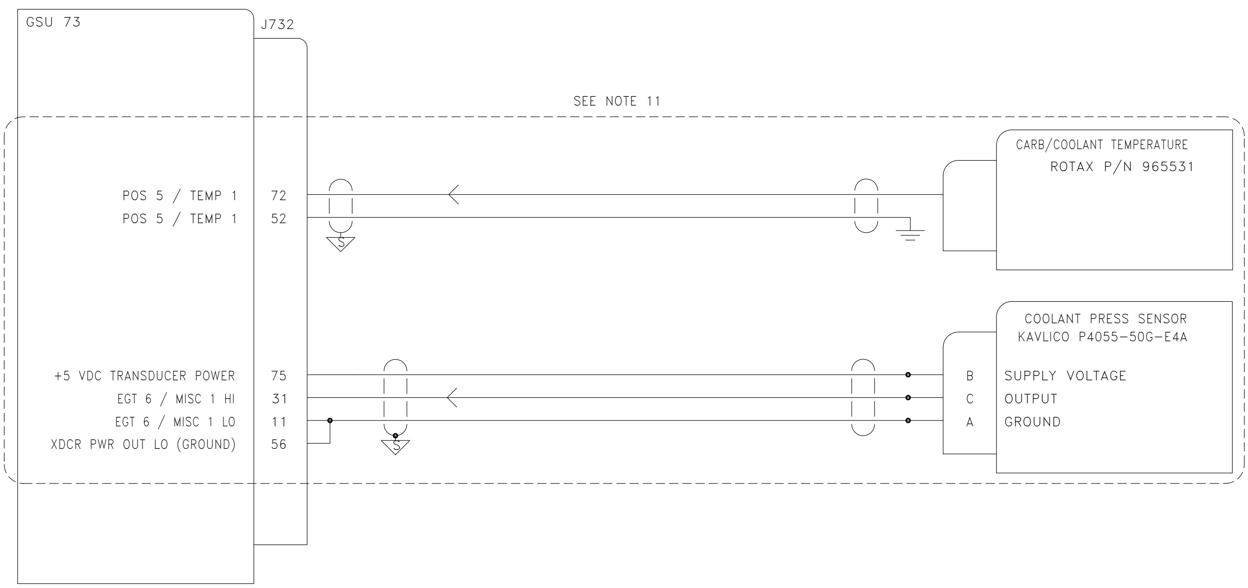

Figure G-3.2 GSU 73 - Rotax 912/914 Sensor Wiring Examples, Page 2 of 2

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APPENDIX H JABIRU SENSOR WIRING 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
   - 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. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS. WIRE COLORS ARE SHOWN FOR REFERENCE ONLY, ALWAYS CONFIRM CORRECT SENSOR CONNECTIONS USING SENSOR MANUFACTURER DOCUMENTATION BEFOR CONNECTING WIRES.
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 H-1.1 Notes for Jabiru Sensor Drawings (for all Appdx H drawings)

H.1 GEA 24 - Jabiru Sensor Drawings

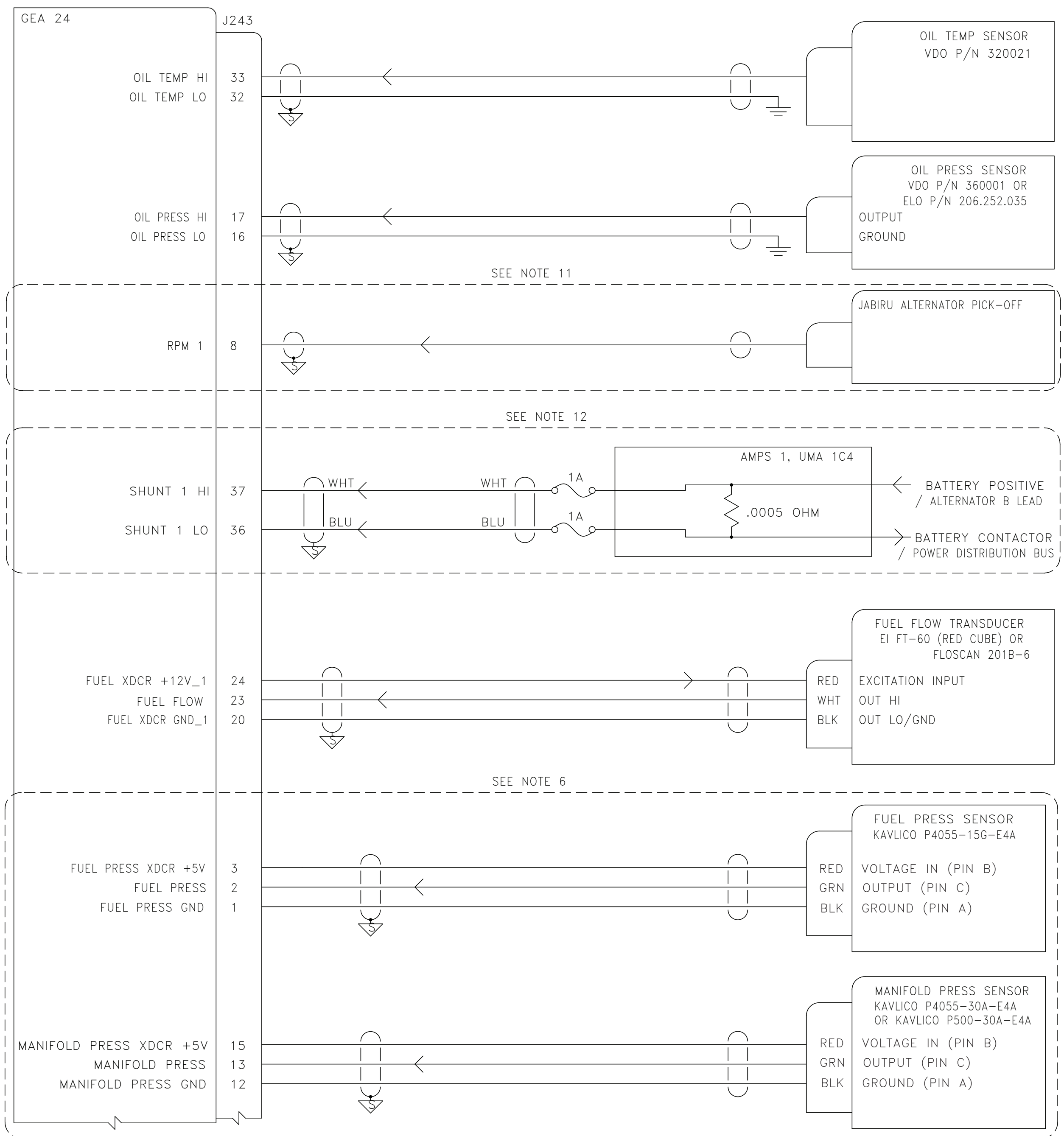

Figure H-2.1 GEA 24 - Jabiru Sensor Wiring Examples, Page 1 of 2

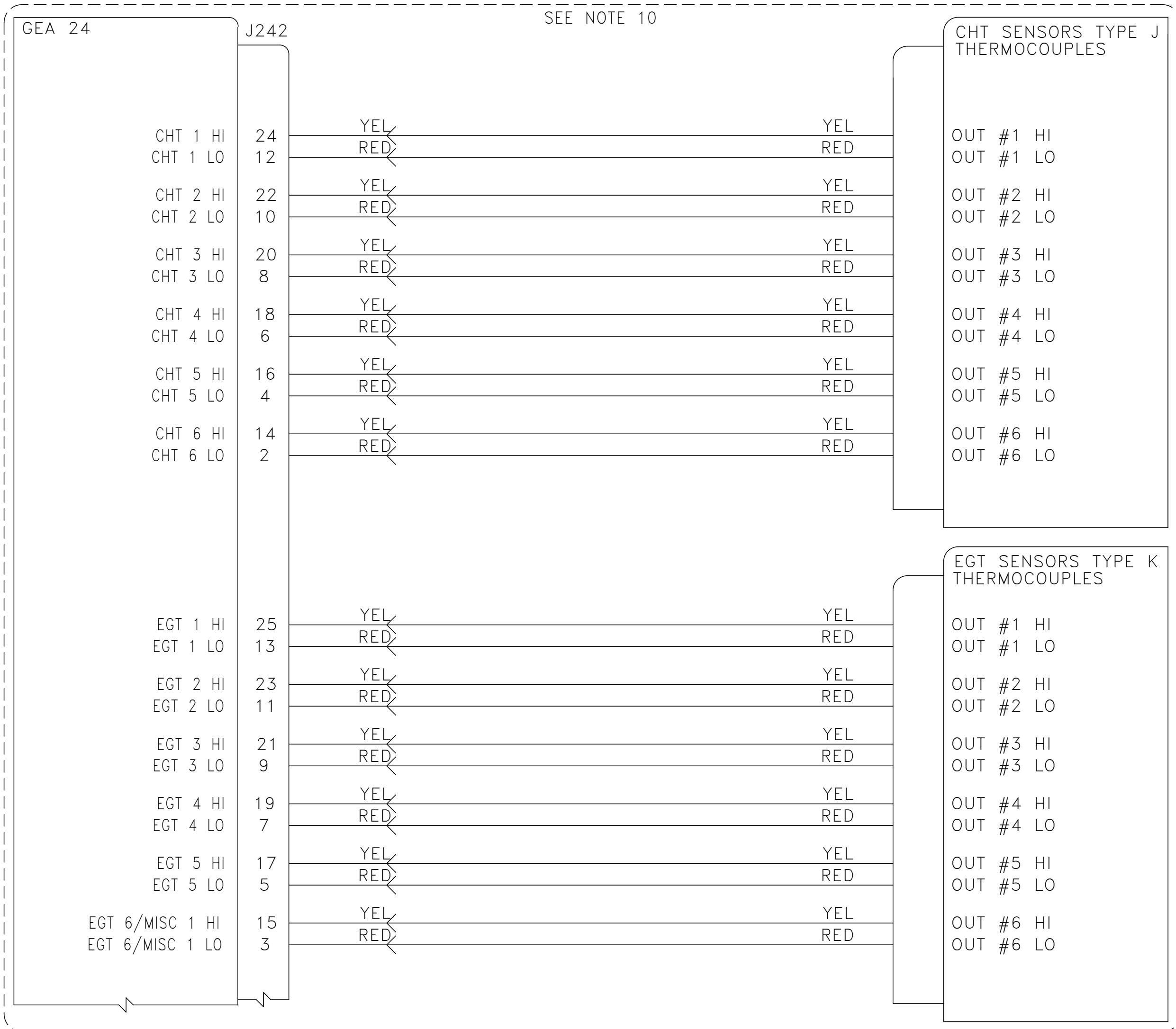

Figure H-2.1 GEA 24 - Jabiru Sensor Wiring Examples, Page 2 of 2

H.2 GSU 73 - Jabiru Sensor Drawings

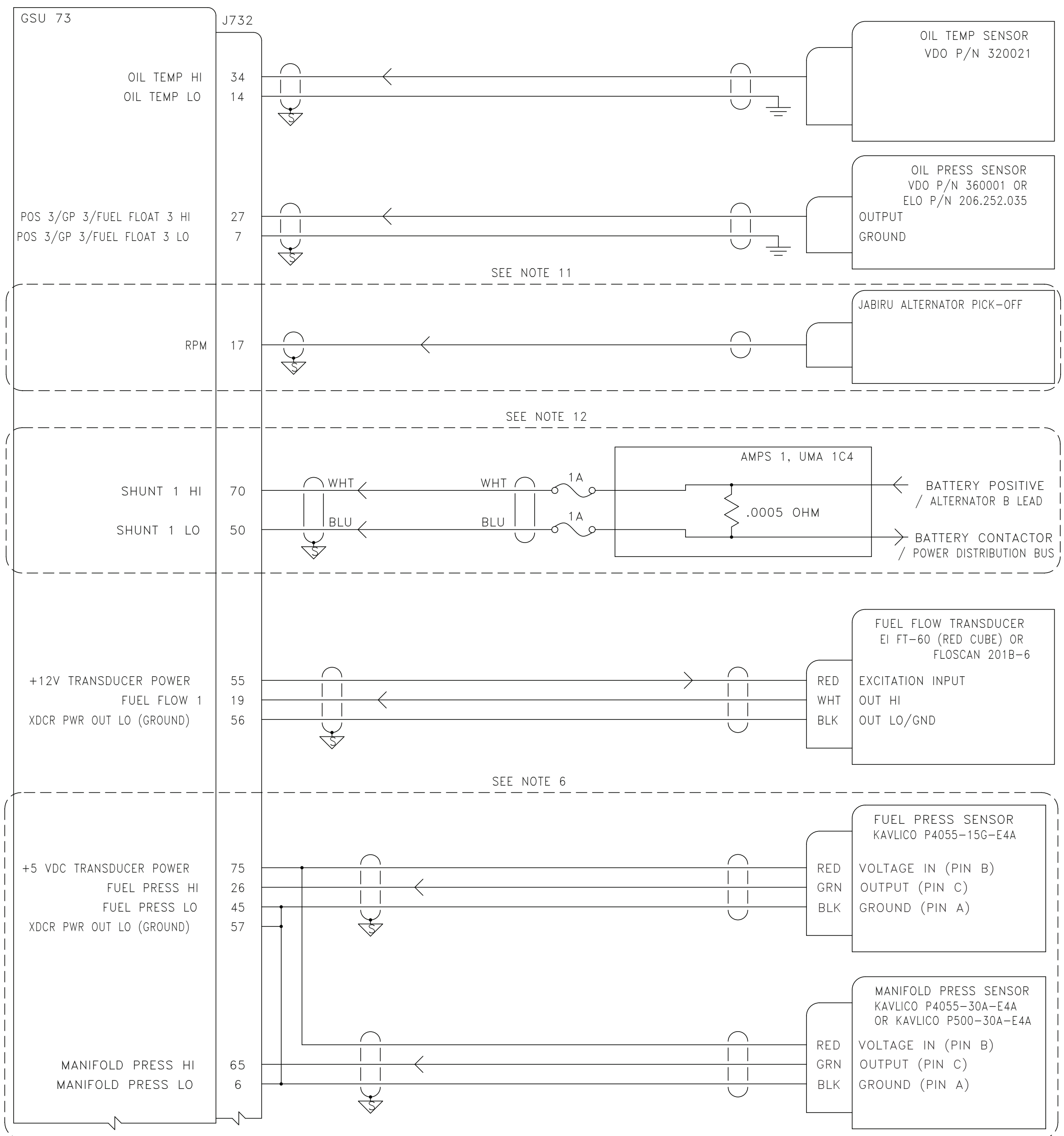

Figure H-3.1 GSU 73 - Jabiru Sensor Wiring Examples, Page 1 of 2

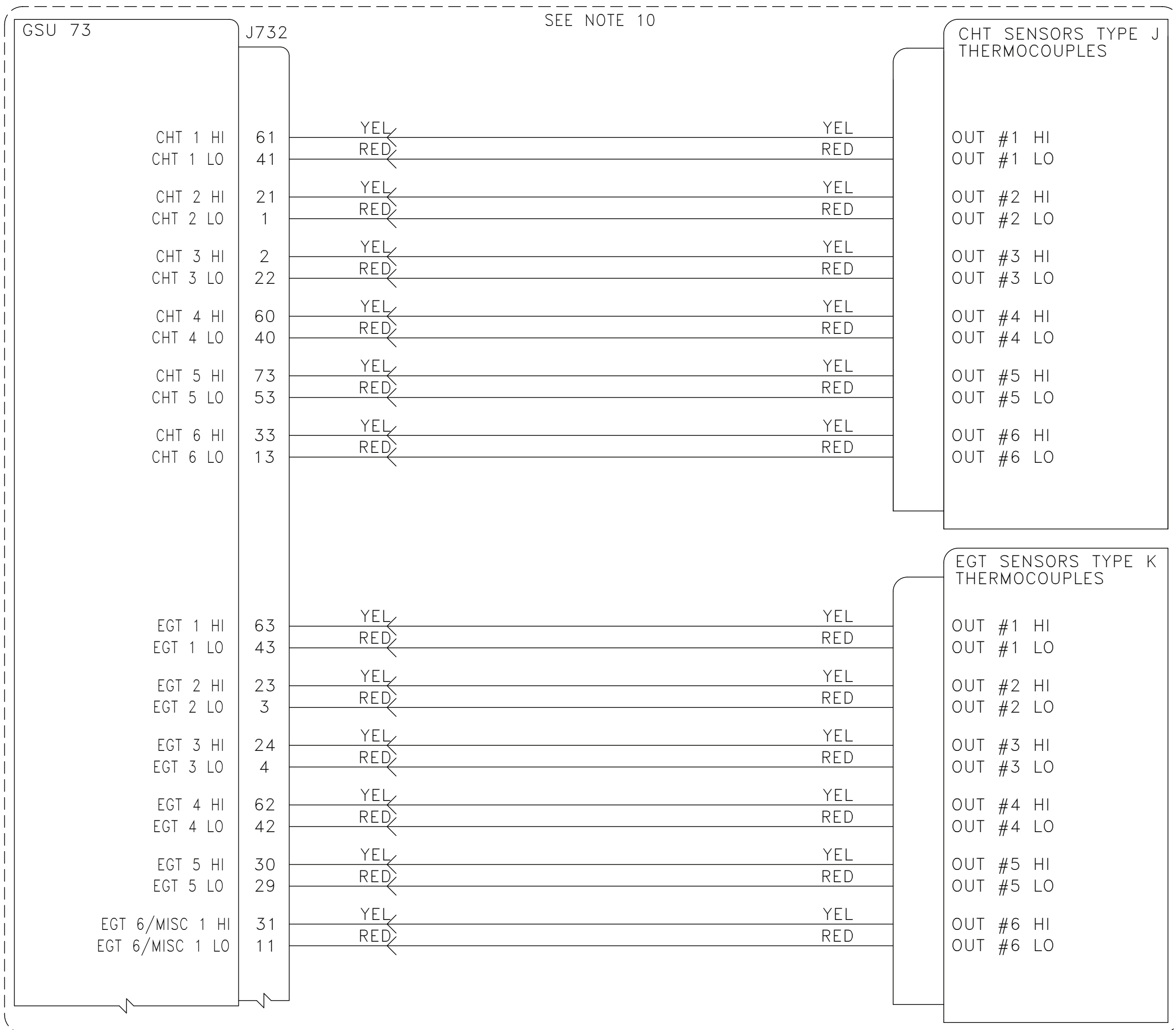

Figure H-3.1 GSU 73 - Jabiru Sensor Wiring Examples, Page 2 of 2

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APPENDIX I RS-232 Text Output Format

This data is output from a GDU 37X RX-232 port that has been configured to the "Text Out" format.

I.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.

I.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.

I.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).

I.4 Attitude/Air Data Message Format

The Attitude/Air Data message is transmitted approximately 10 times per second.

Table I-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
AOA (Angle of Attack)	43	2		00 = AOA below minimum calibrated value 60 = AOA at calibrated warning threshold value 99 = AOA at or above calibrated stall value Min = 00, Max = 99	0	+99
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					

I.5 Engine Data Message Format

The Engine Data message is transmitted approximately 5 times per second.

Table I-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

Table I-2 Engine Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
TIT1	115	4	1 degree C		-999	+999
TIT2	119	4	1 degree C		-999	+999
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					

I.6 GPS Data Message Format

The GPS Data message is transmitted once per second.

Table I-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	0.1 meters/sec		0000	9999
North/south velocity direction	45	1		'N' for north or 'S' for south		
North/south velocity magnitude	46	4	0.1 meters/sec		0000	9999
Vertical velocity direction	50	1		'U' for up or 'D' for down		

Table I-3 GPS Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Vertical velocity magnitude	51	4	0.01 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