GARMIN

G3X™/G3X Touch™ Avionics Installation Manual



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AVIATION LIMITED WARRANTY

G3X/G3X Touch warranty information is available at https://www.garmin.com/en-US/legal/aviation-limited-warranty/.

RECORD OF REVISIONS

Revision	Revision Date	Description
AV	05/13/24	Added new GAD 27 unit info
AW	08/08/24	Added GTR 205X(R) unit info
AY	04/09/25	Added GA 57X info
AZ	09/12/25	Added new GDU 450/470 part numbers
BA	10/28/26	Updated for GDU 4XX v10.00 SW and added GCO™ 14 unit info

CURRENT REVISION DESCRIPTION

Revision	Page Number(s)	Section Number	Description of Change
BA	ii	Front	Added ESD Caution
	1-2	1.3.1	Added GCO 14 info to Table 1-4
	1-4	1.4	Added GCO 14 info to Table 1-7
	1-8	1.5.2	Added GCO 14 info to Table 1-8
	2-2	2.1.1	Added GCO 14 to Figure 2-1
	2-5	2.1.1.4	Updated Outside Air Temperature info
	2-14	2.1.1.21, 2.1.1.22	Updated Carbon Monoxide Detector and Emergency Locator Transmitter (ELT) sections
	2-18	2.2.1.2	Added GCO 14 info to Table 2-2
	2-22, 2-23, 2-25, 2-29	2.3.1.3	Updated CAN Bus info
	2-33	2.4.1	Added GCO 14 info to Table 2-4
	6-1–6-6	6	Added Section 6 GCO 14 Installation
	9-3	9.4	Added reference to Radar Altimeter or Radio AGL section
	17-2	17.1	Updated trim actuator info
	22-3	22.1	Updated the Fuel Pressure Sensors listed in Table 22-1
	22-12	22.2.4	Added manifold air temperature to UL Power Engine Applications section
	24-14	24.3	Added GCO 14 connector info
	25-12	25.1	Updated figure name for Figure 25-1.10
	25-13	25.1	Added Figure 25-1.11
	25-33	25-2	Updated figure name of Figure 25-2.12
	25-40	25.2	Removed redundant Figure 25-2.19
	25-52	25.2	Added Figure 25-2.31 GCO 14 Display Interconnect Example
	31-134, 31-135	31.4.15	Updated Aircraft Tab info
	31-147	31.4.18	Updated PFD1 Startup Display Mode info
	31-156	31.4.21	Updated RS-232 Configuration Page info
	31-160	31.4.23	Updated PFD Configuration Page info
	31-175	31.4.29	Updated Transponder Configuration Page info
	31-190	31.4.32.6	Updated Manifold Pressure info
	31-191	31.4.32.7	Updated Oil Pressure info
	31-194	31.4.32.11	Updated Fuel Pressure info
	31-200	31.4.32.13.2	Updated Fuel Calculator Configuration info
	31-202	31.4.32.15	Updated Electrical Current
	31-208	31.4.32.19	Updated Manifold Air Temperature info
	31-214	31.4.32.26	Corrected Gear Up info
	33-1	33.1.2	Added GCO 14 info to Maintenance section
	C-8	C.7.1	Removed non-applicable note regarding parameter name strings
	E-3	E.1.3	Added config module to Figure E-2
	H-128	H.4.19.3.2	Updated Fuel Pressure sensor list

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

WARNING
A warning means injury or death is possible if the instructions are not obeyed.

CAUTION
A caution means that damage to the equipment is possible.

NOTE
A note gives more information.

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 website at www.garmin.com/prop65.

CAUTION
This unit contains electrostatic sensitive components. While the risk of electrostatic discharge (ESD) exposure is inherently reduced for electronic assemblies that remain fully enclosed, following ESD procedures is recommended when handling the unit outside of its protective packaging, and when not in a completed installation. Unless otherwise instructed, do not attempt to open or disassemble the LRU.

NOTE
System Configuration settings must be verified for the specific build and installation following any software load or update.

NOTE
G3X™ avionics 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, two, three, four, five, and six-display G3X systems.

NOTE

References to the GAD 29 throughout this manual apply equally to the GAD 29C. References to the GAD 29B throughout this manual apply equally to the GAD 29D.

NOTE

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

NOTE

References to the GDU 45X throughout this manual apply equally to the GDU 450 and GDU 455 except where specifically noted.

NOTE

References to the GDU 46X throughout this manual apply equally to the GDU 460 and GDU 465 except where specifically noted.

NOTE

References to the GDU 4XX throughout this manual apply equally to the GDU 45X, GDU 46X, and GDU 47X except where specifically noted.

NOTE

References to the GEA 24 throughout this manual apply equally to the GEA 24B except where specifically noted.

NOTE

References to the GMC Mode Controller throughout this manual apply equally to the GMC 305, GMC 307, and GMC 507 except where specifically noted.

NOTE

References to the GSU 25 throughout this manual apply equally to the GSU 25B, GSU 25C, and GSU 25D 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). However GDU 4XX connectors on the LRU are designated as P4X0X.

NOTE

The GDU 37X/4XX products contain a lithium battery that must be recycled or disposed by professional services according to applicable governing laws. Only Garmin-authorized service facilities are permitted to perform maintenance on this product.

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NOTE

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TABLE OF CONTENTS

Section 1 Inventory of Materials 1-1
1.1 Unpacking Unit 1-1
1.2 Required Garmin Equipment 1-1
1.3 Optional Garmin Equipment 1-2
1.4 Optional Garmin LRUs 1-4
1.5 Required non-Garmin Equipment 1-5
1.6 Optional Garmin Equipment (non-LRU) 1-11
1.7 Optional non-Garmin Equipment 1-11
1.8 Optional 3rd Party Sensors/LRUs 1-11
1.9 Garmin Software and Documents 1-11

Section 2 Installation Preparation 2-1
2.1 System Overview 2-1
2.2 Electrical Considerations 2-17
2.3 Wiring/Cabling Considerations 2-20
2.4 Mechanical Considerations 2-31
2.5 LRU/Sensor Installation Information 2-36

Section 3 GAD 27 (Flaps/Lights/Trim Controller) Installation 3-1
3.1 Equipment Description 3-1
3.2 Equipment Available 3-3
3.3 General Specifications 3-3
3.4 Mounting Requirements 3-3
3.5 Unit Installation 3-3
3.6 Outline and Installation Drawings 3-4

Section 4 GAD 29/29B/29C/29D (ARINC 429 Adapter) Installation 4-1
4.1 Equipment Description 4-2
4.2 Equipment Available 4-2
4.3 General Specifications 4-3
4.4 Mounting Requirements 4-3
4.5 Unit Installation 4-3
4.6 Outline and Installation Drawings 4-4

Section 5 GAP 26 (Pitot/AOA Probe) Installation 5-1
5.1 Equipment Description 5-1
5.2 Equipment Available 5-2
5.3 General Specifications 5-2
5.4 Mounting Requirements 5-3
5.5 Unit Installation 5-5
5.6 Outline and Installation Drawings 5-10

Section 6 GCO™ 14 Installation 6-1
6.1 Description and Identification 6-1
6.2 Equipment Description 6-1
6.3 General Specifications 6-2
6.4 Certification 6-2
6.5 Mounting Considerations 6-2
6.6 Air Circulation and Cooling 6-2
6.7 Equipment Mounting 6-2
6.8 Outline and Installation Drawings 6-6

Section 7 GDU™ 4XX Display Installation 7-1
7.1 Equipment Description 7-2
7.2 General Specifications 7-3
7.3 Installation Information 7-4
7.4 Unit Installation 7-5
7.5 Antennas 7-5
7.6 Mounting Requirements 7-6
7.7 GDU 45X Outline and Installation Drawings 7-7
7.8 GDU 46X Outline and Installation Drawings 7-10
7.9 GDU 470 Outline and Installation Drawings 7-13
7.10 Panel Cutout Drawings 7-16

Section 8 GEA™ 24 Engine Interface Module Installation 8-1
8.1 Equipment Description 8-1
8.2 Equipment Available 8-2
8.3 General Specifications 8-3
8.4 Unit Installation 8-3
8.5 Mounting Requirements 8-3
8.6 Outline and Installation Drawings 8-4

Section 9 GHA 15 Height Advisor Installation 9-1
9.1 Equipment Description 9-1
9.2 Equipment Available 9-1
9.3 General Specifications 9-2
9.4 Mounting Requirements 9-3
9.5 Unit Installation 9-4
9.6 Outline and Installation Drawings 9-5

Section 10 GI 260 (AOA Indicator) Installation 10-1
10.1 Equipment Description 10-1
10.2 Equipment Available 10-1
10.3 General Specifications 10-1
10.4 Unit Installation 10-2
10.5 Unit Calibration 10-2
10.6 Unit Operation 10-2

10.7 Outline and Installation Drawings 10-3

Section 11 GMC 305 (AFCS Mode Controller) Installation 11-1
11.1 Equipment Description 11-1
11.2 Equipment Available 11-1
11.3 General Specifications 11-2
11.4 Mounting and Wiring Requirements 11-2
11.5 Outline and Installation Drawings 11-4

Section 12 GMC 307 (AFCS Mode Controller) Installation 12-1
12.1 Equipment Description 12-1
12.2 Equipment Available 12-1
12.3 General Specifications 12-2
12.4 Mounting and Wiring Requirements 12-2
12.5 Outline and Installation Drawings 12-4

Section 13 GMC 507 (AFCS Mode Controller) Installation 13-1
13.1 Equipment Description 13-1
13.2 General Specifications 13-2
13.3 Mounting and Wiring Requirements 13-2
13.4 Outline and Installation Drawings 13-4

Section 14 GMU 11 (Magnetometer) Installation.....14-1
14.1 Equipment Description 14-1
14.2 General Specifications 14-1
14.3 Equipment Available 14-2
14.4 Unit Installation 14-2
14.5 Outline and Installation Drawings 14-5

Section 15 GMU 22 (Magnetometer) Installation.....15-1
15.1 Equipment Description 15-1
15.2 General Specifications 15-2
15.3 Equipment Available 15-2
15.4 Unit Installation 15-3
15.5 Outline and Installation Drawings 15-7

Section 16 GPS 20A (WAAS GPS Position Source) Installation 16-1
16.1 Equipment Description 16-1
16.2 Statement of Compliance (per AC 90-114A CHG1)..... 16-2
16.3 Equipment Available 16-2
16.4 General Specifications 16-3
16.5 Mounting Requirements 16-3
16.6 Unit Installation 16-3
16.7 Antennas 16-3
16.8 Antenna Cable Requirements 16-3
16.9 Outline and Installation Drawings 16-4

Section 17 GSA 28 (Autopilot Servo) Installation 17-1
17.1 Equipment Description 17-1
17.2 Equipment Available 17-3
17.3 General Specifications 17-3
17.4 Required Equipment 17-5
17.5 Unit Installation 17-6
17.6 Unit Wiring 17-17
17.7 Outline and Installation Drawings 17-17

Section 18 GSU 25/25B/25C/25D (AHRS/Air Data Sensor Unit) Installation 18-1
18.1 Equipment Description 18-1
18.2 General Specifications 18-3
18.3 Required Equipment 18-4
18.4 Unit Installation 18-5
18.5 Outline and Installation Drawings 18-10

Section 19 GTP 59 (Temperature Probe) Installation 19-1
19.1 Equipment Description 19-1
19.2 General Specifications 19-2
19.3 Unit Installation 19-2
19.4 GTP 59 Icing..... 19-4
19.5 Outline and Installation Drawings 19-5

Section 20 GTR 20 (VHF Communications Radio) Installation 20-1
20.1 Equipment Description 20-1
20.2 Equipment Available 20-2
20.3 General Specifications 20-3
20.4 Installation Considerations 20-4
20.5 Antenna Considerations 20-5
20.6 Mounting Considerations..... 20-7
20.7 Mounting, Wiring, and Power Checks..... 20-8
20.8 Outline and Installation Drawings 20-10

Section 21 GPS/XM Antenna Installation 21-1
21.1 Non-Garmin Materials Required 21-1
21.2 Non-Garmin Antennas 21-1
21.3 Garmin Antennas 21-2
21.4 Antenna Mounting Considerations 21-4
21.5 Teardrop Footprint Antenna Installation (GA 35, GA 55, and GA 56)..... 21-9
21.6 ARINC 743 Footprint Antenna Installation (GA 36, GA 37, GA 55A, GA 57X) 21-16
21.7 Non-Structural Mount Installation..... 21-25
21.8 Outline and Installation Drawings 21-31

Section 22 Engine/Airframe Sensor Installation 22-1
22.1 Engine/Airframe Sensor Options 22-1
22.2 Engine Sensor Applications 22-7
22.3 Engine Sensor Installation 22-17

Section 23 Connector Installation Instructions 23-1
23.1 Cable Connector Installation 23-1
23.2 Jackscrew Backshell Assembly 23-1
23.3 Jackscrew Connector Installation 23-15
23.4 Thermocouple Installation into a Backshell 23-16
23.5 Configuration Module Installation into a Backshell 23-18
23.6 P-Lead Resistor Installation (Braid Shield) 23-21
23.7 Circular Connector 23-22

Section 24 LRU Pinouts 24-1
24.1 GAD 27 (Flaps/Lights/Trim Controller) 24-1
24.2 GAD 29/29B/29C/29D (ARINC 429 Adapter) 24-10
24.3 GCO™ 14 24-14
24.4 GDU 4XX (Display Unit) 24-15
24.5 GEA 24 (EIS Interface) 24-24
24.6 GHA 15 Height Advisor 24-40
24.7 GI 260 (AOA Indicator) 24-42
24.8 GMC 305 (AFCS Mode Controller) 24-44
24.9 GMC 307 (AFCS Mode Controller) 24-46
24.10 GMC 507 (AFCS Mode Controller) 24-48
24.11 GMU 11 (Magnetometer) 24-50
24.12 GMU 22 (Magnetometer) 24-52
24.13 GPS 20A (WAAS GPS Position Source) 24-53
24.14 GSA 28 (Autopilot Servo) 24-55
24.15 GSU 25 (AHRS/Air Data Sensor Unit) 24-58
24.16 GTP 59 (Temperature Probe) 24-62
24.17 GTR 20 (VHF Communications Radio) 24-63
24.18 GTX 23 (Mode S Transponder) 24-68

Section 25 G3X™ Avionics w/GSU 25 and/or GAD 29 Interconnect Drawings 25-1
25.1 Core Interconnect Drawings w/GSU 25 and/or GAD 29 25-3
25.2 External Interconnect Drawings w/GSU 25 25-15

Section 26 G3X™ Avionics w/GTR 20/205X(R) Interconnect Drawings....26-1
26.1 Notes for Section 26 Drawings 26-2
26.2 Single GTR 20 Interconnect Drawings 26-3
26.3 Dual GTR 20 Interconnect Drawings 26-7

Section 27 Sensor Wiring Examples 27-1
27.1 Notes for Section 27 Drawings 27-1
27.2 Sensor Wiring Examples w/GEA™ 24 Engine Interface Module 27-2
27.3 Sensor Wiring Examples w/GSU 73 27-8

Section 28 Lycoming/Continental Sensor Wiring Examples 28-1
28.1 Notes for Section 28 Drawings 28-1
28.2 GEA™ 24 Engine Interface Module - Lycoming/Continental Sensor Drawings 28-2
28.3 GSU 73 - Lycoming/Continental Sensor Drawings 28-6

Section 29 Rotax Sensor Wiring Examples 29-1
29.1 Notes for Section 29 Drawings 29-1
29.2 GEA™ 24 Engine Interface Module - Rotax Sensor Drawings 29-2
29.3 GSU 73 - Rotax Sensor Drawings 29-8

Section 30 Jabiru Sensor Wiring Examples 30-1
30.1 Notes for Section 30 Drawings 30-1
30.2 GEA™ 24 Engine Interface Module - Jabiru Sensor Drawings 30-2
30.3 GSU 73 - Jabiru Sensor Drawings 30-4

Section 31 GDU™ 4XX Display Configuration and Post Installation Checkout 31-1
31.1 Recommended Test Equipment 31-3
31.2 Configuration Mode 31-3
31.3 Software Loading Procedure 31-4
31.4 Configuration Pages 31-6
31.5 Garmin Database Updates 31-236
31.6 SiriusXM® Activation Instructions (GDU 455/465 only) 31-239
31.7 External Interface Configuration (Garmin units only) 31-240
31.8 Sharing G3X Touch Flight Plans (Crossfill) with External IFR Navigators 31-245
31.9 Checklist Editor 31-246

Section 32 Troubleshooting 32-1
32.1 General Troubleshooting 32-1
32.2 CAN Network Troubleshooting 32-2
32.3 GDU 37X/4XX 32-2
32.4 Air Data Troubleshooting 32-3
32.5 Engine Indication Troubleshooting 32-4
32.6 ADAHRS Troubleshooting 32-5
32.7 Post Installation Calibration Procedures 32-7
32.8 Sending Troubleshooting Data to Garmin 32-7

Section 33 Maintenance 33-1
33.1 Inspections/Continued Airworthiness/Maintenance 33-1
33.2 Return to Service Information 33-4

Appendix A Flight Test Plan for Autopilot Tuning A-1
A.1 Introduction A-1
A.2 Flight Test Outline A-1

Appendix B Airframe Specific Installation Guidance B-1
B.1 Introduction B-1
B.2 Van's Aircraft B-2
B.3 Lancair Aircraft B-5

Appendix C RS-232 Text Output Format C-1
C.1 Electrical Interface C-1
C.2 Message Output Selection C-1
C.3 General Message Output Format C-1
C.4 Attitude/Air Data Message Format C-2
C.5 Engine Data Message Format C-4
C.6 GPS Data Message Formats C-6
C.7 EIS Complete Data Message Format C-8
C.8 CNI Message Format C-11

Appendix D LRU Performance Specifications/Licensing/Compliance D-1
D.1 GAD 29 ..... D-1
D.2 GAP 26 ..... D-1
D.3 GDU™ 37X Display D-1
D.4 GDU 4XX D-2
D.5 GEA™ 24 Engine Interface Module D-2
D.6 GHA 15 ..... D-3
D.7 GMA™ 245/245R Audio Panel D-5
D.8 GMC 305/307/507 ..... D-6
D.9 GMU 11 ..... D-7
D.10 GMU 22 ..... D-7
D.11 GSA 28 ..... D-7
D.12 GSU 25 ..... D-8
D.13 GSU 73 ..... D-10
D.14 GTP 59 ..... D-11
D.15 GTR 20/200 ..... D-12

Appendix E GDU™ 37X Display Installation E-1
E.1 Equipment Description E-2
E.2 General Specifications E-4
E.3 Installation Information E-4
E.4 Pinouts E-6
E.5 Unit Installation E-11
E.6 Antennas E-11
E.7 Mounting Requirements E-11
E.8 Outline and Installation Drawings E-13

Appendix F GSU 73 Sensor Unit Installation F-1
F.1 Equipment Description F-1
F.2 General Specifications F-2
F.3 Required Equipment F-3
F.4 Unit Installation F-4
F.5 Pinouts F-4
F.6 Outline and Installation Drawings F-19

Appendix G GSU 73 Interconnect Drawings G-1
G.1 Core Interconnect Drawings G-2
G.2 External Interconnect Drawings w/GSU 73 ..... G-5

Appendix H GDU™ 37X Display Configuration and Post Installation Checkout H-1
H.1 Recommended Test Equipment H-2
H.2 Configuration Mode H-3
H.3 Software Loading Procedure H-3
H.4 Configuration Pages H-6
H.5 Garmin Database Updates H-143
H.6 SiriusXM® Activation Instructions (GDU 375 only) H-147
H.7 External Interface Configuration (Garmin units only) H-148
H.8 GDU Start-up Screen H-151
H.9 Checklist Editor H-151

Appendix I GDU 4XX Advanced Gauge Configuration I-1
I.1 Example 1 - Vfe Exceedance Alert I-1
I.2 Example 2 - Dynamic RPM Gauge Markings Based on Oil Temperature I-3
I.3 Example 3 - Takeoff Trim Position Alert I-6

1 INVENTORY OF MATERIALS

This manual provides all of the mechanical and electrical information required for the installation of the G3X™ avionics. This manual is intended to be a step-by-step guide to the installation, therefore it is important 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 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 for G3X systems

Table 1-1 and Table 1-2 list the two available G3X System LRU kits. The standard kit includes the GSU 25 and GMU 11, the performance kit includes the GSU 25 and the GMU 22. Available GDU™ displays are listed in Table 1-3. All other G3X LRUs (listed in Table 1-7) are ordered separately.

Table 1-1 Contents of High Performance G3X LRU Kit* (K10-00016-03)

Item	Part Number	Quantity
GSU 25D, Unit Only	010-01071-51	1
GMU 22, Unit Only	010-01196-00	1
Configuration Module, EEPROM, Temp	010-12253-00	1
GTP 59 OAT Probe Kit	011-00978-00	1

The High Performance Kit must be used if the aircraft performance exceeds that specified for the GSU 25, see Appendix D.12.2

Table 1-2 Contents of G3X Standard LRU (K10-00016-04)

Item	Part Number	Quantity
GSU 25C, Unit Only	010-01071-50	1
GMU 11, Unit Only	010-01788-00	1
Configuration Module, EEPROM, Temp	010-12253-00	1
GTP 59 OAT Probe Kit	011-00978-00	1

Table 1-3 Available GDU Display Units

Item	Part Number
G3X - GDU 370, 7" Portrait Non-Touch Display**	010-00667-15
G3X Touch™ Avionics - GDU 460, 10.6" Display	010-01057-00
G3X Touch - GDU 465, 10.6" Display with SXM Receiver	010-01057-10
G3X Touch - GDU 470, 7" Portrait Display	010-01765-00 010-01765-01
G3X Touch - GDU 450, 7" Landscape Display	010-01056-00 010-01056-03
G3X Touch - GDU 455, 7” Landscape Display with SXM Receiver	010-01056-10

*Any combination of G3X Touch displays can be installed in a single system (maximum of six displays)

**Not compatible with G3X Touch displays

1.3 Optional Garmin Equipment

1.3.1 Garmin Optional LRU Installation Kits

Table 1-4 LRU Connector/Installation Kits

LRU	Connector/Installation Kit Part Number	Installation Kit Included with LRU?
GAD 27 Flaps/Lights/Trim Controller	011-03877-00 (Table 3-2)	N
GAD 29 ARINC 429 Adapter	011-03271-00 (Table 4-2)	N
GAP 26 Air Data Probe	011-03609-00 (Table 5-2)	N
GCO™ 14	010-06537-10 (Table 6-2)	Y
GDU 37X Display	011-01921-00 (Table E-1)	Y
GDU 45X Display	010-12150-01 (Table 7-1)	N
GDU 46X Display	010-12150-00 (Table 7-2)	N
GDU 470 Display	010-12150-02 (Table 7-3)	N
GDL® 39R data transceiver (9 Pin Connector)	010-11825-20 (Table 1-6)	N
GDL 5XR Data Link	010-12498-60 (Table 1-6)	N
GEA™ 24 Engine Interface Module	011-02886-00 (Table 8-2)	N
GHA 15 Height Advisor	011-05278-00, Conn Kit (Table 9-3) 011-06097-00, Install Kit (Table 9-4)	N
GMC 305 Mode Controller	010-12034-00 (Table 11-2)	N
GMC 307 Mode Controller	010-12421-00 (Table 12-2)	N
GMC 507 Mode Controller	010-01946-00 (Table 13-2)	N
GMU 11 Magnetometer	011-04349-90, Install Kit (Table 14-3)	N

Table 1-4 LRU Connector/Installation Kits

LRU	Connector/Installation Kit Part Number	Installation Kit Included with LRU?
GMU 22 Magnetometer	011-00871-10, Conn Kit (Table 15-3)	N
GPS 20A	011-03914-00 (Table 16-3)	N
GSA 28 Servo Actuator	011-02950-00, Conn Kit (Table 17-6) 011-02950-01, 90° Conn Kit (Table 17-7)	N
GSU 25 ADAHRS	K10-00181-00, Conn Kit (Table 18-2)	Y
GSU 73 ADAHRS/EIS	NA	Y
GTP 59 Temperature Probe	011-00978-00 (Table 19-2)	Y
GTR 20	011-03241-00 (Table 20-3)	Y
Garmin GPS and/or XM Antennas	NA	N

Table 1-5 Contents of GDL 39R Connector Kit (010-11825-20)

Item	Part Number	Quantity
Backshell w/Hdw, Jackscrew, 9/15 pin	011-01855-00	1
Conn, Receptacle, d-Sub, Crimp Socket, Commercial, 9 CKT	330-00625-09	1
Contact, Sckt, Mil Crimp, size 20, 20-24 AWG	336-00022-02	9

Table 1-6 Contents of GDL 5XR Connector Kit (010-12498-60)

Item	Part Number	Quantity
Backshell w/Hdw, Jackscrew, 15/26 pin	011-01855-01	1
Conn, Receptacle, d-Sub, Crimp Socket, Commercial, 15 CKT	330-00625-15	1
Contact, Sckt, Mil Crimp, size 20, 20-24 AWG	336-00022-02	16

1.3.2 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 SiriusXM® weather. See Section 21 for required materials for antenna installation including mounting brackets, doubler plates, rivets, hardware, cables, connectors, and sealant.

1.4 Optional Garmin LRUs

Table 1-7 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 1-7 Optional Garmin LRUs

LRU	All Install Info Included In This Manual?	Section
GAD 27 Flaps/Lights/Trim Controller	Yes	Section 3
GAD 29 ARINC 429 Adapter	Yes	Section 4
GAP 26 Air Data Probe	Yes	Section 5
GCO 14 Aircraft Carbon Monoxide Detector	Yes	Section 6
GDL 39/GDL 39R Data Link	No	NA
GDL 5XR Data Link	No	NA
GDU 37X* Display (if installing more than one)	Yes	Appendix E
GDU 45X* Display (if installing more than one)	Yes	Section 7
GDU 46X* Display (if installing more than one)	Yes	Section 7
GDU 470* Display (if installing more than one)	Yes	Section 7
GEA 24 EIS	Yes	Section 8
GHA 15	Yes	Section 9
GI 260	Yes	Section 10
GMC 305 Mode Controller	Yes	Section 11
GMC 307 Mode Controller	Yes	Section 12
GMC 507 Mode Controller	Yes	Section 13
GMU 11 Magnetometer	Yes	Section 14
GNS™ 4XX/5XX Avionics	No	NA
GNS 480 GPS/Comm Navigator	No	NA
GSA 28 Servo Actuator	Yes	Section 17
GSU 25** ADAHRS	Yes	Section 18
GSU 73** ADAHRS/EIS	Yes	Appendix F
GTN™ 6XX/7XX Avionics Units	No	NA

*One GDU 37X or one GDU 4XX are required
**One GSU 25 and/or GSU 73 is required

Table 1-7 Optional Garmin LRUs

LRU	All Install Info Included In This Manual?	Section
GTR 20	Yes	Section 20
GTR 200	No	NA
GTR 205X/GTR 205XR	No	NA
GTX™ Transponder	No	NA
SL30 Nav/Comm Transceiver	No	NA
SL40 Comm Transceiver	No	NA

*One GDU 37X or one GDU 4XX are required
**One GSU 25 and/or GSU 73 is required

1.5 Required non-Garmin Equipment

The following items may be required for system installation.

1.5.1 Wiring/Cabling Considerations

BNC/TNC Coaxial Connectors - May be required to terminate the antenna cable, depending upon which antenna is used. Check the antenna installation instructions for detailed information. Example below:

- Connector, BNC/TNC Coaxial, male, crimp (MIL-PRF-39012)

CAN Bus Wire - See Section 2.3.1.3.2

Cable Ties - (MS3367) or lacing cord A-A-52080 (MIL-T-43435)

Cabling and Wiring: (all are provided by the installer unless otherwise noted)

- 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.
- Shielded wire (MIL-C-27500 cable utilizing M22759/34 wire (SD) and ETFE jacket or MIL-C-27500 cable utilizing M22759/16 wire (TE) and ETFE jacket)
- HSDB (Ethernet) connections may use either aviation grade Category 5 Ethernet cable, or MIL-C-27500 shielded twisted-pair cable.
- RG-400 or RG-142 coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation.

Circuit Breakers - Circuit breakers (MS26574), replaceable fuses, or other circuit protection devices, sized appropriately for the wire gauges used.

Clamps (Adel Clamp) - Various sizes for routing new wiring in the engine cowl (MS21919WDGXX).

Coaxial Cable, 50Ω - MIL-DTL-17 (i.e. RG-400)

Current Shunts - Qualified to AA55524

Environmental Splice - AS81824/1-X (where X=size) or equivalent

Fiberglass Sleeving - Qualified to MIL-I-3190/6

Flat or Tubular Braid:

- 1/16” for the GMU (AA59569F36T0062, AA59569R36T0062, or equivalent)
- 0.171” and to be round or tubular for fuel flow transducer overbraid if required (e.g. QQB575R36T171, AA59569R36N171, or equivalent).

Fuse Holders - Qualified to MIL-PRF-19207 (FHN series holders) or GPN 330-01791-10 (P/O kit 330-01791-00)

Fuses: Qualified to MIL-F-15160 size 3AG (i.e. F02A, F03A, F03B)

Heat Shrink Tubing: (M23053/5, X=color)

- M23053/5-104-X for single conductor wire
- M23053/5-105-X for insulating twisted-pair wire
- M23053/5-106-X for insulating triple conductor wire or RG-400 coax

Heat Shrink Tubing, Self-Sealing - Qualified to AMS-DTL-23054/4:

- P/N M23053/4-103
- Tyco P/N SCL-1/4-0-STK
- Alpha wire FIT-300-1/4

Lamps, Master Warning/Caution Indicator:

- MS25041-2 (red)
- MS25041-4 (amber)
- MS25237-327 (GE or JKL lamp number 327, 28VDC)
- MS25237-330 (GE or JKL lamp number 330, 14VDC)

Resistors:

- 400kΩ (±10%), 0.5W minimum resistors qualified to MIL-R-10509 or MIL-PRF-26 (i.e. RN70C4023BB14)
- 1 kΩ (±1%), 0.5W resistors qualified to MIL-R-10509 or MIL-PRF-26 (i.e. RN70C1001FRE5, RN65E1001FB14)
- 390Ω (±5%), 0.25W minimum resistors qualified to MIL-R-10509 or MIL-PRF-26 (i.e. RN60D3900FB14, RN60D3920FB14, RN65C3900FB14). (For GMA™ 245R Audio Panel)

Ring Terminals - MS25036 or M7928 (for GAD 27)

Shield Terminators:

- AS83519/1-X, AS83519/2-X or equivalent
- AS83519/X-2 for single conductor wire
- AS83519/X-3 for twisted-pair and triple conductor wire
- AS83519/X-4 for RG-400 coax

Silicone Fusion Tape - A-A-59163 (MIL-I-46852C or equivalent)

Switches - Wig-wag installation, high current (>5A) MIL-DTL-3950 (i.e. Honeywell P/N 2TL1-10).

Switches (GAP 26 installation): Conform to MIL-DTL-3950 (i.e. Honeywell P/N 1TL1-2)

Thermocouple Extension Wire, K-type, or J-type Non-shielded:

150°C or higher - Stranded AWG 24-20, colored per ASTM E 230, and tested in accordance with at least one of the following STDS:

- ASTM E 207
- ASTM E 220
- AMS 2750 (e.g. Watlow, SERV-RITE P/Ns K24-3-507 and J20-3-507)

1.5.2 Contact and Crimp Tools

Table 1-8 lists recommended crimp tools used to build the wiring harnesses for the G3X LRUs, other equivalent tooling may also be used.

Table 1-8 Pin Contact and Crimp Tools Part Numbers

LRU	Contact Type	Garmin Contact Part Number	Recommended Positioner	Recommended Insertion/ Extraction Tool	Recommended Hand Crimping Tool
GDU 37X GDU 4XX	Socket, Size 20	336-00022-02 or 336-00094-00	M22520/2-08, Daniels K13-1	M81969/1-04 for size 22D pins and M81969/1-02 for size 20 pins	M22520/2-01
GCO 14	Pin, Size 22D	336-00021-00 (MIL P/N M39029/58-360)	M22520/2-09 Positronic P/N 9502-4, Daniels P/N K42		
GMC 305/ 307/507					
GSU 73					
GTP 59					
011-00979-20 (Config module w/ EEPROM kit)					
011-00981-00 (thermocouple kit)					
GMU 22	Socket, Size 20	336-00022-00 (MIL P/N M39029/63-368)	M22520/2-08, Daniels K13-1		
011-00979-22 (Config module w/ Sockets & Jackscrew kit)	Socket, Size 20, 26-30 AWG	336-00022-01	M22520/2-08, Daniels K13-1 Use crimp setting 6 for 28 AWG		
GAD 27/29	Socket, Size 20, 20-24 AWG	336-00022-02	M22520/2-08, Daniels K13-1		
GEA 24 (J241, J243, J244)					
GMU 11					
GSA 28					
GSU 25					
GTR 20/200					
GAD 29	Pin, Size 20	336-00024-00 (MIL P/N M39029/64-369)			
GEA 24 (J242 only)					
GHA 15	Pin Size 22D	336-00051-00 (MIL P/N 39029/56-348)	M22520/2-07 M22520/7-05		

NOTE

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

1.5.3 Hex Driver

A 3/32” hex drive tool is required to secure the GDU to the panel as described in Appendix E.7.1 GDU 37X Unit Installation and Section 7.6.1 GDU 4XX Unit Installation.

1.5.4 SD Card

An SD Card is required to be used as a DataCard. Garmin recommends a 2 GB SanDisk® brand SD card for GDU 37X units, and an 8 GB SanDisk® brand SD card for GDU 4XX units. SD or SDHC cards up to 32 GB using the FAT32 file format are supported, SDXC and SDUC cards are not supported. See Appendix H.5.1, Section 31.5.1, and Section 32.3.1 for detailed information.

1.5.5 Non-Magnetic Tools (GMU Units)

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

1.5.6 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.

1.5.7 GAD 27/GAD 29/GEA 24/GPS 20A/GSU 25 Mounting Hardware

If the installer does not use the applicable installation kit, an example of alternate mounting hardware is: (4 ea.) #10-32 pan or hex head screws.

1.5.8 GAP 26 Mounting Hardware

The materials listed in Table 1-9 are required to assemble and mount the GAP 26:

Table 1-9 GAP 26 Mounting Hardware

Quantity	Item	Part Number	Notes
4	Screw #6	MS51957-26	Mount tube to probe
2		MS51957-32	Mount tube to mount bracket
2	Washer #6	NAS1149CN632R	
2	Nut #6	MS21044C06	
4	Screw #8	MS24693-CXX (Countersunk) **OR** MS51957-XX (Pan Head)	Mount bracket to inspection panel
4	Washer #8	NAS1149CN832R	
4	Nut #8	MS21044C08	

1.5.9 GMU 11 Mounting Materials

The following materials (or equivalents) required to install the GMU 11 in a non-metallic wingtip:

- Tinned copper flat braid, 1/4”, QQB575F36T0250
- Electrical tie-down strap, adjustable, MS3367- (1, 2, or 7)-X
- Terminal lug, #10, uninsulated, MS25036-108
- Terminal stud, #10
- Terminal lug, #8, uninsulated, MS25036-153

1.5.10 GSU 73 Mounting Hardware

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 Appendix F.5.13)

1.6 Optional Garmin Equipment (non-LRU)

1.6.1 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 B for airframe specific GMU 22 mounting racks and related mounting hardware.

1.6.2 Antenna Brackets/Doubler Plates

See Section 21 for detailed information.

1.6.3 Silicon Fusion Tape

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

1.7 Optional non-Garmin Equipment

1.7.1 Engine/Airframe Sensors

See Section 22.1 for a list of compatible sensors, and Section 22.3 for a list of available sensor kits.

1.7.2 Mounting Hardware

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

1.8 Optional 3rd Party Sensors/LRUs

Refer to Section 27, Section 28, Section 29, and Section 30 for wiring/configuration guidance of supported third party equipment.

1.9 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
- GDU 4XX Cockpit Display Unit Software
- GSU 73 Data Logger Software
- GSU 73 Field Calibration Tool
- Panel Cut-out DXF Files (GDU 37X/4XX, GMC 30X)

2 INSTALLATION PREPARATION

This section provides electrical and mechanical information needed for planning the physical layout of the G3X™ avionics 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 3 through Section 22 (and Appendix E and Appendix F for GDU™ 37X display, GSU 73 installations).

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 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

NOTE

G3X refers to both the legacy GDU™ 37X system and GDU 4XX systems. For items only applicable to the GDU 4XX systems, the system name is referred to as G3X Touch™ avionics.

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, three, four, five, or six displays. 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 a GDU display or GMC control panel) or in a separate avionics bay if desired. This design greatly eases troubleshooting and maintenance of the G3X system. A failure or problem can be isolated to a particular LRU, which can be replaced quickly and easily. Each LRU has a particular function, or set of functions, that contributes to the system's operation. For additional information on LRU functions, see the applicable section of this manual.

2.1.1 System Architecture and Interface Capabilities

The functionality of the G3X system is distributed between multiple interconnected devices, some of which are located in the instrument panel and some of which are remote-mounted elsewhere. An individual device in the G3X system is often referred to as a "Line Replaceable Unit", or LRU. This term is used generically in aviation for devices that can be readily "swapped out" for troubleshooting or repair.

LRUs in the G3X system are interconnected with RS-232 interfaces and a shared CAN bus network (see Section 2.3.1.3). The G3X system can interface to a variety of other devices using RS-232 and ARINC 429 connections.

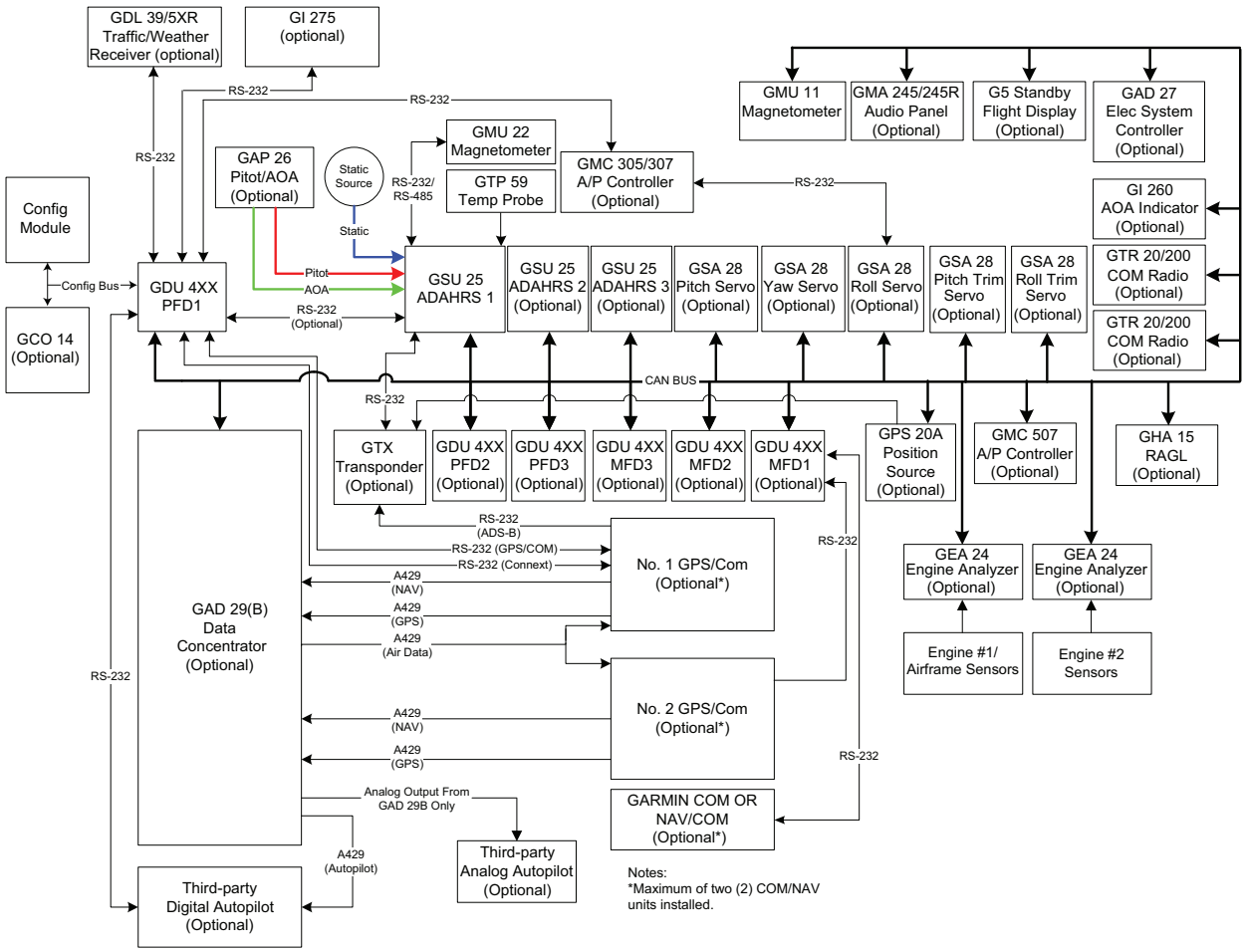


Figure 2-1 G3X Interconnect Example (GDU 4XX)

2.1.1.1 Displays

The foundation of a G3X system is one or more GDU display units. A GDU display is configured with wiring connections as either a primary flight display (PFD) or multi-function display (MFD), with options for arranging display layouts and combining different types of data on a single display. In the event that power is removed from a GDU display, important flight data can still be accessed on the remaining display(s).

A legacy (non-Touch) G3X system can have between one and three GDU 37X displays. Figure E-2 shows some of the various interface options for a GDU 37X-based system. For GDU 37X installation information, refer to Appendix E.

A G3X Touch system can have between one and six GDU 4XX displays, with any combination of 10.6" (GDU 46X) and 7" (GDU 45X or GDU 470) display sizes. Figure 2-1 shows some of the various interface options for a GDU 4XX-based system. For GDU 4XX installation information, refer to Section 7.

NOTE

GDU 37X and GDU 4XX displays may not be combined in the same system.

A G3X system can have up to two G5 standby flight displays. For G5 installation information, refer to the G5 installation manual (190-02072-01).

GDU displays communicate with other LRUs using the CAN bus (with optional RS-232 backup paths supported for some LRUs) and with other devices using RS-232.

A G3X Touch system installed with no ADAHRS units can display MFD data, including engine information, on up to six GDU 4XX displays. This system configuration can also support Garmin autopilot functionality when paired with one or more G5 flight displays.

A single GDU display, installed without any other G3X system components, may be configured as a standalone MFD. A standalone GDU 37X MFD does not support flight or engine instruments, or advanced interface capabilities, and is intended for applications where only basic mapping and navigation features are required.

2.1.1.2 ADAHRS

The GSU 25 is the ADAHRS (air data, attitude, and heading reference system) unit for the G3X system. An ADAHRS senses the aircraft's attitude, measures all air data parameters, and calculates aircraft heading.

Up to three ADAHRS units are supported. In a system with multiple GDU displays and multiple ADAHRS units, each display can present data from a separate ADAHRS, and any GDU display may also be switched to display data from any ADAHRS. Data from multiple ADAHRS units is also automatically cross-compared, and disagreements are noted on the PFD display.

Each GSU 25 ADAHRS is connected to pneumatic pressure inputs for pitot, static, and angle of attack (AOA). Connection of the AOA input is only required for GSU 25 #1, and is optional for GSU 25 #2 and #3. For aircraft capable of indicated airspeeds greater than 300 knots, the GSU 25D is used.

The GSU 25 communicates with other LRUs using the CAN bus, and can optionally be connected to the PFD1 GDU using RS-232 for redundancy. For GSU 25 installation information, refer to Section 18 and Section 25.

The older GSU 73 ADAHRS is also supported. The GSU 73 does not provide AOA data, but a system that includes a GSU 73 may also include additional GSU 25 units. For GSU 73 installation information, refer to Appendix F and Appendix G.

In a system installed with one or more dedicated ADAHRS units and one or more G5 standby flight displays, attitude and air data from the G5 will also be displayed on the GDU displays, in the event that valid data is not available from any dedicated ADAHRS unit.

In a G3X Touch system installed with no dedicated ADAHRS units, attitude and air data from the G5 will be used throughout the system, including for autopilot functionality, but will not be visible on the GDU 4XX displays.

2.1.1.3 Magnetometer

The G3X system requires a minimum of one magnetometer (magnetic field sensor) to provide the ADAHRS unit(s) and/or G5 standby display(s) with magnetic field information. In an installation with multiple ADAHRS units, magnetometer data is shared by the CAN bus. When multiple ADAHRS units are installed, additional magnetometers may be installed for redundancy, although this is not commonly done. In a G3X Touch system with a G5 but no ADAHRS units, only a single magnetometer is supported.

Several different magnetometers are supported:

The GMU 11 magnetometer connects to the G3X system using the CAN bus. Refer to Section 14 for GMU 11 installation information. The GSU 73 does not support the GMU 11.

The GMU 22 magnetometer connects to the ADAHRS LRU using RS-232 and RS-485 interfaces. Refer to Section 15 for GMU 22 installation information. The GMU 44 is also supported and is functionally identical to the GMU 22.

Refer to Appendix B for magnetometer placement information.

2.1.1.4 Outside Air Temperature

The G3X system requires a minimum of one outside air temperature (OAT) probe. The standard OAT probe used in the G3X system is the GTP 59, which is connected to the #1 ADAHRS LRU. Additional OAT probes may be connected to other ADAHRS LRUs for redundancy, although this is not commonly done. Refer to Section 18 for GTP 59 installation information.

The G3X system is also compatible with the GAD 13 temperature probe adapter, which is commonly used with G5 displays. The GAD 13 supports connection to the GTP 59, as well as compatible third-party temperature probes, and shares OAT data via the CAN bus. Refer to the G5 installation manual (190-02072-01) for GAD 13 information.

If a G5 installation with a GAD 13 is later expanded to a full G3X system with one or more ADAHRS units, the GAD 13 may be retained, or the GAD 13 may be removed and a GTP 59 connected to the #1 ADAHRS LRU. If the existing OAT probe is not a GTP 59, the GAD 13 must be retained.

2.1.1.5 Pitot/Static

The ADAHRS units (and optional G5 displays) in the G3X system must be connected to the aircraft's pitot/static system. The airframe manufacturer's guidance should be followed to find the proper location of the pitot tube and static port.

The GAP 26 pitot/AOA probe is a combination pitot tube and angle of attack (AOA) probe. It is available in several configurations, including heated and unheated versions. Refer to Section 5 for GAP 26 installation information.

G3X ADAHRS units and G5 displays may also be used with any other pitot tube, if AOA is not required. Refer to Section 33 for information on conducting periodic tests of the static system.

2.1.1.6 Angle of Attack

The G3X system is capable of sensing and displaying the aircraft's current angle of attack (AOA) when installed with a GSU 25 ADAHRS and a GAP 26 pitot/AOA probe. The GDU displays present on-screen AOA information, and also generate AOA audio alerts.

The optional GI 260 AOA indicator can also be added to provide a separate heads-up indication of AOA.

Refer to Section 10 for GI 260 installation information. The angle of attack sensor can be calibrated to compensate for flap position, which requires either a flap position sensor or a dedicated discrete input.

2.1.1.7 Engine Information

The G3X system includes highly flexible capabilities for monitoring numerous engine sensors and parameters, and can support most piston and turbine engines, including twin-engine installations. Airframe sensors such as voltage, fuel quantity, and discrete (switch/contact) inputs are also supported. Refer to Section 22 for engine application and sensor installation information, and Section 27, Section 28, Section 29, and Section 30 for engine/airframe sensor wiring information.

The engine information system (EIS) unit for the G3X system is the GEA™ 24 engine interface module. The GEA 24 provides the ability to monitor numerous analog, digital, and discrete signals from a variety of engine and airframe sensors. Multiple GEA 24 units may be installed in order to monitor large piston engines, or for twin-engine applications. The GEA 24 also supports a digital interface to a number of FADEC (Full Authority Digital Engine Control) engines. The GEA 24 communicates with other LRUs using the CAN bus, and can optionally be connected to the MFD GDU by RS-232 for redundancy. For GEA 24 installation information, refer to Section 8. For information on EIS sensor configuration and calibration, refer to Appendix H or Section 31. If replacing a GEA 24 with a GEA 24B, please review the guidance in Section 33.2.5.

The GSU 73 also supports EIS inputs. Alternatively, a system that includes a GSU 73 may instead use a GEA 24 for EIS, if the GEA 24 is wired as EIS LRU #2.

The GEA 24 and GSU 73 can drive external annunciator lamps for Master Caution and Master Warning, to provide additional notification of abnormal engine indications. Refer to Section 24 for information on connecting annunciator lamps to GEA 24 or GSU 73 discrete output pins.

2.1.1.8 GPS

Each GDU display includes an internal VFR GPS receiver, and a connection for an external antenna. GPS position data is shared between GDU displays using the CAN bus. For a list of GPS antennas supported by the GDU display, refer to Appendix E, or Section 7.

The GPS 20A is a TSO-compliant WAAS GPS position source that is compatible with the G3X system. The GPS 20A provides GPS data to the G3X system using the CAN bus, and can send ADS-B position data to a transponder using RS-232. For GPS 20A installation information and a list of supported GPS antennas, refer to Section 16.

GPS data is used for ADAHRS performance monitoring, so at least one source of GPS data is required. This requirement can be met by installing a GPS 20A, or by connecting a GPS antenna to at least one GDU GPS receiver. A GTX Series Transponder with built-in GPS, or a GNX 375 connected to the system will also satisfy this requirement. In a system with multiple GDU displays, additional GPS antennas may be connected to the other displays for redundancy, if desired.

The G3X system is capable of displaying basic position data from an external IFR GPS navigator, but this data is not used for ADAHRS monitoring and thus does not satisfy the above requirement.

For general GPS antenna installation information, refer to Section 21.

2.1.1.9 ARINC 429

ARINC 429 is an industry-standard data bus format that is primarily used with IFR GPS or GPS/NAV receivers (see below). The GAD 29 is the primary ARINC 429 data adapter for the G3X system; the GSU 73 also supports ARINC 429 input/output. ARINC 429 data is relayed to and from the rest of the G3X system using the CAN bus. For GAD 29 installation information, refer to Section 4.

2.1.1.10 Navigation

Basic VFR GPS navigation with the G3X system is performed by the GDU displays, using their internal navigation databases in conjunction with GPS data from GDU GPS receivers or the GPS 20A. Flight plan entry and modification is also performed using the GDU displays. For VFR operations, no other source of navigation data is required.

The G3X system also supports up to two external navigation sources. Supported external navigation sources include IFR GPS, VHF NAV, and GPS/NAV receivers.

Lateral and vertical deviation (CDI/VDI) and status data from external navigators is displayed on the GDU displays, as well as external GPS navigator flight plan information. On-screen controls allow switching the current source of navigation data between multiple external sources, as well as to the G3X system's internal flight plan for VFR navigation.

The Garmin GNC® 355 radio, GNS™ 4XX/5XX receiver, GNX™ 375 IFR navigator, GPS 175, and GTN™ 6XX/7XX moving map navigators are supported by the G3X system, including WAAS approach capability. This integration requires the use of a GAD 29 ARINC 429 interface module. GPS navigation data is provided to the G3X system through one RS-232 input and one ARINC 429 input for each GNC 355, GNS 4XX/5XX, GNX 375, GPS 175, and GTN 6XX/7XX IFR GPS navigator unit. The G3X system sends flight data and selected course information back to the external GPS navigator through an ARINC 429 output.

The G3X system uses an additional ARINC 429 input to receive VOR, localizer, and glideslope deviation information from a Garmin GTN 650/750 or GNS 430/480/530 IFR GPS/NAV receiver.

VOR, localizer, and glideslope information from a Garmin GNC 255, GNC 215, or SL30 VHF NAV receiver is also supported. These radios connect to the G3X system using an RS-232 connection to a GDU display.

When two external navigation sources are connected to the G3X system, the determination of which source is #1 and which is #2 is determined by the ordering of the RS-232 connections to the GDU displays. The #1 navigation source should be connected to a lower-numbered RS-232 port on the PFD1 GDU, and the #2 navigation source should be connected either to a higher-numbered RS-232 port on the PFD1 GDU, or to any RS-232 port on the MFD1 GDU. For additional information, refer to Section 2.5.1.

The G3X Touch system can send basic flight plan data to a GNC 355, GNS 4XX/5XX, GNX 375, GPS 175, or GTN 6XX/7XX IFR GPS navigator, allowing VFR flight plans to be created on the G3X system and uploaded to the IFR navigator. The GDU 4XX display in a G3X Touch system can also act as a relay between the GNC 355, GNS 4XX/5XX, GNX 375, GPS 175, and GTN 6XX/7XX IFR GPS navigator and a tablet computer using Bluetooth (see Section 2.1.1.23). Flight plan transfer capability requires a second RS-232 connection between the PFD1 GDU and the #1 GNC 355, GNS 4XX/5XX, GNX 375, GPS 175, or GTN 6XX/7XX IFR GPS navigator, using the "Connext®" RS-232 format. The Connext® computer application and Bluetooth are not supported by the legacy G3X system and GDU 37X display.

If a G5 standby display instrument is installed, data from the external navigation source selected on the G3X PFD is also displayed on the G5. This requires an ARINC 429 connection between the navigator, GAD 29, and G5.

For detailed information on connecting external navigators to a G3X system, refer to Section 25.

2.1.1.11 COM Radios

The G3X Touch system is capable of displaying and controlling up to two VHF COM radios. Supported COM radios include:

- GNC 215
- GNC 355
- GTR 20
- GTR 205
- GTR 205XR
- SL30
- GNC 255 (software version 2.10 or later)
- GTN 635/650/750 (software version 6.11 or later)
- GTR 200/200B
- GTR 205X
- GTR 225 (software version 2.10 or later)
- SL40

Supported Garmin panel-mount COM radios can be controlled either using the GDU displays or through their own front-panel controls.

The GTR 20 and GTR 205XR are remote-mounted COM radios that are entirely controlled by the G3X Touch display, with no front-panel interface. For GTR 20 installation information, refer to Section 20 and Section 26. For GTR 205XR installation information, refer to the GTR 205XR Installation manual, part number 190-02766-21.

The interface between the G3X Touch system and the COM radio portion of a GTN, GNC 215, GNC 255, GNC 355, or SL30 uses the same RS-232 connection described above for navigation data. Interface to a SL40 COM radio requires a dedicated RS-232 connection to a GDU display. The GTR 20, GTR 200, GTR 205X, and GTR 205XR connect to the G3X Touch system through the CAN bus.

For information on connecting and configuring COM radios with the G3X Touch system, refer to Section 25 and Section 31.

The legacy G3X system and GDU 37X displays do not support on-screen display or control of COM radios, and are not compatible with the GTR 20. However, GDU 37X displays do have the ability to send a COM frequency using RS-232 to the standby position of connected radio.

2.1.1.12 NAV Radios

NAV Tuning

The G3X Touch system is capable of displaying and controlling up to two VHF NAV radios. Supported NAV radios include:

- GNC 215
- GNC 255 (software version 2.20 or later)
- GTN 650/750 (software version 6.70 or later)
- SL30

Supported Garmin panel-mount NAV radios can be controlled either by the GDU displays or through their own front-panel controls.

The interface between the G3X Touch system and the NAV radio portion of a GTN, GNC 255, or SL30 uses the same RS-232 connection described above for navigation data.

For information on connecting and configuring NAV radios with the G3X Touch system, refer to Section 31.4.28.

The legacy G3X system and GDU 37X displays do not support on-screen display or control of NAV radios. However, GDU 37X displays do have the ability to send a NAV frequency by RS-232 to the standby position of a connected radio.

2.1.1.13 ADS-B

When equipped with a Mode S transponder with extended squitter capability, and a GPS position source that meets TSO performance requirements, the G3X system provides full ADS-B Out capability. Refer to Section 2.1.1.14 for additional information.

The G3X system also supports full ADS-B In capabilities, including FIS-B weather and dual-frequency traffic data reception. In a legacy G3X system with GDU 37X displays, ADS-B In is provided by the GDL® 39R data transceiver. A G3X Touch system with GDU 4XX displays supports ADS-B In using the GTX™ 45R/345/345R transponder, the GDL 39R, or the GDL 52R.

For additional information on interfacing a transponder to the G3X Touch system, see Section 2.1.1.14. For information on interfacing a GDL 39R or GDL 52R ADS-B receiver, see the appropriate installation guide (190-11110-00 or 190-02087-10).

2.1.1.14 Transponder

The G3X system can interface to any Garmin transponder with a digital interface (all models except the GTX 320). The transponder code, operating mode, and flight ID can all be displayed and controlled using the GDU displays.

A panel-mount transponder such as the GNX 375, GTX 327, 328, 330, 335 and 345 can be controlled either from the GDU displays or by the transponder's front-panel interface. Remote-mount transponders such as the GTX 23ES, 32, 33, 35R/45R and GTX 335R/345R lack front-panel controls, and are controlled only using the GDU displays. The diversity GTX 345D, GTX 335D, GTX 335RD, and GTX 345RD are all supported.

The transponder connects using RS-232 to the #1 ADAHRS unit, which relays transponder data to the rest of the G3X system through the CAN bus. The ADAHRS provides pressure altitude data to the transponder, so a separate altitude encoder is not required. A second connection from the transponder to the #2 ADAHRS can be made to provide a backup datapath for this information.

In a G3X system with a transponder and a GTN, the transponder is typically controlled by the G3X system, not the GTN. Note the GTX 23ES and GTX 35R/45R can only be controlled by the G3X system, not by the GTN.

The GTX 23ES, 33ES, 35R, 45R, 330ES, 335/335R/335D/335RD, and GTX 345/345R/345D/345RD are Mode S transponders with extended squitter capability. When provided with a GPS position source that meets the TSO performance requirements specified in 14 CFR 91.227, these transponders are an acceptable method of complying with the requirements for ADS-B Out. Compliant GPS position sources include the GPS 20A, GTN, GNS WAAS units, or the internal WAAS GPS contained in certain models of the GTX 335/345/45R. The GDU GPS receiver does not meet the TSO GPS requirements, thus it is not sufficient to provide position data to a transponder for ADS-B Out compliance.

NOTE

If a GTX 45R with on-board GPS receiver is installed, an external source of GPS position is not required.

Certain transponders support ADS-B or TIS-A traffic data, and/or FIS-B weather data. See below for information on traffic (Section 2.1.1.17) and weather (Section 2.1.1.16) interface capabilities.

For information on connecting and configuring a transponder with the G3X system, refer to Section 25 and Appendix H or Section 31. Refer to Section 33 for information on performing periodic tests of the transponder.

For information on installing remote transponders, refer to 190-00906-01 for the GTX 23ES, or 190-01499-10 for the GTX 35R/45R. For all other transponders, refer to the appropriate installation manual.

2.1.1.15 Autopilot

The GFC 500X is an advanced digital flight director and autopilot based around the GSA 28 smart autopilot servo, intended to be installed in a wide variety of fixed-wing aircraft. Servo installation kits are available for numerous popular aircraft, and universal installation brackets are available for other aircraft. Up to five GSA 28 servos are supported (pitch, roll, yaw damper, pitch trim, and roll trim). GSA 28 servos can optionally control aircraft electric trim motors; this keeps the aircraft in trim when the autopilot is engaged, and also provides trim motor speed control and stuck-switch protection when hand-flying. The GSA 28 can also be used as the trim actuator in the pitch and roll axes. The GSA 28 servos also support enhanced stability and protection features (ESP™ corrective technology) which increase safety when hand-flying. For GSA 28 installation information, refer to Section 17 and Section 25. For GFC 500X autopilot and ESP setup and adjustment information, refer to Appendix H or Section 31. Refer to the G3X Pilot's Guide or G3X Touch Pilot's Guide for information on GFC 500X autopilot and flight director operation.

The GMC mode control panels are a family of optional accessories that provide a convenient set of dedicated controls for the GFC 500X autopilot and flight director. A GFC 500X autopilot installation with a GMC mode control panel also has increased redundancy, allowing control of basic autopilot modes using the GMC even when power is removed from all GDU displays.

The GMC 307 supports all the features of the GMC 305, and adds dedicated control knobs for heading and altitude. Autopilot operation in a reversionary condition without operational GDU displays is provided by an RS-232 connection from the GMC 305/307 to the GSA 28 roll servo. For GMC 305/307 installation information, refer to sections Section 11 and Section 12.

The GMC 507 is physically similar to the GMC 307, but it connects to the G3X system through the shared CAN bus. Up to two GMC 507 Mode Control panels can be installed. The GMC 507 adds an additional flight director mode button. For GMC 507 installation information, refer to section Section 13.

In a G3X Touch system with GDU 4XX displays and one or more ADAHRS units, all autopilot and flight director functions can be controlled either from the GDU display or the optional GMC control panel. Refer to the G3X Touch Pilot's Guide (190-01754-00) for more information.

In a G3X Touch system with no ADAHRS units, one or more G5 displays and a GMC control panel are required for autopilot and flight director operation using the G5. Refer to the G5 Pilot's Guide (190-02072-00) for more information.

In a legacy G3X system with GDU 37X displays, a GMC control panel is required to enable certain advanced flight director modes; refer to the G3X Pilot's Guide (190-01115-00) for more information.

Certain third-party autopilots that are designed to be integrated with the G3X system may also be used in conjunction with the G3X flight director and GMC control panel. Consult the third-party autopilot manufacturer for further information.

Third-party digital autopilots that are not integrated with the G3X system are typically connected either through a GDU display RS-232 output that provides NMEA 0183 format data, or through various connections to a GTN/GNS navigator. Consult the autopilot manufacturer for further information.

The GAD 29B can provide analog heading and course error outputs to non-Garmin analog autopilots.

2.1.1.16 Weather Data

The G3X system supports a variety of airborne weather data sources:

FIS-B weather data can be provided to GDU displays from a GDL 39R remote-mounted ADS-B receiver. The GDL 39R can be connected to a single GDU display using RS-232. In a G3X Touch system, the GDL 39R may also be connected to additional GDU 4XX displays wirelessly using Bluetooth.

A G3X Touch system with GDU 4XX displays can receive FIS-B weather data from GTX 45R, and GTX 345/345R transponders through an RS-232 connection from the GTX to each GDU display. These transponders can also simultaneously provide FIS-B weather data to a GTN or GNS WAAS navigator. The legacy G3X system with GDU 37X displays does not support FIS-B weather data from GTX transponders.

The GDU 3X5 and GDU 4X5 displays contain a built-in XM satellite weather receiver. These displays require a separate antenna connection and active XM subscription in order to receive satellite weather data. For XM antenna installation information, refer to Section 21.

A G3X Touch system with GDU 4XX displays is also compatible with the GDL 51R SXM receiver and the GDL 52R dual ADS-B/SXM receiver. The GDL 51R/52R connect to each GDU 4XX display using an RS-232 connection, or wirelessly through Bluetooth.

A WX-500 or similar lightning detector can be used with the G3X Touch system using an RS-232 connection to a GDU 4XX display. The G3X system displays lightning strike or cell data and provides heading data output to the lightning detector.

For any of the above data sources, weather data is displayed only on the GDU displays that are connected to the weather source (either by an RS-232 connection, wirelessly through Bluetooth, or from an internal XM receiver). Weather data is not shared between GDU displays through the CAN bus.

On a GDU display that has access to multiple sources of weather data simultaneously, the pilot may switch between available weather sources at any time.

When connected to a FIS-B weather receiver, the GDU 4XX can receive METARs, TAFs, Winds aloft, NEXRAD, TFRs, AIRMETs, SIGMETs, PIREPs, NOTAMs, Cloud Tops Forecast, Icing Forecast, Lightning, and Turbulence Forecast over either an RS-232 or Bluetooth connection.

2.1.1.17 Traffic

The G3X system supports a variety of airborne traffic data sources:

ADS-B traffic data can be provided by a GDL 39R receiver using the same connection method used for FIS-B weather data.

A G3X Touch system with GDU 4XX displays can receive traffic data from a GDL 52R dual ADS-B/SXM receiver through the same connection method used for FIS-B weather data.

A G3X Touch system with GDU 4XX displays can receive ADS-B traffic data from GTX 45R and GTX 345/345R transponders using the same RS-232 connection used for FIS-B weather data. These transponders can also simultaneously provide ADS-B traffic data to a GTN or GNS WAAS navigator. The legacy G3X system with GDU 37X displays does not support ADS-B traffic data from GTX transponders.

The GTS™ 8XX traffic system is compatible with the G3X system. The GTS interface to the G3X system requires an RS-232 connection to a GDU display. TCAS-capable GTS 8XX units also require a separate data connection to the GTX transponder.

TIS-A traffic data can be provided by GTX 23ES, 33, 330, and GTX 335/335R transponders. Traffic data is provided to the G3X system using the CAN bus from the #1 ADAHRS unit, to which the transponder is connected.

Traffic data from various third-party devices that emulate the Garmin TIS-A format is supported using an RS-232 connection from the traffic device to a GDU display.

For any of the above data sources, traffic data is shared between GDU displays using the CAN bus. If multiple sources of traffic data are available, the best source is selected automatically. Refer to the Pilot's Guide for further information on traffic data source selection.

In an installation that includes a GTN/GNS navigator and transponder with ADS-B or TIS-A traffic capability, traffic data is provided to the GTN/GNS through an ARINC 429 or HSDB (High Speed Data Bus) connection. For further information, refer to Section 25 and the transponder installation manual.

2.1.1.18 Electrical System

The G3X system supports a variety of connections to the aircraft's electrical system:

Most important LRUs support dual power inputs, allowing them to be powered from separate dual electrical busses. Alternatively, one of the power inputs may be connected to a backup battery to provide adequate electrical power supply in the event of alternator failure, or during engine start. Backup batteries designed for the G3X system are available from third-party suppliers, or a backup battery can be integrated into the aircraft's electrical system design in order to power additional devices.

In a G3X Touch system with GDU 4XX displays, the GAD 27 electrical control system provides low-voltage protection during engine start, as well as control of the flaps, trim, external lighting, and cockpit lights. The GAD 27 is not compatible with legacy G3X systems that use GDU 37X displays. For further GAD 27 installation information, refer to Section 3 and Section 25.

If the aircraft is equipped with a cockpit light dimming system, the GDU displays and various other Garmin panel-mount avionics support connection to the dimming bus to control display brightness.

The G3X system is compatible with Vertical Power products through an RS-232 connection to a GDU display. For further information on interfacing Vertical Power products to the G3X system, consult the manufacturer.

2.1.1.19 Audio

The G3X system interacts with the aircraft's audio system in the following ways:

- Audio alerts are generated by the GDU displays for various events, including audio notification of abnormal conditions. Typically, alert audio from the PFD1 GDU is wired to the aircraft's audio panel or intercom.
- Stereo audio for XM music is provided by the GDU 3X5 and GDU 4X5 displays, and can be connected to any stereo audio panel or intercom.
- A G3X Touch system with GDU 4XX displays may be connected using the CAN bus to the GMA™ 245/245R audio panel, allowing full control of audio panel functionality from the GDU display. The GMA 245 is a panel-mounted digital audio panel with intercom and Bluetooth input; the GMA 245R has the same capabilities but is remote-mounted with no front-panel controls. For further information, refer to Section 31.4.25, the GMA 245/245R Pilot's Guide (190-01879-10), and Installation Manual (190-01879-11).
- The GTR 20, GTR 200, GTR 205X, and GTR 205XR COM radios contain a built-in two-place intercom with alert audio and stereo music inputs. For simple two-place VFR aircraft, the GTR 20, GTR 200, GTR 205X, or GTR 205XR can provide all audio functionality, with no separate audio panel required. For installations with more complex audio switching requirements, including multiple COM radios, NAV radios, or 4+ seat aircraft, a separate audio panel is recommended.

2.1.1.20 Video

In a G3X Touch system with GDU 4XX displays, each display has a rear connector which supports composite (NTSC/PAL/SECAM) video. Video input to a GDU 4XX display can be used with various cameras or entertainment systems, with the video image displayed on a dedicated MFD page, or in an inset window on the GDU 46X PFD. Wireless remote control of Garmin VIRB® action cameras is also supported, allowing recording to be started or stopped from the GDU 4XX display.

2.1.1.21 Carbon Monoxide Detector

In a G3X Touch system with GDU 4XX displays, a Garmin GCO™ 14 can be connected to the PFD1 GDU, and its data relayed to other displays through the CAN bus. Alerts will appear on the PFD display for excessive carbon monoxide levels, and the current CO level can be displayed in a data field. For GCO 14 installation information, refer to Section 6.

A CO Guardian or other compatible carbon monoxide detector can be connected to a GDU display using RS-232, and its data relayed to other displays through the CAN bus. Alerts will appear on the PFD display for excessive carbon monoxide levels, and the current CO level can be displayed in a data field. Cabin Altitude as determined by a CO Guardian can be displayed in a data field. CO detectors with pulse oximeter functions are also supported. For installation information, consult the CO detector manufacturer.

2.1.1.22 Emergency Locator Transmitter (ELT)

The G3X system can provide NMEA 0183 or "Aviation" formatted GPS position data to an ELT through an RS-232 output from a GDU display. In an installation with a GTN/GNS navigator, an RS-232 output from the IFR GPS using the "Aviation" data format may be preferred. For further ELT interface guidance, consult the ELT manufacturer.

2.1.1.23 Bluetooth

The GDU 4XX displays in a G3X Touch system include Bluetooth transceivers. This allows a wireless connection to a tablet computer, using Garmin Pilot™ app or another application that supports the Garmin Connext protocol. The tablet computer can receive GPS position and attitude data from the G3X Touch system, and can exchange flight plan information with the GDU 4XX or with a connected GTN navigator. In an installation with multiple GDU 4XX displays, the Bluetooth connection to the tablet computer should be made to the PFD1 GDU only. Refer to the G3X Touch Pilot's Guide (190-01754-00) for Bluetooth connection information.

A tablet computer can also establish a separate Bluetooth connection to a GDL 39R/51R/52R ADS-B receiver, or to a GTX 45R/345/345R transponder. This allows the display of ADS-B traffic and weather data on the tablet computer, using Garmin Pilot or another application that supports the Garmin Connext protocol.

In a G3X Touch system with a GDL 39R ADS-B receiver, the primary connection between the GDL and a single GDU 4XX display is through RS-232. However, Bluetooth may also be used to connect additional GDU 4XX displays to the GDL 39R, in order to view FIS-B weather data on multiple displays.

2.1.1.24 Standby Instruments

Although there is no regulatory requirement to equip the aircraft with backup flight instruments, Garmin strongly recommends the installation of backup instruments for aircraft that will be flown in other than Day VFR conditions. In case of an electrical system failure, or in the unlikely event of an issue with the G3X system, backup instruments should at minimum provide a secondary reference for aircraft attitude, airspeed, and altitude.

The G5 standby flight display is designed as a complementary backup instrument for the G3X system. It features dissimilar hardware and software design to eliminate common-mode failures, supports an optional built-in backup battery, and synchronizes data such as baro setting and selected heading with the G3X system. In conjunction with a GMC mode control panel, the G5 is also capable of driving the GSA 28 autopilot servos even if power is removed from all GDU displays. A G3X Touch system with no ADAHRS units can also operate the GSA 28 autopilot servos if a G5 and a GMC mode control panel are present. For further information, refer to the G5 installation/operation manual (190-02072-00).

The GI 275 is also capable of being installed as a standby flight display with GDU 4XX systems. The altitude bug, heading track bug, and barometric setting are synced between the two displays. The G3X Touch syncs course, minimum's bug, CDI selection, and VFR GPS guidance to the GI 275, in addition to sending OAT and magnetic heading to the GI 275. A connection can optionally be made from the GSU 25 serial port to the GI 275, to facilitate comparison between the two ADAHRS sources to notify the pilot of a disagreement in attitude, altitude or airspeed. Unlike the G5, the GI 275 cannot act as a backup flight director when installed alongside a G3X Touch system in the case of a primary display failure.

2.1.1.25 Smart Glide™ Engine-Out Navigation

Smart Glide is designed to assist the pilot by enhancing situational awareness and providing helpful automation during an emergency inoperative engine event. The G3X Touch is capable of providing this assistance internally, without the need for an external navigator. Upon activation, Smart Glide assists the pilot with three critical components of a safe recovery from an engine failure:

- If equipped with a compatible autopilot, provides flight director guidance to pitch for and hold best glide airspeed
- Identifies and provides navigation guidance, as well as optional flight director guidance to a suitable landing location (if one is available)
- Provides quick access to relevant communication channels and emergency checklists

When GSA 28 Smart Autopilot servos or other compatible autopilot is installed, the autopilot automatically couples to the flight director guidance provided by Smart Glide, if sufficient altitude is available. An optional discrete input can be programmed to provide a dedicated external panel mounted switch for Glide Activation (Garmin p/n 011-05930-00).

2.1.1.26 Radar Altimeter and Radio AGL

Knowing precise height above the ground can be helpful to pilots during landings and flying in areas where limited barometric altimeter setting information is available.

The Garmin GHA 15 uses radar technology to provide height above ground level (RAGL) information for the G3X Touch. GHA 15 AGL data is available up to 500 feet AGL.

Alternatively, the G3X Touch system can receive Radar Altimeter AGL data from a connected radar altimeter unit via ARINC 429.

Audible alerts based on radio AGL or radar altitude can be configured beginning at 300 feet AGL, and at select intervals down to 1 foot AGL

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 GAD 27 which is 14 VDC only, and the GAP 26, see Note in Section 5). Table 2-1 and Table 2-2 list supply voltage and current draw info 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 Power Requirements

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 and 010-01074-20 are listed in Table 2-1. See Section 5.5.2 for acceptable wiring configurations.

CAUTION

Do not connect the heated/regulated version of the GAP 26 (010-01074-20) to 28 VDC. The heated/non-regulated version of the GAP 26 (010-01074-10) may be connected to either 14V or 28V. See Section 5 for wiring information.

Table 2-1 GAP 26 Initial Current Draw vs Probe Temperature (-10, -20 units only)

Probe Temperature	-40°C (-40°F)	0°C (32°F)	50°C (122°F)	100°C (212°F)	175°C (347°F)
Amps	12 Amp	9.25 Amp	7.3 Amp	5.85 Amp	4.36 Amp

Table 2-1 refers to probe temperature at initial turn-on. For example, upon turn-on at -40°C, the standard (-10) or regulated (-20) heated probes will initially draw 12 amps, but will draw less current as they warm up.

The -10 non-regulated probe draws current proportional to the probe temperature as shown in Table 2-1.

The -20 heated regulated probe uses similar power to the -10 probe when airborne, but will limit the current to regulate the probe temperature to ~75°C (167°F) when the probe temperature reaches this value.

2.2.1.2 Other LRU Power Requirements

Table 2-2 G3X LRU Power Requirements

LRU	Supply Voltage	Current Draw
GAD 27	14 Vdc	0.2 Amp (varies with connected devices)
	28 Vdc	Not supported, do not use in 28V installations
GAD 29	14 Vdc	0.2 Amp
	28 Vdc	0.1 Amp
GCO 14	3.3 Vdc	.002 Amp
GDL 39/39R	14 Vdc	0.25 Amp
	28 Vdc	0.125 Amp
GDL 51R	14 Vdc	0.16 Amp
	28 Vdc	0.09 Amp
GDL 52R	14 Vdc	0.29 Amp
	28 Vdc	0.15 Amp
GDU 37X**	14 Vdc	1.10 Amp
	28 Vdc	0.540 Amp
GDU 45X**	14 Vdc	1.25 Amp
	28 Vdc	0.7 Amp
GDU 46X**	14 Vdc	2.0 Amp
	28 Vdc	1.0 Amp
GDU 470**	14 Vdc	1.25 Amp
	28 Vdc	0.7 Amp
GEA 24	14 Vdc	0.43 Amp max (typical external sensor loading)
	28 Vdc	0.21 Amp max (typical external sensor loading)
GHA 15	14 VDC	0.272 Amp typical, 0.350 Amps max
	28 VDC	0.139 Amp typical, 0.175 Amps max
GI 260	14 Vdc	0.4 Amp
	28 Vdc	0.2 Amp
GMC 305	14 Vdc	0.050 A (50 mA)
	28 Vdc	0.028 A (28 mA)

*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.

**The specified current draw is measured with the display backlight set to 100%

Table 2-2 G3X LRU Power Requirements

LRU	Supply Voltage	Current Draw
GMC 307	14 Vdc	0.120 A (120 mA)
	28 Vdc	0.067 A (67 mA)
GMC 507	14 Vdc	0.20 A (200 mA)
	28 Vdc	0.11 A (110 mA)
GMU 11	14/28 Vdc	0.1 A (100 mA)
GMU 22	12 Vdc (from GSU 25/GSU 73)	Included in GSU 25/GSU 73 Current Draw
GPS 20A	14 Vdc	0.2 Amp
	28 Vdc	0.1 Amp
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)
GTR 20 GTR 200**	14 Vdc	0.6 Amp, Typical when receiving 3.0 Amp, Typical when transmitting 7.50Amp, Maximum, 90% modulated into 3:1 VSWR and 11V power input voltage
	28 Vdc	0.30 Amp, Typical when receiving 1.40 Amp, Typical when transmitting 3.75 Amp, Maximum, 90% modulated into 3:1 VSWR and 22 V power input voltage
GTR 205XR	14 Vdc	0.63 A (typical) 3.35 A (max)
	28 Vdc	0.33 A (typical) 1.61 A (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.

**The specified current draw is measured with the display backlight set to 100%

2.3 Wiring/Cabling Considerations

Section 24 lists the pin information for all LRU connectors. Section 24 lists the connector (including configuration modules) installation information. Section 25 through Section 30 contain interconnect drawings for all required/optional LRUs and sensors. These sections, along with Section 3 through Section 22 contain all the information needed to construct the wiring harnesses/cables. It is recommended that LRUs/sensors be installed before 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.

Use MIL-C-27500 (or other approved cable) for all shielded cable connections unless otherwise specified.

HSDB (Ethernet) connections may use either aviation grade Category 5 Ethernet cable, or MIL-C-27500 shielded twisted-pair cable.

RG-400 or RG-142 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, follow these precautions:

- All cable routing should be kept as short and as direct as possible.
- Check 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, pins, etc. are provided with LRU Installation Kits. 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 24 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 1-8 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, Shield Block Ground, and Thermocouple are located in Section 23.

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. A configuration module (Figure 2-2 and Figure 2-3) is installed in the connector backshell of the PFD1 display to store important configuration data. Only the PFD1 display uses a configuration module; in systems using a GSU 73, an additional configuration module is installed in the GSU 73 connector backshell. See Section 23 for installation instructions.



Figure 2-2 Original Green Configuration Module P/N 011-00979-20

Figure 2-3 shows the Apple® iOS compatible configuration module that installs on the GDU 4XX (PFD 1) connector backshell. This configuration module is required for using Connext capability with Apple products. Contact Garmin Aviation Product Support if the GDU 4XX unit was sold with an original green configuration module. See Section 23 for installation instructions.

NOTE

Please refer to the G3X Touch Pilot's Guide (190-01754-00) for guidance in using Connext Bluetooth connections to Garmin Pilot device(s).

To test for the installation of the Apple iOS compatible configuration module, enter config mode, select the System Information page, highlight PFD1, press Menu, and run the Apple compatibility test.

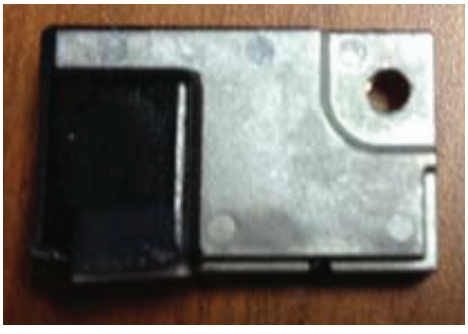


Figure 2-3 Apple iOS Compatible Black Configuration Module P/N 010-12253-00

2.3.1.3 CAN Bus

The primary digital interface used to exchange data between LRUs in the G3X system is the Controller Area Network, also known as the CAN bus. CAN was developed by Bosch GmbH in the 1980s, and its specifications are currently governed by ISO 11898-2. CAN is widely used in aviation, automotive, and industrial applications due to its simplicity and reliability.

2.3.1.3.1 CAN Bus Architecture

The electrical architecture of the CAN bus takes the form of a linear "backbone" consisting of a single twisted wire pair with an LRU connected (terminated) at each end (Figure 2-4). The maximum bus length is 32 meters (104 ft) for 120 Ohm impedance matched harnesses. The maximum bus length is 25 meters (82 ft) for harnesses that are not impedance matched. At each of the two extreme ends of the CAN bus, a 120 Ω resistor is installed to "terminate" the bus. In the G3X system, termination resistors are provided either within the LRUs themselves, or using termination adapters that plug into an LRUs CAN connection (see Section 2.3.1.3.3).

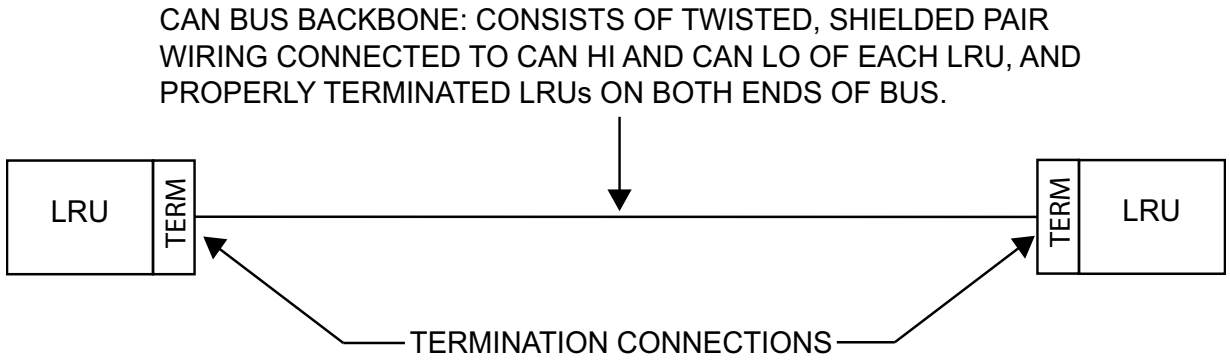


Figure 2-4 CAN Bus Backbone

Multiple LRUs may be connected in a daisy-chain manner along the backbone of the CAN bus (Figure 2-5).

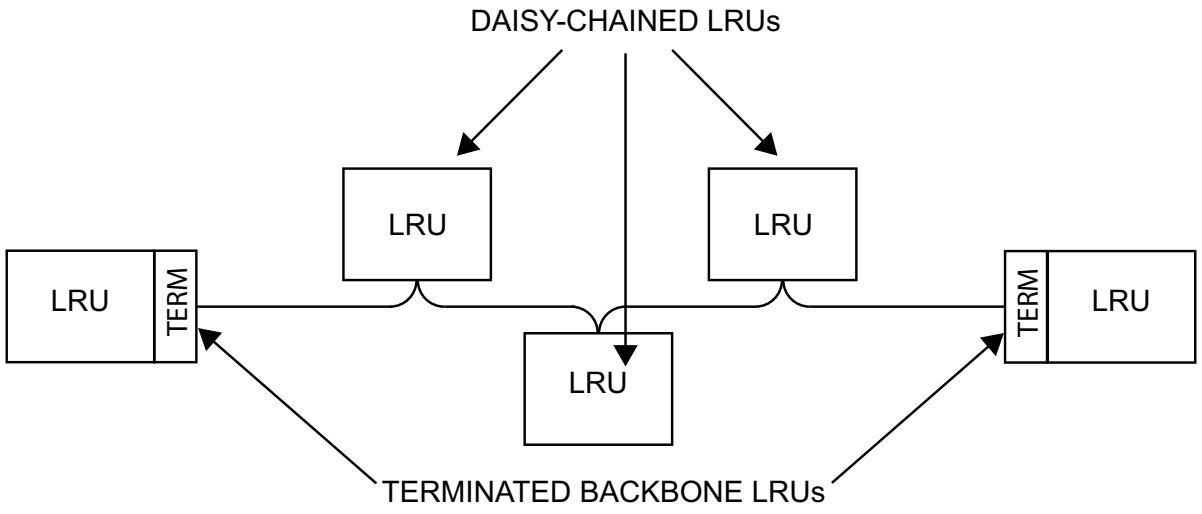


Figure 2-5 Daisy-chained LRUs on Backbone

Daisy-chained LRUs (LRUs not at the extreme ends of the CAN bus) connect to the CAN backbone through short “stub” or “node” connections (Figure 2-6). The length of each node connection should be kept as short as possible. Follow the instructions in Section 23.2.9 for splicing signal cables. Proper shielding technique limits the maximum CAN bus stub length to 3 inches. Unshielded wire sections should be kept as short as practical.

Multiple devices must not connect to the CAN bus backbone at the same point. Rather than splicing two or more stub node connections together, the CAN bus should instead be daisy chained from one device to the next (Figure 2-6).

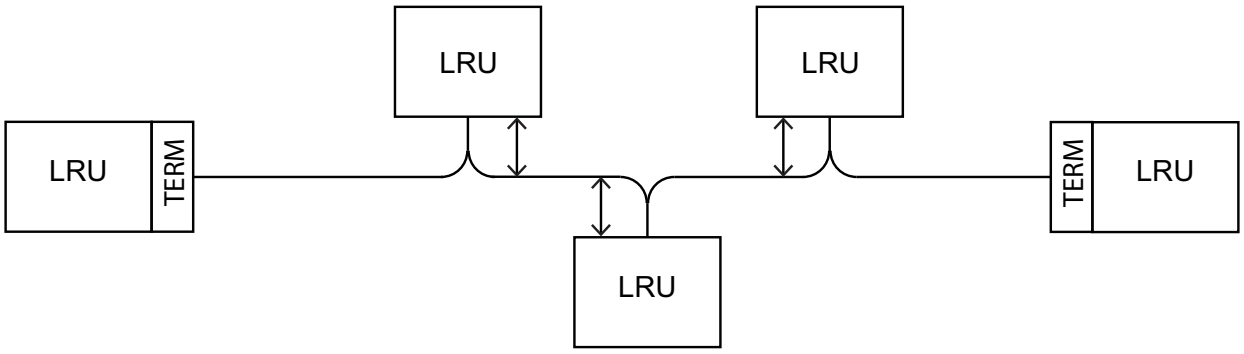
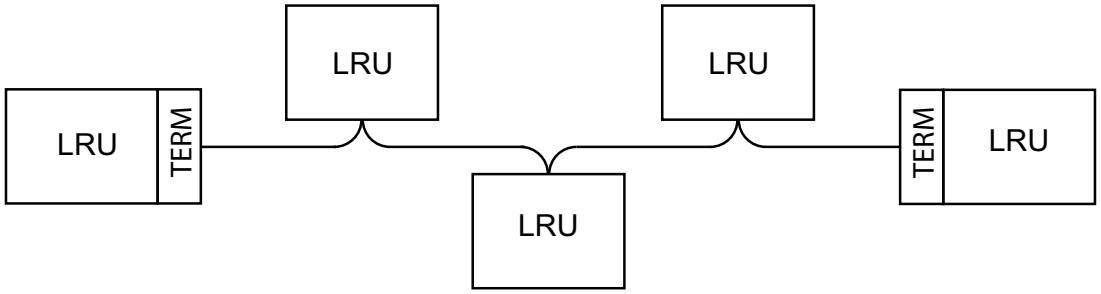


Figure 2-6 Node Connections

The layout of the CAN bus must be a single linear backbone with exactly two distinct end points (Figure 2-7). Other layouts such as “star” or “Y” arrangements must be avoided. Similarly, hub devices must not be used with the G3X CAN bus. (Figure 2-8)



LINEAR CAN BACKBONE, DAISY-CHAINED CONNECTIONS WITH SHORT STUB NODE LENGTHS. MULTIPLE LRUs ARE NOT CONNECTED TO BACKBONE AT THE SAME LOCATION.

Figure 2-7 Correct CAN Wiring Example

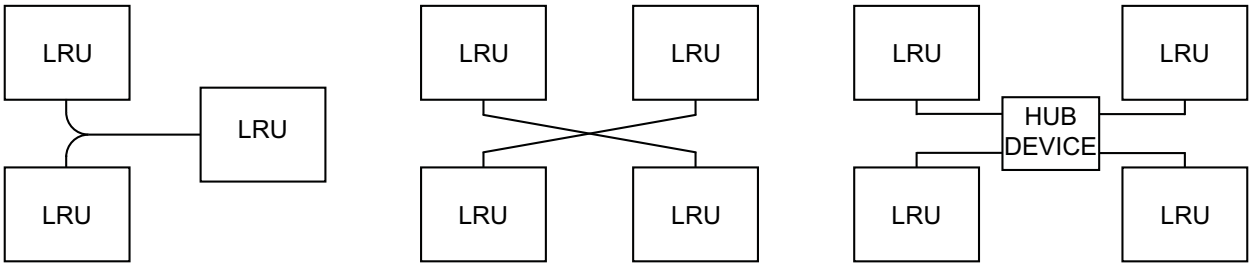


Figure 2-8 Incorrect CAN Wiring Examples

2.3.1.3.2 CAN Bus Wiring

120 Ohm impedance matched cable is recommended (see recommendations below). Shielded twisted pair cable, MIL-C 27500 or equivalent 22 AWG or larger wire can be used if your total CAN bus length is less than 25 meters. 120 Ohm impedance match cable is required for the maximum 32 meter bus length:

CAN Bus Wire, 120Ω:

- GigaFlight Connectivity P/N GF120-24CANB-1:

  GigaFlight Connectivity Inc.
  6180 Industrial Ct.
  Greendale, WI 53129
  United States
  Toll Free: +1 (844) 303-1093
  Phone: +1 (414) 488-6320
  Email: info@gigaflightinc.com

- Carlisle IT P/N CAN24TST120(CIT), (must be ordered from the following Carlisle IT facility):

  Carlisle Interconnect Technologies
  5300 W. Franklin Drive
  Franklin, WI 53132
  United States
  Toll Free: +1 (800) 327-9473
  Phone: +1 (414) 421-5300
  Fax: +1 (414) 421-5301

The shields for each CAN bus wire segment should be interconnected, forming a continuously connected shield from one end of the CAN bus to the other (Figure 2-9 and Section 23-13). At minimum, the CAN bus shield should always be grounded to the device connector backshells at the two extreme ends of the bus, but it is acceptable to also ground the shield at any or all other devices on the CAN bus.

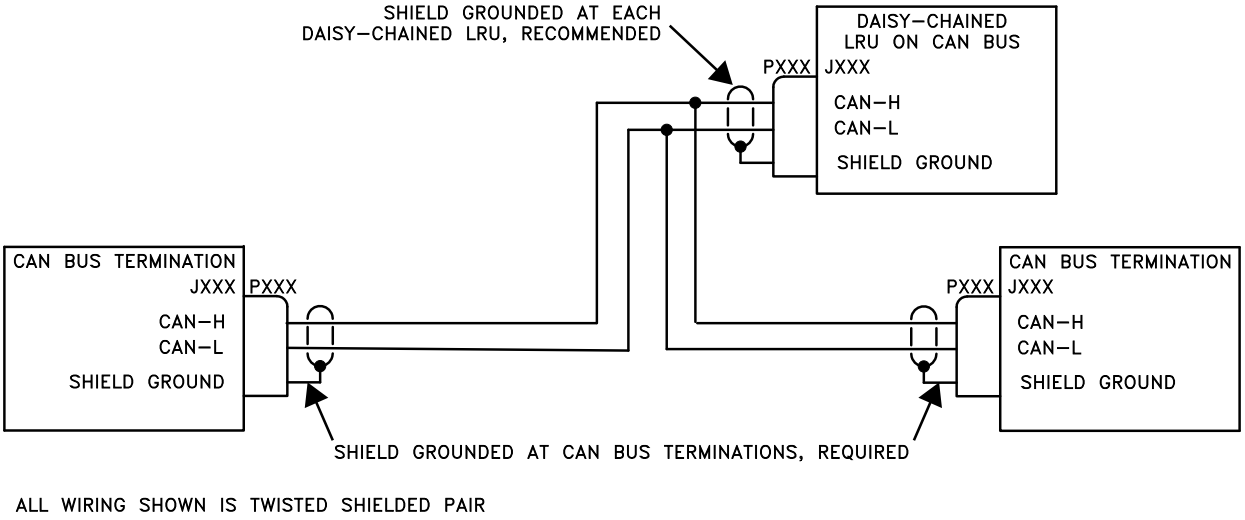


Figure 2-9 CAN Bus Shield Grounding

For proper CAN bus operation, it is important for all devices on the CAN bus to share a common power ground reference. Connect all LRU power ground pins to a single common ground point - do not use local ground points or use the aircraft structure as a ground return path.

For reliable operation, avoid introducing unnecessary connectors into the CAN bus wiring. If the addition of an in-line connector is unavoidable, use a high-reliability connector with locking features.

2.3.1.3.3 CAN Bus Termination

At each of the two extreme ends of the CAN bus backbone, a 120 Ω resistor is installed to terminate the bus. In the G3X system, separate resistors are not required. Instead, termination resistors are provided either within the LRUs themselves, or using termination adapters that plug into an LRU's CAN connection.

- The GAD 29, GEA 24, GMU 11, GPS 20A, GSU 25, and G5 installation kits provide a 9-pin termination adapter that provides termination when attached to the device's main connector. The termination adapter contains a 120 Ω resistor that is connected between pins 1 and 2 (Figure 2-10).
- The GDU 37X, GDU 4XX, GAD 27, GHA 15, and GSU 73 contain a 120 Ω resistor inside the unit that provides termination when the CAN LO pin is connected externally to the CAN TERM pin (Figure 2-11).
- The GMC 507, GSA 28, GTR 20/200, GTR 205X and GTR 205XR contain a 120 Ω resistor inside the unit that provides termination when the two CAN TERM pins are connected together (Figure 2-12 and Figure 2-13).
- The GI 260 and GMA 245 do not have provisions for CAN termination. The GI 260 cannot be installed at the end of the CAN bus. The total amount of extra wire length the GI 260 adds to the CAN HI and CAN LO wires should not exceed 0.4 meters (15 inches). The GMA 245 can use the 9 pin termination adapter (011-02887-00) for a termination solution, by installing the unit in-line rather than directly to the LRU connector. See GMA 245 Installation Manual for further information.

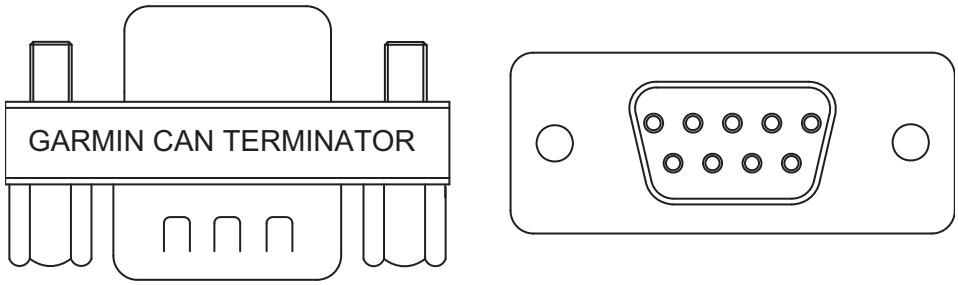


Figure 2-10 CAN Bus Termination (011-02887-00) for GAD 29, GEA 24, GMA 245, GMU 11, GPS 20A, GSU 25, and G5

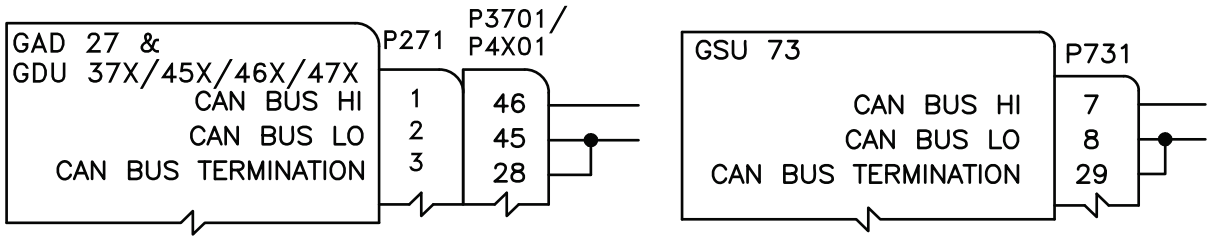


Figure 2-11 CAN Bus Termination for GAD 27, GDU 37X/4XX, GHA 15, and GSU 73

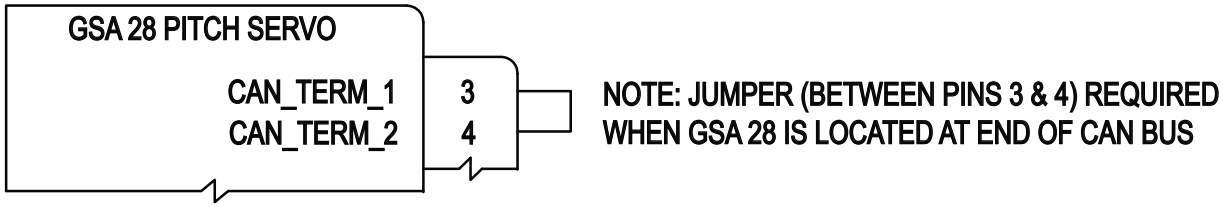


Figure 2-12 CAN Bus Termination for GSA 28

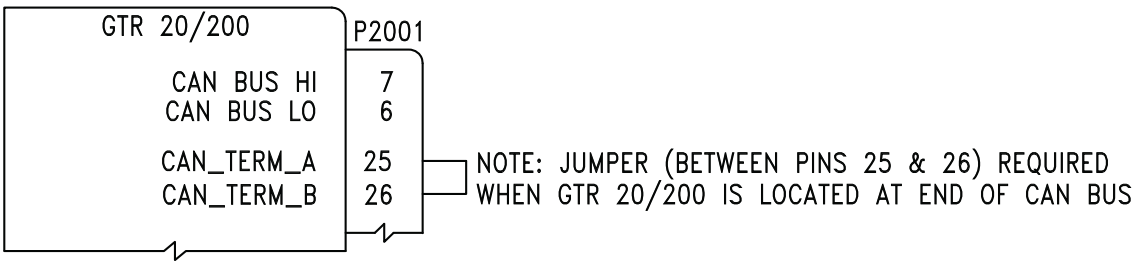
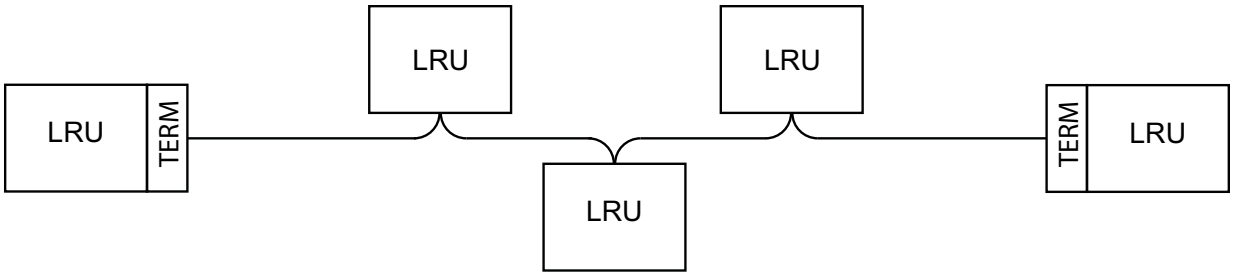


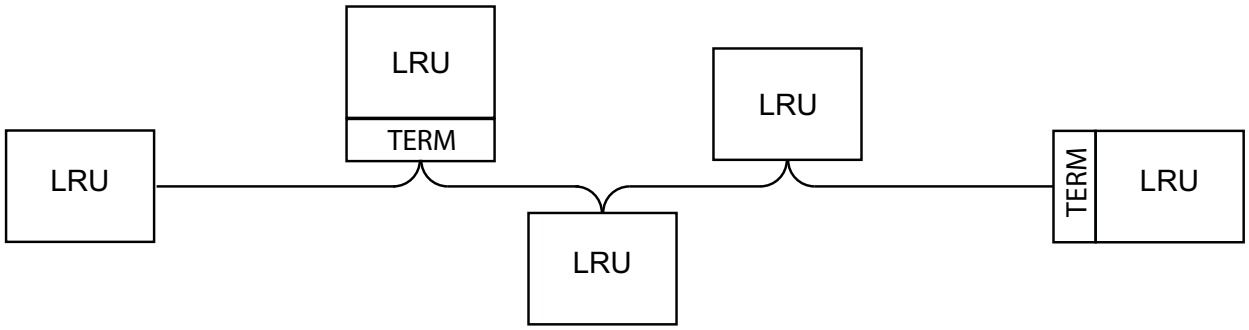
Figure 2-13 CAN Bus Termination for GTR 20/200

Both ends of the CAN bus should be terminated (Figure 2-14), but devices that are not at the ends of the CAN bus should not be terminated (Figure 2-15).

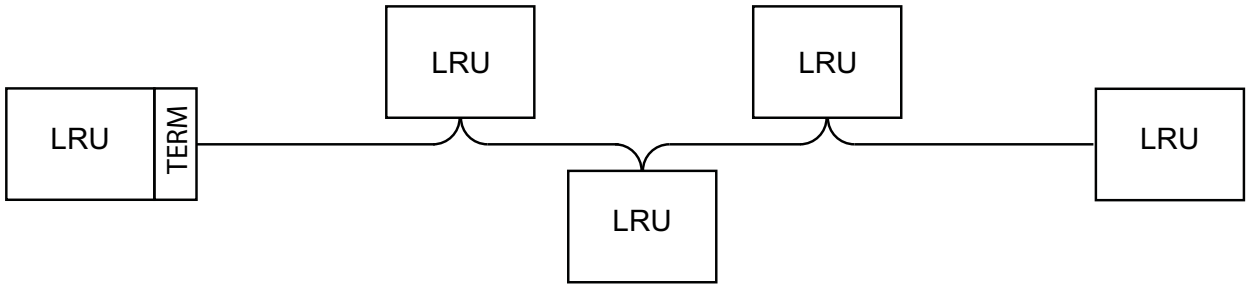


CORRECT - CAN BUS TERMINATED AT EACH END OF BACKBONE

Figure 2-14 Correct CAN Bus Termination Example



INCORRECT - ONE OF THE TERMINATIONS IS NOT AT END OF BACKBONE



INCORRECT - ONLY ONE END OF BACKBONE IS TERMINATED

Figure 2-15 Incorrect CAN Bus Termination Examples

2.3.1.3.4 CAN Bus LRU Removal Guidelines

The following should be considered when removing an LRU from the ends of G3X CAN network:

- GEA 24, GSU 25, GAD 29, GPS 20A, G5, or other devices that uses the 9-pin CAN termination adapter: The CAN bus will remain terminated as long as the CAN termination adapter is left connected.
- GDU 37X, GDU 4XX, GAD 27, GMC 507, or GSU 73: The CAN bus will be unusable until the LRU is reconnected, or the bus is properly terminated at both ends of the CAN backbone.
- GSA 28: A removal adapter (part number 011-03158-00) is provided with each GSA 28 connector kit. This adapter can be used when a GSA 28 is removed from the aircraft. The removal adapter keeps the node on the CAN bus in the same state as when the servo was installed (either terminated or un-terminated). The removal adapter also allows trim signals to pass through when no servo is installed.

2.3.1.3.5 CAN Bus Installation Guidelines

For maximum reliability of the CAN bus, the following guidelines should be followed:

- The CAN bus backbone must be a single linear path with exactly two distinct ends. CAN bus connections should be “daisy chained” from device to device. Avoid “star” and “Y” topologies, and do not use a hub device (see Figure 2-11).
- The overall length of the bus should not exceed 32 meters (104 feet).
- Avoid connecting more than one device to the CAN bus backbone at the same point. Instead, daisy chain the CAN bus backbone from one device to the next.
- Follow proper wiring, shielding, and grounding requirements described in section Section 2.3.1.3.2.
- Terminate the CAN bus at the two extreme ends of the bus, as described in Section 2.3.1.3.3.
- When adding a new device to the CAN bus, evaluate proposed modifications to the CAN bus wiring connections to maintain compliance with all above requirements.

2.3.1.3.6 CAN Bus Troubleshooting

CAN is very simple, and a properly installed CAN bus is normally very reliable. If problems are occurring, there is a good reason and the following steps can help to identify the issue.

1. Review the status LED of devices on the CAN bus such as the GSU25, GEA24, and GSA 28 servos (see Section 32.1.1). The status indications are listed in Table 2-3.

Table 2-3 Status LED Indications

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

2. Make sure the CAN bus is daisy-chained between CAN device around the system, and that CAN devices are not connected by a single point like a star or routed through a hub device. This can

cause unwanted signal reflections and “orphan” some devices on the bus and prevent their communication.

3. Make sure the CAN bus is terminated in only two locations, and only at the extreme ends of the CAN bus.
4. With power removed, remove a connector from one of the devices that is not located at either of the extreme ends of the CAN bus.

a) Using an ohm meter, verify the resistance between the CAN HI and CAN LO pins on the connector is 60 ohms. This will verify the CAN backbone is properly terminated at each end (two 120 ohm terminating resistors in parallel).

b) A resistance of 120 ohms indicates that one of the two required CAN terminations is missing.

c) A resistance of 40 ohms or less indicates that too many terminations are installed.

5. Verify the CAN HI and CAN LO signals are not swapped, shorted together, or open-circuited at any LRU connector.
6. Verify the CAN HI and CAN LO signals are not shorted to ground (this can happen when shielded wire is installed incorrectly).
7. Highlight each device on the configuration mode system information page (Section 31.4.3) and verify the value displayed for Network Error Rate is a steady 0% (Figure 2-16).

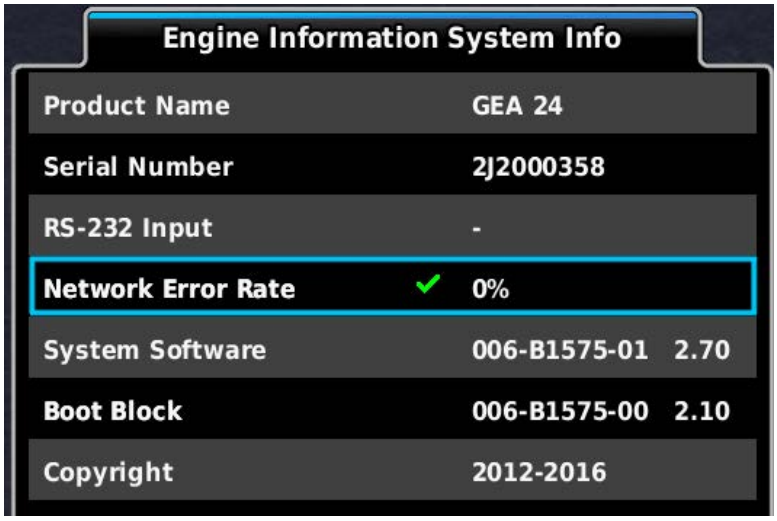


Figure 2-16 Network Error Rate (configuration mode)

8. Start only the PFD1 display and one other CAN device at a time, and verify the connection quality for each device. Sometimes a device will communicate with PFD1 only when it is the only powered device on the CAN bus, if one or more of the above issues is present. Evaluating each CAN device in turn can help narrow down a problem.
9. It is very important for each device on the CAN bus to share a common power/signal ground. Ground potential differences between devices on the CAN bus can cause communication errors. Ground devices to a common ground bus, not to the airframe or to multiple grounding buses.

2.4 Mechanical Considerations

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

2.4.1 Physical Specifications

Follow the panel requirements in Table 2-4. All width, height, and depth measurements are taken with unit rack (if applicable) and connectors. LRU dimensions are listed in each LRU section. Panel cutout templates are available for the GDU 37X, GDU 45X, GDU 46X, GDU 470, GMC 305, and GMC 307 in the respective LRU sections of this document. Cutout templates for the GDU 37X/4XX displays and the GMC 507 are also available in digital form (.DXF files) from the G3X manuals download page on www.garmin.com.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Weight of Unit and Connector(s)
GAD 27 (Flaps/ Lights/ Trim Controller)	3.78 inches [96.01 mm]	1.954 inches [49.63 mm] no connector 3.569 inches [90.65 mm] with connector	5.204 inches [132.18 mm] no connector 6.533 inches [165.93 mm] with connector	0.64 lbs (0.29 kg)	0.97 lbs (0.44 kg)
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	GAD 29 0.38 lbs (0.172 kg)	GAD 29 0.63 lbs (0.285 kg)
GAP 26 -00, -10 (Air Data Probe)	0.82 inches [20.9 mm]	16.0 inches [406.4 mm]	6.12 inches [157.7 mm]	-00 probe: 0.33 lbs (0.15 kg) -10 probe: 0.39 lbs (0.18 kg)	-00 probe with adjustable mounting kit: **0.53 lbs (0.20 kg) -010 probe with adjustable mounting kit: **0.59 lbs (0.22 kg)

*weight includes nut plate

**Previous versions of the mounting kit used a steel mount tube that is heavier by 0.14 lbs than the weights listed in this table. The steel mount tube has welded mounting tabs and a constant wall thickness. The currently used aluminum mount tube has machined mounting tabs and the wall thickness is greater at the upper end vs. the lower end. Add 0.14 lbs to listed weights when using the steel mounting tube.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Weight of Unit and Connector(s)
GAP 26 -20 (Air Data Probe and Heater Control Box)	Probe .82 inches [20.9 mm]	Probe 16.0 inches [406.4 mm]	6.12 inches [157.7 mm]	-20 probe: 0.39 lbs (0.18 kg)	**-20 probe with adjustable mounting kit: 0.59 lbs (0.22 kg)
	Control Box 2.25 inches [57.0 mm] (includes wiring grommet and screw heads, but not harness)	Control Box: 1.11 inches [28.2 mm]	Control Box: 4.55 inches [115.6 mm]	-20 control box 0.36 lbs (0.16 kg)	NA
GCO 14	1.2 inches (31 mm)	0.9 inches (22 mm)	1.5 inches (37 mm)	1.0 oz (28 g)	NA
GDL 39R	5.00 inches (127.0 mm)	1.63 inches (41.35 mm)	6.17 inches (156.7 mm)	17.7 oz (502 g)	19.5 oz (552 g)
GDL 51R	6.10 inches (154.9 mm)	1.60 inches (40.6 mm)	5.00 inches (127.0 mm)	0.78 lbs (0.35 kg)	0.904 lbs (0.41 kg)
GDL 52R				0.83 lbs (0.38 kg)	0.954 lbs (0.43 kg)
GDU 370 (Display)	6.04 inches (153.4 mm)	7.83 inches (198.8 mm)	3.41 inches (86.6 mm)	1.6 lbs (0.71 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 (0.77 kg)	1.9 lbs*, (0.862 kg)
GDU 450 (Display)	8.00 inches (203.0 mm)	5.93 inches (150.5 mm)	Depth behind panel including recommended backshell 3.68 inches (93.4 mm)	2.71 lbs (1.23 kg)	2.98 lbs*, (1.35 kg)
GDU 455 (Display)	8.00 inches (203.0 mm)	5.93 inches (150.5 mm)	Depth behind panel including recommended backshell 3.68 inches (93.4 mm)	2.84 lbs (1.29 kg)	3.11 lbs*, (1.41 kg)

*weight includes nut plate

**Previous versions of the mounting kit used a steel mount tube that is heavier by 0.14 lbs than the weights listed in this table. The steel mount tube has welded mounting tabs and a constant wall thickness. The currently used aluminum mount tube has machined mounting tabs and the wall thickness is greater at the upper end vs. the lower end. Add 0.14 lbs to listed weights when using the steel mounting tube.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Weight of Unit and Connector(s)
GDU 460 (Display)	10.85 inches (275.5 mm)	7.82 inches (198.6 mm)	3.57 inches (90.7 mm)	4.60 lbs (2.09 kg)	4.81 lbs*, (2.18 kg)
GDU 465 (Display)	10.85 inches (275.5 mm)	7.82 inches (198.6 mm)	3.57 inches (90.7 mm)	4.73 lbs (2.15 kg)	4.94 lbs*, (2.24 kg)
GDU 470 (Display)	6.01 inches (152.6 mm)	7.82 inches (198.6 mm)	Depth behind panel including recommended backshell 3.68 inches (93.4 mm)	2.66 lbs (1.21 kg)	2.93 lbs (1.33 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)
GHA 15	3.55 inches (90.2 mm)	4.35 inches (110.5 mm)	1.02 inches (25.9 mm) 2.47 inches (62.7 mm) w/connectors	0.5 lbs (0.23 kg)	0.65 lbs (0.29 kg)
GI 260 (AOA Indicator) Including Socket Mount	1.36 inches (34.6 mm)	3.19 inches (81.0 mm)	2.36 inches (60.0 mm)	0.27 lbs (0.122 kg)	NA
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)	0.60 lbs, (0.272 kg)
GMC 307 (Mode Controller)	6.25 inches (158.8 mm)	2.10 inches (53.3 mm)	3.43 inches (87.1 mm)	0.62 lbs (0.281 kg)	0.72 lbs, (0.327 kg)
GMC 507 (Mode Controller)	6.25 inches (158.8 mm)	2.10 inches (53.3 mm)	2.61 inches (66.3 mm)	0.68 lbs (0.308 kg)	0.78 lbs, (0.354 kg)
GMU 11 (Magneto meter)	2.74 inches (6.96 mm)	0.93 inches (2.36 mm)	3.78 inches (9.60 mm)	0.16 lbs (0.0725 kg)	0.302 lbs (0.1368 kg)

*weight includes nut plate

**Previous versions of the mounting kit used a steel mount tube that is heavier by 0.14 lbs than the weights listed in this table. The steel mount tube has welded mounting tabs and a constant wall thickness. The currently used aluminum mount tube has machined mounting tabs and the wall thickness is greater at the upper end vs. the lower end. Add 0.14 lbs to listed weights when using the steel mounting tube.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Weight of Unit and Connector(s)
GMU 22 (Magnetometer)	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)
GPS 20A	5.06 inches (128.5 mm)	1.76 inches (44.7 mm)	3.49 inches (88.65 mm)	0.56 lbs (0.254 kg)	0.67 lbs (0.304 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)	Refer to Table 17-5 for connector/ accy weights
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)	0.68 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)
GTP 59	-	-	-	0.3 lbs (0.136 kg)	-
GTR 20	6.15 inches (156.2 mm)	1.28 inches (32.4 mm)	8.80 inches (223.5 mm) 10.22 inches (259.5 mm) w/connectors	1.23 lbs (0.560 kg)	1.34 lbs, (0.608 kg)
GTR 205XR	6.25 inches (158.7 mm)	1.35 inches (34.3 mm)	10.64 inches (270.2 mm)	2.0 lbs (0.9 kg)	2.6 lbs (1.2 kg)
GTX 23ES	Modular Rack 1.72 inches (44 mm)	Modular Rack 6.30 inches (160 mm)	11.05 inches (281 mm) Including Connectors (measured from front face of unit to rear of connector backshells)	3.1 lbs (1.41 kg)	Modular Rack, Unit , and Connectors 3.9 lbs (1.77 kg)
	Remote Rack 1.78 inches (45 mm)	Remote Rack 6.92 inches (176 mm)			Remote Rack, Unit , and Connectors 4.4 lbs (2.00 kg)

*weight includes nut plate

**Previous versions of the mounting kit used a steel mount tube that is heavier by 0.14 lbs than the weights listed in this table. The steel mount tube has welded mounting tabs and a constant wall thickness. The currently used aluminum mount tube has machined mounting tabs and the wall thickness is greater at the upper end vs. the lower end. Add 0.14 lbs to listed weights when using the steel mounting tube.

Table 2-4 G3X LRU Physical Specifications

LRU	Width	Height	Depth	Unit Weight	Weight of Unit and Connector(s)
GTX 35R	6.3 inches (160 mm)	1.7 inches (43 mm)	9.9 inches (252 mm) (unit, mount, and connector backshells)	1.7 lbs (0.77 kg)	Unit, Standard Mouting Tray, Backplate, and Connectors 2.5 lbs (1.13 kg)
GTX 45R	6.3 inches (160 mm)	1.7 inches (43 mm)	9.9 inches (252 mm) (unit, mount, and connector backshells)	2.0 lbs (0.91 kg)	Unit, Standard Mouting Tray, Backplate, and Connectors 2.9 lbs (1.32 kg)

*weight includes nut plate

**Previous versions of the mounting kit used a steel mount tube that is heavier by 0.14 lbs than the weights listed in this table. The steel mount tube has welded mounting tabs and a constant wall thickness. The currently used aluminum mount tube has machined mounting tabs and the wall thickness is greater at the upper end vs. the lower end. Add 0.14 lbs to listed weights when using the steel mounting tube.

2.4.2 Cooling Requirements

While no forced cooling air is required for the G3X system, it is highly recommended the air behind the panel be kept moving (by ventilation or a fan). Units tightly packed in the avionics stack heat each other through radiation, convection, and sometimes by direct conduction. Even a single unit operates at a much higher temperature in still air than in moving air. Fans or some other means of moving the air around electronic equipment are usually a worthwhile investment.

No cooling air is required for most G3X LRUs, with the following exceptions:

- 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 Appendix F.
- No cooling air is required for the GTR 20/200, however, as with all electronic equipment, lower operating temperatures extends equipment life. Reducing the operating temperature by 15° to 20°C (27° to 36°F) reduces the mean time between failures (MTBF).

NOTE

Avoid installing the G3X LRUs near heat sources. If this is not possible, make sure 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.

2.4.3 Compass Safe Distance

After reconfiguring the avionics in the cockpit panel, if the unit is mounted less than 12 inches from the compass, recalibrate the compass and make the necessary changes for noting correction data.

2.5 LRU/Sensor Installation Information

Each LRU/sensor has unique considerations the installer should be familiar with before beginning the physical installation. Become familiar with all installation information by studying sections 3-18 of this document before actually beginning the installation of the LRUs/sensors.

2.5.1 External Navigator Connection/Configuration

External Navigators are connected LRUs that can be used for GPS navigation, as well as providing a backup source of position data in the event that all other sources of GPS data are unavailable. For installations without a GPS 20A, 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 4XX/5XX, GNS 480, or GTN 6XX/7XX series unit, see Section 25.2 or Appendix G.2) if installed/configured (accuracy will be degraded when using an external GPS navigator).

The G3X automatically assigns the hierarchy of any connected external navigation devices. The first device found (by software) with GPS capability becomes the #1 external navigator. If two equal devices are found (as in dual GTN/GNS installations), the RS-232 serial port number of the GDU 4XX/37X determines the hierarchy. 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 in the MFD. In the case of an SL 30 or GNC 255 being added to a system with a GTN, the SL 30 or GNC 255 gets assigned as the #2 external navigator. The hierarchy applies to the entire navigation radio even if only the GPS source is in use. So, in a system with a GTN 625 and a GNC 255, GPS1 and NAV2 (respectively) would be available as external navigation sources.

3 GAD 27 (FLAPS/LIGHTS/TRIM CONTROLLER) INSTALLATION

This section contains general information as well as installation information for the GAD 27. Use this section to mount the GAD 27 unit.

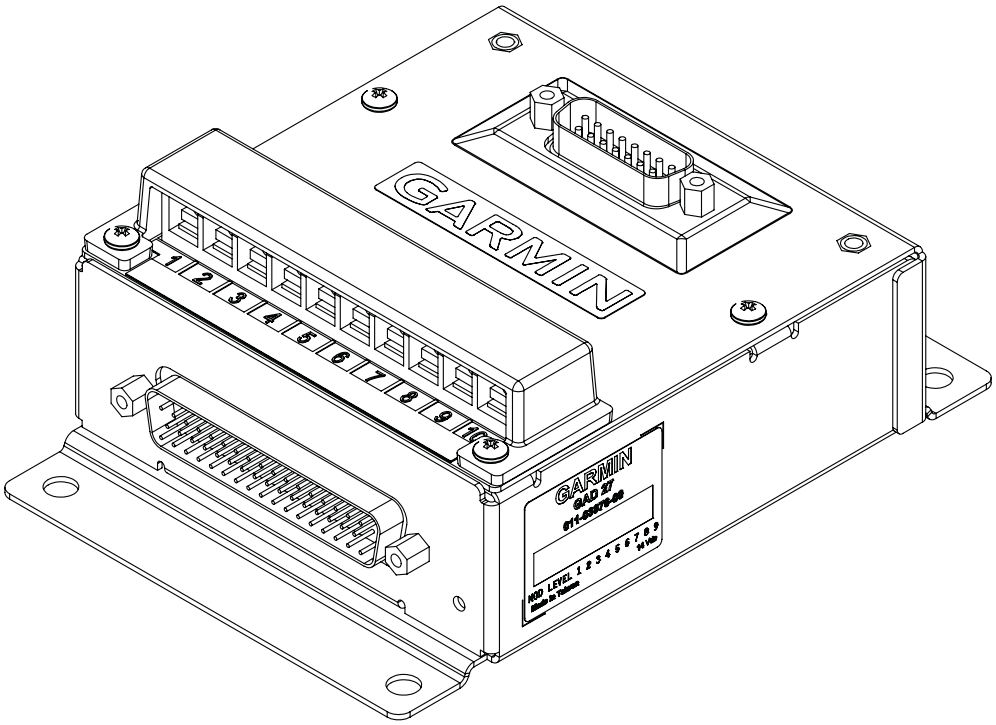


Figure 3-1 GAD 27 Unit View

3.1 Equipment Description

The GAD 27 is a small, compact, all solid state (no relays) integrated controller that provides a solution to many of the typical airframe interfacing needs of G3X™ avionics equipped aircraft. Configuration of the GAD 27 is conveniently handled through the PFD without requiring the use of a laptop or other external device. The following is a summary of the functionality provided by the GAD 27.

CAUTION

The GAD 27 is not intended for 28V installations.

Flap Controller

The Flap Controller interfaces directly to the flap motor and uses flap position measured by the GEA™ 24 engine interface module from an external position sensor to support up to 8 pre-programmed flap settings. The GAD 27 can automatically move the flaps between pre-programmed positions in response to a momentary press of the flap control switch by the pilot. Each momentary press of the flap switch causes the flaps to move by one step in the specified direction, stopping at the next pre-programmed position.

For example, Up, Middle, and Down pre-programmed flap positions can be defined. By "bumping" the momentary flap switch downward, the GAD 27 will automatically move the flaps from the Up position to the Middle position in the downwind. Similarly, after turning final, the pilot can bump the switch downward again and the GAD 27 will automatically extend the flaps to the full down position. Since the GAD 27 receives airspeed from the G3X Touch™ avionics, it can also prevent flap extension when the

airspeed is above user-defined limits.

Optional flap limit switches can also be used with the GAD 27, which will cause the flap motor to stop upon reaching the extreme ends of its travel.

If the flap switch is held longer than 1 second, the flaps will run in the specified direction until the flap switch is released or the flap limit switch is triggered. This method of manually moving the flaps is not affected by user-defined airspeed limits. This behavior can also be used in conjunction with a non-momentary switch in order to fully retract the flaps with a single pilot action. Note that if any of the pre-programmed flap positions are negative (i.e. "reflexed") the flaps will still stop at the pre-programmed "zero" position during manual flap retraction.

Aircraft Trim

Aircraft Trim provides trim mixing of pilot and copilot trim switches to provide a combined single interface to the trim motors or autopilot servos. Switches used on pilot/copilot control sticks do not supply trim motor power or control relays (just provide ground to discrete inputs) which improves switch reliability. No external relays are needed, the stick switches can be wired directly to the GAD 27.

Discrete Inputs

Provides 9 additional user configurable discrete inputs (in addition to the 4 provided by the GEA 24).

Lighting Bus Outputs

One to three external panel mounted potentiometers (dimmer controls) can be mapped to any of the six lighting bus outputs with configurable lighting curves to meet all the typical lighting bus needs of the aircraft.

There are two types of lighting bus outputs:

- A voltage output which can be used as a reference voltage. This input cannot source current to drive lights.
- A PWM designed to dim LED or incandescent bulbs.

Light Control with Flashing

Controls up to two external lights using simple low power switches to ground discrete inputs. An alternating flash (wig-wag) function can either be switch activated or automatically turned on/off based on a user-selected airspeed.

Voltage Stabilizer

Provides a 12V power bus output to keep essential avionics online during engine start when battery voltage drops.

3.1.1 Status LED

The GAD 27 has an LED on its outer case that indicates its current status. See Section 32.1.1 for details.

3.2 Equipment Available

3.2.1 Required Equipment

Table 3-1 GAD 27 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GAD 27	010-01525-10*	011-03876-10*

*Part numbers 011-03876-00 and 011-03876-10 are functionally equivalent

3.2.2 Additional Equipment Required

The connector kit in Table 3-2 is required to install the unit, and is not provided with the GAD 27 unit.

Table 3-2 Contents of GAD 27 Connector Kit (011-03877-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 15/26 Pin	011-01855-01	1
Backshell w/Hdw, Jackscrew, 50/78 Pin	011-01855-04	1
Terminal Block Label Flags	161-04025-00	1
Ring Terminal, Insulated, 14-16 AWG, #6	235-00094-00	12
D-Sub Connector Receptacle, Crimp Socket, 15 pin	330-00625-50	1
D-Sub Connector Receptacle, Crimp Socket, 50 pin	330-00625-50	1
Military Crimp Socket Contact, Size 20, 20-24 AWG	336-00022-02	70

3.3 General Specifications

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

3.4 Mounting Requirements

The GAD 27 is remotely mounted and is secured to the airframe using four screws supplied by the installer. Refer to Section 3.6 for outline and installation drawings.

3.5 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GAD 27. Refer to Section 2.3 for wiring considerations, and to Section 24.1 for pinouts.

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 backshell connectors.
4. Screw down ring terminals to terminal block. The screws in the terminal block should be removed, the ring terminal inserted, and then the screw replaced.

3.6 Outline and Installation Drawings

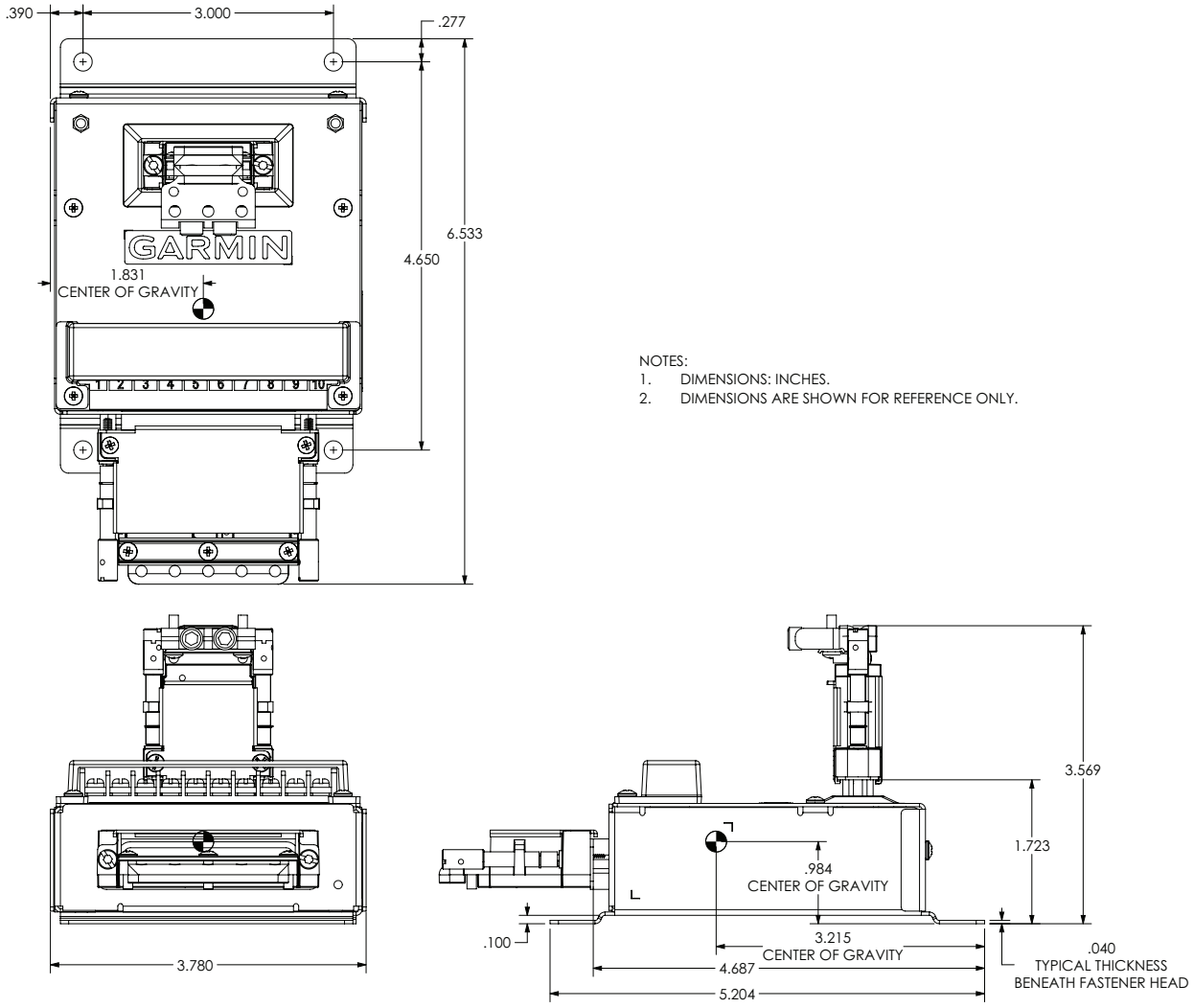


Figure 3-2 GAD 27 Outline Drawing

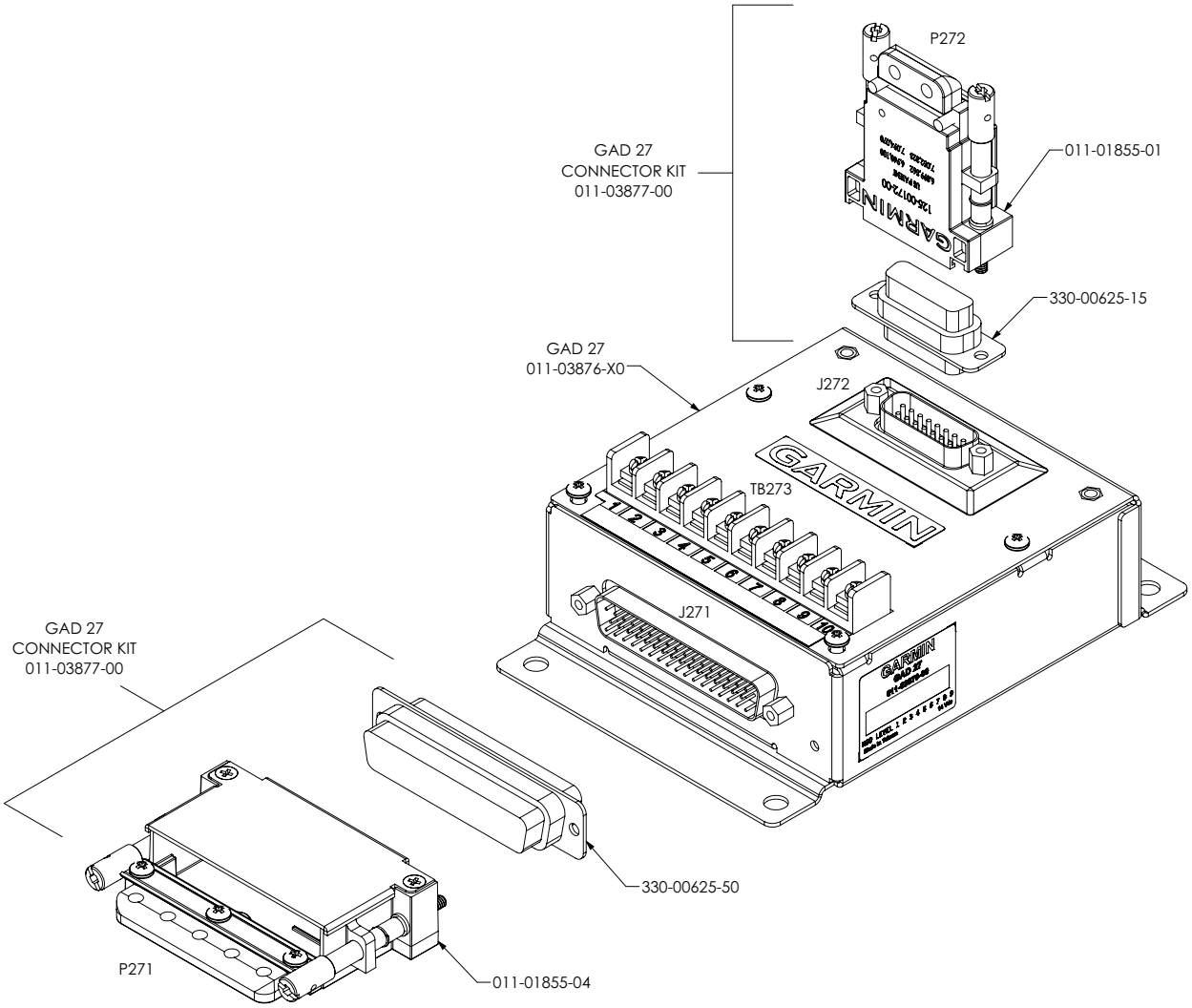


Figure 3-3 GAD 27 Installation Drawing

4 GAD 29/29B/29C/29D (ARINC 429 ADAPTER) INSTALLATION

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.

NOTE

All information for the GAD 29 is applicable to the GAD 29B/29C/29D unless explicitly noted.

NOTE

The GAD 29 was a prior version of the GAD 29C, all form, fit, and functions are identical for the two models.

NOTE

The GAD 29B was a prior version of the GAD 29D, all form, fit, and functions are identical for the two models.

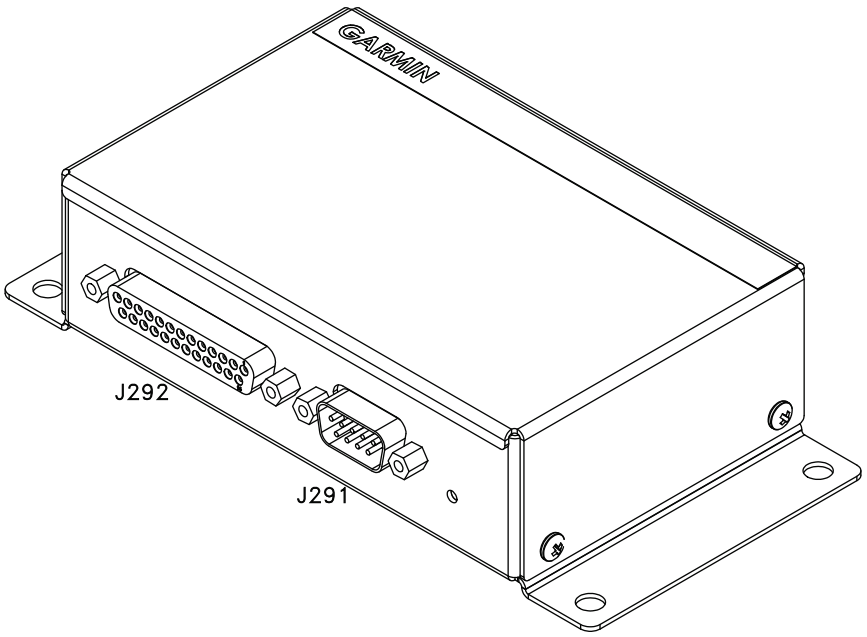


Figure 4-1 GAD 29 Unit View

4.1 Equipment Description

The GAD 29 allows the G3X™ avionics to interface to IFR navigators such as the GNC® radio, GNS™ receiver, GNX™ IFR navigator, GPS and GTN™ touchscreen avionics. 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
- *Analog Outputs
- *Excitation Pass Through

*GAD29B only

4.1.1 Status LED

The GAD 29 has an LED on its outer case that indicates its current status. See Section 32.1.1 for details.

4.2 Equipment Available

4.2.1 Required Equipment

Table 4-1 GAD 29 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GAD 29	010-01172-00	011-03236-00
GAD 29B	010-01172-10	011-03236-10
GAD 29C	010-01172-20	011-03236-20
GAD 29D	010-01172-21	011-03236-21

4.2.2 Additional Equipment Required

The connector kit in Table 4-2 is required to install the unit, it is not provided with the GAD 29 unit.

Table 4-2 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

4.3 General Specifications

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

4.4 Mounting Requirements

The GAD 29 will mount remotely. The GAD 29 will be secured to the airframe using four screws supplied by the installer. Refer to Section 4.6 for outline and installation drawings.

4.5 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GAD 29. Refer to Section 2.3 for wiring considerations, and to Section 24.2 for pinouts.

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 2.3.1.3.3).
4. Connect backshell connectors.

4.6 Outline and Installation Drawings

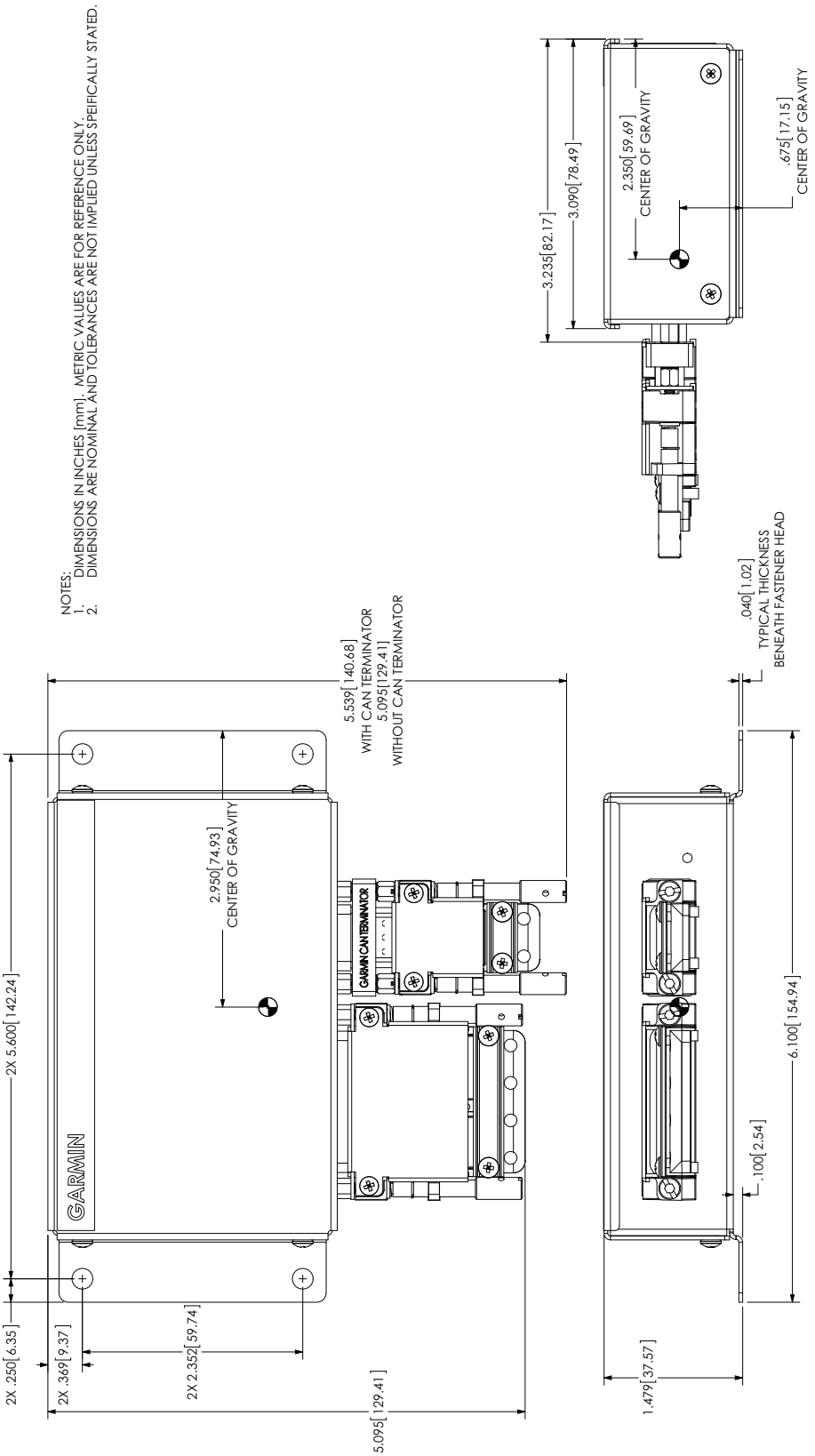


Figure 4-2 GAD 29 Outline Drawing

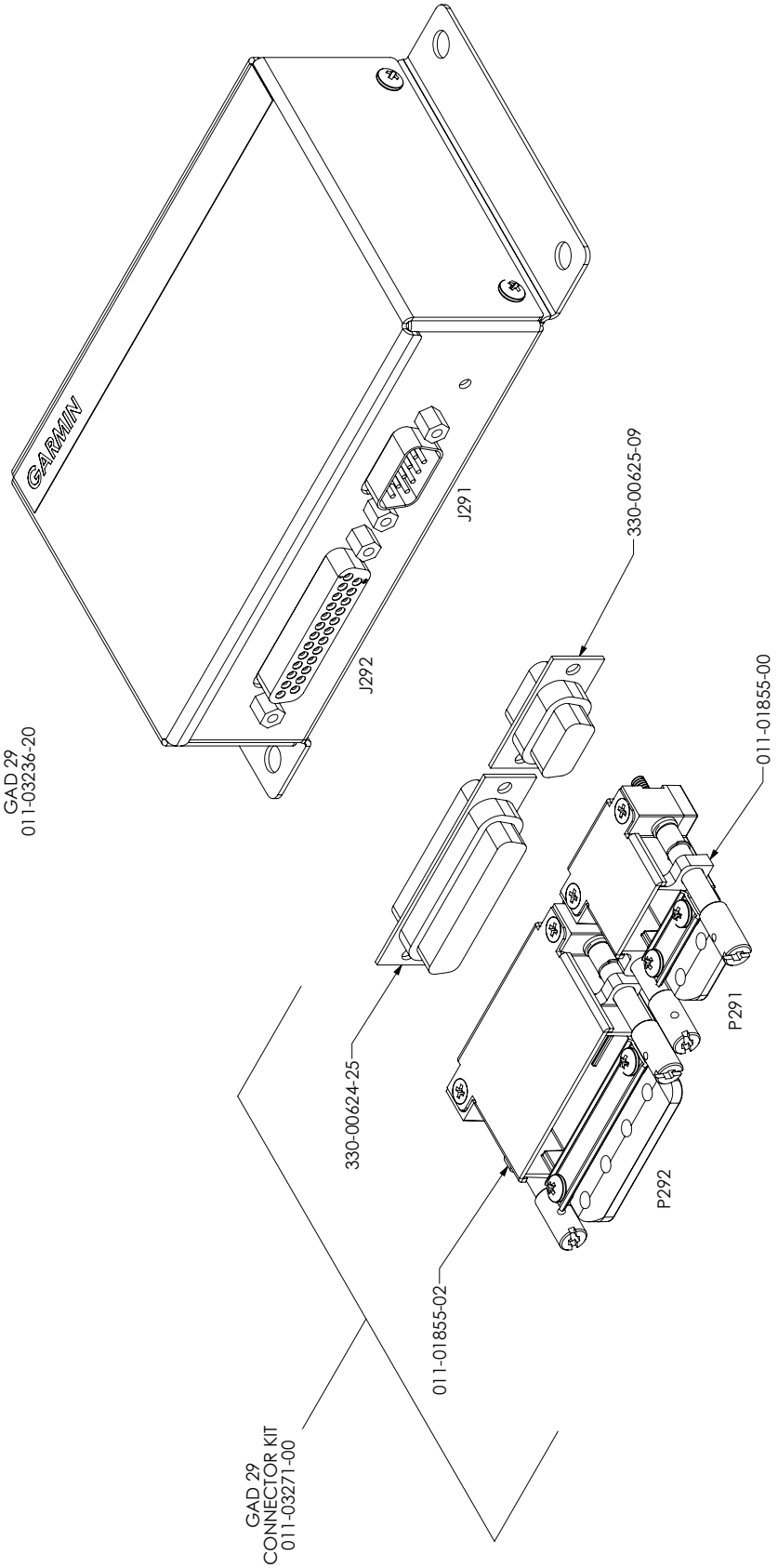


Figure 4-3 GAD 29 Installation Drawing (no CAN terminator)

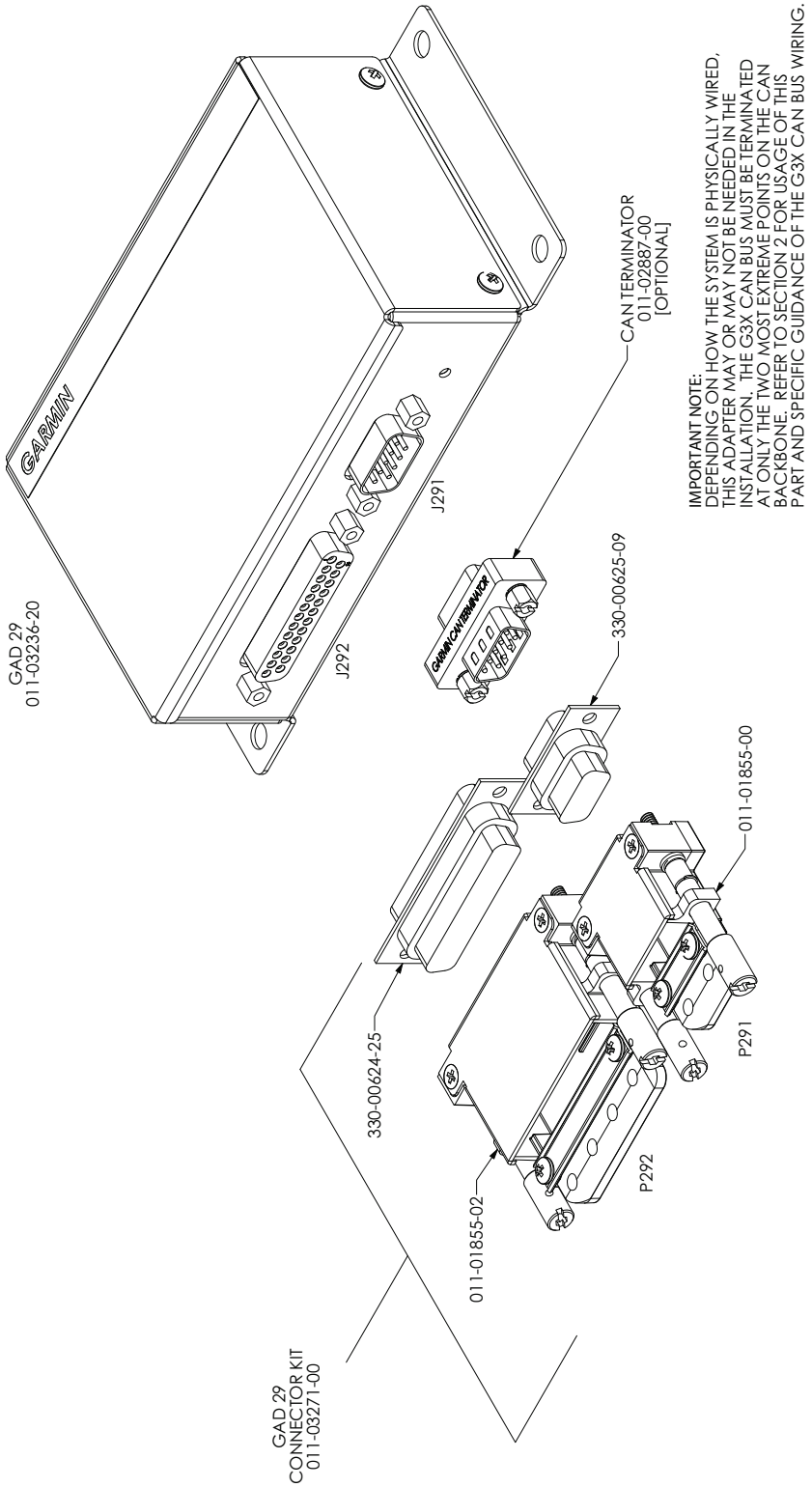


Figure 4-4 GAD 29 Installation Drawing (with CAN terminator)

5 GAP 26 (PITOT/AOA PROBE) INSTALLATION

This section contains information for the GAP 26 Pitot/AOA (Angle of Attack) probe. Use this section to install the GAP 26.

5.1 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™ avionics 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 three different versions of the GAP 26, the -00 (unheated), the -10 (heated, for ice protection), and the -20 (heated, with ice protection and regulated temperature limit). 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. The -20 version of the GAP 26 includes a heater control box, that is mounted separately from the probe (Section 5.5.3).

5.1.1 Moisture Protections

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

5.1.2 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. In addition to the same level of ice protection (as the -10 probe), the heated/regulated version of the GAP 26 (010-01074-20) limits the maximum tip temperature to make the probe safer if powered on the ground and to provide a discrete output that indicates when the heater is powered and providing sufficient heat.

NOTE

The pneumatic tubing for pitot pressure is the longer of the two tubes extending out of the probe (Figure 5-1).



Figure 5-1 GAP 26 Unit View (-10 version shown)

5.2 Equipment Available

Table 5-1 GAP 26 Part Numbers

Model	Assembly Part Number	Unit Only Part Number	Heater Control Box Part Number
GAP 26 Adjustable Mount	010-01380-00	011-03609-00	N/A
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
GAP 26 Probe Only, Heated, Regulated	010-01074-20	011-02964-20	011-02965-00

5.2.1 Required Equipment

- GAP 26 Pitot/AOA Probe (010-01074-00, 010-01074-10, or 010-01074-20)
- Electrical and pneumatic connectors per installer preference. For heated probe installations where the installer desires to shorten the provided aluminum tubing, a minimum of 8 inches of aluminum tubing should remain between the probe and any transition to non-metallic tubing to protect the non-metallic tubing from excessive heat.
- Mount: Standard AN5812 pitot tube mount.
- #6-32 screws (4 pcs), required length (.218” min - .312” max), recommend screws with nylon patch on threads for thread locking for mounting probe.
- #4 or #6 (4 pcs) pan or hex head screws for mounting heater control box.

5.2.2 Additional Equipment

The connector kit in Table 5-2 can be used to install the unit, it is not provided with the GAP 26 unit.

Table 5-2 Contents of GAP 26 Adjustable Mounting Kit (011-03609-00)

Item	Garmin P/N	Quantity
GAP 26 Adjustable Mount, Washer Plate	115-02075-00	1
GAP 26 Adjustable Mount, Tube Bracket	117-00659-00	1
GAP 26 AN5812 Mount Tube, Aluminum	117-02013-00	1

5.3 General Specifications

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

5.4 Mounting Requirements

- The GAP 26 pitot/AOA probe is intended to be installed in the same location as an existing non-structural inspection panel on the aircraft wing. A replacement mounting plate that meets the minimum requirements listed in this section may be fabricated to replace the existing inspection panel or the existing inspection panel may be used with an added doubler plate (if needed) to meet the minimum strength requirements listed below. If it is desired to use a structural panel to mount the GAP 26, or to create a new mounting location by making a hole in the aircraft skin, a structural analysis will be required to evaluate the affects of the installation on existing structure and the installation will no longer be considered a minor alteration.
- The minimum thickness of the replacement mounting plate or inspection panel shall be .063". If the existing inspection panel is to be used, and it does not meet this minimum thickness requirement, then a doubler plate shall be added between the inspection panel and the GAP 26 adjustable mount so the combined thickness meets or exceeds the minimum thickness requirement.
- A sheet metal template for the cutout and mounting holes has been included. Using this template will provide required clearance to make the five degree adjustment after installation if needed. To make the five degree pitch down adjustment, remove the leading edge mounting bolt where the AN5812 Mast connects to the mounting bracket (see Figure 5-2). Loosen the aft side mounting bolt and turn the mast downward until the leading edge mounting hole aligns with the offset hole provided on the mounting bracket. Install the leading edge mounting bolt with the mast in this position and tighten the aft side bolt.
- If a doubler plate is required for the installation, refer to AC 43.13-1B, Chapter 4 for appropriate fabrication and riveting methods. The doubler plate perimeter should be no further than 1.5" from the centerline of the inspection panel mounting screws (see Figure 5-3).
- The maximum hole spacing for the mounting plate screws shall be 2-3". If the existing inspection panel hole spacing is greater, a nut plate and screws (to match existing) shall be added to accommodate this maximum spacing requirement.
- Screws of appropriate length for the specific installation shall be used to fasten the GAP 26 adjustable mount to the inspection panel (or combination panel and doubler). Required screw size is #8-32. Screws shall meet MS24693 or equivalent. Locking nuts shall meet MS21044 or equivalent. Washers shall meet NAS 1149 or equivalent.
- The GAP 26 is intended to be mounted in the supplied adjustable mount. If other mounting methods are to be used the installer must follow installation guidance in AC 43.13-2B Chapters 1 and 3. In addition, the installer must show the installation is adequate for expected loading and does not affect the surrounding structure of the aircraft.

- The GAP 26 probe and mount shall be installed as shown following:

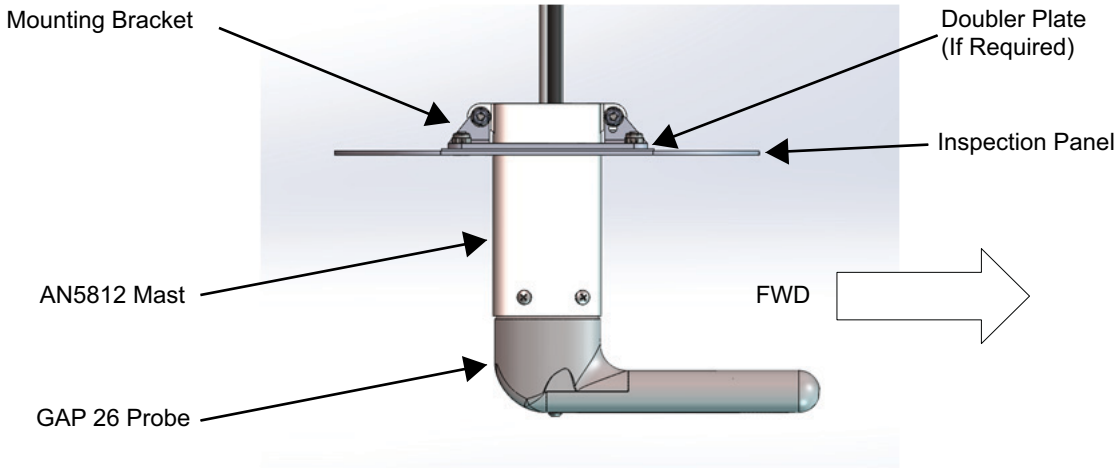


Figure 5-2. GAP 26 Probe and Mount (Side View)

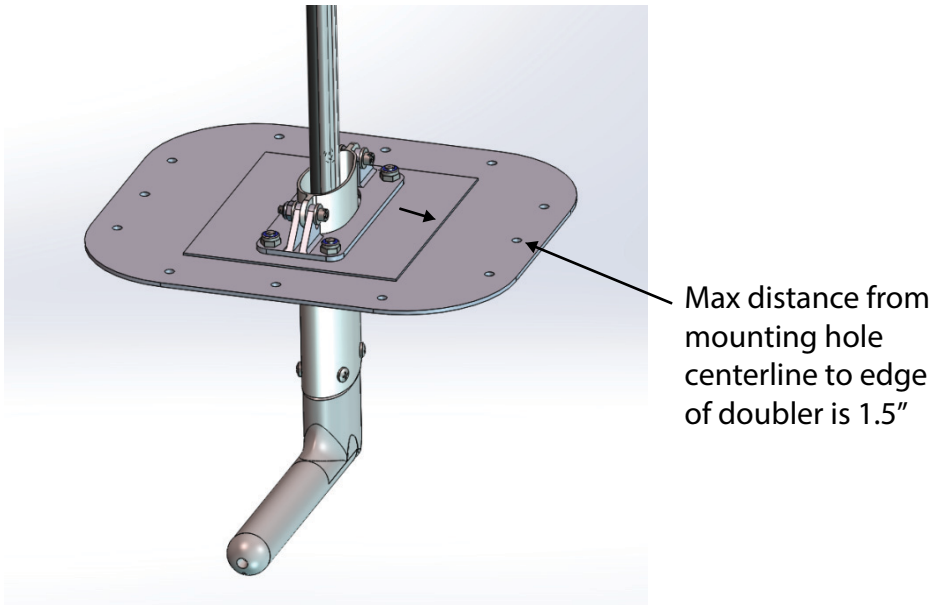


Figure 5-3. GAP 26 Shown with Inspection Panel and Doubler Plate

5.5 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 and -20 units only).

5.5.1 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 probe tip may protrude up to 2” max in front of the leading edge of the wing.
- Viewed from the side, the GAP 26 probe bayonet centerline should be mounted within ±5° from parallel to the wing chord line.
- Viewed from the top, the GAP 26 bayonet centerline should be mounted within ±5° from parallel with the aircraft centerline.
- Consider using the aircraft designer/manufacturer’s recommended mounting location (if specified). For all Van’s RV aircraft with wing-mounted pitot tubes, the GAP 26 probe is known to function correctly when mounted in the location specified in the plans. For other aircraft, optimal AOA functionality results when the tip of the GAP 26 probe is located no further back than approximately 25% of the wing chord length from the leading edge. (See Figure 5-4)
- 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 the GAP 26 not be used on aircraft where the ship static pressure port is located under the wing (due to the likelihood the AOA measurement will be significantly impacted). If the static port is located under the wing, it is recommended 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 15.4 for further magnetometer installation considerations.

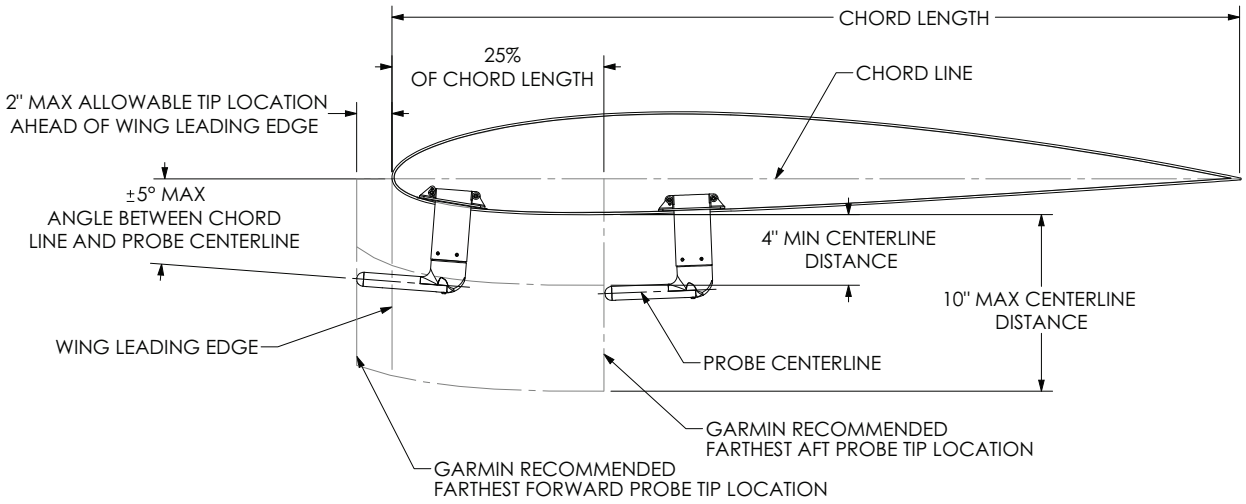


Figure 5-4 GAP 26, Mounting Location Guidance

5.5.2 Heater Wiring Configuration

The GAP 26 uses two internal heaters that may be powered by 14 or 28 volt systems. Each of the heaters has two wires, one of these two wires is “banded” (Figure 5-5) to help identify individual heaters. These heaters can be connected to a power source as shown in Figure 5-6 and Figure 5-7.

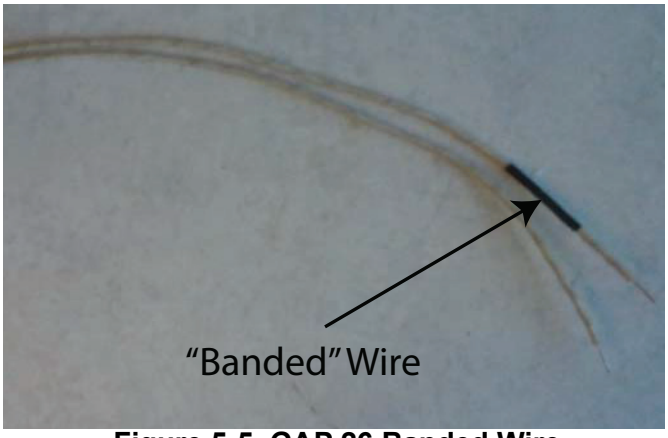


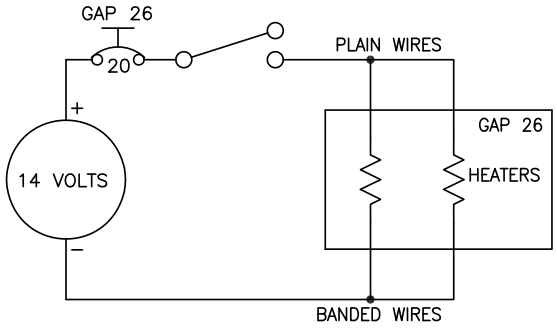
Figure 5-5 GAP 26 Banded Wire

CAUTION

Do not use the heated/regulated version of the GAP 26 (010-01074-20) in 28V installations. The heated/non-regulated version of the GAP 26 (010-01074-10) may be used in either 14V or 28V installations when connected as per Figure 5-6 or Figure 5-7.

CAUTION

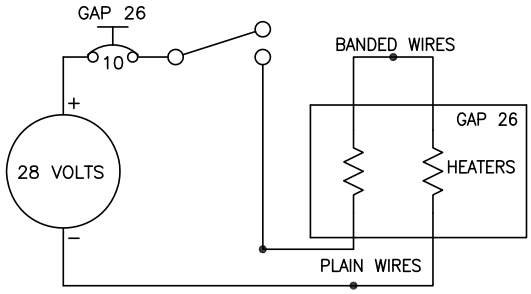
Do not connect the heaters in parallel to 28V. See Figure 5-7 for use on 28V aircraft. The heaters will be damaged if connected incorrectly to 28V.



NOTES FOR 14V INSTALLATION

1. AIRCRAFT POWER WIRING TO PROBE SHOULD BE MINIMUM 14 AWG UP TO 12 FT, 12 AWG FROM 13 TO 20 FT, AND 10 AWG FROM 21 TO 30 FT. (AC 43.13-1B)

Figure 5-6 GAP 26, 14V Installation Configuration (010-01074-10 only)



NOTES FOR 28V INSTALLATION

1. CAUTION: 28V INSTALLATIONS MUST FOLLOW THIS GUIDANCE AND CONNECT HEATERS IN SERIES AS SHOWN OR PROBE WILL BE DAMAGED.

2. AIRCRAFT POWER WIRING TO PROBE SHOULD BE MINIMUM 18 AWG UP TO 12 FT, 16 AWG FROM 13 TO 20 FT, AND 14 AWG FROM 21 TO 30 FT. (AC 43.13-1B)

3. CONNECT BANDED WIRES WITH INSULATED MS25181 22-18 AWG BUTT SPLICE CONNECTOR OR EQUIVALENT. BANDED WIRES MAY BE SHORTENED IF DESIRED.

Figure 5-7 GAP 26, 28V Installation Configuration (010-01074-10 only)

5.5.3 Control Box Installation (-20 version only)

Mount the control box (Figure 5-11) to a suitable mounting location within two feet of the GAP 26 using (4) #4 or #6 pan or hex head screws (choose screw length that is appropriate to mounting location).

Connect the white connector from the probe to the white connector from the control box (this allows the control box to sense probe temperature). Connect the red connectors from the probe to the red connectors from the control box, (Figure 5-9) this provides power and ground to the heaters. The red wires with red connectors from the control box connect to the plain wires with red connectors from the heater and the black wires with red connectors from the control box connect to the banded wires with red connectors from the heater (Figure 5-8, Figure 5-9). The bare red and black heater wires from the control box should be connected to 14 VDC as shown in Figure 5-8. The bare blue wire from the control box can be run to a spare discrete input (Section 5.5.4).

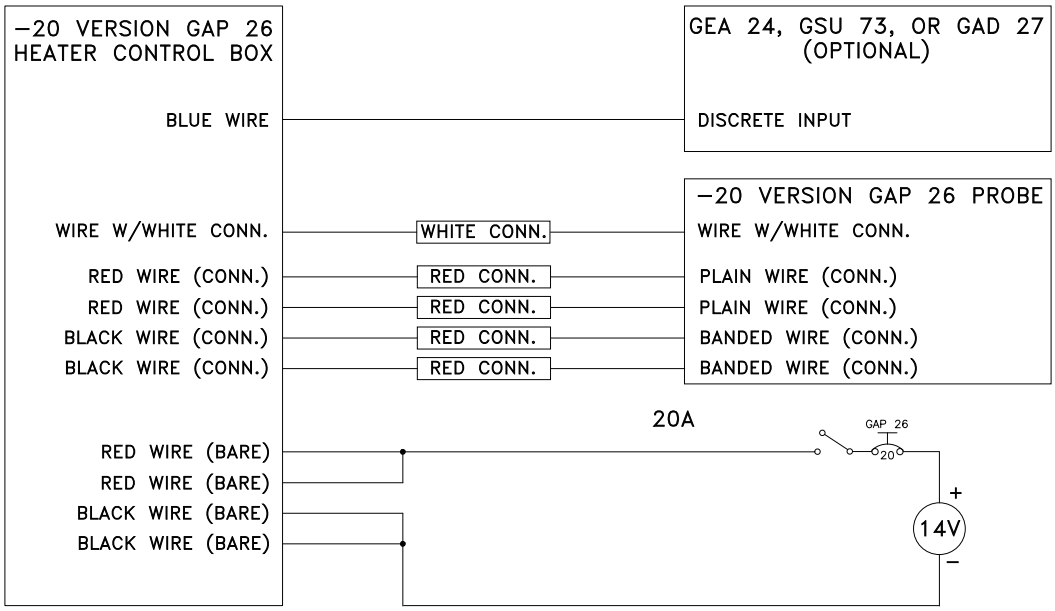


Figure 5-8 011-02964-20 Probe Wiring

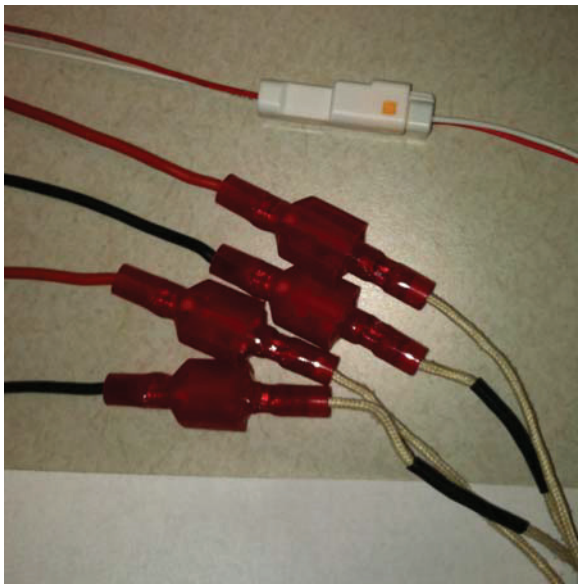


Figure 5-9 011-02964-20 Probe to Control Box Connectors

5.5.4 Discrete Output Specification (-20 version only)

The discrete output (bare blue wire) from the control box (011-02965-00) can be connected to any available discrete input. The discrete output is floating (open-circuit) when the probe is powered off, or when powered on and below 25° C. When the probe is above 25° C and powered on, the discrete output will be shorted to ground. See GAP 26 Alert Configuration (-20 version only) (for GDU™ 37X display versions) or GAP 26 Alert Configuration (-20 version of GAP 26 only) (for GDU 4XX versions) for discrete input alert configuration.

5.5.5 System Leak Considerations

The AOA pitot system leak test is not a regulatory requirement. If the system experiences inconsistent performance or an inability to calibrate the AOA System, leak testing may be performed to provide assurance that any leakage is within an acceptable range.

If a pitot/static tester is used to perform this test, the recommended airspeed input applied to the probe pressure ports is 150 knots. The leak rate should be less than 5 knots/min with the probe removed from the aircraft. If the leak rate is less than 5 knots/min with the probe removed, attach the probe and perform the test with the GAP 26 in line (make sure drain holes are fully sealed).

The guidance for pitot system tests listed in AC 43.13-1B, Section 4 are not directly applicable to this AOA pitot system. However, using it as a reference, it specifies the system shall be tested per the manufacturer's instructions but further states that if the manufacturer does not provide instructions, the default test is to apply 150 knots pressure to the system and measure the pressure loss over one minute. This loss is not to exceed 10 knots/min. While some GAP 26 probes will pass a test of this type, some may not. Garmin has determined that a leak rate of 250 knots/min or less is allowable and still provides proper functionality.

NOTE

Both pressure chambers on the GAP 26 probe have drain holes that when open during normal operation would constitute a "designed-in" leak that is several times higher than 250 knots/min but does not add significant error.

CAUTION

When the GSU 25 is used in conjunction with the GAP 26 pitot/AOA probe to perform Part 43 Appendix E altimeter tests, the probe adapter from the pitot-static tester must completely cover the pitot and AOA ports and drain holes on the GAP 26 to avoid over-pressuring (and causing damage to) the internal AOA sensor of the GSU 25. If the GAP 26 is installed but AOA is unused (i.e., the AOA port of the GAP 26 is not connected to the AOA port of the GSU 25) then the GAP 26 AOA port must be connected to the same pressure port as the pitot port during pitot-static testing.

**Note: If the AOA is unused and connected to the static port (as described in the preceding Caution statement) it can remain connected to the static port for the pitot-static test.*

After the leak test is completed, make sure that all pressure ports and drain holes on the GAP 26 are open and clear of debris.

5.6 Outline and Installation Drawings

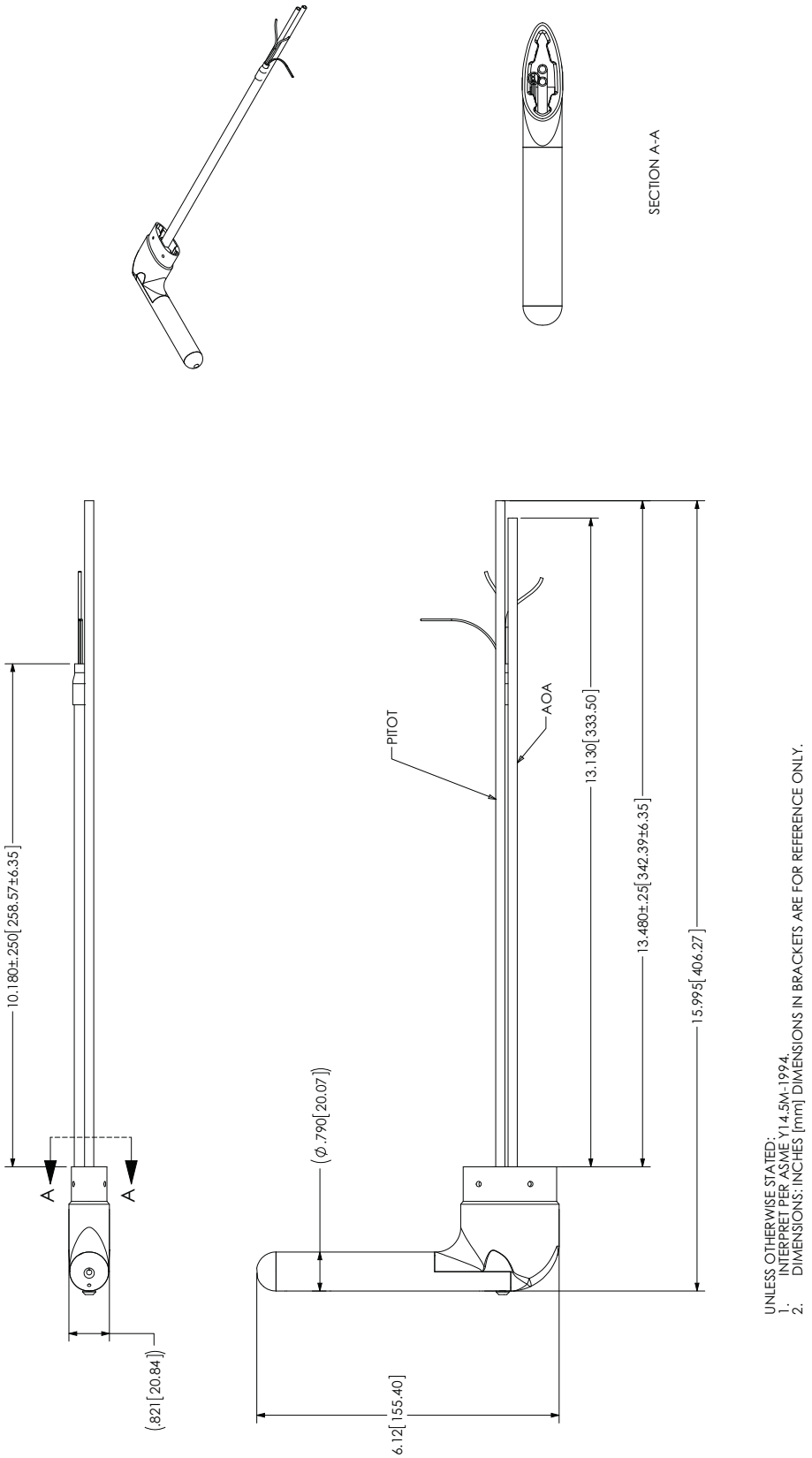
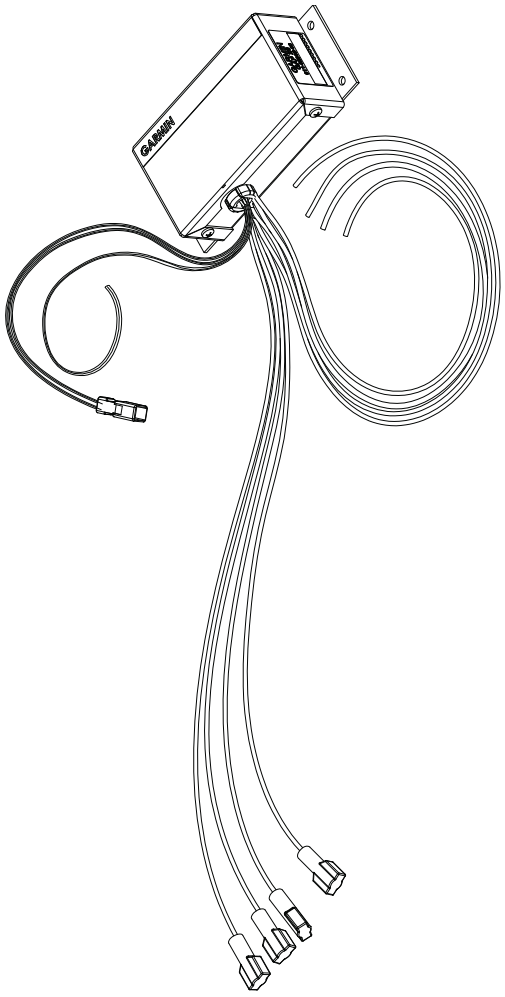


Figure 5-10 GAP 26 Outline Drawing



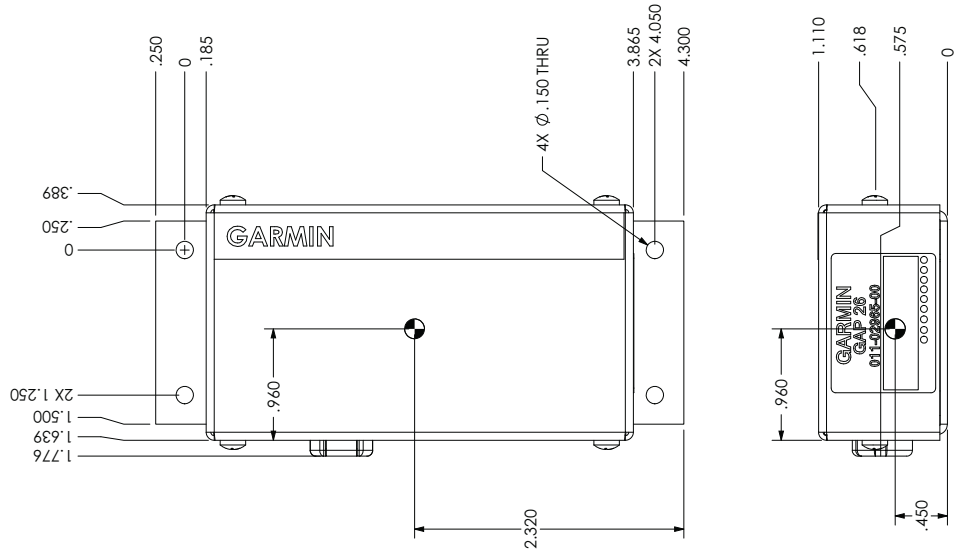


Figure 5-11 GAP 26 Heater Control Box (used with -20 unit only)

6 GCO™ 14 INSTALLATION

This section contains information for the GCO 14 Aircraft Carbon Monoxide Detector. Use this section to install the GCO 14.

WARNING

Perchlorate Material - Special handling my apply. Refer to www.dtsc.ca.gov/perchlorate.

6.1 Description and Identification

The GCO 14 is a carbon monoxide sensor that provides CO level information to its host LRU. The host LRU uses this data to alert the pilot of potentially hazardous levels of CO.

6.2 Equipment Description

6.2.1 Unit Configuration

Table 6-1 GCO 14 Part Numbers

Model	Unit P/N	Unit Only P/N	Standard Kit
GCO 14	011-06537-00	010-02975-00	010-02975-01

6.2.2 Unit Accessories

Table 6-2 Standard Kit Accessory

Model	Item	P/N
GCO 14	Cable Kit	011-06537-10

Table 6-3 Contents of Cable Kit (011-06537-10)

Item	P/N	Quantity
Screw, 8-32x1.125, PHP, SS/P, w/NYL	211-60239-21	2
Cable Assy, GCO 14	320-01701-00	1
Contact, Pin, Mil Crimp, Size 22D	336-00021-00	5

6.3 General Specifications

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

6.4 Certification

Refer to GCO 14 TSO Installation Manual 190-03084-00 for TSO certification information.

6.5 Mounting Considerations

The GCO 14 is designed to mount in the following ways:

- To a cable harness using zip ties or lacing cord
- To the back of a D-sub connector

6.6 Air Circulation and Cooling

The GCO 14 meets all requirements without external cooling. Keep air vents clear of wires and other obstructions.

6.7 Equipment Mounting

The GCO 14 is intended for use with the standard aviation accessories.

- Tie wraps or lacing cord

6.7.1 Tie Wrap Method

1. Align GCO 14 to harness.
2. Secure with two tie wraps (shown) or lacing cord.

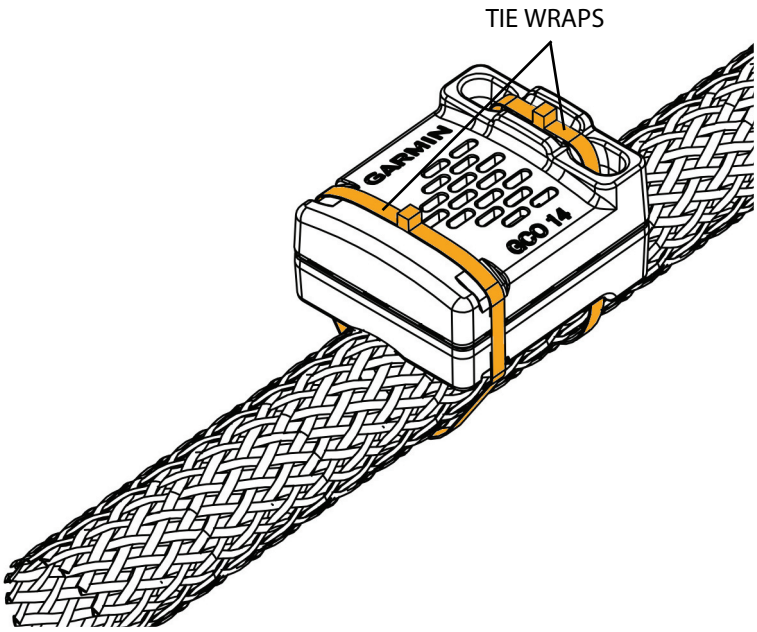


Figure 6-1 Tie Wrap Method

6.7.2 D-sub Method

1. Align GCO 14 to holes on d-sub connector.
2. Secure with supplied screws, Garmin P/N 211-60239-21, 8-32 1.125, PHP, SS/P, with nylon.
3. Torque screws to 10 ±1 in lbs.

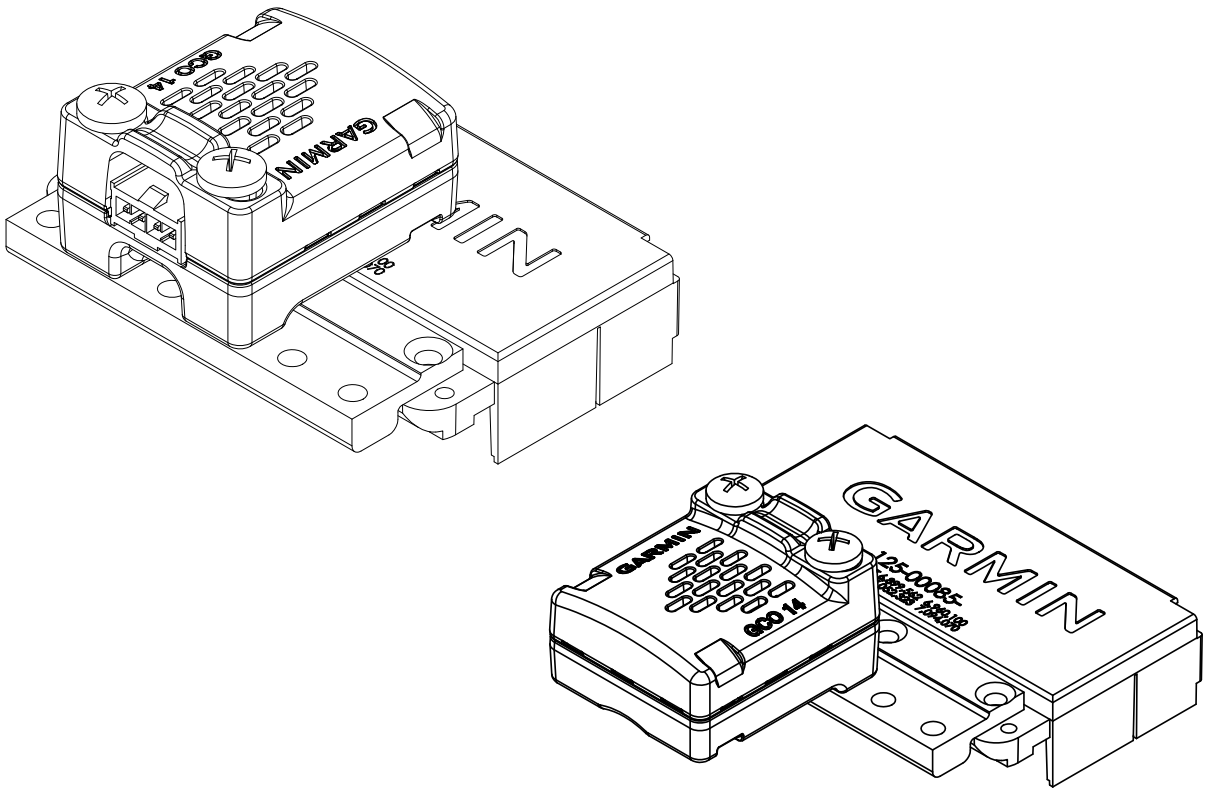


Figure 6-2 GCO 14 - D-sub Mounting Options

6.7.3 GCO 14 with Cable Harness

NOTE

Drain lugs can go in any 8-32 drain wire hole the GCO 14 is not occupying.

Refer to figure3-3 and figure3-4 for reference.

1. If necessary, remove the paper tape around retention clip.
2. Attach the 4-pin connector of included cable harness by inserting the retention clip into the GCO 14. A click sounds when it is inserted properly.
3. Ensure the retention clip is fully seated by lightly pulling on the cable.
4. Attach other end of 4-pin connector to configuration module.

To prepare the cable harness for crimp pin installation:

1. Strip at least 0.17 inches of insulation from all wires going to connectors. It is the responsibility of the installer to determine the proper length of insulation to be removed.
2. Insert the wire into the supplied pin and crimp with one of the recommended (or equivalent) crimping tools listed in table2-1.
3. Insert the pin into the connector housing location as specified by the interconnect drawing in figure9-1.
4. Install ring terminals, #8, insulated, onto the shield drain wires, grouping wires as appropriate for the connector.
5. Secure ring terminals with two screws, 8-32 (drain lugs) to shield block.
6. Verify the pins are properly engaged into the connector by gently tugging on the wire.
7. Repeat steps 1 through 6 for the remaining wires.

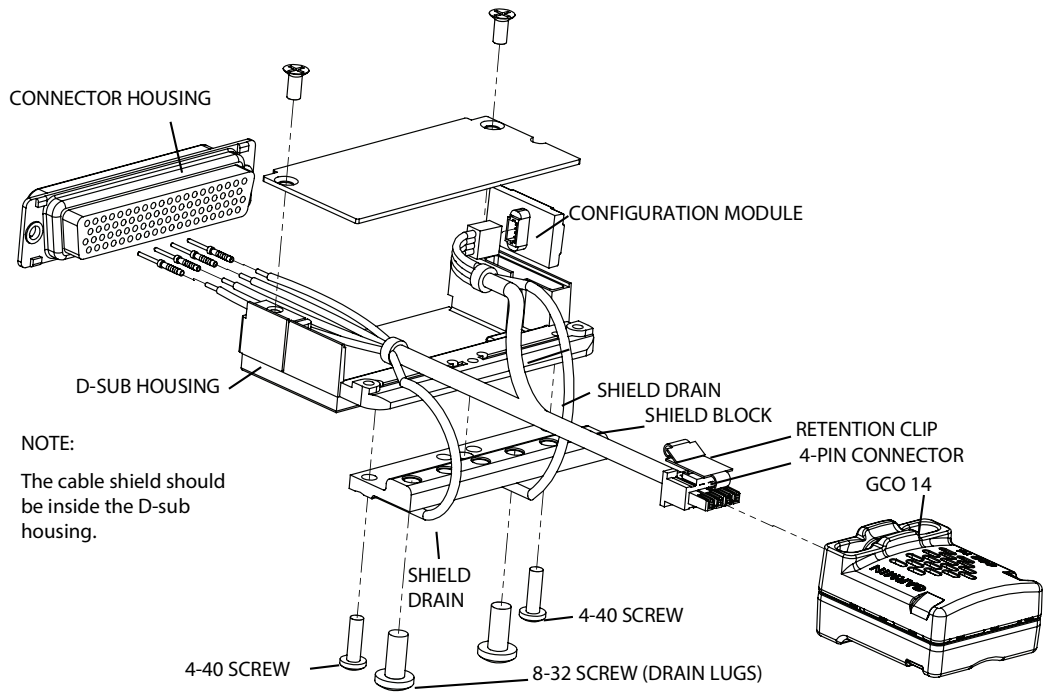


Figure 6-3 GCO 14 with Cable Harness

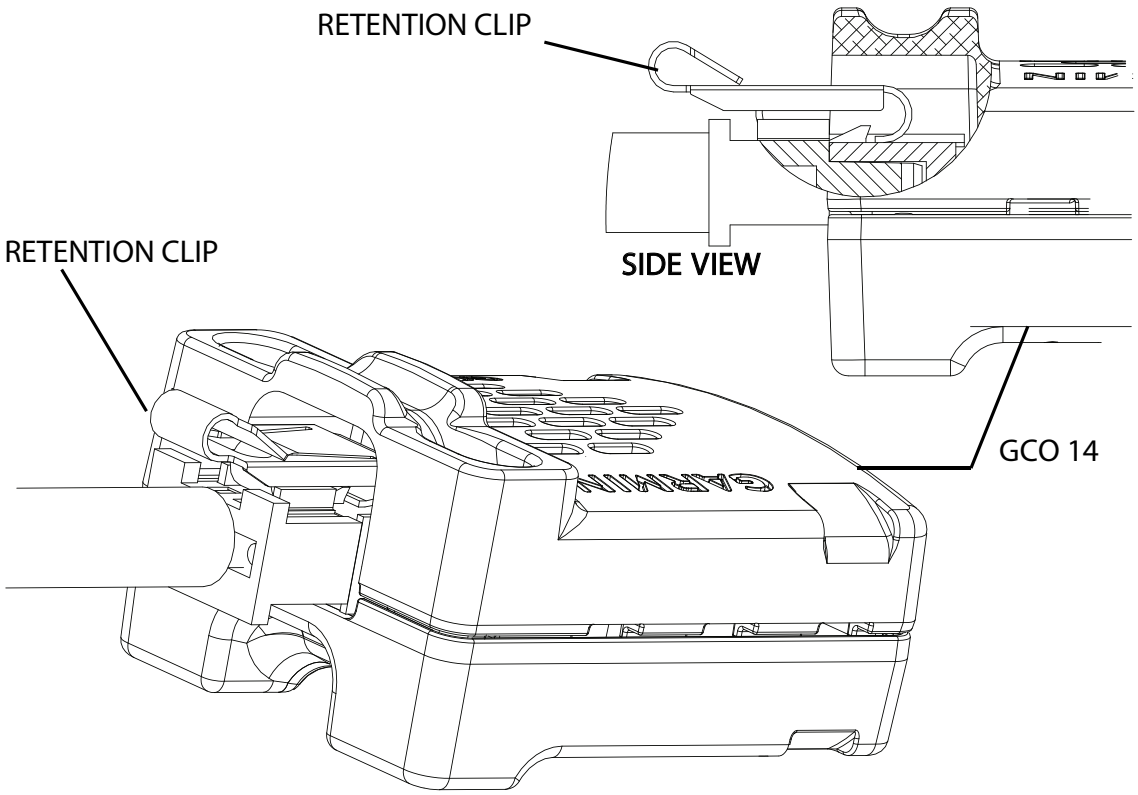


Figure 6-4 Retention Clip Insertion

6.8 Outline and Installation Drawings

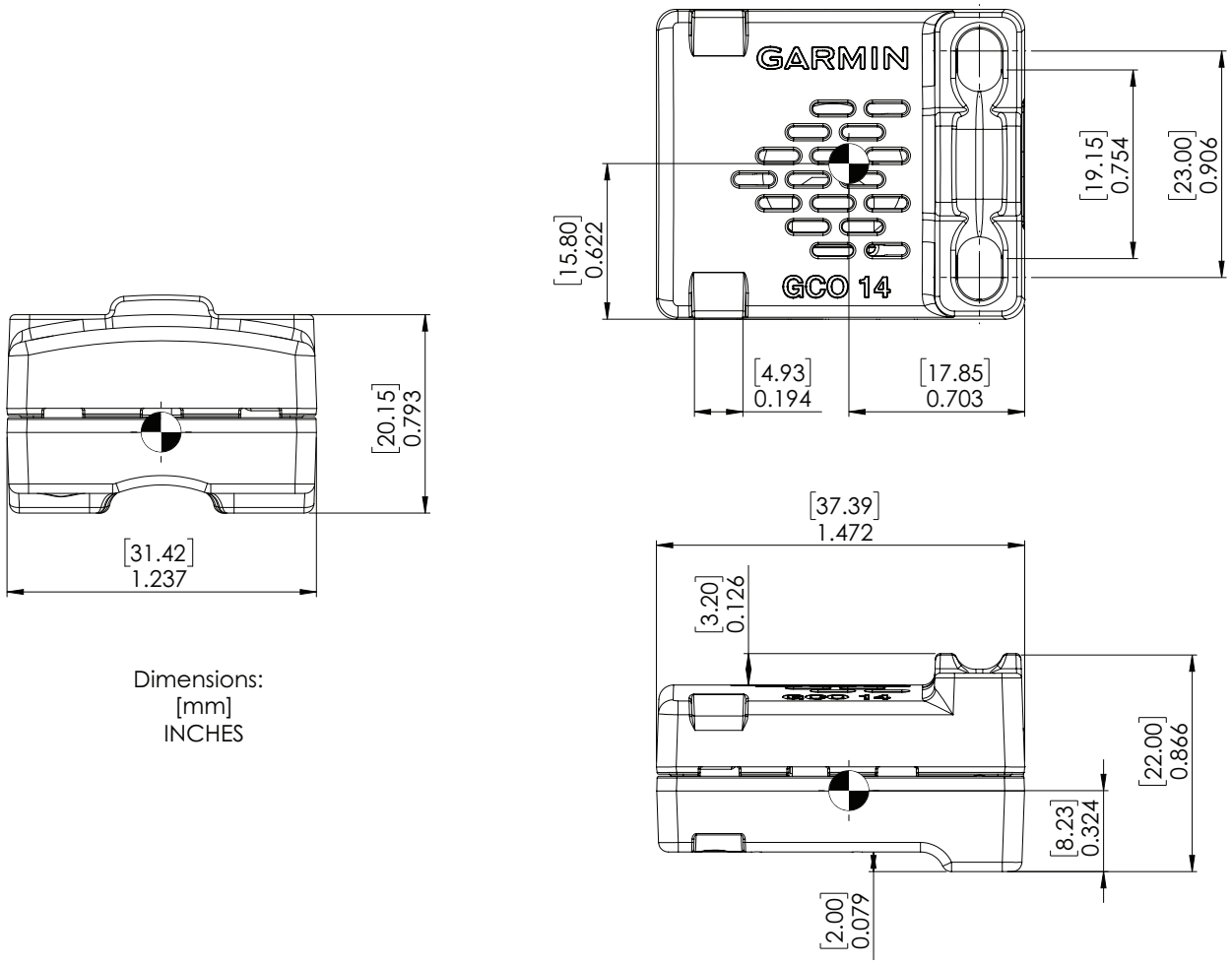


Figure 6-5 GCO 14 Outline Drawing

7 GDU™ 4XX DISPLAY INSTALLATION

NOTE

References to the GDU 4XX throughout this manual apply equally to the GDU 45X, GDU 46X, and GDU 47X except where specifically noted.

This section contains general information as well as installation information for the GDU 4XX units. Use this section to mount the GDU 45X/46X/470 unit(s).



Figure 7-1 GDU 45X Unit View



Figure 7-2 GDU 46X Unit View



Figure 7-3 GDU 470 Unit View

7.1 Equipment Description

NOTE

There is no TSO/ETSO applicable to the GDU 4XX.

NOTE

GPS data is used for ADAHRS sensor drift correction, so at least one source of GPS data is required. This requirement can be met by installing a GPS 20A, or by connecting a GPS antenna to at least one GDU GPS receiver. In a system with multiple GDU displays, additional GPS antennas may be connected to the other displays for redundancy, if desired.

NOTE

Make sure that no dust or grit accumulates at the bottom of the display glass. The GDU 4XX displays us invisible infrared beams for touch detection, this makes it very important to keep the screen clean, especially along the edges.

NOTE

See Section 33.2.1.5 for information on replacing a GDU 37X display with a GDU 4XX display.

The GDU 4XX units are not suitable for installation in a type-certificated aircraft.

GDU 4XX displays are mounted flush to the aircraft instrument panel using four #6 screws. Each display contains a GPS receiver and video input, and the GDU 455/465 units additionally provide a built-in SiriusXM® receiver.

7.1.1 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

7.1.2 Interface Summary

NOTE

A G3X™ avionics installation can use either GDU 37X or GDU 4XX displays, but a G3X system installation cannot use GDU 37X and GDU 4XX displays.

NOTE

If upgrading from a GDU 37X to a GDU 4XX display, refer to upgrade instructions in Section 33.2.1.5 for information pertaining to preserving/transferring stored system calibration information.

NOTE

Please refer to the G3X Touch™ Avionics Pilot's Guide (190-01754-00) for guidance in using Connext® computer application Bluetooth connections to Garmin Pilot™ app device(s).

The GDU 4XX uses CAN and RS-232 interfaces to communicate with Garmin LRUs and other devices. Refer to sections Section 2, Section 25, Appendix G, Section 26, and Section 31 for interconnect and configuration information.

The GDU 4XX supports video input through a wired connection (see Section 24.4.4).

The GDU 4XX includes a wireless Bluetooth transceiver than can communicate with tablet computers and other Garmin devices that support the Connext interface protocol. Refer to the G3X Touch Pilot's Guide (190-01754-00) for guidance in using Connext Bluetooth connections.

7.2 General Specifications

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

7.3 Installation Information

7.3.1 Required Equipment

A installation kit (Table 7-1, Table 7-2, Table 7-3) is required to install the unit, one kit is required for each GDU 4XX installed. The GDU 4XX Nut Plate (Figure 7-6 GDU 45X, Figure 7-9 GDU 46X, Figure 7-12 GDU 470) is included in the installation kit for use when it is not possible to tap the instrument panel for 6-32 screw threads. The installation kits are not included with the GDU 4XX.

Table 7-1 Contents of GDU 45X Installation Kit (010-12150-01)*

Item	Garmin P/N	Quantity
GDU 45X Connector Kit*	011-01921-10	1
Nut Plate Kit	115-01725-00	1
Machine Screw for Panel Mounting, 0.550”, Black	211-00169-01	4

*Contents of the connector kit are listed in Table 7-4

Table 7-2 Contents of GDU 46X Installation Kit (010-12150-00)

Item	Garmin P/N	Quantity
GDU 46X Connector Kit*	011-01921-10	1
Nut Plate Kit	115-01725-01	1
Machine Screw for Panel Mounting, 0.550”, Black	211-00169-01	4

*Contents of the connector kit are listed in Table 7-4

A separate drilling guide is included to aid the installation of a GDU 470 in a panel that formerly contained a GDU 37X display.

Table 7-3 Contents of GDU 470 Installation Kit (010-12150-02)*

Item	Garmin P/N	Quantity
GDU 4XX Connector Kit*	011-01921-10	1
Nut Plate Kit	115-01725-03	1
GDU 47X Drill Guide	115-01725-04	1
Machine Screw for Panel Mounting, 0.550”, Black	211-00169-01	4

*Contents of the connector kit are listed in Table 7-4

Table 7-4 Contents of GDU 4XX Connector Kit (011-01921-10)

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	336-00022-02	30

7.3.1.1 GDU 4XX PFD Configuration Module

The GDU 4XX 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. This allows critical data to be retained with the airframe even if the PFD 1 display is replaced.

7.3.2 Additional Equipment Required

A 3/32" hex drive tool is required to secure the GDU 4XX to the panel as described in Section 7.6.1 Unit Installation and shown in Figure 7-5 (GDU45X), Figure 7-8 (GDU 46X), and Figure 7-11 (GDU470).

7.4 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GDU 4XX. Refer to Section 2.3 for wiring considerations, and to Section 24.4 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 23.

Replacement cursor knobs (part number K00-00578-00) for the GDU 4XX are available from a Garmin dealer.

7.5 Antennas

Refer to Section 21 for antenna information.

NOTE

GDU 4XX units cannot be used with GA 35, GA 36, or GA 37 antennas.

7.6 Mounting Requirements

Refer to Section 7.7 (GDU 45X), Section 7.8 (GDU 46X), and Section 7.9 (GDU 470) for outline and installation drawings.

7.6.1 Unit Installation

The GDU 4XX is installed by holding the unit flush with the instrument panel and fastening the four 3/32" hex socket head screws to the panel as shown in Figure 7-5 (GDU 45X), Figure 7-8 (GDU 46X), and Figure 7-11 (GDU 470).

7.6.2 Panel Cutout Template

The GDU 45X Nut Plate (115-01725-00), GDU 46X Nut Plate (115-01725-01), or GDU 470 Nut Plate (115-01725-04) can be used as a template when marking the panel for cutout. See Figure 7-6 (GDU 45X), Figure 7-9 (GDU 46X), and Figure 7-12 (GDU 470), (dimensions on the figures are to verify accuracy of printout only) for complete cutout dimensions. For .dxf versions of these drawings, see https://support.garmin.com/support/manuals.

7.6.3 GDU 470 Panel Drilling Guide

The GDU 470 Drill Guide (115-01725-04) can be used as a template when marking the panel for cutout (Figure 7-15, dimensions on the figure are to verify accuracy of printout only). See Figure 7-12 for complete dimensions. The drill guide is especially useful when updating from the GDU 37X to the GDU 470, as the rivet holes on the GDU 470 drill guide and nut plate match the GDU 37X nut plate rivet holes. The drill guide is attached to the panel using the existing GDU 37X nutplate holes, and is used to make the panel modifications and drill the new mounting holes. The corners of the existing GDU 37X panel cutout must be slightly enlarged using the drilling guide as a template. The nut plate is then used to mount the GDU 470 to the updated panel opening.

7.7 GDU 45X Outline and Installation Drawings

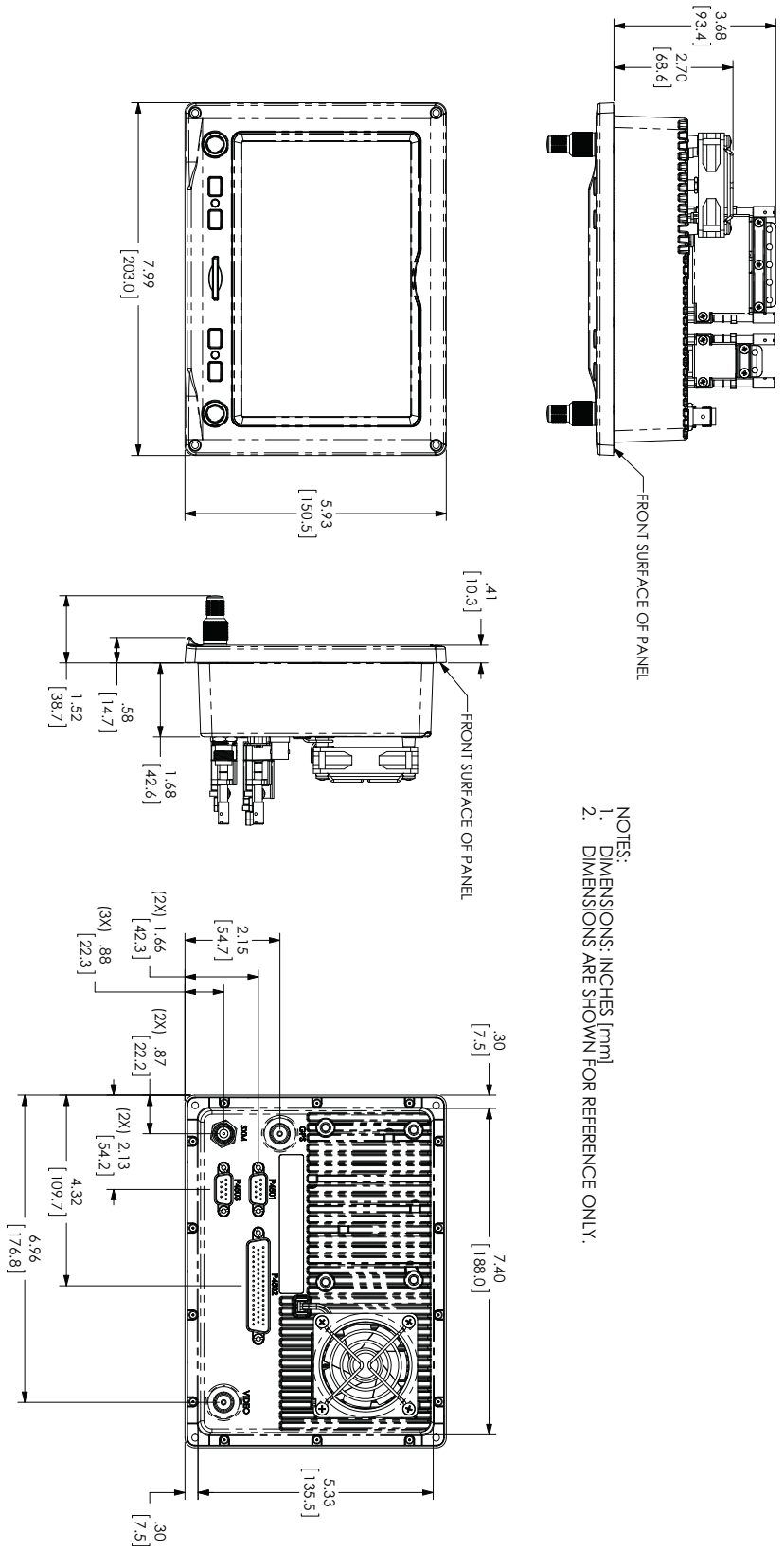


Figure 7-4 GDU 45X Outline Drawing

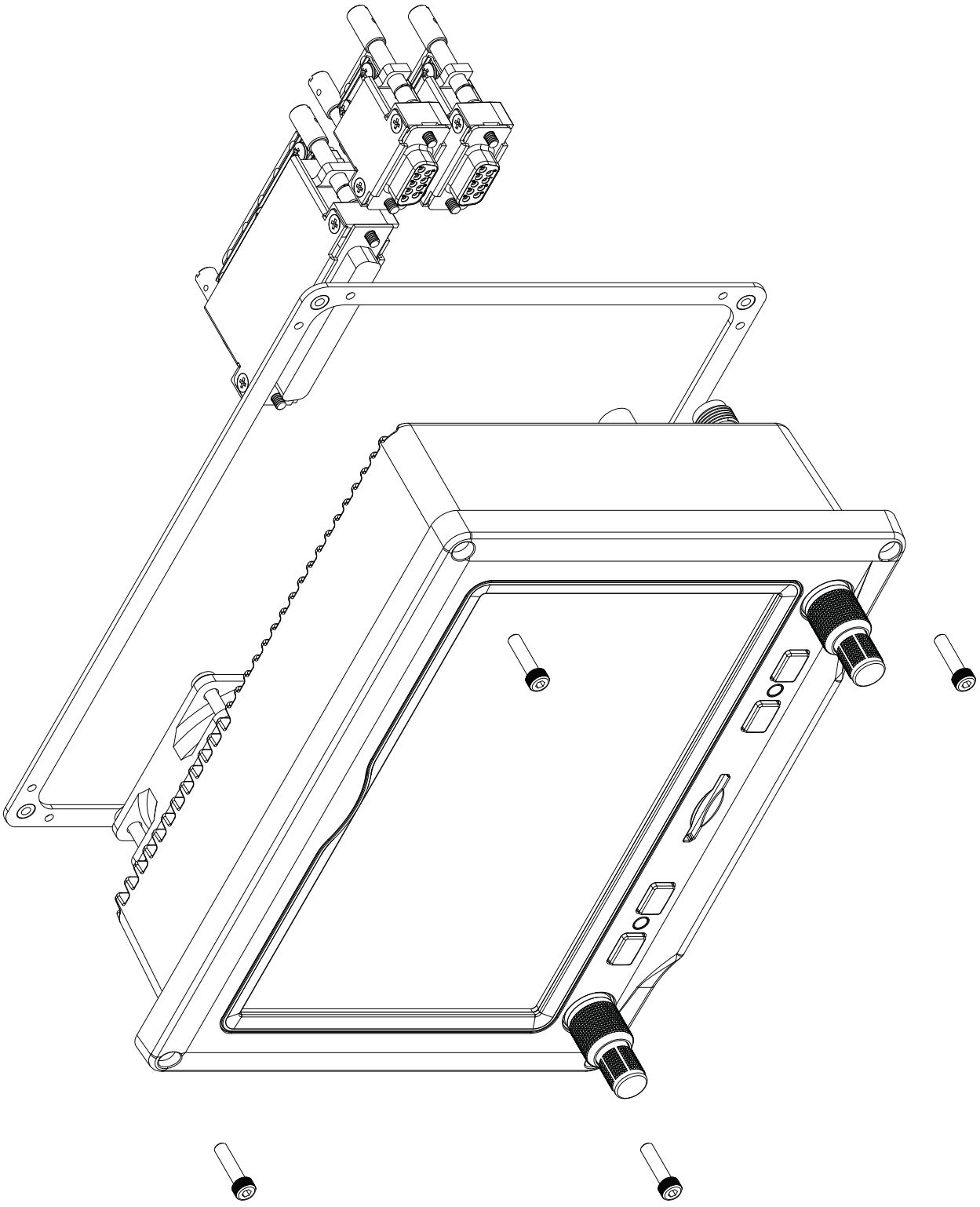


Figure 7-5 GDU 45X Assembly Drawing

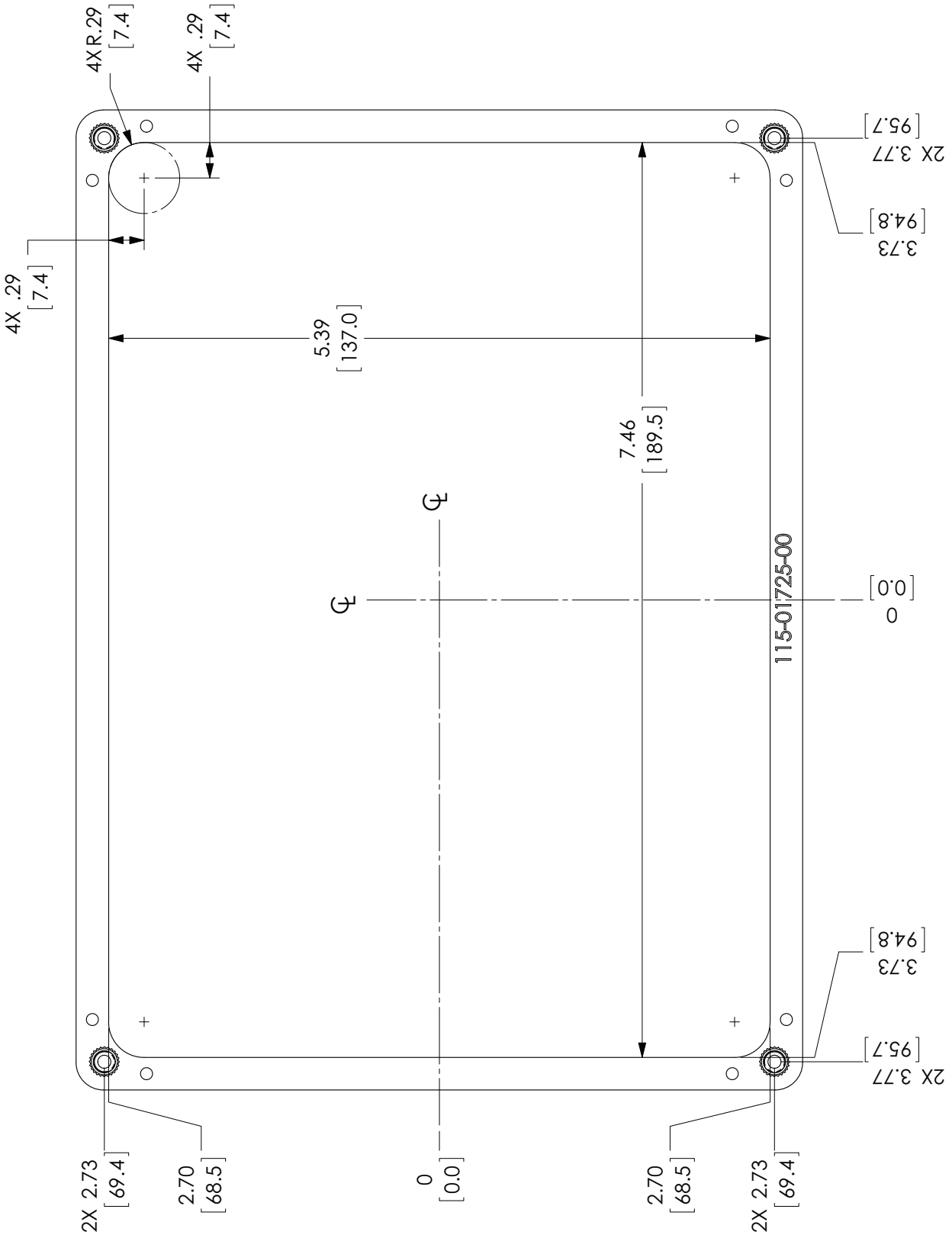


Figure 7-6 GDU 45X Panel Cutout Drawing (not to scale)

7.8 GDU 46X Outline and Installation Drawings

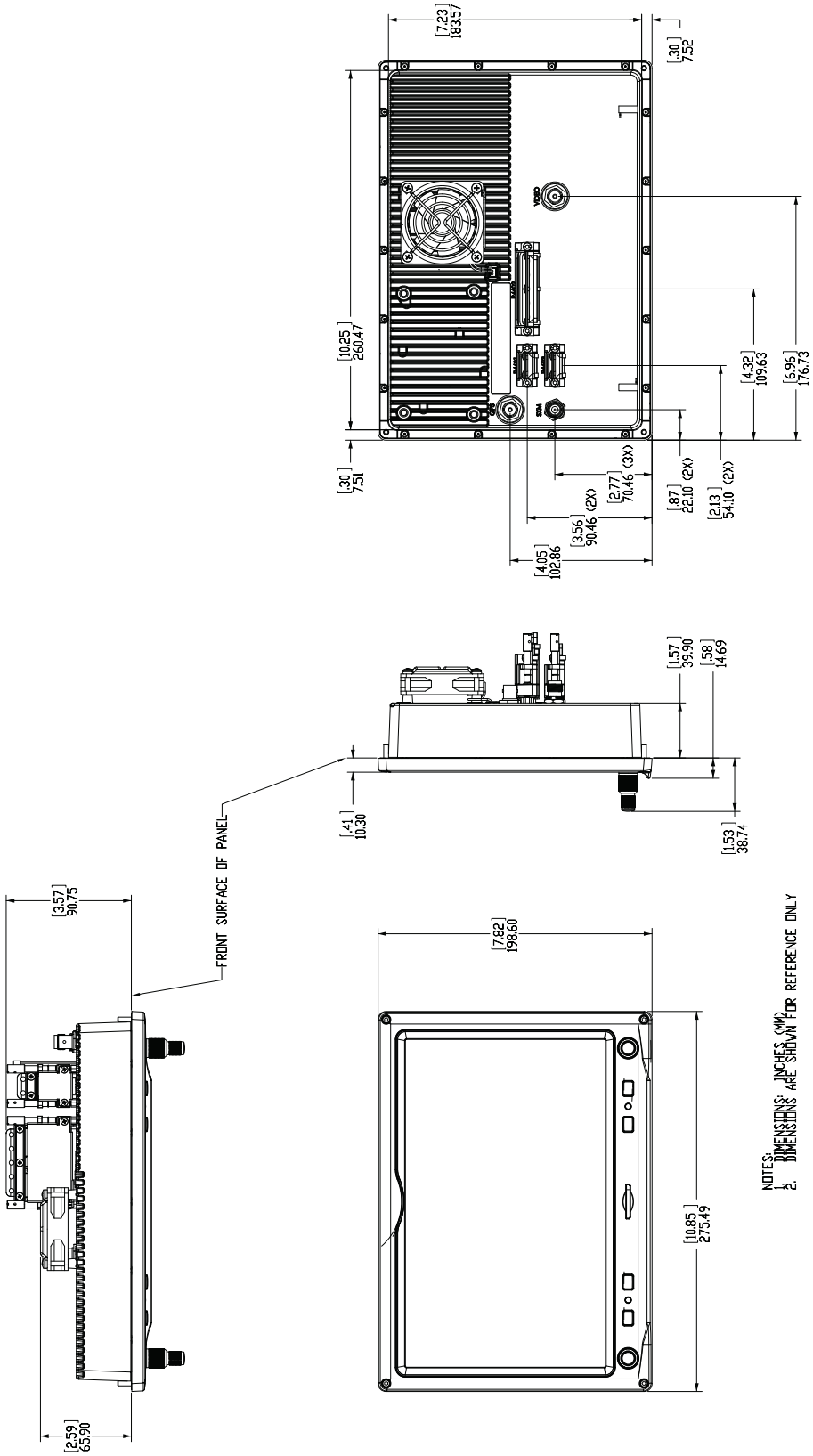


Figure 7-7 GDU 46X Outline Drawing

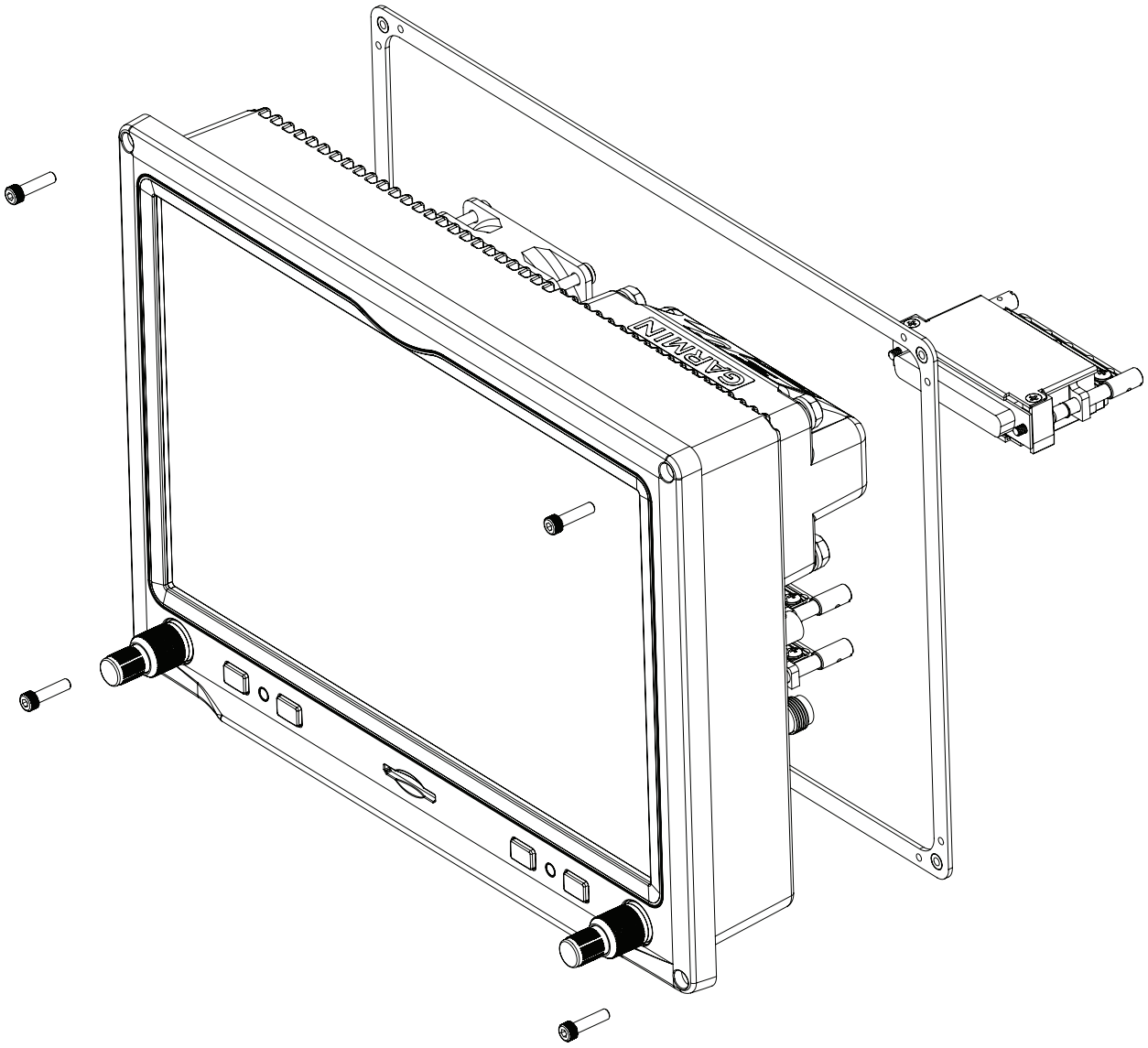


Figure 7-8 GDU 46X Assembly Drawing

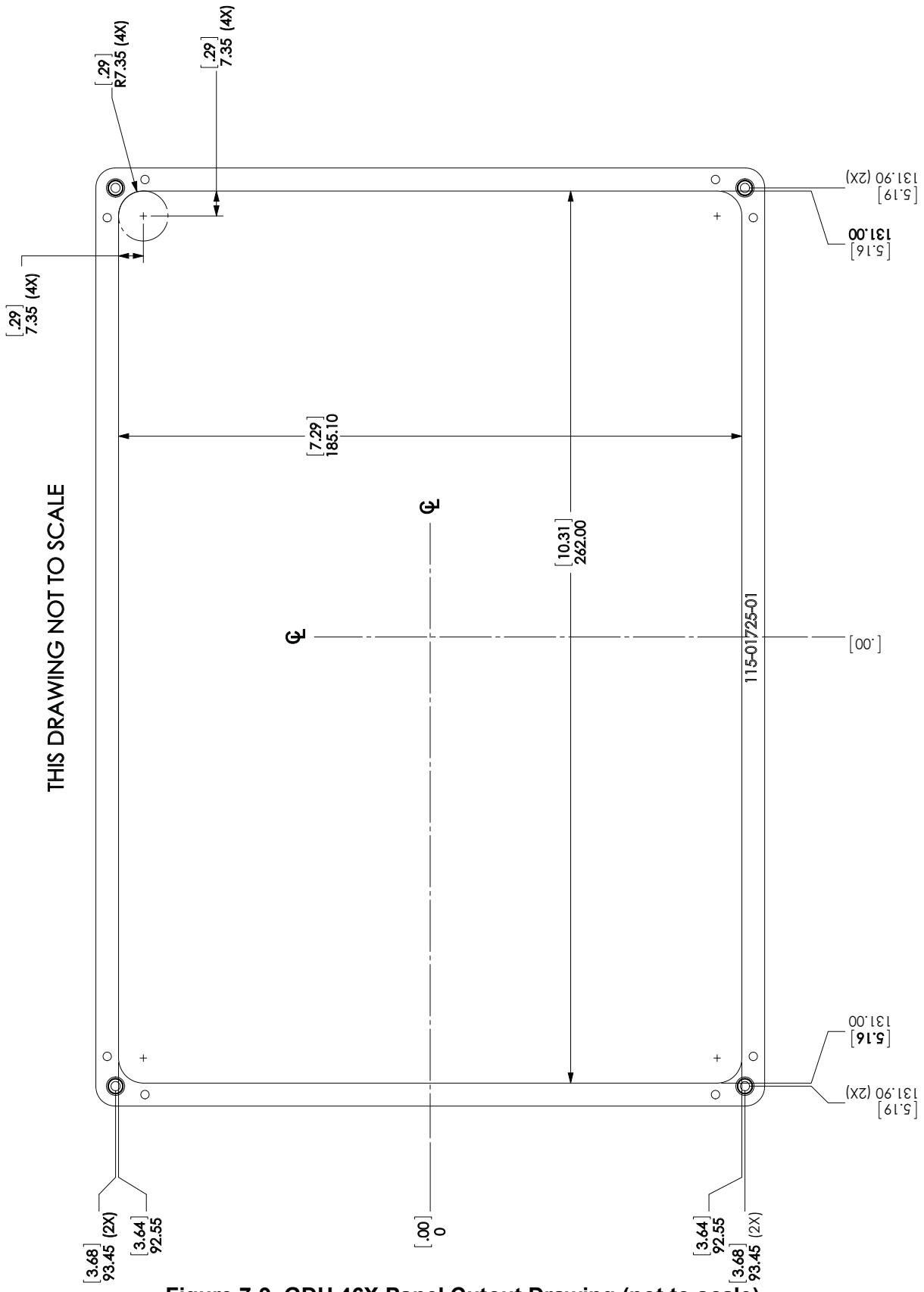


Figure 7-9 GDU 46X Panel Cutout Drawing (not to scale)

7.9 GDU 470 Outline and Installation Drawings

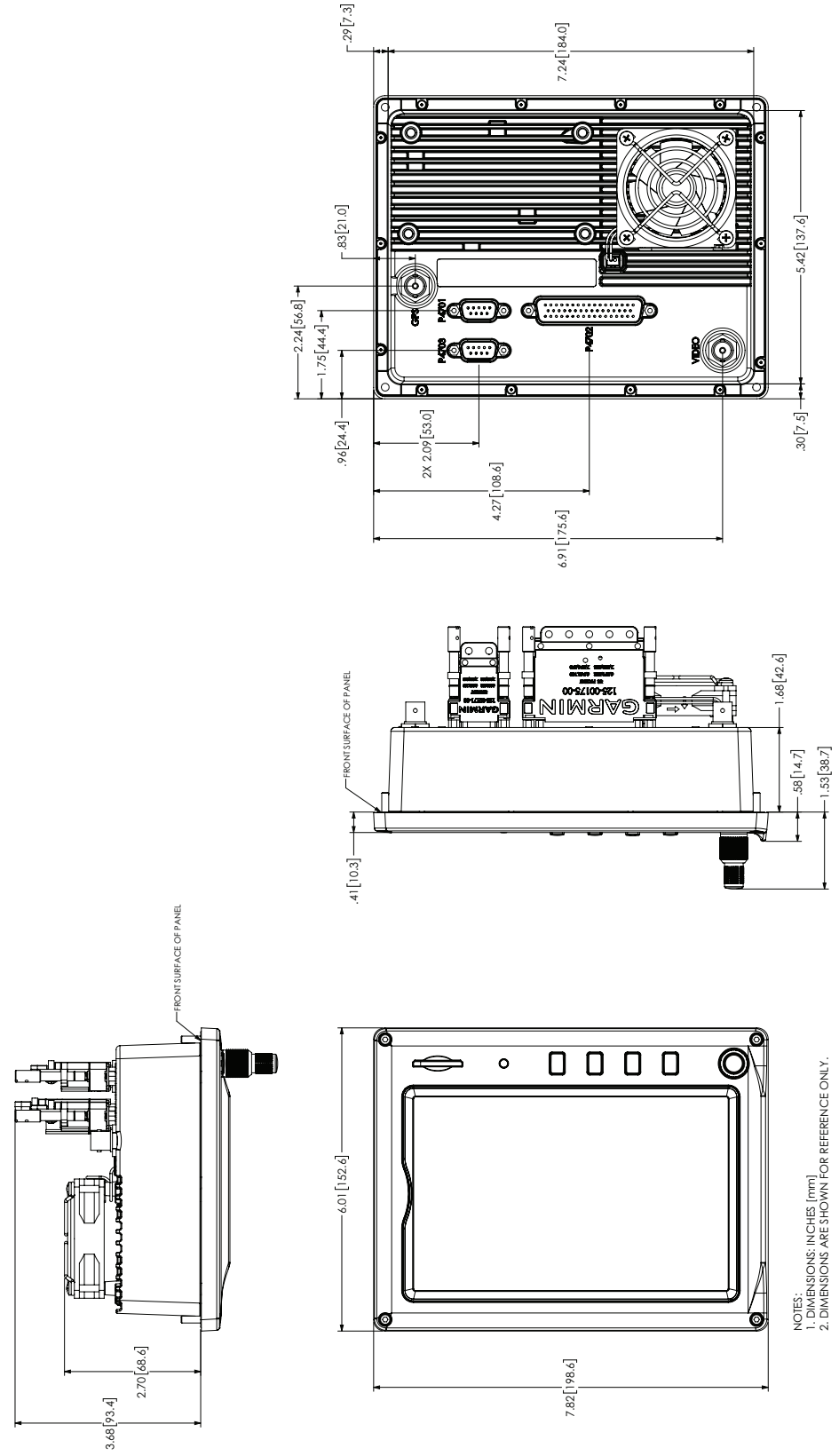


Figure 7-10 GDU 470 Outline Drawing

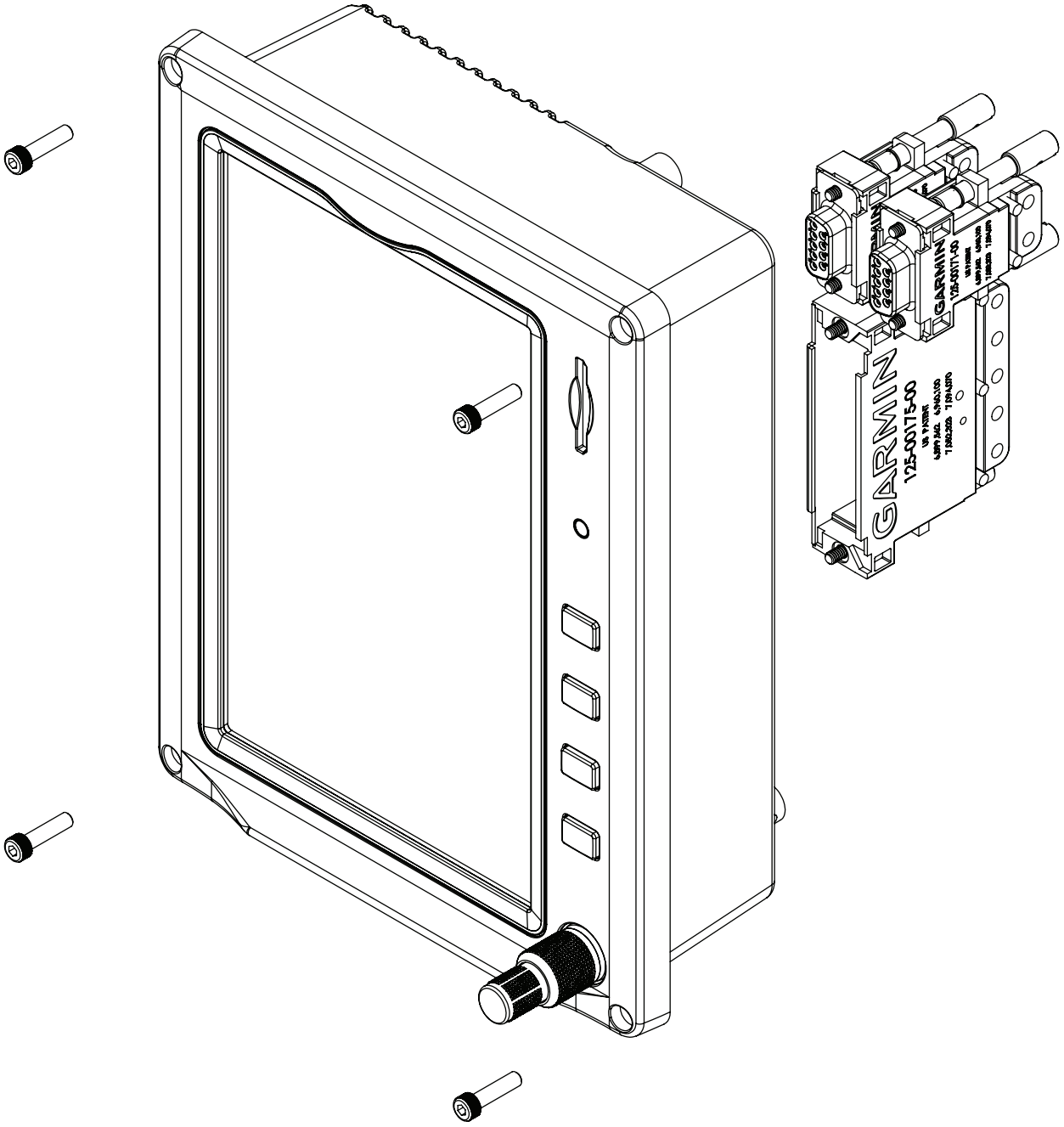


Figure 7-11 GDU 470 Assembly Drawing

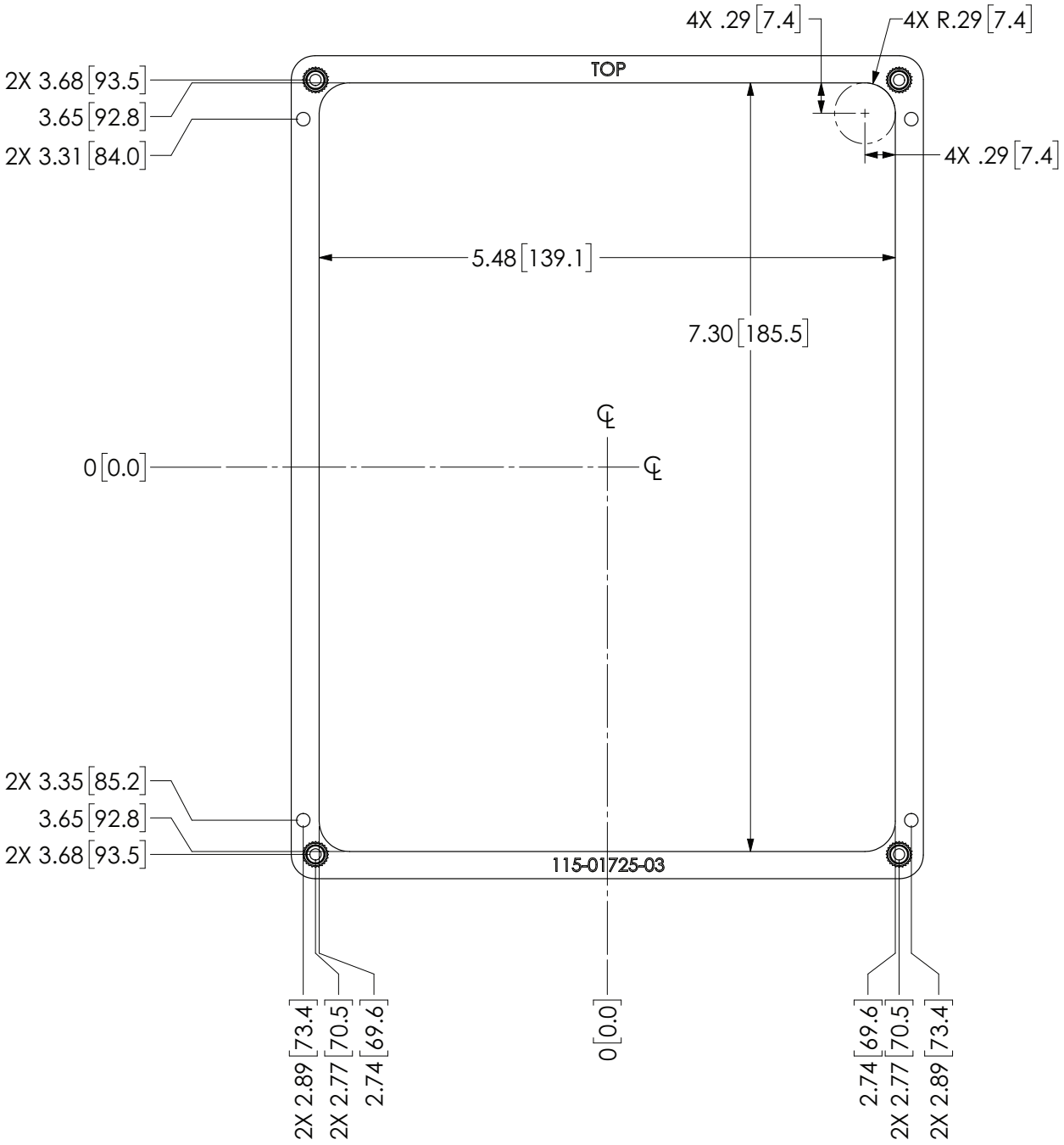


Figure 7-12 GDU 470 Panel Cutout Drawing (not to scale)

7.10 Panel Cutout Drawings

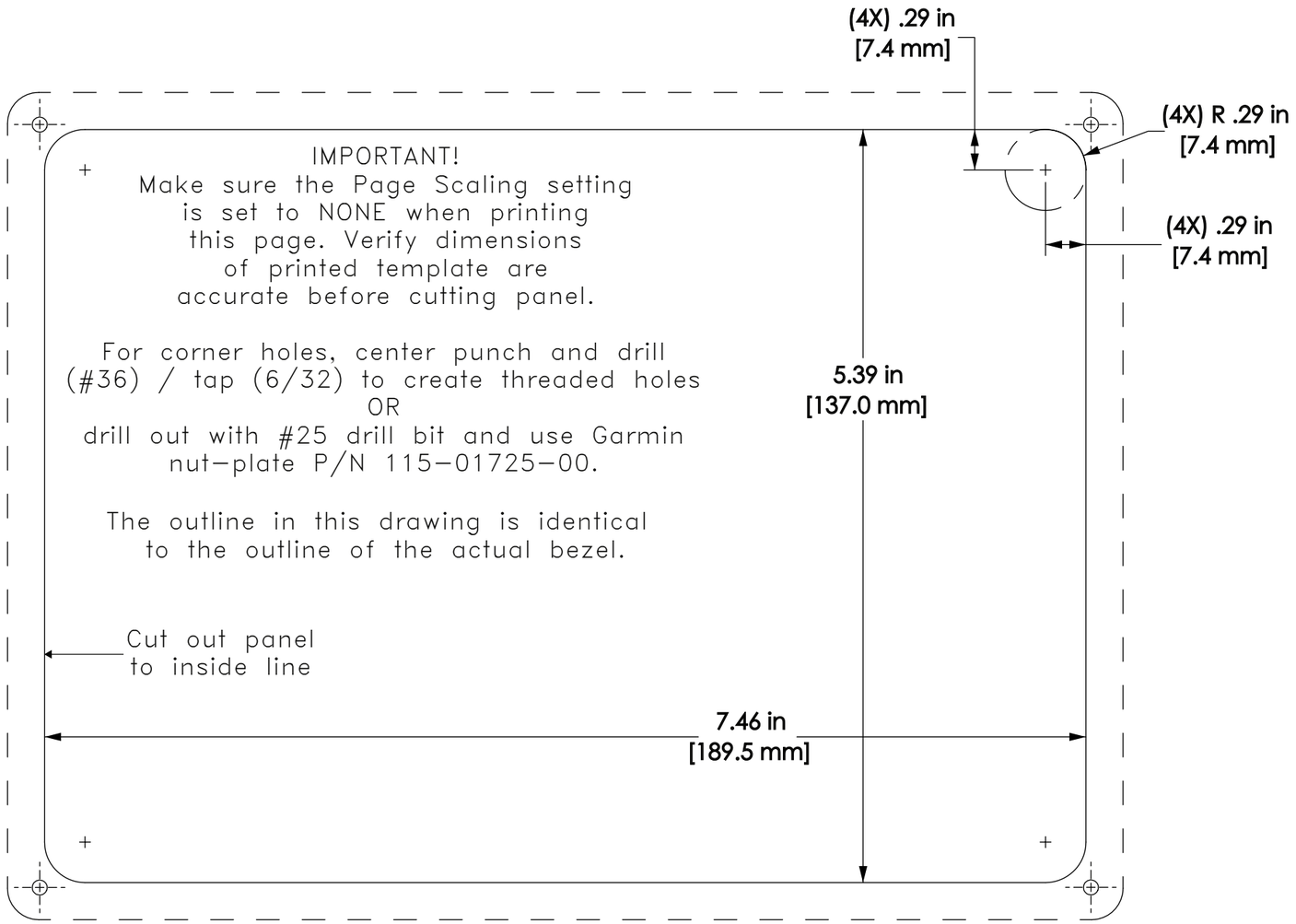


Figure 7-13 GDU 45X Panel Cutout Drawing

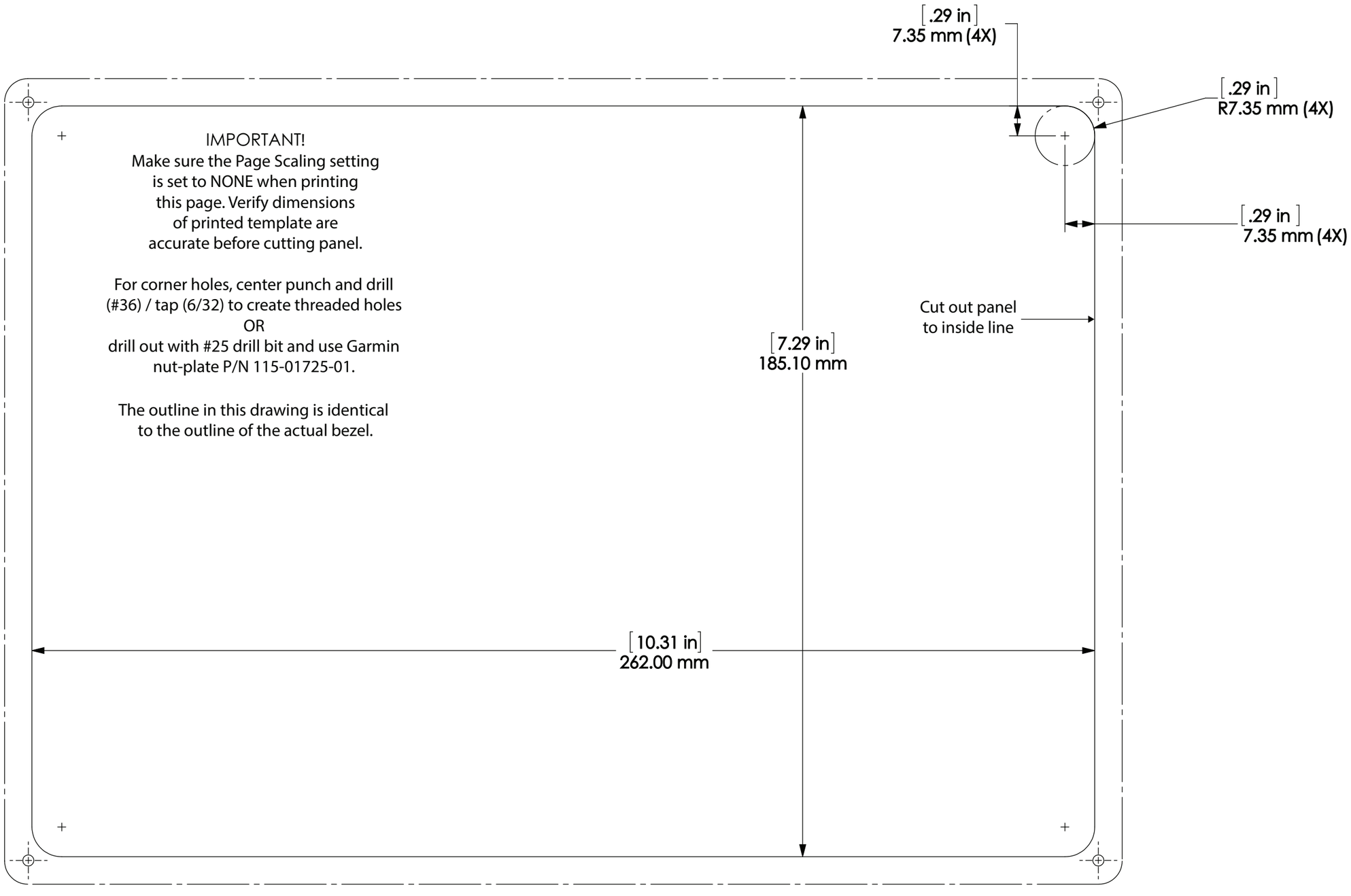


Figure 7-14 GDU 46X Panel Cutout Drawing

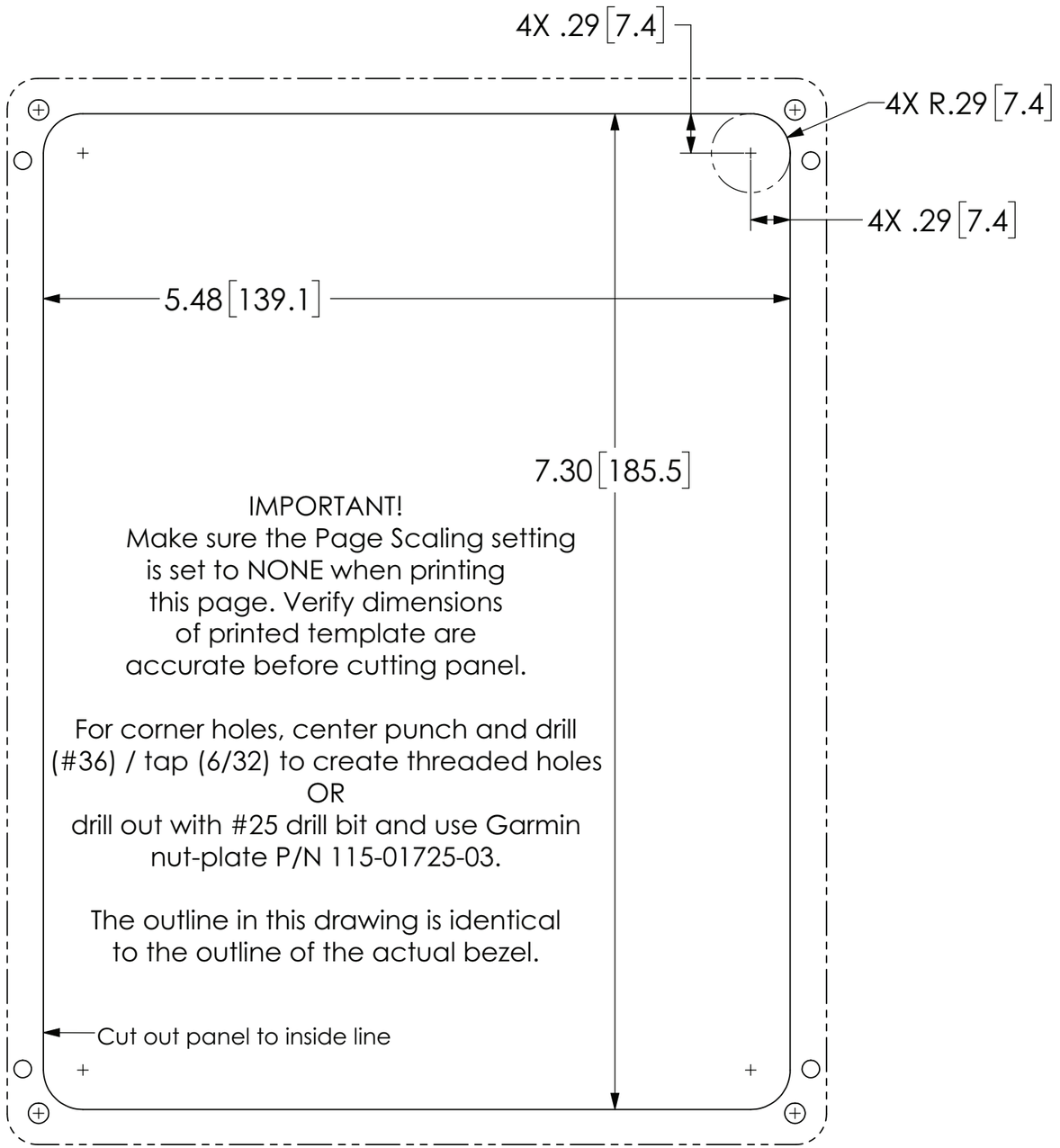


Figure 7-15 GDU 470 Panel Cutout Drawing

8 GEA™ 24 ENGINE INTERFACE MODULE INSTALLATION

NOTE

References to the GEA 24 throughout this manual apply equally to the GEA 24B except where specifically noted.

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

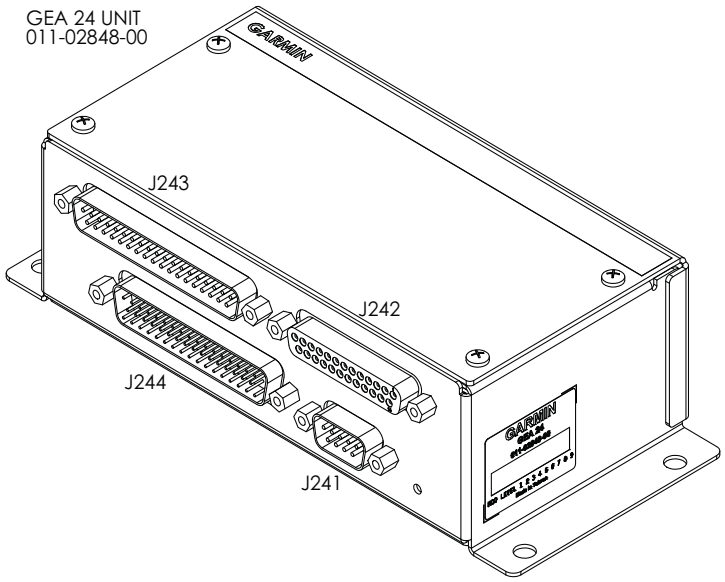


Figure 8-1 GEA 24 Unit View

8.1 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. In a G3X™ avionics or G3X Touch™ avionics system, two GEA 24 units may be installed to monitor and display engine data for twin-engine aircraft, or single-engine aircraft with more than six cylinders. The second GEA 24 must be configured as EIS #2 as described in Section 24.5.16.

- 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 24.5.16.

8.1.1 Status LED

The GEA 24 has an LED on its outer case that indicates its current status. See Section 32.1.1 for details.

8.2 Equipment Available

8.2.1 Required Equipment

Table 8-1 GEA 24 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GEA 24	010-01042-00	011-02848-00
GEA 24B	010-02770-00	011-05991-00

NOTE

Refer to Section 33.2.5 for information regarding swapping GEA 24 and GEA 24B units.

8.2.2 Additional Equipment Required

Table 8-2 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 2.3.1.3.3.

Table 8-2 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

8.3 General Specifications

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

8.4 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GEA 24. Refer to Section 2.3 for wiring considerations, and to Section 24.5 for pinouts.

The GEA 24 connects to other LRUs in the G3X system using the CAN bus. To provide an optional redundant path for engine data, a secondary RS-232 connection to a single GDU™ display is also supported. See Figure 25-1.12 for wiring and configuration information.

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 2.3.1.3.3).
4. Connect backshell connectors.

8.5 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.

CAUTION

Do not mount the GEA 24 on the 'hot' side (engine side) of the firewall, or in any location where it would be exposed to radiated heat from the engine.

8.6 Outline and Installation Drawings

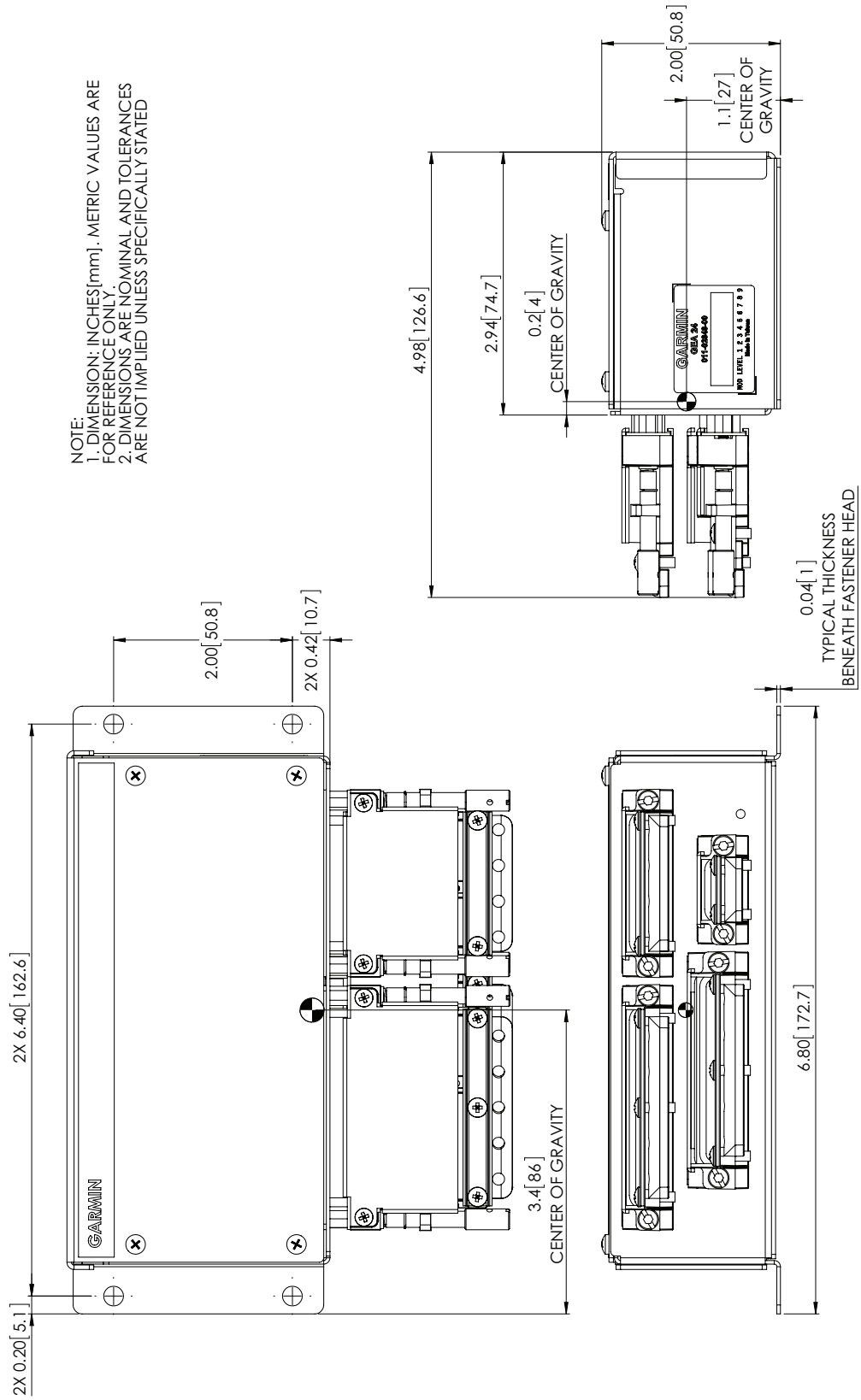


Figure 8-2 GEA 24 Outline Drawing

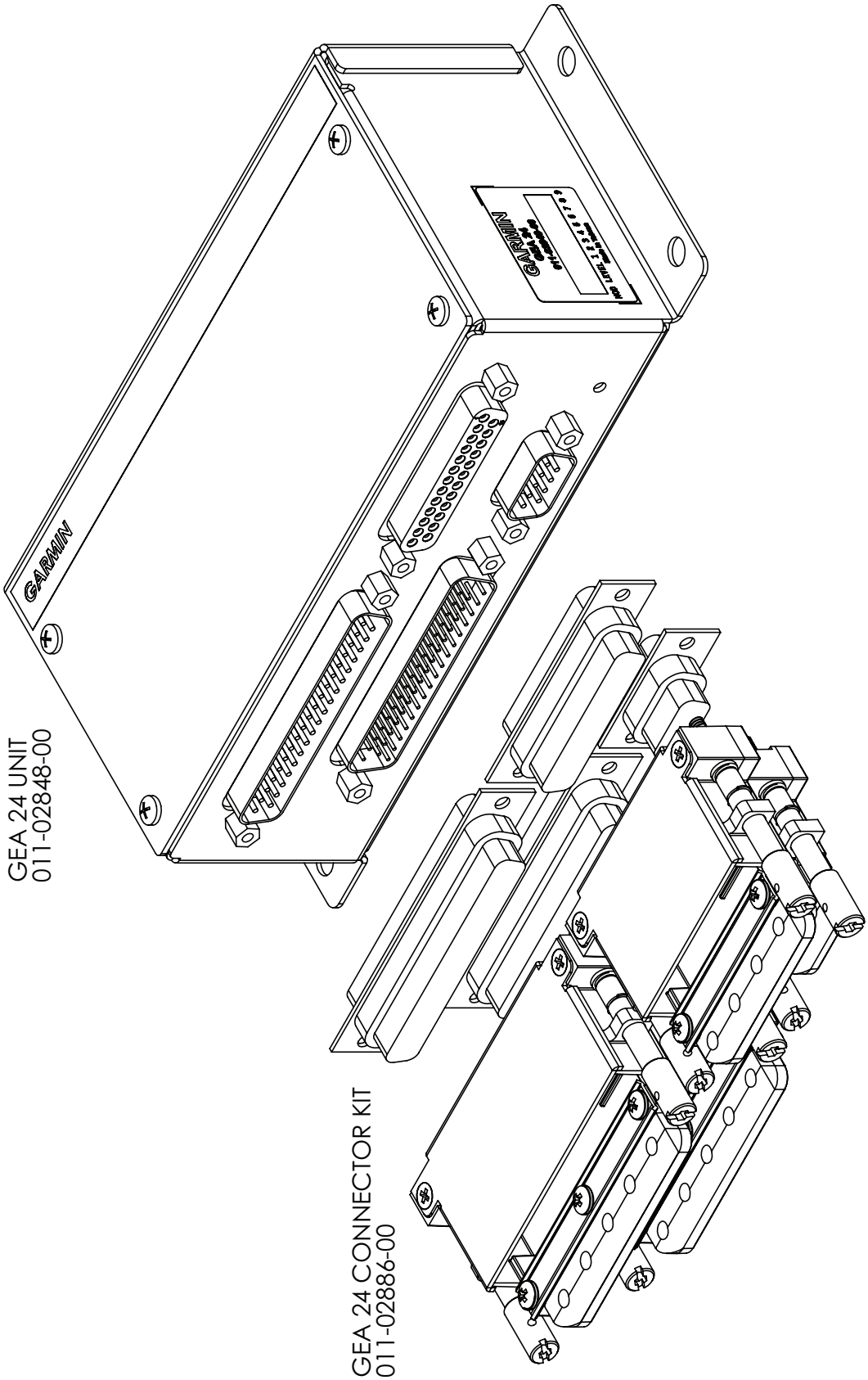


Figure 8-3 GEA 24 Assembly Drawing (no CAN terminator)

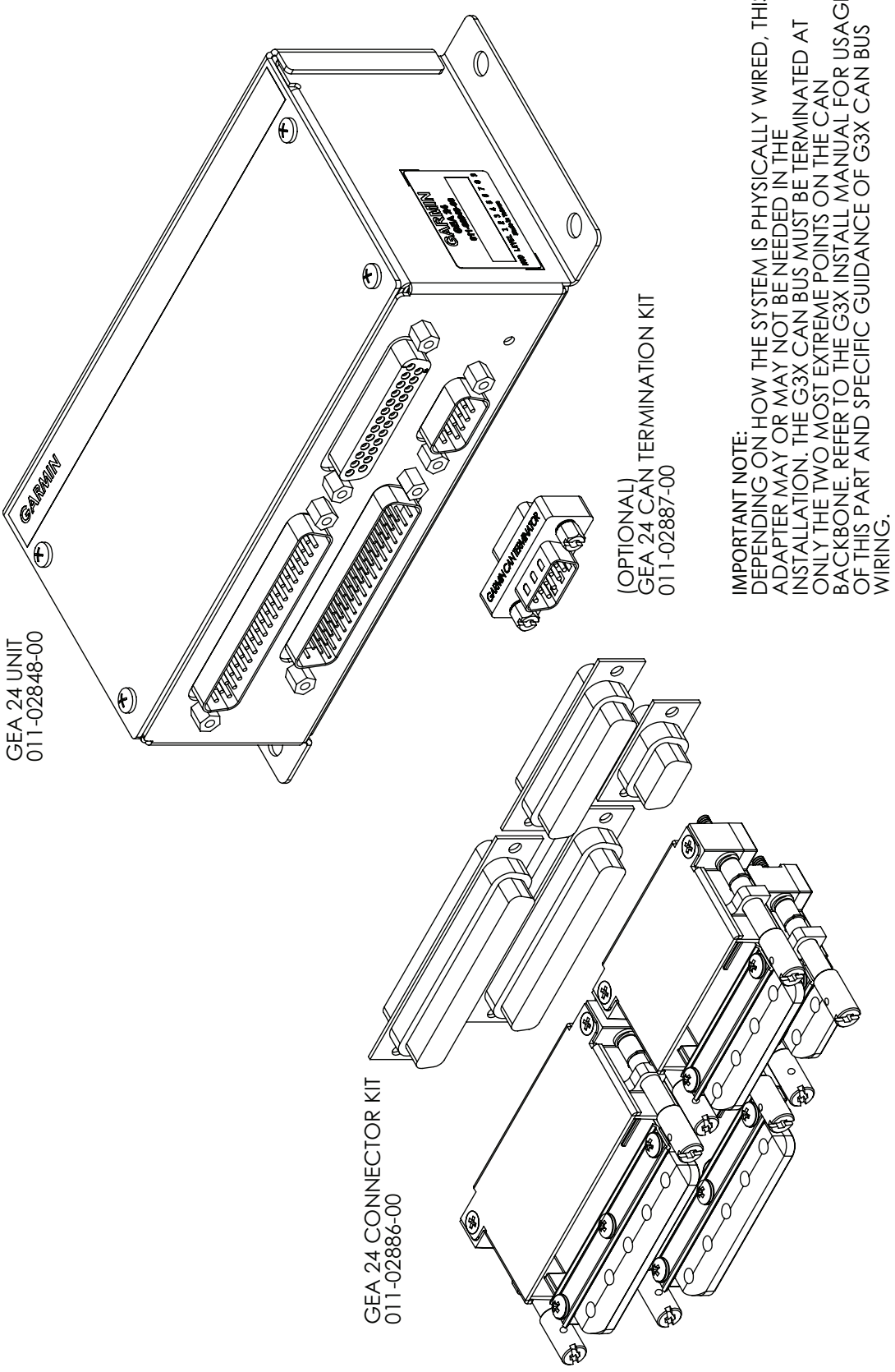


Figure 8-4 GEA 24 Assembly Drawing (with CAN terminator)

9 GHA 15 HEIGHT ADVISOR INSTALLATION

This section contains information for the GHA 15 Height Advisor. Use this section to install the GHA 15.

9.1 Equipment Description

The GHA 15 Height Advisor uses radar to provide above ground level (AGL) sensor readings up to a maximum of 500 ft and is designed for aircraft flying up to 25,000 ft. The GHA 15 output provides AGL data and configurable audio callouts for reference only. The GHA 15 does not satisfy aircraft radar altimeter requirements.

The GHA 15 features low-power FMCW operation, operation from ground to 500 ft AGL Max., accuracy of +/- 1.5 ft (3 – 100 ft AGL), +/- 2% (>100 – 500 ft AGL), CAN interface for convenient unit configuration, calibration and software updates, in addition to a standard USB high speed interface for diagnostics purposes.

NOTE

It is recommended to install a USB harness to provision the installation for access to diagnostic information, see Section 24.6.4 for more information.

9.2 Equipment Available

Table 9-1 GHA 15 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GHA 15	010-02463-00	011-05259-50
GHA 15*, Standard	010-02942-00	011-05259-50

*Includes connector kit (011-05278-00) and install kit (011-06097-00)

9.2.1 Accessories

Table 9-2 Available Accessories

Item	Garmin P/N	Quantity
GHA 15 USB-B Pigtail*	011-01782-00	1
GHA 15 Connector Kit	011-05278-00	1
GHA 15 Install Kit	011-06097-00	1

*USB connection is optional for diagnostics and troubleshooting while aircraft is on ground. Contact Garmin for additional guidance.

Table 9-3 Contents of GHA 15 Connector Kit (011-05278-00)

Item	Garmin P/N	Quantity
Conn,Circ, Plug, D38999/26, Ins 13- 35, Alum,Crimp, Key A	330-01288-01	1
Conn Seal Plug, MS27488-22	330-90013-01	20
Backshell, Circular, Strain Relief, AS85049/126, RA, Size 13	330-90049-03	1

Table 9-4 Contents of GHA 15 Install Kit (011-06097-00)

Item	Garmin P/N	Quantity
Screw, 10-32x1.00, PHP, SS/P	211-60212-20	4
O-Ring, MS28775-134, Nitrile, Hydraulic Resistant	251-00011-00	1

9.2.2 Accessories not Supplied

The installation accessories listed in Table 9-5 are required but not provided:

Table 9-5 Additional Equipment Required

Item	Specification
Circuit Breakers (1 per installation)	1 amp aircraft circuit breakers are recommended for 28 VDC operation.

9.3 General Specifications

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

9.4 Mounting Requirements

NOTE

Stated performance specifications for the GHA 15 can only be achieved when the system is installed in accordance with all the guidelines stipulated in this section and with all other instructions given in this Installation Manual.

WARNING

This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

The installer will need to find the best mounting location and surface. Outline and Installation drawing Figure 9-1 defines the hole pattern for mounting. This hole pattern is the same as the standard antenna mounting pattern for most modern radar altimeters.

1. Location on Aircraft: The GHA 15 must be mounted on a surface on the bottom of the aircraft near the center point of pitch and roll rotation (this reduces the effect of momentary pitch and roll altitude offsets/inaccuracies during approach and landing or while maneuvering the aircraft).
2. Angle of Antenna to Ground: The GHA 15 must be mounted so the surface of the GHA 15 is within +/- 6° of horizontal during level flight. If the adapter plates are manufactured to make sure this angle is met, the adapters must not recess the unit surface within the skin of the aircraft. The adapters must only extrude the GHA 15 surface outside the skin of the aircraft.
3. Mounting Surface: The GHA 15 may be mounted on non-metallic surfaces or on a continuous metallic surface.
4. Minimum Height: The minimum unit height possible above ground while parked, taxiing, or at aircraft touchdown is 20 inches for any aircraft.
5. Antenna Clearance Cones: The location chosen for the GHA 15 must be free of aircraft projections (landing gear, flaps, drainage vents, etc.…) within a 120° cone from the GHA 15 downward to prevent locking onto false altitude returns. Consider all possible modes of aircraft operation when establishing compliance with this guideline (e.g. – landing gear distances while in transition, flap distances while fully extended, etc., see also Section 31.4.35).
6. Distance to Other Antennas: It is encouraged to maximize GHA 15 separation from other antennas aboard the aircraft when possible while meeting remaining guidelines in this section. See also Section D.6.2 for further information.

9.4.1 Mounting/Doubler Plate

The installation of a doubler is essential to maintain structural integrity of the antenna installation. Some aircraft may have existing provisions for a doubler (permanently attached to the skin) or backing plate (removable). If the aircraft is not equipped with mounting provisions, refer to AC 43.13-2B for guidance on manufacturing and installing doublers.

9.4.2 Grounding

Grounding of the GHA 15 is necessary for equipment operation.

NOTE

Good electrical bonding is important.

9.5 Unit Installation

Refer to AC 43.13-2B, Chapter 3 for general guidance on external antenna installation.

1. Refer to Section 9.6 for the appropriate mounting cutout. Drill or punch the mounting holes as necessary.
2. Install a doubler plate to reinforce the aircraft skin, as necessary.
3. Secure the O-ring in the O-ring groove on the underside of the unit.
4. Place unit over mounting holes, using the four screw holes to align the unit. Insert the supplied four screws.
5. Washers and locking nuts (not provided, may be part of doubler plate) are required to secure the unit using the supplied screws (or equivalent). Torque should be evenly applied across all mounting screws to avoid deformation of the mounting area. Do not over tighten screws.

Table 9-6 Mounting Specifications

Antenna	Mounting Screws	Torque Specifications
GHA 15	10-32 Stainless Steel	25-30 inch-pounds

6. Make sure the unit is electrically bonded. Good electrical bonding is important for operation.
7. Seal the unit to the fuselage using a good quality electrical grade sealant. Run a bead of the sealant along the edge of the unit where it meets the exterior aircraft skin. Use caution to make sure the unit connector is 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.

9.6 Outline and Installation Drawings

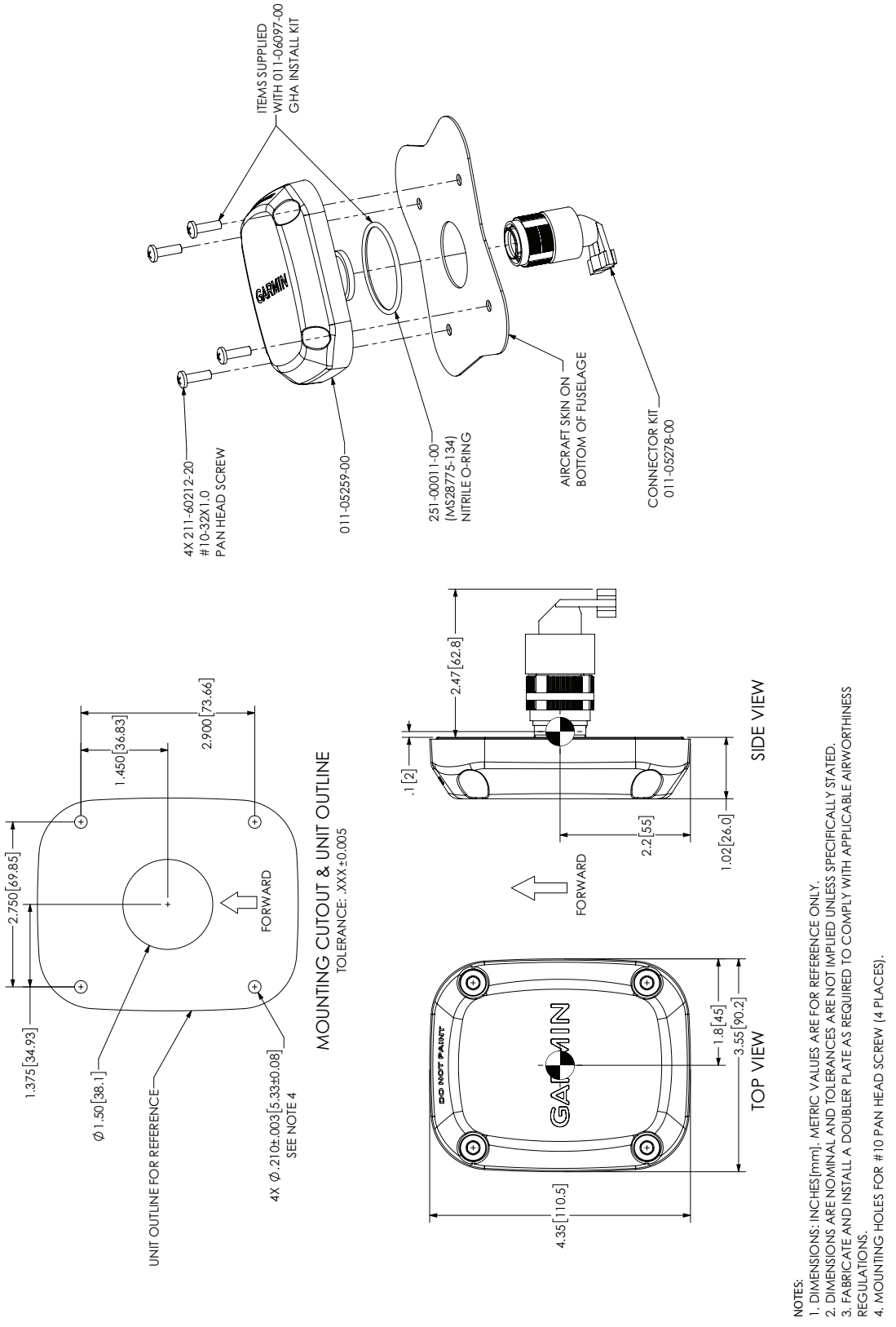


Figure 9-1 GHA 15 Outline Drawing

10 GI 260 (AOA INDICATOR) INSTALLATION

This section contains general information as well as installation information for the GI 260. Use this section to mount the GI 260 unit.



Figure 10-1 GI 260 Unit View

10.1 Equipment Description

The GI 260 is a remote mount Angle of Attack (AOA) indication. The GI 260 has a pigtail harness for network communication and power connections.

10.2 Equipment Available

10.2.1 Required Equipment

Table 10-1 GI 260 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GI 260	010-01287-00	011-03458-00

10.2.2 Additional Equipment Required

The GI 260 Socket Mount (011-03562-00) is included with the unit. The Socket Mount is secured using (3) #6-32 100º flat head screws be supplied by the installer.

10.3 General Specifications

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

10.4 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GI 260. Refer to Section 2.3 for wiring considerations, and to Section 24.6 for pinouts.

1. Select a mounting location where the GI 260 is easily visible, but does not impede the pilot's field of view, typically the glareshield.
2. If needed, make a hole in the glareshield to run the pigtail harness through.
3. Secure the Socket Mount to a suitable mounting location (glareshield) using (3) #6-32 100º flat head screws.
4. Insert the GI 260 into the Socket Mount, adjust for best viewing angle.
5. Make connections (Figure 25-1.6) to the pigtail harness by either splicing wires or adding a D-sub connector to the end of the pigtail (after it has run through glareshield or mounting surface) and connect to another D-sub connector on harness.
6. Shields should be continued through any splices by grounding your shield to the spare shield ground drain wires.
7. If applicable, assemble the connector backshells and connect backshell connectors.

10.5 Unit Calibration

An in-flight AOA calibration is required for GI 260 installations, see Appendix H.4.6.1 and Appendix H.4.6.2 (for GDU™ 37X display installations) or Section 31.4.9.1 and Section 31.4.9.2 (for GDU 4XX installations). For GDU 4XX installations, AOA calibration can be completed twice to compensate for flap position.

10.6 Unit Operation

See Figure 10-2 for AOA display descriptions.

The GI 260 has two buttons below the display labeled as TEST and MUTE. When the TEST button is pressed, the GI 260 performs a self test. During the self test, all indicators on the display will be illuminated to signal the unit passes the test. The red chevrons on the display will flash on and off to indicate a failure. Releasing the TEST button restores normal operation.

Pressing the MUTE button mutes any currently playing audio. The audio will then remain muted until any Stall Warning (red) or Caution Alert (yellow) conditions have returned to a Minimum Visible (green) condition. The mute operation is then reset, and audio is unmuted.

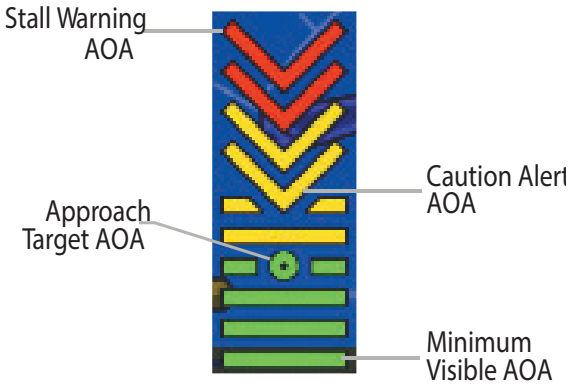


Figure 10-2 GI 260 Display

10.7 Outline and Installation Drawings

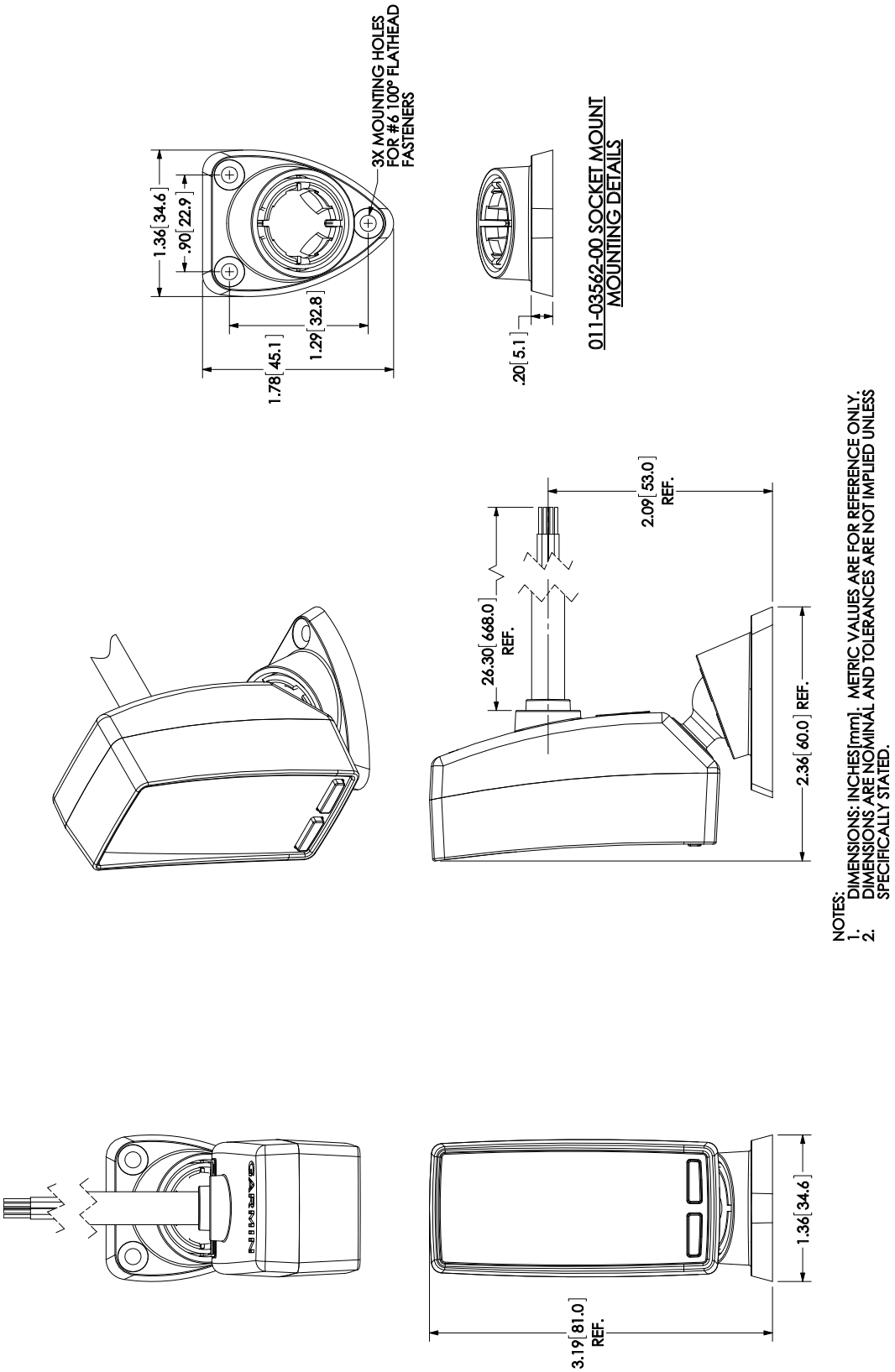


Figure 10-3 GI 260 Outline/Assembly Drawing

11 GMC 305 (AFCS MODE CONTROLLER) INSTALLATION

NOTE

References to the GMC Mode Controller throughout this manual apply equally to the GMC 305, GMC 307, and GMC 507 except where specifically noted.

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

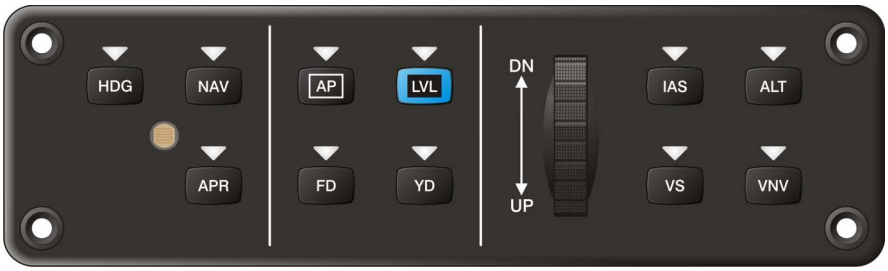


Figure 11-1 GMC 305 Unit View (-20 version shown, -00 version has no YD button)

11.1 Equipment Description

The GMC 305 is a Garmin Automatic Flight Control System (AFCS) Mode Controller that can be used in a G3X™ avionics installation. The GMC 305 provides a 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.

11.2 Equipment Available

11.2.1 Required Equipment

Table 11-1 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

11.2.2 Additional Equipment Required

The following accessories are not provided with the GMC 305 unit. The Installation Kit (Table 11-2) is required to install the unit. The Installation Kit includes the Connector Kit (Table 11-3) and the Mounting Kit (Table 11-4).

Table 11-2 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 11-3 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 11-4 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

11.3 General Specifications

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

11.4 Mounting and Wiring Requirements

11.4.1 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.

11.4.2 Panel Cutout Template

Figure 11-5 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 11-4 for complete cutout dimensions. A .dxf version of the drawing is also available for download at https://support.garmin.com/support/manuals.

11.4.3 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GMC 305. Refer to Section 2.3 for wiring considerations, and to Section 24.6 for pinouts.

1. Drill holes in panel to locate nut plates and LRU (see Figure 11-5, Figure 11-3, and Figure 11-4).
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).

CAUTION

To remove the GMC from the instrument panel, turn each of the two pawl latches counterclockwise. After initially breaking the pawl latch loose, continue to loosen while not exceeding 15 in-lbs of torque.

11.4.4 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 25-1.7). Backup power is optional.

The GMC 305 is connected through RS-232 to any GDU™ 37X/4XX display (Figure 25-1.7). 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 25-1.7). 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/4XX 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 25-2.24.

11.5 Outline and Installation Drawings

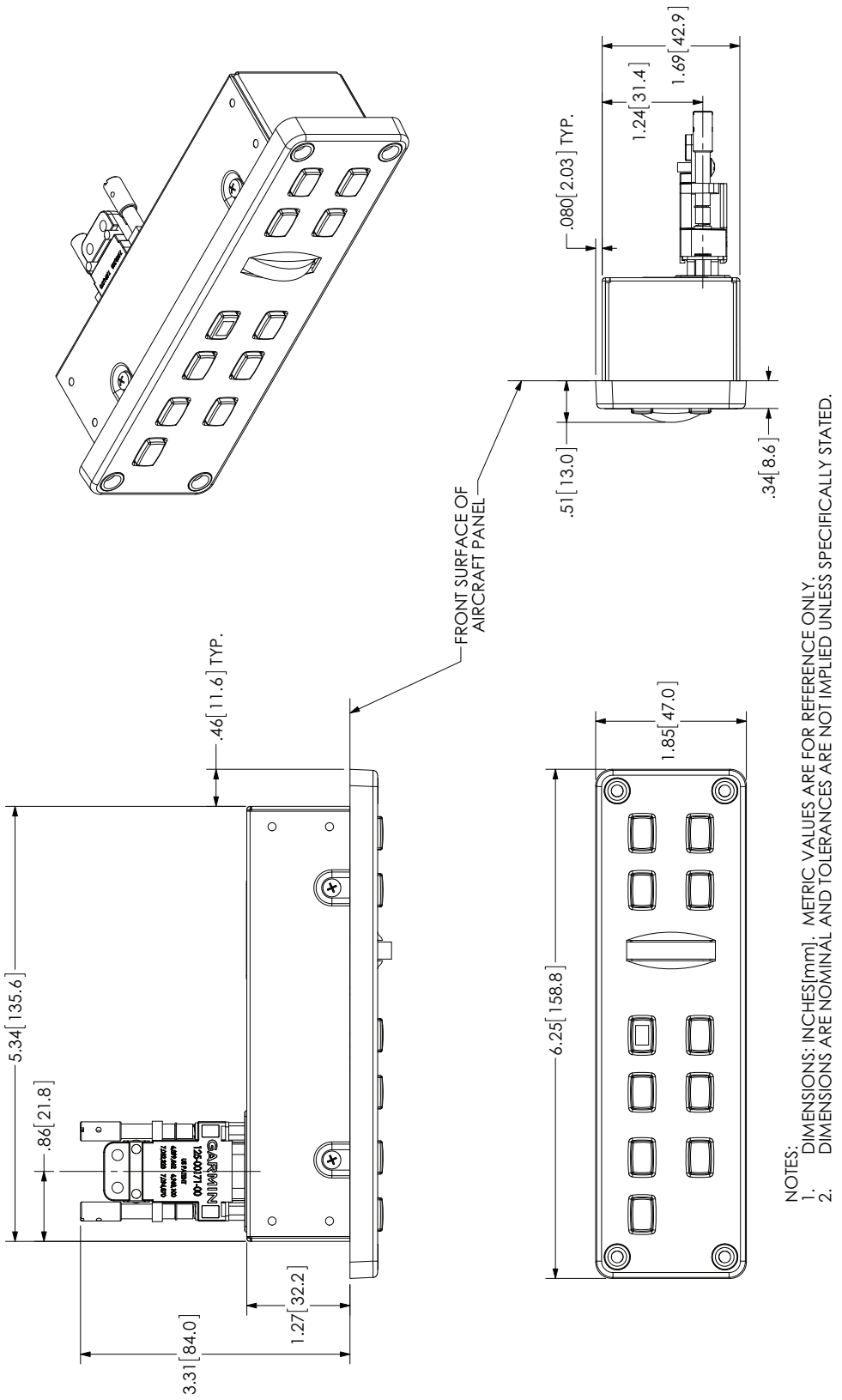


Figure 11-2 GMC 305 Outline Drawing

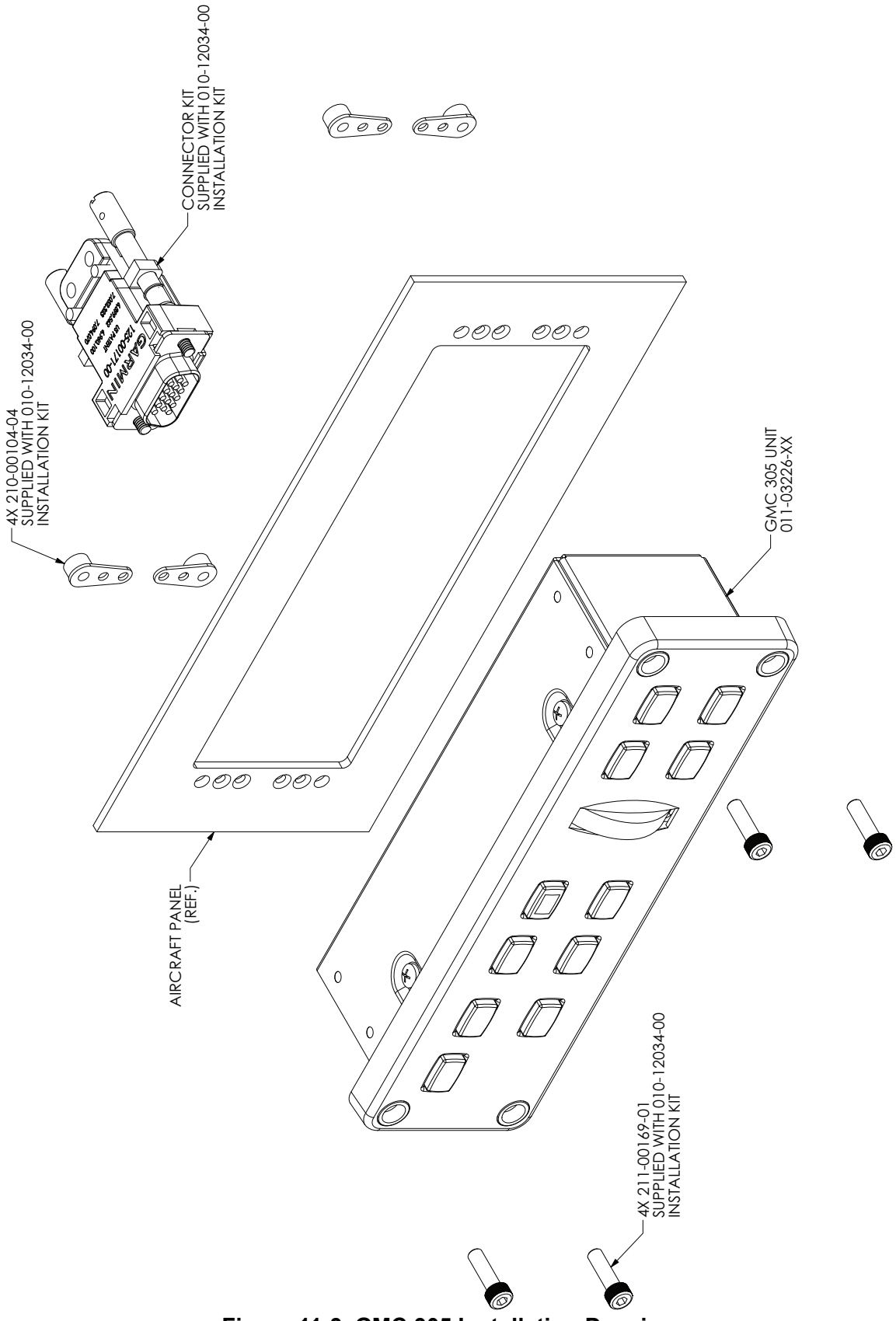


Figure 11-3 GMC 305 Installation Drawing

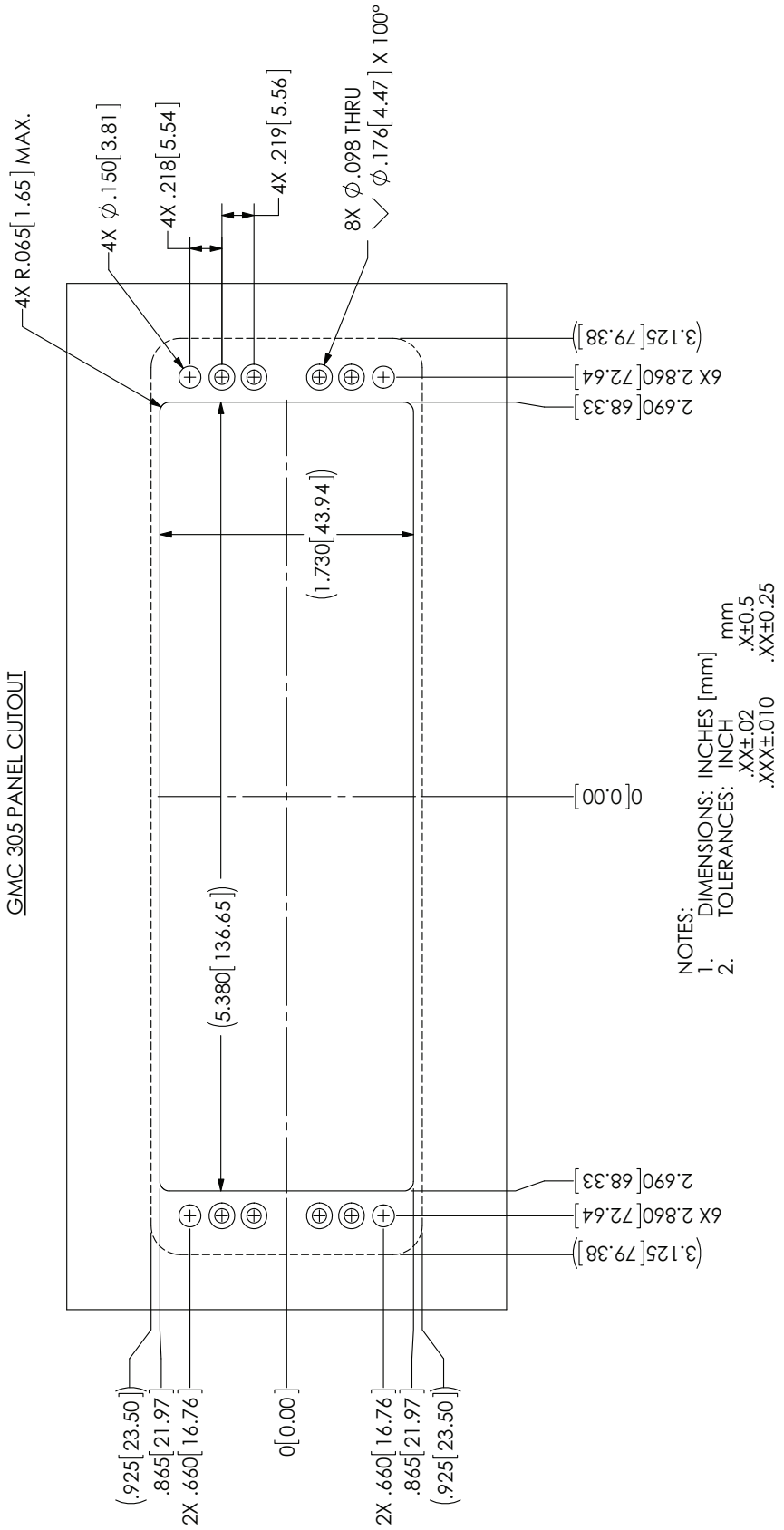
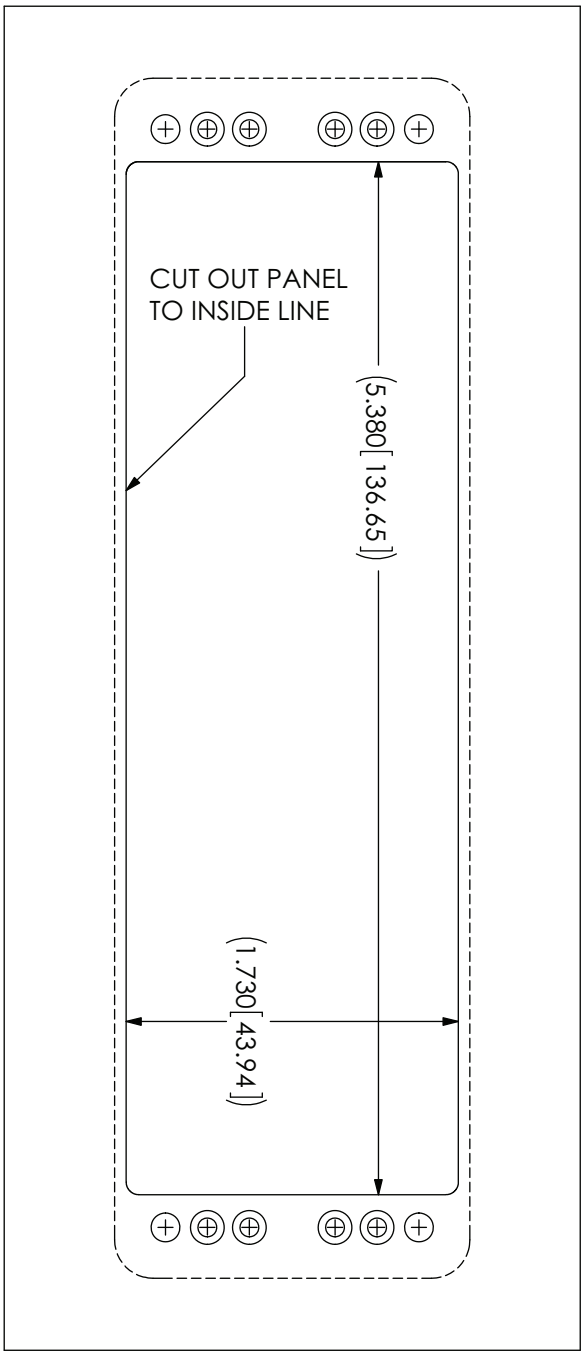


Figure 11-4 GMC 305 Cutout Drawing (Not to Scale)

GMC 305 PANEL CUTOUT

IMPORTANT!
Make sure 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 11-5 GMC 305 Panel Cutout Template

12 GMC 307 (AFCS MODE CONTROLLER) INSTALLATION

NOTE

References to the GMC Mode Controller throughout this manual apply equally to the GMC 305, GMC 307, and GMC 507 except where specifically noted.

This section contains general information as well as installation information for the GMC 307. Use this section to mount the GMC 307 unit.



Figure 12-1 GMC 307 Unit View (-00 version shown, -20 version has no YD button)

12.1 Equipment Description

The GMC 307 is a Garmin Automatic Flight Control System (AFCS) Mode Controller that can be used in a G3X™ avionics installation. The GMC 307 provides a user interface for the autopilot function of the G3X system. The GMC 307 mounts flush to the aircraft instrument panel using two pawl latches.

12.2 Equipment Available

12.2.1 Required Equipment

Table 12-1 GMC 307 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GMC 307 w/Yaw Damper	010-01595-00	011-03993-00
GMC 307 no Yaw Damper	010-01595-20	011-03993-20

12.2.2 Additional Equipment Required

The following accessories are not provided with the GMC 307 unit. The Installation Kit (Table 12-2) is required to install the unit.

Table 12-2 Contents of GMC 307 Installation Kit (010-12421-00)

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

Table 12-3 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

12.3 General Specifications

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

12.4 Mounting and Wiring Requirements

12.4.1 Panel Cutout Template

Figure 12-6 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 12-5 for complete cutout dimensions. A .dxf version of the drawing is also available for download at https://support.garmin.com/support/manuals.

12.4.2 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GMC 307. Refer to Section 2.3 for wiring considerations, and to Section 24.6 for pinouts.

1. Per Figure 12-2, make sure the pawl latch fasteners are fully retracted and in the vertical position.
2. Hold the unit flush with the instrument panel.
3. Using a 3/32" hex drive tool turn each of the two pawl latches clockwise until tightened to 20 +/-2 in-lbs. When tightened, the pawl latches are in the horizontal position.

CAUTION

To remove the GMC from the instrument panel, turn each of the two pawl latches counterclockwise. After initially breaking the pawl latch loose, continue to loosen while not exceeding 15 in-lbs of torque.

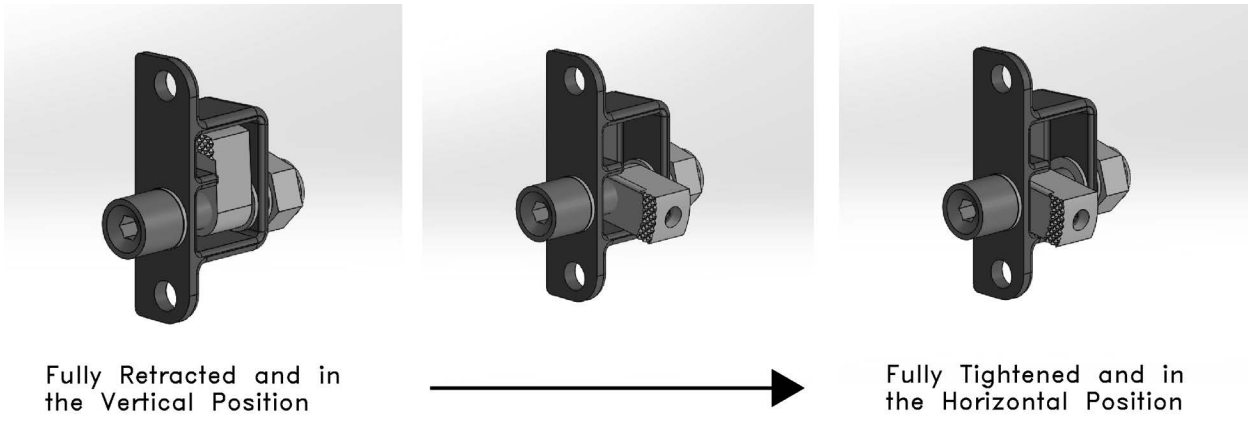


Figure 12-2. Pawl Latch

12.4.3 Wiring

The 15 pin connector, pins, and backshell supplied in the GMC 307 installation kit are used to add wiring for the GMC 307.

It is recommended that a 2 Amp fuse or circuit breaker be used to supply power to the GMC 307 (Figure 25-1.7). Backup power is optional.

The GMC 307 is connected through RS-232 to any GDU™ 37X/4XX display (Figure 25-1.7). 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 307 installation also includes an RS-232 connection to the GSA 28 roll servo (Figure 25-1.7). GMC 307 RS-232 channel 1 must be connected to any one of the available RS-232 channels on one of the GDU 37X/4XX units. The GMC 307 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 307 controller, refer to Figure 25-2.24.

12.5 Outline and Installation Drawings

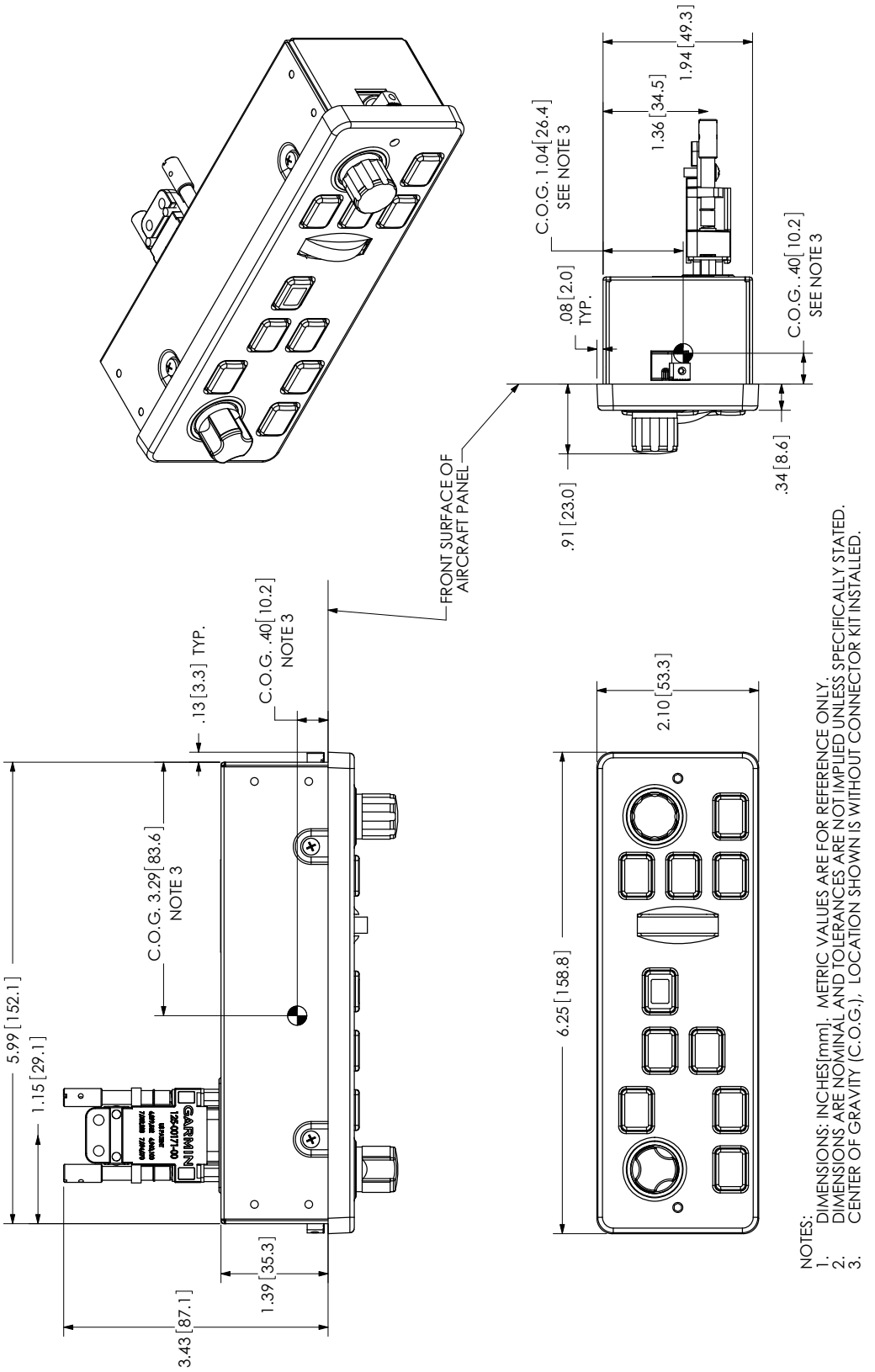


Figure 12-3 GMC 307 Outline Drawing

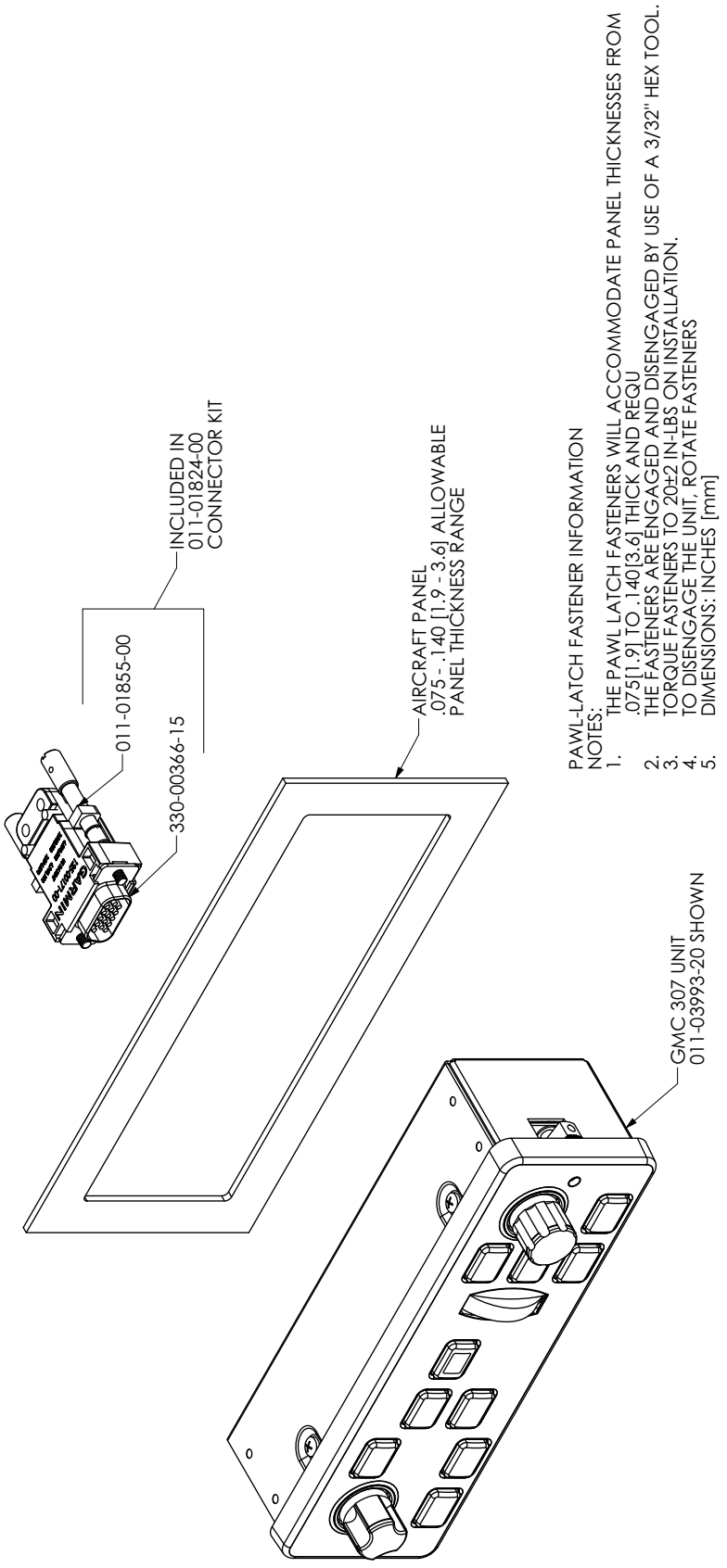


Figure 12-4 GMC 307 Installation Drawing

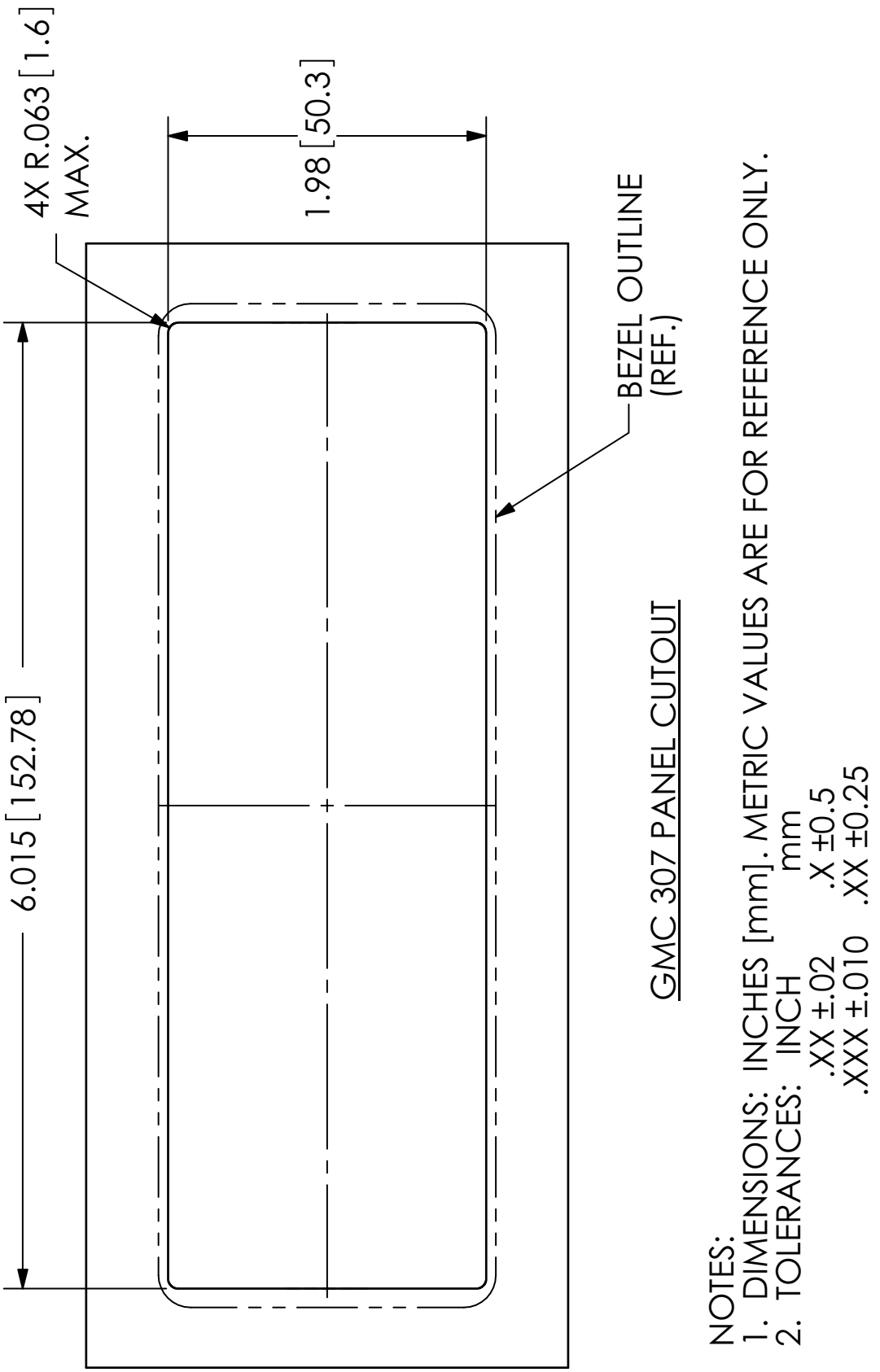
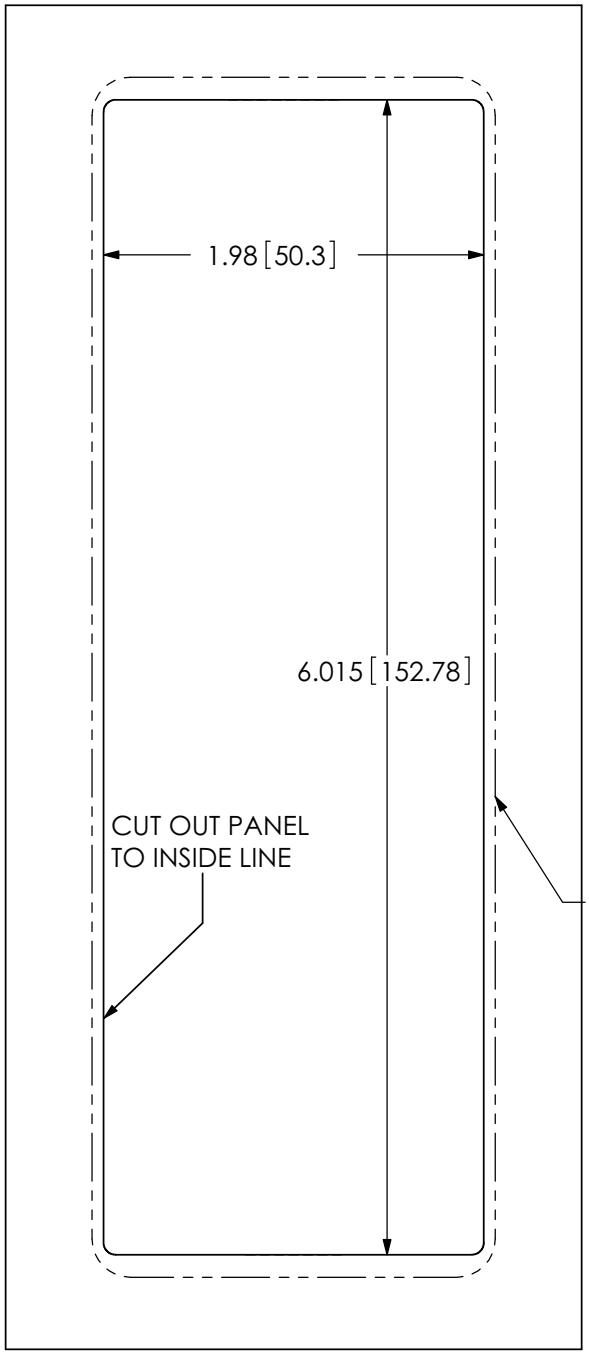


Figure 12-5 GMC 307 Cutout Drawing (Not to Scale)

GMC 307 PANEL CUTOUT



IMPORTANT!
MAKE SURE 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. TOLERANCES: INCH mm
.XX ±.02 .X ±0.5
.XXX ±.010 .XX ±0.25

Figure 12-6 GMC 307 Panel Cutout Template

13 GMC 507 (AFCS MODE CONTROLLER) INSTALLATION

NOTE

References to the GMC Mode Controller throughout this manual apply equally to the GMC 305, GMC 307, and GMC 507 except where specifically noted.

This section contains general information as well as installation information for the optional GMC 507. Use this section to mount the GMC 507 unit.



Figure 13-1 GMC 507 Unit View (-00 version)

13.1 Equipment Description

The GMC 507 is a Garmin Automatic Flight Control System (AFCS) Mode Controller that can be used in a G3X™ avionics installation. Up to two GMC 507 Mode Controllers may be installed. The GMC 507 provides a user interface for the autopilot function of the G3X system. The GMC 507 mounts flush to the aircraft instrument panel using two pawl latches or may be mounted in the radio stack using the optional mounting rack listed in Table 13-3.

13.1.1 Equipment Available

The GMC 507 is available by the part numbers listed in Table 13-1.

Table 13-1 Available LRU Part Numbers

LRU	Assembly Part Number	Unit Only Part Number
GMC 507	010-01946-00	011-04548-00

13.1.2 Additional Equipment Required

The following accessories are not provided with the GMC 507 unit. The Connector Kit (Table 13-2) is required to install the unit.

Table 13-2 Contents of Connector Kit (011-01824-01)

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	15

13.1.3 Optional Equipment

Table 13-3 GMC 507 Installation Rack Kit (010-12700-10)

Item	Garmin P/N	Quantity
GMC 507 Installation Rack	115-02774-00	1

13.2 General Specifications

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

13.3 Mounting and Wiring Requirements

13.3.1 Panel Cutout Template

Figure 13-6 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 13-5 for complete cutout dimensions. A .dxf version of the drawing is also available for download at https://support.garmin.com/support/manuals.

CAUTION

Exercise caution when installing the rack in the instrument panel. Deformation of the rack will make it difficult to install and remove the GMC 507.

NOTE

If the front edges of the installation rack are behind the front surface of the aircraft panel, the GMC 507 pawl latches may not fully engage.

NOTE

The GMC 507 install rack may be used as a template for drilling the mounting holes.

13.3.2 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GMC 507. Refer to Section 2.3 for wiring considerations, and to Section 24.10 for pinouts.

13.3.2.1 Panel Cutout Installation

1. Per Figure 13-2, make sure the pawl latch fasteners are fully retracted and in the vertical position.
2. Insert the unit into the instrument panel cutout so the backside of the bezel rests against the instrument panel. Orient the install rack as shown in Figure 13-8.
3. Using a 3/32" hex drive tool turn each of the two pawl latches clockwise until tightened to 20 +/-2 in-lbs. When tightened, the pawl latches are in the horizontal position (see Figure 13-2).

13.3.2.2 Radio Stack Installation

The GMC 507 Install Rack (115-02774-00) is to be used when installing the GMC 507 unit into a radio stack. Figure 13-9 shows the various radio stack cutout configurations that will accommodate the Install Rack.

1. Make sure the left and right front edges of the install rack are flush with the front surface of the instrument panel.
2. Secure the install rack to a rigid, primary aircraft structure using (qty. 4) #6 100° flat head machine screws as noted in Figure 13-7. The screws are inserted from the inside of the installation rack and may be secured using self-locking hex nuts on the outside.
3. With the pawl latch fasteners retracted, insert the GMC 507 into the Install Rack until the bezel contacts the front edges of the Install Rack.
4. Using a 3/32" hex drive tool turn each of the two pawl latches clockwise until tightened to 20 +/-2 in-lbs. When tightened, the pawl latches are in the horizontal position (see Figure 13-2).

CAUTION

To remove the GMC from the instrument panel, turn each of the two pawl latches counterclockwise. After initially breaking the pawl latch loose, continue to loosen while not exceeding 15 in-lbs of torque.

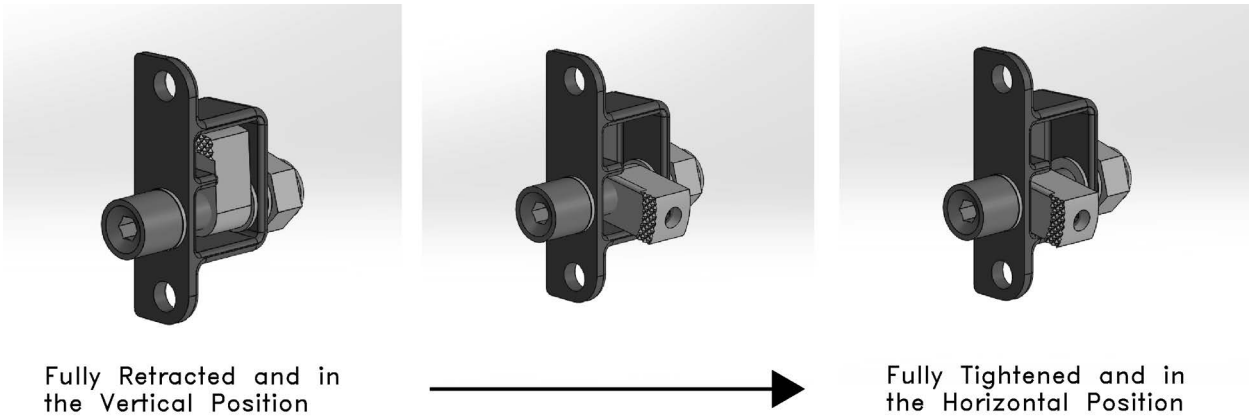


Figure 13-2. Pawl Latch

13.3.3 Wiring

The 15 pin connector, pins, and backshell supplied in the GMC 507 installation kit are used to add wiring for the GMC 507.

See Figure 25-1.8 for example interconnect drawing.

13.4 Outline and Installation Drawings

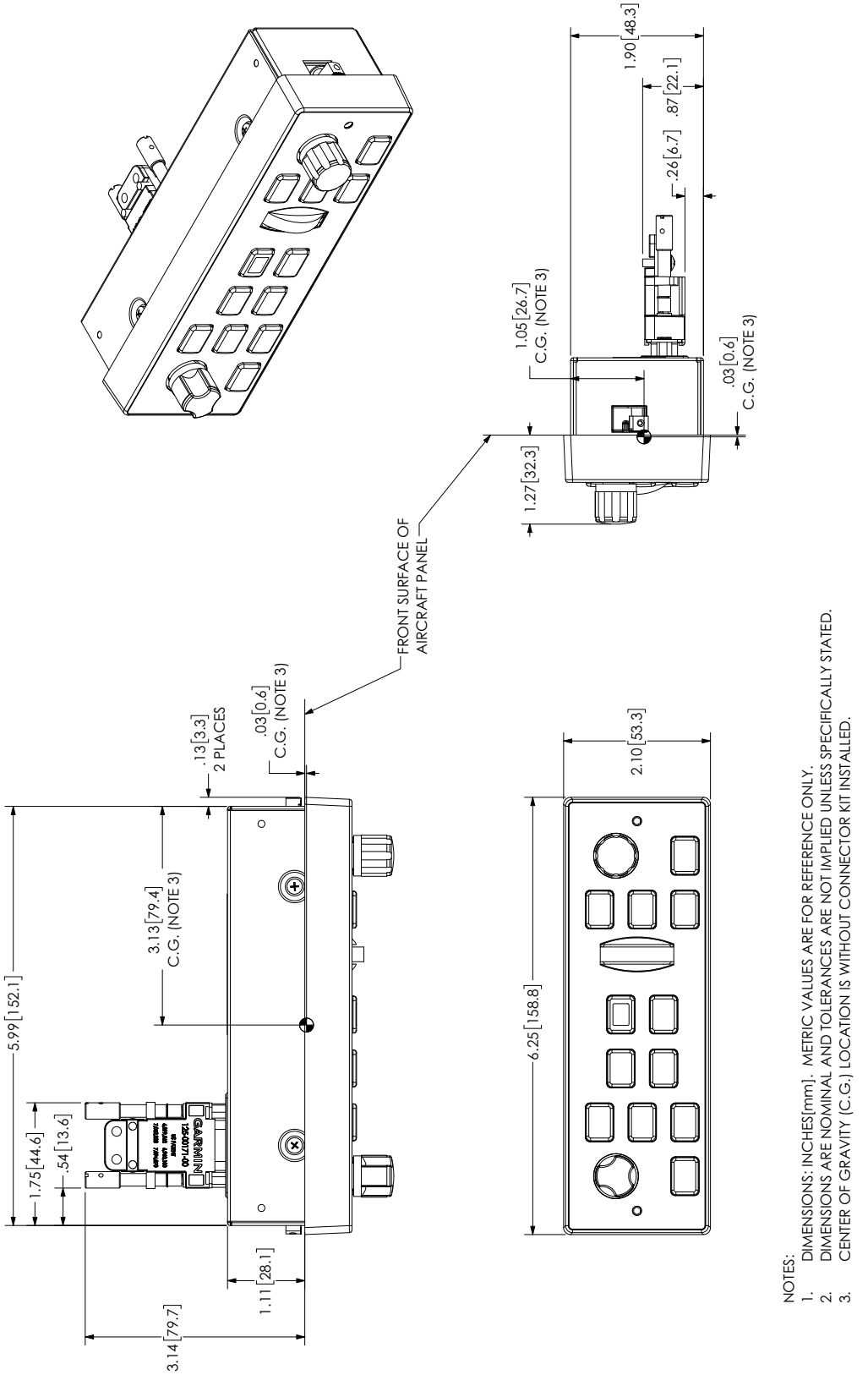


Figure 13-3 GMC 507 Outline Drawing (no installation rack)

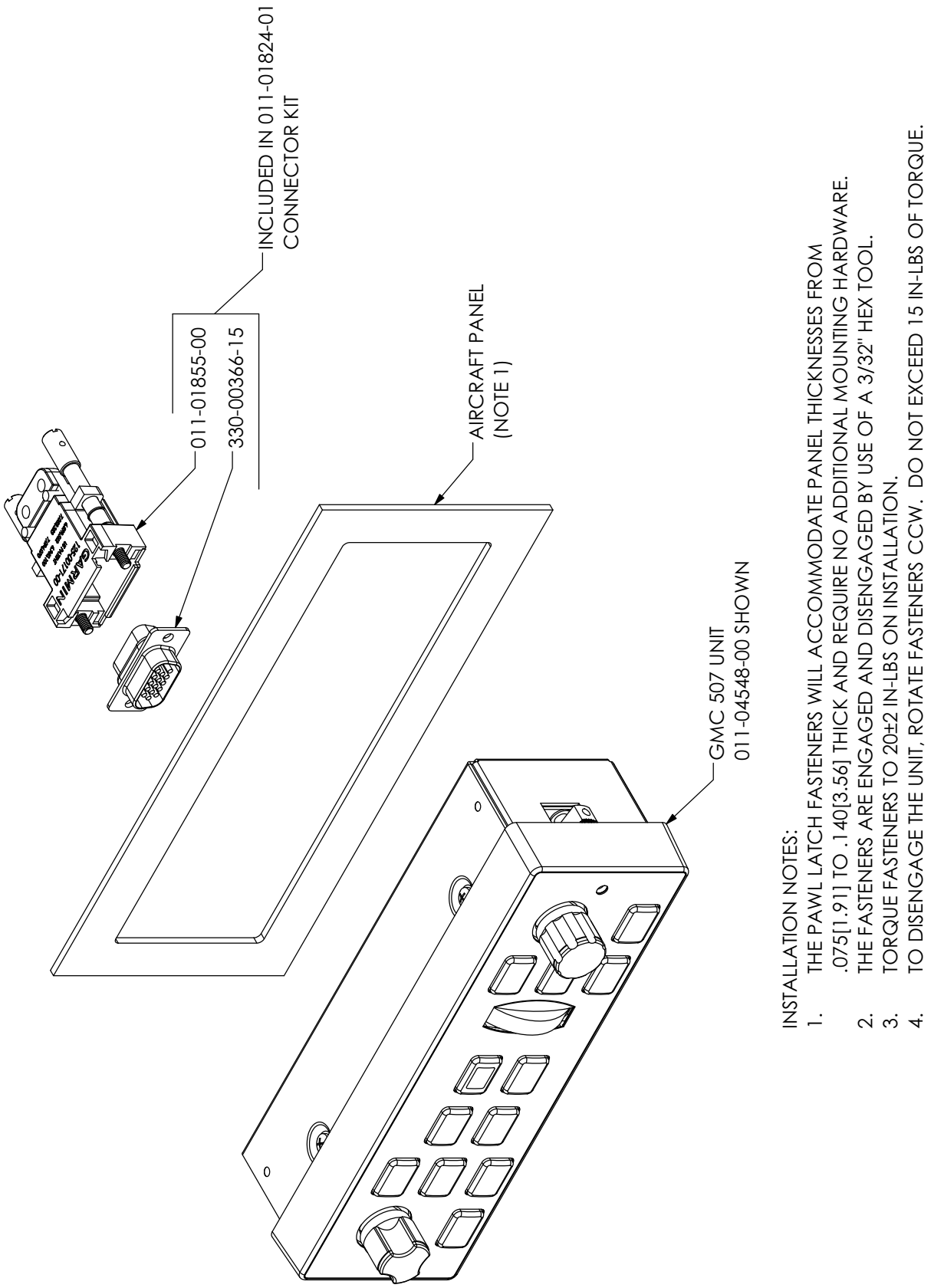


Figure 13-4 GMC 507 Installation Drawing (no installation rack)

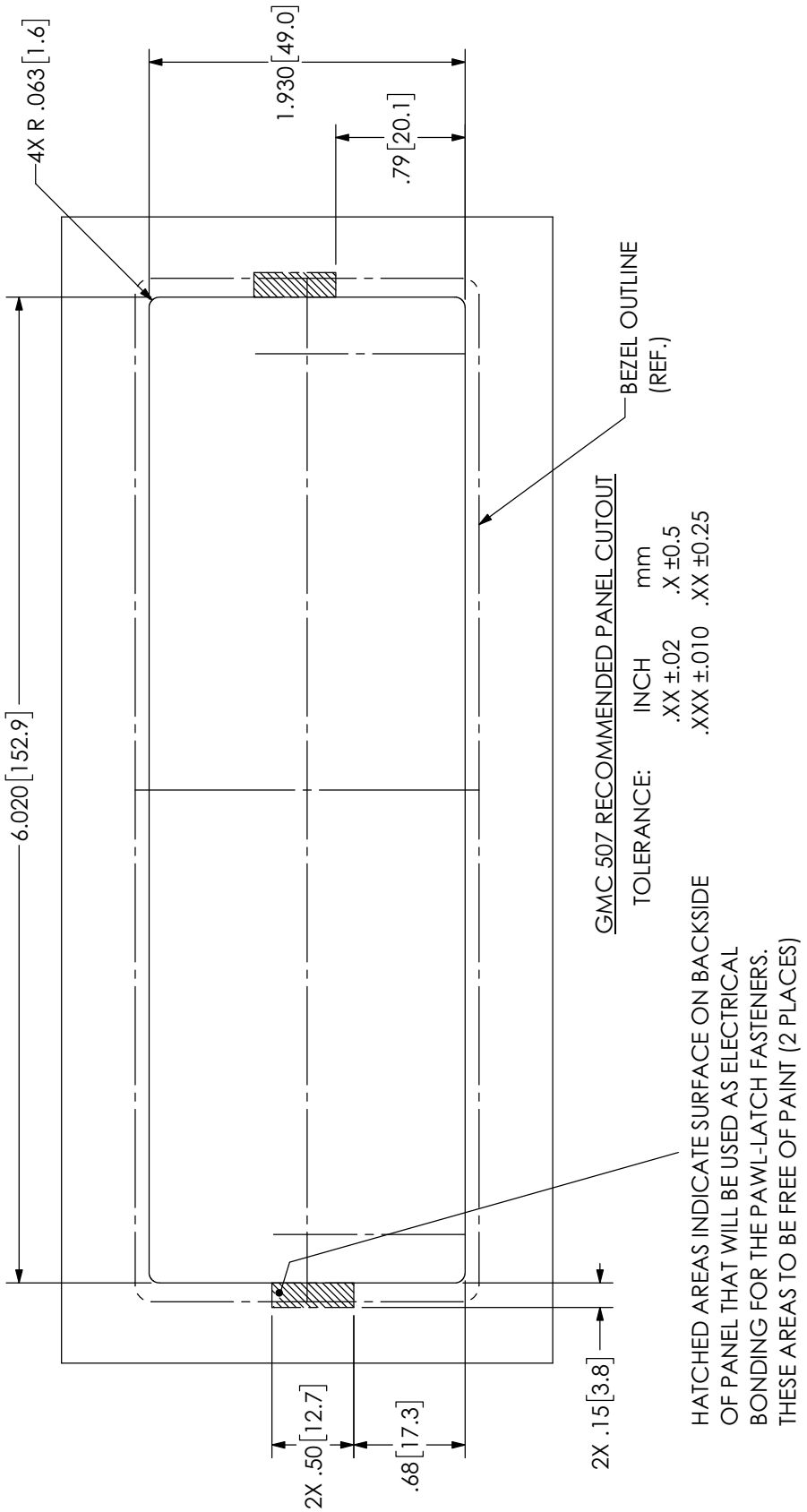
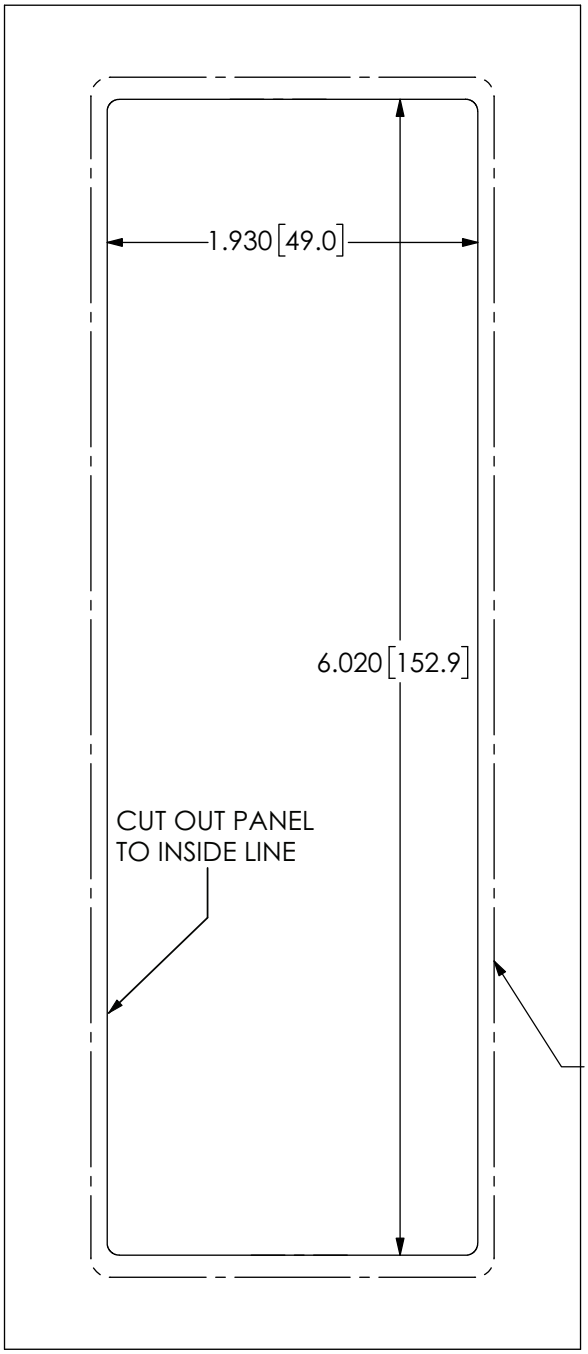


Figure 13-5 GMC 507 Cutout Drawing, No Installation Rack (Not to Scale)

GMC 507 PANEL CUTOUT



IMPORTANT!
MAKE SURE THE PAGE SCALING SETTING IS SET TO NON 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. TOLERANCES: INCH mm
.XX ±.02 .X ±0.5
.XXX ±.010 .XX ±0.25

Figure 13-6 GMC 507 Panel Cutout Template (no installation rack)

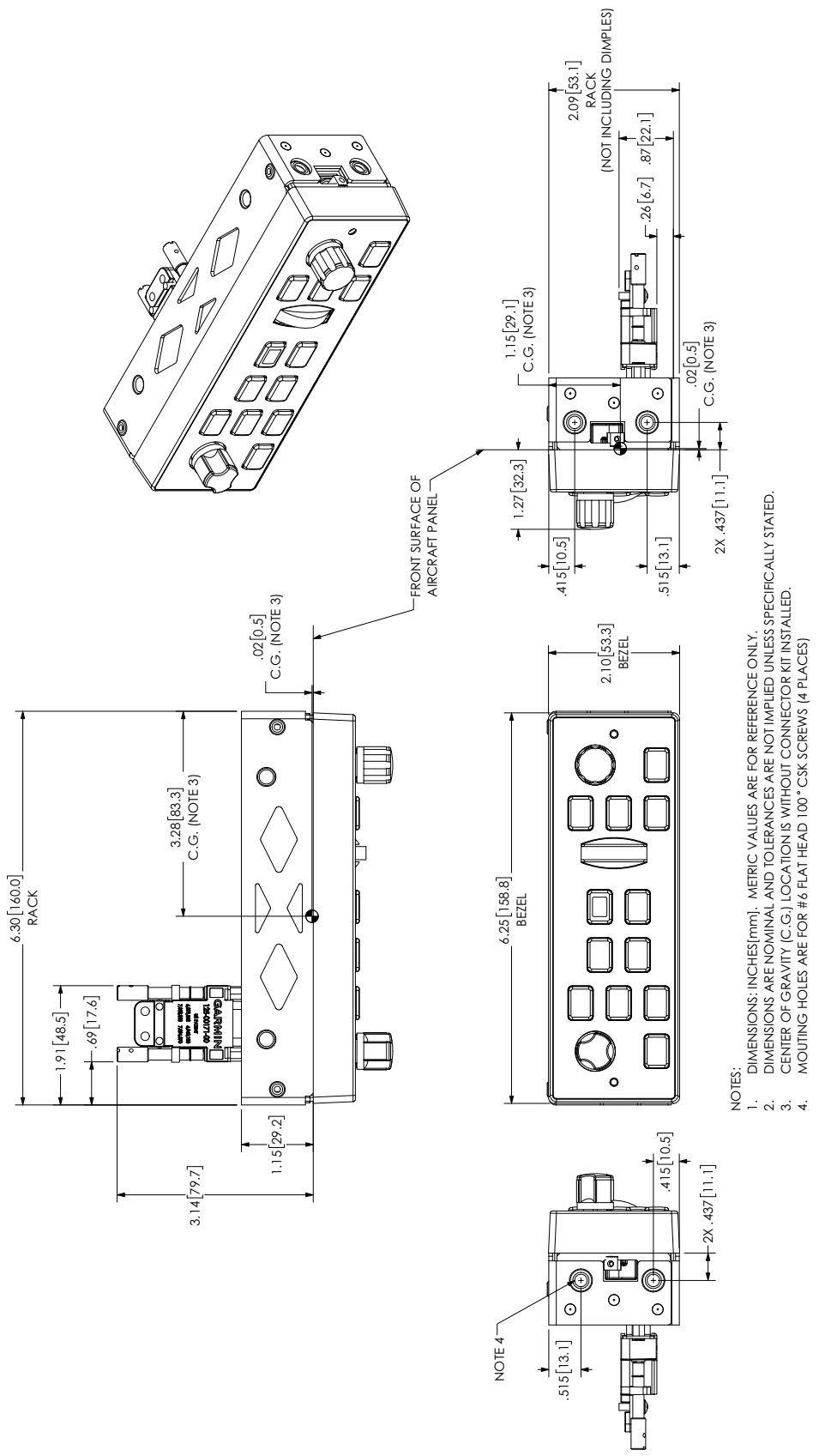


Figure 13-7 GMC 507 Outline Drawing with Installation Rack

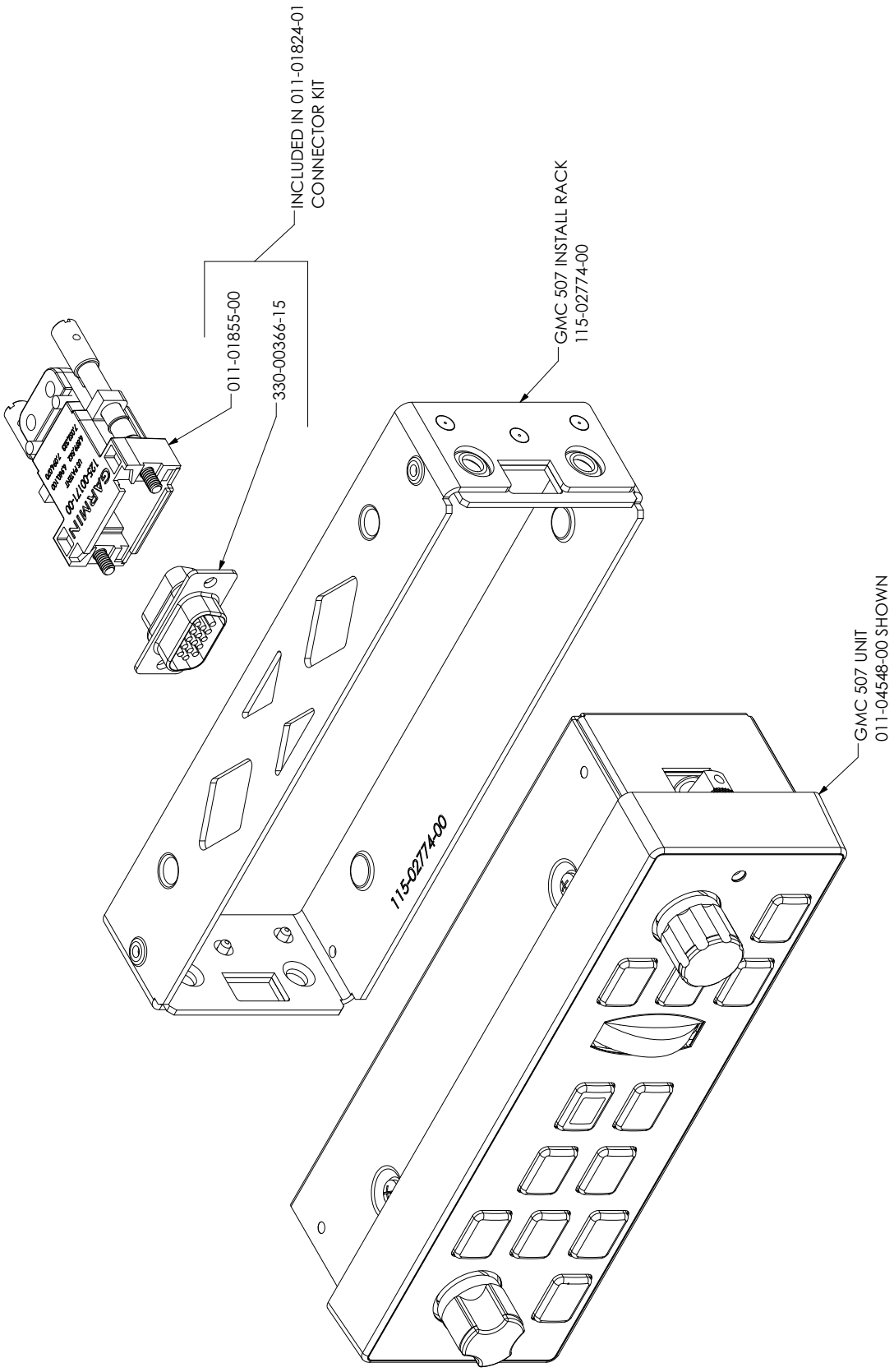


Figure 13-8 GMC 507 Installation Drawing with Installation Rack

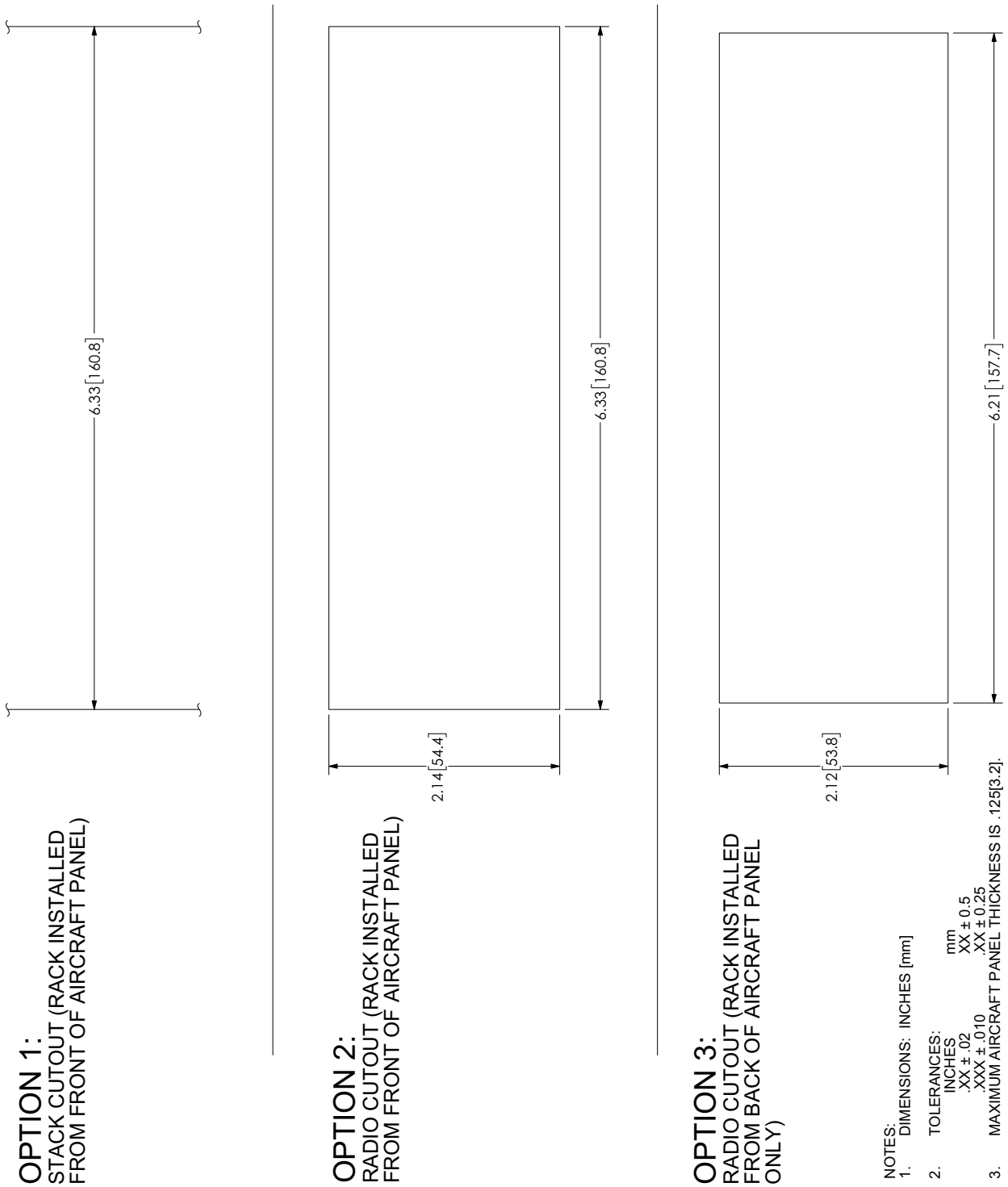


Figure 13-9 GMC 507 Panel Cutout Template for Installation with Installation Rack

14 GMU 11 (MAGNETOMETER) INSTALLATION

This section contains general information as well as installation information for the GMU 11. Use this section to mount the GMU 11 unit.

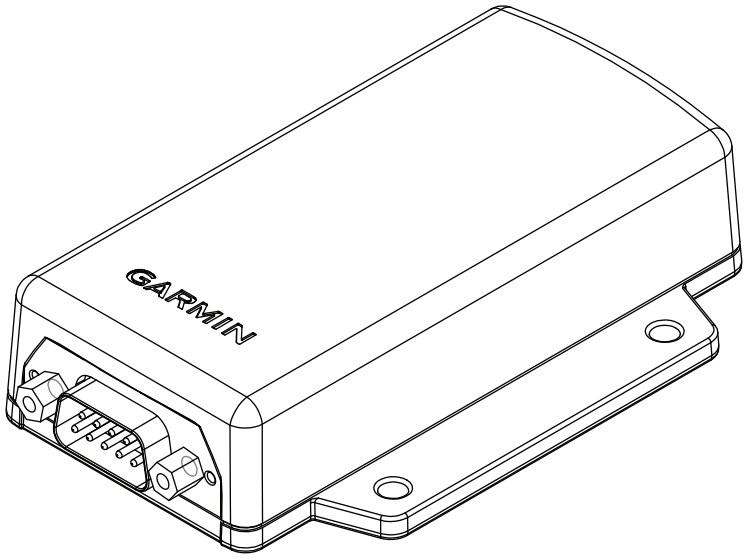


Figure 14-1 GMU 11 Unit View

14.1 Equipment Description

The GMU 11 magnetometer is a remote mounted device that provides magnetometer data to a Garmin GSU 25 ADAHRS. The Garmin ADAHRS and magnetometer replace traditional rotating mass instruments.

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 11 Magnetometer uses magnetic field measurements to create an electronically stabilized AHRS.

The GMU 11 magnetometer provides magnetic information to support the function of the ADAHRS (GSU 25). The supply voltage for the GMU 11 Magnetometer comes from aircraft power (9-32 V 100mA.)

NOTE

The GSU 73 is not compatible with the GMU 11 magnetometer. Installations that include a GSU 73 must also include a GMU 22 connected to the GSU 73.

14.2 General Specifications

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

14.3 Equipment Available

Table 14-1 GMU 11 Part Numbers

Model	Assembly Part Number	Unit Only Part Number	Installation Rack
GMU 11	010-01788-00	011-04349-00	No

Table 14-2 GMU 11 Accessories

Item	Garmin P/N	Quantity
GMU 11, Installation Kit	011-04349-90	1

Table 14-3 Contents of GMU 11 Installation Kit (011-04349-90)

Item	Garmin P/N	Quantity
Connector Kit, 9 Pin, w/CAN Term	011-03002-00	1
Nut, Hex, Nyl Locking, 316SS/P, 6-32	210-10008-08	4
Screw, 6-32x.500, PHP, SS/P	211-60207-12	4
Washer, Flat, SAE, SS, #6	212-00024-06	4

14.4 Unit Installation

The following guidelines describe proper mechanical installation of the Garmin GMU 11 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 11. Refer to Section 2.3 for wiring considerations and to Section 24.9 for pinouts.

The GMU 11 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 11, see the distances from objects or devices that can disturb the magnetic field in Table 14-4 which specifies recommended distances from magnetic disturbances for GMU 11 location.

NOTE

If the requirements listed in Table 14-4 cannot be met, a magnetometer interference test must be performed to make sure of proper operation of the G3X™ avionics system. Refer to the AHRS/Magnetometer Installation Considerations document (190-01051-00) available from the Garmin website (www.garmin.com).

Table 14-4 Recommended Distance from Magnetic Disturbances

Disturbance Source*	Minimum Distance from GMU 11
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 [(should 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 other than another GMU 11 (e.g. installed flux gates, even if not powered)	2 feet (0.6 meter)
Electrical conductors passing less than 100 mA current [(should be twisted shielded pair if within 10 feet (3.0 meters)]	1.3 feet (0.4 meter)

*Disturbance sources listed in table do not apply to a second installed GMU 11

Make sure that any electrical conductor that comes within 10 feet (3.0 meters) of the GMU 11 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 11, 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 11 magnetometer is preferred (unless as noted in Appendix B). Fuselage mounting is less desirable because of numerous potential disturbances that interfere with accurate operation. For installations with dual GMU 11 magnetometers, co-locating the two magnetometers close to each other in the tail or in one wing is recommended as this reduces the likelihood of heading splits or miscompares when operating on the ground in the vicinity of local magnetic anomalies.

Mechanical mounting fixtures for the GMU 11 must be rigidly connected to the aircraft structure. Use of typical aircraft-grade non-magnetic materials and methods for rigid mounting of components is acceptable, so long as adequate measures are taken to provide a stiffened mounting structure.

Level the GMU 11 to within 3.0° of the in-flight level cruise attitude.

Per Figure 14-4, align the GMU 11's forward direction to within 0.5° of the any of the 4 cardinal directions with relation between its connector and the nose of the aircraft. Make sure the bottom of the unit is facing downwards (towards earth) per Figure 14-4.

14.4.1 Consideration for Wing Grounded Lighting Fixtures

The following installation practices are recommended if the GMU 11 is mounted 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 using 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 11.

These installation practices will prevent magnetically interfering currents from flowing in the wing skin that encloses the GMU 11. Electrically isolating the light assembly should not be used as an alternative to the preceding consideration, unless the isolated light assembly has been analyzed for adequate protection against direct attachment of lightning.

Refer to Section 14.5 for outline and installation drawings.

14.4.2 Mounting Instructions

After evaluation of the mounting location has been completed and verifying that requirements are met, install the unit assemblies.

Mount the GMU 11 in its mounting location, 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 11. Do **not** use a screwdriver that contains a magnet when installing or servicing the GMU 11.

Refer to Section 14.5 for outline and installation drawings.

14.5 Outline and Installation Drawings

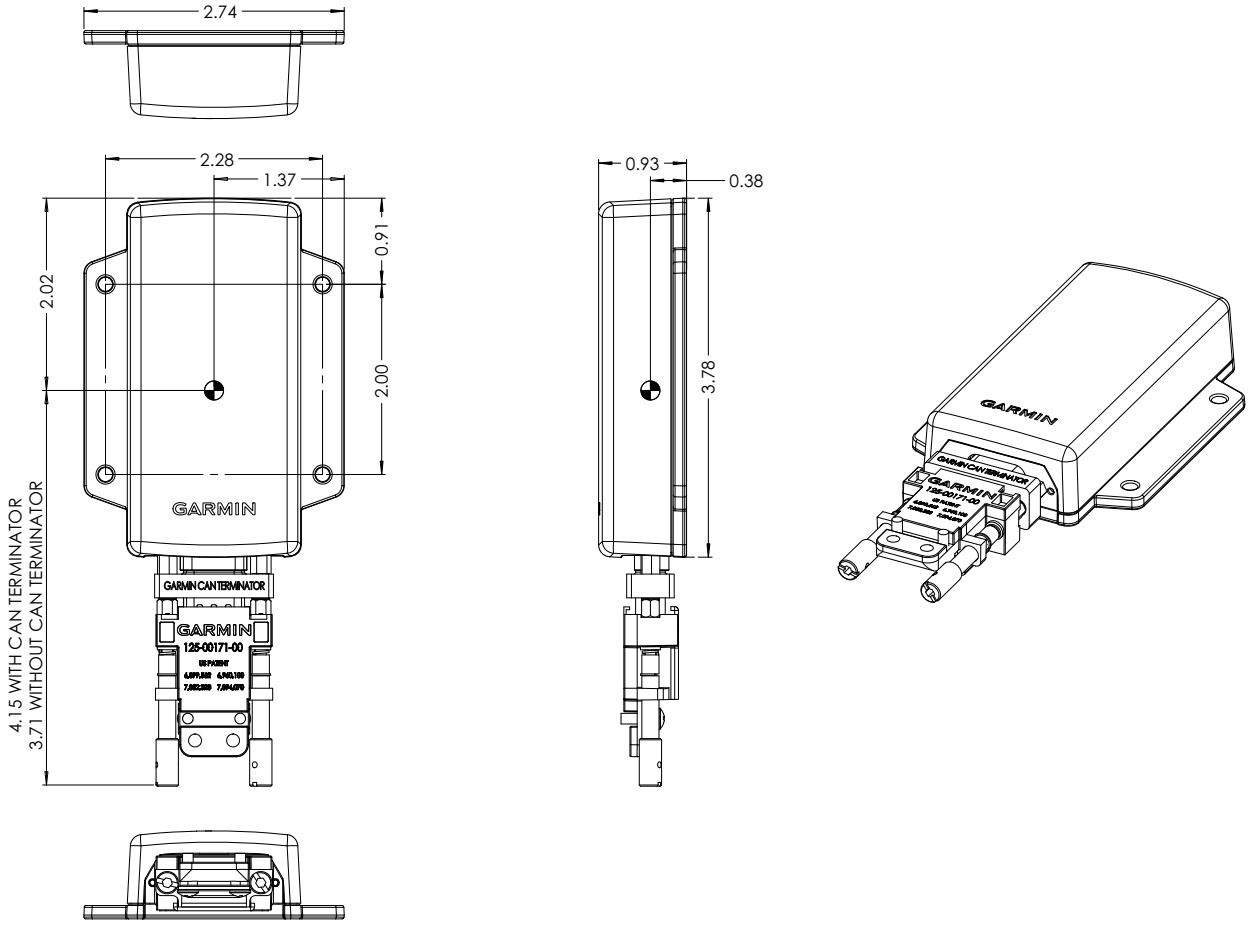


Figure 14-2 GMU 11 Outline Drawing

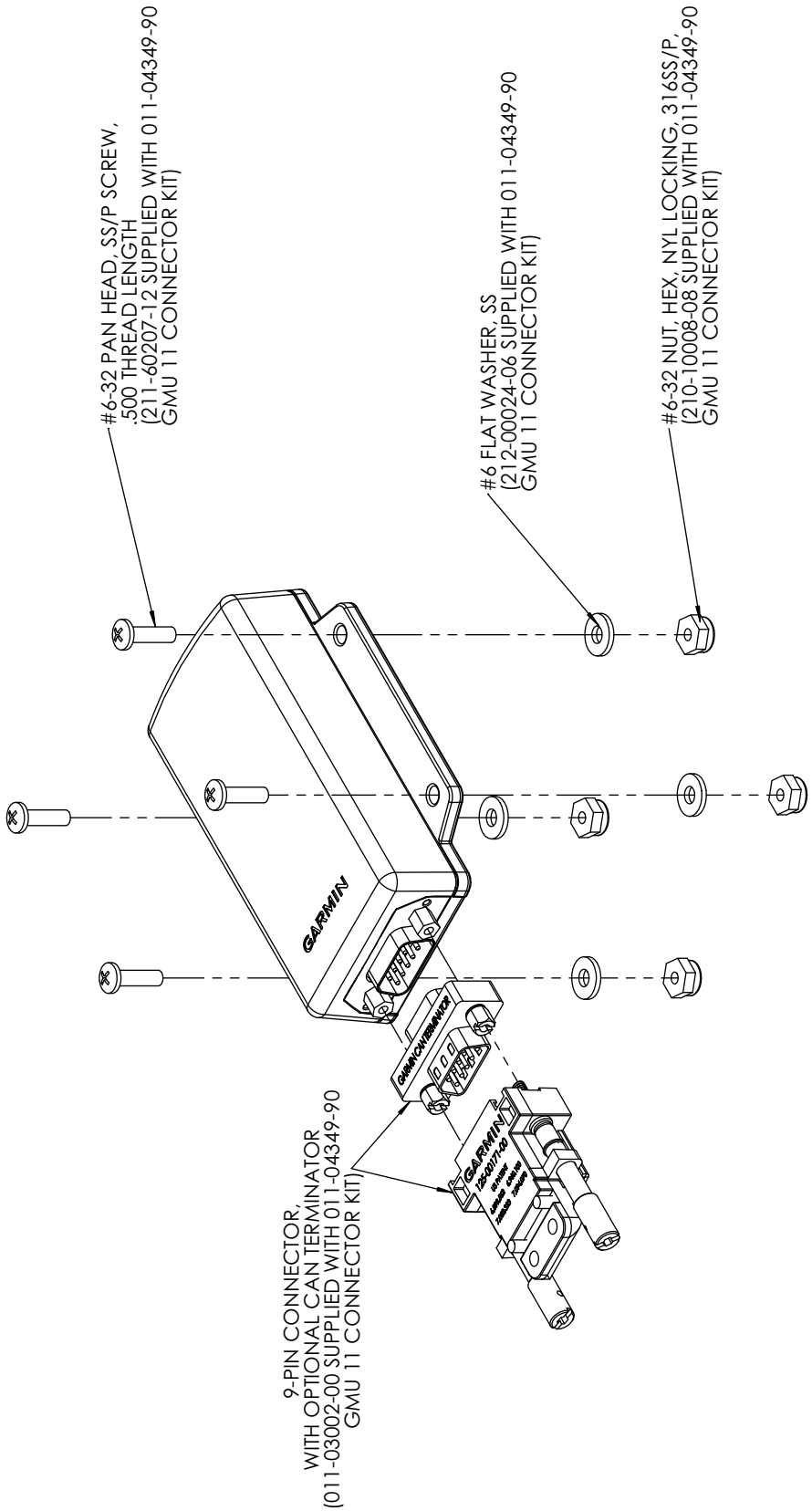


Figure 14-3 GMU 11 Installation Drawing

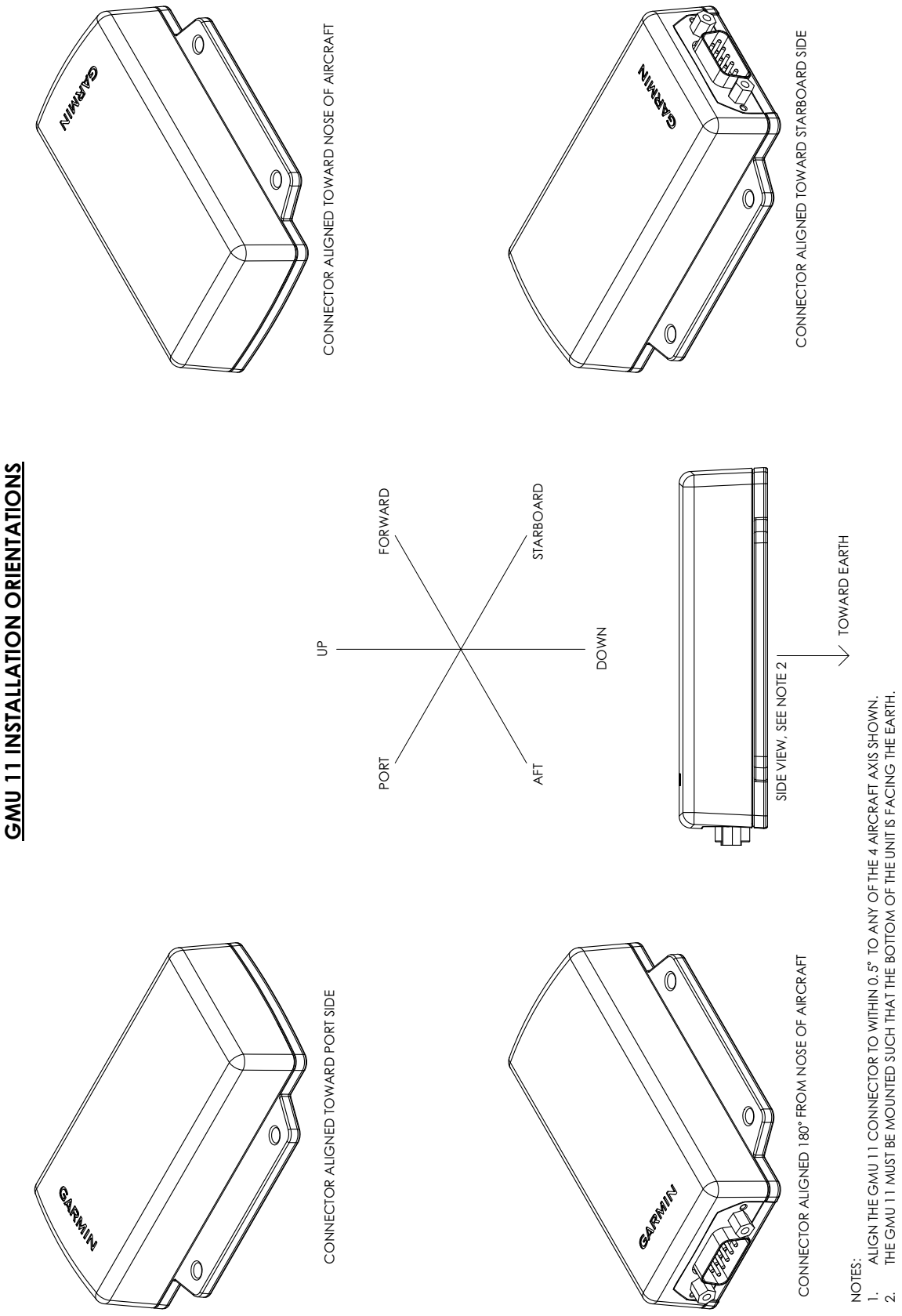


Figure 14-4 GMU 11 Orientation Drawing

15 GMU 22 (MAGNETOMETER) INSTALLATION

NOTE

All GMU 22 information in this Installation Manual also applies to the GMU 44, which had previously been the G3X™ avionics 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 benefit from studying Appendix B, which provides guidance for installing the GMU 22 into specific experimental airframes.



Figure 15-1 GMU 22 Unit View

15.1 Equipment Description

The GMU 22 magnetometer is a remote mounted device that provides magnetometer data to Garmin ADAHRS devices (GSU 25/73). The Garmin ADAHRS and magnetometer replace traditional rotating mass instruments.

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.

15.1.1 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)

15.2 General Specifications

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

15.3 Equipment Available

Table 15-1 GMU 22 Part Numbers

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

Table 15-2 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 15-3 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

15.4 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 24.9 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, see the distances from objects or devices that can disturb the magnetic field listed in Table 15-4 specifies recommended distances from magnetic disturbances for GMU 22 location.

NOTE

If the requirements listed in Table 15-4 cannot be met, a magnetometer interference test must be performed to make sure of 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 15-4 Recommended 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 [(should 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 other than another GMU 22 (e.g. installed flux gates, even if unpowered)	2 feet (0.6 meter)
Electrical conductors passing less than 100 mA current [(should be twisted shielded pair if within 10 feet (3.0 meters)]	1.3 feet (0.4 meter)

*Disturbance sources listed in table do not apply to a second installed GMU 22

Make sure 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 B).

Fuselage mounting is less desirable because of numerous potential disturbances that interfere with accurate operation. For installations with dual GMU 22 magnetometers, co-locating the two magnetometers close to each other in the tail or in one wing is recommended as this reduces the likelihood of heading splits or miscompares when operating on the ground in the vicinity of local magnetic anomalies.

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 provide 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 22 connected will use magnetometer data supplied by other ADAHRS as long as they are both communicating through CAN.

15.4.1 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 using 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 Section 15.5 for outline and installation drawings.

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

Table 15-5 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 15-7.

Table 15-5 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 15-6 lists material in the GMU 22 connector kit and the associated reference number, as shown in Figure 15-7. The GMU 22 magnetometer has an attached pigtail with male polarity. The harness connector for the GMU 22 has female polarity.

Table 15-6 GMU 22 Connector Kit (011-00871-00) Contents, Reference Figure 15-7**

Item	Garmin P/N	Quantity	Figure 15-7 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)

15.4.3 Mounting Instructions

After evaluation of the mounting location has been completed and verifying that requirements are met, assemble the GMU 22 mounting plate kits according to the dimensions given in Figure 15-3. 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 make sure that any remaining magnetic effect can be compensated for using the Magnetometer Calibration (Appendix H.4.4.3 for GDU™ 37X display systems and Section 31.4.8 for GDU 4XX systems).

See Figure 15-2 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.

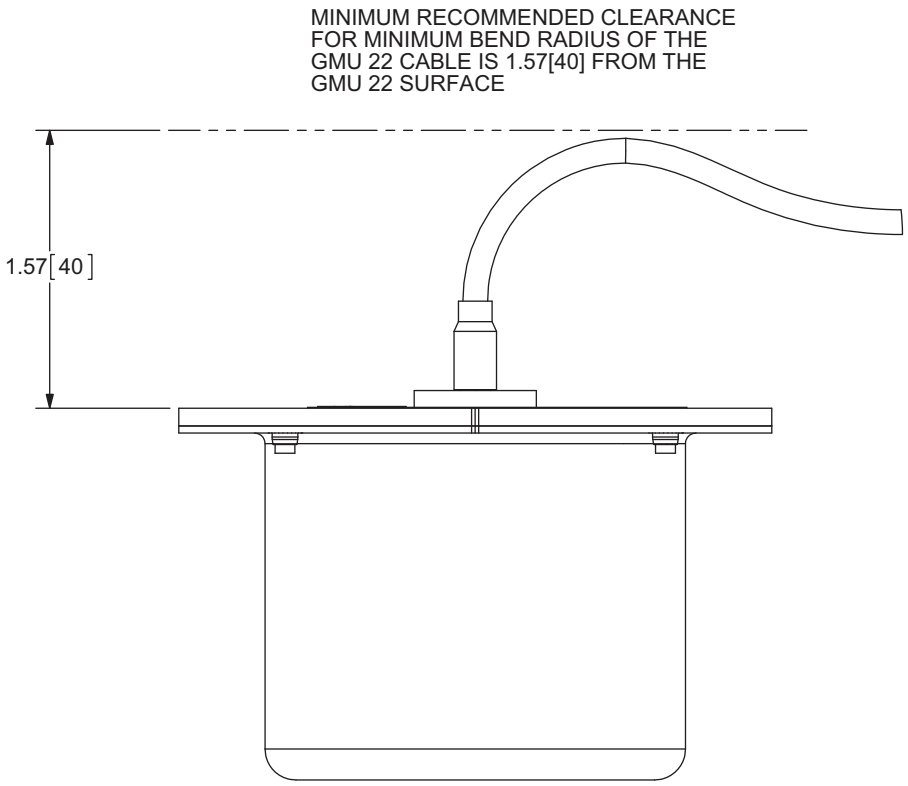


Figure 15-2 GMU 22 Minimum Recommended Clearance

15.5 Outline and Installation Drawings

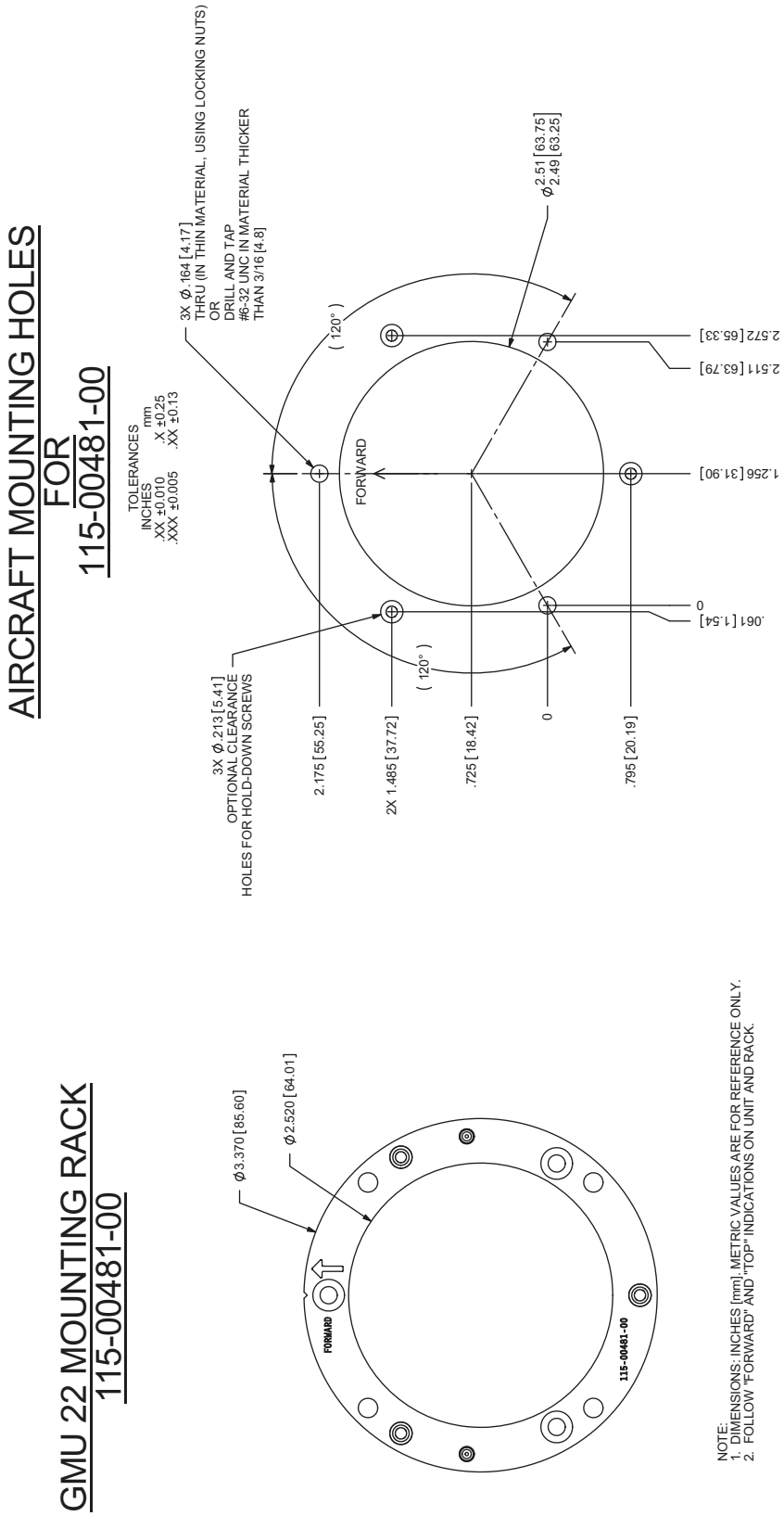


Figure 15-3 GMU 22 Mounting Rack (115-00481-00)

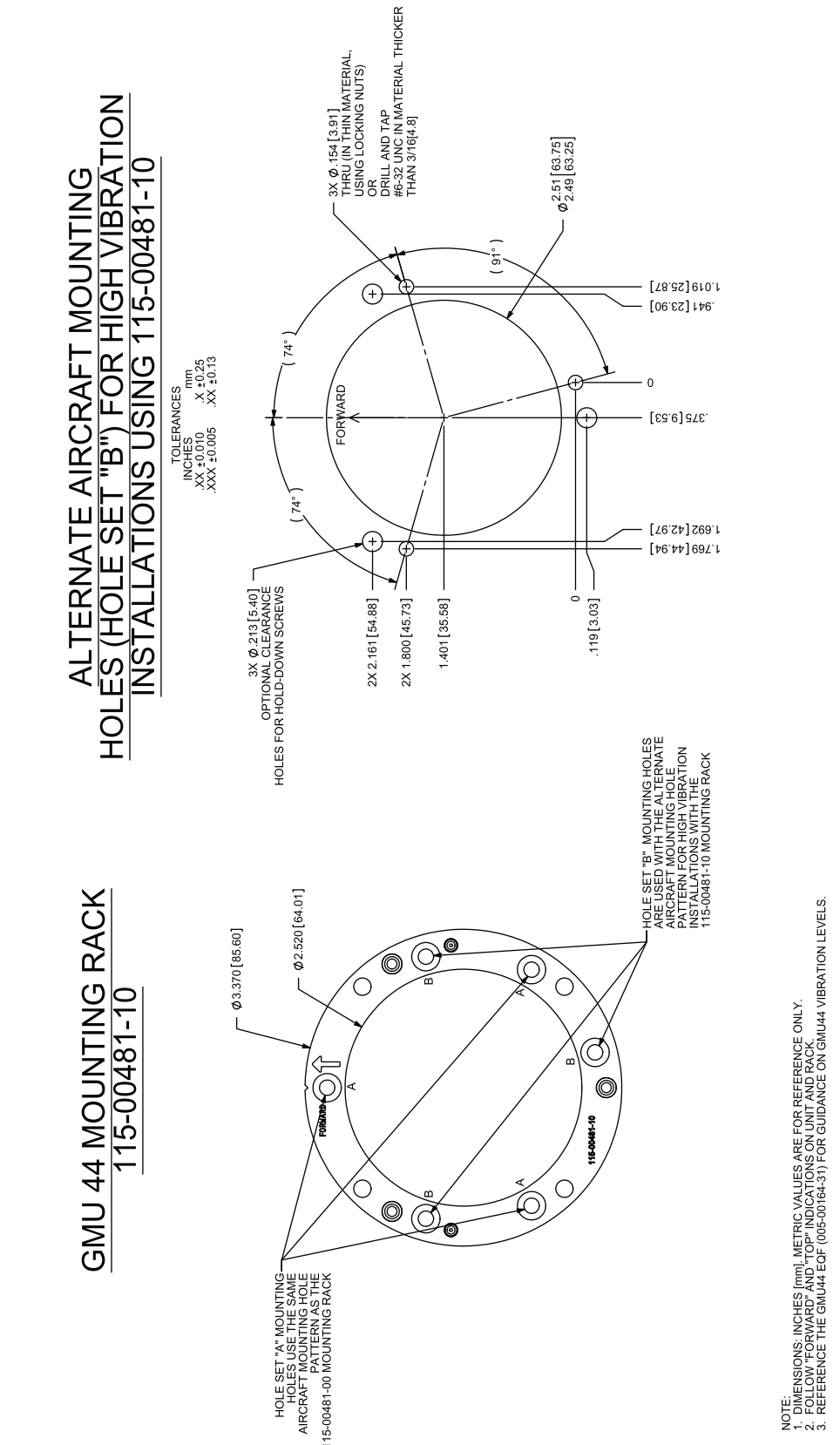


Figure 15-4 GMU 22 Mounting Rack (115-00481-10)

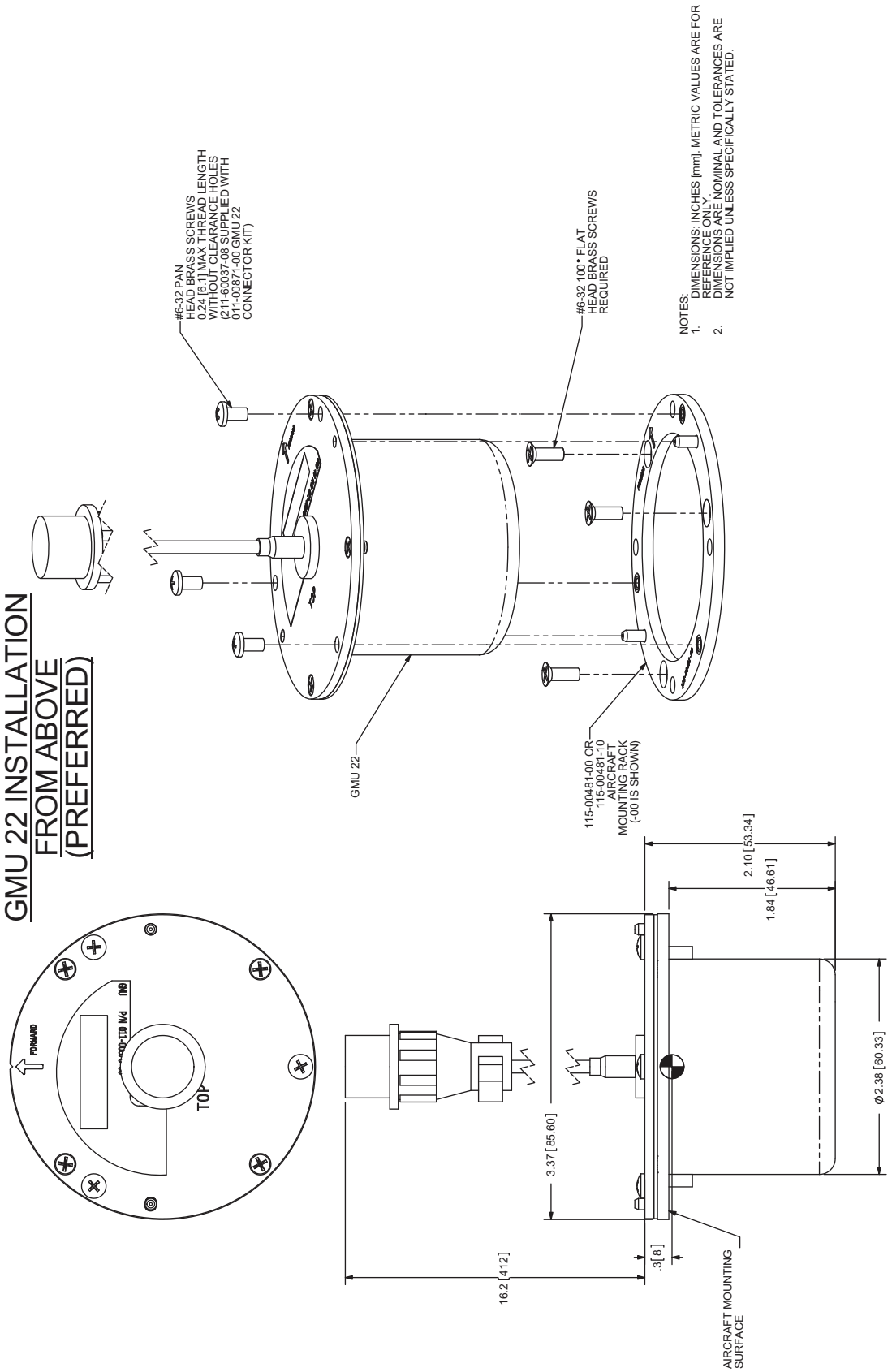


Figure 15-5 GMU 22 Top Mounted Installation

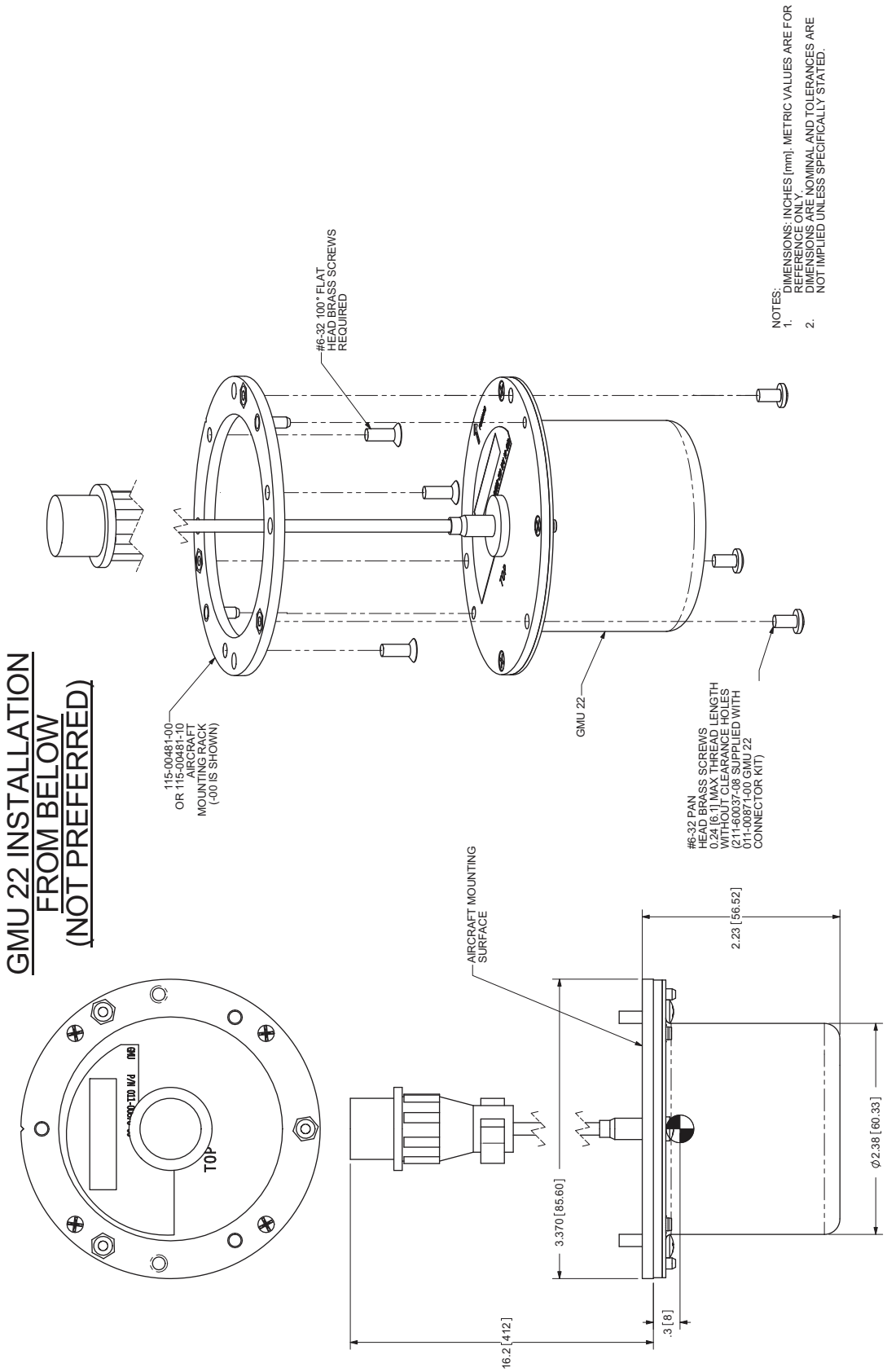


Figure 15-6 GMU 22 Bottom Mounted Installation

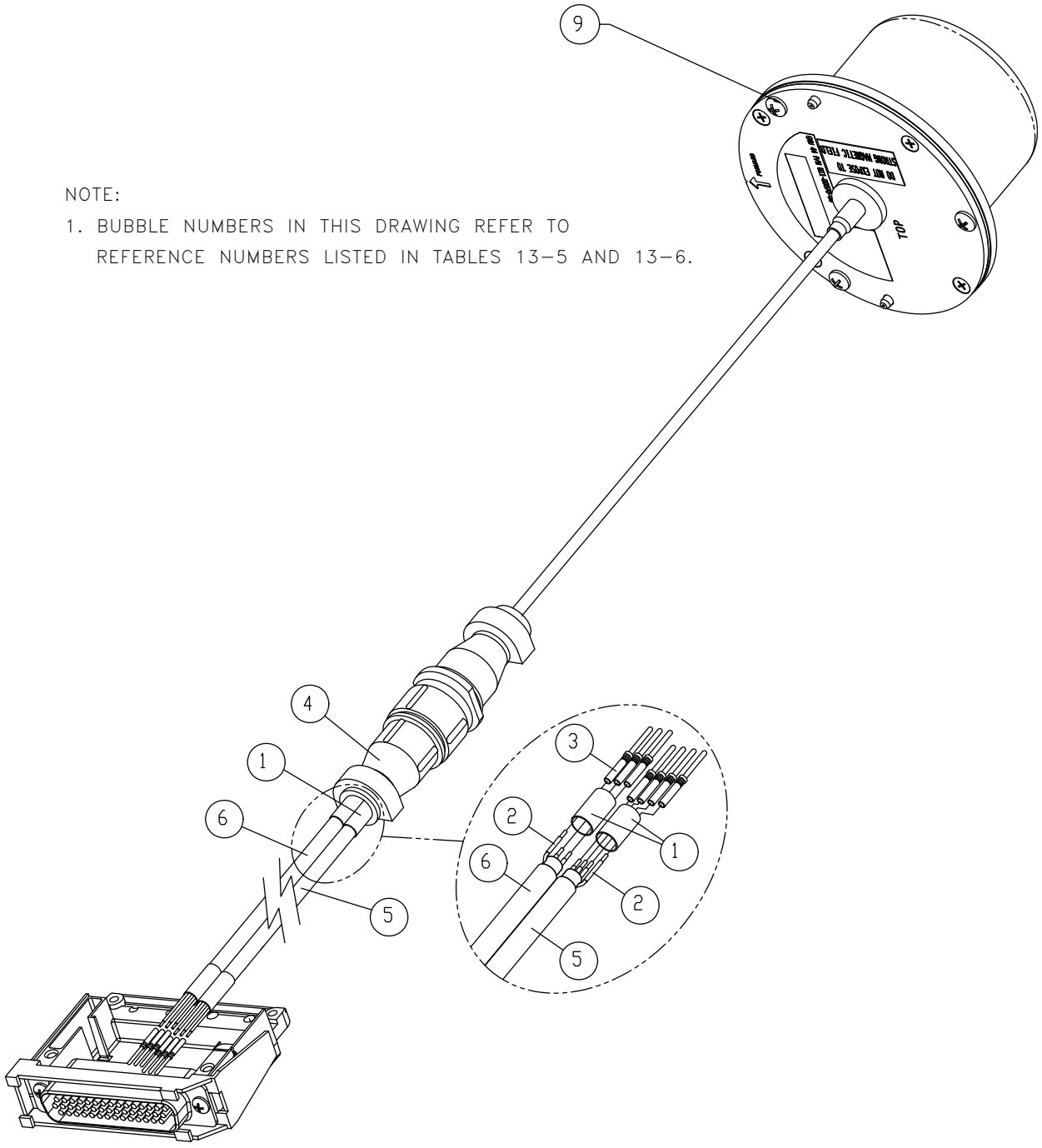


Figure 15-7 GMU 22 Wiring Details

16 GPS 20A (WAAS GPS POSITION SOURCE) INSTALLATION

This section contains general information as well as installation information for the GPS 20A. Use this section to mount the GPS 20A unit.

NOTE

The GPS 20A can only be used with GA 35, GA 36, or GA 37 antennas.

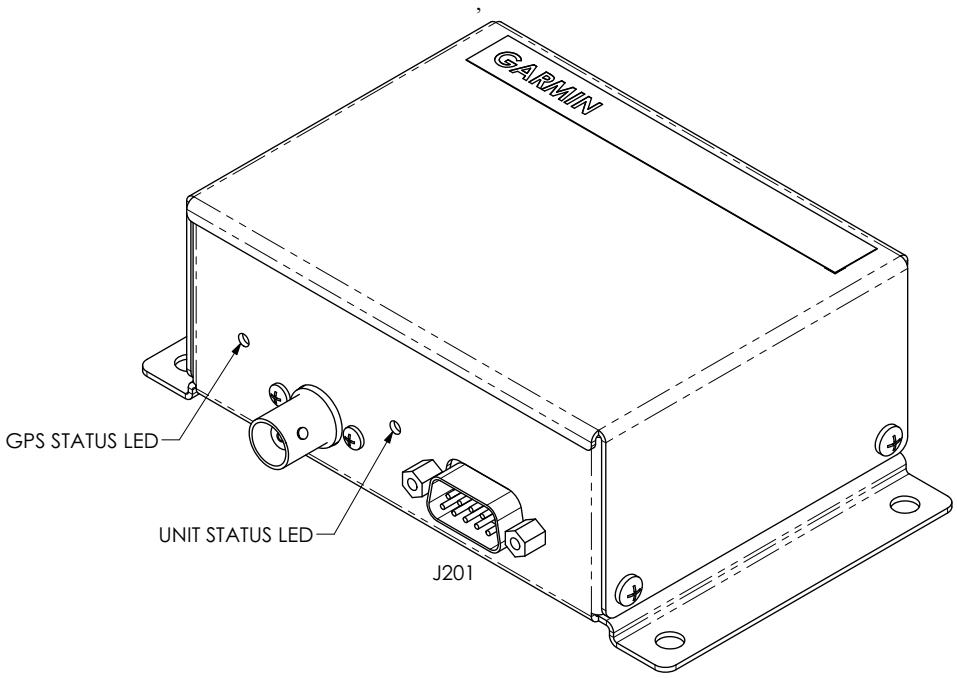


Figure 16-1 GPS 20A Unit View

16.1 Equipment Description

The GPS 20A provides an ADS-B Out position source. The WAAS/SBAS position information is compatible with a wide range of 1090 ES transponders to meet the position requirements of 14 CFR 91.227. The GPS 20A also provides position data to all G3X™ avionics and G3X Touch™ avionics displays.

NOTE

If a GPS 20A (and connected GA 35, GA 36, or GA 37 antenna) is used for GPS position, additional GPS antennas (connected to GDU™ 37X/4XX display units) may be used for redundancy, but are not required.

NOTE

The GPS 20A is not an FAA-approved product and thus is not eligible for installation in certified aircraft.

16.1.1 Status LED

The GPS 20A has two LEDs on its outer case that indicate its current unit and GPS status (Figure 16-1).

The unit status LED is in the middle of the outer case between the coax and 9 pin connectors. See Section 32.1.1 for details.

The GPS status LED is on the edge of the outer case, to the left of the coax connector. Table 16-1 lists the GPS status indications.

Table 16-1 GPS Status LED Indications

LED Indication	Description
Red	GPS hardware failure
No Light	GPS acquiring, low signal to noise ratio or antenna not connected
Slow Flashing Green	GPS acquiring, good signal to noise ratio
Fast Flashing Green	GPS fix acquired
Steady Green	GPS WAAS fix acquired
Alternating Red/Green	CAN bus network error, two similar devices are configured with same unit ID

16.2 Statement of Compliance (per AC 90-114A CHG1)

The Garmin GPS 20A, while not TSO approved, meets the ADS-B Out position source performance requirements for FAR 91.227 compliance when used in combination with a Mode S ADS-B Out transponder meeting the requirements of TSO-C166b and installed in accordance with the instructions in this document. Example transponders which may be used in combination with the GPS 20A for FAR 91.227 compliance are the Garmin GTX™ 330ES transponder, GTX 23ES, GTX 35R, GTX 45R, GTX 345/345R, and GTX 335/335R.

16.3 Equipment Available

16.3.1 Required Equipment

Table 16-2 GPS 20A Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GPS 20A	010-01546-00	011-03913-00

16.3.2 Additional Equipment Required

The connector kit in Table 16-3 is required to install the unit, it is not provided with the GPS 20A unit.

Table 16-3 Contents of GPS 20A Connector Kit (011-03914-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew, 9 Pin	011-01855-00	1
CAN Termination Kit	011-02887-00	1
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 09 CKT	330-00625-09	1
Contact, Socket, Military Crimp, Size 20	336-00022-02	10

16.4 General Specifications

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

16.5 Mounting Requirements

The GPS 20A will mount remotely. The GPS 20A will be secured to the airframe using four screws supplied by the installer. Refer to Section 16.9 for outline and installation drawings.

16.6 Unit Installation

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GPS 20A. Refer to Section 2.3 for wiring considerations, and to Section 24.13 for pinouts.

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 2.3.1.3.3).
4. Connect backshell connectors.

16.7 Antennas

The GPS 20A requires the installation and use of a GA 35, GA 36, GA 37. Refer to Section 21 for antenna information.

16.8 Antenna Cable Requirements

Cable loss from the GPS/SBAS antenna should be between 1.5 dB and 6.5 dB in order to maintain proper rejection to interference signals.

Coaxial connectors and adapters, such as TNC to BNC, add additional loss to the cable and should be considered when computing the cable loss. A typical loss of 0.2 dB can be used for each connection.

For RG-142B or RG-400, 1.5 dB equates to a length of approximately 6.5 feet of cable with a connector on each end.

For installations that require less than 6.5 ft of cable, the cable may be coiled, taking into account the minimum bend radius of the cable.

16.9 Outline and Installation Drawings

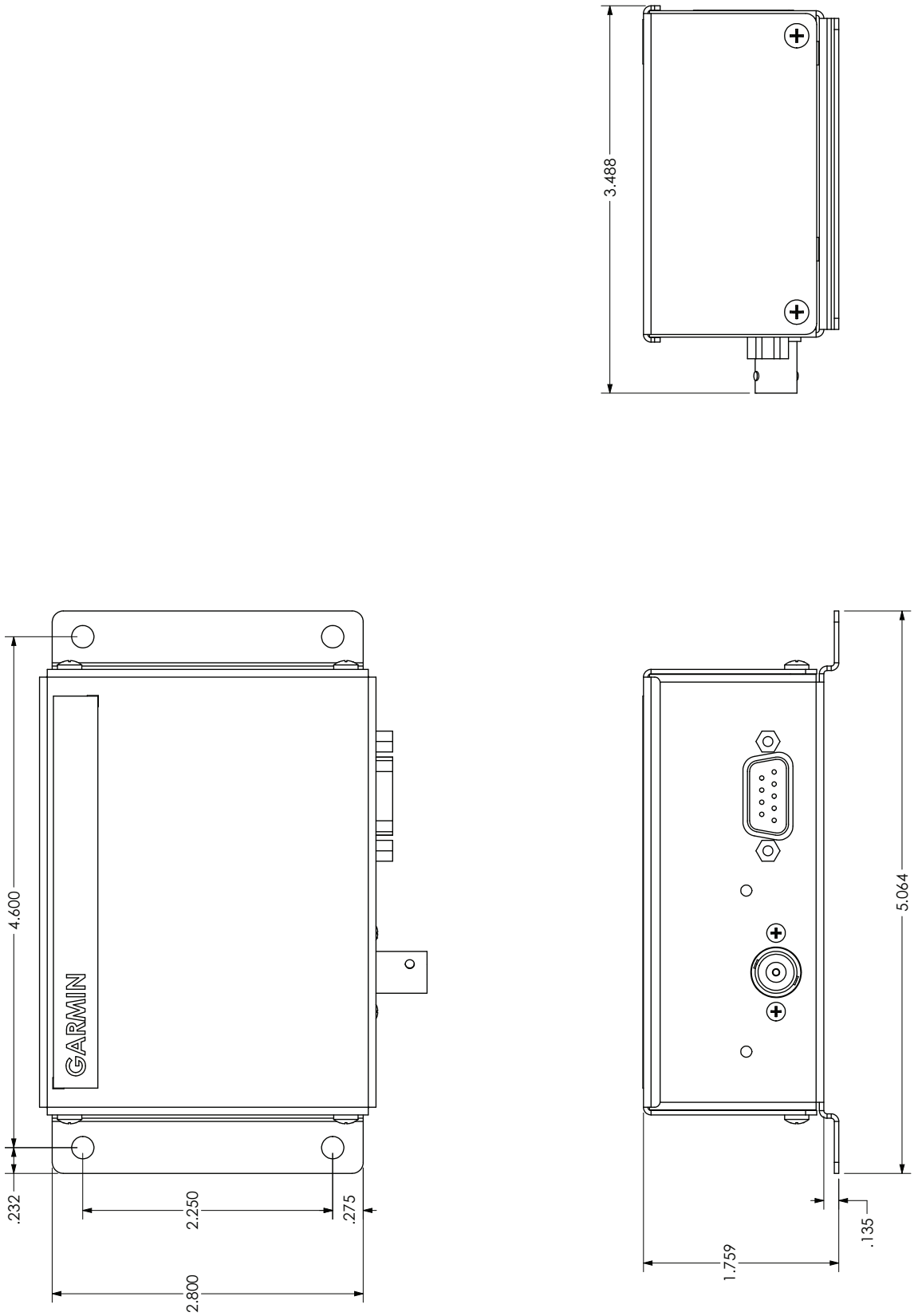


Figure 16-2 GPS 20A Outline Drawing

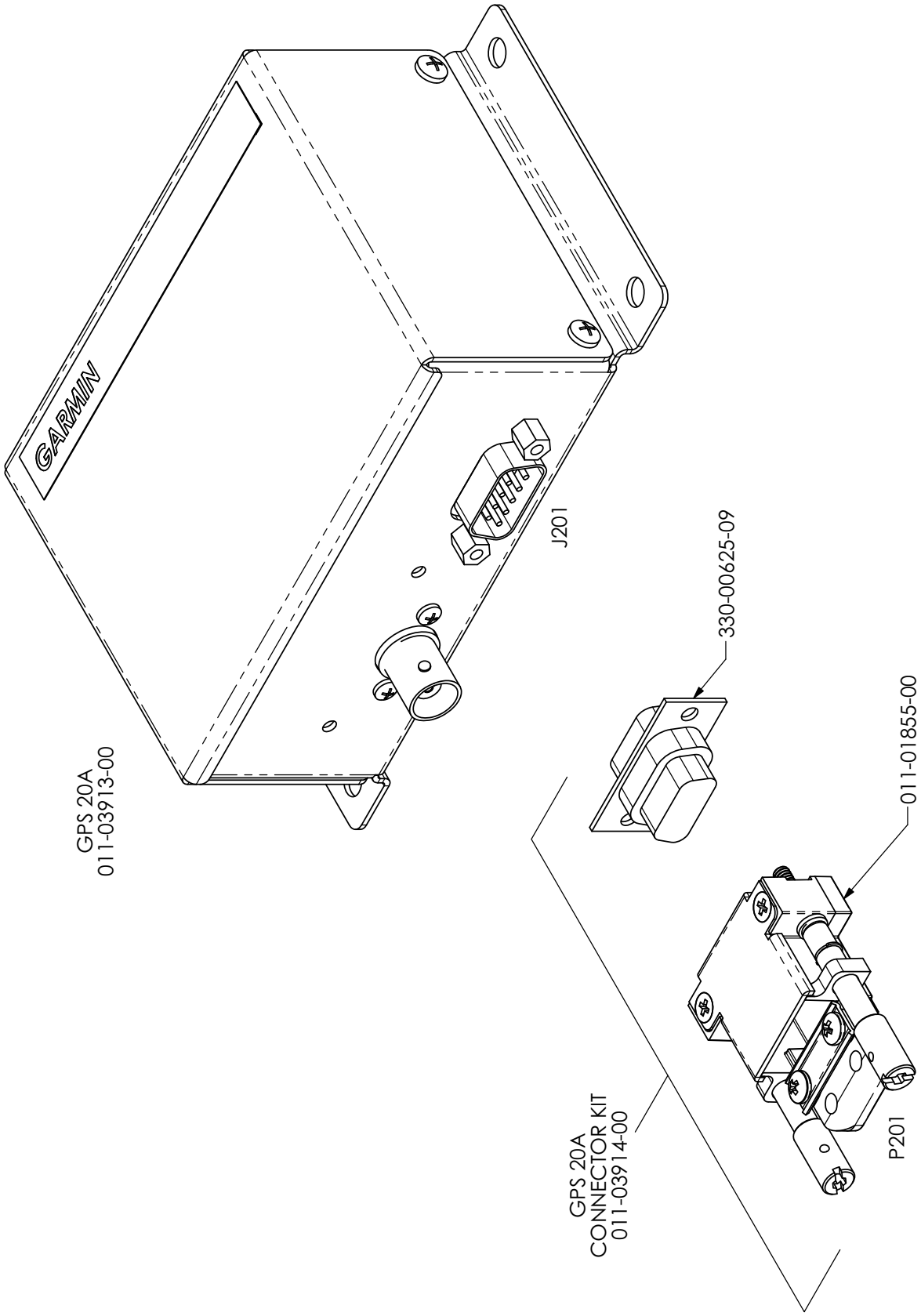


Figure 16-3 GPS 20A Installation Drawing (no CAN terminator)

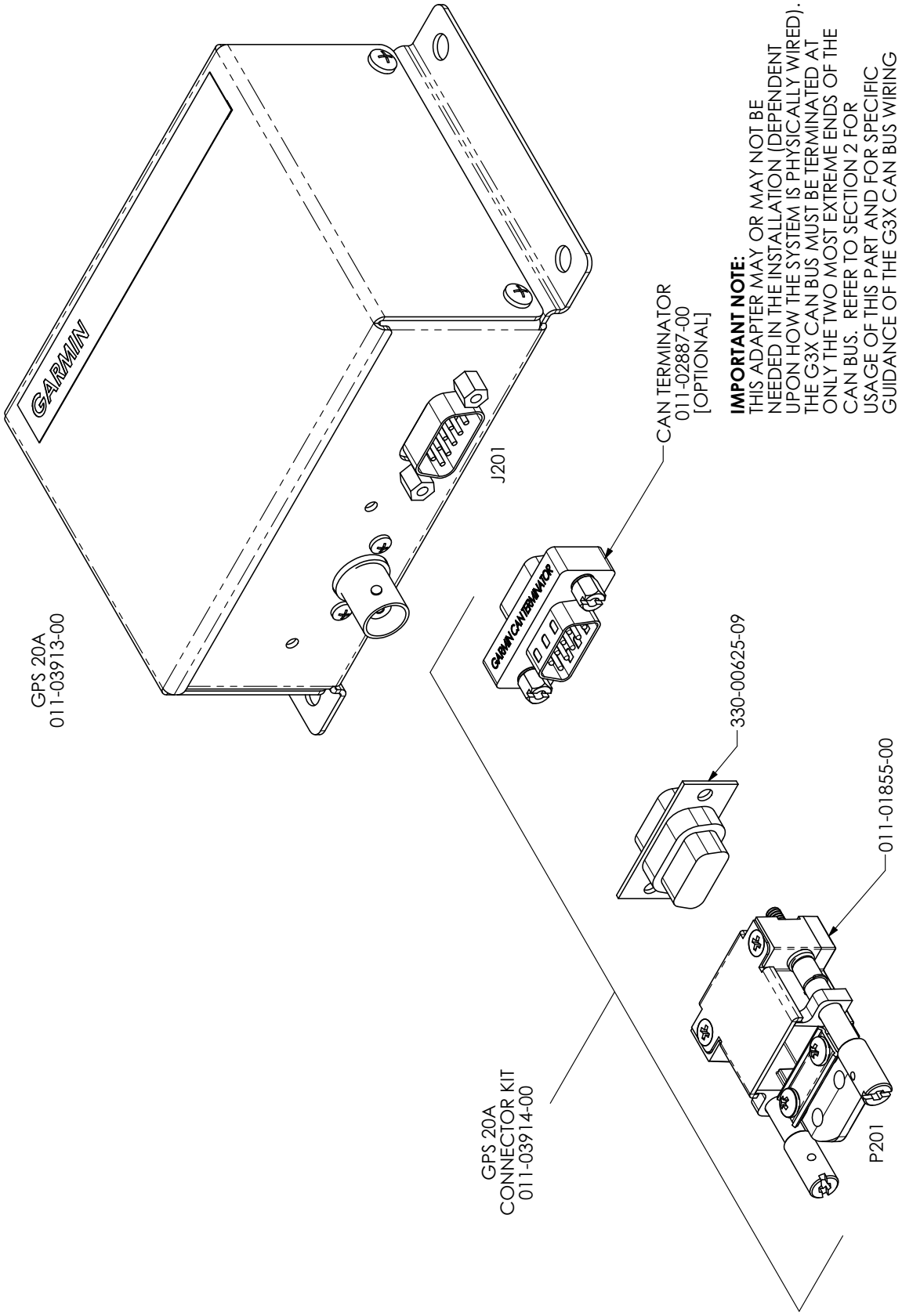


Figure 16-4 GPS 20A Installation Drawing (with CAN terminator)

17 GSA 28 (AUTOPILOT SERVO) INSTALLATION

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.

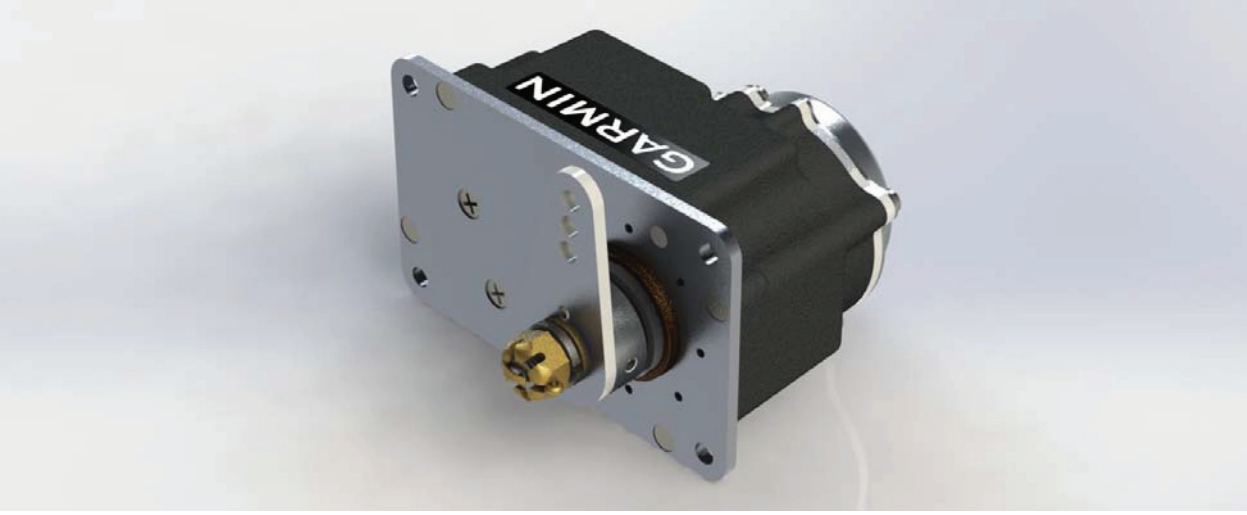


Figure 17-1 GSA 28 Unit View

17.1 Equipment Description

NOTE

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

NOTE

The GSA 28 is intended to be installed in fixed-wing aircraft only.

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™ avionics 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 drive support is available for any axis using various 3rd party (i.e. Ray Allen) trim motors. The GSA 28 can also be used as the trim actuator in the pitch and/or roll 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™ 370/375/460/465 display). When used with an optional GMC 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.

GSA 28 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 in the air, the servos can adjust the trim control to minimize the force on the primary controls. This helps make sure the aircraft will be properly trimmed when the autopilot is later disengaged. This feature works the same whether using a 3rd party trim motor or a GSA 28 as the trim actuator. When using a GSA 28 as the trim actuator, the following must be considered:

- The GSA 28 cannot hold a fixed position when disengaged, as the shaft will turn freely. It can only be used in installations where the trim actuator does not need to hold a fixed position when powered off. An acceptable application is the GSA 28 driving a manual pitch trim system using capstan and bridle cables.
- When used as the trim servo, the GSA 28 communicates using the CAN bus (same as the other servos communicate), no RS-232 or other data connection is required. The GSA 28 needs to be ID strapped appropriately for the pitch trim location (see Section 24.14.5 and Figure 25-1.9).
- The GSA 28 should be connected to the CWS/DISCONNECT input when used as a trim servo. For manual electric trim, trim inputs from the stick or relay should be wired directly to the GSA 28 being used as the trim actuator, as well as the main autopilot servo for that axis (refer to Figure 25-1.11).

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

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

17.1.1 Status LED

The GSA 28 has an LED on its outer case that indicates its current status. See Section 32.1.1 for details.

17.2 Equipment Available

Table 17-1 GSA 28 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GSA 28 Servo Actuator, Unit Only	010-01068-00	011-02927-00
	010-01068-20	011-02927-20*

*Requires minimum software level of v8.71 or higher

17.3 General Specifications

Table 17-2 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

17.3.1 Power Specifications

The GSA 28 trim outputs are capable of sourcing a maximum of 1A of current to drive a DC trim motor at 12V, or a maximum of 500 mA of current to drive a DC trim motor at 24V.

To use the GSA 28 to drive DC trim motors requiring higher current, a third-party interface may be used (see Figure 25-1.10).

CAUTION

The DC trim motor connected to the GSA 28 should be rated for the full power supply voltage being used to power the GSA 28. If the GSA 28 is connected by a 24-28V power input, the trim motor must also be rated for 28V.

NOTE

The GSA 28 does not provide a voltage step-up service. To drive a 24V trim motor, the GSA 28 must be supplied with 24V or higher.

Table 17-3 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)

17.3.2 Torque Specifications

Table 17-4 GSA 28 Torque Specifications

Characteristic	Specification
Maximum Rated Torque	60 in-lbs

17.4 Required Equipment

Table 17-5 lists the kits available for the GSA 28.

Table 17-5 GSA 28 Available Equipment w/Weights

Item	Garmin P/N	Weight
GSA 28 Connector Kit	011-02950-00	0.12 lb (0.054 kg)
GSA 28 Connector Kit, 90°	011-02950-01	0.13 lb (0.059 kg)
GSA 28 Stop Bracket Kit	011-02951-00	0.03 lb (0.014 kg)
GSA 28 Mounting Kit, Generic, Push-Pull	011-02952-00	0.26 lb (0.118 kg)
GSA 28 Mounting Kit, Generic, W/Bracket	011-02952-01	0.50 lb (0.227 kg)
GSA 28 Mounting Kit, Generic, Capstan	011-02952-02	0.14 lb (0.064 kg)
GSA 28 Mounting Kit, RV-6 Roll	011-02952-10	0.55 lb (0.250 kg)
GSA 28 Mounting Kit, RV-4/8 Pitch	011-02952-11	0.51 lb (0.231 kg)
GSA 28 Mounting Kit, RV-7/8/10 Roll	011-02952-12	0.42 lb (0.191 kg)
GSA 28 Mounting Kit, RV-9 Roll	011-02952-13	0.42 lb (0.191 kg)
GSA 28 Mounting Kit, RV-6/7/9 Pitch	011-02952-14	0.37 lb (0.168 kg)
GSA 28 Mounting Kit, RV-10 Pitch	011-02952-15	0.48 lb (0.218 kg)
GSA 28 Mounting Kit, RV-10 Yaw	011-02952-16	0.60 lb (0.272 kg)
GSA 28 Removal Adapter	011-03158-00	0.03 lb (0.014 kg)

Table 17-6 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
GSA 28 Removal Adapter	011-03158-00	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

Table 17-7 Contents of Connector Kit, 90° (011-02950-01)

Item	Garmin P/N	Quantity
Sub-Assy, Bkshl w/Hdw, Jackscrew, 90°,15/26 Pin	011-01959-01	1
GSA 28 Removal Adapter	011-03158-00	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

17.4.1 Additional Equipment Required

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

17.5 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 24.13 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 23.

17.5.1 Pinouts

See Section 24.13 for pinout information.

17.5.2 Mounting Requirements

WARNING

It is vital to make sure the autopilot servo and aircraft control linkage is free to move throughout its entire range of travel without binding or interference. Failure to provide 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.

CAUTION

Do not mount the GSA 28 on the 'hot' side (engine side) of the firewall, or in any location where it would be exposed to radiated heat from the engine.

17.5.2.1 Optional Attachments

The GSA 28 is supplied from the factory with a standard crank arm attachment (Figure 17-2, Figure 17-8.1, Figure 17-8.2, and Figure 17-8.3). 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 17-8.3 and Figure 17-8.4 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.

WARNING

Do not use crank arm attachments to actuate cable driven controls. A Capstan attachment should be used for this purpose.

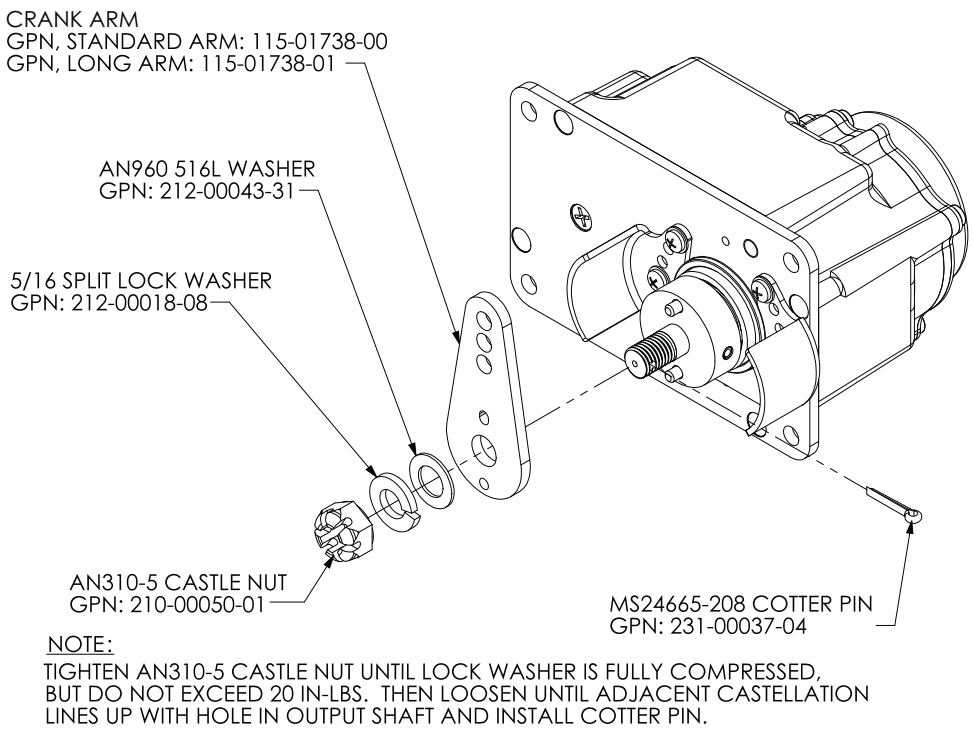


Figure 17-2 Crank Arm Assembly

17.5.2.2 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 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 so 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 17-8.2, and Figure 17-8.3 for more details.

After installation of the servo is complete, verify 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 before 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 17-8.2.

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 make sure 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.

17.5.2.3 Trim Motor Interface to a 3rd Party Motor

The GSA 28 provides an optional interface between the pilot's electric trim switch and a 14 Vdc trim motor. This interface shall be used only when interfacing to a 3rd party trim motor. This interface is not to be used when a GSA 28 is being used as the trim actuator.When the GSA 28 servo is engaged (i.e. autopilot on) in the air, 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.

CAUTION

The GSA 28 can supply a maximum of 1 Amp of current to the trim motor. Do not connect a trim motor that requires higher current.

NOTE

The GSA 28 supports a single trim switch input only. For use with multiple trim switches (e.g. pilot and co-pilot), a GAD 27 or other third-party device capable of mixing multiple trim switches into one is required. See Figure 25-1.10 for additional details.

17.5.2.4 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 25-1.7).

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.

17.5.2.5 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 Ω 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.

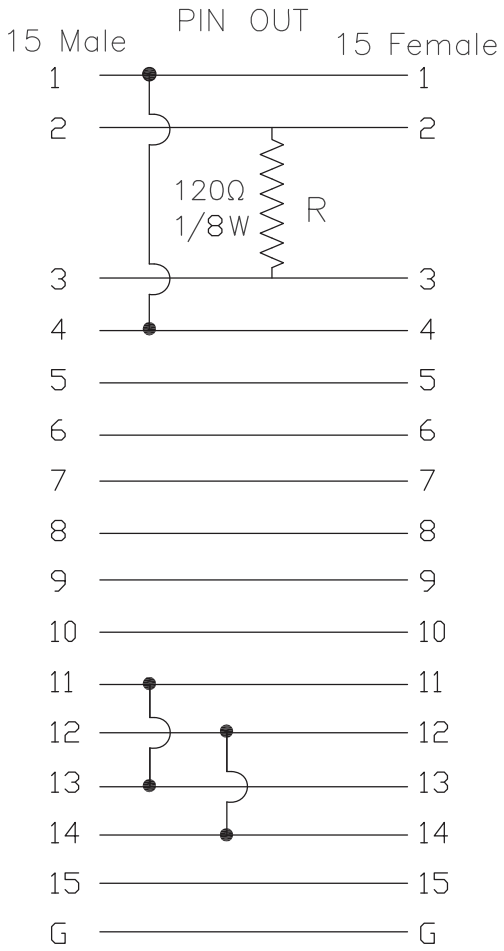


Figure 17-3 Wiring Diagram For GSA 28 Removal Adapter

17.5.2.6 GSA 28 Mounting Kits

Garmin currently provides the mounting kits listed in Table 17-8 for the GSA 28 Servo:

Table 17-8 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	17-8.7
011-02952-01	Sub-Assy, GSA 28 Mounting Kit, Generic, W/Bracket	Yes	17-8.8
011-02952-02	Sub-Assy, GSA 28 Mounting Kit, Generic, Capstan	No	17-8.4
011-02952-10	Sub-Assy, GSA 28 Mounting Kit, RV-6 Roll	Yes	17-9.1, 17-9.1, 17-9.1
011-02952-11	Sub-Assy, GSA 28 Mounting Kit, RV-4/8 Pitch	Yes	17-10.1, 17-10.1, 17-10.1, 17-10.1
011-02952-12	Sub-Assy, GSA 28 Mounting Kit, RV-7/8/10 Roll	Yes	17-11.1, 17-11.1
011-02952-13	Sub-Assy, GSA 28 Mounting Kit, RV-9 Roll	Yes	17-12.1, 17-12.1
011-02952-14	Sub-Assy, GSA 28 Mounting Kit, RV-6/7/9 Pitch	Yes	17-13.1, 17-13.1
011-02952-15	Sub-Assy, GSA 28 Mounting Kit, RV-10 Pitch	Yes	17-14.1, 17-14.1
011-02952-16	Sub-Assy, GSA 28 Mounting Kit, RV-10 Yaw	Yes	17-15.1, 17-15.1 17-15.1

The “generic” kits listed in Table 17-8 (011-02952-00, -01, & -02) are not specific to any airframe. The airframe specific kits (GPN 011-02952-10 through -16) 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 17-8.

17.5.2.7 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 17-4). 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.

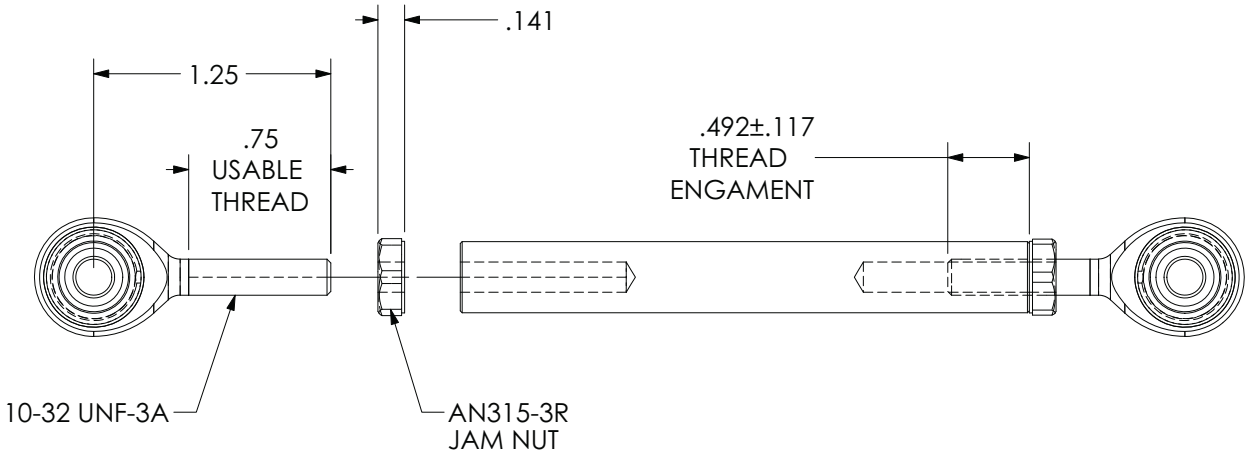


Figure 17-4 General Dimensions For Servo Push Rod And Rod End Bearings

17.5.2.8 Capstan Kit

The capstan kit is part number 011-02952-02. This kit contains a capstan, a cable guard, and fasteners used to attach these items.

The capstan is 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 as these items are generally specific to each aircraft type. The required bridle cable (Figure 17-5) is a 1/16” cable with a MS20663C2 ball and double shank fitting swaged onto the cable where it engages with the capstan drive wheel. The MS20664C2 ball and shank fittings on the ends keep the cable from fraying.

Several companies sell custom made cable assemblies suitable for this application, a few of these are:

McFarlane Aviation	Aircraft Spruce
Phone: 866-920-2741	Customer Service: 1-800-861-3192
www.mcfarlane-aviation.com	www.aircraftspruce.com/catalog/appages/cableassy.php

NOTE

When determining the length of the bridle cable to be ordered, be sure to allow for enough cable to make the required number of wraps around the capstan (see Figure 17-6).

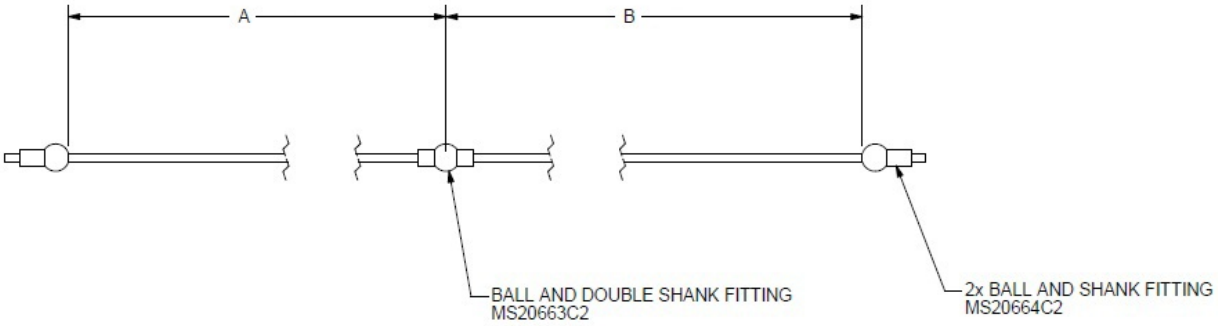


Figure 17-5 Bridle Cable

Garmin recommends using the cable arrangement (ball centered in capstan) shown in Figure 17-6 to avoid side-loading the servo center shaft.

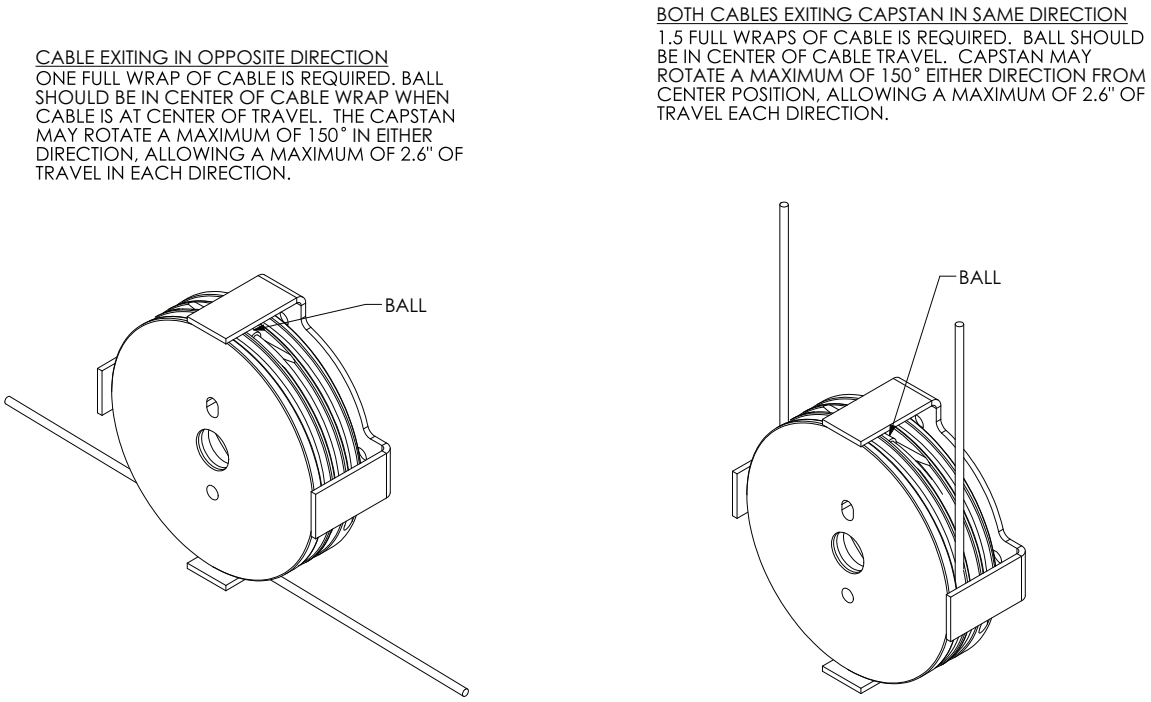


Figure 17-6 Cable in Capstan

WARNING

The ball must be located in the center of travel on the capstan when the flight control is in the neutral position. When the flight control is moved to the limits of its travel, the ball must not have any possibility of exiting the capstan groove.
The bridle cable must wrap around the capstan either 1 or 1.5 full turns, as shown in Figure 17-6, and must be routed in a way that avoids the possibility of binding.
If the installation would require more than +/- 150° of capstan rotation or more than +/- 2.6 inches of cable travel, the GSA 28 servo and capstan cannot be used.
Failure to closely follow the capstan installation guidance in this section could cause the aircraft flight controls to jam, resulting in serious injury or death

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 17-8.4.

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 make sure 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.

17.5.2.9 Aircraft Specific Mounting Kits

GSA 28 mounting kits are available for several experimental airframes. These mounting kits are listed in Table 17-8. All of these kits contain sheet metal mounting brackets that have been designed for the specific application and some contain 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 17.5.2.2 on stop bracket kit for more details on mounting the stop bracket.

17.5.2.10 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 17-7 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, make sure 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 17-8.1 for GSA 28 outline dimensions. See Figure 17-8.5 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 make sure 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 make sure the bracket is structurally adequate for the application.

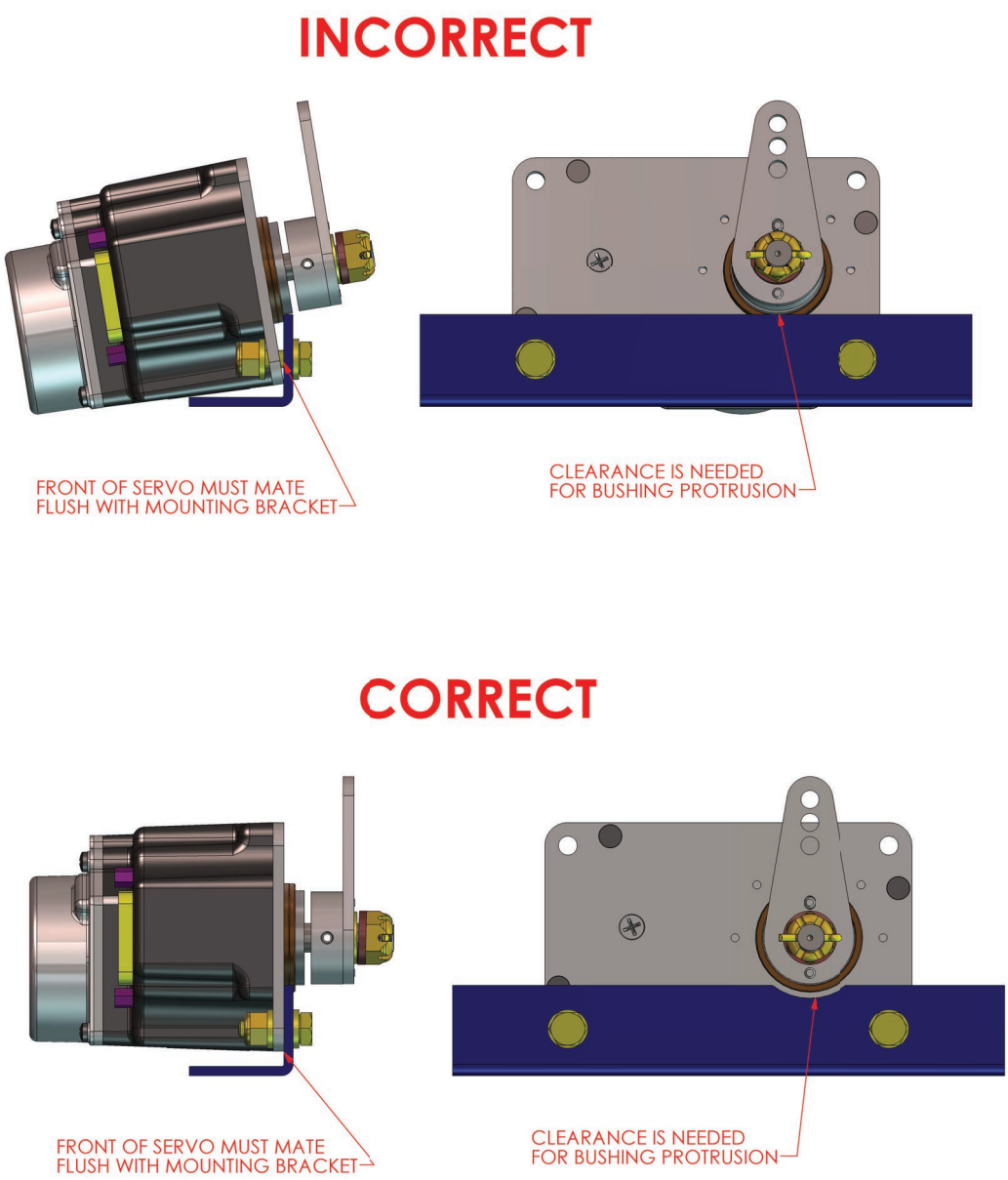


Figure 17-7 Non-Garmin GSA 28 Bracket

17.5.3 Unit Mounting

For final installation and assembly, refer to the outline and installation drawings Figure 17-8.1 through Figure 17-14.1.

WARNING

Unless otherwise specified, tighten all threaded fasteners in accordance with FAA advisory circular AC 43-13-1B section 7.40, including adjustment for friction drag torque.

17.6 Unit Wiring

Refer to the Section 25-1.7 interconnect drawing for connecting GSA 28 wiring.

17.7 Outline and Installation Drawings

Refer to the following figures for GSA 28 installation guidance.

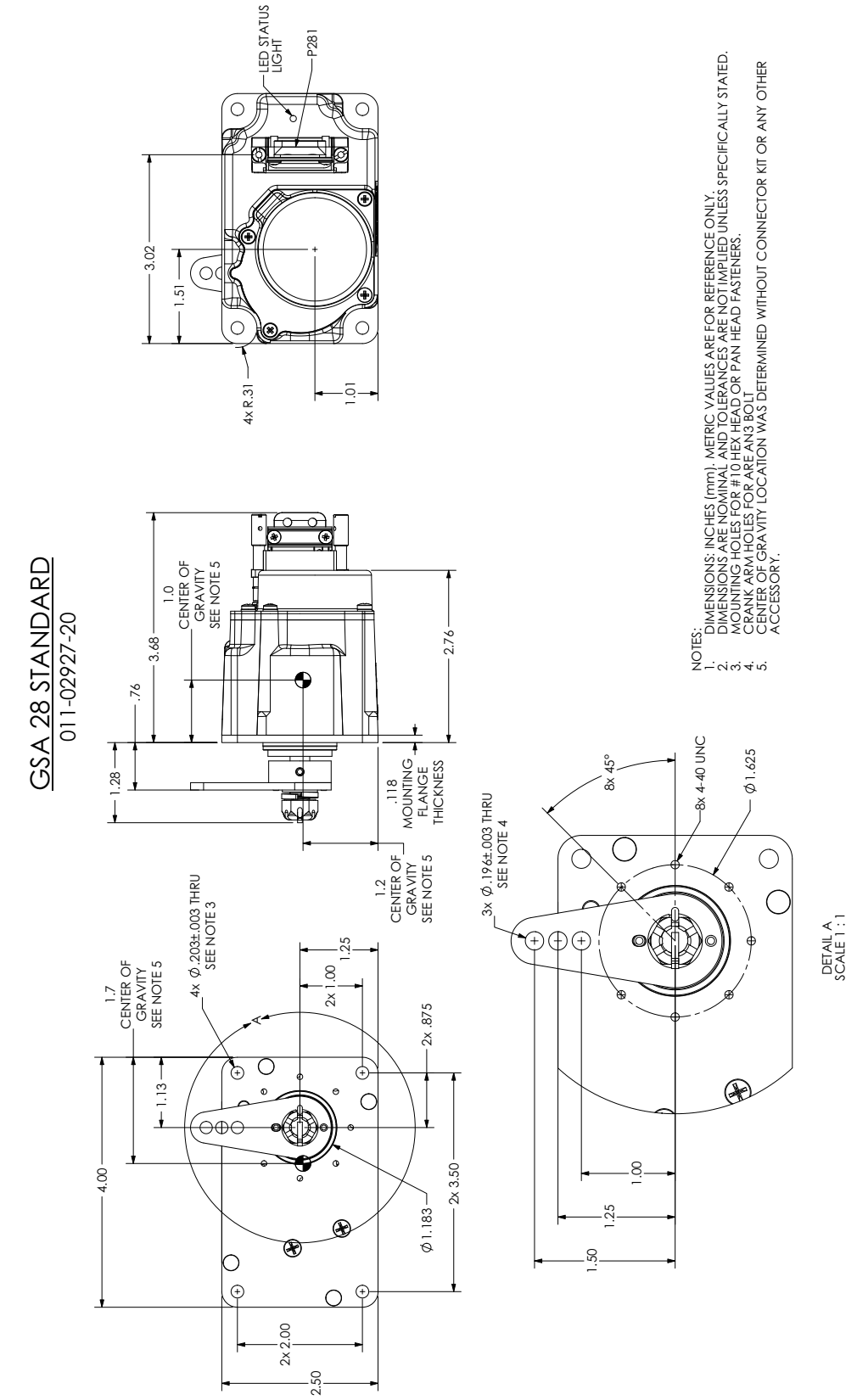


Figure 17-8.1 GSA 28 Outline/Installation Drawing 011-02927-20

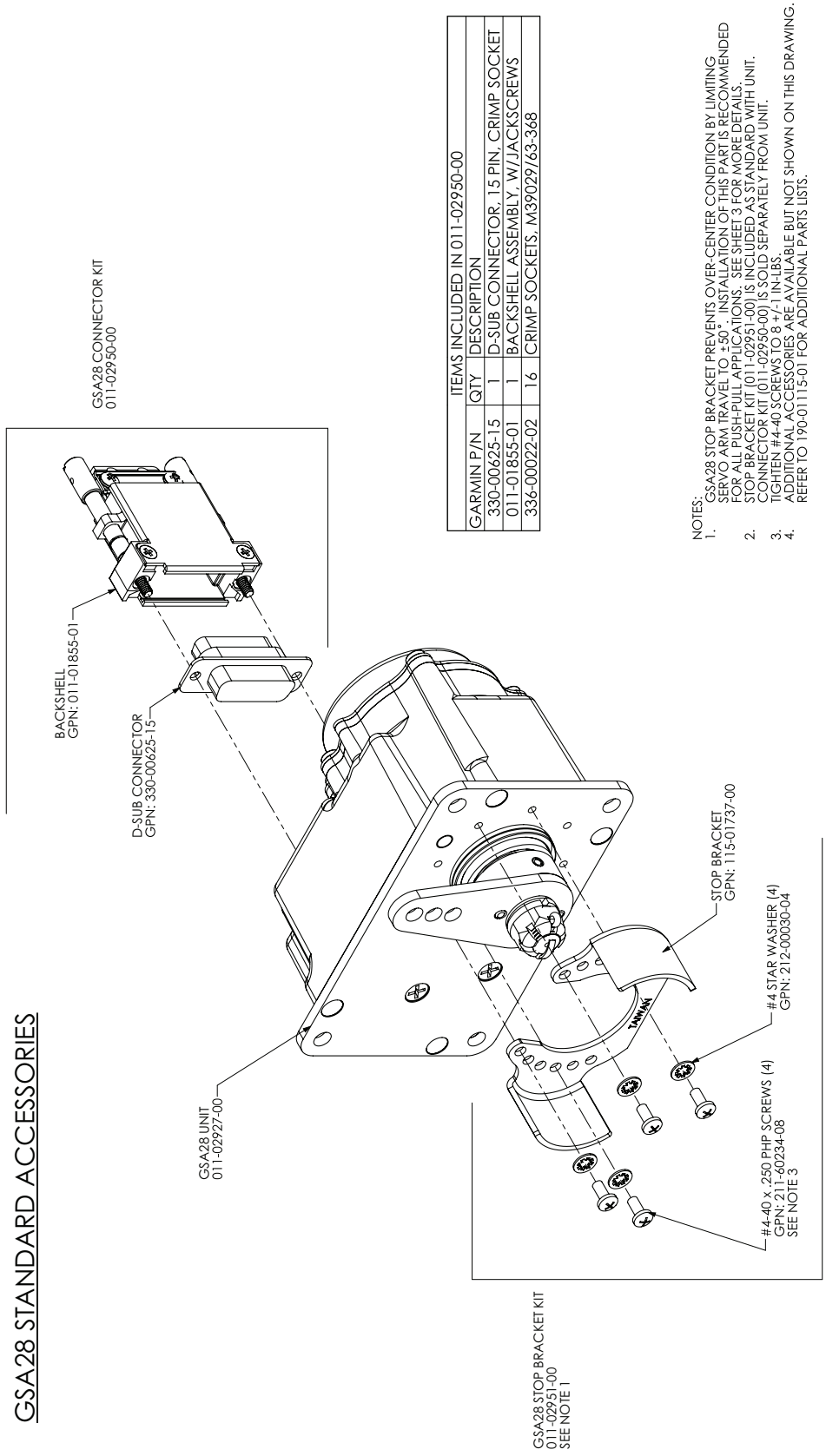


Figure 17-8.2 GSA 28 Accessory Installation Drawing

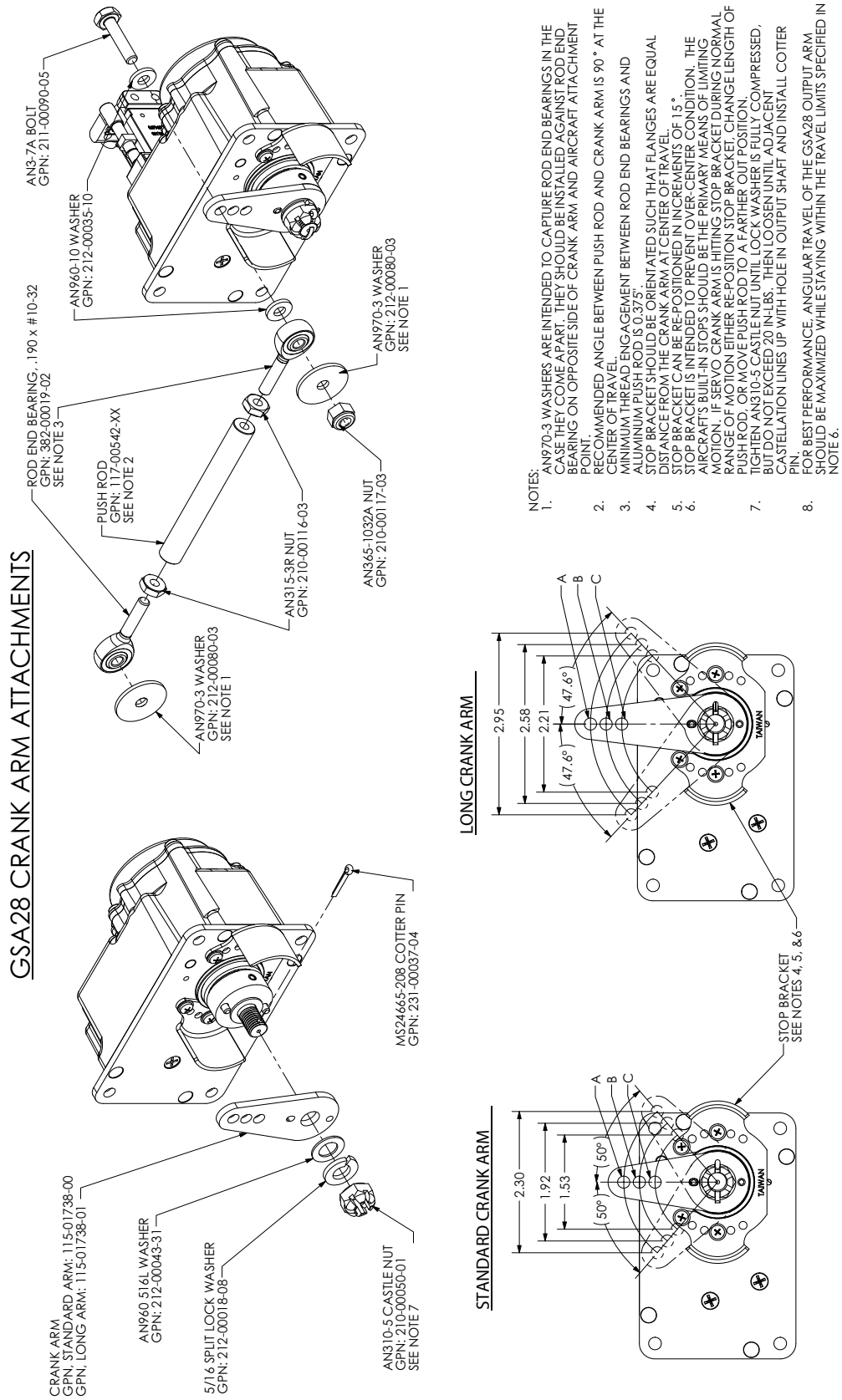


Figure 17-8.3 GSA 28 Crank Arm Attachments Drawing

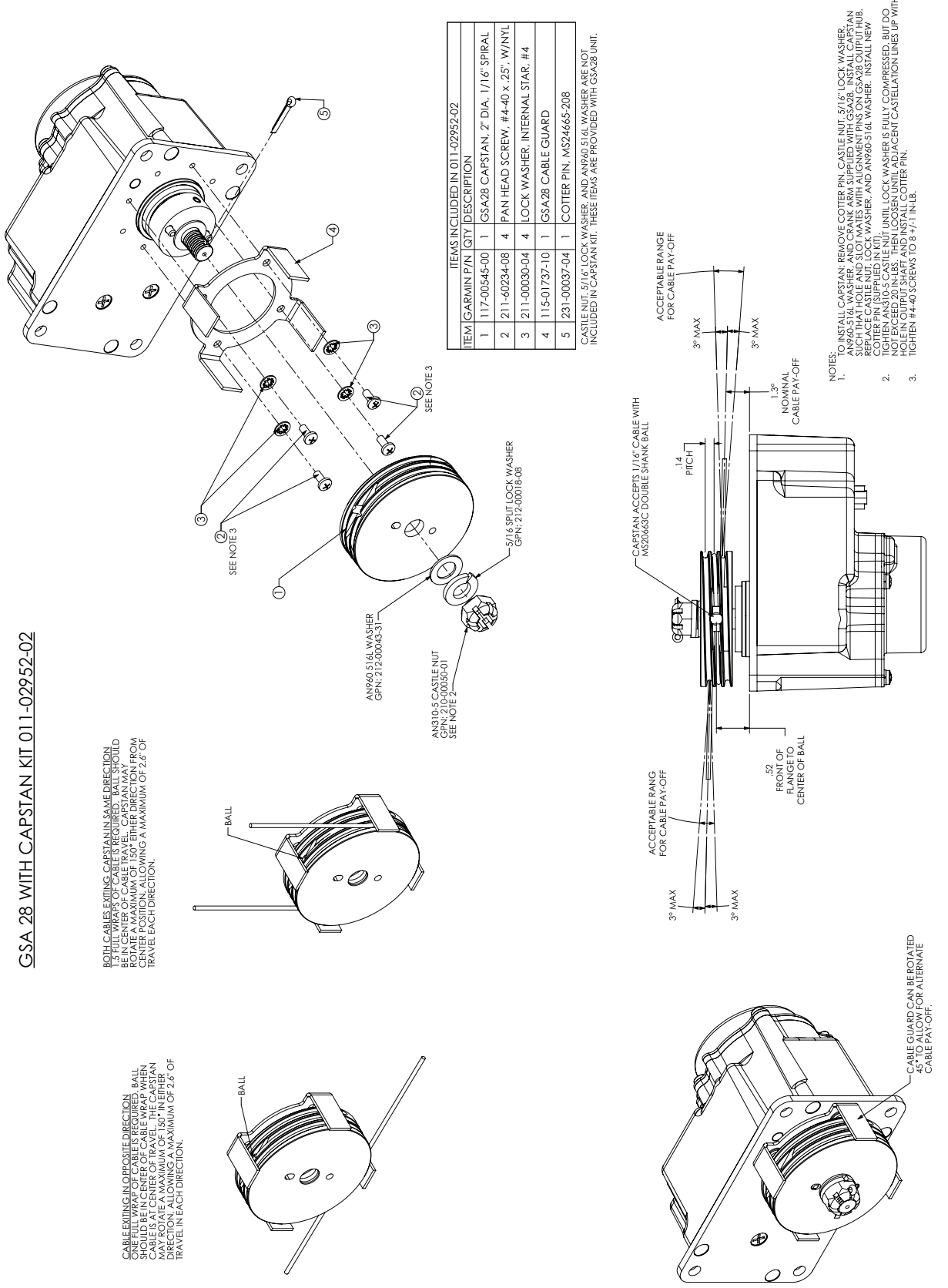


Figure 17-8.4 GSA 28 with Capstan Kit and Cable Instructions (011-02952-02)

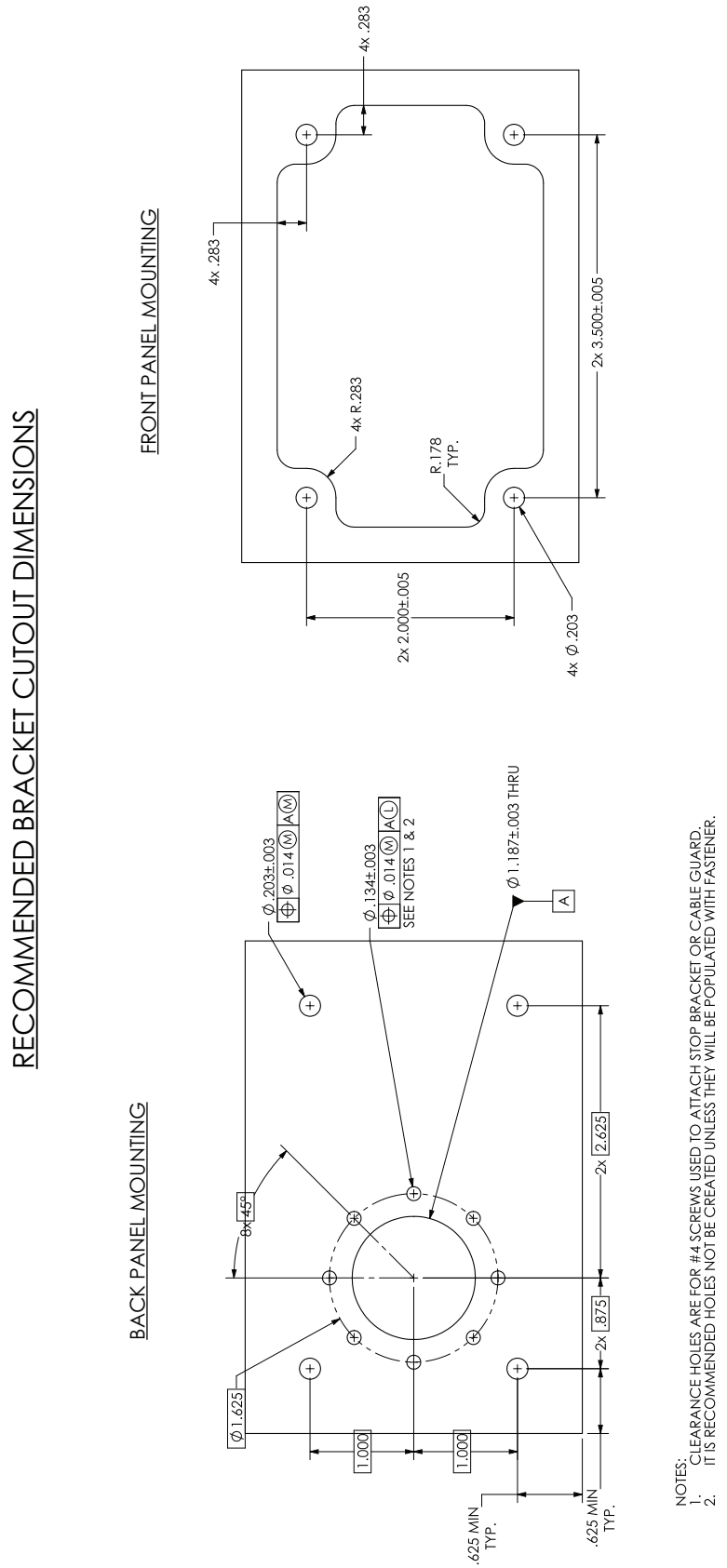


Figure 17-8.5 GSA 28 Recommended Bracket Cutout Dimensions

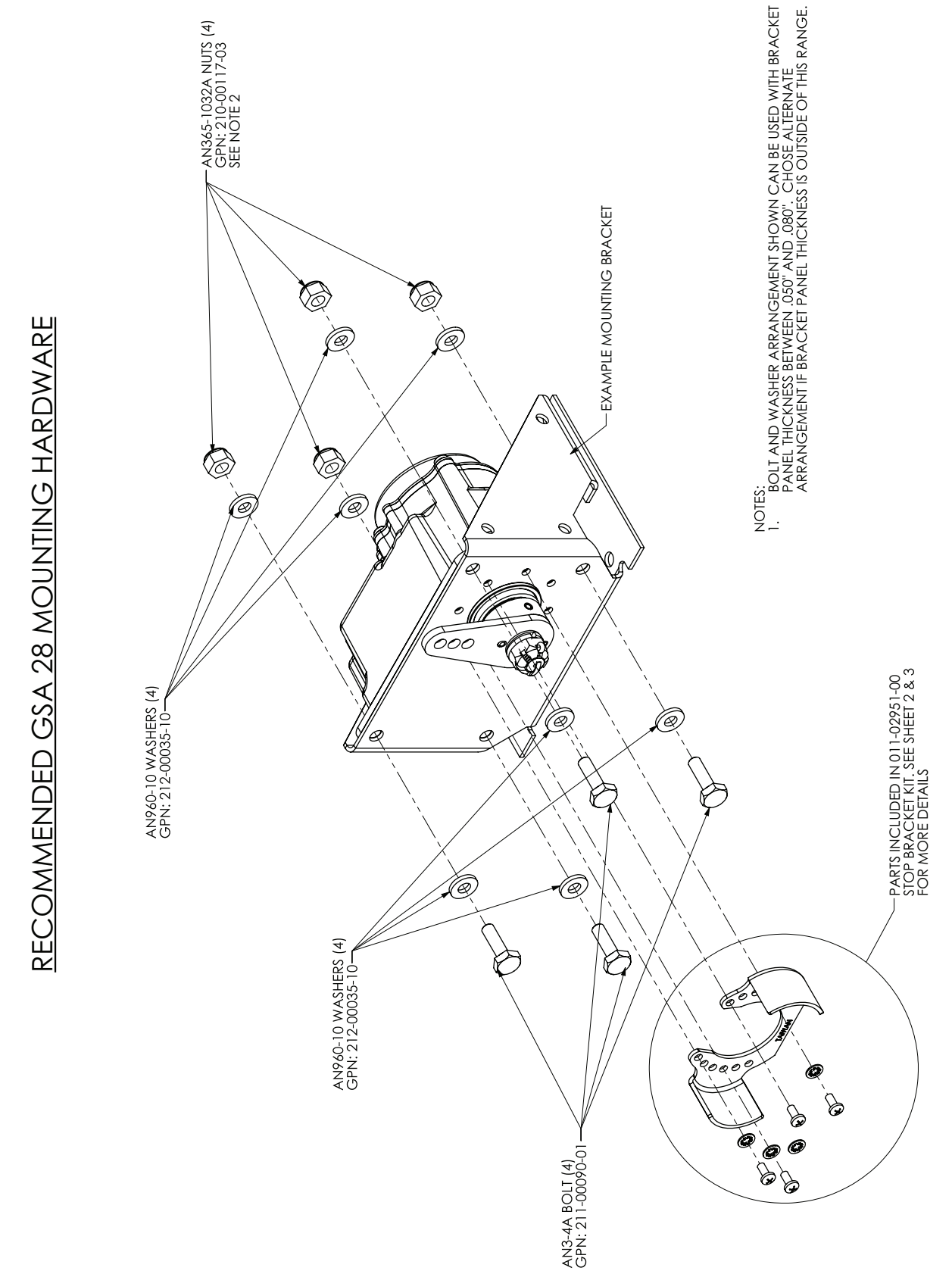
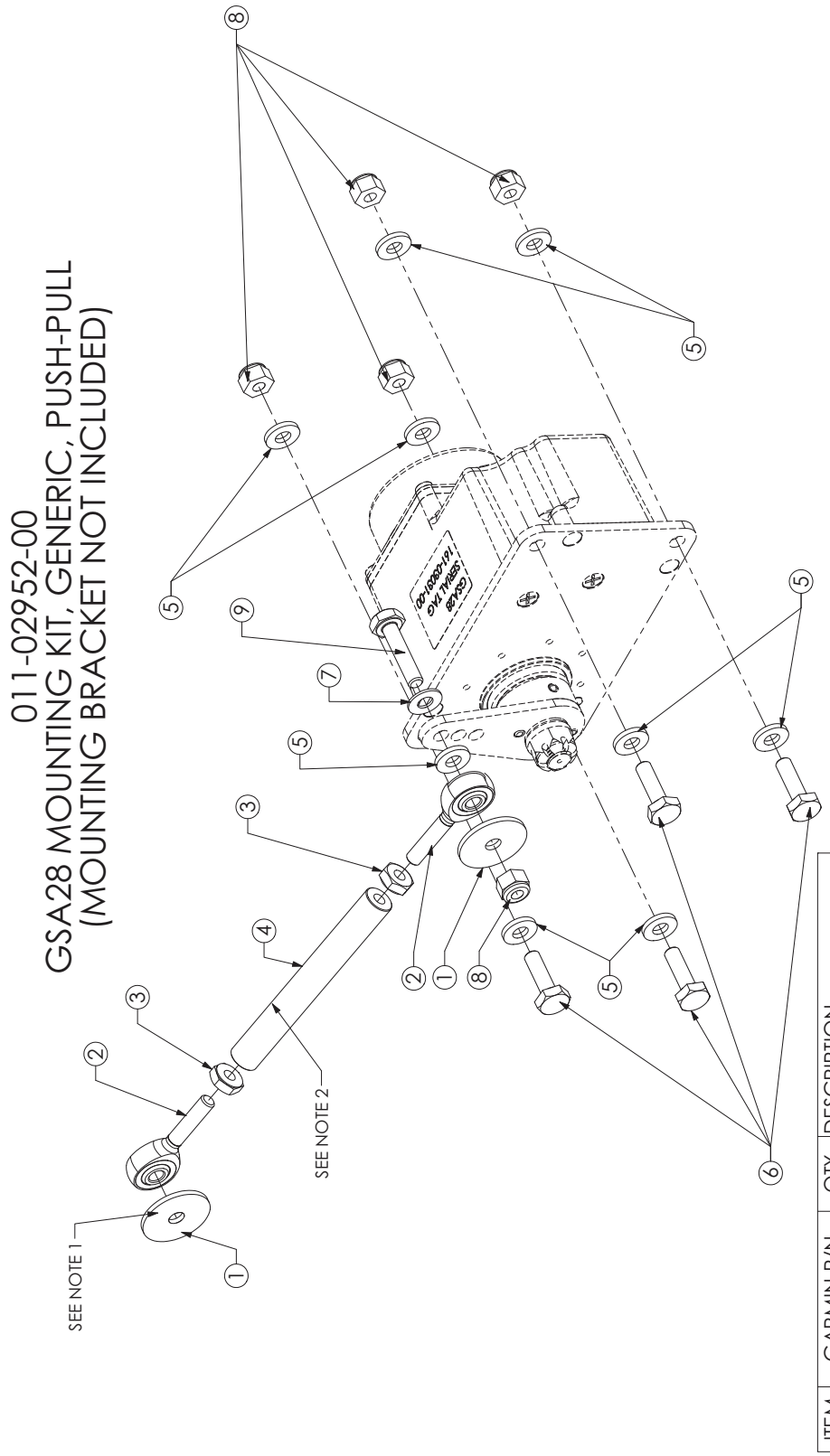
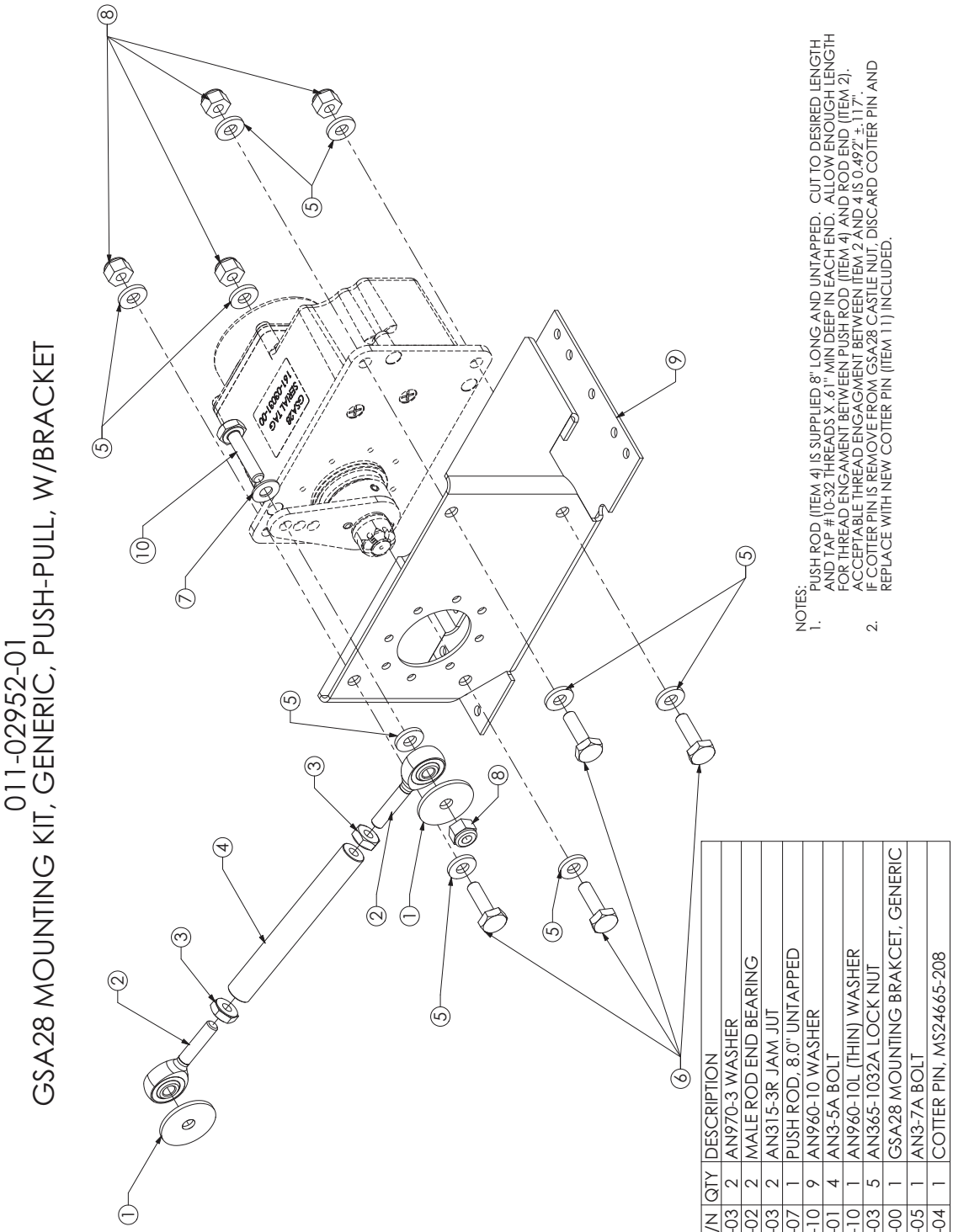


Figure 17-8.6 GSA 28 Recommended Mounting Hardware



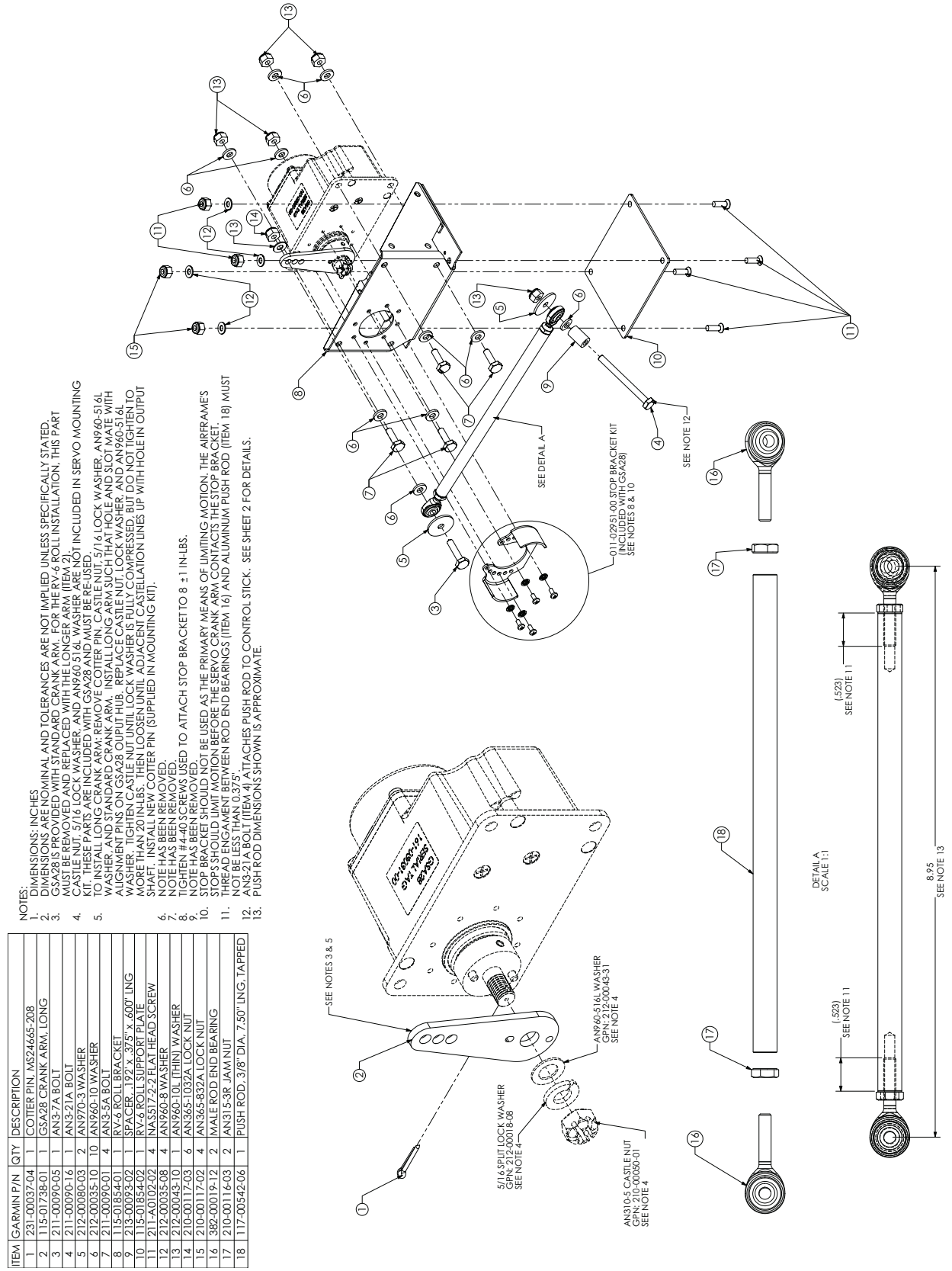
ITEM	GARMIN P/N	QTY	DESCRIPTION
1	212-00080-03	2	AN970-3 WASHER
2	382-00019-02	2	MALE ROD END BEARING
3	210-00116-03	2	AN315-3R JAM JUT
4	117-00542-07	1	PUSH ROD, 8.0" UNTAPPED
5	212-00035-10	9	AN960-10 WASHER
6	211-00090-01	4	AN3-5A BOLT
7	212-00043-10	1	AN960-10L (THIN) WASHER
8	210-00117-03	5	AN365-1032A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

Figure 17-8.7 GSA 28 Generic, Push-Pull Mounting Kit (No Bracket) 011-02952-00



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

Figure 17-8.8 GSA 28 Generic, Push-Pull Mounting Kit w/Bracket 011-02952-01



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. NOTE HAS BEEN REMOVED.
7. NOTE HAS BEEN REMOVED.
8. TIGHTEN #4-40 SCREWS USED TO ATTACH STOP BRACKET TO 8 ±1 IN-LBS.
9. NOTE HAS BEEN REMOVED.
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 ENGAGMENT 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 DIMENSION IS SHOWN IS APPROXIMATE.

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	4	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

Figure 17-9.1 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 1 of 3)

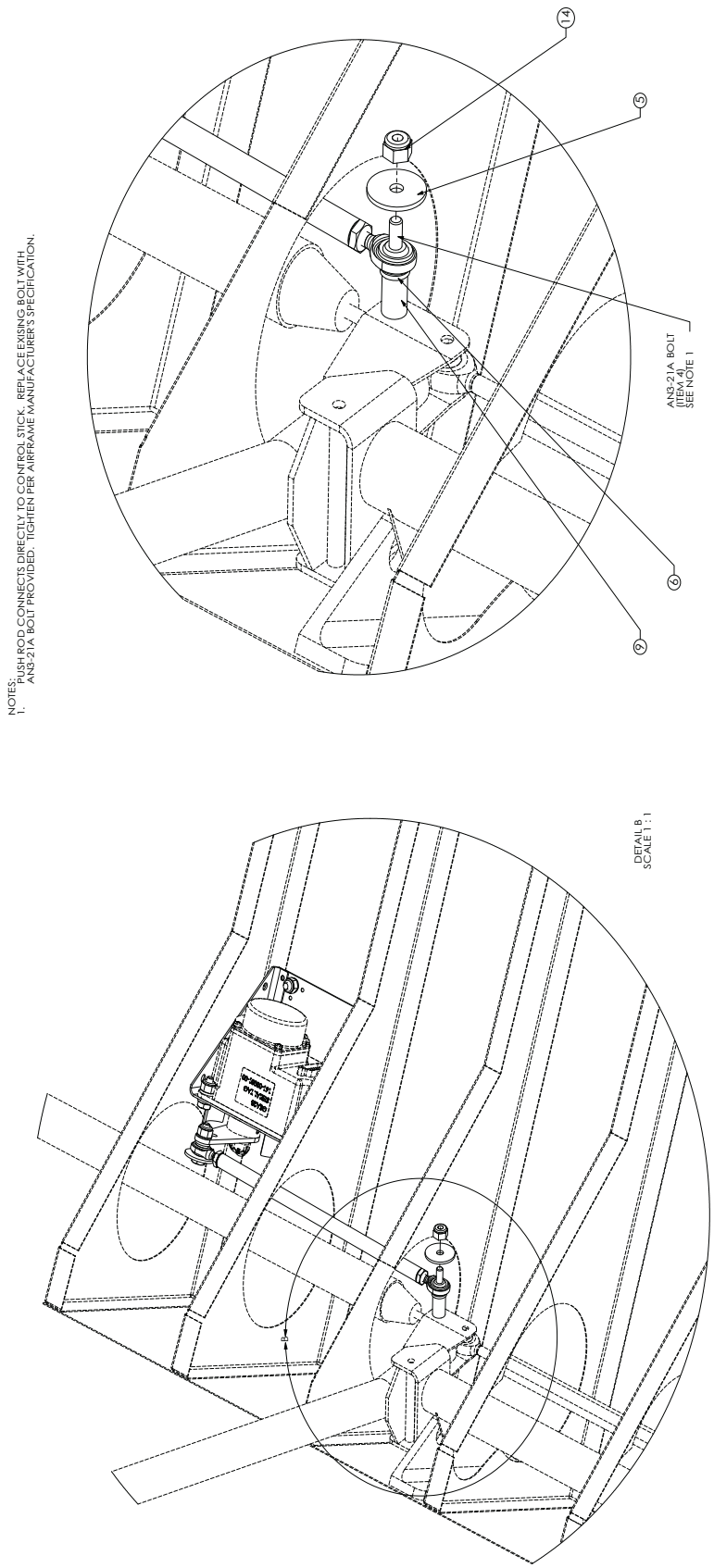
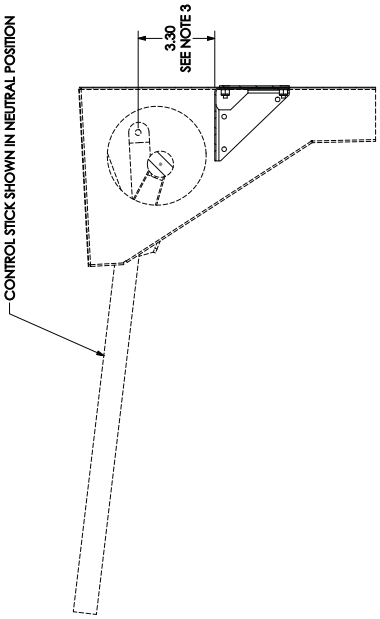
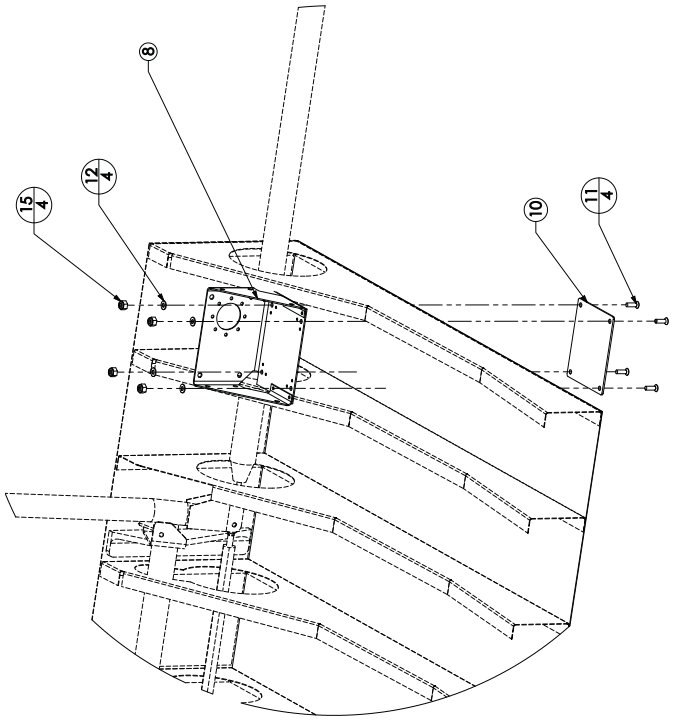


Figure 17-9.1 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 2 of 3)

NOTES:
1. ATTACH MOUNTING BRACKET TO FLOOR AS SHOWN USING SUPPORT PLATE WITH #8 FLAT HEAD SCREWS, WASHERS, AND NUTS PROVIDED OR USE MS21055 CORNER NUT PLATES (NOT INCLUDED).
2. MATCH DRILL THROUGH FLOOR FOR #8 SCREWS ONCE BRACKET LOCATION HAS BEEN DETERMINED.
3. DIMENSION SHOWN IS APPROXIMATE. IT IS HIGHLY RECOMMENDED SERVO WITH BRACKET AND PUSH ROD ARE PLACED THEN INTERFERENCE AND FREEDOM OF MOTION ARE VERIFIED PRIOR TO DRILLING MOUNTING HOLES THROUGH FLOOR.
4. PUSH TUBE CLEARANCE HOLES IN FLOOR RIBS MAY NEED TO BE TRIMMED TO CREATE MORE CLEARANCE FOR SERVO PUSH ROD.





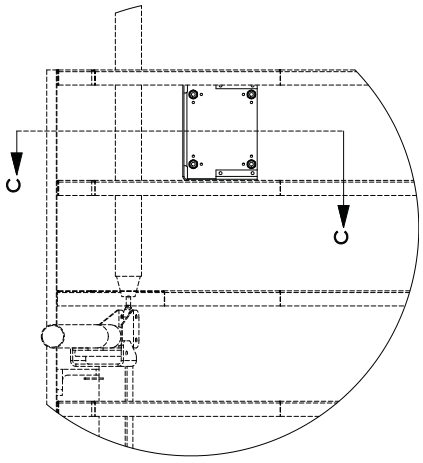
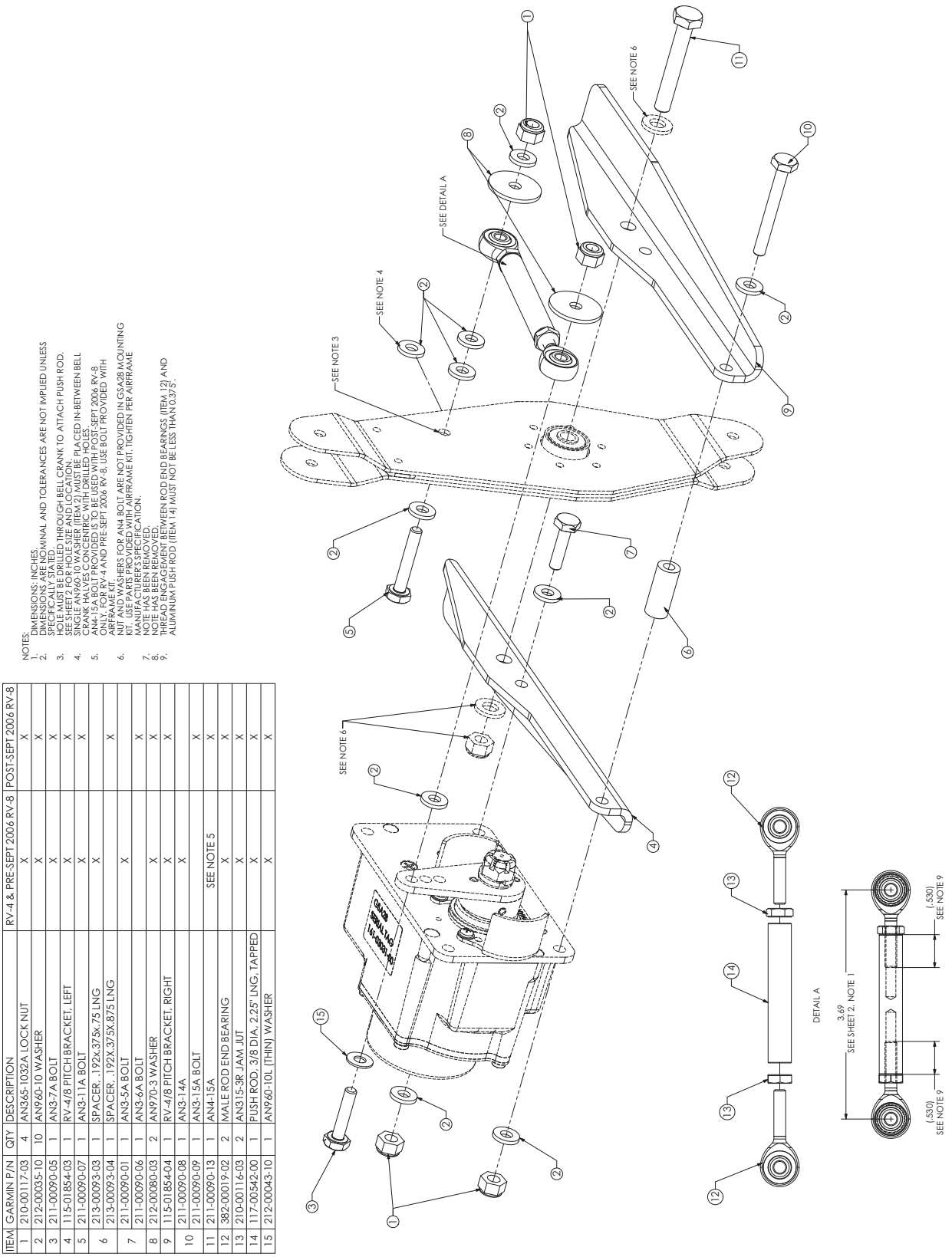


Figure 17-9.1 GSA 28 RV-6 Roll Mounting Kit 011-02952-10 (page 3 of 3)

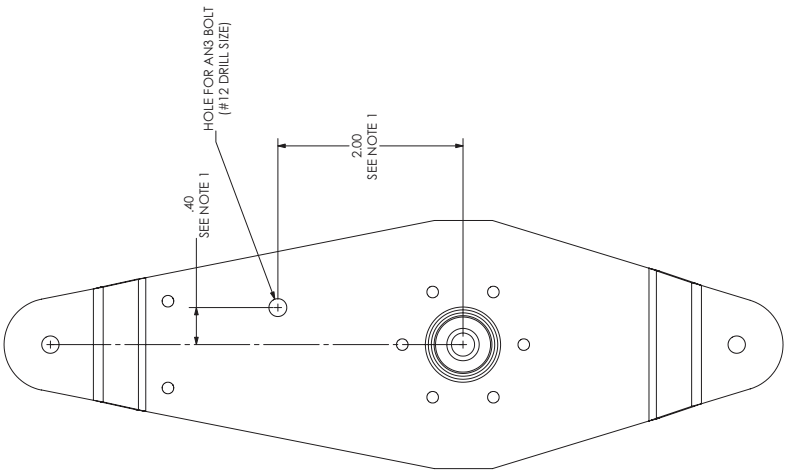


NOTES:
1. DIMENSIONS: INCHES.
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS SPECIFICALLY STATED.
3. HOLE MUST BE DRILLED THROUGH BELL CRANK TO ATTACH PUSH ROD. SEE SHEET 2 FOR HOLE SIZE AND LOCATION.
4. SINGLE AN960-10 WASHER (ITEM 2) MUST BE PLACED IN-BETWEEN BELL CRANK HALVES TO CONCENTRIC WITH DRILLED HOLES.
5. AN4-15A BOLT PROVIDED 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. NOTE HAS BEEN REMOVED.
8. NOTE HAS BEEN REMOVED.
9. THREAD ENGAGEMENT BETWEEN ROD END BEARINGS (ITEM 12) AND ALUMINUM PUSH ROD (ITEM 14) MUST NOT BE LESS THAN 0.375".

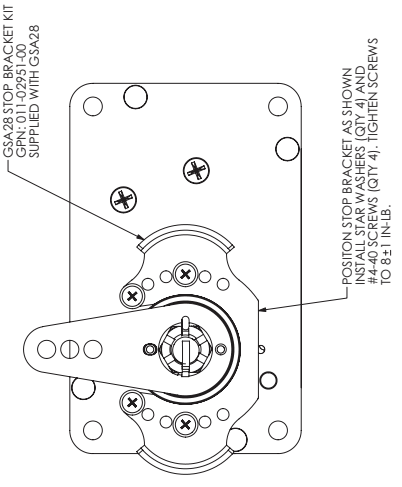
ITEM	GARMIN P/N	QTY	DESCRIPTION	RV-4 & PRE-SEPT 2006 RV-8	POST-SEPT 2006 RV-8
1	210-00117-03	4	AN365-1032A LOCK NUT	X	X
2	212-00035-10	10	AN960-10 WASHER	X	X
3	211-00090-05	1	AN3-7A BOLT	X	X
4	115-01854-03	1	RV-4/8 PITCH BRACKET, LEFT	X	X
5	211-00090-07	1	AN3-11A BOLT	X	X
6	213-00093-03	1	SPACER, .192x.375x.75 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

Figure 17-10.1 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 1 of 4)

BELL CRANK MODIFICATION, RV-4/8
(ALL VERSIONS)



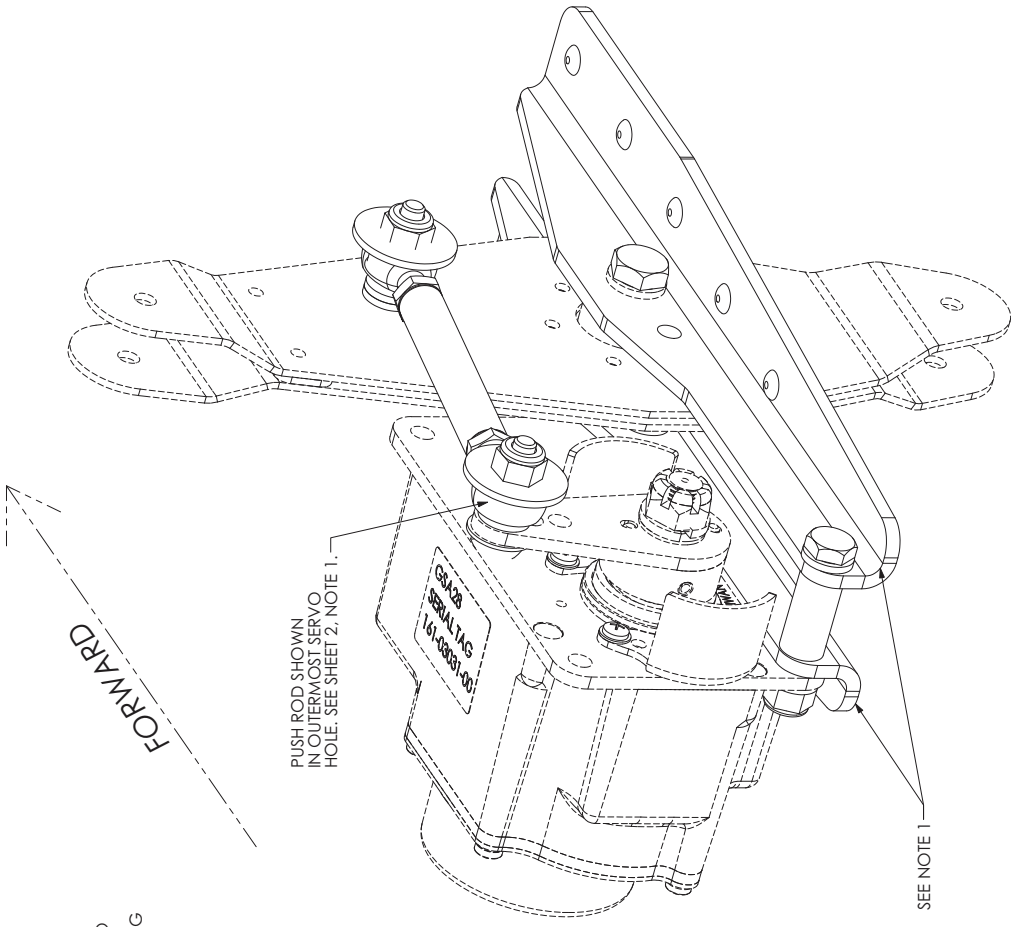
GSA28 STOP BRACKET POSITION, RV-4/8
(ALL VERSIONS)



NOTES:
1. FOR BEST AUTOPILOT PERFORMANCE, ANGULAR TRAVEL OF THE GSA28 SHOULD BE MAXIMIZED. AIRCRAFT ATTACHMENT POINT, SERVO ATTACHMENT POINT, AND PUSH ROD LENGTH ARE SHOWN FOR GUIDANCE ONLY. DEVIATING FROM THIS GUIDANCE IN EFFORT TO INCREASE SERVO TRAVEL IS PERMISSIBLE PROVIDED IT DOES NOT RESULT IN AN OVER-CENTER CONDITION. TO REDUCE THE RISK OF AN OVER-CENTER CONDITION, IT IS HIGHLY RECOMMENDED THE GSA28 STOP BRACKET BE INSTALLED AS SHOWN, WITH THE GSA28 STOP BRACKET INSTALLED, IT IS RECOMMENDED THE SERVO CRANK ARM STOPS JUST SHORT OF HITTING THE STOP BRACKET AT FULL TRAVEL IN BOTH DIRECTIONS. BEST CASE SCENARIO WOULD BE TO ACCOMPLISH THIS WITH THE PUSH ROD ATTACHED TO THE OUTERMOST HOLE IN SERVO. IF ANGULAR SERVO TRAVEL CANNOT BE MAXIMIZED USING THE OUTERMOST HOLE, USING THE MIDDLE HOLE IS RECOMMENDED PROVIDED THERE IS NO RISK OF CREATING AN OVER-CENTER CONDITION.

Figure 17-10.1 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 2 of 4)

RV-4 AND PRE-SEPTEMBER 2006 RV-8 INSTALLATION



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 17-10.1 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 3 of 4)

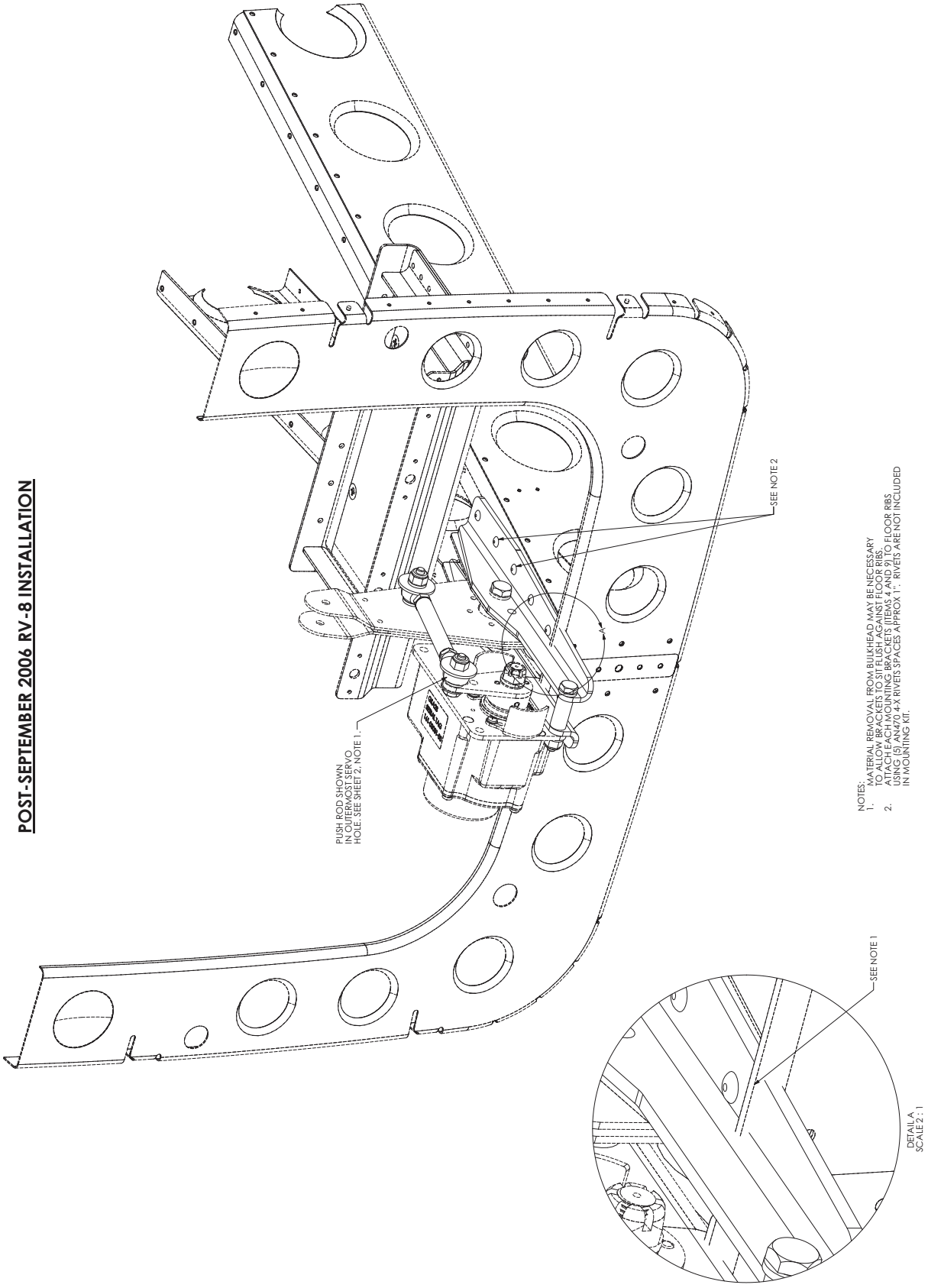
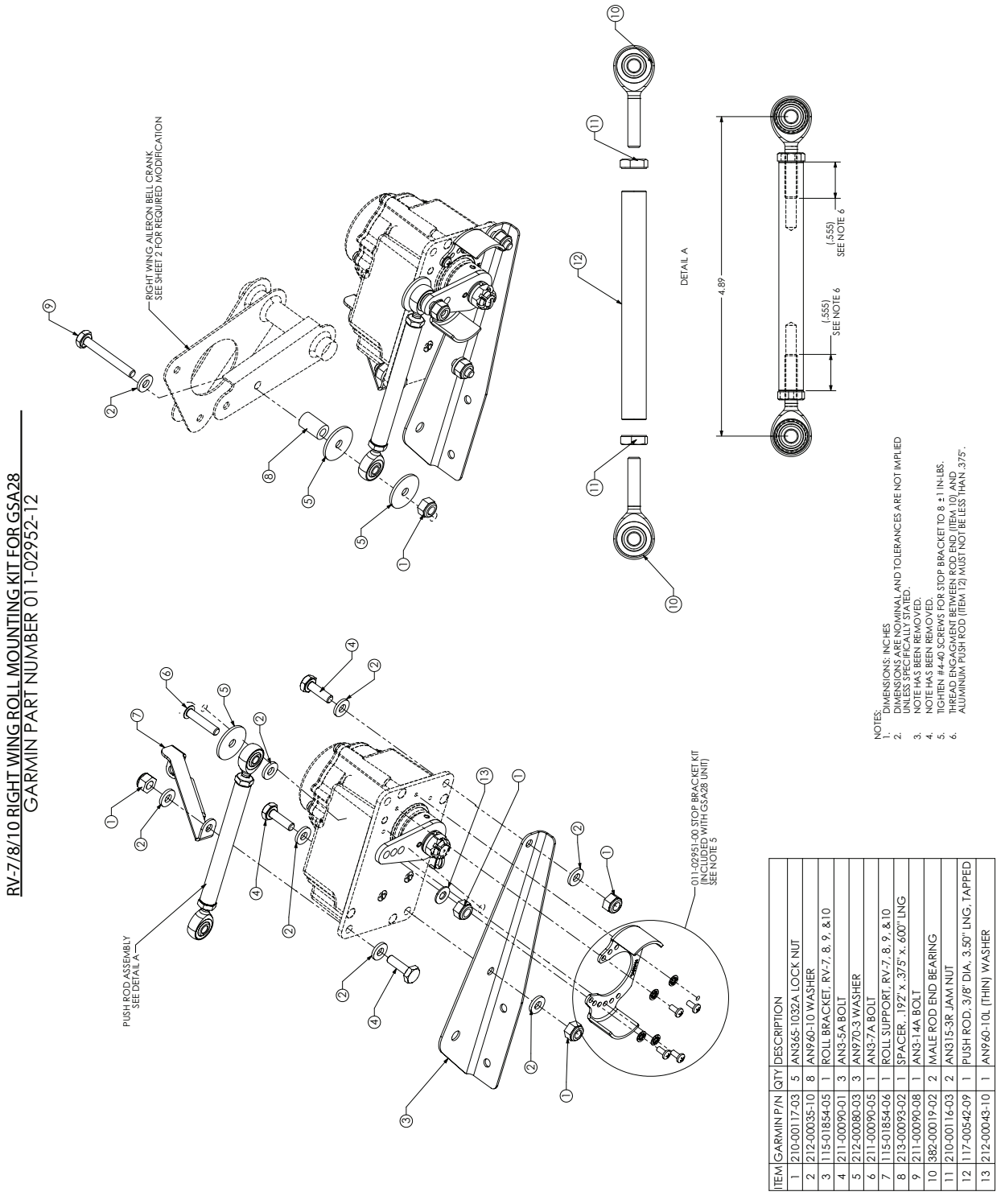


Figure 17-10.1 GSA 28 RV-4/8 Pitch Mounting Kit 011-02952-11 (page 4 of 4)



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

Figure 17-11.1 GSA 28 RV-7/8/10 Roll Mounting Kit 011-02952-12 (page 1 of 2)

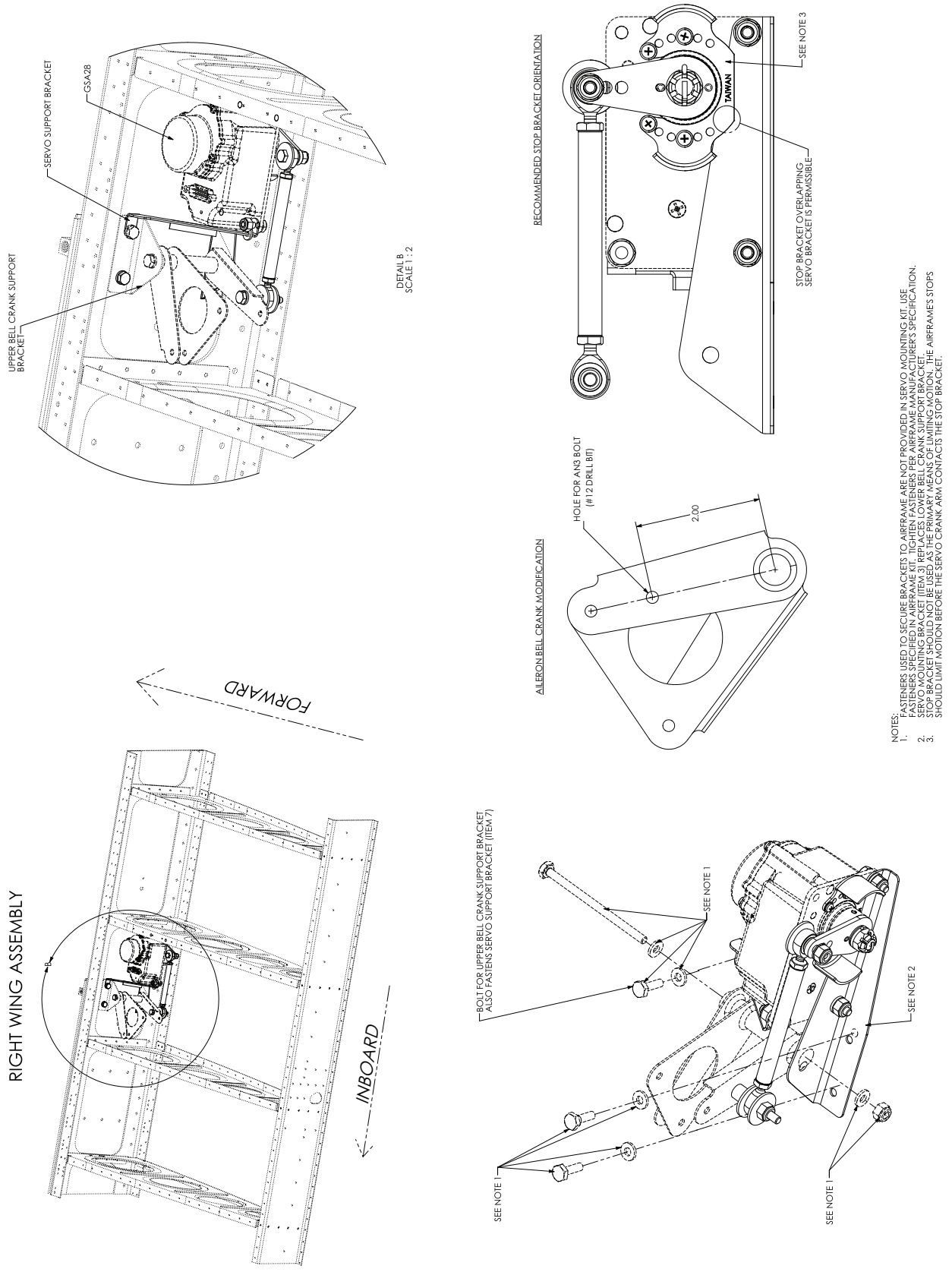
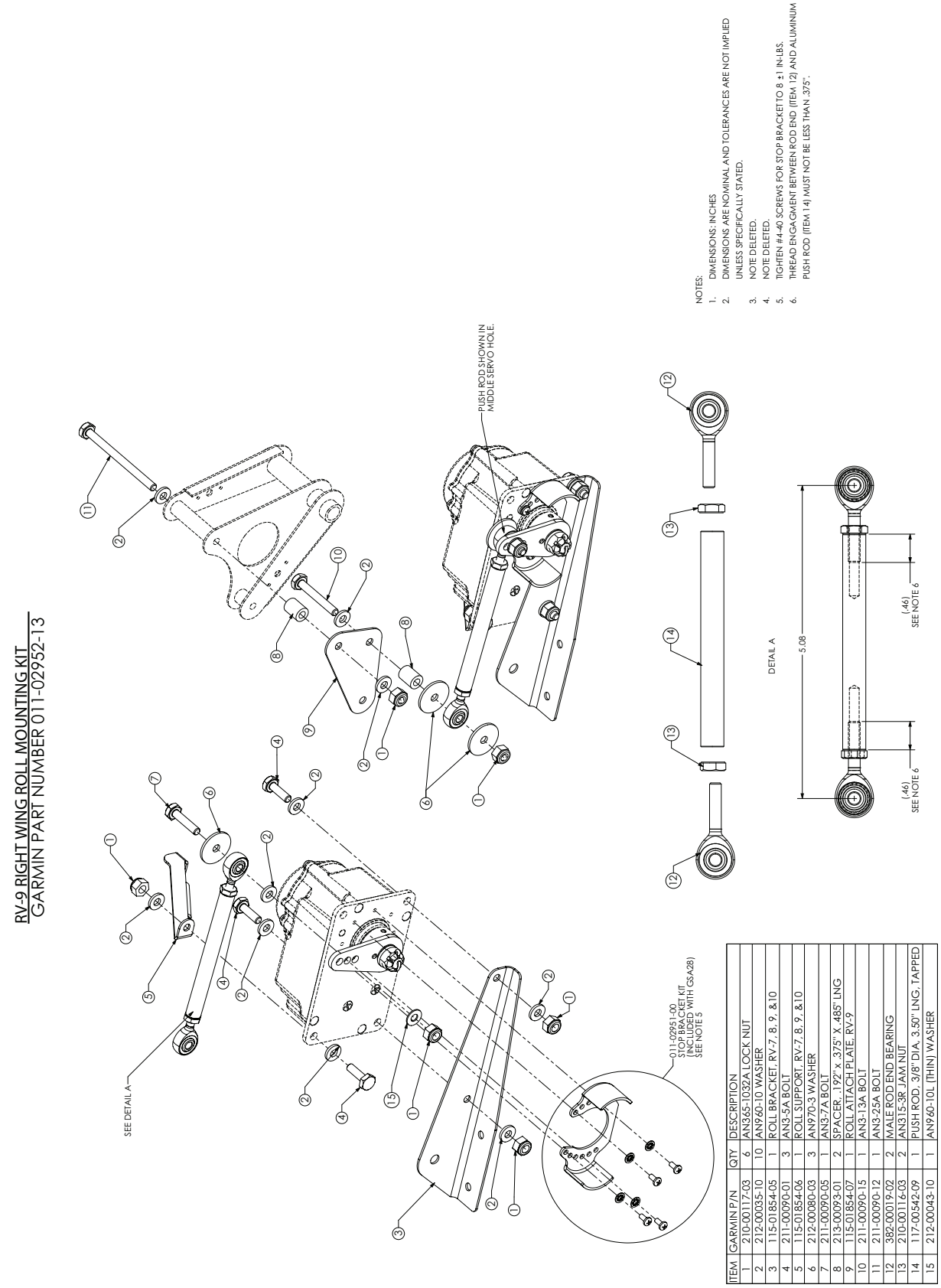


Figure 17-11.1 GSA 28 RV-7/8/10 Roll Mounting Kit 011-02952-12 (page 2 of 2)



ITEM	GARMIN P/N	QTY	DESCRIPTION
1	210-00117-03	6	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

Figure 17-12.1 GSA 28 RV-9 Roll Mounting Kit 011-02952-13 (page 1 of 2)

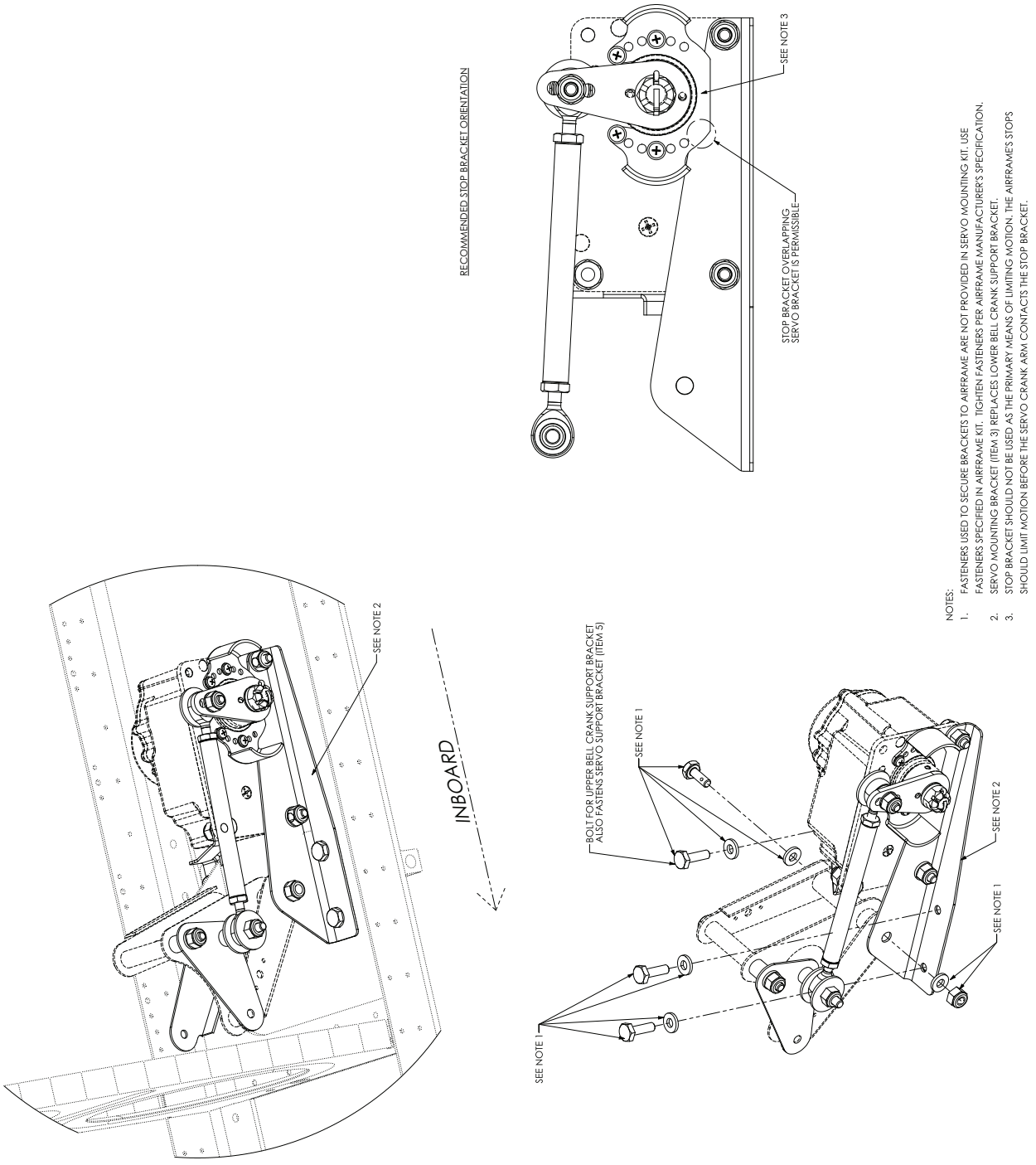
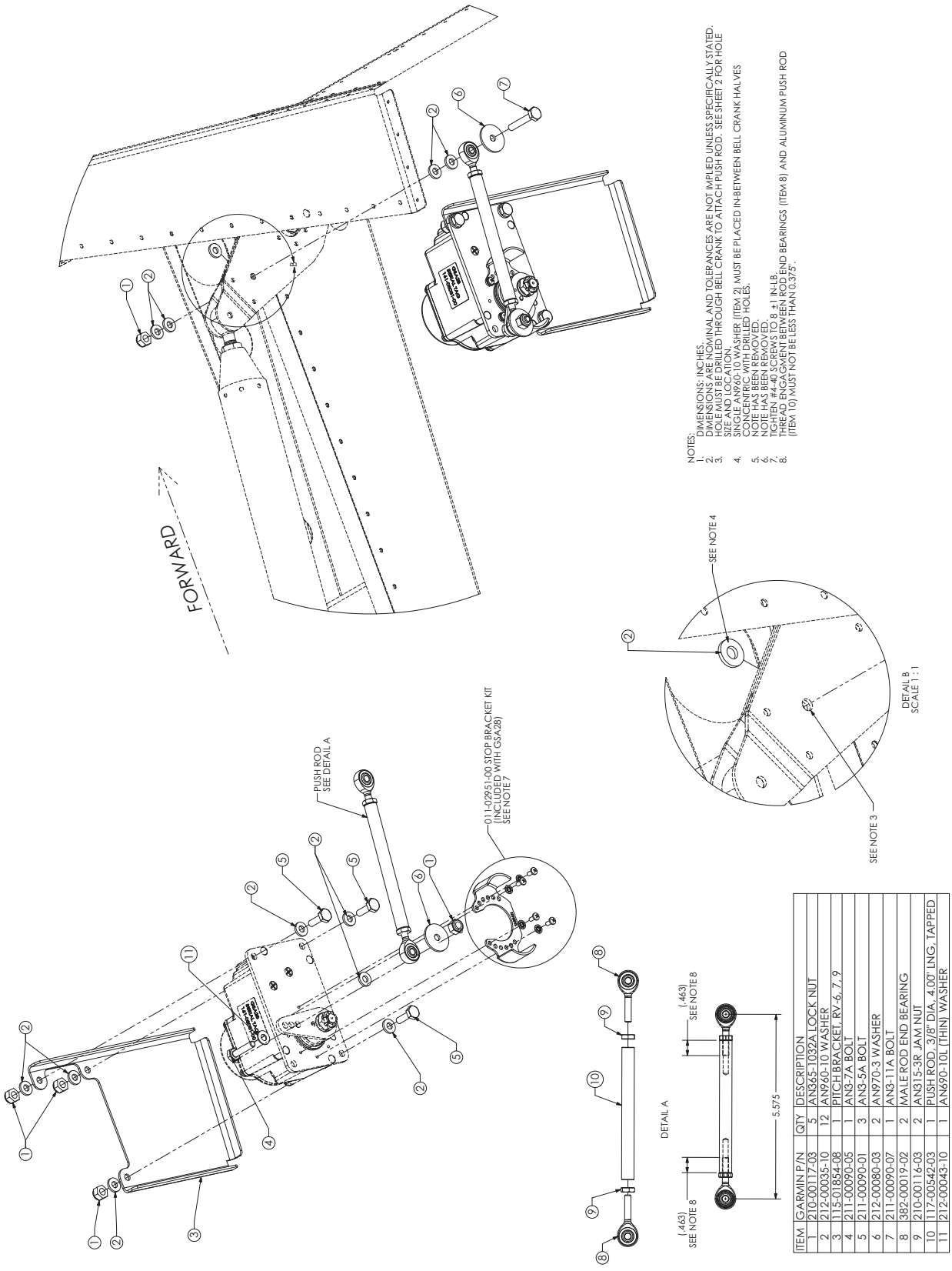


Figure 17-12.1 GSA 28 RV-9 Roll Mounting Kit 011-02952-13 (page 2 of 2)



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 17-13.1 GSA 28 RV-6/7/9 Mounting Kit 011-02952-14 (page 1 of 2)

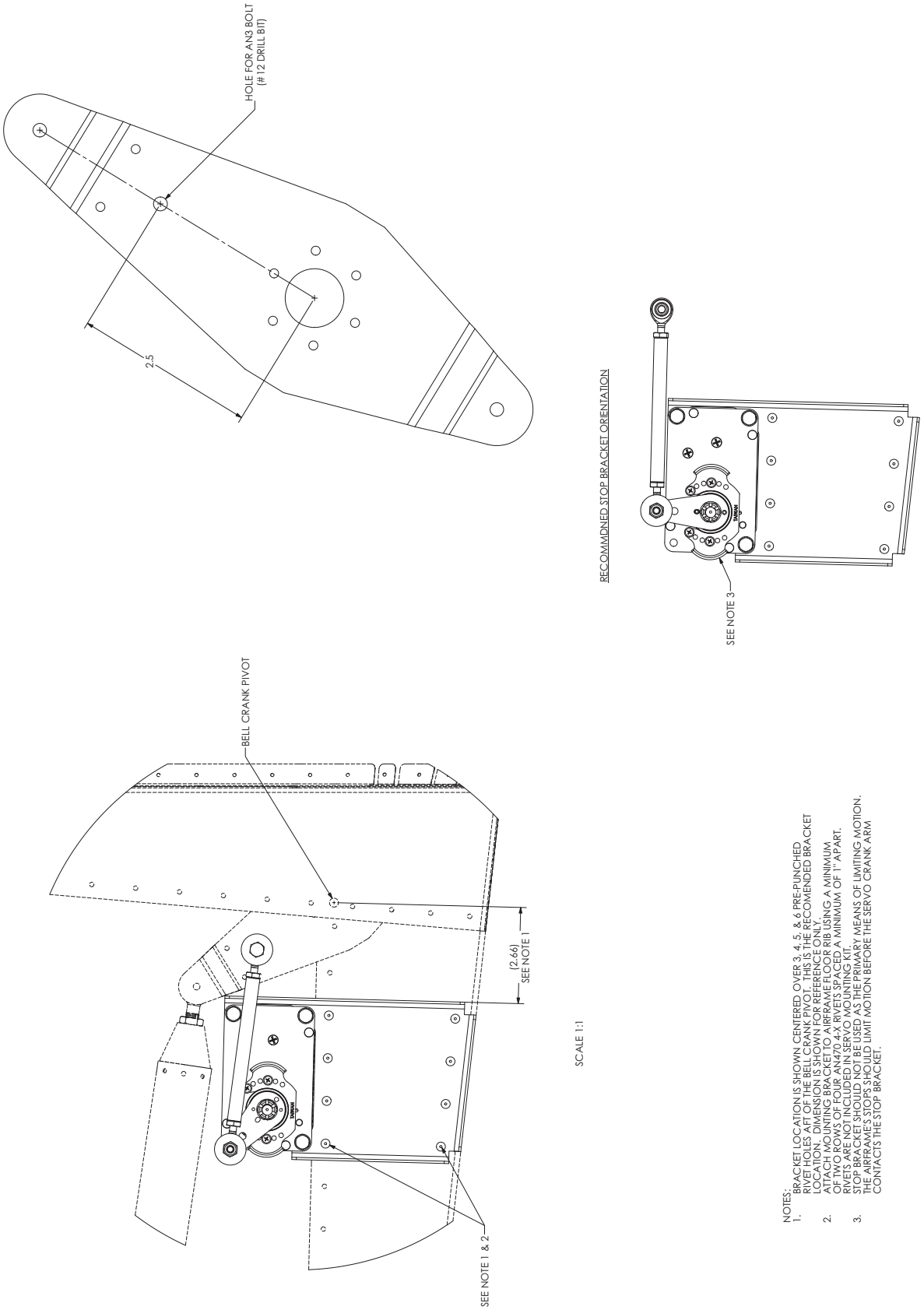
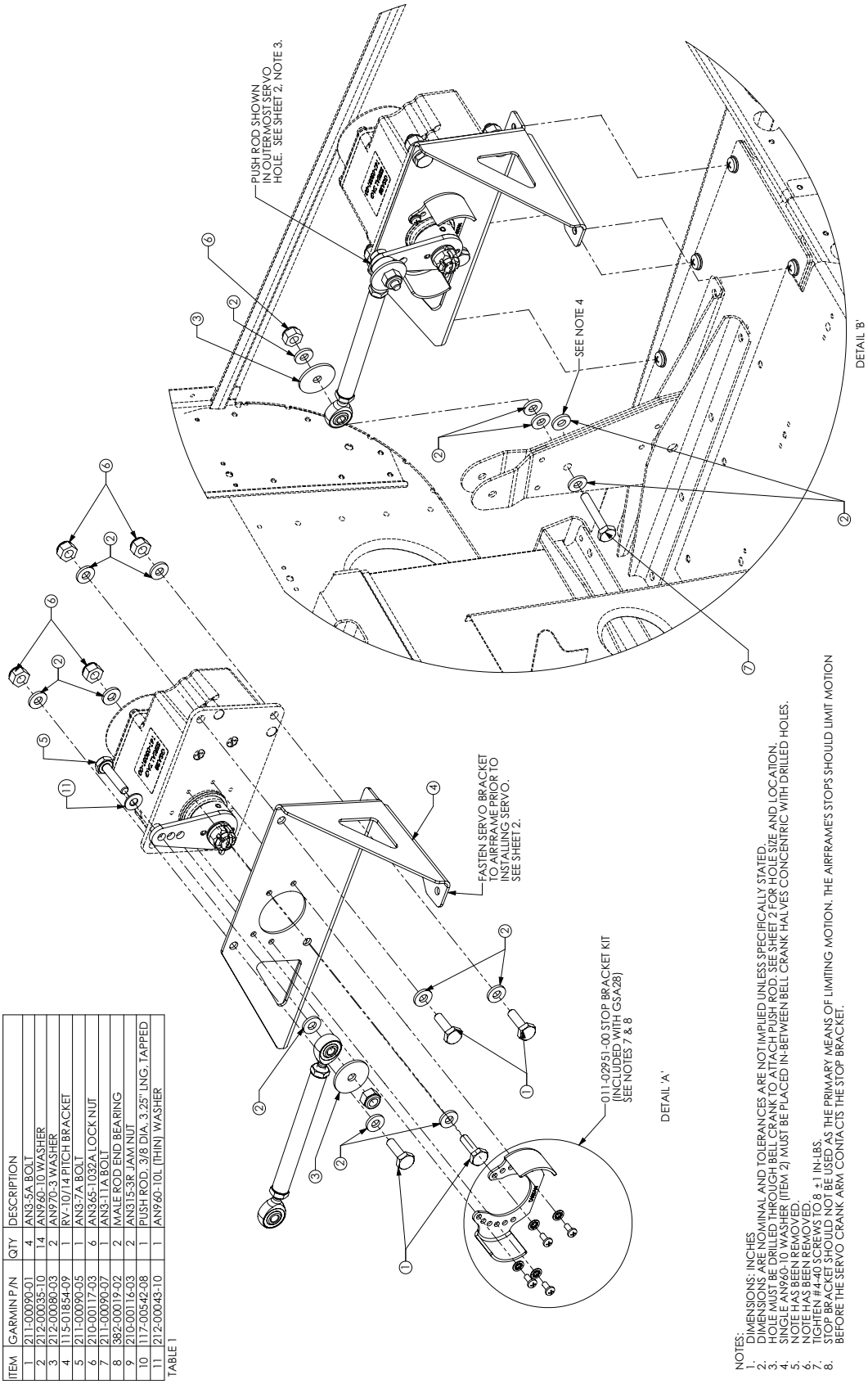


Figure 17-13.1 GSA 28 RV-6/7/9 Pitch Mounting Kit 011-02952-14 (page 2 of 2)



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

TABLE 1

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. NOTE HAS BEEN REMOVED.
6. NOTE HAS BEEN REMOVED.
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.

Figure 17-14.1 GSA 28 RV-10 Pitch Mounting Kit 011-02952-15 (page 1 of 2)

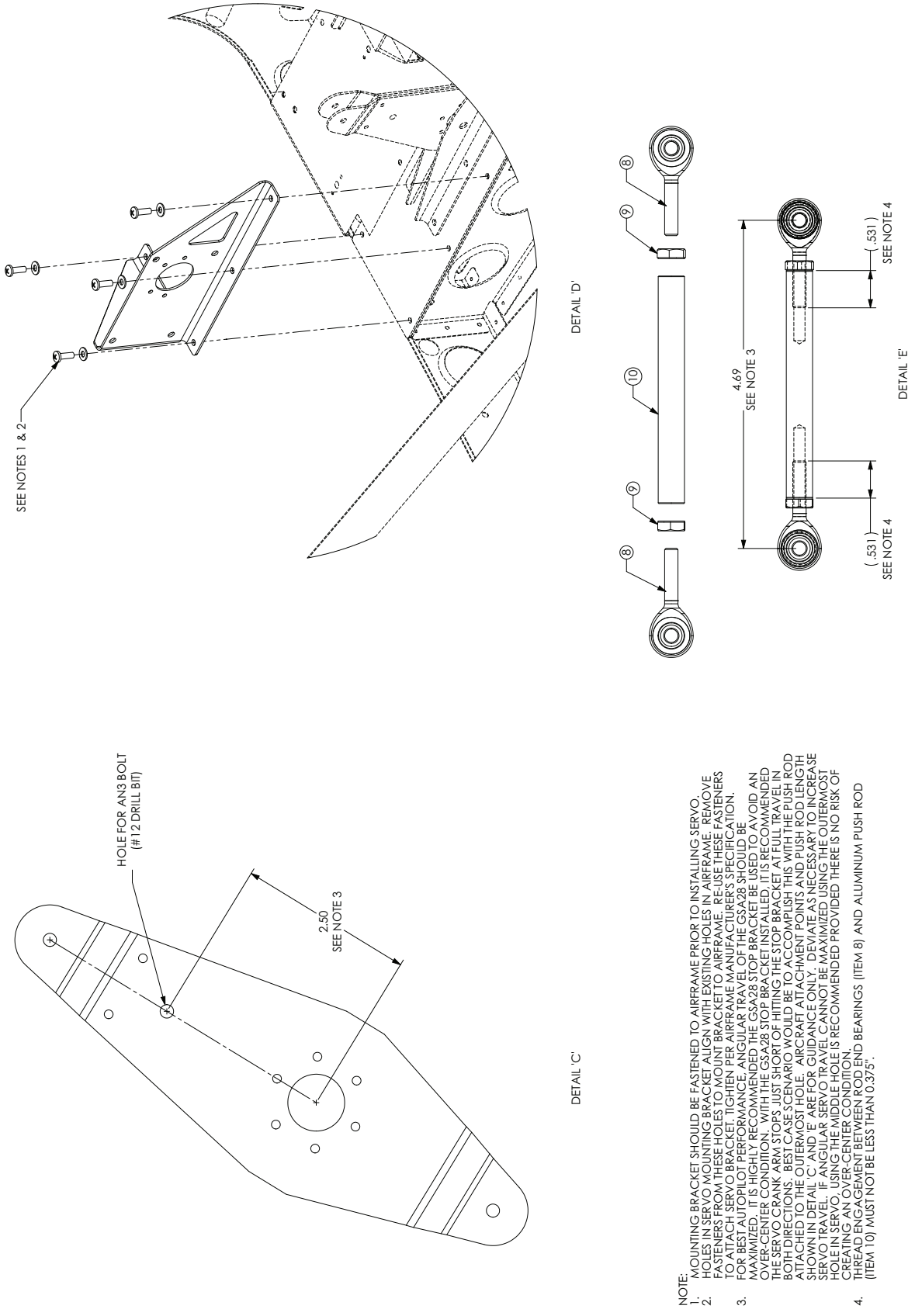
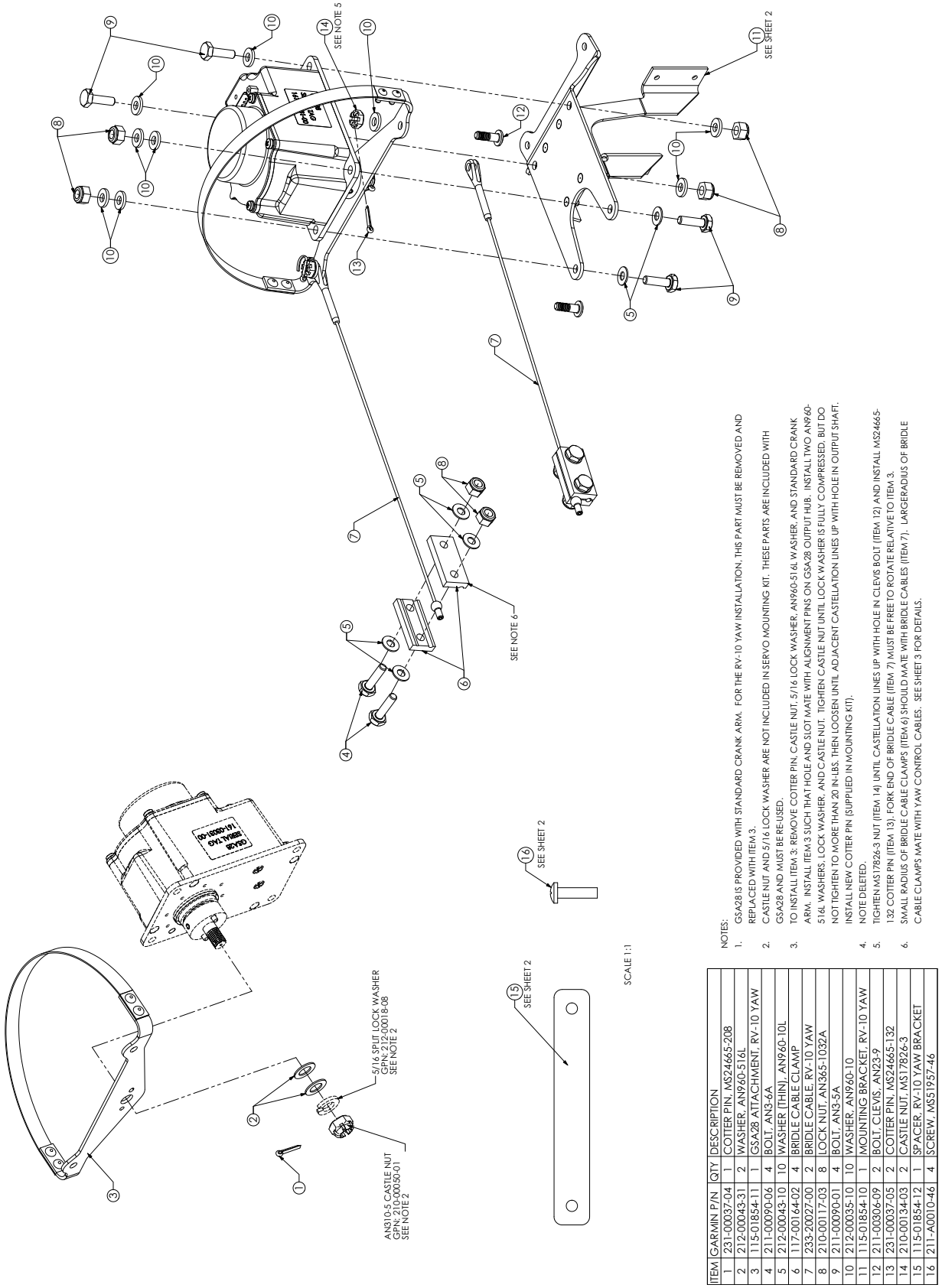


Figure 17-14.1 GSA 28 RV-10 Pitch Mounting Kit 011-02952-15 (page 2 of 2)



NOTES:

1. GSA28 IS PROVIDED WITH STANDARD CRANK ARM. FOR THE RV-10 YAW INSTALLATION, THIS PART MUST BE REMOVED AND REPLACED WITH ITEM 3.
2. CASTLE NUT AND 5/16 LOCK WASHER ARE NOT INCLUDED IN SERVO MOUNTING KIT. THESE PARTS ARE INCLUDED WITH GSA28 AND MUST BE RE-USED.
3. TO INSTALL ITEM 3: REMOVE COTTER PIN, CASTLE NUT, 5/16 LOCK WASHER, AN960-516L WASHER, AND STANDARD CRANK ARM. INSTALL ITEM 3 SUCH THAT HOLE AND SLOT MATE WITH ALIGNMENT PINS ON GSA28 OUTPUT HUB. INSTALL TWO AN960-516L WASHERS, LOCK WASHER, AND CASTLE NUT. 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).
4. NOTE DELETED.
5. TIGHTEN MS17826-3 NUT (ITEM 14) UNTIL CASTELLATION LINES UP WITH HOLE IN CLEVIS BOLT (ITEM 12) AND INSTALL MS24665-132 COTTER PIN (ITEM 13). FORK END OF BRIDLE CABLE (ITEM 7) MUST BE FREE TO ROTATE RELATIVE TO ITEM 3.
6. SMALL RADIUS OF BRIDLE CABLE CLAMPS (ITEM 6) SHOULD MATE WITH BRIDLE CABLES (ITEM 7). LARGERADIUS OF BRIDLE CABLE CLAMPS MATE WITH YAW CONTROL CABLES. SEE SHEET 3 FOR DETAILS.

ITEM	GARMIN P/N	QTY	DESCRIPTION
1	231-00037-04	1	COTTER PIN, MS24665-208
2	212-00043-31	2	WASHER, AN960-516L
3	115-01854-11	1	GSA28 ATTACHMENT, RV-10 YAW
4	211-00090-06	4	BOLT, AN3-6A
5	212-00043-10	10	WASHER (THIN), AN960-10L
6	117-00164-02	4	BRIDLE CABLE CLAMP
7	233-20027-00	2	BRIDLE CABLE, RV-10 YAW
8	210-00117-03	8	LOCK NUT, AN365-1032A
9	211-00090-01	4	BOLT, AN3-5A
10	212-00035-10	10	WASHER, AN960-10
11	115-01854-10	1	MOUNTING BRACKET, RV-10 YAW
12	211-00306-09	2	BOLT, CLEVIS, AN23-9
13	231-00037-05	2	COTTER PIN, MS24665-132
14	210-00134-03	2	CASTLE NUT, MS17826-3
15	115-01854-12	1	SPACER, RV-10 YAW BRACKET
16	211-A0010-46	4	SCREW, MS51957-46

Figure 17-15.1 GSA 28 RV-10 Yaw Mounting Kit 011-02952-16 (page 1 of 3)

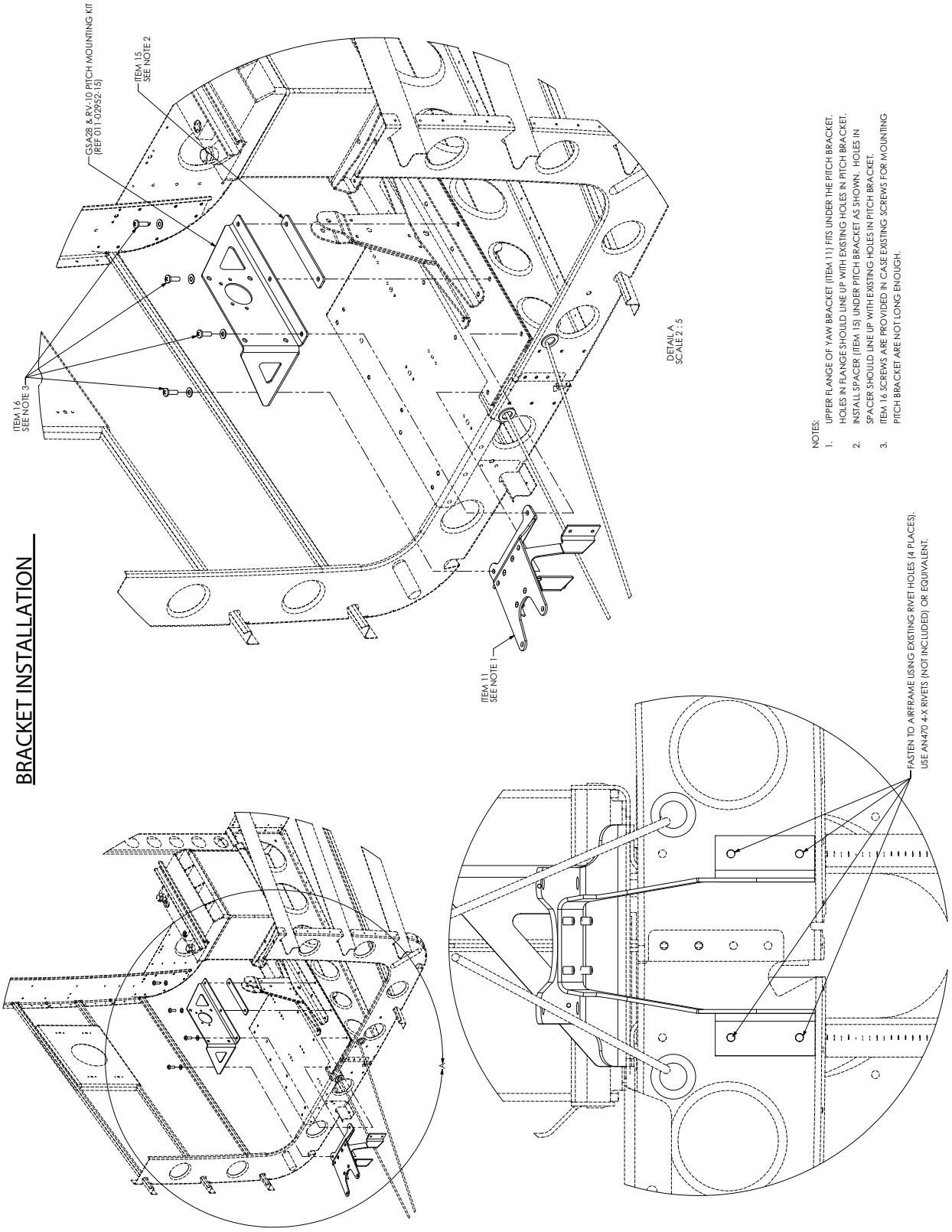


Figure 17-15.1 GSA 28 RV-10 Yaw Mounting Kit 011-02952-16 (page 2 of 3)

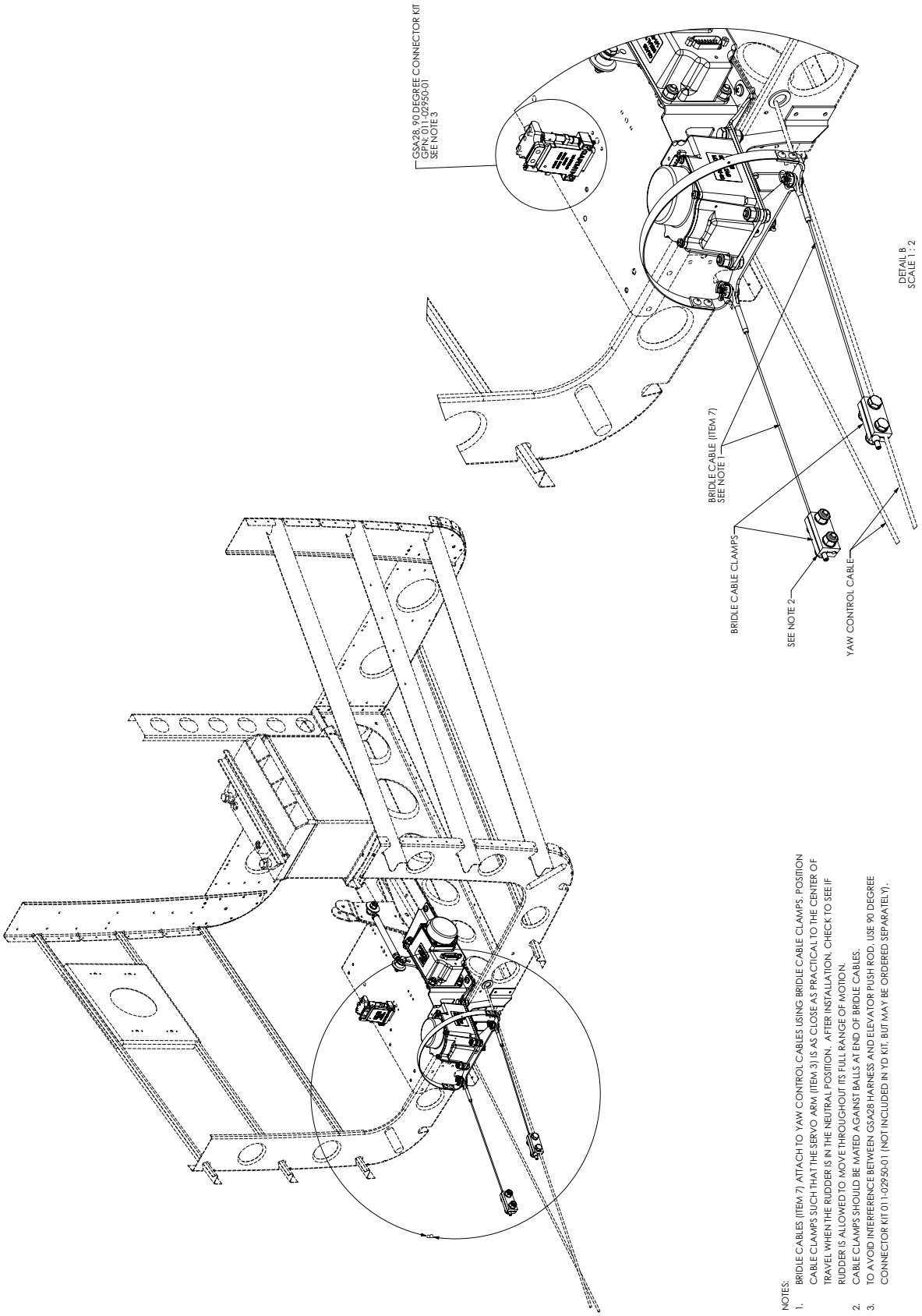


Figure 17-15.1 GSA 28 RV-10 Yaw Mounting Kit 011-02952-16 (page 3 of 3)

18 GSU 25/25B/25C/25D (AHRS/AIR DATA SENSOR UNIT) INSTALLATION

NOTE

References to the GSU 25 throughout this manual apply equally to the GSU 25B, GSU 25C, and GSU 25D except where specifically noted.

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

NOTE

The GSU 25 was a prior version of the GSU 25C, all form, fit, and functions are identical for the two models.

NOTE

The GSU 25B was a prior version of the GSU 25D, all form, fit, and functions are identical for the two models.

18.1 Equipment Description

NOTE

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

The GSU 25 is not supported for installations in type certificated aircraft using the guidance in this installation manual.

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 magnetometer for heading information and also computes OAT and TAS from inputs provided by the GTP 59. 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 functions in Table 18-1.

Table 18-1 GSU 25 Functions

Air Data	Interfaces	AHRS
Pressure Altitude	CAN (1)	Magnetic Heading (with input from GMU magnetometer)
Density Altitude	RS-232 (2 TX/2 RX)	Pitch Angle
Vertical speed	OAT Probe (GTP 59)	Roll Angle
Mach Number	Magnetometer (GMU 22) (1 RS-232 TX/ 1 RS-485 RX)	Linear Accelerations
Indicated Airspeed		Pitch, Roll, Yaw Rotation Rates
True Airspeed		3 axis angular rates
Angle of attack		3 axis accelerations

Table 18-1 GSU 25 Functions

Air Data	Interfaces	AHRS
Outside and total air temperature (from GTP 59)		

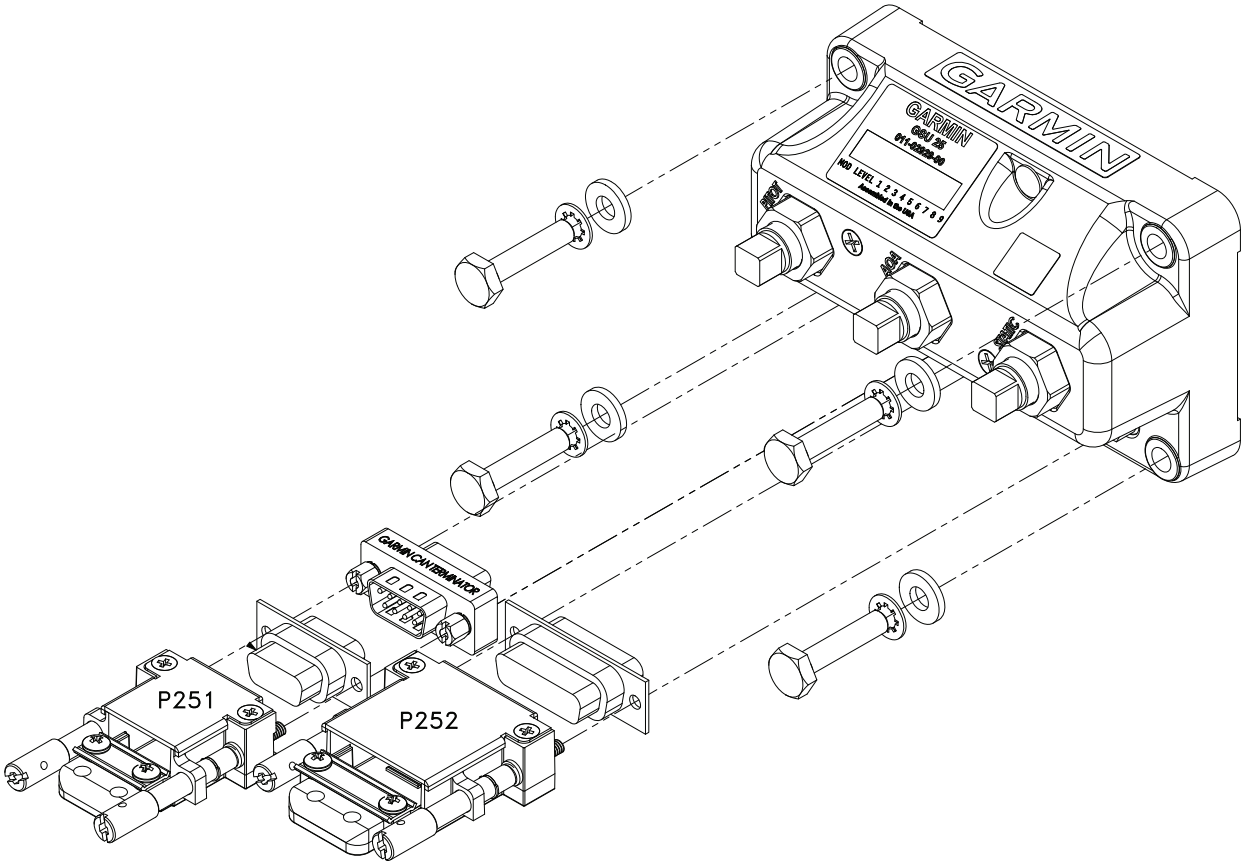


Figure 18-1 GSU 25 Unit View

18.1.1 Status LED

The GSU 25 has an LED on the outer case that indicates current status. See Section 32.1.1 for details.

18.2 General Specifications

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

GSU 25D (011-02929-51 only) HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GSU 25D 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	Changed Maximum Pressure Altitude from 30,000 feet to 55,000 feet

18.3 Required Equipment

Table 18-2 lists the kits available for the GSU 25.

Table 18-2 GSU 25 Available Equipment

Item	Garmin P/N	Quantity
GSU 25C Unit Assembly	011-02929-50*	1
GSU 25D Unit Assembly	011-02929-51**	1
GSU 25 Connector Kit (contains all items in Table 18-3 and Table 18-4)	K10-00181-00	1

*Part numbers 011-02929-50 and 011-02929-55 are functionally equivalent.
**Part numbers 011-02929-51 MOD 1 and 011-02929-56 are functionally equivalent. A non- MOD 1 011-02929-51 has a decreased Pressure Altitude Range. See Appendix D.12.1.

Table 18-3 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 18-4 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
Washer, Int Star, MS35334, #10	212-00081-03	4
D-Sub, Crimp Socket Connector, 15 CKT	330-00625-15	1
Contact Socket, Mil Crimp, Size 20, 20-24 AWG	336-00022-02	15

18.3.1 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 18.4.4).

18.4 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 24.15 for pinouts.

The GSU 25 connects to other LRUs in the G3X system using the CAN bus. To provide an optional redundant path for attitude and air data, a secondary RS-232 connection to a single GDU™ display (typically PFD1) is also supported. See Figure 25-1.12 for wiring and configuration information.

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 23.

NOTE

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

NOTE

Make sure that backshell connectors are fully tightened. Loose connectors may cause vibration-related performance issues that are difficult to troubleshoot.

18.4.1 Mounting/Calibration Overview

It is critical the GSU 25 is mounted in alignment with the centerline of the aircraft. The GSU 25 must be mounted with the connectors aligned within 1.0 degree of either the longitudinal or lateral axis of the aircraft. (see Section 18.4.1 for complete requirements)

The specification for mounting the GSU 25 such it is level with respect to pitch/roll of the aircraft is not nearly as restrictive, and must only be within 30.0 degrees in each axis. In most installations, the GSU 25 is mounted relatively level with respect to the zero waterlines of the aircraft (e.g. longerons), even though it is not required (again, must only be within 30.0 degrees). (see Section 18.4.2 for complete requirements

Calibrating the pitch/roll offsets is also a crucial part of the installation (see Section 31.4.7). During calibration, while on the ground, the aircraft must be level in both pitch/roll so it accurately represents the in-cruise attitude of the aircraft. This part of the calibration determines the displayed measured attitude of the GSU 25 is zero degrees in pitch/roll when the aircraft is in level, coordinated cruise flight. (Note the PFD allows +/- 5 degrees of pitch offset adjustment in flight. This allows the pilot to adjust the pitch offset while in flight to show a correct attitude indication on the PFD, even if the pitch attitude was slightly off when the on the ground pitch/roll offset calibration was performed.)

18.4.2 Mounting Requirements

The GSU 25 contains 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 24 orientations (Figure 18-6 and Figure 18-6), 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.

NOTE

The "Tubes Up" mounting orientations are not recommended as any moisture in the pitot/static/AOA line could drain into the GSU 25 and damage the pressure sensors.

NOTE

Select the "Tubes Forward/Connectors Down" orientation when the GSU 25 is mounted to the back of the GDU 4XX unit.

- Although mounting the GSU 25 to the threaded holes on the back of the GDU 4XX display is not generally recommended due to instrument panel flexing, the "Tubes Forward/Connectors Down" configuration should be selected when this location is used. Instrument panel material should be at least 0.063" in thickness to produce satisfactory results.
- 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 18-2.
- 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 18-5.
- 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. Example 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 ideal location to install the GSU 25. Installing a GSU 25 in the wing may exceed the lateral CG boundary for the unit, exposes the unit to potential wing flex (of which any amount is a problem), and may expose the unit to unacceptable levels of acoustic noise resulting from precipitation impacting the leading edge of the wing. These are potential sources of error in the determination of attitude and should be avoided.

- The GSU 25 must be leveled to within 30.0° of the in-flight level cruise attitude and an aircraft leveling and offset calibration procedure carried out before flight. (This procedure is described in Appendix H.4.3.2 for GDU 37X systems and Section 31.4.7.2 for GDU 4XX systems.)
- 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.

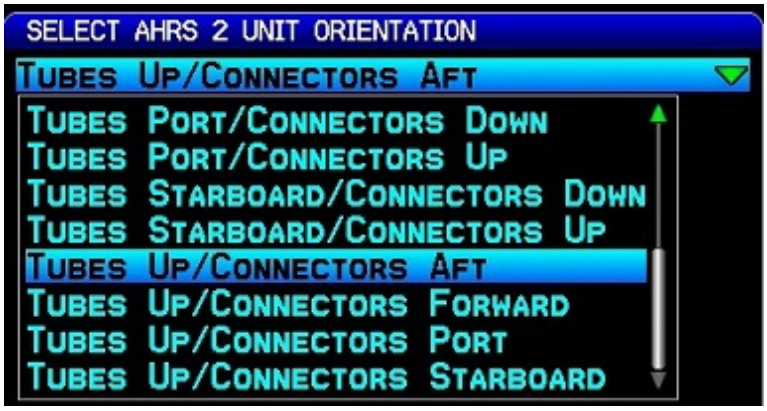


Figure 18-2 AHRS Orientation Selection

18.4.3 Unit Mounting

For final installation and assembly, refer to the outline and installation drawing Figure 18-4 and Figure 18-5 of this manual.

1. Mount the unit to a suitable mounting location using the hardware in the connector kit (Table 18-4) per the requirements in Section 18.4.2.
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 2.3.1.3.3).

NOTE

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

18.4.4 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 18-3). 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 them before installation of the GSU 25 into aircraft.

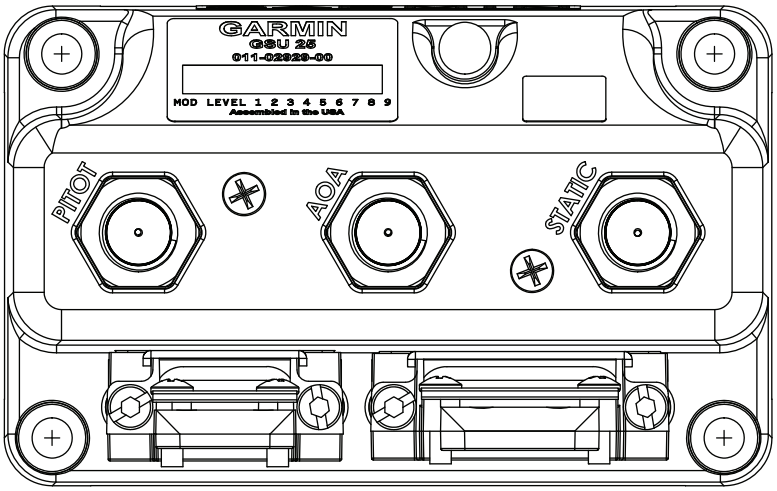


Figure 18-3 GSU 25 Air Hose Fitting Locations

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 25-1.6. 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. Make sure 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.

18.4.5 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.

CAUTION

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

CAUTION

When the GSU 25 is used in conjunction with the GAP 26 pitot/AOA probe to perform Part 43 Appendix E altimeter tests, the probe adapter from the pitot-static tester must completely cover the pitot and AOA ports and drain holes on the GAP 26 to avoid overpressuring (and causing damage to) the internal AOA sensor of the GSU 25. If the GAP 26 is installed but AOA is unused (i.e., the AOA port of the GAP 26 is not connected to the AOA port of the GSU 25) then the GAP 26 AOA port must be connected to the same pressure port as the pitot port during pitot-static testing.

**Note: If the AOA is unused and connected to the static port (as described in the preceding Caution statement) it can remain connected to the static port for the pitot-static test.*

CAUTION

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.

See 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 make sure 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 18-4 and Figure 18-5 for reference.

18.5 Outline and Installation Drawings

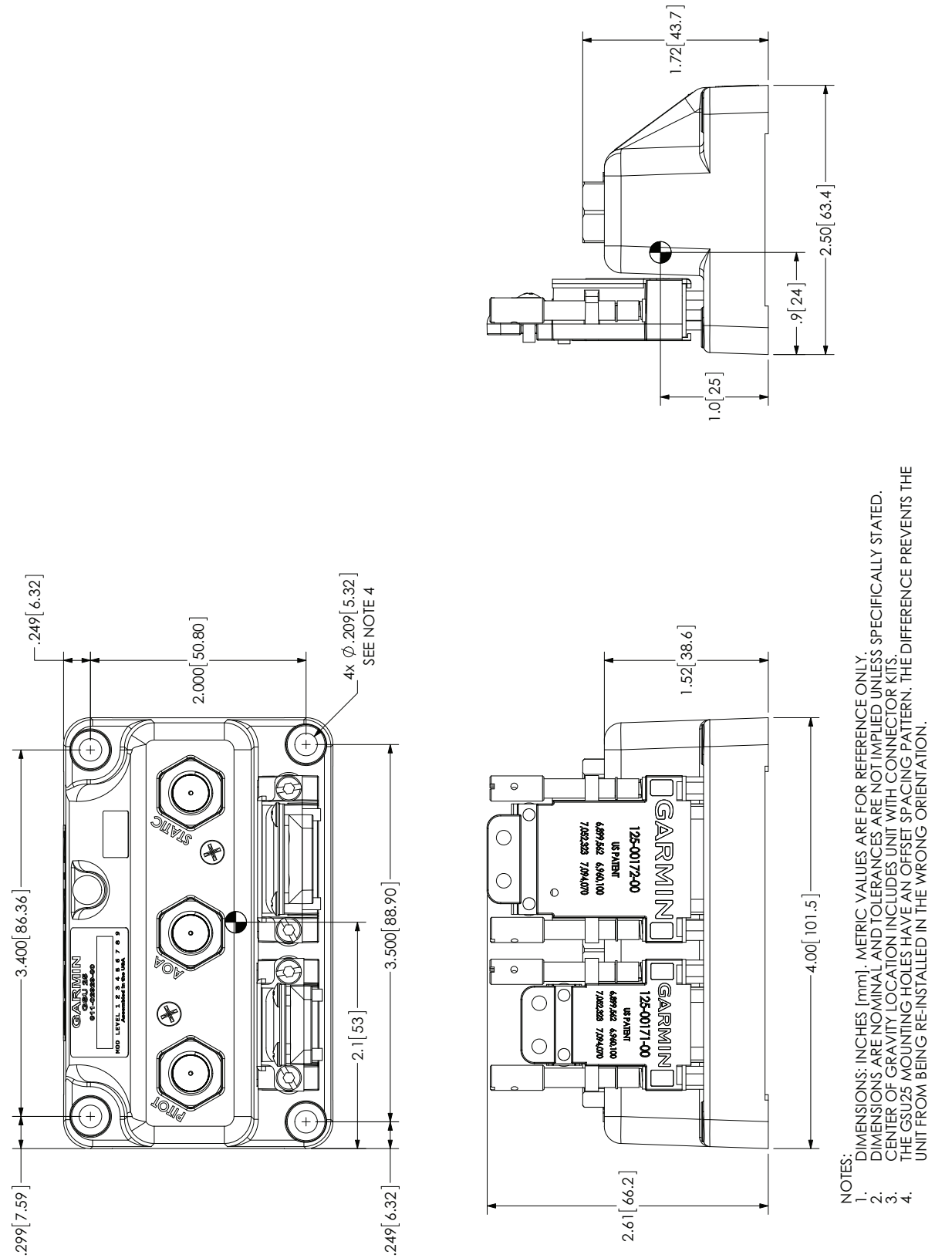


Figure 18-4 GSU 25 Outline Drawing

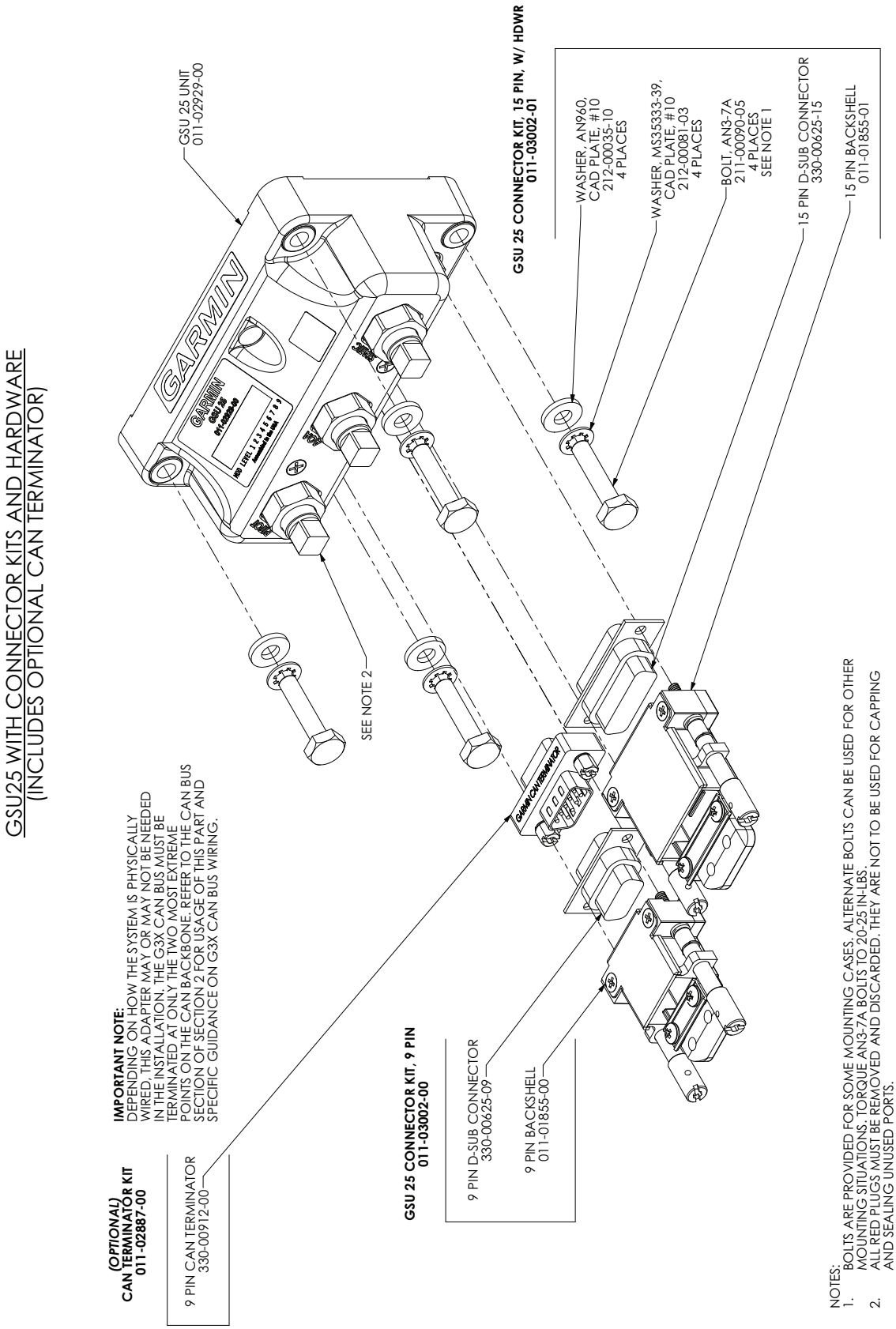


Figure 18-5 GSU 25 Installation Drawing

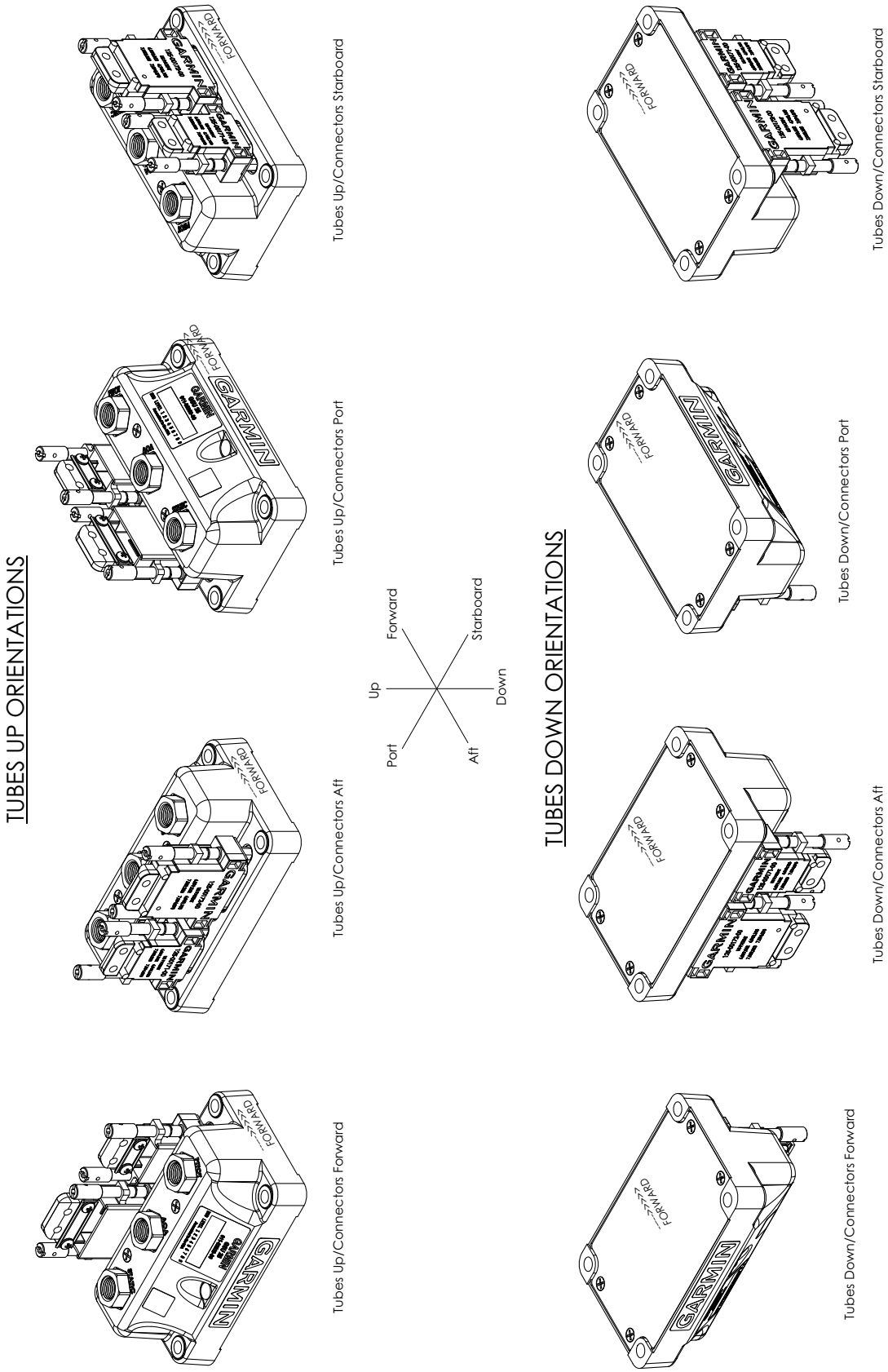


Figure 18-6 GSU 25 Orientation Drawings (page 1 of 3)

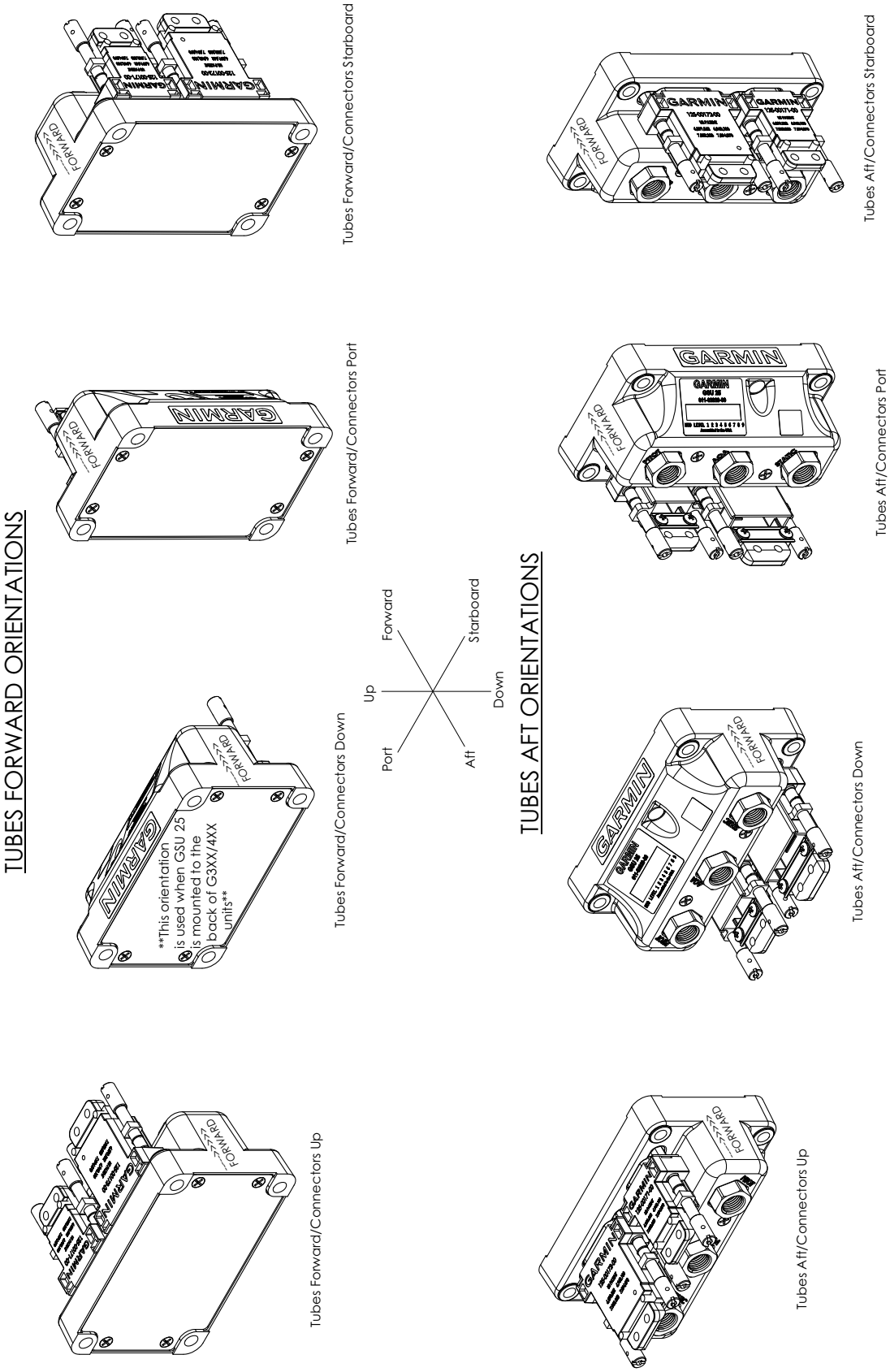


Figure 18-6 GSU 25 Orientation Drawings (page 2 of 3)

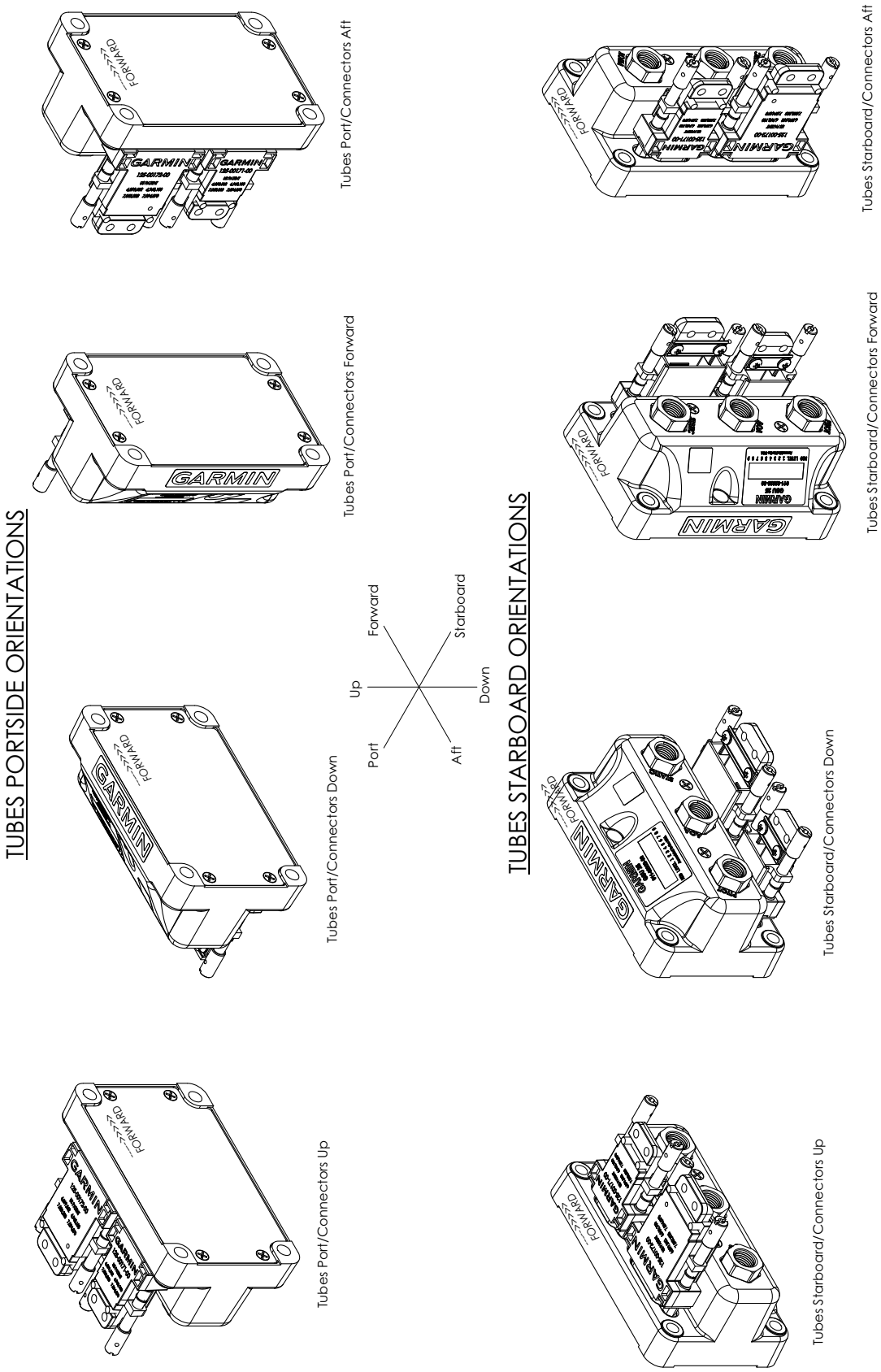


Figure 18-6 GSU 25 Orientation Drawings (page 3 of 3)

19 GTP 59 (TEMPERATURE PROBE) INSTALLATION

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 using the CAN bus.



Figure 19-1. GTP 59

19.1 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 19-1 GTP 59 Part Number

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

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

Table 19-2 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 19-2 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)

19.1.1 Additional Equipment Required

- Cables - The installer will supply all system cables.

19.2 General Specifications

See Section 19-2 for mounting dimensions.

19.3 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.

Consider the following recommendations when determining the mounting location for the GTP 59:

- Do not mount the GTP 59 where aircraft exhaust gases will flow over it.
- Do not mount the GTP 59 where it would be affected by heated air from the engine or exhaust. On most aircraft this includes any location downstream of the engine compartment.
- The GTP 59 must be exposed to the outside airflow. Do not mount the GTP 59 in a sheltered location where it is not exposed to outside airflow (for example, inside a wing or landing gear bay).
- For best results, do not mount the GTP 59 where it will be directly heated by the sun when the aircraft is parked.

Table 19-3 contains a list of parts needed for the GTP 59 installation and interconnect harness. Refer to Figure 19-2 GTP 59 O.A.T. Probe Installation Drawing for wiring and mounting instructions.

Table 19-3 Parts Needed for GTP 59 Installation

Description	Qty. Included	GPN
Nut	1	210-00055-00
Screw	2	211-60234-08
Washer	1	212-00026-00
Contact, Pin, Mil Crimp, Size 22D	5	336-00021-00
Ring Terminal	1	494-00022-XX
3-Conductor Cable		
OAT Sensor		

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 provide 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 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.

19.4 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).

19.5 Outline and Installation Drawings

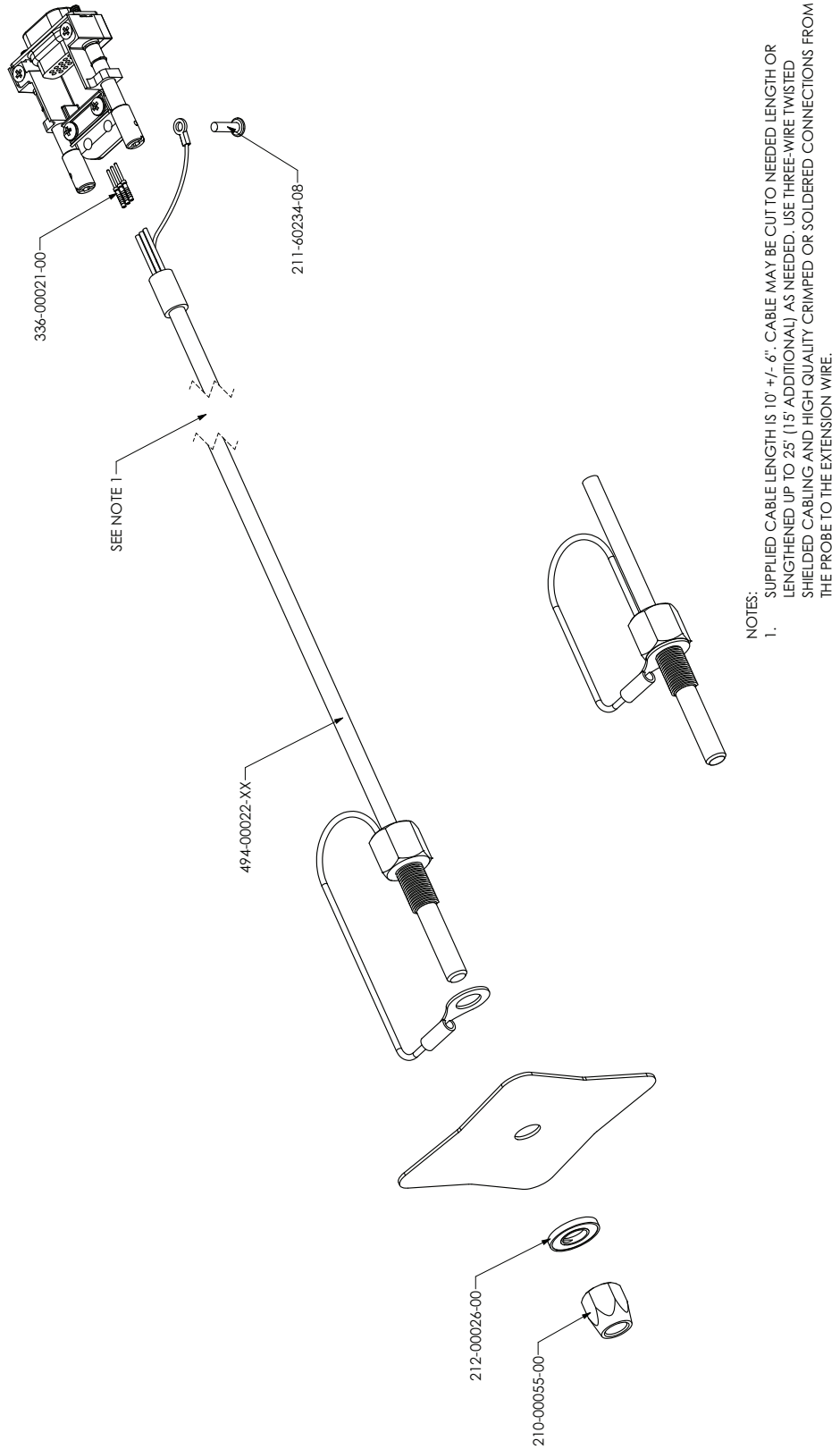


Figure 19-2. GTP 59 O.A.T. Probe Installation Drawing

20 GTR 20 (VHF COMMUNICATIONS RADIO) INSTALLATION

This section contains general information as well as installation information for the GTR 20. Use this section to mount the GTR 20 unit. Careful planning and consideration of the suggestions in this section are required to achieve the desired performance and reliability from the GTR 20. The guidance of FAA advisory circulars AC 43.13-1B and AC 43.13-2B, where applicable, may be found useful for making retro-fit installations that comply with FAA regulations.

NOTE

A GTR 20 cannot be installed in a system that also includes a GDU™ 37X display. The GTR 20 will only work with the G3X™ avionics system that uses the new GDU 4XX displays. The GTR 20 is not supported with G3X installations using GDU 37X displays.

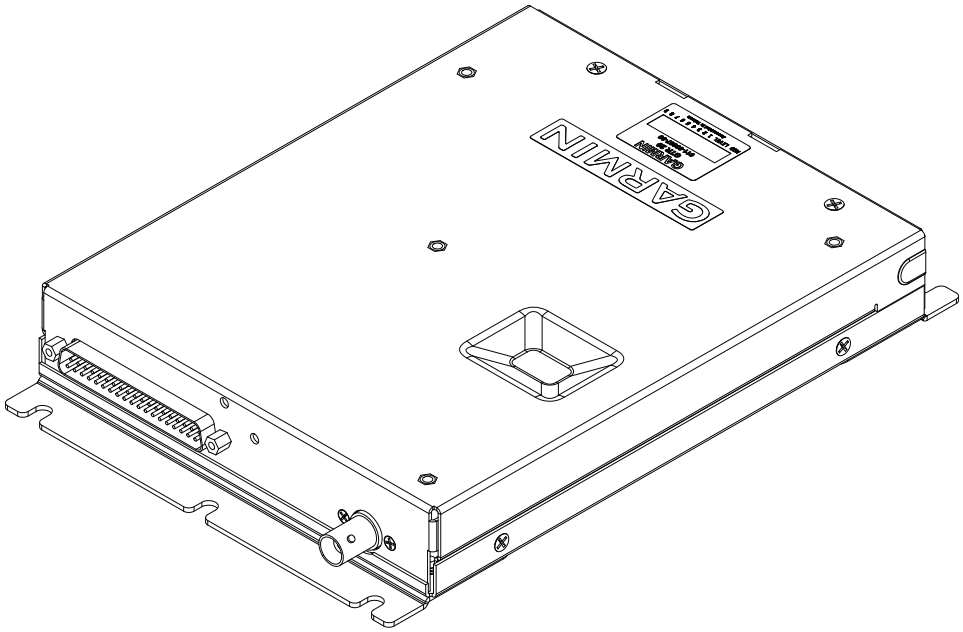


Figure 20-1 GTR 20 Unit View (shown with mounting brackets on ends)

20.1 Equipment Description

The GTR 20 is a transceiver that operates in the 118.000 to 136.975 MHz frequency range. The receiver sensitivity SINAD is greater than 6dB when the RF level is -107 dBm with 30% modulation. The transmitter power is 10 W carrier minimum.

Table 20-1 Available Units

Model	Part Number	TX Power (Watt)	8.33 KHz Spacing	25 KHz Spacing
GTR 20	011-03007-00	10	N/A	Yes
GTR 20	011-03007-10	10	N/A	Yes

CAUTION

The use of ground-based cellular telephones while aircraft are airborne is prohibited by FCC rules. Due to potential interference with onboard systems, the use of ground-based cell phones while the aircraft is on the ground is subject to FAA regulation 14 CFR §91.21. FCC regulation 47 CFR §22.925 prohibits airborne operation of ground-based cellular telephones installed in or carried aboard aircraft. Ground-based cellular telephones must not be operated while aircraft are off the ground. When any aircraft leaves the ground, all ground-based cellular telephones on board that aircraft must be turned off. Ground-based cell phones that are on, even in a monitoring state, can disrupt GPS/SBAS performance.

20.1.1 Status LED

The GTR 20 has an LED located in the hole to the right of the D-sub connector (J2001) that indicates its current status. See Section 32.1.1 for details.

20.2 Equipment Available

20.2.1 Unit Configurations

Table 20-2 GTR 20 Part Numbers

Model	Assembly Part Number	Unit Only Part Number
GTR 20 unit only	010-01076-00	011-03007-00
GTR 20 Standard (includes items in Table 20-3)*	010-01076-01	011-03007-00
GTR 20 (New) unit only	010-01076-10	011-03007-10
GTR 20 (New) Standard (includes items in Table 20-3)*	010-01076-11	011-03007-10

*Includes 011-03241-00 connector kit

20.2.2 Additional Equipment Required

The connector kit in Table 20-3 is required to install the unit, it is not provided with the GTR 20 unit only (010-01076-00, 010-01076-10).

Table 20-3 Contents of GTR 20 Connector Kit (011-03241-00)

Item	Garmin P/N	Quantity
Backshell w/Hdw, Jackscrew,37 Pin	011-01855-03	1
Screw, 8-32 x .312, PHP, SS/P	211-60209-09	5
Washer, Split Lock, Size 8	212-00018-04	5
Washer, Flat, Non-Std, SS, ID .195, OD .354	212-20065-00	5
Conn, Rcpt, D-Sub, Crimp Socket, Commercial, 37 CKT	330-00625-37	1
Contact, Socket, Military Crimp, Size 20	336-00022-02	37

20.3 General Specifications

See Table 2-2 for power/current specifications, and Table 2-4 for dimension/weight specifications.

20.3.1 COM Specifications

The GTR 20 transmitter meets the requirements of RTCA DO-186B section 2.3 for a class 4 transmitter.

Table 20-4 Transmitter Specifications

Characteristic	Specification
Microphone Input	Two inputs, standard carbon or dynamic mic with integrated preamp. The GTR 20 provides a 150 Ω AC input impedance and supplies the microphone with an 11 V bias through 470 Ω +/- 5%.
Modulation Capability	85% with 150 to 1500 mVRMS microphone input at 1000 Hz. Range can be extended from 20 mVrms to 2500 mVrms with mic gain adjustment.
Modulation	AM Double sided Emission Designator: 6K00A3E (118 - 136.975 MHz)
Frequency Range	118.000 to 136.975 MHz, 25 kHz channel spacing
Frequency Tolerance	+/-5 ppm from -20°C to +55°C
Output Power	10 Watts carrier minimum
Duty Cycle	20%
Carrier Noise Level	At least 35 dB (SNR)
Stuck Mic Time-Out	35 seconds time-out, reverts to receive
Demodulated Audio Distortion	Less than 25% distortion when the transmitter is at 85% modulation at 350 to 2500 Hz

The GTR 20 receiver meets the requirements of RTCA DO-186B section 2.2 for a class C receiver.

Table 20-5 Receiver Specifications

Characteristic	Specification
Frequency Range	118.000 to 136.975 MHz, 25 kHz channel spacing
Headset Audio Output	60 mW minimum into a 150 Ω load
Audio Response	Less than 6 dB of variation between 350 and 2500 Hz
Audio Distortion	Less than 25% at rated output power
Sensitivity	SINAD greater than 6 dB when the RF level is -107 dBm with 30% modulation
Squelch	Automatic squelch with manual override

20.4 Installation Considerations

20.4.1 COM Antenna

A COM Antenna that meets TSO-C37( ) and C38( ) or TSO-C169( ), 50W, vertically polarized with coaxial cable is recommended but not provided.

CAUTION

To avoid damage to the GTR 20, take precautions to avoid transmitting when no antenna is connected.

20.4.2 Installation Materials

The GTR 20 is intended for use with the standard aviation accessories. The following items are recommended for installation, but not supplied:

- Wire (MIL-W-22759/16 or equivalent)
- Shielded Wire (MIL-C-27500 or equivalent)
- Mounting Hardware - #10 hardware recommended
- Push/Pull (that can be manually reset) Circuit Breaker
- Tie Wraps or Lacing Cord
- Ring Terminals (for grounding)
- Coaxial Cable (RG-400, RG-142B or coaxial cable with 50 Ω impedance meeting applicable aviation regulations should be used.

20.4.3 Cabling and Wiring

Refer to the interconnect examples in Section 26 for wire gauge guidance.

Use wire and cable meeting the applicable aviation regulation. See the following precautions when routing wire and cable:

- Keep as short and as direct as possible
- Avoid sharp bends
- Avoid routing near power sources (e.g. 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting
- Do not route cable near high voltage sources

NOTE

The GTR 20 connects to the G3X system using the CAN bus. If communication is lost or no GDU displays are present, the GTR 20 will automatically tune the emergency frequency (121.500 MHz) and set the COM radio volume to a pre-determined level. See Section 31.4.27.1 for information on configuring the emergency volume level.

20.5 Antenna Considerations

This section contains mounting location considerations for the antennas required for the GTR 20. For mounting the COM antenna, refer to the aircraft manufacturer's data.

20.5.1 COM Antenna Location

The GTR 20 COM antenna should be well removed from all projections, engines and propellers. The ground plane surface directly below the antenna should be a flat plane over as large an area as possible (18 inch square, minimum). The antenna should be mounted a minimum of six feet from any DME or other COM antennas, and four feet from any ADF sense antennas. The COM antenna should also be mounted as far as practical from the ELT antenna. Some ELTs have exhibited re-radiation problems that cause interference with other radios, including GPS. This can happen when the COM (GTR 20 or any other COM) is transmitting on certain frequencies such as 121.15 or 121.175 MHz, which may cause the ELT output circuit to oscillate from the signal coming in on the ELT antenna coax.

If simultaneous use of two COM transceivers is desired (split-COM or simul-comm), the COM antennas should be spaced for maximum isolation. A configuration of one topside antenna and one bottom side antenna is recommended. The GTR 20 requires a transmit interlock.

Simultaneous COM performance varies significantly across installations and is affected by both the isolation between the COM antennas and the separation of the tuned frequencies. Each installation should be individually examined to verify the expected performance of simultaneous COM.

CAUTION

Garmin recommends the COM antenna be mounted a minimum of six feet from any other COM antennas. For aircraft which cannot comply with the recommended separation, COM antenna spacing should never be less than three feet to reduce the chance of damage to the COM receiver. All dual COM installations must use the GTR 20 interlock. An example of direct line of sight is both antennas mounted on the bottom or top surface of the aircraft. For metallic aircraft, it is recommended that one antenna is mounted on the bottom close to the front and the other on the top of the aircraft close to the tail so the aircraft structure is between the two antennas. For composite aircraft, additional shielding may be needed between top and bottom mounted COM antennas.

NOTE

Canadian installations are required to meet Industry Canada specifications for maximum radiation as documented in Radio Specifications Standard 102 (RSS-102). For more information about RF exposure and related Canadian regulatory compliance, contact:

Manager, Radio Equipment Standards
Industry Canada
365 Laurier Avenue
Ottawa, Ontario
K1A 0C8

In accordance with Canadian Radio Specifications Standard 102 (RSS 102), an RF safety separation distance of 26 cm from the antenna should be maintained for an RF field strength exposure to persons of less than the 10W/m^2 occupational safety limit.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry

Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The GTR 20 has been approved by Industry Canada to operate with the antenna types listed below. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

A COM Antenna that meets TSO-C37( ) and C38( ) or TSO-C169( ), 50W, vertically polarized. Maximum gain of 1 dBi with an impedance of 50 Ω.

20.5.2 Interference of GPS

On some installations, VHF COM transceivers, Emergency Locator Transmitter (ELT) antennas, and Direction Finder (DF) receiver antennas can re-radiate to the GPS antenna. Placement of the GPS antenna relative to a COM transceiver and COM antenna (including the GTR/ COM antenna), ELT antenna, and DF receiver antenna is critical.

Use the following guidelines, in addition to others in this document, when locating the GTR 20 and its antenna.

- Locate the GTR 20 as far as possible from all GPS antennas.
- Locate the COM antenna as far as possible from all GPS antennas.

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

- Replace or clean VHF COM rack connector to provide good coax ground.
- Place a grounding brace between the GTR 20 and ground.
- Shield the GTR 20 wiring harness.

20.6 Mounting Considerations

The GTR 20 is designed to mount remotely.

20.6.1 Bracket Installation

The GTR 20 is shipped with the brackets positioned on the ends of the unit. The brackets can be removed from the bottom of the GTR 20 and repositioned by the installer. The GTR 20 mounting brackets can be positioned on the sides or the ends of the GTR 20. The installer determines the orientation and position of the brackets that best suits the installation. See Figure 20-2 and Figure 20-3 for bracket positions.

20.6.2 Unit Mounting

Secure the GTR 20 to the airframe in a suitable mounting location using a minimum of four #10 fasteners (not provided). Hardware is intended to be located in the 4 outermost mounting locations. The center locations in each bracket are additional locations provided for the installer's convenience.

Do not mount the GTR 20 on the "hot" side (engine side) of the firewall. To reduce interference, route the GTR 20 wiring harness separately from any COM radio or transponder antenna coax.

No cooling air is required for the GTR 20/200, however, as with all electronic equipment, lower operating temperatures extends equipment life. Reducing the operating temperature by 15° to 20°C (27° to 36°F) reduces the mean time between failures (MTBF).

For final installation and assembly, see Figure 20-2, Figure 20-3, and Figure 20-4.

20.6.3 Antenna Installation and Connections

The GTR 20 requires a standard 50 Ω vertically polarized antenna. Follow the antenna manufacturer's installation instructions for mounting the antenna.

The antenna should be mounted on a metal surface or a ground plane with a minimum area of 18 inches x 18 inches. Refer to Section 20.5.1 for installation location considerations.

20.6.4 Antenna Coaxial Cable Installation

The antenna coax cable should be made of RG-142B, RG-400 or a comparable quality 50 Ω coax. See Section 2.4 or follow the BNC connector manufacturer's instructions for cable preparation/connector installation.

Check there is ample space for the cabling and mating connectors. Avoid sharp bends in the antenna cable, and routing near aircraft control cables. Route the COM antenna cable as far as possible away from any GPS antenna cables.

Check for insertion loss and Voltage Standing Wave Ratio (VSWR). VSWR should be checked with an in-line type VSWR/wattmeter inserted in the coaxial transmission line between the transceiver and the antenna. The VSWR meter should be inserted as close to the transceiver as possible. When rack and harness buildup is performed in the shop, the coax termination may be provisioned by using a 6-inch in-line BNC connection. This would be an acceptable place to insert the VSWR meter. Any problem with the antenna installation is most likely seen as high reflected power. A VSWR of 3:1 may result in up to a 50% loss in transmit power. VSWR at the low, mid and high end of the tuning range should be less than 3:1, for best performance VSWR should be less than 2:1. A high VSWR decreases the amount of power radiated by the antenna and increases power supply current and heat dissipated by the radio when the radio is transmitting.

20.7 Mounting, Wiring, and Power Checks

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are recommended for installation of the GTR 20. Refer to Section 2.3 for wiring considerations, and to Section 24.17 for pinouts.

Verify that all cables are properly secured and shields are connected to the shield block of the connectors. Check the movement of the flight and engine controls to verify there is no interference between the cabling and control systems. Make sure that all wiring is installed as described in Section 2.3.

Before powering up the unit, the wiring harness must be checked for proper connections to the aircraft systems and other avionics equipment. Point to point continuity must be checked to expose any faults such as shorting to ground. Any faults or discrepancies must be corrected before proceeding.

After accomplishing a continuity check, perform power and ground checks to verify proper power distribution to the GTR 20. Any faults or discrepancies should be corrected at this time. Remove power from the aircraft upon completion of the harness checkout.

The GTR 20 can be installed after completion of the continuity and power checks. The GTR 20 should be secured appropriately, as described in Section 20.6. The GTR 20 must be connected to the wiring harness and antenna.

20.7.1 Unit Ground Checks (Normal Mode)

20.7.1.1 TX Interlock Checkout

Connect pins 4 and 5 per Section 26.

Table 20-6 TX Interlock Connections

Pin	Pin Name	Description
4	TX INTERLOCK OUT	Active low output that indicates the GTR 20 is transmitting. This output is normally connected to the TX INTERLOCK IN of other COM radios installed in the aircraft.
5	TX INTERLOCK IN	Active Low Input that ‘desenses’ (protects) the GTR 20 receiver when another communications radio is transmitting. This input comes from another communication radio's interlock output or MIC KEY line.

20.7.1.2 Antenna Check

If desired, the antenna VSWR can be checked using an inline wattmeter in the antenna coaxial using frequencies near both ends of the band. The VSWR should be less than 2:1. A VSWR of 2:1 will cause a drop in output power of approximately 12%.

20.7.1.3 Receiver/Transmitter Check

Tune the unit to a local VHF frequency and verify the receiver output produces a clear and understandable audio output. Verify the transmitter functions properly by contacting another station and getting a report of reliable communications.

20.7.2 Flight Checks

20.7.2.1 COM Flight Check

After the installation is complete, perform the following required flight checks to provide satisfactory transceiver performance.

Check the communications transceiver at a range of at least 50 nautical miles: (This check verifies unit receiver sensitivity test and transmitter range)

1. Maintain an altitude of 5000 ft AGL.
2. Select the frequency of a ground station facility at a range of at least 50 nautical miles.
3. Verify that communication (RX and TX) can be established with that facility.

Check the communications receiver by receiving transmission from a ground station in close proximity (range of less than 10 nautical miles): (This check verifies the receiver has a high signal to noise ratio when receiving a strong signal.)

1. Select the frequency of a ground station facility at a range of less than 10 nautical miles.
2. Make sure the received audio from that station is clear (no background electrical noise).
3. If possible, perform the preceding steps 1 and 2 for frequencies in the high (~136.XXX MHz), mid (~127.XXX MHz), and low (~118.XXX MHz) range of the GTR 20.

20.7.3 Noise

As audio signals are routed to and from the GTR 20 (Headset, Microphone, Music, AUX), care must be taken to minimize effects from coupled interference and ground loops.

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

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

The GTR 20 audio inputs may detect the desired input signal plus an unwanted component injected by ground differentials, a common cause of alternator-related noise. This can be minimized by isolating all audio jacks from ground.

Terminating shields at just one end (single-point grounding) eliminates another potential ground loop injection point. The single-point grounding method is critical for the installation of various avionics that produce and process audio signals. Single-point, in this context, means the various pieces of equipment share a single common ground connection back to the airframe.

Good aircraft electrical/charging system ground bonding is important.

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

20.8 Outline and Installation Drawings

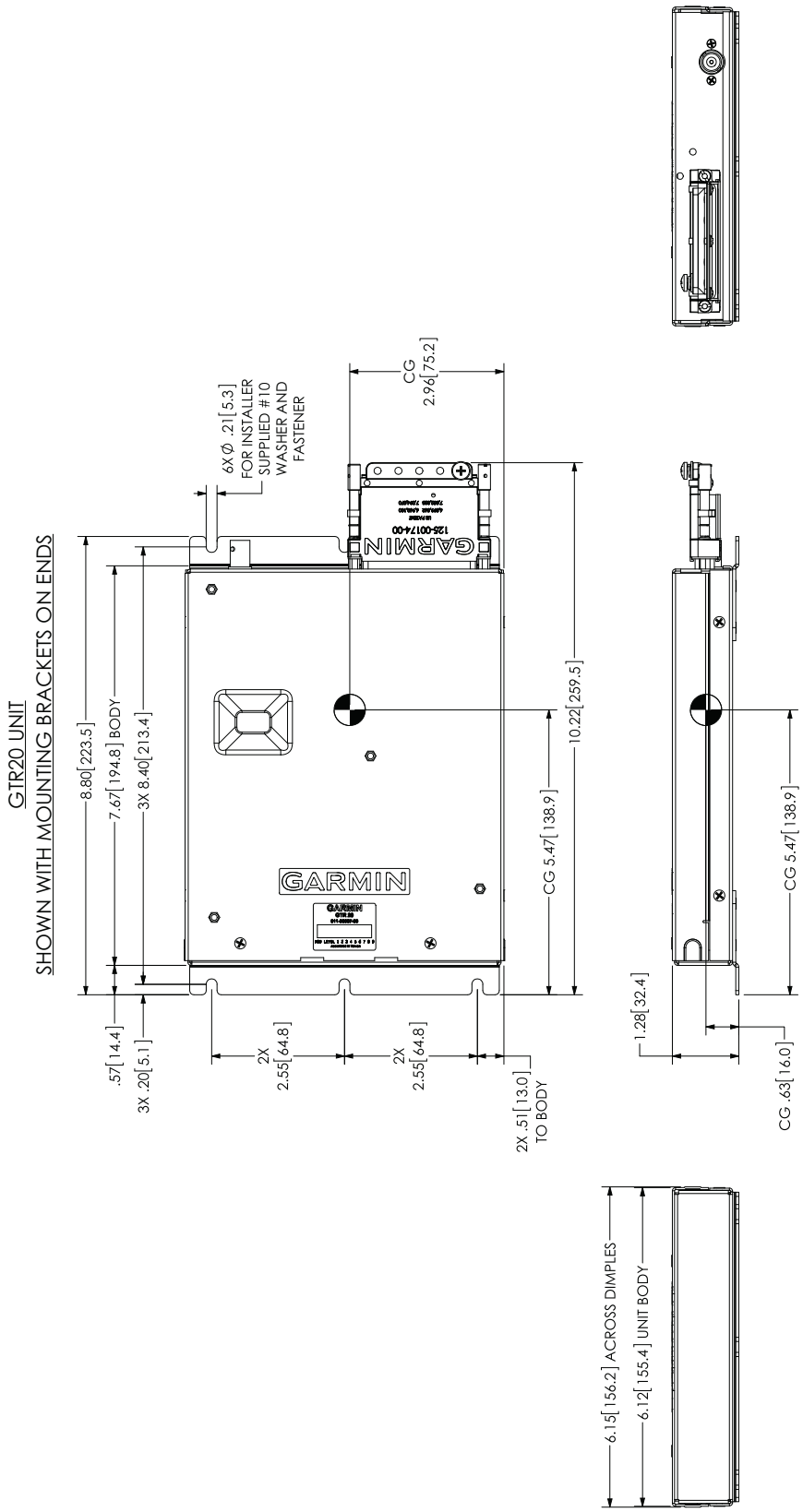


Figure 20-2 GTR 20 Outline Drawing (Mounting Brackets on Ends)

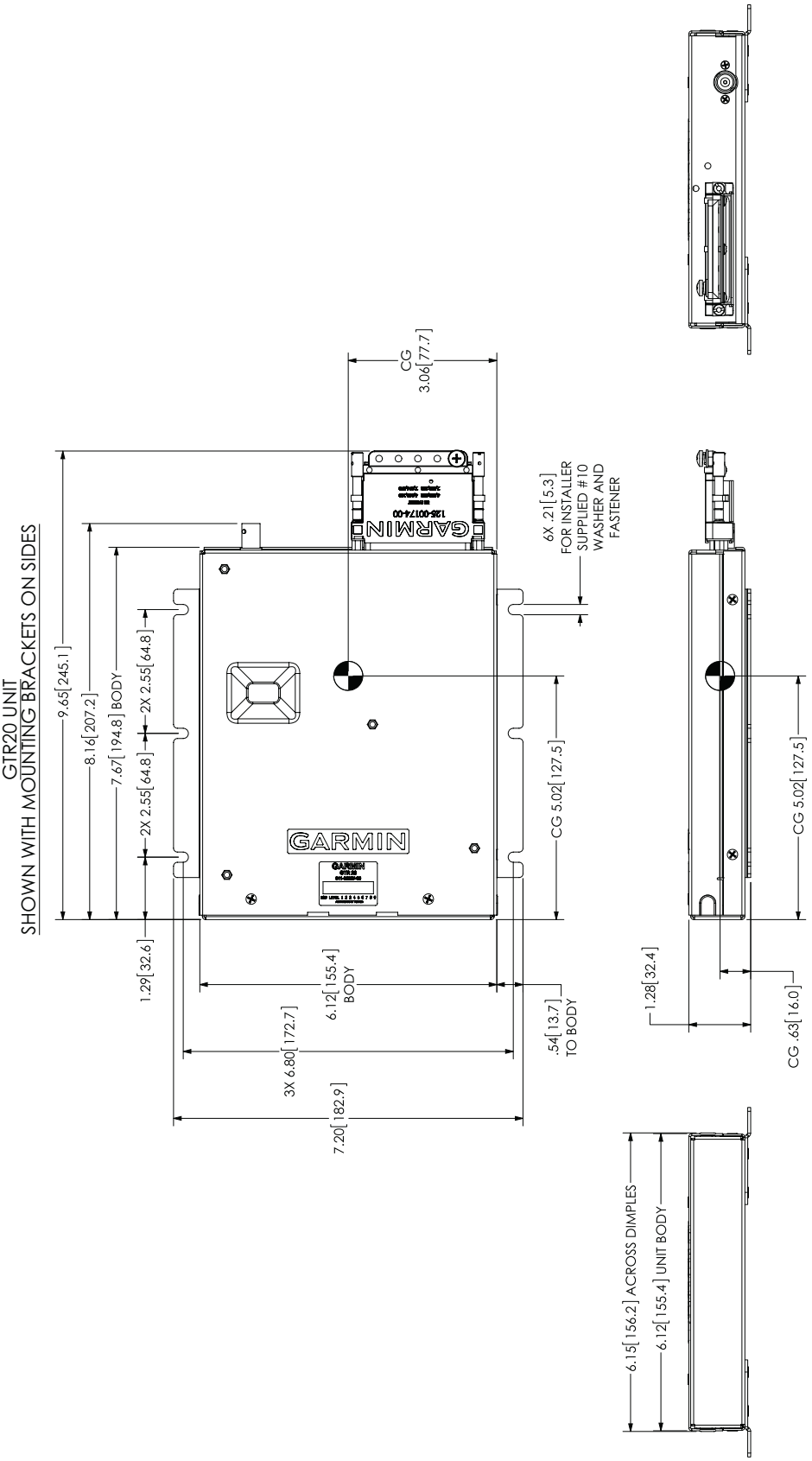


Figure 20-3 GTR 20 Outline Drawing (Mounting Brackets on Sides)

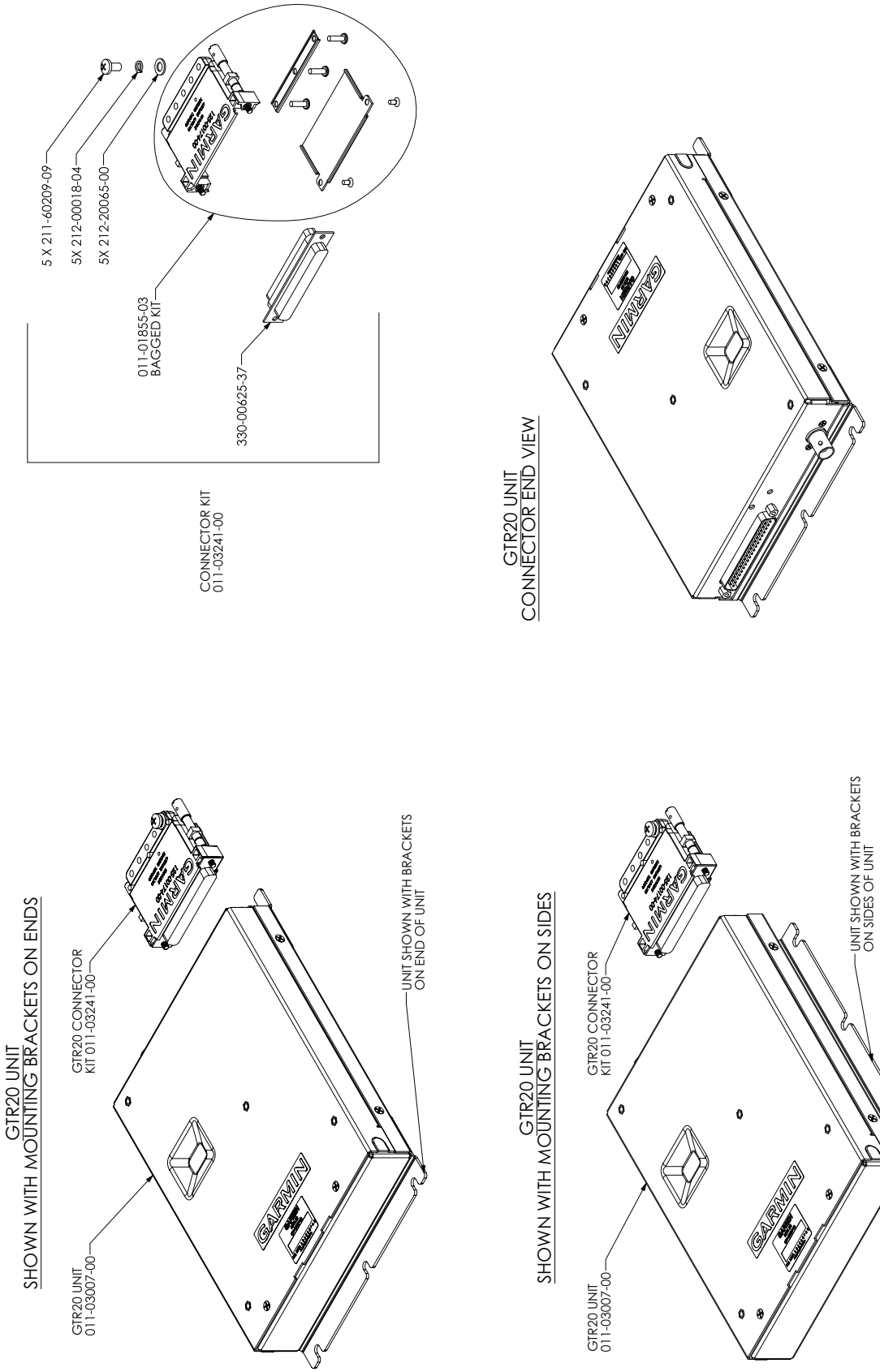


Figure 20-4 GTR 20 Installation Drawing

21 GPS/XM ANTENNA INSTALLATION

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

In an installation with multiple GDU™ 37X/4XX display 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/4XX unit, as the GDU will "share" the GPS information with all GDU units. Additional GPS antennas may be used for redundancy, but are not required. See Appendix H.4.15 (for GDU 37X systems) or Section 31.4.24 (for GDU 4XX systems) for further information.

NOTE

The GPS 20A can only be used with GA 35, GA 36, or GA 37 antennas.

NOTE

GA 35, GA 36 and GA 37 antennas cannot be used with GDU 37X/4XX units.

NOTE

When a GPS 20A (and connected GPS/WAAS antenna) is installed, it can be used as the sole GPS for the system, however it is recommended to install a GPS antenna on at least one of the GDU 37X/4XX units for redundancy.

21.1 Non-Garmin Materials Required

BNC/TNC Coaxial Connectors - May be required to terminate the antenna cable, depending upon which antenna is used. Check the antenna installation instructions for detailed information. Example below:

- Connector, BNC/TNC Coaxial, male, crimp (MIL-PRF-39012)

Coaxial Cable, 50Ω - MIL-DTL-17 (i.e. RG-400)

21.2 Non-Garmin Antennas

Table 21-1 lists non-Garmin antennas currently supported by the GDU 37X/4XX. For non-Garmin antennas, follow the manufacturer's installation instructions. It is the installer's responsibility to make sure the chosen 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/4XX supplies power to the antenna at 4.5 V–5V with a maximum current of 50 mA.

Table 21-1 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.

21.3 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 35, GA 55/55A, or GA 56 or GA 57X antennas, refer to this section and the outline and installation drawings in Section 21.8.

Garmin recommends the antennas shown in Table 21-2. However, any equivalent GPS, GPS/WAAS, or XM antenna that meets the specifications listed in Table 21-3 and Table 21-4 should work with the G3X™ avionics.

Table 21-2 Supported Garmin Antennas

Model	Part Number	Description	Weight	Mounting Configuration
GA 26X	010-13287-00	GA 26X GPS Antenna Kit	NA	Flange, Magnetic, or Suction Cup Mount (for in-cabin mounting)
GA 35* (used with GPS 20A only)	013-00235-00	GPS/WAAS Antenna	0.47 lbs (0.21 kg)	Thru-mount (Tear-drop form factor)
GA 36* (used with GPS 20A only)	013-00244-00	GPS/WAAS Antenna	0.47 lbs (0.21 kg)	Thru-mount (ARINC 743 style mount)
GA 37* (used with GPS 20A only)	013-00245-00	GPS/WAAS + SiriusXM Antenna	0.50 lbs (0.23 kg)	Thru-mount (ARINC 743 style mount)
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)

*For use with GPS 20A only, cannot be used with GDU 37X/4XX units

Table 21-3 GPS or GPS/WAAS 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 Ω
Supply Voltage	4.5 to 5.5 VDC
Supply Current	up to 50 mA
Output Connector	BNC or TNC

Table 21-4 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 Ω
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.

It is the installer's responsibility to make sure their choice of antenna meets FAA standards according to the specific installation. This installation manual discusses only the antennas listed in Table 21-2. 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.

21.4 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.

21.4.1 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 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 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 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 provide good coax ground.
2. Place grounding straps between the GDU unit, VHF COM, and a good ground.
3. Shield the VHF COM wiring harness.

21.4.2 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 selecting the optimum location 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 (Appendix H.4.15.1 for GDU 37X systems or Section 31.4.24.1 for GDU 4XX systems) 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 21-1 shows the recommended placement of antennas.

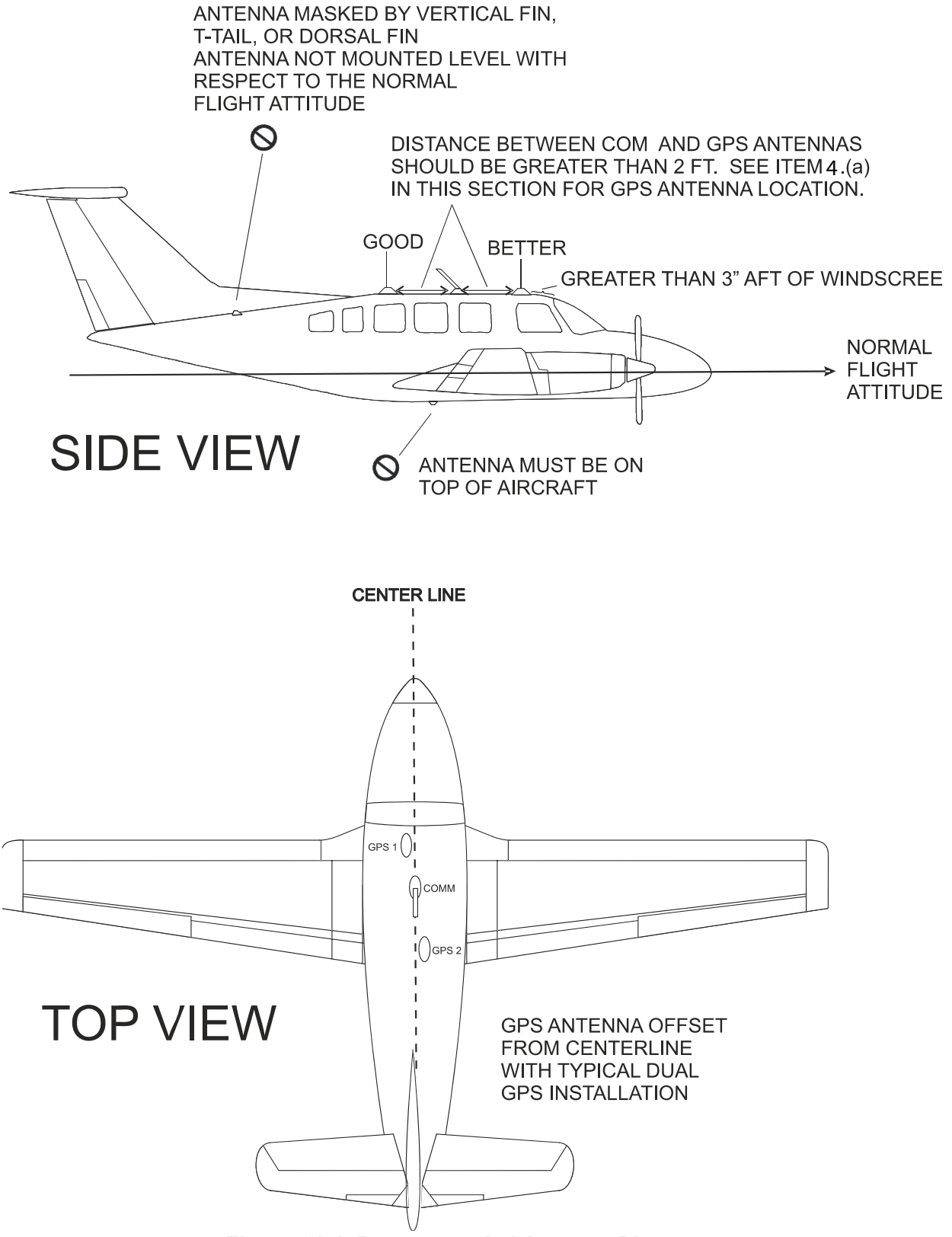


Figure 21-1 Recommended Antenna Placement

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

WARNING

GA 57X cannot be used in a buried or glare shield mounted antenna configuration. Installing in a buried or glare shield location can lead to possible instabilities.

There are potential performance issues related to buried antennas the kit builder/installer should be aware of before electing to install a buried antenna. See also Section 21.7.2, 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, 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 21-2 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 find the full impact of these locations, however initial flight testing has not shown any significant impact to availability, your results may vary.

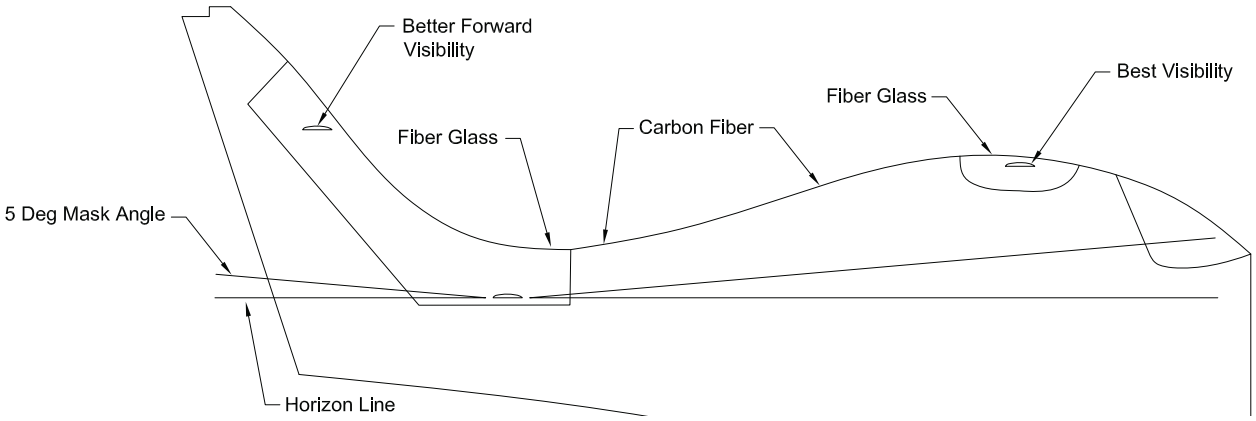


Figure 21-2 Carbon/Glass Buried Antenna Area

Mounting the antenna under the glare shield (Figure 21-3) 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.

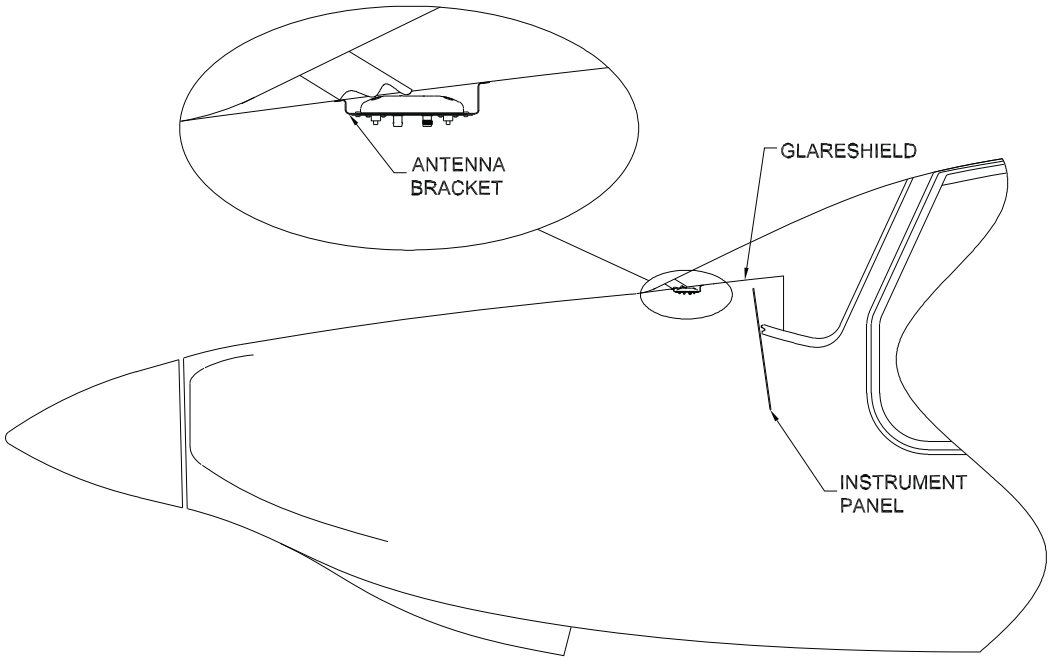


Figure 21-3 Glare Shield Buried Antenna Area

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.

21.4.4 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.

21.4.5 Antenna Grounding Plane

For most antennas 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.

For GA 57X installations a conductive ground plane surface of 12" diameter minimum is required. To use the antenna in aircraft with fabric or composite skin, a ground plane is also required. It is usually installed under the skin of the aircraft, below the antenna, and is made of either aluminum sheet or of wire mesh.

21.4.6 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 to provide 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).

21.4.7 Connector Clearance (GA 57X only)

A clearance of 0.25" around the TNC connectors of the GA 57X and mating connectors is required for proper operation. For pressurized aircraft, ensure that the expanded interior shell does not interfere with the antenna connections.

21.5 Teardrop Footprint Antenna Installation (GA 35, 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 35 through-hole, or GA 55/GA 56 stud mount antennas. Another acceptable method is to fabricate and install one of three doublers (Figure 21-4, Figure 21-5, and Figure 21-6), 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 21-5 provides a summary of design and installation details for selecting the appropriate antenna doubler/backplate.

Figure 21-7 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 21-5 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 21-4	Figure 21-5	Figure 21-6
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 21-8	Figure 21-9	Figure 21-10
Doubler Installation (Figure)	Figure 21-11	Figure 21-12	Figure 21-13

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

Refer to the drawings in Section 21.8 for Garmin Antenna installation drawings.

21.5.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-10, or refer to Table 21-5 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 21-8) and doubler installation (Figure 21-11) are required.

21.5.2 Teardrop Antenna Installation Instructions

1. Refer to Table 21-5 and the outline and installation drawings in Section 21.8 for installation guidance and 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 21.5.1 for doubler preparation and Table 21-5 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 GA 35, secure the O-ring in the O-ring groove on the underside of the antenna. Place the antenna over the mounting holes, using the four screw holes to align the antenna and insert the supplied four screws (Figure 21-32).

CAUTION

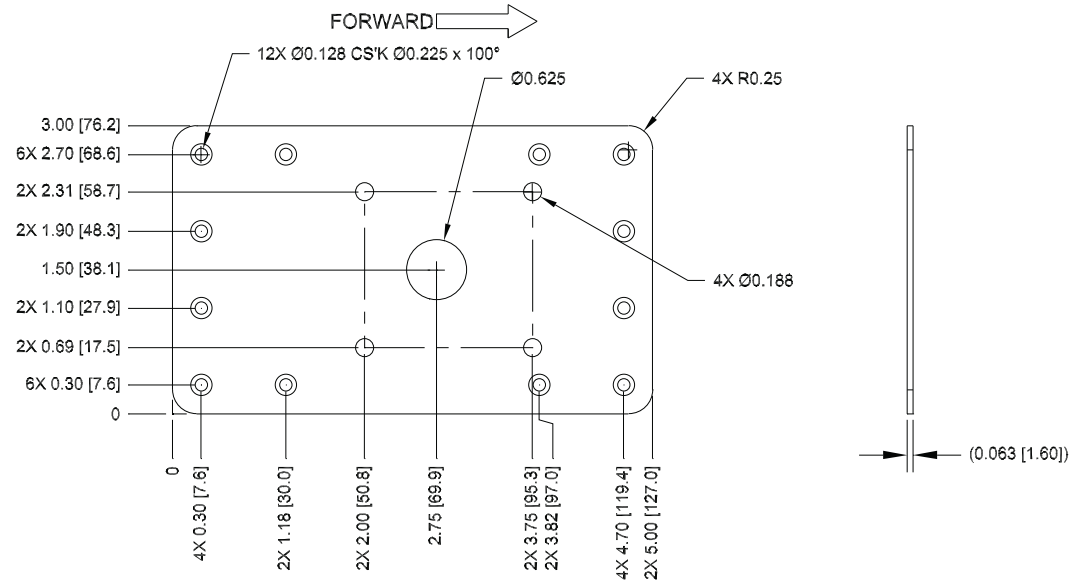
GA 35 serial numbers below 110000 required screws with 80 degree countersink angle and most aviation fasteners (AN509) are NOT compatible. Serial numbers 110000 and higher, AN509 hardware is compatible. Antennas installed with incompatible hardware or screws that have been over tightened will void antenna warranty.

4. For a stud mount teardrop footprint antenna, place the install gasket on top of aircraft skin using the four screw holes to align the gasket (Figure 21-35, Figure 21-37).
5. Washers and locking nuts (not provided) 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.
6. Make sure the antenna base and aircraft skin are in continuous contact with the gasket or o-ring, as appropriate to the antenna model.
7. 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 make sure the antenna connectors are not contaminated with sealant.

CAUTION

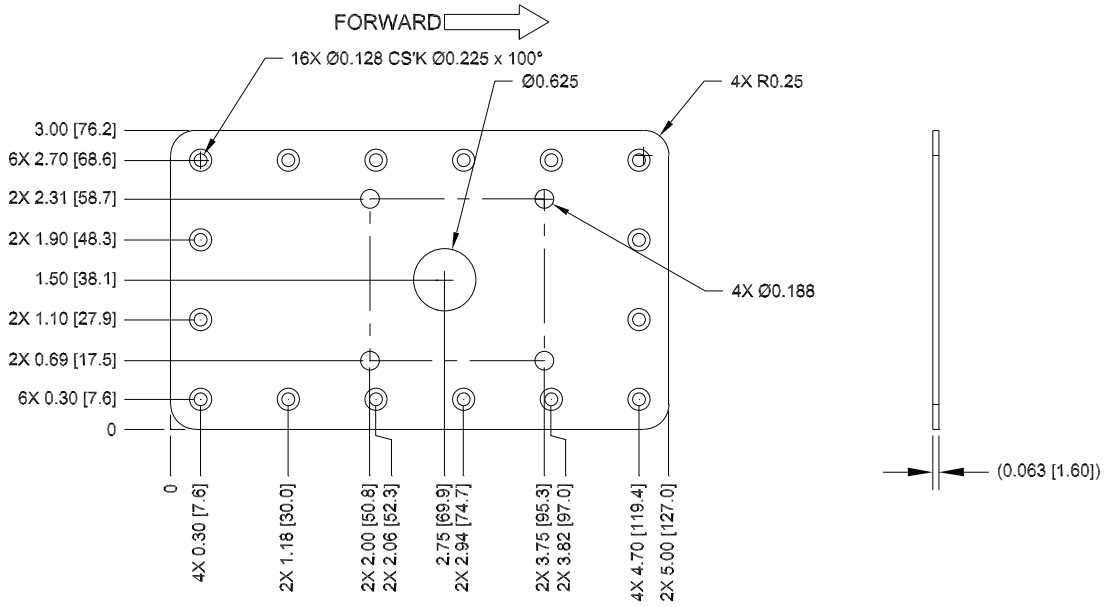
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

21.5.3 Reference Figures



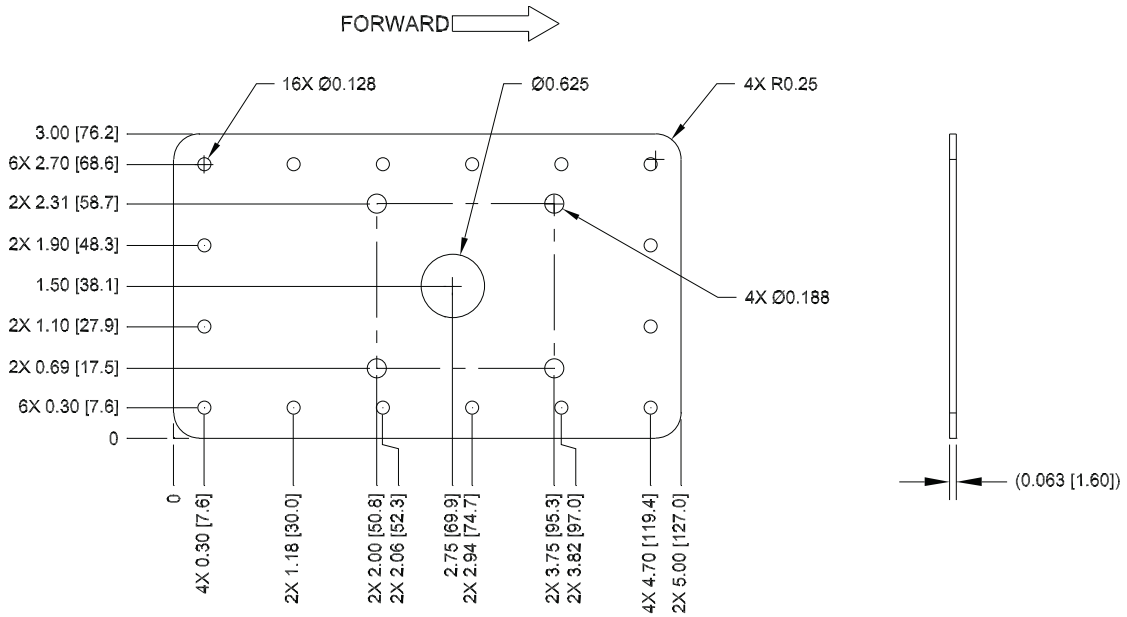
NOTES:
1. DIMENSIONS: INCHES
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES

Figure 21-4 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 21-5 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 21-6 Doubler Design, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

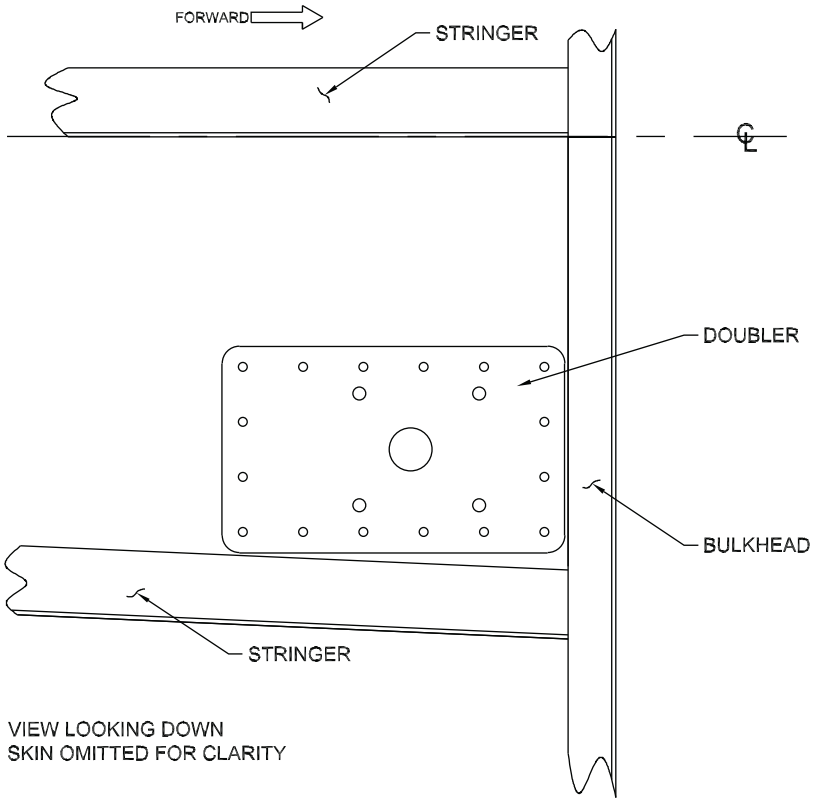
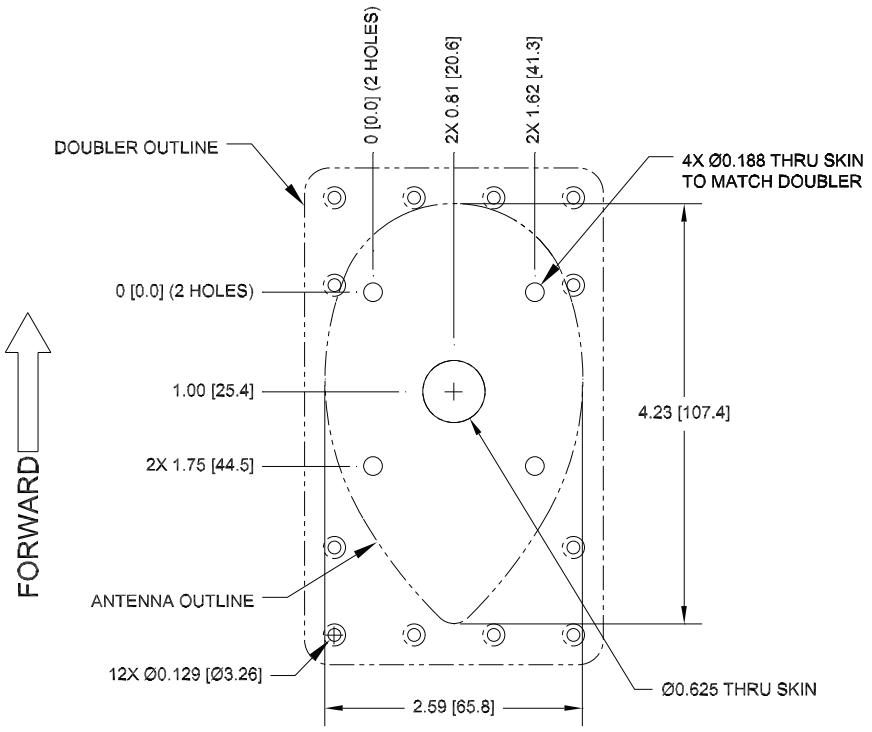
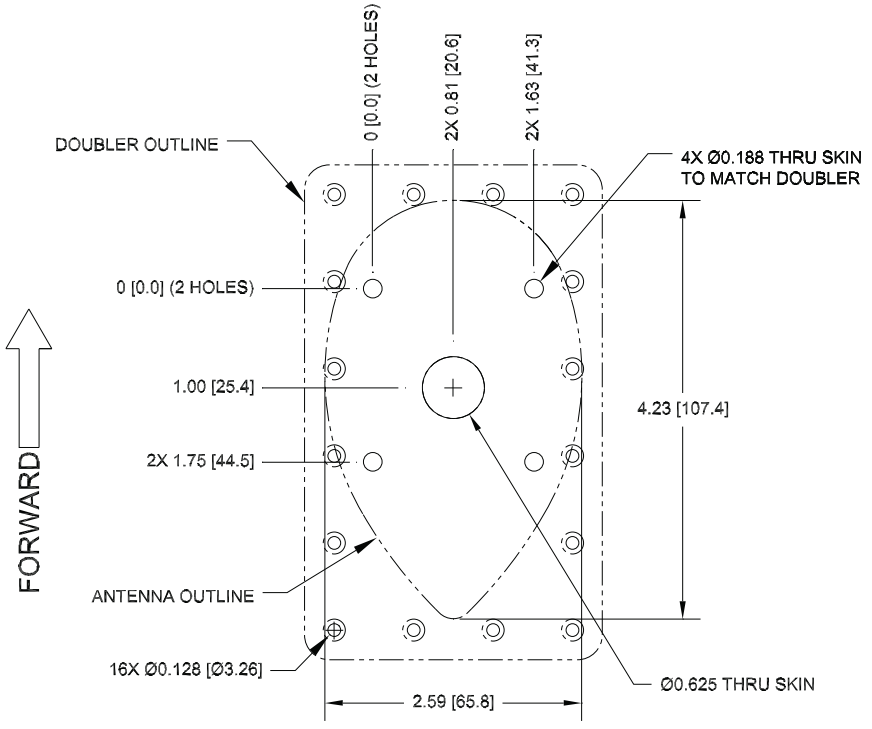


Figure 21-7 Sample Doubler Location, Teardrop Footprint Antenna, Metal Skin Aircraft



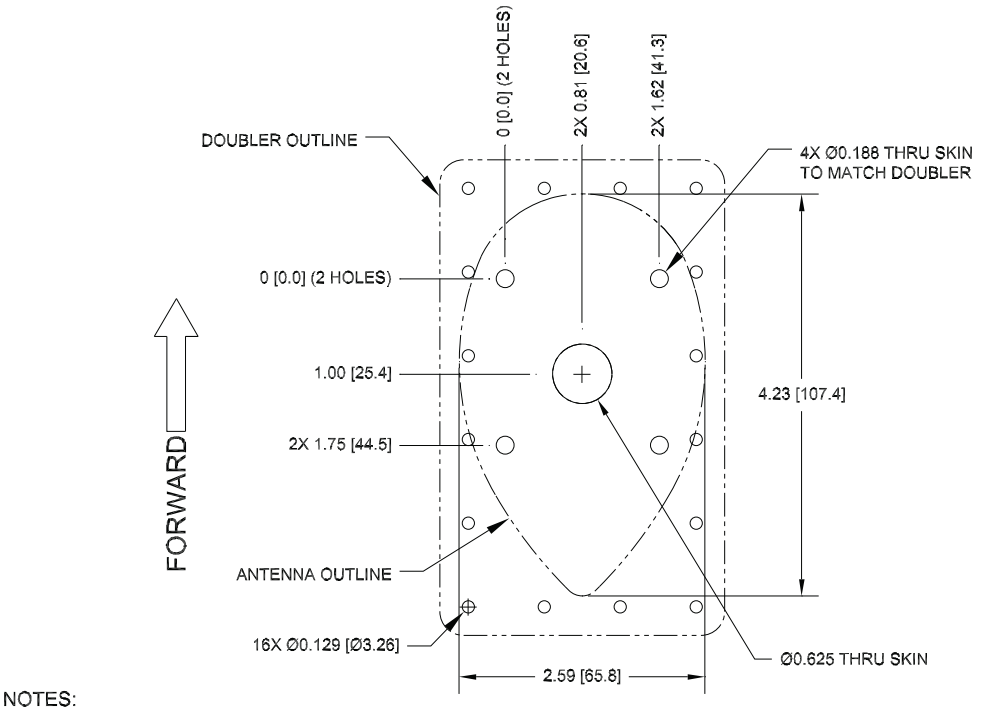
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 21-8 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.032" to 0.049"



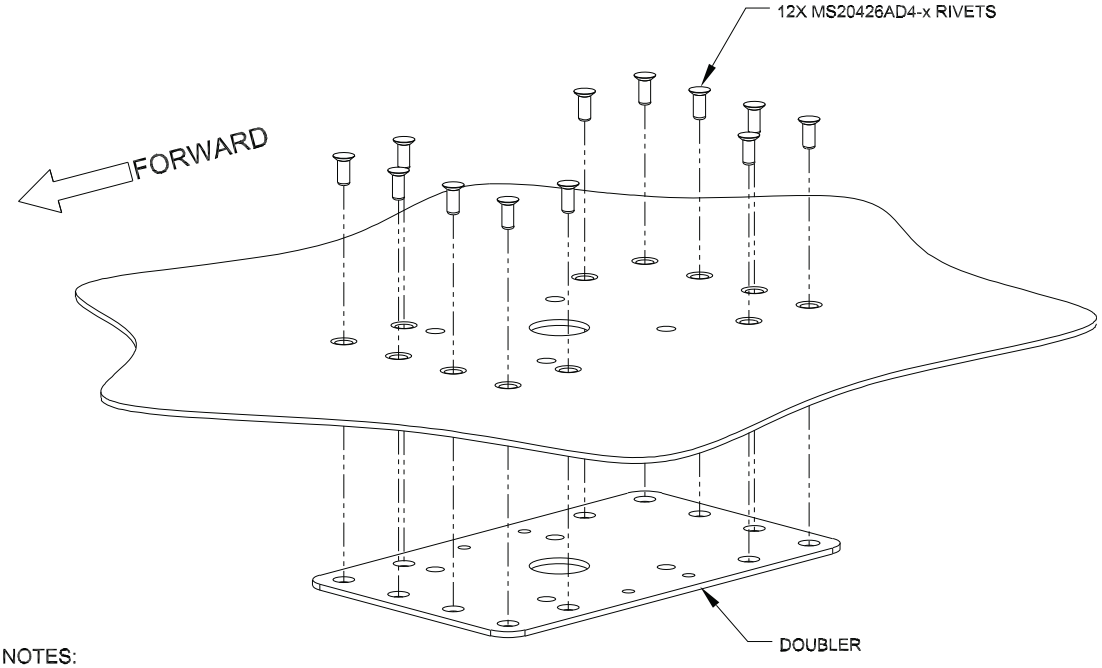
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 21-9 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.049" to 0.051"



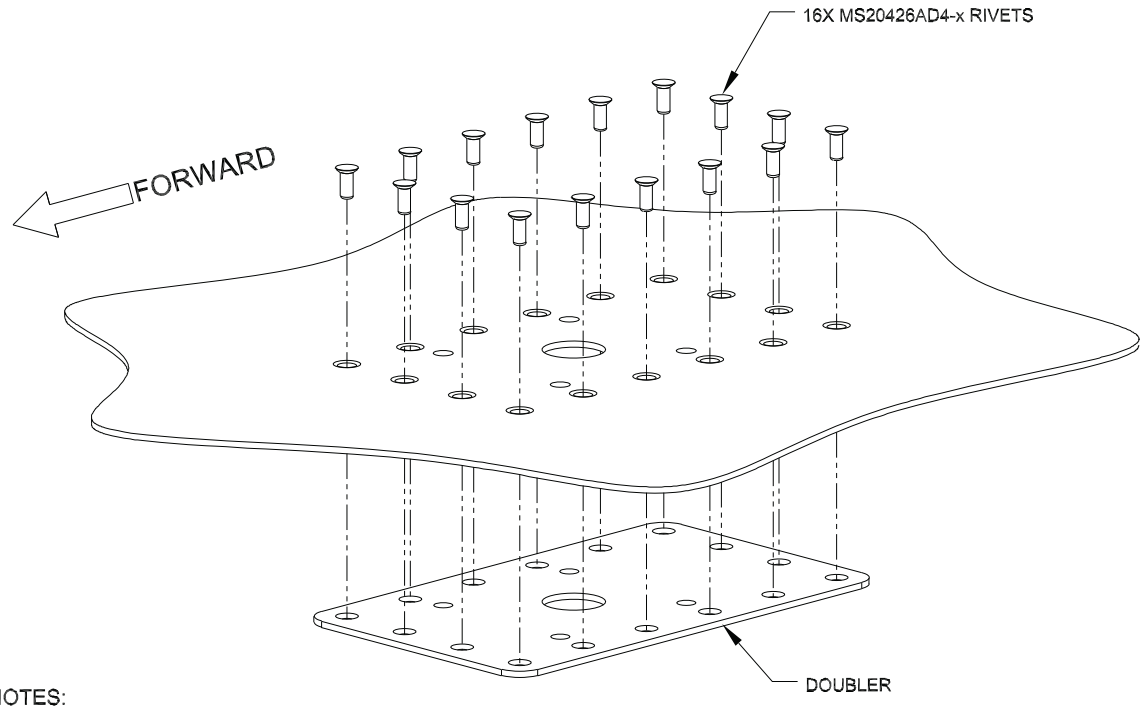
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 21-10 Skin Cutout Detail, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"



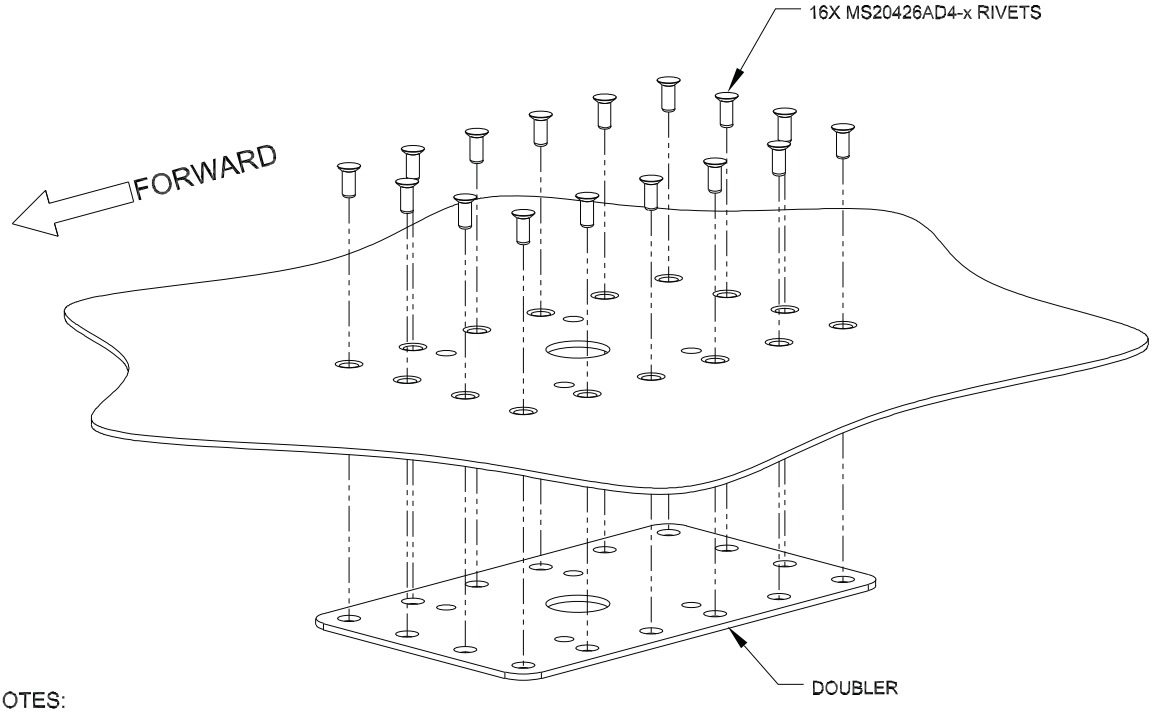
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

Figure 21-11 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 21-12 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 21-13 Doubler Installation, Teardrop Footprint Antenna, Skin Thickness 0.051" to 0.063"

21.6 ARINC 743 Footprint Antenna Installation (GA 36, GA 37, GA 55A, GA 57X)

This section describes the structural mounting of the ARINC 743 footprint antenna (GA 36, GA 37, 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 21-14, Figure 21-15, or Figure 21-16, 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 21-24 shows installation of the ARINC 743 footprint antenna.

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

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

21.6.1 Preparation of Doubler

1. Use Garmin P/N: 115-00846-00, or refer to Table 21-6 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 21-18) and doubler installation (Figure 21-21) are required.

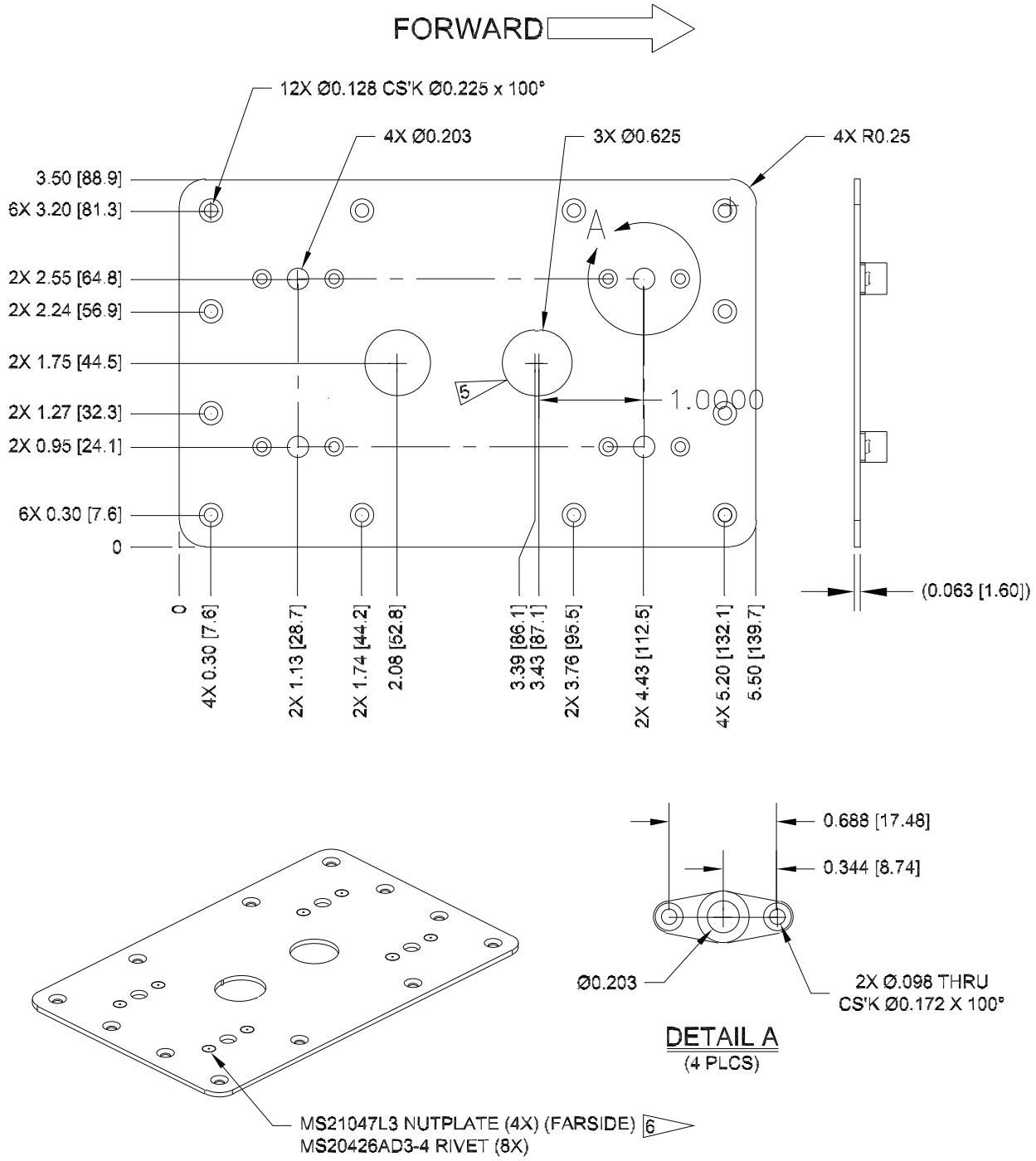
21.6.2 ARINC 743 Antenna Installation Instructions

1. Refer to Table 21-6 and the outline and installation drawings in Section 21.8 for installation guidance and 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 21.6.1 for doubler preparation and Table 21-6 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. Secure the O-ring in the O-ring groove (if applicable, per Figure 21-33, Figure 21-34) on the underside of the antenna.
4. Place the install gasket (if applicable, per Figure 21-36 or Figure 21-38) on top of aircraft skin using the four screw holes to align the gasket.
5. Locking nuts and washers (not provided) are required to secure the GA 36 and GA 37 per Figure 21-33, Figure 21-34 (or may use locking nuts installed on doubler plate, if applicable). GA 55A (Figure 21-36) and GA 57X (Figure 21-38) use locking nuts installed on doubler plate. 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.
6. Make sure the antenna base and aircraft skin are in continuous contact with the gasket (if applicable).
7. 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 make sure the antenna connectors are not contaminated with sealant.

CAUTION

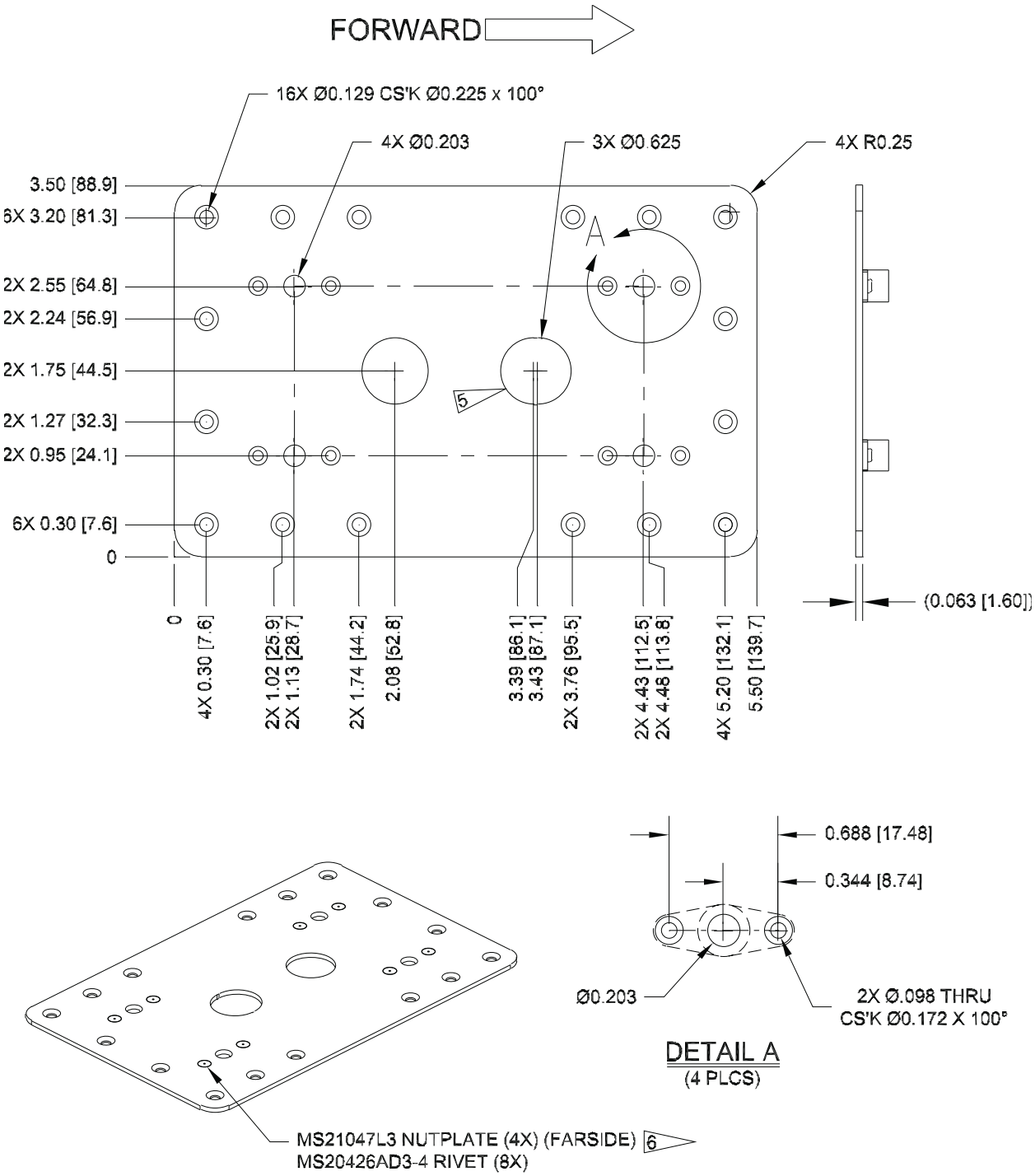
Do not use construction grade RTV sealant or sealants containing acetic acid. These sealants may damage the electrical connections to the antenna. Use of these type sealants may void the antenna warranty.

21.6.3 Reference Figures



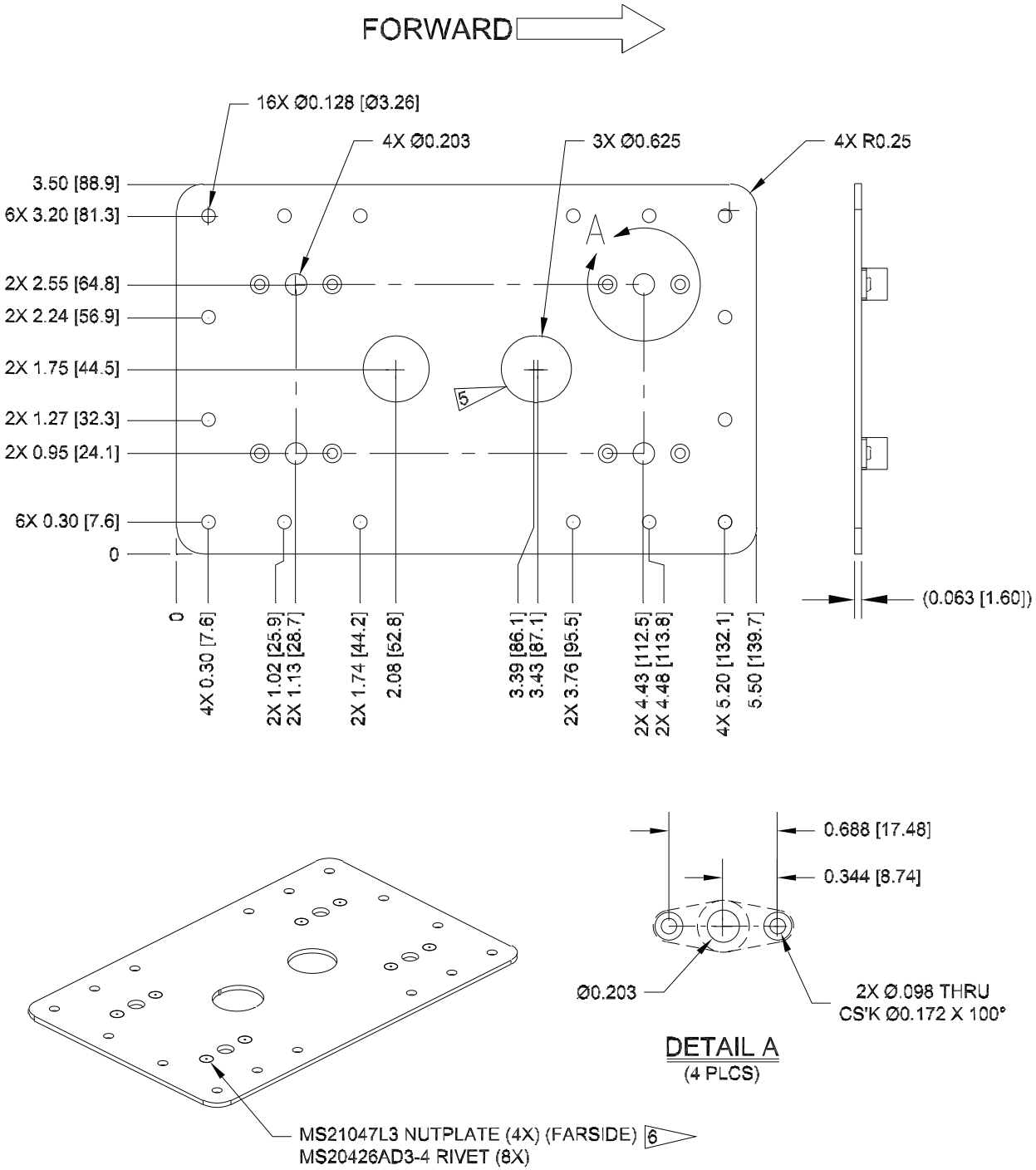
NOTES:
1. DIMENSIONS: INCHES [mm]
2. MATERIAL: 0.063" THICKNESS 2024-T3 ALUMINUM (AMS-QQ-A-250/5)
3. TOLERANCE: .XX +/- 0.030", .XXX +/- 0.010"
4. REMOVE BURRS AND BREAK SHARP EDGES
5. HOLE OPTIONAL, GA55A ANTENNA INSTALLATION
6. MS21059L3 MAY BE USED IN PLACE OF MS21047L3.

Figure 21-14 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 21-15 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 21-16 Doubler Design, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063”

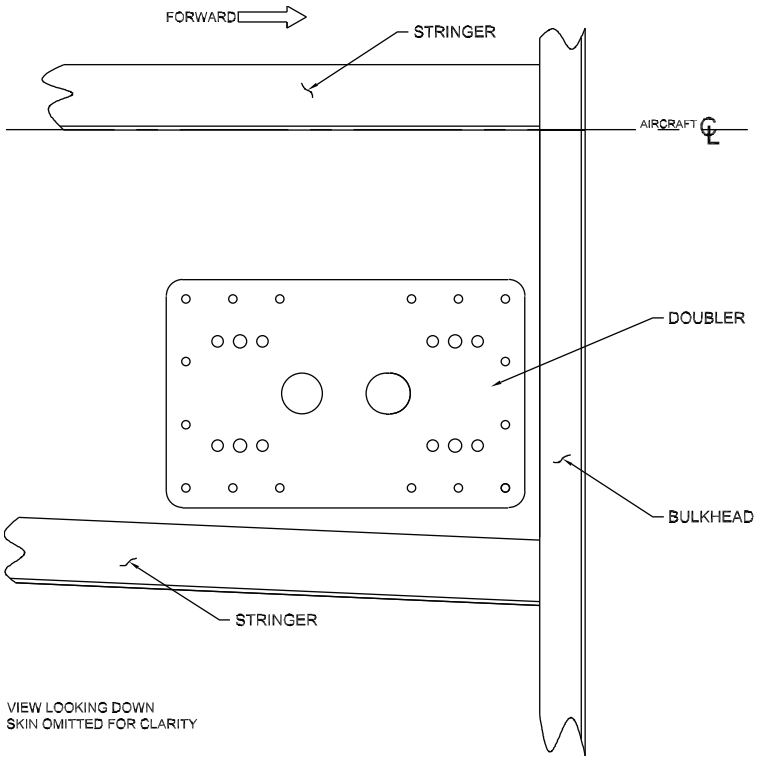


Figure 21-17 Sample Doubler Location, ARINC 743 Antenna, Metal Skin Aircraft

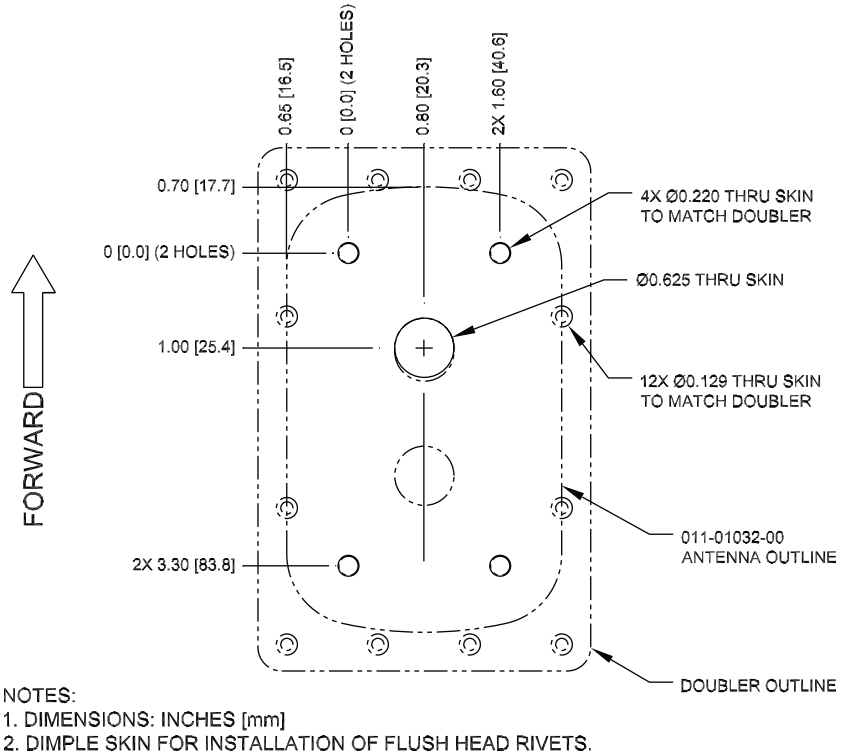
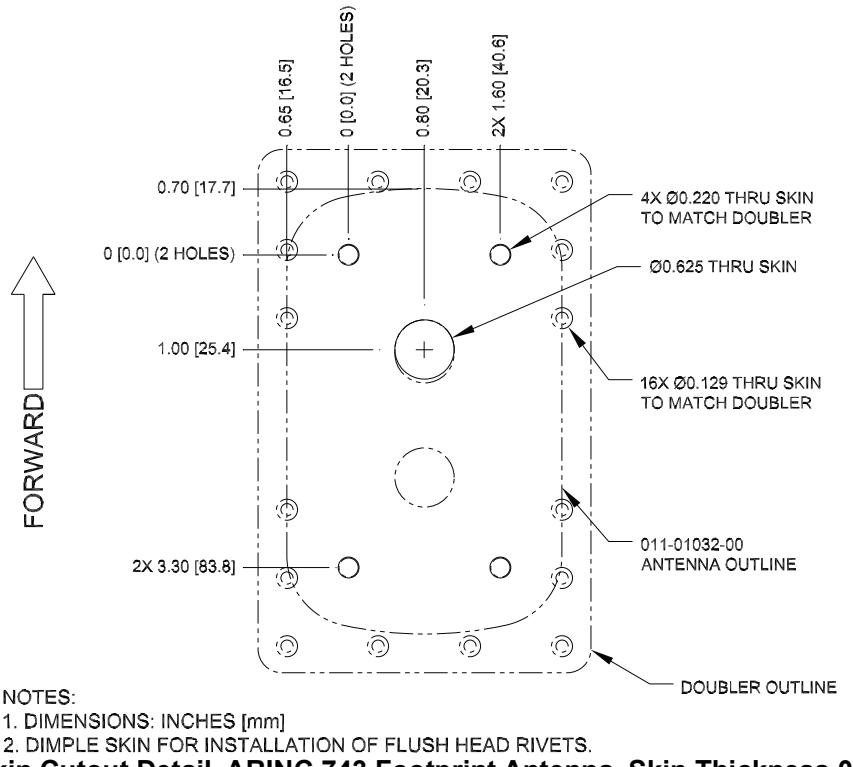
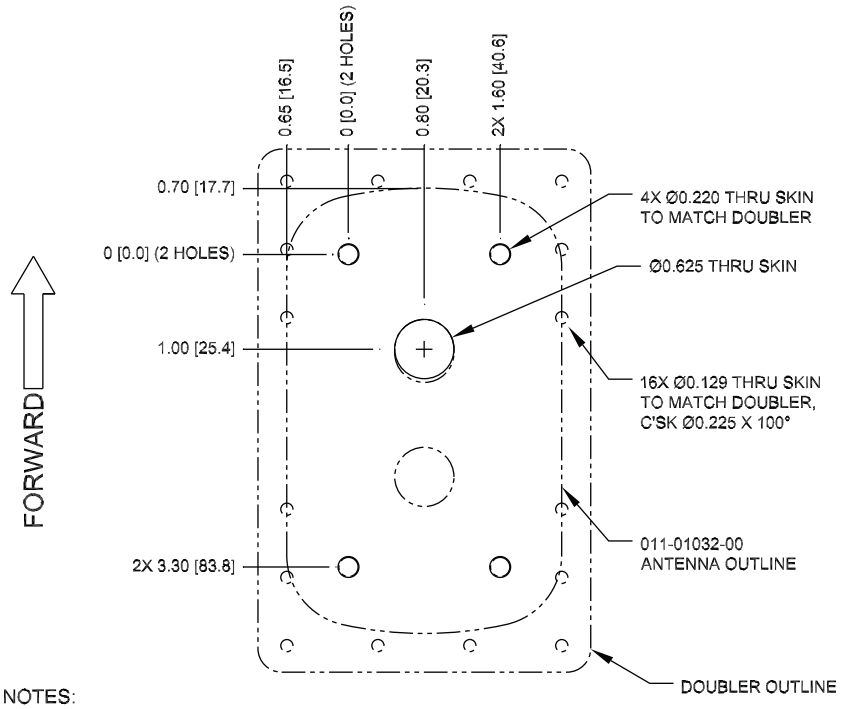


Figure 21-18 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.032" to 0.049"



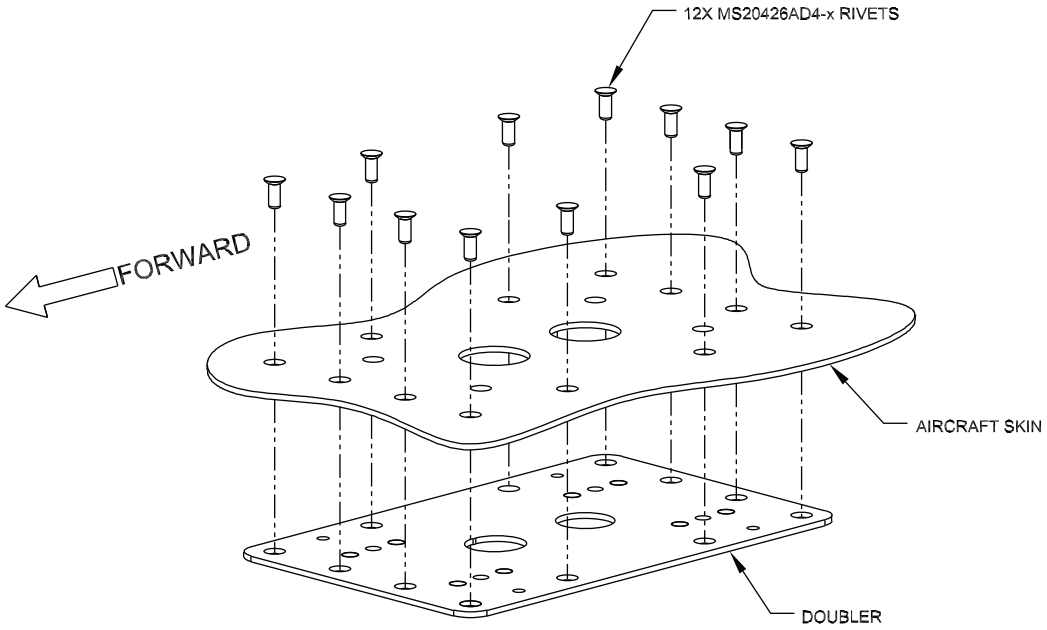
NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMPLE SKIN FOR INSTALLATION OF FLUSH HEAD RIVETS.

Figure 21-19 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.049" to 0.051"



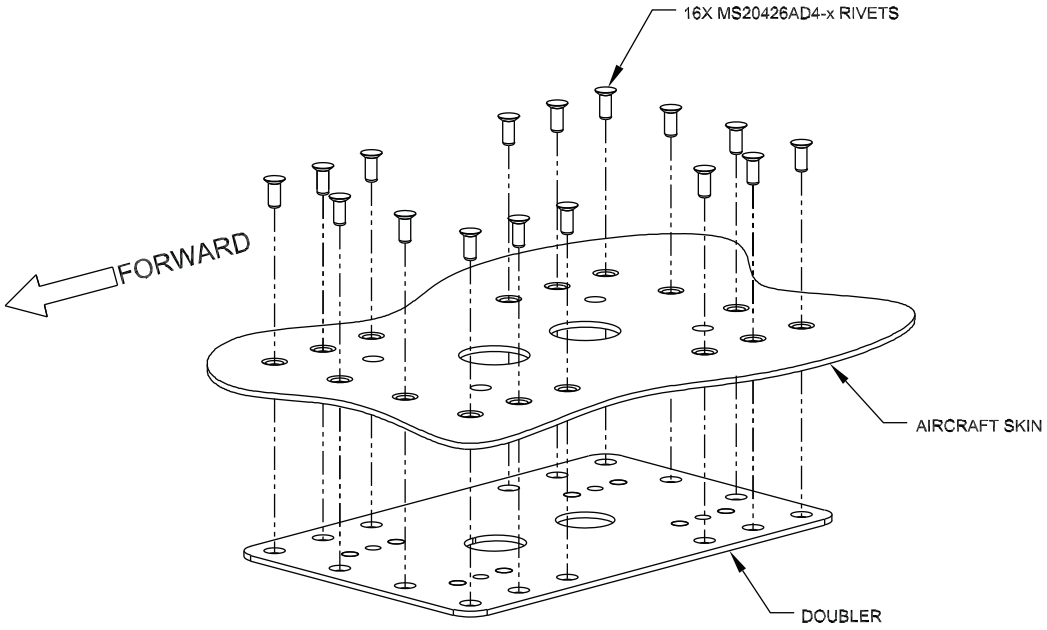
NOTES:
1. DIMENSIONS: INCHES [mm]
2. COUNTERSINK EXTERNAL AIRCRAFT SKIN FOR INSTALLATION OF FLUSH RIVETS.

Figure 21-20 Skin Cutout Detail, ARINC 743 Footprint Antenna, Skin Thickness 0.051" to 0.063"



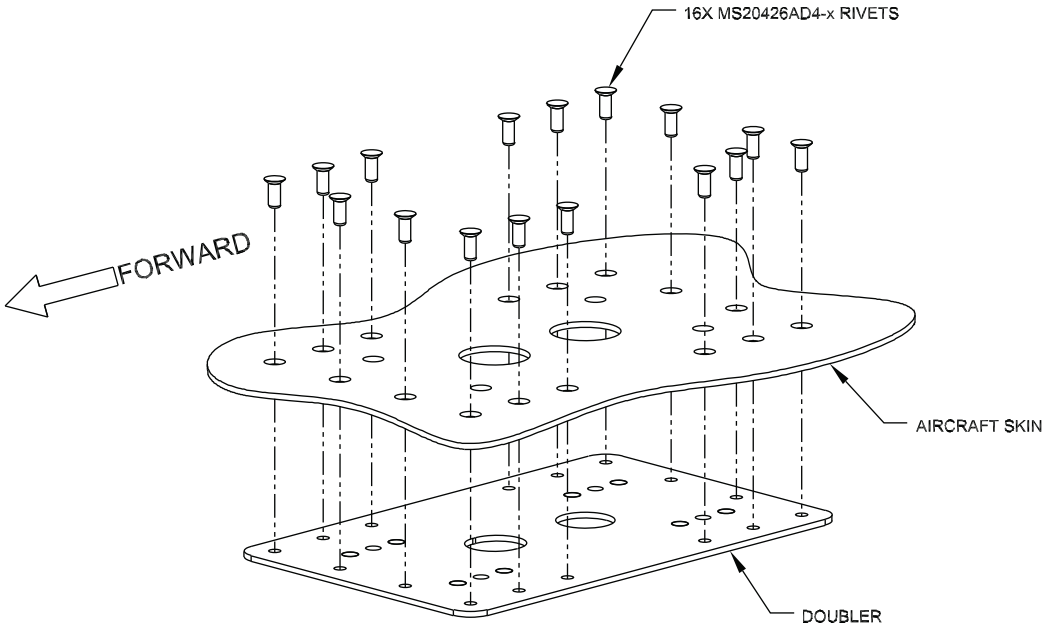
NOTES:
1. MS20426AD4-X RIVET SELECTION (LENGTH) AND INSTALLATION DETERMINED USING THE GUIDANCE FOUND IN AC43.13-1B.

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

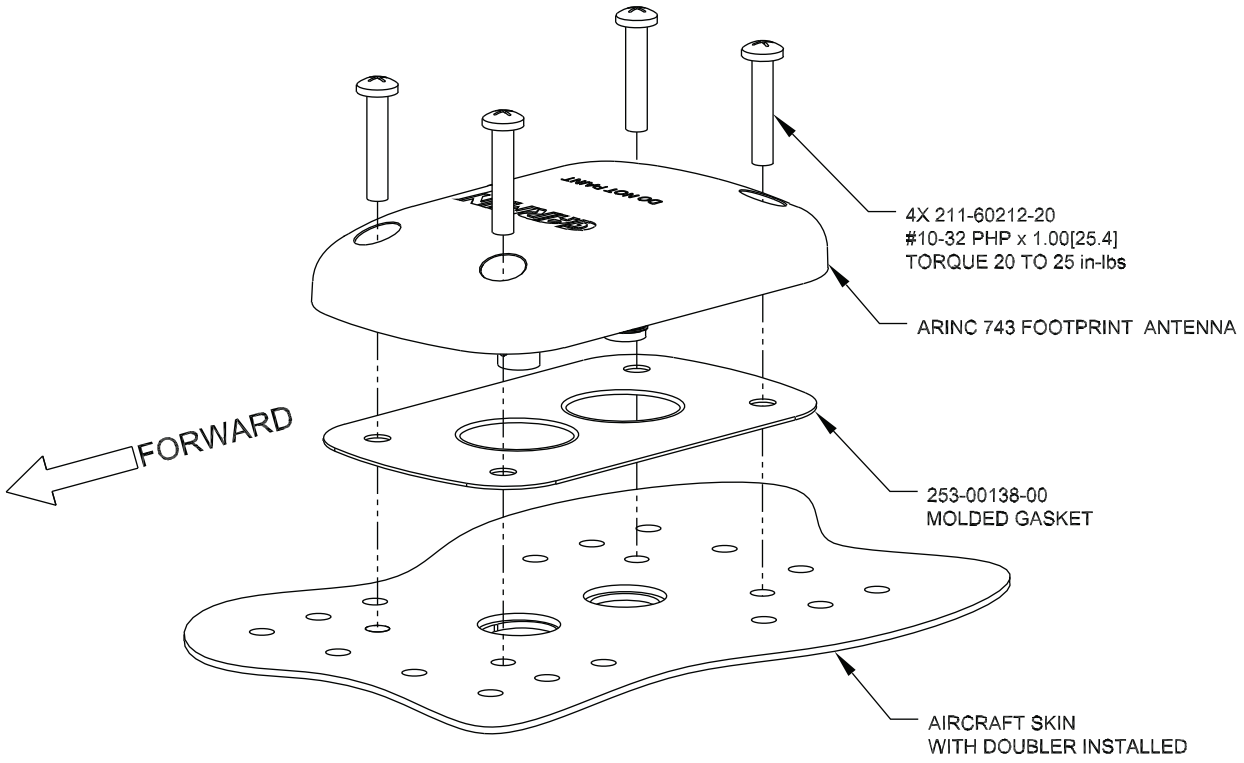


Figure 21-24 Installation of ARINC 743 Footprint Antenna

21.7 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.

The GA 57X cannot be installed internal to the aircraft, it must be installed externally with a sufficient ground plane.

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.

21.7.1 Generic Non-structural Antenna Installation

Figure 21-25 shows the generic non-structural installation for the ARINC 743 footprint (GA 36, GA 37, GA 55A) antenna. The teardrop footprint antennas (GA 35, GA 55, GA 56 stud mount) can also be installed in this manner.

For mounting the teardrop style antenna (GA 35, GA 55, or GA 56), a doubler plate similar to Figure 21-4 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 in Section 21.8 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 21-11, 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.

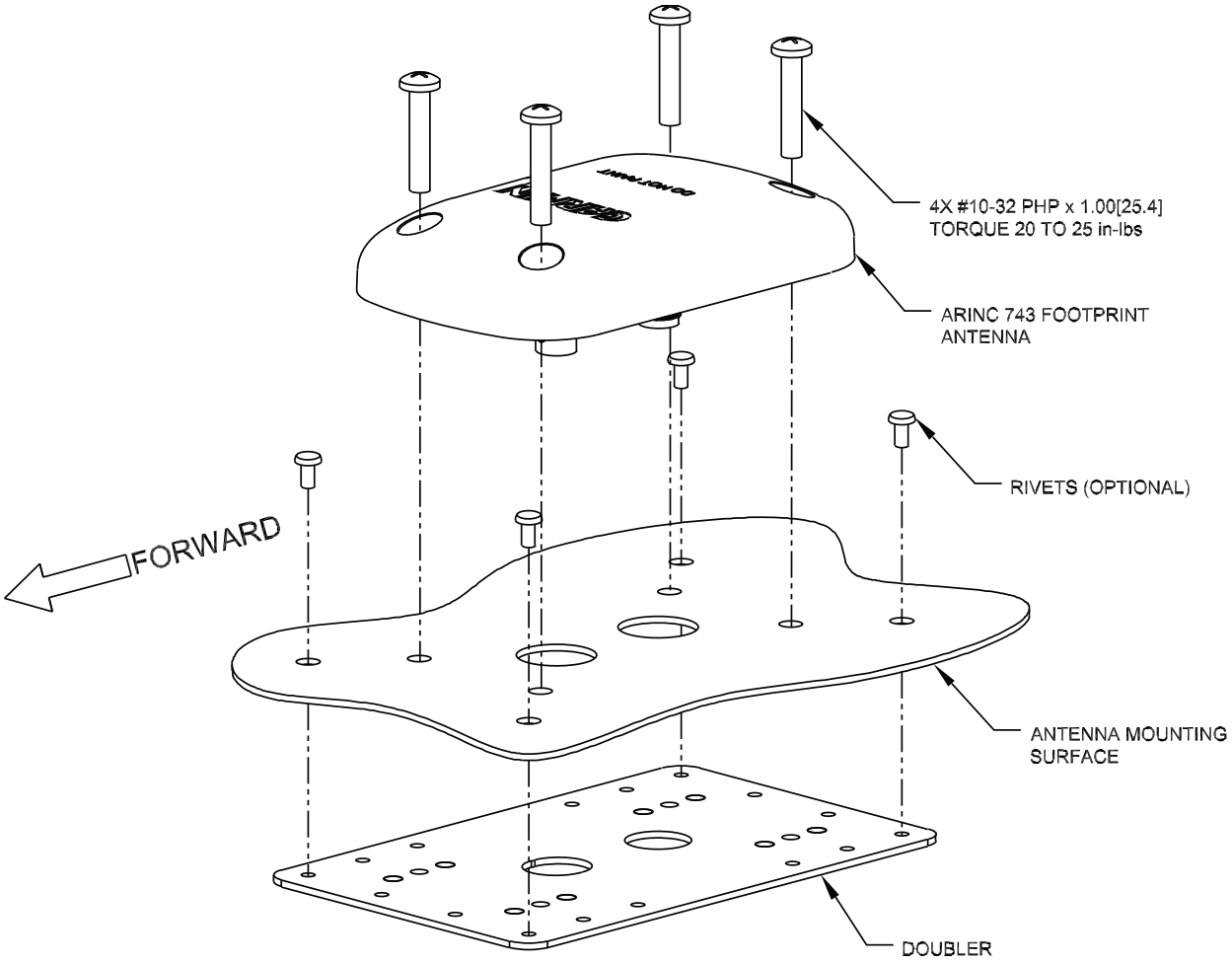
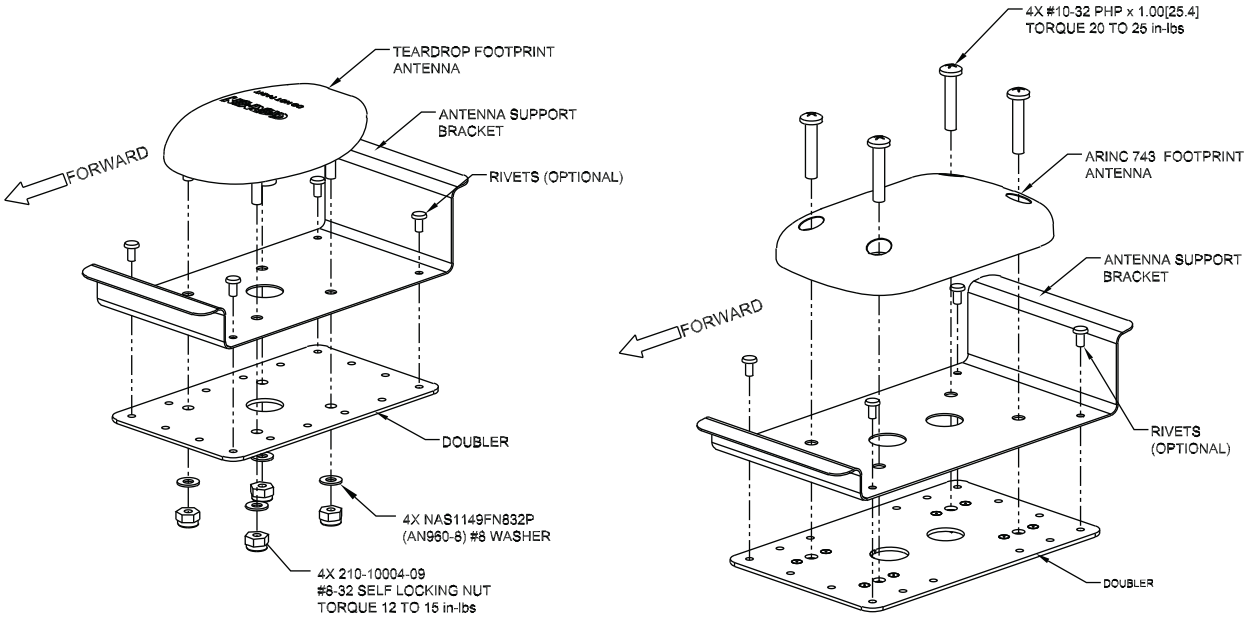


Figure 21-25 Generic Non-structural ARINC 743 Footprint Antenna Installation

21.7.2 Non-Structural Installation to Glareshield

Figure 21-26 shows an example of a bracket created to support an antenna mounted on the underside of the glare shield. Figure 21-27 shows the non-structural mounting of the antenna under the glareshield, with the bracket assembly shown in Figure 21-26.



EXAMPLE INSTALLATION, COMPOSITE AIRCRAFT
STUD MOUNT TEARDROP FOOTPRINT ANTENNA
SURROUNDING STRUCTURE NOT SHOWN FOR CLARITY

EXAMPLE INSTALLATION, COMPOSITE AIRCRAFT
ARINC 743 FOOTPRINT ANTENNA
SURROUNDING STRUCTURE NOT SHOWN FOR CLARITY

Figure 21-26 Example Bracket Antenna Mounting Under Glareshield

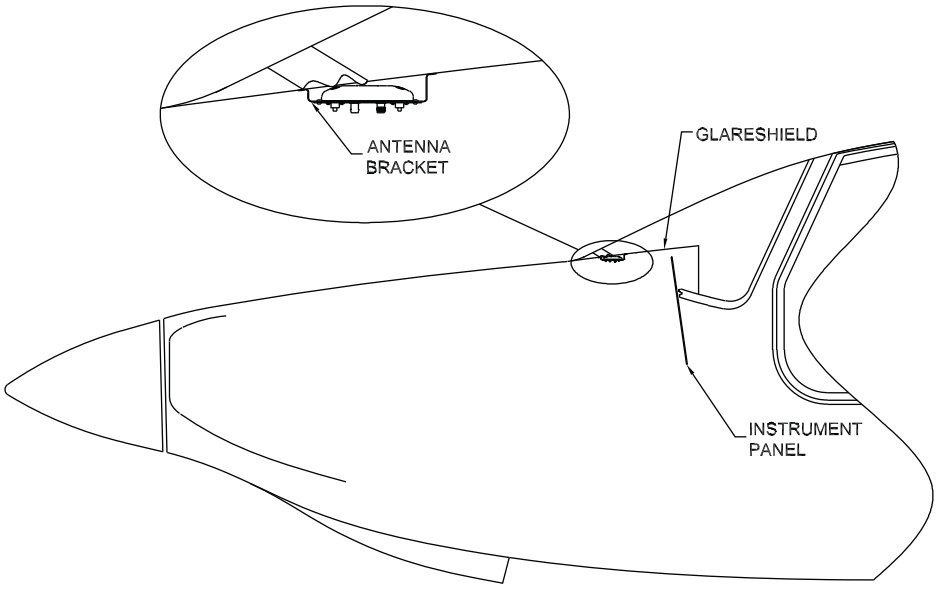


Figure 21-27 Example Non-structural Antenna Mounting Under Glareshield

21.7.3 Non-structural Installation to Airframe

Internal Non-structural Installation

Figure 21-28 and Figure 21-29 show examples of under the fabric skin non-structural mounting of the antenna to the airframe of a tube-and-fabric aircraft.

In Figure 21-28, 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 21.7.1) are used with the bracket as the antenna mounting surface. In Figure 21-29, 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.

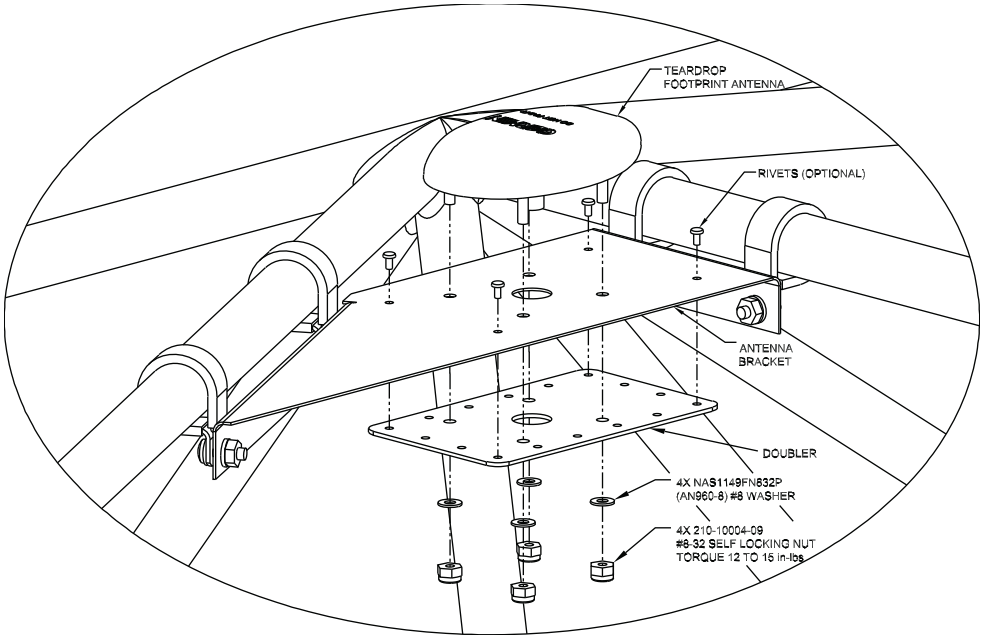


Figure 21-28 Example Teardrop Antenna Installation In Airframe Under Fabric Skin

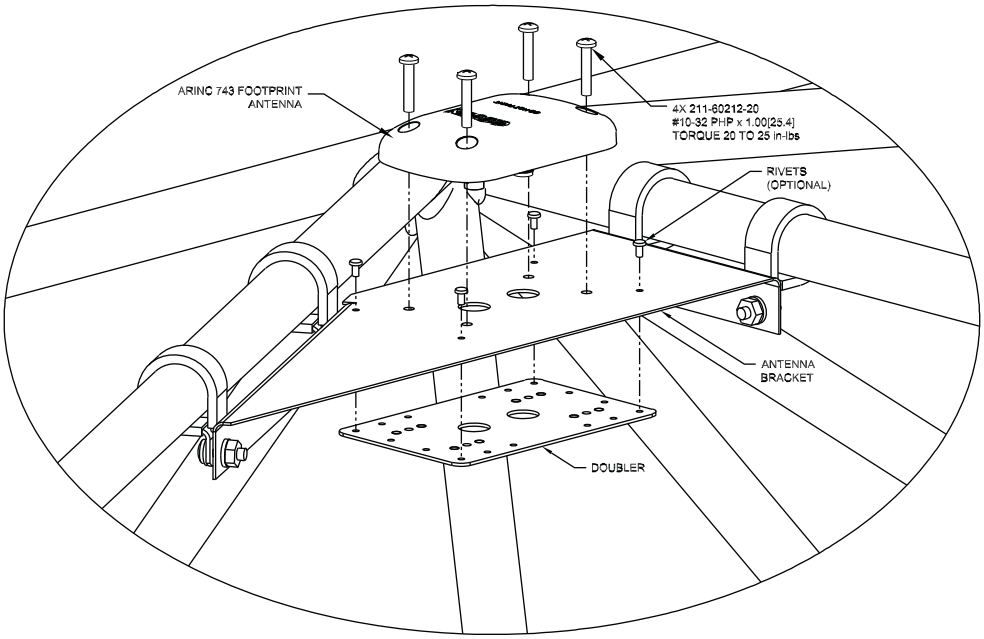


Figure 21-29 Example ARINC 743 Footprint In Airframe Under Fabric Skin

External Non-structural Installation

Figure 21-30 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 21.7.1) antenna is used, with the antenna support bracket as the mounting surface. Follow the applicable gasketing and sealant instructions in Section 21.5.2 (Teardrop style) or Section 21.6.2 (ARINC 743 style).

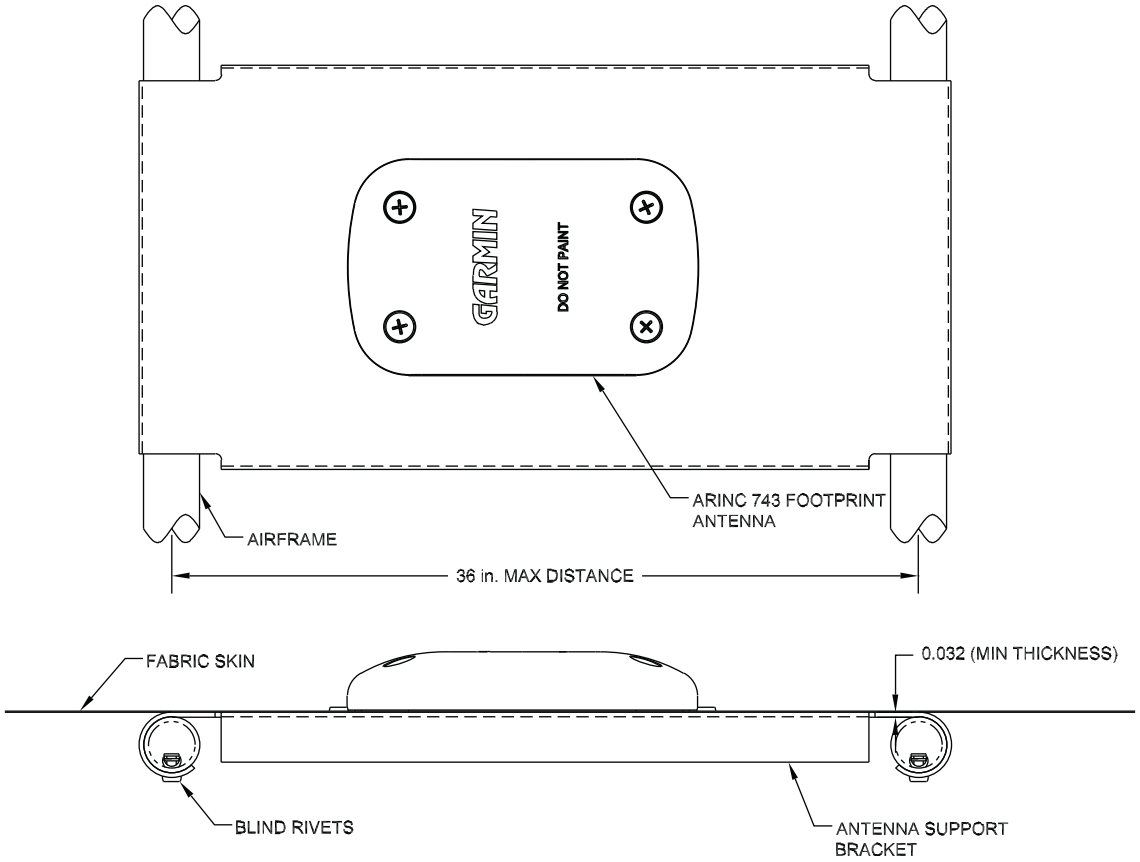


Figure 21-30 Example Non-structural Antenna Mounting On Airframe

Minimum Distance from Metal Tube Structure Requirements

Figure 21-31 shows minimum distance from metal tube structure requirements for internal, non-structural mounting of the antenna. Table 21-7 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 21-31 illustrates the tube diameter (d) and minimum distance (l) references in the Table 21-7.

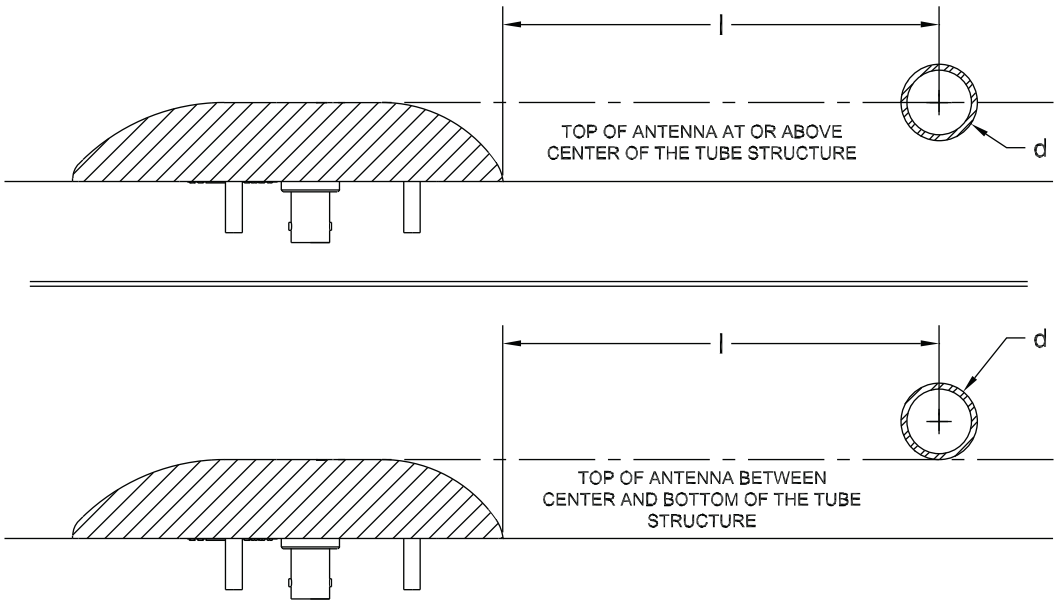


Figure 21-31 Example Teardrop Footprint Antenna Mounting Under Fabric Skin

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Table 21-7 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 21-31, 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 21-31, bottom)	0.625	7.2
	0.75	8.6
	1.00	11.5
	1.25	14.3

21.8 Outline and Installation Drawings

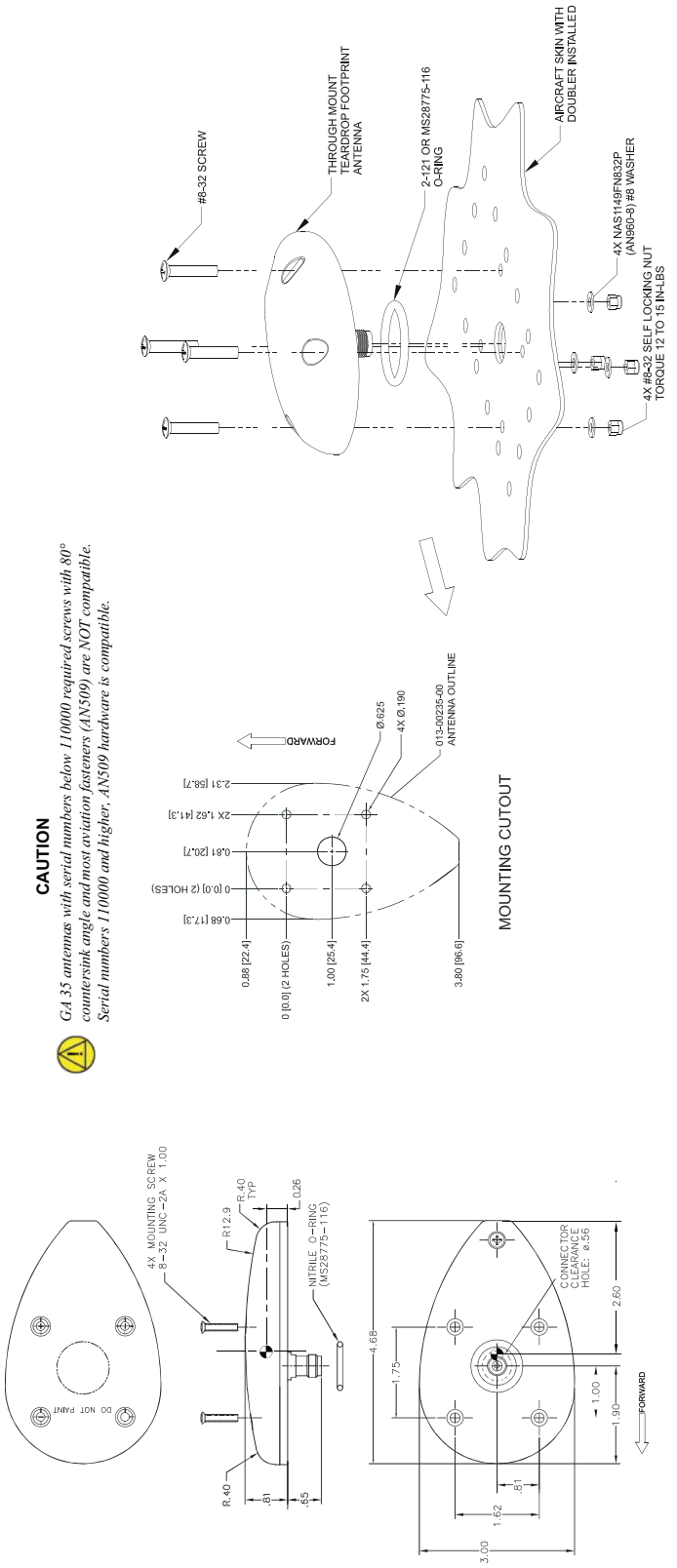


Figure 21-32 GA 35 Installation Drawing

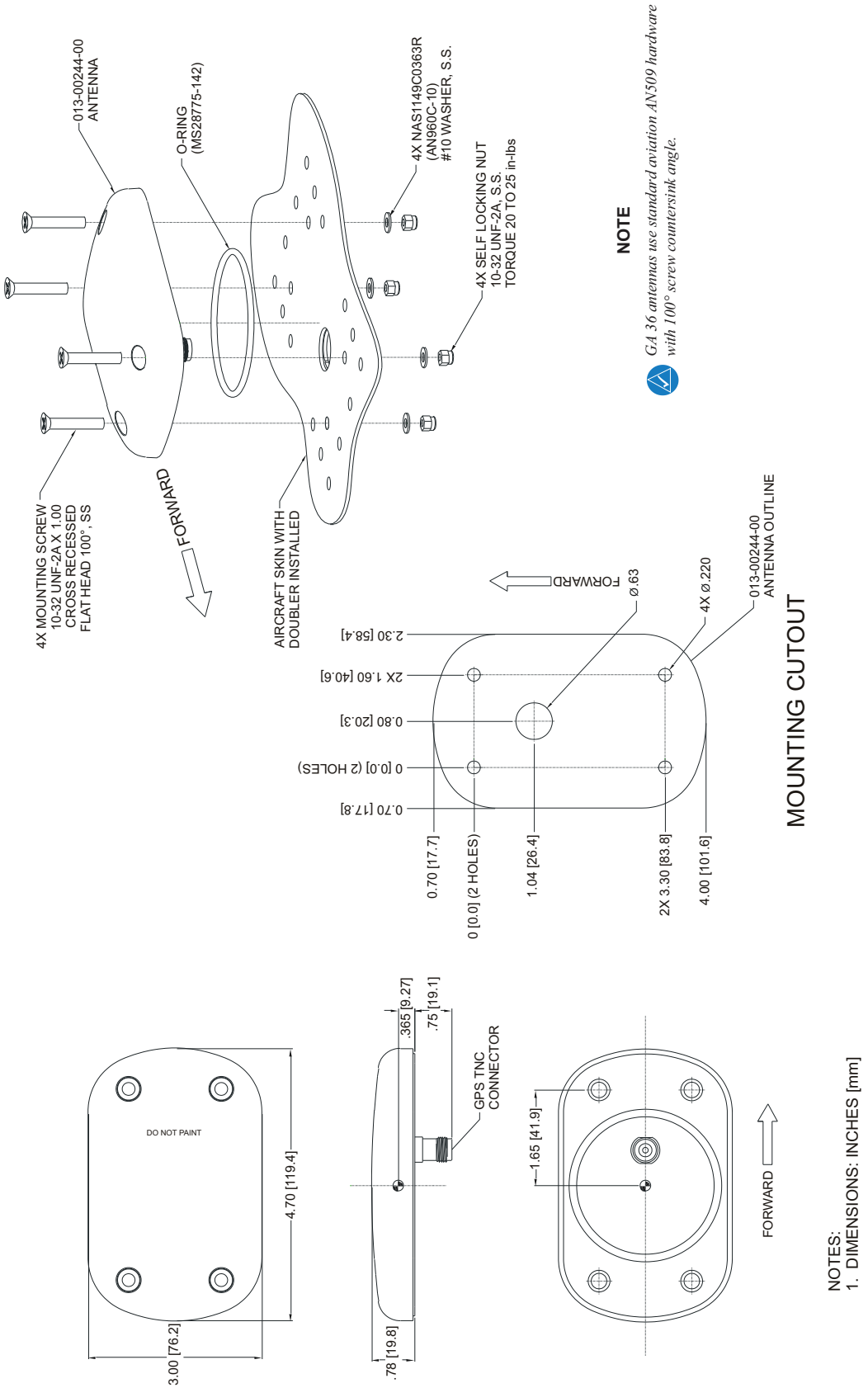


Figure 21-33 GA 36 Installation Drawing

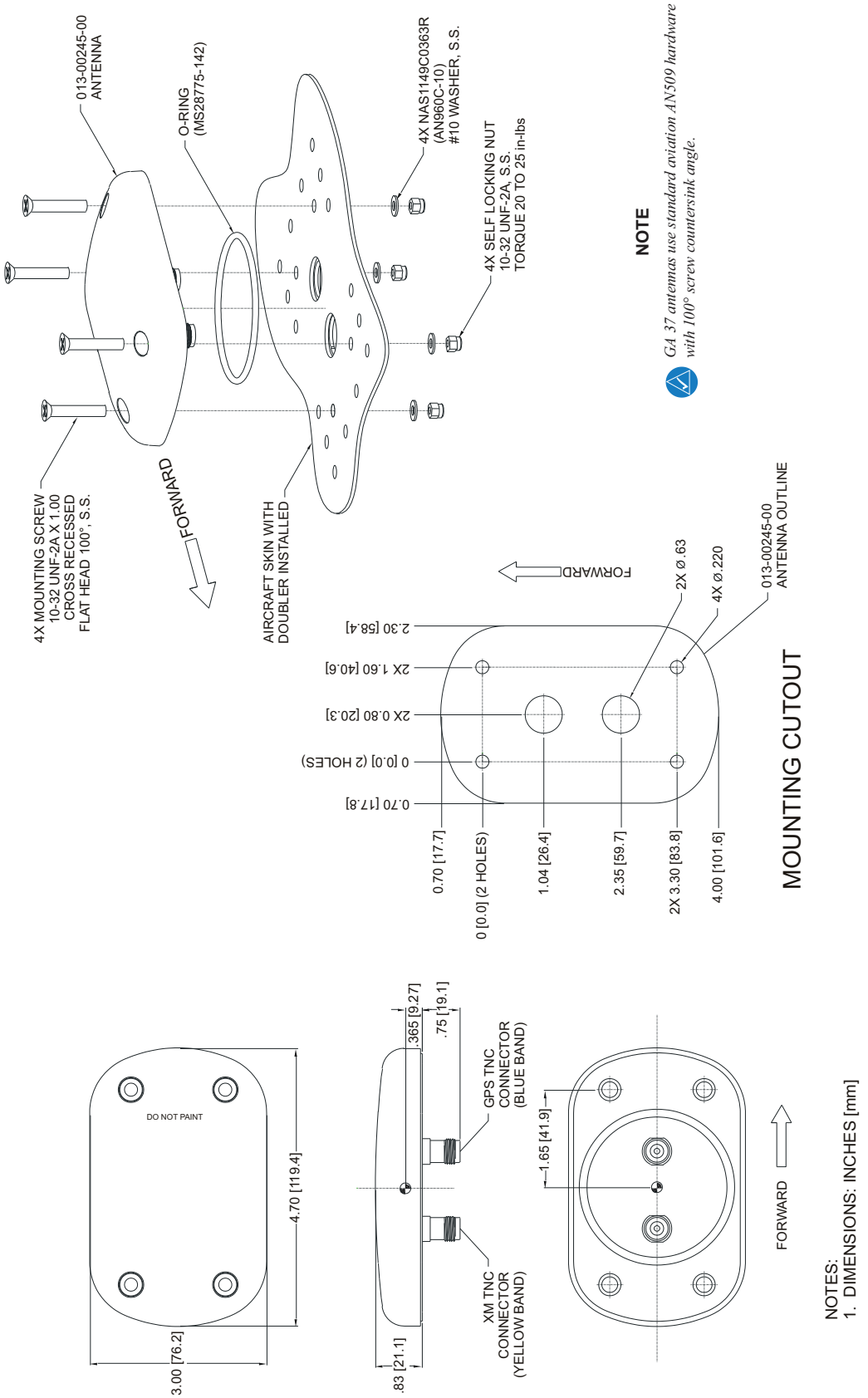


Figure 21-34 GA 37 Installation Drawing

GA 55 STUD MOUNT

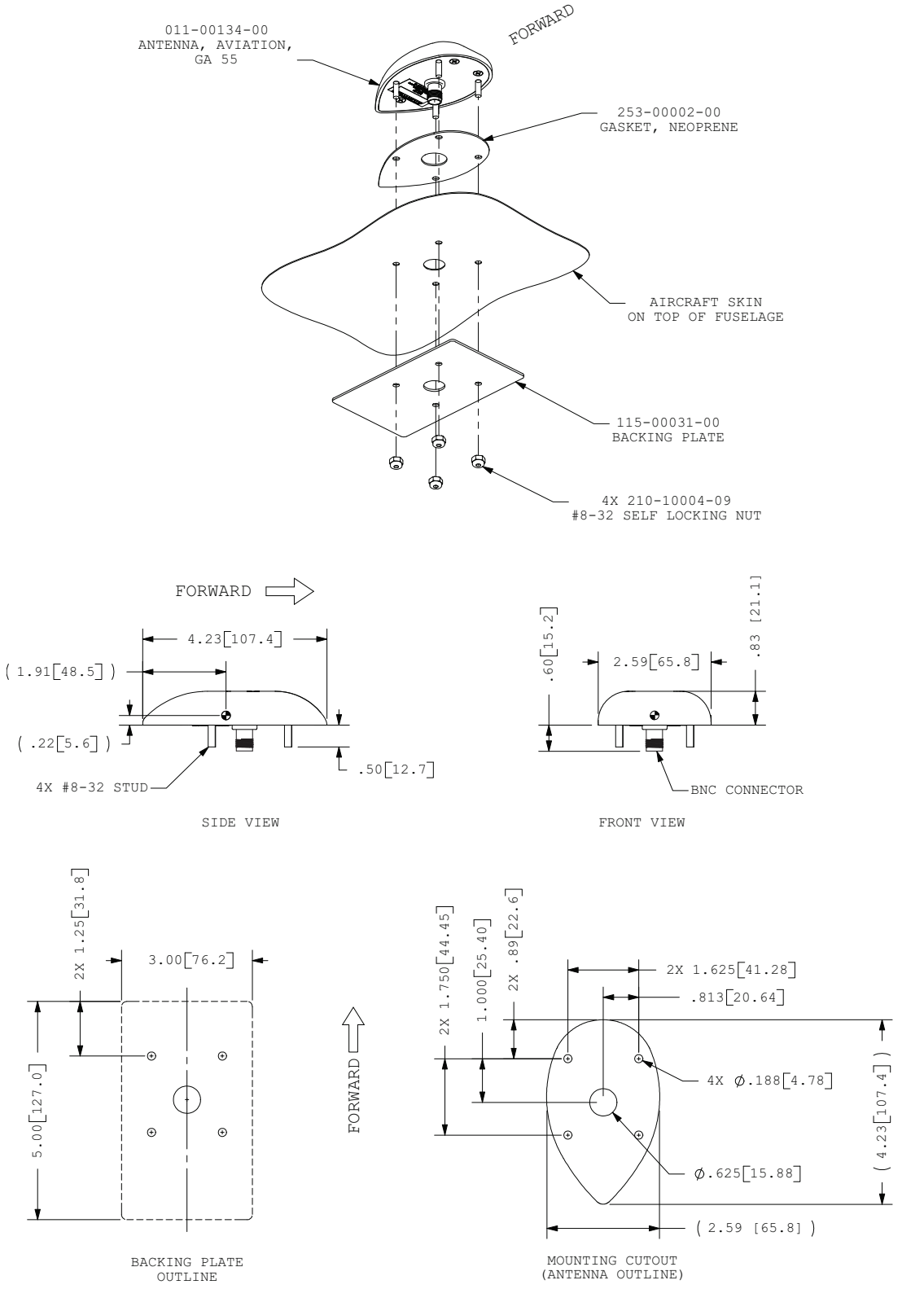


Figure 21-35 GA 55 Installation Drawing

GA 55A FLANGE MOUNT

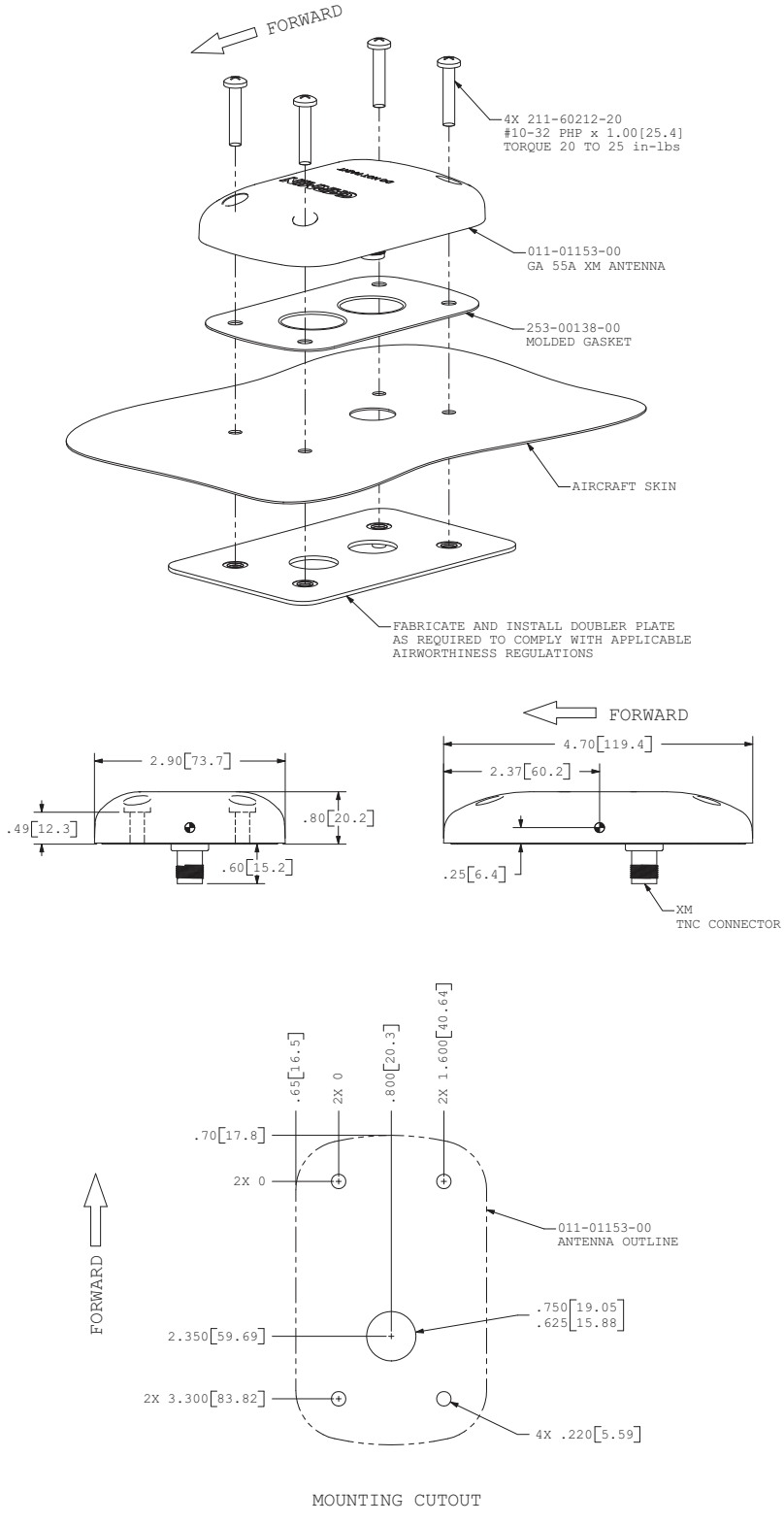


Figure 21-36 GA 55A Installation Drawing

GA 56 STUD MOUNT

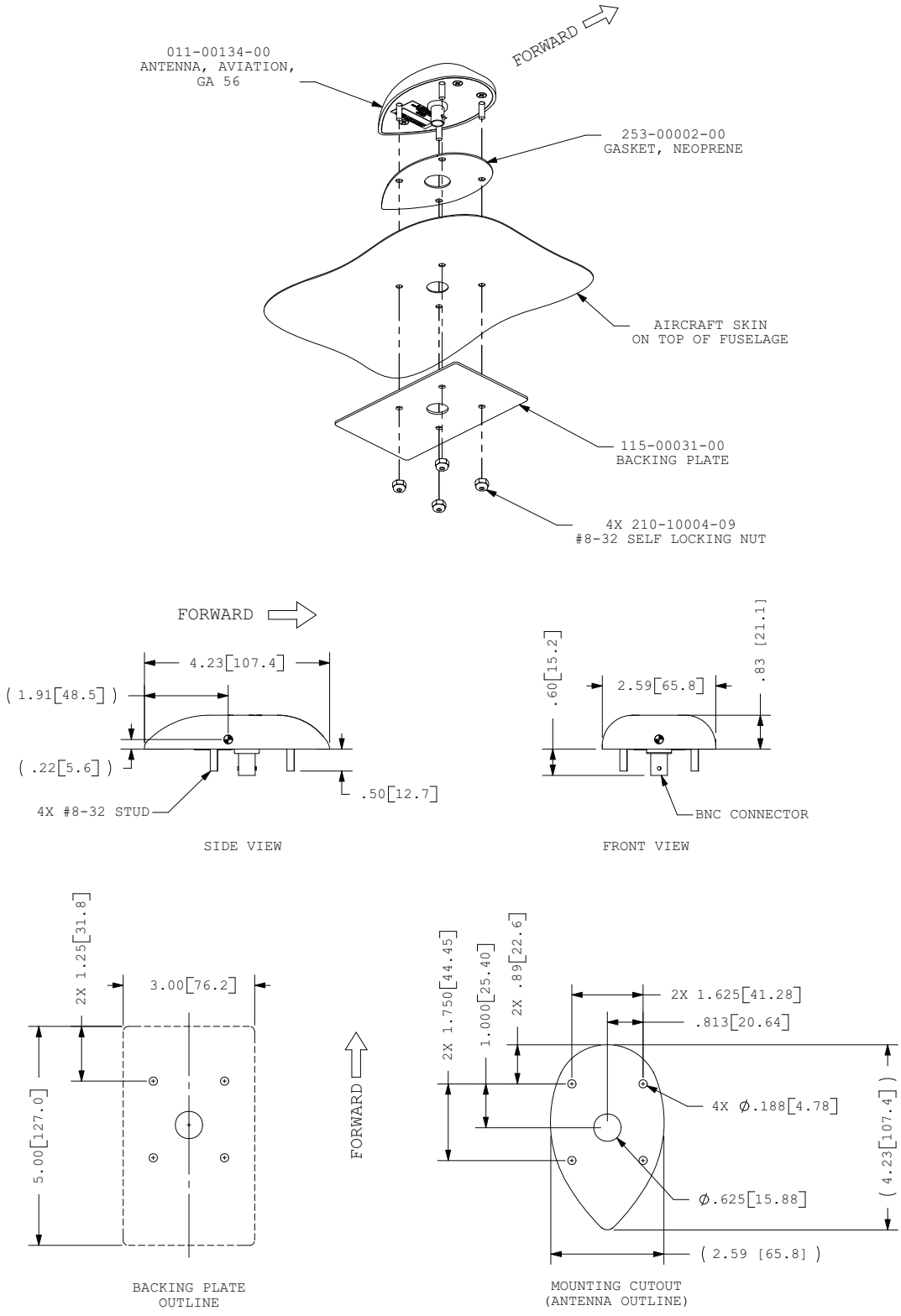


Figure 21-37 GA 56 Installation Drawing

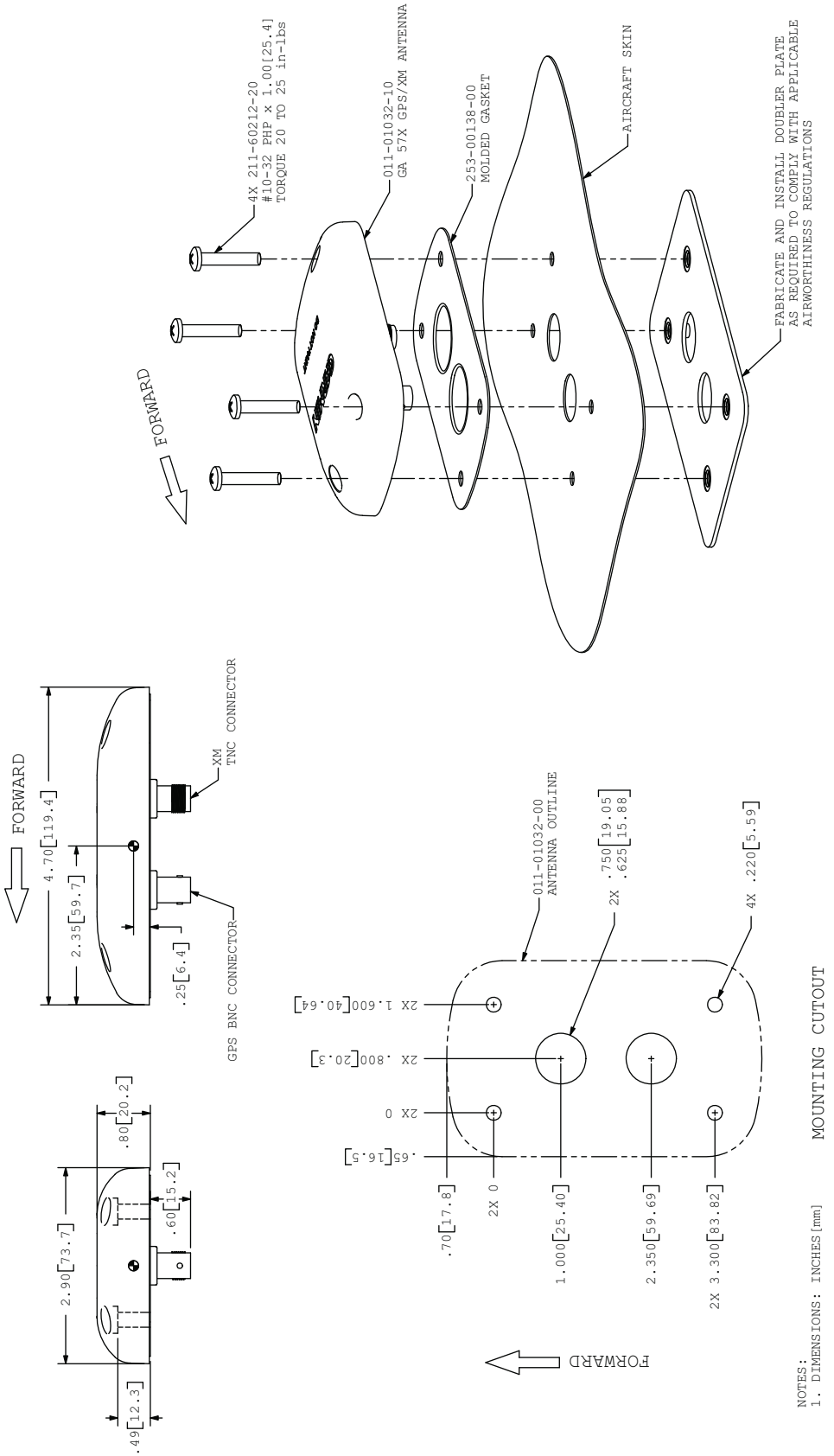


Figure 21-38 GA 57X Installation Drawing

22 ENGINE/AIRFRAME SENSOR INSTALLATION

22.1 Engine/Airframe Sensor Options

Table 22-1 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™ avionics Sensor Kits (Section 22.2). Each of the sensors must be correctly installed and configured (Appendix H.4.19 for GDU™ 37X display systems and Section 31.4.32 for GDU 4XX systems) before use.

NOTE

In addition to the engine sensors listed in Table 22-1, the G3X system can also work with many other sensors (not listed) that output a compatible signal, refer to the sensor specifications to establish compatibility.

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Bus Current	10-29 Vdc input	N/A	
	Amploc KEY100 Hall effect sensor	N/A	+/- 100 A
	UMA 1C4 shunt	909-D0000-00	+/- 100 A
	Other ammeter shunt or Hall effect sensor types	N/A	Uses custom user-defined calibration (millivolts to amps)
Carburetor Temperature	Rotax 965531	N/A	
	Rotax 966385	N/A	
	50-150C Thermistor (e.g. VDO 320-XXX series)	N/A	
	Type K Thermocouple	N/A	
	MS28034/ MIL-T-7990 RTD	N/A	
	UMA 1B10R RTD	494-70005-00	UMA temperature sensors without the "R" designation are not compatible
Coolant Pressure	Garmin GPT 75G	011-05783-20	0-75 psiG
	Kavlico P4055-5020-3	N/A	0-75 psiG
	Any voltage-output pressure transducer	N/A	Uses custom user-defined calibration (voltage to pressure)
Custom Analog Parameter	Any voltage-output sensor	N/A	Uses custom user-defined sensor calibration

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Custom Temperature	50-150C Thermistor (e.g. VDO 320-XXX series)	N/A	
	RTD (e.g. UMA 1B3XR series)	N/A	UMA temperature sensors without the "R" designation are not compatible
	Rotax 965531 (thermistor)	N/A	
	Rotax 966385 (thermistor)	N/A	
	Type J thermocouple	N/A	
	Type K thermocouple	N/A	
	MS28034 (MIL-T-7990 RTD)	N/A	
Cylinder Head Temperature (CHT)	50-150C Thermistor (e.g. VDO 320-XXX series)	N/A	
	Type J Thermocouple	N/A	
	Type K Thermocouple (Alcor 86253)	494-70000-00	
	Type K Thermocouple (other)	N/A	
	Rotax 965531	N/A	
	Rotax 966385	N/A	
Discrete Inputs	Active High or Low: Canopy Warning, Gear Down Reminder, etc.	N/A	
Engine Torque	Garmin GPT 150G	011-05783-30	Uses custom user-defined calibration (0-150 psiG pressure to torque)
	Kavlico P4055-5020-4	N/A	Uses custom user-defined calibration (0-150 psiG pressure to torque)
	Any voltage-output torque transducer	N/A	Uses custom user-defined calibration (voltage to torque)
Exhaust Gas Temperature (EGT)	Type K thermocouple (Alcor 86255)	494-70001-00	
	Type K thermocouple (other)	N/A	

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Fuel Flow (two sensors required for differential fuel flow)	EI FT-60	494-10001-00	0-70 gal/hr
	EI FT-90	N/A	0-125 gal/hr
	EI FT-180	N/A	0-250 gal/hr
	Floscan Series 200	N/A	0-60 gal/hr
	Floscan 231	N/A	0-90 gal/hr
	Any frequency-output fuel flow transducer	N/A	Uses custom user-defined calibration (0-5 kHz frequency to fuel flow)
Fuel Pressure	Garmin GPT 15G	011-05783-10	0-15 psiG
	Kavlico P4055-5020-2	011-04202-10	0-15 psiG
	Garmin GPT 75G	011-05783-20	0-75 psiG
	Kavlico P4055-5020-3	N/A	0-75 psiG
	Kavlico P4055-75G	N/A	0-75 psiG
	Kavlico P500-75A	N/A	0-75 psi absolute
	UMA EU07D	N/A	0-7 psi differential
	UMA 1EU35G	N/A	0-35 psiG
	UMA 1EU70D	N/A	0-70 psi differential
	UMA 1EU70G	N/A	0-70 psiG
	UMA 1EM2K	N/A	0-2500 psiG
	Any voltage-output pressure sensor	N/A	Uses custom user-defined calibration (voltage to pressure)
Fuel Quantity	Any capacitive fuel quantity sensor (requires external conversion to voltage or frequency)	N/A	Uses custom user-defined calibration (voltage or frequency to fuel quantity)
	Any resistive fuel quantity sensor	N/A	Uses custom user-defined calibration (voltage to fuel quantity)
	Any voltage-output fuel quantity sensor	N/A	Uses custom user-defined calibration (voltage to fuel quantity)
	Any frequency-output fuel quantity sensor	N/A	Uses custom user-defined calibration (frequency to fuel quantity)

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Manifold Pressure	UMA 1EU50A	N/A	0-25 psiA, 0-50 inches Hg
	Garmin GPT 30A	011-05783-00	0-30psiA, 0-60 inches Hg
	Kavlico P4055-30A-E4A	N/A	0-30 psiA, 0-60 inches Hg
	Kavlico P500-30A-E4A	N/A	0-30 psiA, 0-60 inches Hg
	UMA 1EU70A	N/A	0-35 psiA, 0-70 inches Hg
	Any voltage-output pressure transducer	N/A	Uses custom user-defined calibration (voltage to pressure)
Miscellaneous Pressure	Garmin GPT 75G	011-05783-20	0-75 psiG
	Kavlico P4055-5020-3	N/A	0-75 psiG
	Garmin GPT 150G	011-05783-30	0-150 psiG
	Kavlico P4055-5020-4	N/A	0-150 psiG
	UMA 1EM2K	N/A	0-2500 psiG
	Any voltage-output pressure transducer	N/A	Uses custom user-defined calibration (voltage to pressure)
Oil Pressure	Jabiru (VDO 360-003)	N/A	
	Garmin GPT 150G	011-05783-30	0-150 psiG
	Kavlico P4055-5020-4	N/A	0-150 psiG
	Rotax 456180	N/A	
	Rotax 956413	N/A	
	Rotax 956415	N/A	
	UMA 1EU150G	N/A	0-150 psiG
	Any voltage-output pressure sensor	N/A	Uses custom user-defined calibration (voltage to pressure)

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Oil Temperature	Jabiru (VDO 320-021)	N/A	
	Rotax 965531	N/A	
	Rotax 966385	N/A	
	50-150C Thermistor (e.g. VDO 320-XXX series)	N/A	
	Type K Thermocouple	N/A	
	UMA 1B3-2.5R RTD	494-70004-00	UMA temperature sensors without the "R" designation are not compatible
	MS28034 (MIL-T-7990 RTD)	N/A	
Position Sensor	Any trim servo with integrated position potentiometer	N/A	Uses custom user-defined calibration (voltage to position)
	Any standalone potentiometer	N/A	Uses custom user-defined calibration (voltage to position)
RPM	Electronic Ignition	N/A	1-4 pulses/revolution
	Jabiru Alternator Output	N/A	Single phase, 6 pulses/revolution
	JPI 4208XX (Slick/Bendix magneto, pressurized)	N/A	
	Rotax Trigger Coil	N/A	
	UMA 1A3C-2	N/A	
	UMA 1A3C-4	N/A	
	UMA T1A9-1 (Slick magneto)	494-50005-00	
	UMA T1A9-2 (Bendix magneto)	494-50005-01	
	Turbine engine RPM (requires Sandia ST26 signal converter)	N/A	Uses custom user-defined calibration (0-1000 Hz to RPM)
	Any frequency-output RPM sensor	N/A	Uses custom user-defined calibration (0-1000 Hz to RPM)

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

Table 22-1 Compatible Engine/Airframe Input Sensors

SENSOR TYPE	COMPATIBLE SENSORS	GARMIN PART NUMBER*	NOTES
Turbine Inlet / Outlet / Interstage Temperature (TIT/TOT/ITT)	Type K thermocouple	N/A	

*Items with a Garmin part number may be included in a G3X Sensor Kit (Section 22.2), and are available individually from Garmin Dealers

The Engine inputs being monitored are displayed as gauges on the EIS display (Figure 22-1) and also on the MFD Engine Page.

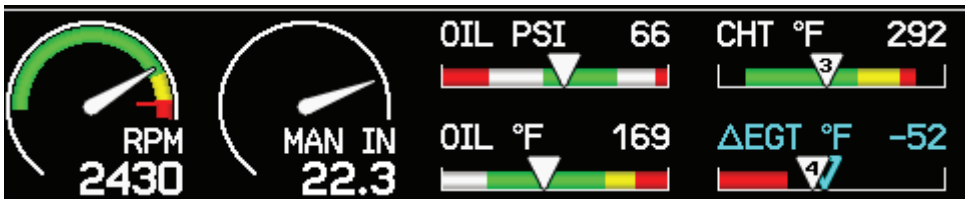


Figure 22-1 EIS Display (Engine Bar)

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

22.2 Engine Sensor Applications

22.2.1 Lycoming/Continental Engine Applications

Table 22-2 and Table 22-3 list Garmin sensor kits available for G3X installations with 4-cylinder and 6-cylinder Lycoming and Continental piston engines. Refer to Sensor Interface drawings in Section 28 for sensor wiring guidance.

Table 22-2 Contents of G3X Sensor Kit, 4 Cylinder Lycoming/Continental (K00-00512-10)

Item	Garmin P/N	Quantity
Garmin GPT 150G	011-05783-30	1
Fuel Flow Transducer, EI FT-60	494-10001-00	1
Absolute Pressure Transducer, Kavlico 30 PSI	011-05783-00	1
Type K Thermocouple, 3/8-24 Threaded, CHT, Alcor 86253	494-70000-00	4
Type K Thermocouple, Clamp, 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 22-3 Contents of G3X Sensor Kit, 6 Cylinder Lycoming/Continental (K00-00513-10)

Item	Garmin P/N	Quantity
Garmin GPT 150G	011-05783-30	1
Fuel Flow Transducer, EI FT-60	494-10001-00	1
Absolute Pressure Transducer, Kavlico 30 PSI	011-05783-00	1
Type K Thermocouple, 3/8-24 Threaded, CHT, Alcor 86253	494-70000-00	6
Type K Thermocouple, Clamp, 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

For 8-cylinder Lycoming engine applications, refer to Section 22.2.5.

For retrofit applications, where a G3X system is installed in a completed aircraft with a Lycoming/ Continental engine, refer to Section 22.2.6.

22.2.1.1 Lycoming/Continental RPM

Engine speed for Lycoming and Continental engines may be sensed by an RPM sensor mounted on the mechanical tach drive, a sensor mounted on the magneto, or through the digital tach signal output from an electronic ignition system. Refer to Section 22.3.5.

22.2.1.2 Lycoming/Continental Fuel Pressure

Fuel pressure sensors for Lycoming and Continental engines are not included in the Garmin sensor kits, due to differences between pressure ranges for carbureted and fuel-injected engines. For monitoring Lycoming/Continental engine fuel pressure, select a sensor from Table 22-1 as appropriate:

- Fuel-injected engines typically use the Garmin GPT 75G sensor (0-75 psiG, Garmin part number 011-5783-20).
- Carbureted engines typically use the Garmin GPT 15G sensor (0-15 psiG, Garmin part number 011-05783-10)

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.

22.2.1.3 Lycoming iE2

The G3X system is capable of monitoring the following engine parameters from the Lycoming iE2 FADEC digital interface, when connected to a GEA™ 24 engine interface module:

- RPM
- Manifold pressure
- Oil pressure
- Oil temperature
- Exhaust gas temperature
- Cylinder head temperature
- Turbine inlet temperature
- Fuel pressure
- ECU bus voltage

22.2.2 Rotax Engine Applications

Refer to the Sensor Interface drawings in Section 29 for all Rotax engine applications.

22.2.2.1 Rotax 912

Table 22-4 lists the Garmin sensor kit available for G3X installations with Rotax 912 engines.

Table 22-4 Contents of G3X Sensor Kit, Rotax 912 (K00-00514-10)

Item	Garmin P/N	Quantity
G3X External Components for Rotax 912 RPM Signal (see Table 22-5)	011-02348-00	1
Garmin GPT 15G	011-05783-10	1
Absolute Pressure Transducer, Kavlico 30 PSI	011-05783-00	1
Type K Thermocouple, Clamp, EGT, Alcor 86255	494-70001-00	2
Shunt, Ammeter, +/-50 mV, 100 Amps, UMA 1C4	909-D0000-00	1

Rotax engine RPM is sensed through a connection to the engine trigger coil. The external components listed in Table 22-5 are required for use with the GSU 73 (see Figure 32.3).

Table 22-5 Contents of G3X External Components for Rotax 912 RPM Signal Kit (011-02348-00)

Item	Garmin P/N	Quantity
Silicon Diode, 1A, 200V	680-00006-D0	2
7.5 V Zener Diode	682-00012-00	1
300 Ω Resistor, 1%, 0.5 W	902-A300R-F0	2

22.2.2.2 Rotax 914

Table 22-6 lists the sensors used for G3X installations with Rotax 914 engines. Order all sensors in the Rotax 912 sensor kit except the fuel pressure sensor. Instead, use the UMA 1EU07D differential fuel pressure sensor.

Table 22-6 Rotax 914 Sensors

Sensor Type	Details/Part Number
RPM	Use Rotax tachometer output along with external components from 011-02348-00 kit
Manifold pressure	Use Garmin GPT 30A (011-05783-00)
Oil pressure	Use Rotax-supplied sensor
Oil temperature	Use Rotax-supplied thermistor
Exhaust gas temperature	Use Type K thermocouple (494-70001-00)
Cylinder head temperature	Use Rotax-supplied thermistor
Fuel pressure	Use UMA 1EU07D differential fuel pressure sensor
Fuel flow	Use EI FT-60 (494-10001-00) or Floscan 201B-6

22.2.2.3 Rotax 912iS/915iS/916iS

The G3X system is capable of monitoring the following engine parameters from the Rotax 912iS/915iS /916iS FADEC digital interface, when connected to the dedicated FADEC CAN interface on a GEA 24:

- RPM
- Manifold pressure
- Manifold air temperature
- Oil pressure
- Oil temperature
- Exhaust gas temperature
- Coolant temperature
- Fuel flow
- ECU bus voltage
- Throttle position
- Percent Power (Rotax 915iS and 916iS only)

See Figure 29-2.2 for GEA 24 to Rotax FADEC wiring information.

The GEA 24B (010-02770-00) is capable of dual CAN connections to the Rotax FADEC. This provides greater communication redundancy with the Rotax ECU. See Figure 29-2.3 for GEA 24B to Rotax FADEC wiring information. The wiring method represented in Figure 29-2.2 remains compatible with the GEA 24B.

Fuel pressure for Rotax FADEC engines may be monitored using one of the two following methods:

- Use UMA 1EU70D differential sensor for fuel pressure.
- With a GDU 4XX system, select an appropriate fuel pressure sensor from Table 22-1 as appropriate, and configure the sensor to display fuel pressure relative to manifold pressure (see Section 31.4.32.11).

Refer to Section 22.2.10 for information about FADEC engine status display.

22.2.3 Jabiru Engine Applications

Table 22-7 lists the sensors used in G3X installations with Jabiru engines. See Section 30 for Jabiru engine sensor wiring information.

Table 22-7 Jabiru Sensors

Sensor Type	Details/Part Number
RPM	Use Jabiru tachometer output from alternator
Manifold pressure	Use Garmin GPT 30A (011-05783-00)
Oil pressure	Use Jabiru-supplied VDO pressure sensor, or 150 GPT
Oil temperature	Use Jabiru-supplied VDO 50-150°C thermistor, or any compatible RTD such as UMA 1B3XR series
Exhaust gas temperature	Use Jabiru-supplied Type K thermocouples
Cylinder head temperature	Use Jabiru-supplied Type J thermocouples
Fuel pressure	Use Garmin GPT 15G (011-05783-10)
Fuel flow	Use EI FT-60 (494-10001-00) or Floscan 201B-6

22.2.4 UL Power Engine Applications

The G3X system is capable of monitoring the following engine parameters from the UL Power FADEC digital interface, when connected to the dedicated FADEC CAN interface on a GEA 24:

- RPM
- Manifold pressure
- Manifold air temperature
- Oil pressure
- Oil temperature
- Cylinder head temperature
- Exhaust gas temperature
- Fuel pressure
- Fuel flow
- ECU bus voltage

Refer to Section 22.2.10 for information about FADEC engine status display.

For UL Power engine installations that do not support a digital interface to the GEA 24, the engine sensors shown in Table 22-8 may be used.

Table 22-8 UL Power Sensors

Sensor Type	Details/Part Number
RPM	Use ECU tachometer output and select "Electronic Ignition (2 pulses/revolution)"
Manifold pressure	Garmin GPT 30A (011-05783-00
Oil Pressure	Garmin GPT 150G (011-05783-30)
Oil temperature	UMA 1B3-2.5R RTD (494-70004-00)
Exhaust gas temperature	Type K thermocouples
Cylinder head temperature	Type K thermocouples
Fuel Pressure	Garmin GPT 75G (011-05783-20)
Fuel flow	Use ECU fuel consumption pulse output and select "Custom" fuel flow configuration. UL Power specifies a pulse frequency of 170 Hz at 72 L/hour, which suggests an initial scale factor of 32176.

22.2.5 Other Piston Engine Applications

In addition to the engines described previously, the G3X system's engine/airframe inputs can be configured for use with a variety of other engine types.

Sensors for Other Piston Engines - Many other piston engines can be monitored using the supported engine sensors shown in Table 22-1, along with custom engine sensor configuration as described in Appendix H.4.19 for GDU 37X units, or Section 31.4.32 for GDU 4XX units.

Table 22-9 Sensors for Other Piston Engines

Sensor Type	Details/Part Number
RPM	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter frequency-to-RPM calibration
Manifold pressure	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Oil pressure	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Oil temperature	Use any supported sensor from Table 22-1
Exhaust gas temperature	Use Type K thermocouples. Up to 6 cylinders are supported, or up to 12 cylinders in a GDU 4XX system with dual GEA 24 EIS units.
Cylinder head temperature	Use Type J or Type K thermocouples. Up to 6 cylinders are supported, or up to 12 cylinders in a GDU 4XX system with dual GEA 24 EIS units.
Turbine inlet temperature	Use Type K thermocouples
Carburetor temperature	Use any supported sensor from Table 22-1
Fuel pressure	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Fuel flow	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter pulses-per-gallon calibration
Coolant pressure	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Coolant temperature (or other temperature)	Use "Custom" temperature configuration with RTD, thermistor, or thermocouple
Hydraulic pressure (or other pressure)	Use appropriate Garmin pressure sensor or select "Custom" configuration and enter voltage-to-pressure calibration
Other parameters	Use any supported sensor from Table 22-1

Large Piston Engines - A GDU 4XX system with dual GEA 24 EIS units installed can monitor a single engine with up to 12 cylinders, including radial engines. For large single-engine applications, cylinders 1-6 are connected to GEA 24 #1 and cylinders 7-12 are connected to GEA 24 #2. (see Section 24.5.16)

Twin Piston Engines - A GDU 4XX system with dual GEA 24 EIS units installed can monitor twin piston engines with up to 6 cylinders each (see Section 22.2.8).

22.2.6 Retrofit Engine Applications

When installing a G3X system in a completed aircraft with a typical piston engine, it is generally possible to reuse a number of the existing engine sensors that may already be present. Consult Section 27 for general engine sensor wiring guidance that can be applied to existing sensors.

Table 22-10 Retrofit Engine Sensors

Sensor Type	Notes on Suitability for Reuse
RPM	Sensors that provide a digital output signal can be used without modification, if calibration characteristics are known. Only connect G3X RPM inputs directly to magneto P-Leads on MOD Level 2 GEA 24 units.
Manifold Pressure	Sensors that provide a voltage output can be used without modification, if calibration characteristics are known. Sensors that provide a resistance or current output may require replacement with a supported sensor (e.g. 011-05783-00).
Oil Pressure	Sensors that provide a voltage output can be used without modification, if calibration characteristics are known. Sensors that provide a resistance or current output may require replacement with a supported sensor (e.g. 011-05783-30).
Oil Temperature	Existing sensors are generally likely to require replacement with a supported sensor (e.g. 494-70004-00).
Exhaust Gas Temperature	Type K thermocouples can be used without modification. The GEA 24 J242 connector matches the pinout used by certain other engine monitoring systems.
Cylinder Head Temperature	Type J or K thermocouples can be used without modification. The GEA 24 J242 connector matches the pinout used by certain other engine monitoring systems.
Turbine Inlet Temperature	Type K thermocouples can be used without modification.
Fuel Pressure	Sensors that provide a voltage output can be used without modification, if calibration characteristics are known. Sensors that provide a resistance or current output may require replacement with a supported sensor (e.g. 494-30004-02 or 494-30004-03).
Fuel Flow	Most sensors that provide a digital output signal can be used without modification, if calibration characteristics are known. Many existing installations use Floscan or Electronics International fuel flow sensors that are directly supported by the G3X system.
Bus Current	Most shunt-type or Hall-effect sensors can be used without modification, if calibration characteristics are known.

Table 22-10 Retrofit Engine Sensors

Sensor Type	Notes on Suitability for Reuse
Fuel Quantity	Most sensors that provide a resistance, voltage, or frequency output can be used without modification. New fuel quantity calibration will be performed during G3X system installation. For capacitive fuel quantity measurement, a third-party capacitance-to-frequency or capacitance-to-voltage converter is required; the G3X system does not support direct connection to capacitive fuel tank probes.
Control Surface Position	Most potentiometer-type sensors can be used without modification. New position calibration will be performed during G3X system installation.

22.2.7 Turbine Engine Applications

Turbine Engines - Many turbine engines can be monitored using the supported engine sensors shown in Table 22-1, along with custom engine sensor configuration as described in Section 31.4.32 for GDU 4XX displays. Turbine engines are not supported by the GDU 37X display.

Table 22-11 Sensors for Turbine Engines

Sensor Type	Details/Part Number
N1 / N2 RPM	Two separate turbine engine RPM gauges can be displayed. Select "Custom" configuration for GEA 24 RPM1 / RPM2 inputs and enter frequency-to-RPM calibration. A Sandia ST26 tachometer signal converter is typically required to provide proper digital signal conditioning.
Torque	Use Garmin GPT 150G (011-05783-30) for pressures under 150 PSI and enter pressure-to-torque calibration, or select "Custom" and enter voltage-to-torque calibration
Oil pressure	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Oil temperature	Use any supported sensor from Table 22-1
Turbine inlet or outlet temperature	Use Type K thermocouple
Fuel pressure	Use supported Garmin or UMA pressure sensor, or select "Custom" configuration and enter voltage-to-pressure calibration
Fuel flow	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter pulses-per-gallon calibration
Hydraulic pressure (or other pressure)	Use any supported sensor from Table 22-1, or select "Custom" configuration and enter voltage-to-pressure calibration
Other parameters	Use any supported sensor from Table 22-1

22.2.8 Twin-Engine Applications

A GDU 4XX system using two GEA 24 units can monitor data from two engines with up to 6 cylinders each. Engine #1 is connected to GEA 24 #1, and engine #2 is connected to GEA 24 #2. Data from both engines is presented on the same GDU display. Due to its larger display size, the GDU 46X is preferred over the GDU 45X or GDU 47X for twin-engine applications.

The two GEA 24s in a twin-engine installation use the same input configuration for analog and digital inputs, with a configuration choice to allow data for a particular input to be monitored from both GEA 24s, or from #1 only. The second GEA 24 may also be used to support additional discrete inputs. For information on configuring twin-engine sensor inputs, see Section 31.4.6 and Section 31.4.32.3.

22.2.9 Rotorcraft Applications

Rotorcraft engine monitoring can be accomplished with a GDU 4XX system, using the engine sensor application information in Section 22.2.1 through Section 22.2.7. Typically, the GEA 24 RPM 1 input is used to monitor rotor RPM.

Table 22-12 Sensors for Rotorcraft Applications

Sensor Type	Details
Rotor RPM	Select "Custom" configuration for GEA 24 RPM1 input and enter frequency-to-RPM calibration. A Sandia ST26 tachometer signal converter may be required to provide proper digital signal conditioning.
Engine RPM	Select appropriate configuration for GEA 24 RPM 2 input as described in Section 22.2.1 through Section 22.2.7.
Other engine sensors	Select appropriate sensors and configuration as described in Section 22.2.1 through Section 22.2.7.

A GDU 4XX system using two GEA 24 units can be used to monitor engine information for a twin-engine rotorcraft, as described in Section 22.2.8.

22.2.10 FADEC Engine Status

When used with a digital interface to a FADEC engine, FADEC status and maintenance information can be viewed in configuration mode or in normal mode from the Engine page Option Menu. To view FADEC status, access the configuration mode System Information page and highlight the FADEC item. The specific FADEC status data that is displayed (Figure 22-2) will vary based on the configured engine type.

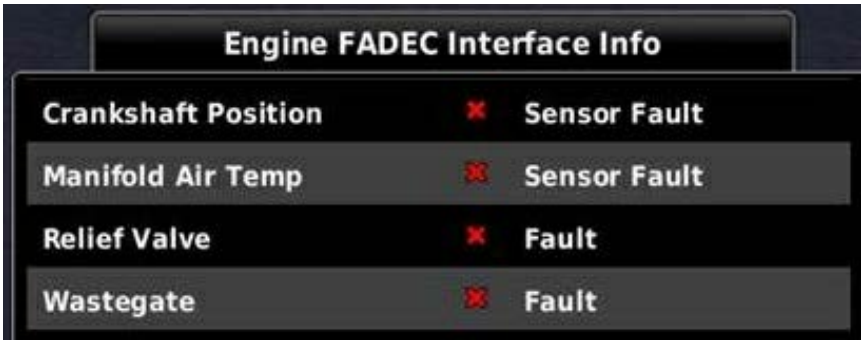


Figure 22-2 Configuration Mode FADEC Interface Status

In normal mode, caution and warning indications from the FADEC interface are displayed in the form of CAS messages. Refer to the G3X Touch™ Avionics Pilot's Guide (190-01754-00) for further information.

22.3 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.

Section 27, Section 28, Section 29, and Section 30 contain interface drawings for sensor installations using the Garmin sensor kits, and for other sensor installations.

22.3.1 CHT (Cylinder Head Temperature)

Both Type J and Type K grounded thermocouples are supported for cylinder head temperature (CHT) measurements. Type K thermocouples are more commonly used for CHT.

To maintain measurement accuracy, appropriate thermocouple extension wire must be used to connect the CHT probe sensor wires directly to the inputs of the GEA 24/GSU 73. To minimize risk of breakage, it is recommended that a high-quality stranded (as opposed to solid) thermocouple wire be used. For Type K thermocouples, one such example of appropriate wire is TT-K-22S Type K thermocouple wire from Omega Engineering.

Thermocouple extension wire lengths may vary between cylinders for installation convenience; there is no requirement to use the same length of thermocouple extension wire for each engine cylinder. However, for each individual thermocouple lead, the positive and negative wires should be the same length. When attaching thermocouple extension wire with splices or connectors, the connections for an individual pair of positive/negative wires should be located close together to make sure they are exposed to similar ambient temperatures.

NOTE

If ungrounded thermocouples are used, the low side must be connected to a GEA 24/ GSU 73 ground pin.

22.3.1.1 Lycoming/Continental CHT Sensor Installation

Garmin sensor kits for Lycoming and Continental engines include Alcor 86253 Type K thermocouple probes (Garmin P/N 494-70000-00). 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 make sure that no chafing of the wires occurs.

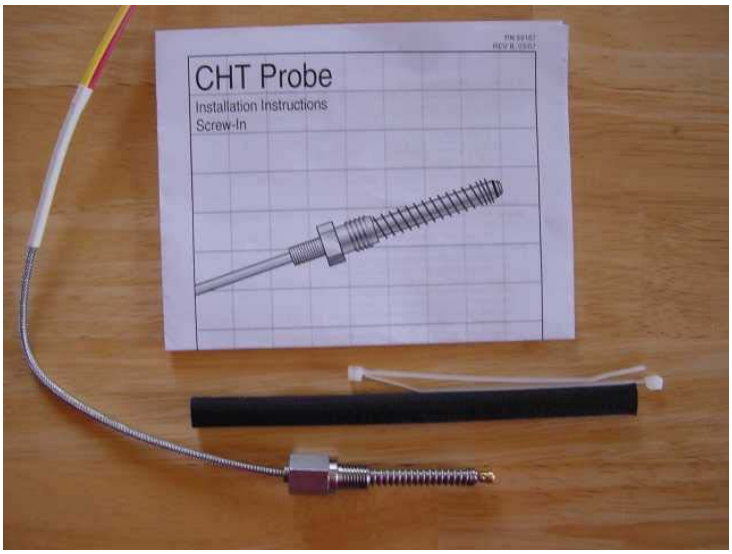


Figure 22-3 CHT Probe Package

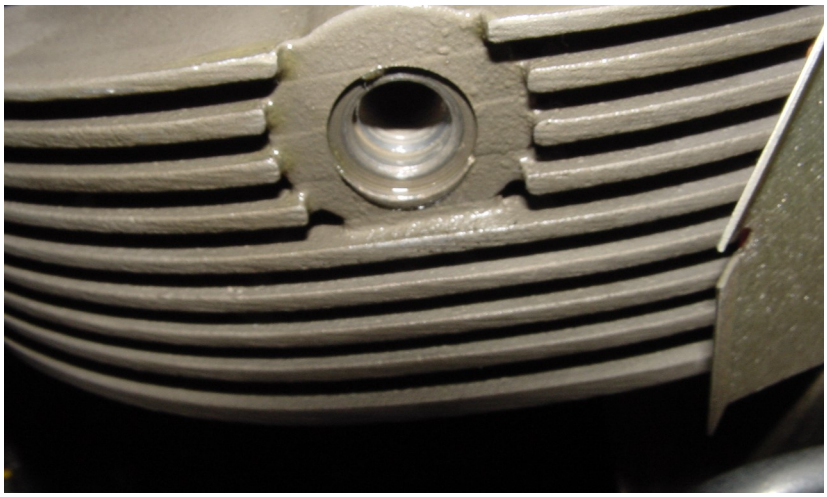


Figure 22-4 CHT Probe Well

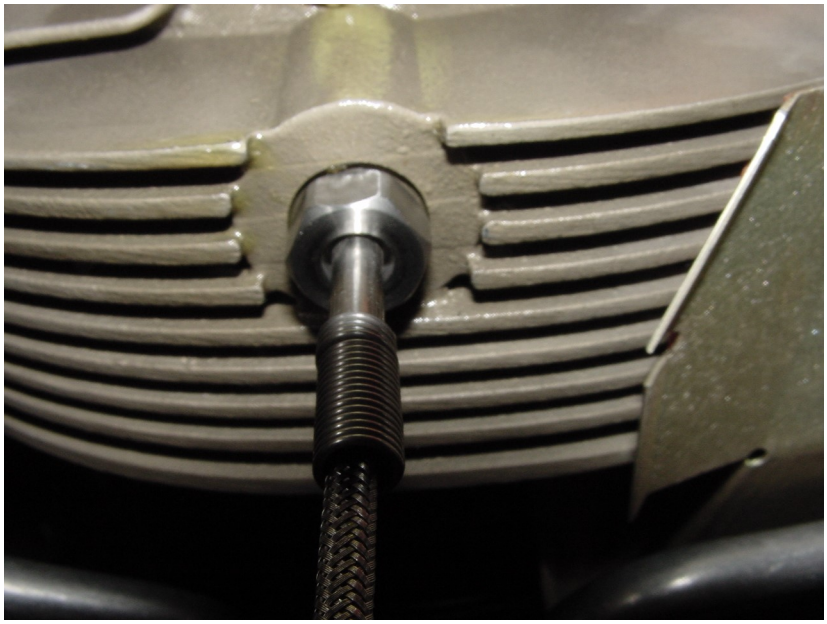


Figure 22-5 One Piece CHT Probe Installed

22.3.2 EGT (Exhaust Gas Temperature)

Type K grounded thermocouples are supported for exhaust gas temperature (EGT) measurements.

NOTE

If ungrounded thermocouples are used, the low side must be taken to a GEA 24/*GSU 73 ground pin.*

To maintain measurement accuracy, Type K thermocouple extension wire must be used to connect the EGT probe sensor wires directly to the inputs of the GEA 24/GSU 73. 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 TT-K-22S Type K thermocouple wire from Omega Engineering.

Thermocouple extension wire lengths may vary between cylinders for installation convenience; there is no requirement to use the same length of thermocouple extension wire for each engine cylinder. However, for each individual thermocouple lead, the positive and negative wires should be the same length. When attaching thermocouple extension wire with splices or connectors, the connections for an individual pair of positive/negative wires should be located close together to make sure they are exposed to similar ambient temperatures.

22.3.2.1 EGT Sensor Installation

General Installation Guidance – Garmin sensors kits include Alcor 86255 Type K thermocouple probes (Garmin P/N 494-70001-00). 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 22-6, Figure 22-7, and Figure 22-8 to install an EGT sensor.

1. EGT probes (Figure 22-6) should optimally be mounted a minimum 2 inches and a maximum of 4 inches from the cylinder exhaust port flange on a flat portion of the exhaust tube. For highly supercharged engines, the EGT probe should optimally be mounted a minimum 5 inches and a maximum of 7 inches from the cylinder exhaust port flange 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 the external portion of the probe does not interfere with any other parts of the engine or cowling (Figure 22-7). 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 make sure 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 make sure that no chafing of the wires occurs. See Figure 22-8 for an example of an installed EGT probe.

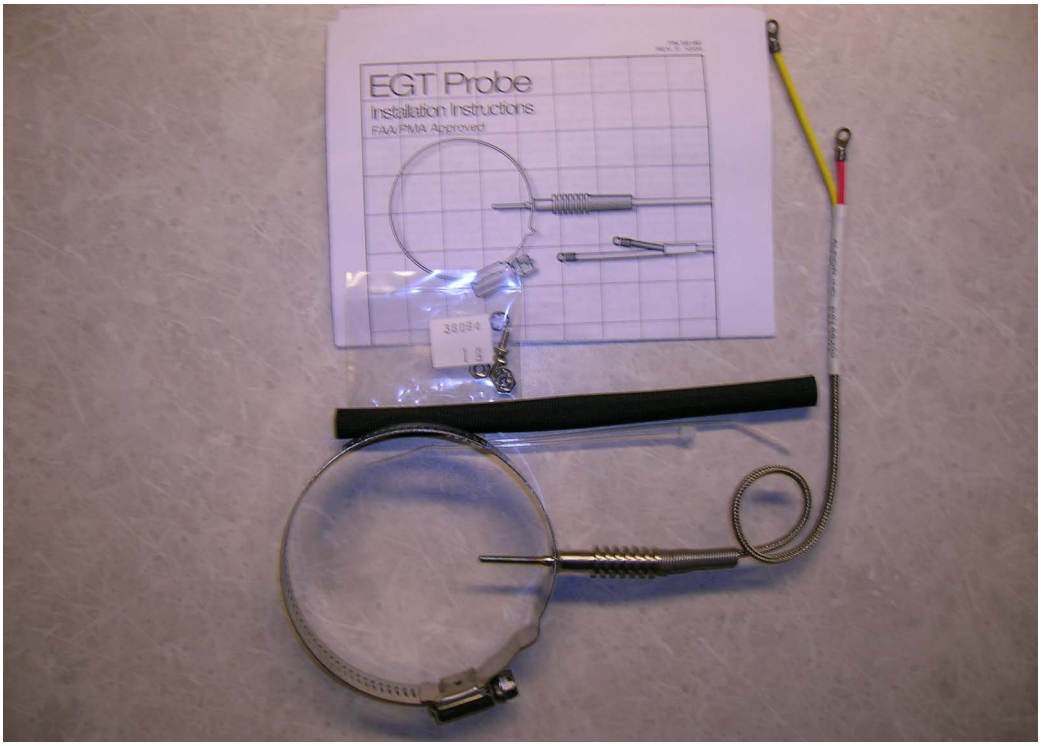


Figure 22-6 EGT Package

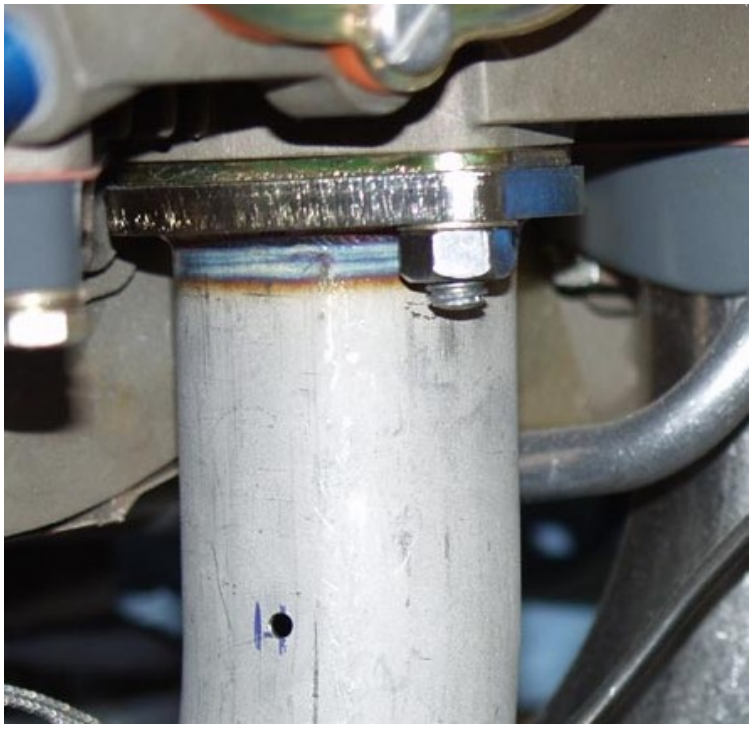


Figure 22-7 Exhaust Pipe Drilled

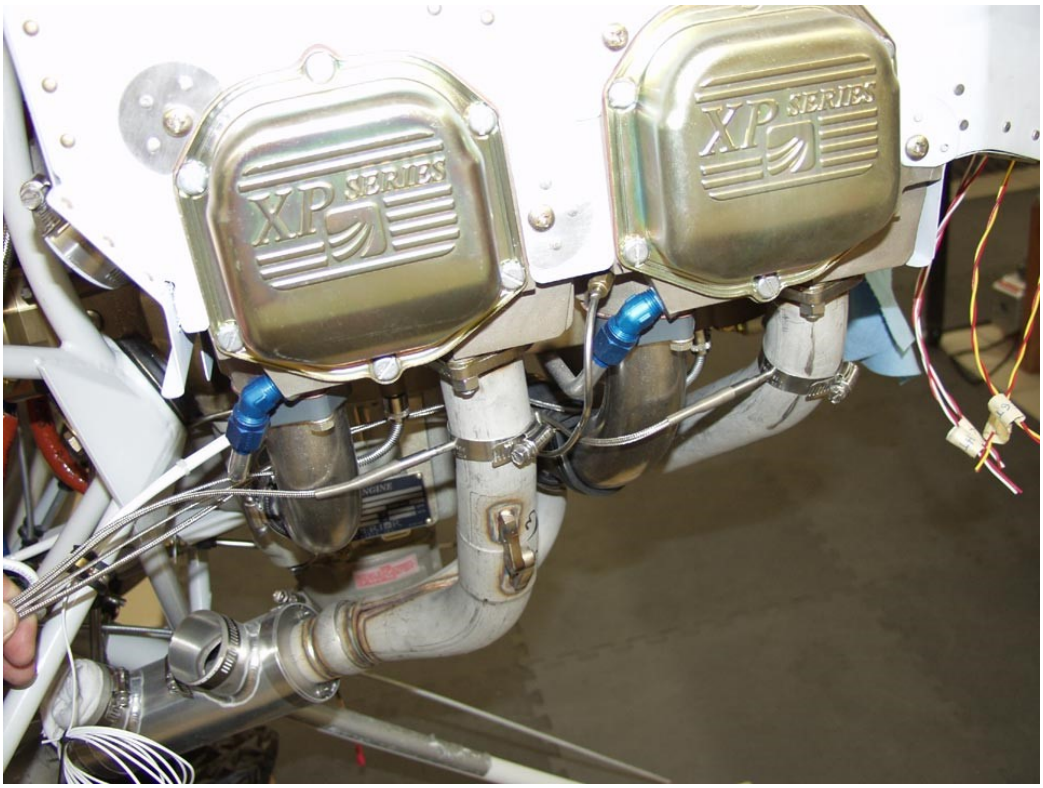


Figure 22-8 Installed EGT Probe Orientation

22.3.3 Oil Temperature

Oil temperature can be measured using the specific resistance temperature detector (RTD) and thermistor sensors listed in Table 22-1.

22.3.3.1 Lycoming/Continental Oil Temperature Sensor Installation

Garmin sensor kits for Lycoming and Continental engines include the UMA 1B3-2.5R platinum RTD probe (Garmin P/N 494-70004-00). This probe is designed for oil temperature probe wells with 5/8-18 threads.

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 plug, if installed.
2. To prevent galling of the threads, apply a small amount of engine oil to the probe threads.
3. Make sure that an unused copper crush gasket is present on the probe, and install the probe into the engine (split side of crush gasket towards engine).

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 as appropriate.
6. Connect the supplied connector to the appropriate inputs on the GEA 24/GSU 73 as referenced in the G3X interconnects in Section 28. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

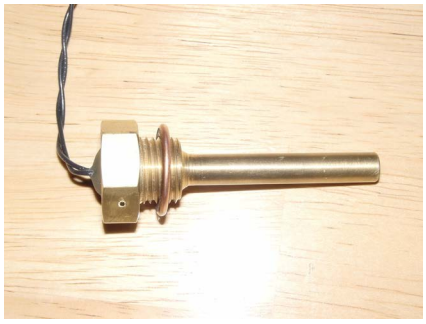


Figure 22-9 Oil Temperature Probe

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

Select the pressure sensor from Table 22-1 that is best suited for the aircraft system and installation location. Maximum system operating or surge pressures must not exceed the sensor's rated pressure.

General Mounting Methods – The specified pressure transducers provide for two different mounting options:

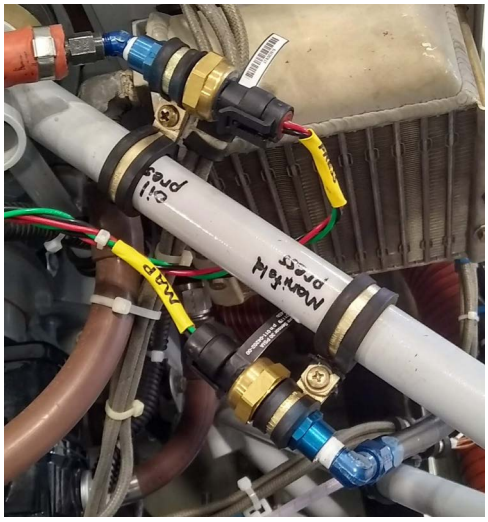


Figure 22-10 Pressure Transducer Mounting

a) Sensor body secured to the engine mount or firewall using 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).

WARNING

The sensor must not be mounted directly to the engine. Mechanical failure of the sensor could result in leaks and loss of pressure.

WARNING

Test all fuel, oil, and coolant pressure sensors for leakage following installation and before flight.

Installation Guidance:

1. Hoses and fittings - Fuel and oil hoses installed in the engine compartment should meet TSO-C53a Type C or D (fire resistant) and rated for the pressure, temperature, and be compatible with the fuel or oil. Sensor hoses must be routed as far away from the aircraft exhaust system as practical and no closer than 6 inches. Fittings should be AN/AS-spec or Mil-spec.
2. Sensors - Do not install sensors directly below fittings or components that may leak flammable fluid. To prevent water from settling in the fuel pressure sensor and causing freeze damage, install sensor with the electrical connector angling upward or with a hose/line with an upward bend that will trap heavier water before entering the sensor.

3. Routing - Line fittings, routing, alignment, bonding, and support spacing should be installed as defined in the aircraft maintenance manual or Section 8-31 of AC 43.13-1B, Aircraft Inspection and Repair
4. Mount the sensor using one of the two methods noted above.
5. Refer to the applicable engine manual to identify the appropriate connecting port on the engine for the parameter being sensed. 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. Thread sealant or tape should be used for the NPT threads. To reduce the risk of system contamination, a minimal amount of sealant or tape should be applied leaving at least two threads at the end of the fitting clear of all sealant/tape.

WARNING

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.

NOTE

A restrictor or snubber fitting (not available from Garmin) may be installed (between the hose and the sensor) to dampen manifold pressure fluctuations. One example is the PS-8G fitting from Omega Engineering.

6. Connect the supplied connector to the appropriate inputs of the GEA 24/GSU 73 as referenced in the Sensor Interface Drawings in Section 28 through Section 30. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

NOTE

Kavlico P4055 pressure sensors use Packard Metri-Pack 150 connectors.

7. To avoid fuel pressure sensor damage or rupture, verify the aircraft fuel system nominal and surge pressures will not exceed the rated operating pressure of the sensor. Verify that pressure caused by thermal expansion of fuel in the pressure sensor line is not trapped by the fuel shut-off valve or other components.

22.3.5 RPM (Revolutions Per Minute)

22.3.5.1 Lycoming/Continental RPM Sensor Installation

The following two types of mechanical RPM sensors are supported:

UMA 1A3C-2, UMA 1A3C-4 - Standard mechanical tach drive sensors

The standard mechanical tach drive sensor is installed on the engine accessory case:

1. Remove the cap from the tachometer drive output (Figure 22-11) 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, verify the adapter tang on the sensor aligns with the slotted keyway in the drive port (Figure 22-12).
4. Connect the supplied connector to the appropriate inputs on the GEA 24/GSU 73 as referenced in the G3X interconnects in Section 31. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.

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)

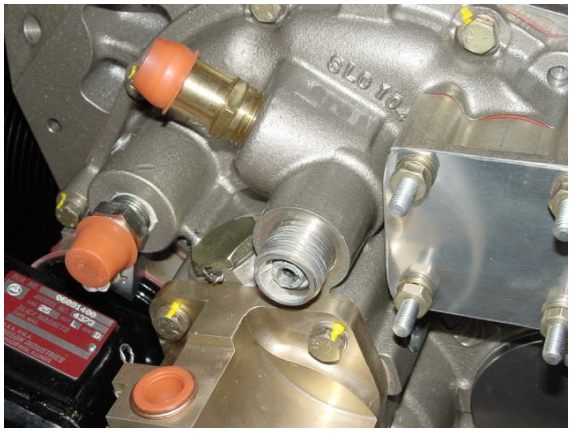


Figure 22-11 Tachometer Drive Output

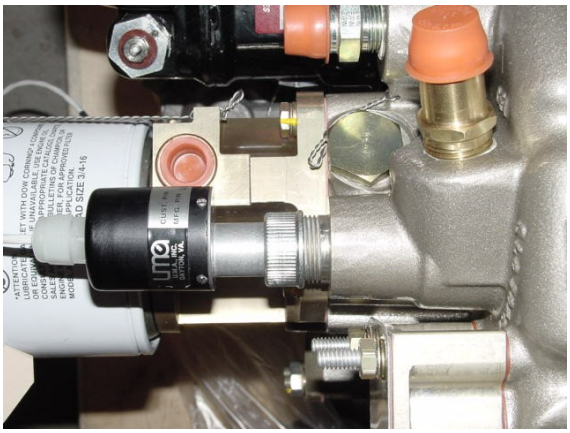


Figure 22-12 Installed Tachometer Sensor

UMA N/T1A9-X, JPI 4208XX - Magnetic pickup tach sensors:

The magnetic pickup tach sensor is installed in the magneto bleed port. It is recommended 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 UMA N/T1A9-X sensors are suitable for non-pressurized magnetos only. JPI 4208XX RPM sensors are available in different versions for both pressurized and non-pressurized magnetos. Given the bleed port size on Slick and Bendix magnetos differ, the installer should verify the sensor part number is appropriate for the magneto type.

1. Remove the existing vent plug from the magneto bleed port (Figure 22-13).
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 make sure sealer is applied only to the threads and not the pickup face itself.
3. Install the sensor into the port (Figure 22-15). 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 Section 28. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.



Figure 22-13 Magneto Bleed Port

NOTE

There are two plugs on a Slick/Unison 43xx series magneto (Figure 22-14) 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.

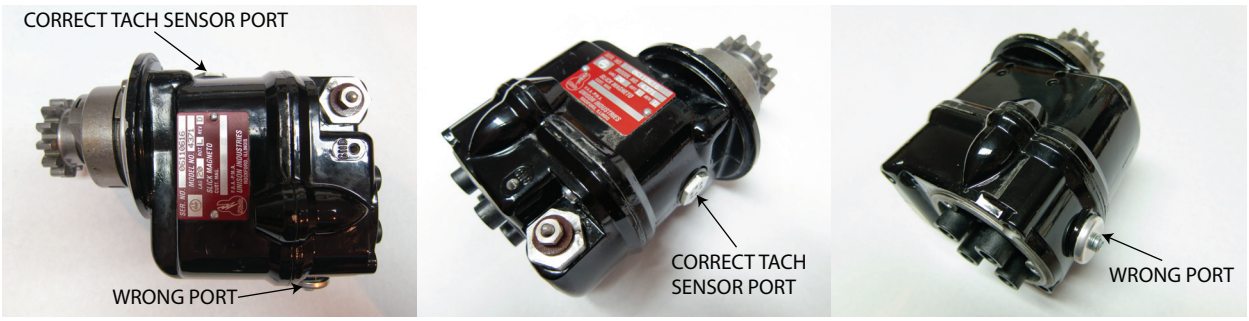


Figure 22-14 Plugs on Slick/Unison 43XX Magneto

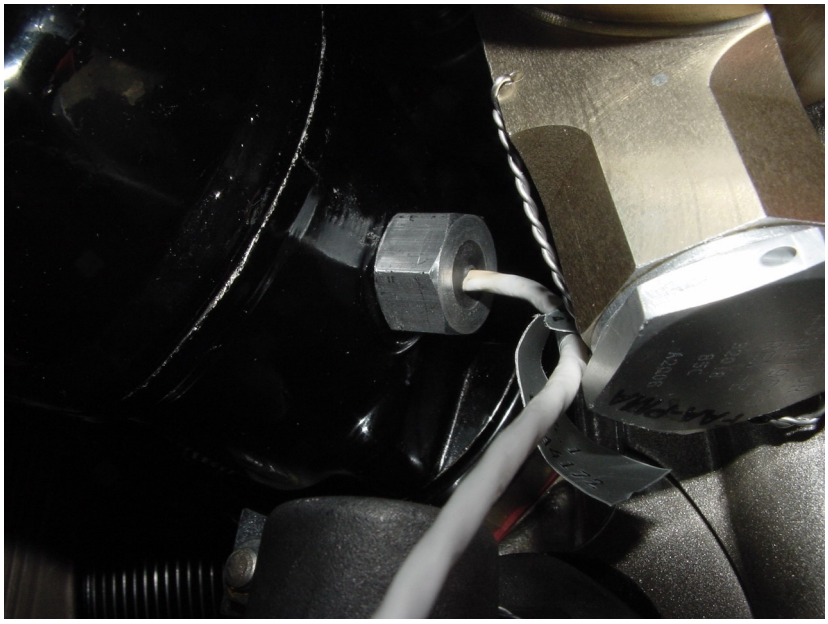


Figure 22-15 Magneto Tach Sensor Installed

22.3.5.2 Electronic Ignition RPM

For engines with electronic ignition, RPM can be sensed through a digital tach signal output from the electronic ignition system. The G3X system provides configurations for ignition systems that output 1 through 4 pulses per crankshaft revolution, or a custom RPM input configuration may be used to accommodate other types of electronic ignition.

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 28-2). The RPM 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.

22.3.5.3 P-Lead RPM Sensing

CAUTION

Only a MOD Level 2 GEA 24 or any GEA 24B can be connected to a P-Lead. Do not connect MOD Level 1 or MOD Level 0 units to a P-Lead. The MOD Level status can be determined by checking the serial tag on the unit. If a P-Lead is connected to a non-MOD Level 2 GEA, an "Engine Interface 1 configuration error" System Message will be generated, and configuration status will be reported to be in error in the system information menu.

For a direct connection, the GEA 24 measures the electrical signal generated by the primary magneto coils or "P-Leads" from both engine magnetos. The connections can be made to the magneto P-Lead stud or to the P-Lead wire at the ignition switch as shown in Figure 28-4. If the magneto does not have a ring terminal stud, connect the GEA 24 to the ignition switch. Otherwise, connect it to whichever minimizes the wire length to the GEA 24.

When making a connection directly to a P-Lead, a 400kΩ (±10%) resistor needs to be installed. To prevent errant shorts to ground in case of a broken or shorted wire, (as outlined in Figure 23-14) the wire length between the P-Lead connection and the resistor must not exceed six inches. Shielded wires must be used.

Use a resistor that is 400K ohm (±10%), 0.5W, rated to maintain resistance and power rating at 150°C, and qualified to MIL-R-10509.

Following the installation of the P-Lead signal wires, verify the continuity of each magneto P-Lead to airframe ground while the ignition key is OFF. If there is evidence of discontinuity in the magneto P-Lead grounding circuit, it must be corrected before further engine maintenance or checks. Continuity can only be measured if the magneto points are open or the wire is disconnected from the magneto. Use a magneto timing light to make sure the ohmmeter will not measure false continuity through the points or coil windings.

WARNING

Do not turn the propeller and stay clear of the propeller arc when installing the P-Lead signal wires.

22.3.5.4 Surefly TACH2 Module (P-Lead RPM Sensing)

The SureFly TACH2 module is used like a P-Lead input when a SureFly Ignition Module (SIM) is installed. The TACH2 outputs a 0-5V rpm signal to the GEA for a SureFly Ignition Module (SIM). The 0-5V output from a SureFly TACH2 can replace a magneto P-Lead input to measure RPM if a SureFly Ignition Module (SIM) is installed. This method does not require the resistor in-line with the signal.

22.3.6 Fuel Quantity

22.3.6.1 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 Section 27 through Section 30 for proper wiring considerations.

CAUTION

For composite and tube-and-fabric airframe installations that include a GEA 24 (010-01042-00), it is recommended to install 2 - 2.2 kΩ resistors as shown in Section 27, to improve the grounding path. This is optional for metal aircraft, either wiring method can be used. The additional components have no effect on GSU 73 fuel inputs. When in-line resistors are installed, use "Voltage" configuration setting, if in-line resistors are not installed, use "Resistive" configuration setting. It is not recommended to install these resistors in a GEA24B (010-02770-00) installation, although they are acceptable if already present.

NOTE

Refer to Section 33.2.5 for information regarding swapping GEA 24 and GEA 24B units.

22.3.6.2 Capacitive Type Fuel Quantity Sensors

Capacitive fuel quantity sensors require the use of an external transducer to convert capacitance to either a frequency or a voltage.

Fuel quantity transducers that convert capacitance to a voltage of up to 28V may be used, including 0-5V and 0-12V transducers. Examples of this type of transducer include the Skysports and Westach units. Voltage-output fuel quantity transducers may be connected to any of the four fuel quantity inputs on the GEA 24, or to any of the four analog fuel quantity inputs on the GSU 73 (FUEL 1/2/3/4).

Fuel quantity transducers that convert capacitance to a frequency of up to 50 kHz may be used. Examples of this type of transducer include the Princeton, Vision Microsystems, and EI P-300C units. The transducer's output waveform must meet the requirements of the GEA 24/GSU 73 digital inputs (see Section 24.5.8 for the GEA 24 and Appendix F.5.8 for the GSU 73). When using a GEA 24, frequency-output fuel quantity transducers may be connected to any of the four fuel quantity inputs (FUEL 1/2/3/4). When using a GSU 73, frequency-output fuel quantity transducers must be connected to the two digital fuel quantity inputs (CAP FUEL 1/2).

NOTE

Vision Microsystems capacitive level senders used with a GSU 73 may require installing a 5 kΩ pull-down resistor at the sensor output.

NOTE

The GEA 24 and GSU 73 can provide +5V or +12V excitation voltage to capacitive fuel quantity transducers. The power supply output pins on the GEA 24 and GSU 73 are designed for low-current transducers only. Transducers that require higher supply currents, including Princeton capacitive fuel quantity transducers, may require power be supplied from the aircraft electrical bus instead.

22.3.7 TIT (Turbine Inlet Temperature) Sensor

The G3X system supports Type K grounded thermocouples for sensing turbine inlet temperature (TIT), turbine outlet temperature (TOT), or inter-turbine temperature (ITT). This type of sensor is applicable to all turbocharged or turbine engines.

To maintain measurement accuracy, appropriate thermocouple extension wire must be used to connect the TIT probe sensor wires directly to the inputs of the GEA 24/GSU 73. To minimize risk of breakage, it is recommended that a high-quality stranded (as opposed to solid) thermocouple wire be used. For Type K thermocouples, one such example of appropriate wire is TT-K-22S Type K thermocouple wire from Omega Engineering. When attaching thermocouple extension wire with splices or connectors, the connections for an individual pair of positive/negative wires should be located close together to make sure they are exposed to similar ambient temperatures.

NOTE

If ungrounded thermocouples are used, the low side must be connected to a GEA 24/ GSU 73 ground pin.

22.3.8 Bus Voltage Monitor

Bus voltage is normally sensed from an external voltage signal connected to a GEA 24/GSU 73 analog input (refer to Section 27 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 Voltage portion of Appendix H.4.19.3.2 for GDU 37X systems and Section 31.4.32.14 for GDU 4XX systems (Volts 1 and Volts 2 Inputs) for configuration guidance.

22.3.9 Bus Current

Electrical current can be sensed by the G3X system either by Hall Effect current sensors or through the use of a traditional ammeter shunt.

22.3.9.1 Ammeter Shunt Installation

The UMA 1C4 ammeter shunt included in Garmin sensor kits (Garmin P/N 909-D0000-00) is a 100 Amp/ 50 mv shunt. Other ammeter shunts with different specifications can be supported using calibration adjustments. See Current portion of Appendix H.4.19.3.2 for GDU 37X systems and Section 31.4.32.15 for GDU 4XX systems (Volts 1 and Volts 2 Inputs) for configuration guidance.

General Installation Guidance – 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 through the use of #8 ring terminals.



Figure 22-16 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 1A 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 Section 27 through Section 30. 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.

22.3.9.2 Hall Effect Current Sensor

Hall Effect current sensors can be used to sense electrical current through induced magnetic fields, without direct connection to high-current conductors.

The default Hall Effect current sensor supported by the G3X system is the AMPLOC KEY100. This sensor outputs 2.273V at zero amps, with a sensitivity of 15.9 mV/Amp up to +/- 100A. Other Hall Effect sensors with different specifications can be supported using calibration adjustments. See Current portion of Appendix H.4.19.3.2 for GDU 37X systems and Section 31.4.32.15 for GDU 4XX systems for configuration guidance.

22.3.10 Fuel Flow

Fuel flow in the G3X system is sensed using a mechanical transducer which converts the movement of fuel to a series of digital pulses.

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 30-2.1). The value displayed on the fuel flow gauge will be the difference between the main (supply) fuel flow and secondary (return) fuel flow measurements.

22.3.10.1 K-Factor Adjustment

The number of electrical pulses sensed per gallon of fuel flow is referred to as the K-Factor. The G3X system uses the configured K-Factor to convert pulse frequency to fuel flow. 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.

Although each fuel flow sensor has a default K-Factor value, 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 for accurate fuel flow measurement.

If the fuel usage reported by the G3X system 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]

Refer to the K-Factor portion of Appendix H.4.19.4 for (GDU 37X) or Section 31.4.32.13 (for GDU 4XX) for information on entering K-Factor calibration.

22.3.10.2 Electronics International Fuel Flow Sensor Installation

Garmin sensor kits include the Electronics International FT-60 “red cube” fuel flow sensor (Garmin P/N 494-10001-00). Refer to Electronics International document # 1030032 for FT-60 installation guidance.

The default K-Factor for the FT-60 is 68,000 pulses/gallon. No sensor specific calibration is required for the FT-60, but variations in the installation can affect the K-Factor as described above.

Other Electronics International FT-series fuel flow sensors are also supported; consult the manufacturer for installation guidance.

22.3.10.3 Floscan Fuel Flow Sensor Installation

The information 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 make sure 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 before 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 Section 27 through Section 30.

The Floscan 201B-6 (201-030-000) fuel flow sensor K-Factor value can range from 28,000 to 31,000 pulses/gallon.

The G3X default K-Factor for the 201B-6 is 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 22-17).

NOTE

If the Floscan tag shown in Figure 22-17 is lost, the serial number of the Floscan sensor can be supplied to Floscan to obtain the calibrated K-factor value.

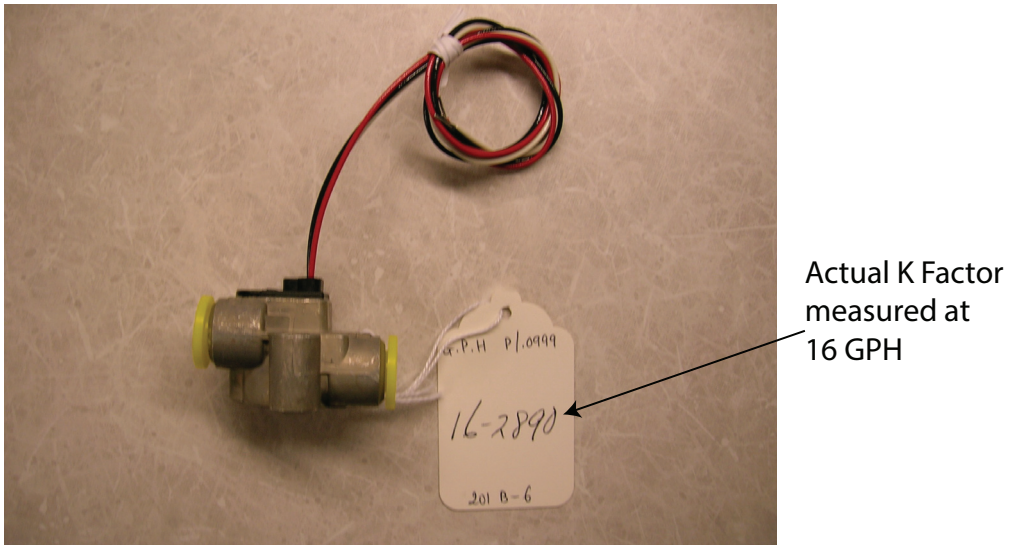


Figure 22-17 Example Floscan Fuel Flow Sensor

The tag shown in Figure 22-17 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 34.4.19.4 (for GDU 37X) and Section 31.4.32.13 (for GDU 4XX). To find 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.

22.3.11 Carburetor Temperature Sensor

22.3.11.1 Lycoming and Continental Engine Sensor Installation

The UMA 1B10R platinum resistance temperature detector (RTD) is applicable to all carbureted Lycoming and Continental engines that accept a temperature probe with ¼-28 threads.

General Installation Guidance:

1. Locate and remove the threaded ¼-28 brass plug (Figure 22-18 and Figure 22-19) on the side of the carburetor as shown in Figure 22-18. 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 22-20).
3. Connect the supplied connector to the appropriate inputs of the GEA 24/GSU 73 as referenced in the G3X interconnects in Section 28 and Section 29. Secure the connector and wire assembly to an appropriate location in the engine compartment to provide strain relief.



Figure 22-18 Carb Temp Sensor Mounting Location



Figure 22-19 Carb Temp Sensor Mounting Location w/Screw Removed

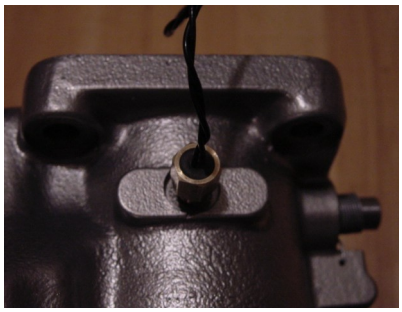


Figure 22-20 Carb Temp Sensor Installed

22.3.12 Position Sensor

In general, most potentiometer-type resistive position sensors can be used with the G3X system. Typically these sensors take the form of a 0–5kΩ or 0–10kΩ variable resistor. Electric trim motors with integrated position potentiometers do not require separate position sensors.

Each position sensor installation will vary widely according to the aircraft, motion being sensed, and mechanical installation. A standalone position sensor should ideally be mounted so the full travel of the sensor is just slightly greater than the full travel of the control surface.

Refer to the appropriate trim motor or position sensor installation manual and G3X interconnects in Section 30 for proper wiring connections. Section 34.4.19.3.2 (for GDU 37X systems) and Section 35.4.27.1 (for GDU 4XX systems) provides calibration instructions.

23 CONNECTOR INSTALLATION INSTRUCTIONS

NOTE

Make sure that backshell connectors are fully tightened. Loose connectors may cause vibration-related performance issues that are difficult to troubleshoot.

23.1 Cable Connector Installation

Coaxial cables are required for antenna connections for GPS, XM, transponder, comm, VHF Nav, ADS-B, and video 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 connector per the connector manufacturer's instructions for cable preparation.

23.2 Jackscrew Backshell Assembly

23.2.1 Shield Block Installation Parts

Table 23-1 and Table 23-2 list the parts needed to install a Shield Block, the item numbers in these tables correspond to Figure 23-1. Parts listed in Table 23-1 are supplied in the LRU Connector Kits (see Table 1-4). Parts listed in Table 23-2 are to be provided by the installer.

Table 23-1 Parts supplied for a Shield Block Installation (Figure 23-1)

Item #	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 23-2 Parts not supplied for a Shield Block Installation (Figure 23-1)

Item #	Description	GPN or MIL spec
2	Multiple Conductor Shielded Cable (2-conductor shown in Figure 23-1)	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

Table 23-2 Parts not supplied for a Shield Block Installation (Figure 23-1)

Item #	Description	GPN or MIL spec
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 23-1, "AR" denotes quantity "As Required" for the particular installation.

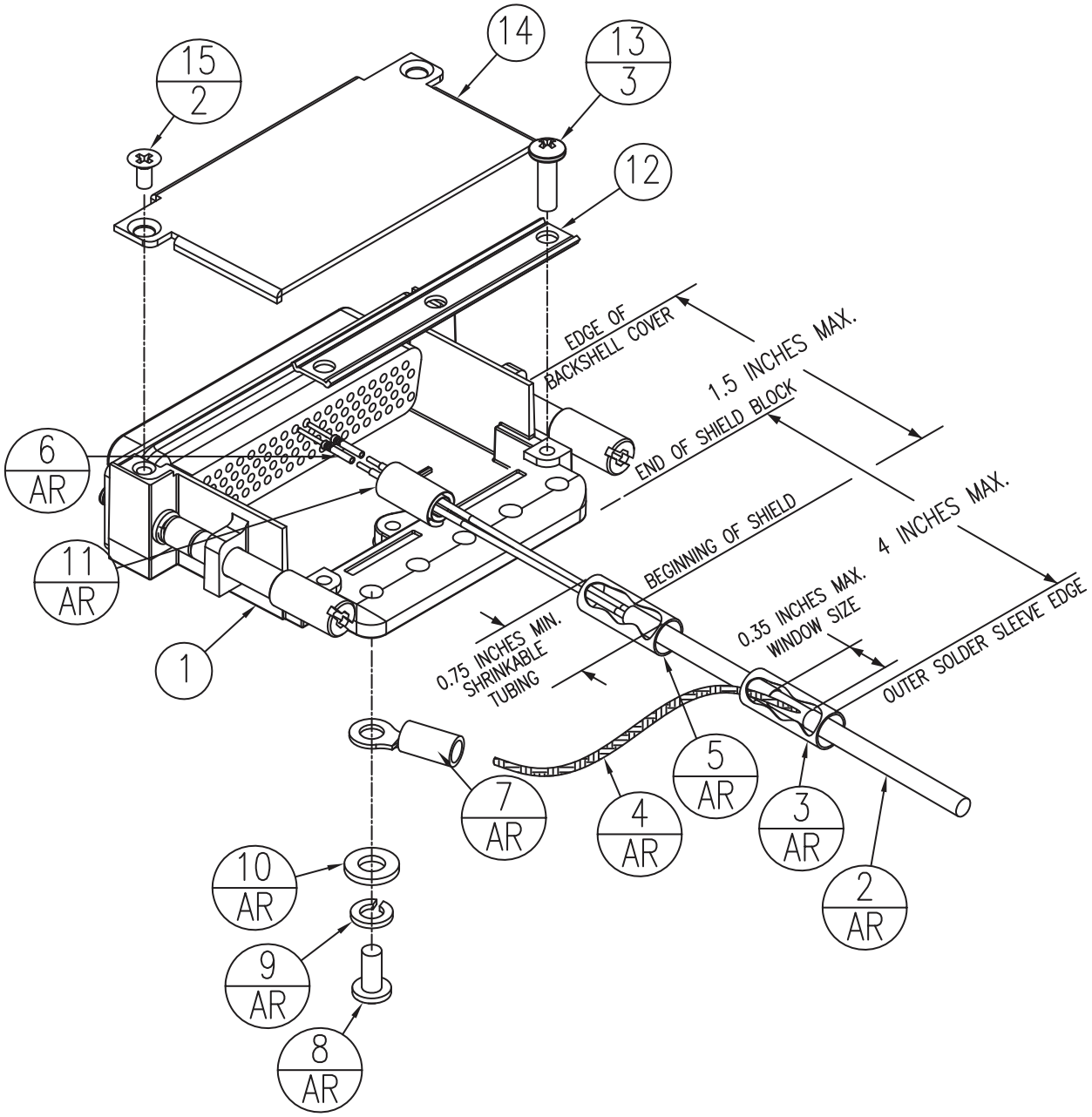


Figure 23-1 Shield Install onto a Jackscrew Backshell (78 pin example)

23.2.2 Backshell Assembly (refer to Figure 23-1)

1. Insert the crimped wire harness contacts (6) into the D-sub connector.
2. Wrap the cable bundle with silicone fusion tape (11) where the strain relief clamps the bundle.
3. Place the smooth side of the backshell strain relief clamp (12) across the cable bundle.
4. Secure strain relief with three 4-40 x 0.375 pan head screws (13).
5. Attach the cover (14) to the backshell using the supplied screws (15).

6. Install a ring terminal onto the cable shield drains, grouping wires as appropriate for the connector. See following note.
7. Place the following items on the 8-32 x 0.312 pan head shield terminal screw (8) in the order they are presented.
   a) Split washer (9)
   b) Flat washer (10)
   c) First ring terminal (7)
   d) Second ring terminal (if necessary)
8. Insert the pan head shield terminal screw (8) into a tapped hole on the shield block.

NOTE

Each tapped hole on the shield block may accommodate up to two ring terminals. It is preferred that only two wires be terminated per ring terminal. This necessitates the use of a #8 ring terminal, insulated, 14-16 AWG (MS25036-153). If only a single wire is left or if only a single wire is needed for this connector, a #8 ring terminal, insulated, 18-22 AWG (MS25036-149) can be used. If more wires exist for the connector than two per ring terminal, it is permissible to terminate a maximum of three wires per ring terminal.

9. Secure connector to mating connector on avionics device using the knurled thumb screws. The end of each thumb screw accepts a 3/32” hex wrench (Figure 23-9) to aid in securing the connector.

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

NOTE

For the following steps please refer to Figure 23-1 and Figure 23-2.

1. The appropriate number of Jackscrew Backshells will be included in the particular LRU connector kit.

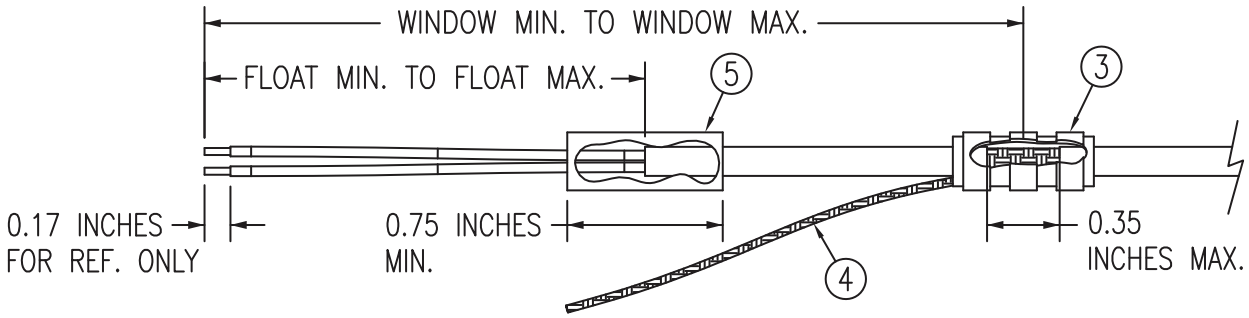


Figure 23-2 Method A.1 for Shield Termination

Table 23-3 Shielded Cable Preparations for Garmin Connectors

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

2. At one end of a shielded cable (item 2, Figure 23-1) measure a distance between “Window Min” to “Window Max” (Table 23-3) and cut a window (max size 0.35”) in the jacket to expose the shield (item 4, Figure 23-2). Use caution when cutting the jacket to avoid damaging the individual braids of the shield. When dealing with a densely populated connector with many cables, it may prove beneficial to stagger the windows throughout the “Window Min” to “Window Max” range. If staggering is not needed the “Ideal Window” length is recommended.

Suggested tools to accomplish the window cut:

- Coaxial Cable Stripper
- Thermal Stripper
- Sharp Razor Blade

3. Connect a Flat Braid (item 4, Figure 23-2) to the shield exposed through the window of the prepared cable assembly (item 2, Figure 23-1) 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 23-2). Make this connection using an approved shield termination technique.

NOTE

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

Preferred Method:

Slide a solder sleeve (item 3, Figure 23-1) onto the prepared cable assembly (item 2, Figure 23-1) and connect the Flat Braid (item 4, Figure 23-2) 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, Figure 23-2) 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, Figure 23-2. 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, Figure 23-2) to the shield exposed through the window of the prepared cable assembly (item 2, Figure 23-1). Create 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, Figure 23-2) 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, Figure 23-2) 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, Figure 23-1) and ahead of the previous shield termination, strip back “Float Min” to “Float Max” (Table 23-3) length of jacket and shield to expose the insulated center conductors (Figure 23-2). The “Ideal Float” length may be best to build optimally.

   Preferred Method:

   The jacket and shield should be cut off at the same point so no shield is exposed. Slide 0.75 inches minimum of Teflon heat shrinkable tubing (item 5, Figure 23-2) 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, Figure 23-2) 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, Figure 23-3) and crimp a contact (item 6, Figure 23-3) to each conductor. It is the responsibility of the installer to find 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 23-3.

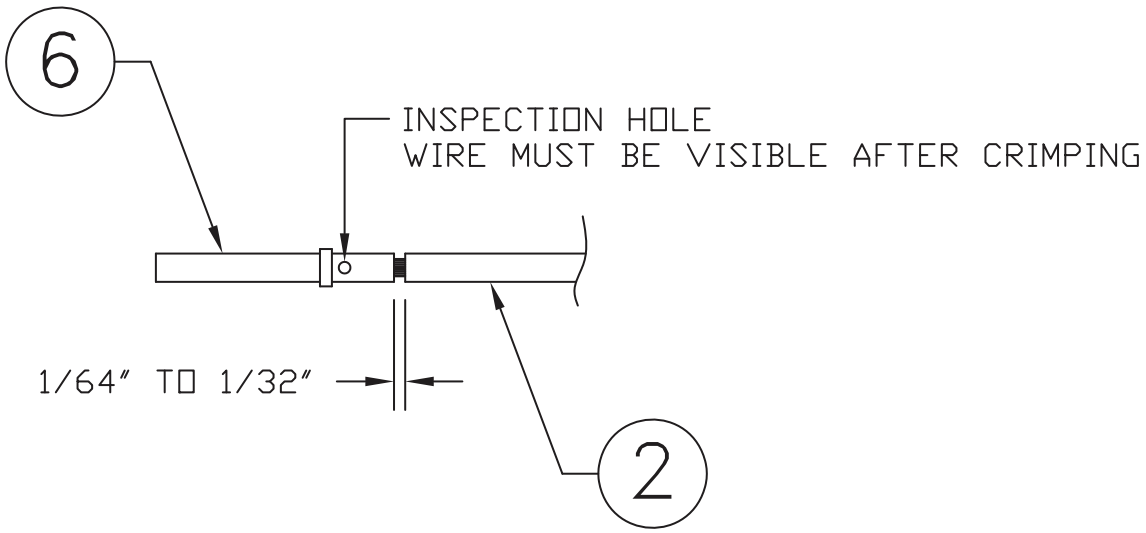


Figure 23-3 Insulation/Contact Clearance

NOTE

For the item numbers in the following steps 6-13 please refer to Figure 23-1..

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). 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).

23.2.4 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 23-4). 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.

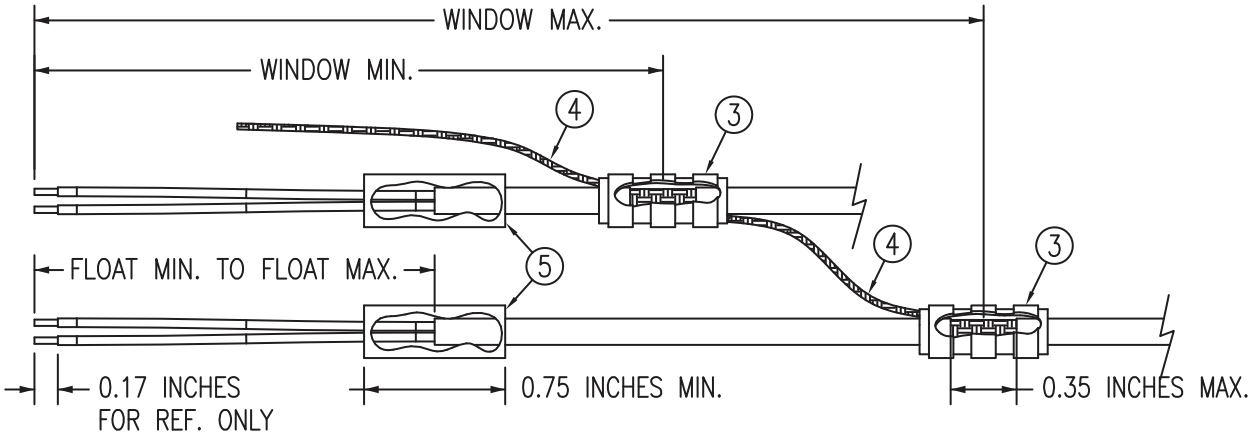


Figure 23-4 Method A.2 (Daisy Chain) for Shield Termination

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

If desired, the drain wire termination (item 3, Figure 23-4) and the floating shield termination (item 5, Figure 23-4) 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 23-5.

NOTE

The original purpose for separating the shield drain termination (item 3, Figure 23-4) from the float termination (item 5, Figure 23-4) in Method A was to allow for a variety of lengths for the drain wires so the shield drain terminations (item 3, Figure 23-4) 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 make sure 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, Figure 23-4) a larger area to be dispersed across.

Using this method, the instructions from Section 23.2.3 (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, Figure 23-1), strip "Quick Term Min" to "Quick Term Max" (Table 23-4) 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, Figure 23-1) 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 23-5). 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, Figure 23-1) onto the prepared cable assembly (item 2, Figure 23-1) and connect the Flat Braid (item 4, Figure 23-1) 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, Figure 23-1) to be attached.

NOTE

Reference Section 23.2.3 for recommended solder sleeves and flat braid. The same recommendations are applicable to this technique.

Secondary Method:

Solder a Flat Braid (item 4, Figure 23-5) to the folded back shield on the prepared cable assembly (item 2, Figure 23-1). Create 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, Figure 23-5) onto the prepared wire assembly and shrink using a heat gun. The chosen size of heat shrinkage tubing must accommodate both the number of conductors present in the cable as well as the Flat Braid (item 4, Figure 23-5) to be attached.

Teflon Heat Shrinkable Tubing:

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

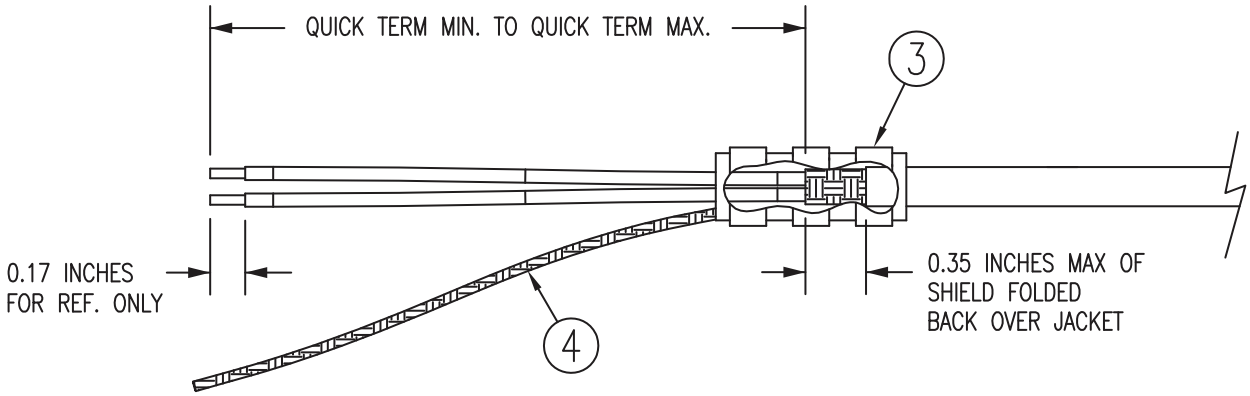


Figure 23-5 Method B.1 (Quick Term) for Shield Termination

Table 23-4 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

23.2.6 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 23-6). 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.

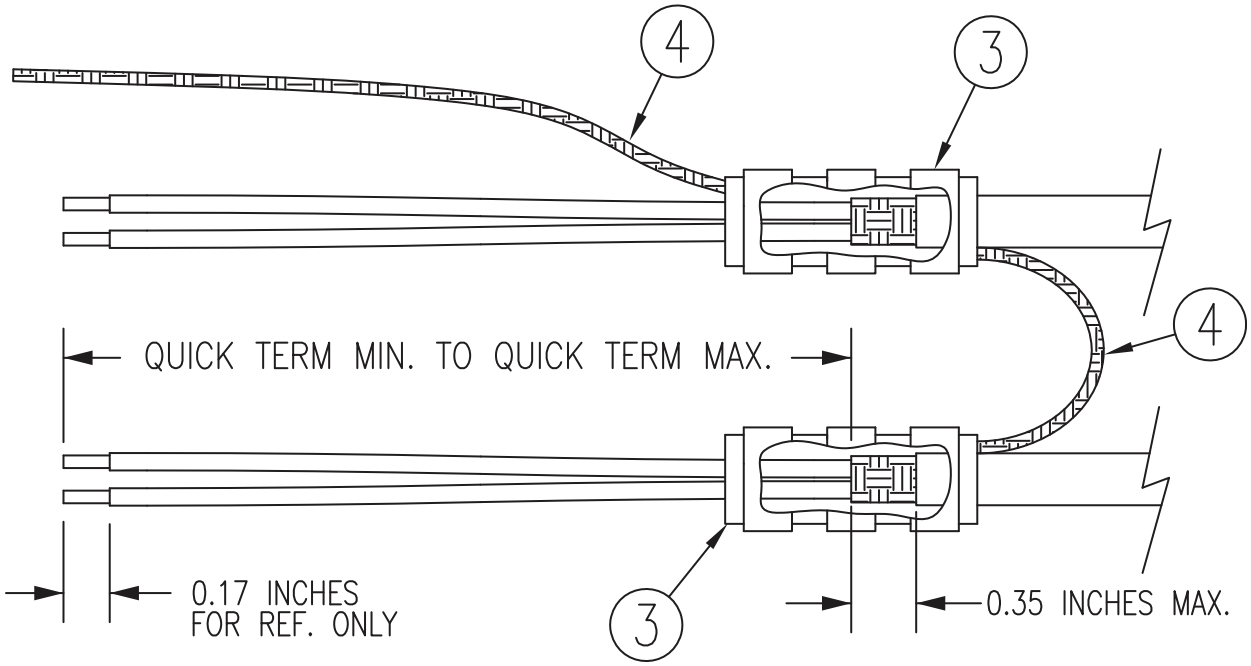


Figure 23-6 Method B.2 (Daisy Chain-Quick Term) for Shield Termination

23.2.7 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 23-7). 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.

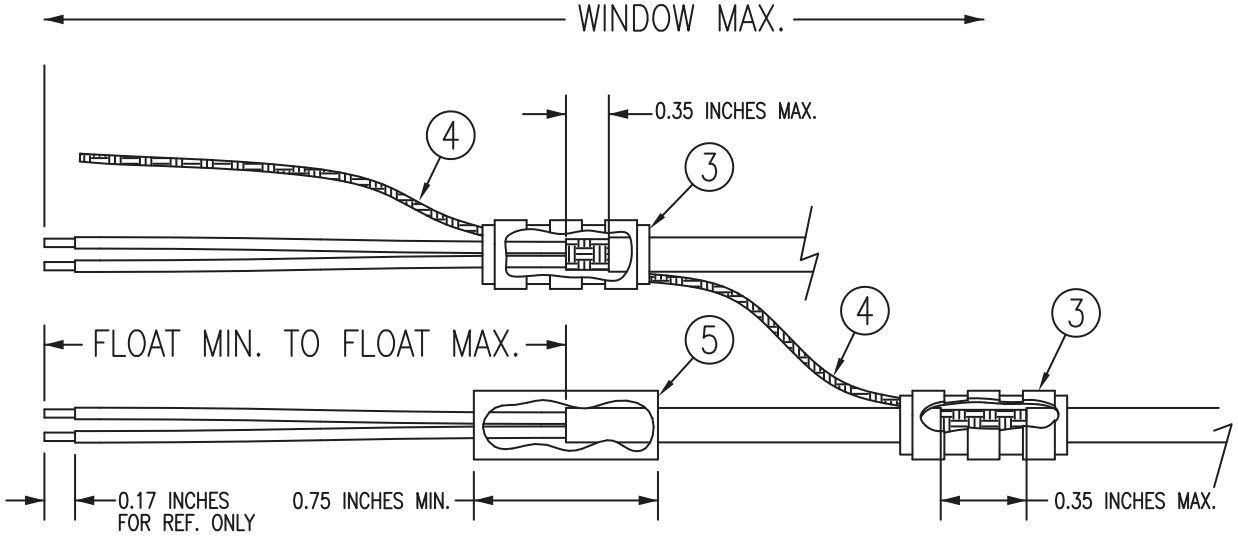


Figure 23-7 Daisy Chain between Methods A and B

23.2.8 ID Program Pins (Strapping)

ID Program Pins provide a ground reference used by the hardware as a means of configuration for system identification. The following instructions will illustrate how this ground strapping should be accomplished with the 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, Figure 23-3) to the 4" length of 22 AWG insulated wire. It is the responsibility of the installer to find 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 23-3.
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 using the ring terminals with the other Flat Braid per Steps 8 through 11 (Section 23.2.3) pertaining to shield termination. If this ground strap is the only wire to terminate, attach a Ring terminal, #8, insulated, 18-22 AWG (MS25036-149).

23.2.9 Splicing Signal Wires

NOTE

Figure 23-8 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 23-8 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.

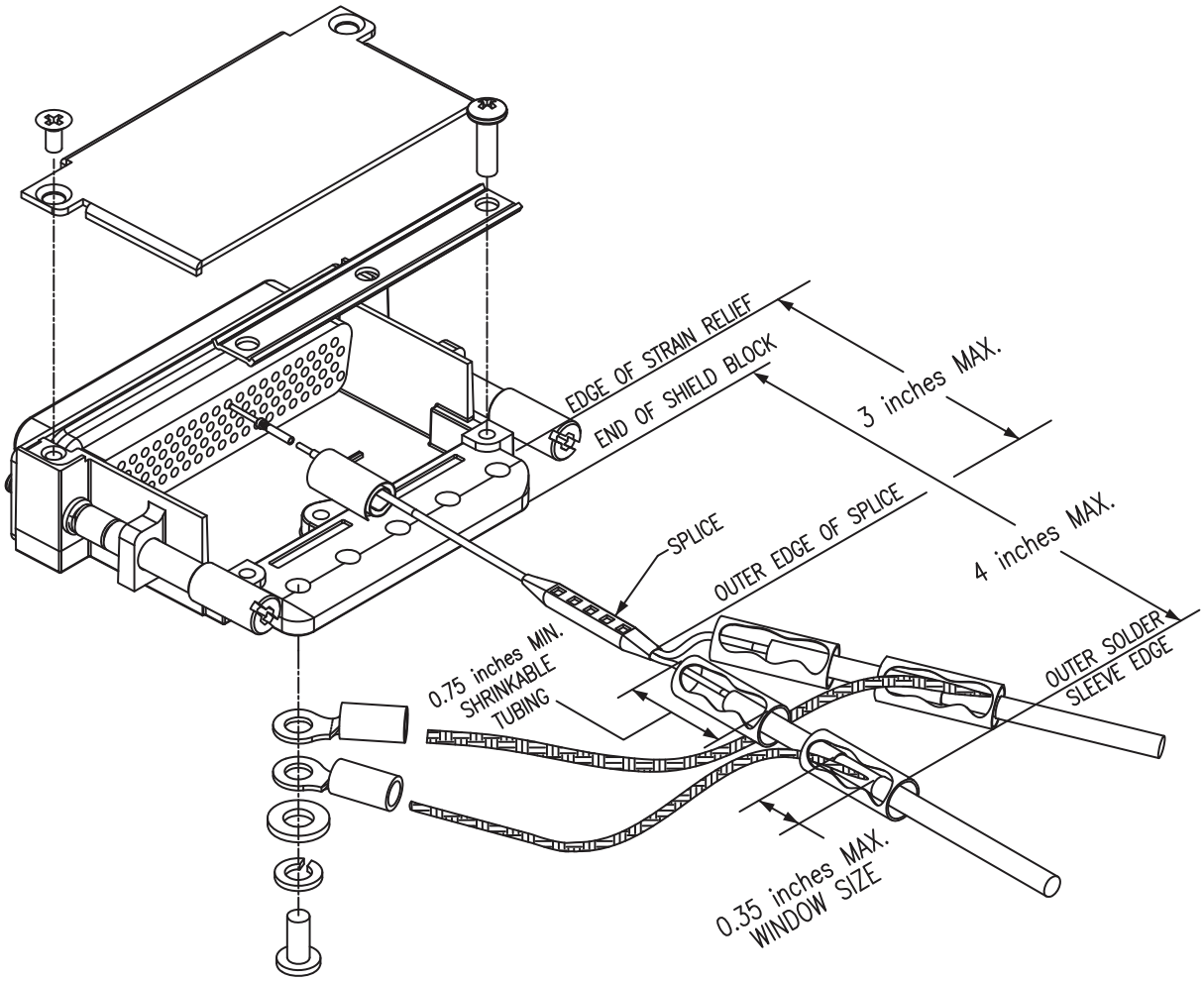


Figure 23-8 D-Sub Spliced Signal Wire illustration

23.3 Jackscrew Connector Installation

The D-sub connectors in a G3X™ avionics/G3X™ Touch avionics system use metal backshells with a convenient shield block for grounding the cable shields, and knurled jackscrews to attach the connector to the mating connector on the avionics module. The jackscrews should be tightened to 6-8 in. lbs. with a small slotted screwdriver, or a 3/32" hex tool (preferred, Figure 23-9).

NOTE

It is important to make sure that connectors are fully tightened. Loose connectors may cause vibration-related performance issues that are difficult to troubleshoot.

The connector jackscrews are also pre-drilled to accept safety wire where additional security is desired. It is generally not a requirement to safety wire these connectors, especially when tightened with a hex tool. Do not tighten more than 8 in. lbs. to prevent damage to the mating hardware.

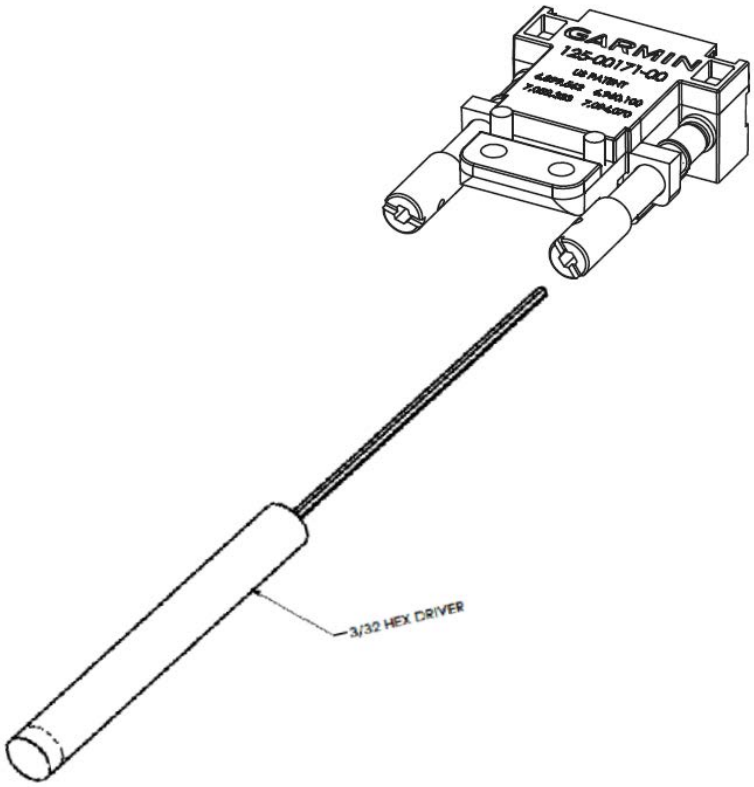


Figure 23-9 Jackscrew Hex Driver

23.4 Thermocouple Installation into a Backshell

Table 23-5 lists parts needed to install a Thermocouple, the item numbers correspond to Figure 23-10 and Figure 23-11. Parts for this installation are included in the Thermocouple Kit (011-00981-00), which is included in the G3X w/GSU 73 Installation Kit (K10-00017-00).

Table 23-5 Thermocouple Kit GPN 011-00981-00

Item #	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

1. Strip back approximately 0.17 inches of insulation from both the positive and negative thermocouple leads (item 1, Figure 23-10) and crimp a pin (item 2, Figure 23-10) to each lead. It is the responsibility of the installer to find 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 23-10.

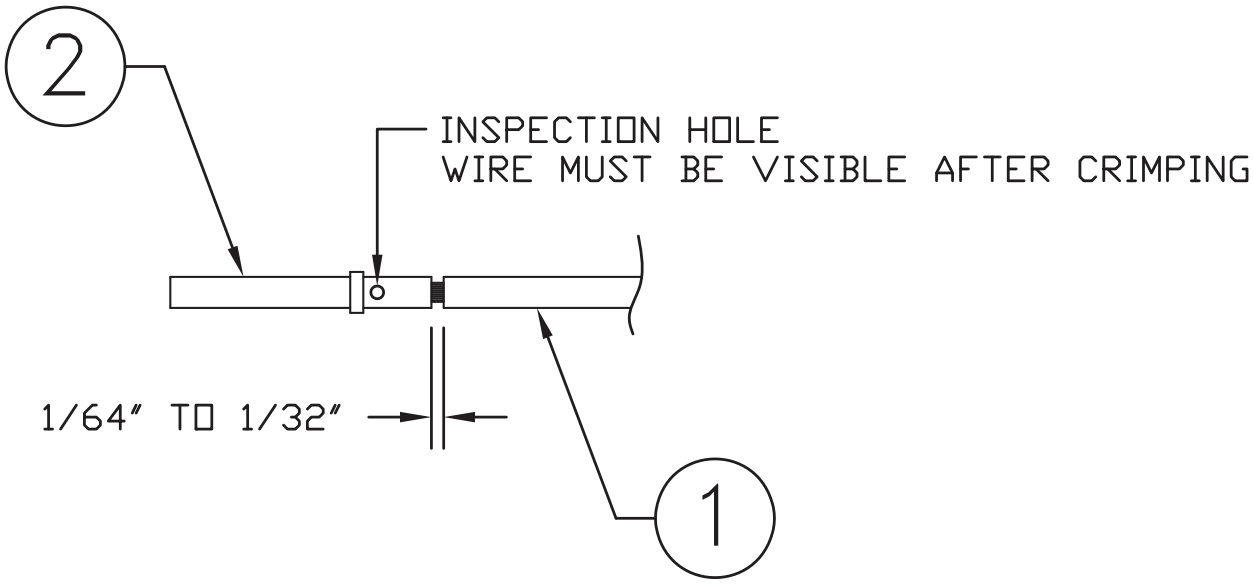


Figure 23-10 Insulation/Contact Clearance

NOTE

Refer to Figure 23-11 for all item numbers in the following steps 2-5.

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 so 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).

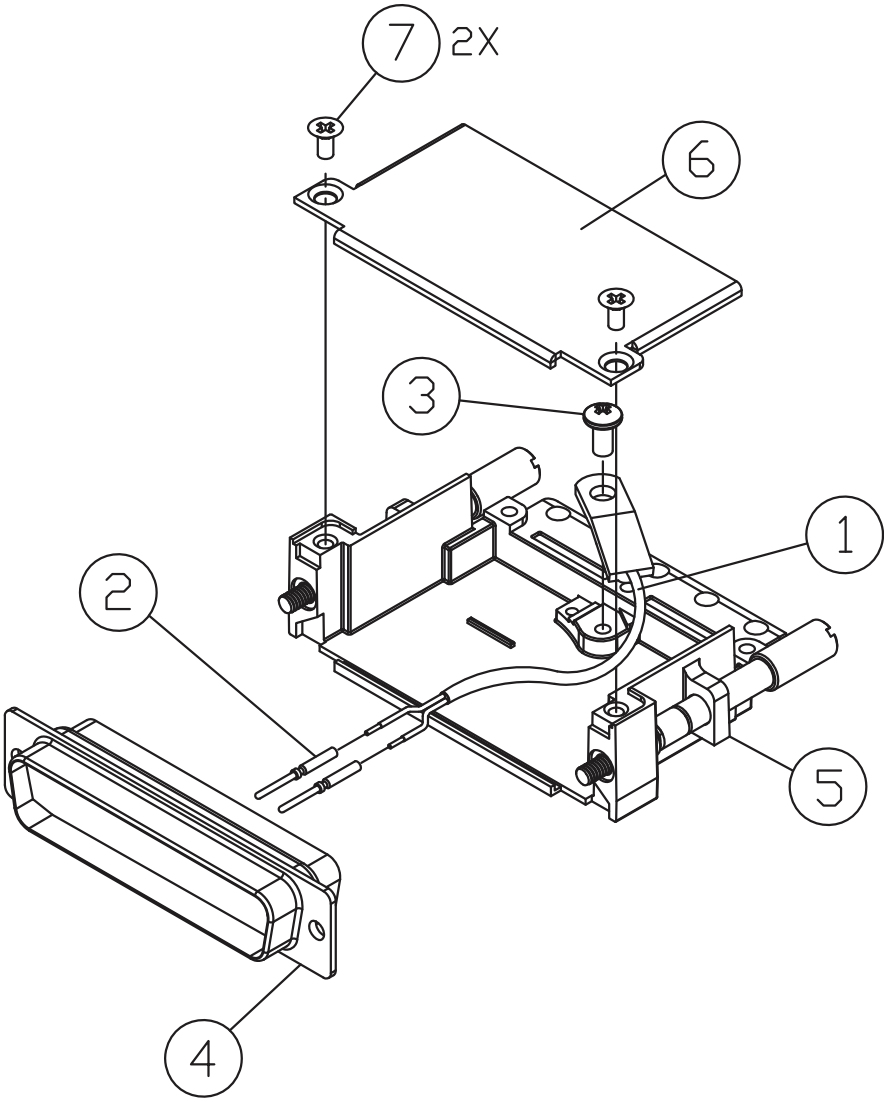


Figure 23-11 Jackscrew Backshell Thermocouple Installation

23.5 Configuration Module Installation into a Backshell

Table 23-6 & Table 23-7 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 in Table 23-6), the P3701 connector for GDU™ 37X display designated as PFD1 (use 011-00979-22 in Table 23-7), or the P4X02 connector for the GDU 4XX designated as PFD1 (use 010-12253-00 in Table 23-8)

Item numbers in Table 23-6, Table 23-7, and Table 23-8 correspond to Figure 23-12 and Figure 23-13.

Table 23-6 GPN: 011-00979-20 – Kit (w/EEPROM and pins)

Item #	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 23-7 GPN: 011-00979-22 – Kit (w/EEPROM and sockets)

Item #	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

Table 23-8 GPN: 010-12253-00 – Config Module (w/EEPROM, Temp, & Connext® computer application)

Item #	Description	Qty. Needed	GPN or MIL spec
1	Config Module (w/Sockets, Jackscrew, Temp, Connext)	1	011-03702-00
3	4 cond. Cable harness	1	325-00122-00
9	Socket, Size 20, 26-30 AWG	5	336-00022-01
10	Pan head screw	1	211-60232-07

NOTE

For the following steps please refer to Figure 23-12 & Figure 23-13.

1. Strip back approximately 0.17 inches of insulation from each wire of the four conductor wire harness (item 3, Figure 23-12) and crimp either a pin (item 4, Figure 23-12) or a socket (item 9, Figure 23-12) to each conductor. It is the responsibility of the installer to find 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 23-12.

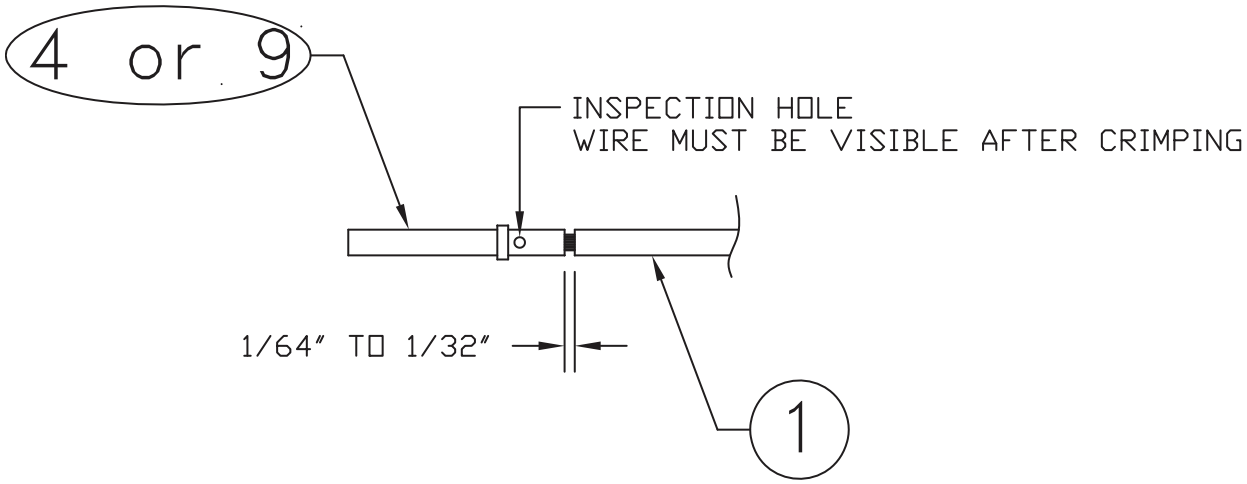


Figure 23-12 Insulation/Contact Clearance

NOTE

Refer to Figure 23-13 for all item numbers in the following steps 2-6.

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 the inserted four conductor wire harness (item 3) is on the same side of the backshell (item 6) as the module (item 1).
6. Attach cover (item 7) to backshell (item 6) using screws (item 8).

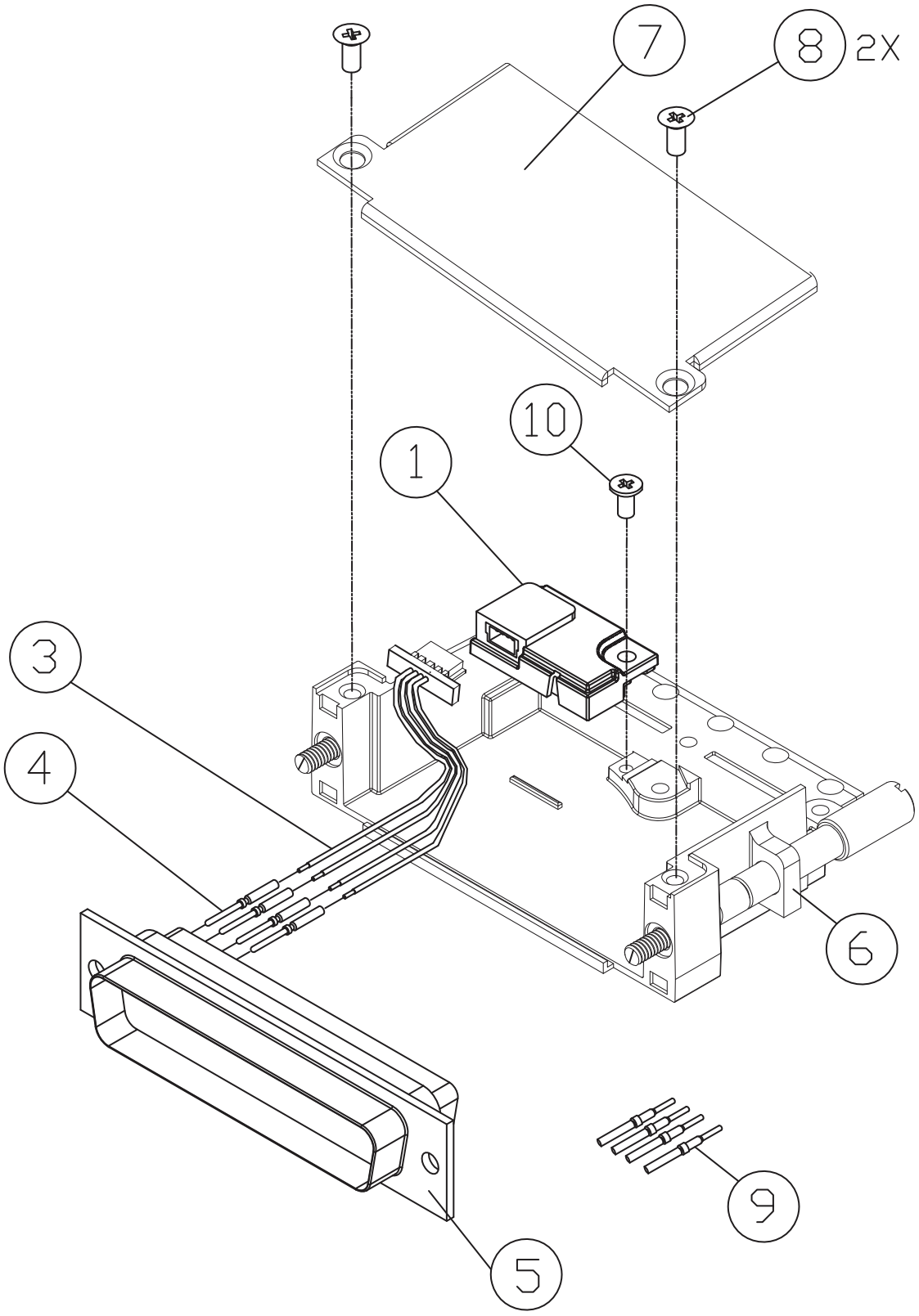
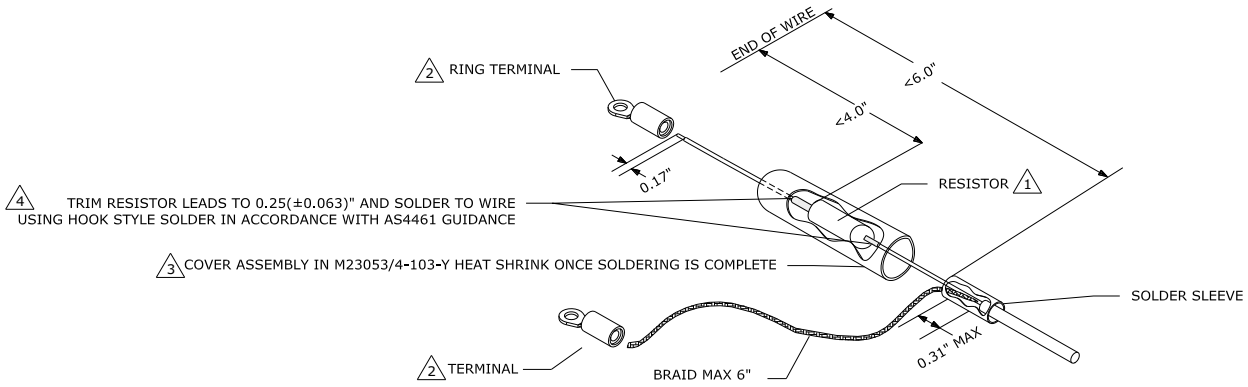


Figure 23-13 Jackscrew Backshell Installation

23.6 P-Lead Resistor Installation (Braid Shield)

See Section 22.3.5.3.

P-LEAD RESISTOR INSTALLATION (BRAID SHIELD)



NOTES

1. USE A RESISTOR THAT IS 400K OHM (±10%), 0.5W, RATED TO MAINTAIN RESISTANCE AND POWER RATING AT 150°C AND BE QUALIFIED TO MIL-R-10509.
2. USE MS25036 TERMINALS OF APPROPRIATE SIZE FOR THE BRAID AND GROUND STUD ON THE MAGNETO OR THE IGNITION SWITCH.
3. THE "-Y" CHARACTER IN THE HEAT SHRINK P/N IS COLOR OF THE HEAT SHRINK, COLOR OF HEAT SHRINK IS THE INSTALLER'S CHOICE.
4. ACCEPTABLE SOLDER TYPES ARE SN60 OR SN63. CLEAN FLUX RESIDUES USING AN APPROPRIATE FLUX CLEANER.

Figure 23-14 P-Lead Resistor Installation (Braid Shield)

23.7 Circular Connector

Components for a Circular Connector with AS85049/124S Saddle Clamp Strain Relief or AS85049/126S Right Angle Saddle Clamp Strain Relief Installation (see Figure 23-15 for Right Angle Strain Relief)

Table 23-9 Components for a Circular Connector

Figure Ref	Description	GPN, NAS, or military p/n
1*	Circular Connector	Reference Product Installation Manual
2*	Contacts (provided with circular connector)	Reference Product Installation Manual
3*	Saddle Clamp Strain Relief (AS85049/124S, self-locking or AS85049/126S right angle, self-locking)	Reference Product Installation Manual
	#4 Captive Self-Locking Nut and #4 Screw (connector size 17 and smaller) #6 Captive Self-Locking Nut and #6 Screw (connector size 19 thru size 23) #8 Captive Self-Locking Nut and #8 Screw (connector size 25)	Parts supplied with strain relief
	Cable Clamps	
4	Multiple Conductor Shielded Cable (2 –conductor demonstrated here)	Reference Installation Wiring Diagrams
5	Drain Wire Shield Termination (method optional)	Parts used depend on method chosen (see Section 5 thru Section 11)
6	Braid, Flat (19-20 AWG equivalent, tinned plated copper strands 36 AWG, Circular Mil Area 1000 -1300)	Parts used depend on method chosen
7	Floating Shield Termination (method optional)	Parts used depend on method chosen (see Section 5 thru Section 11)

*Indicates part is included in Garmin connector kit

Table 23-9 Components for a Circular Connector

8	Ring terminal, #4, insulated, 18-22 AWG	MS25036-148
	Ring terminal, #4, insulated, 14-16 AWG (connector size 17 and smaller) or Ring terminal, #6, insulated, 18-22 AWG	MS25036-152 or MS25036-102
	Ring terminal, #6, insulated, 14-16 AWG	MS25036-107
	Ring terminal, #6, insulated, 10-12 AWG (connector size 19 thru size 23) or Ring terminal, #8, insulated, 18-22 AWG	MS25036-111 or MS25036-149
	Ring terminal, #8, insulated, 14-16 AWG	MS25036-153
	Ring terminal, #8, insulated, 10-12 AWG (connector size 25)	MS25036-156
9*	Flat Washer, Stainless, #4, .032” thick, .115”ID, .209”OD (connector size 17 and smaller) Flat Washer, Stainless, #6, .032” thick, .143”ID, .267”OD (connector size 19 thru size 23) Flat Washer, Stainless, #8, .032” thick, .169”ID, .304”OD (connector size 25)	NAS620C4 or NAS620C6 or NAS620C8
10	Silicone Fusion Tape	249-00114-00 or similar
Not Shown*	Connector Seal Plug - sized to match the connector contact size (install connector seal plugs in unused pin position per section 12)	Reference Product Installation Manual

*Indicates part is included in Garmin connector kit

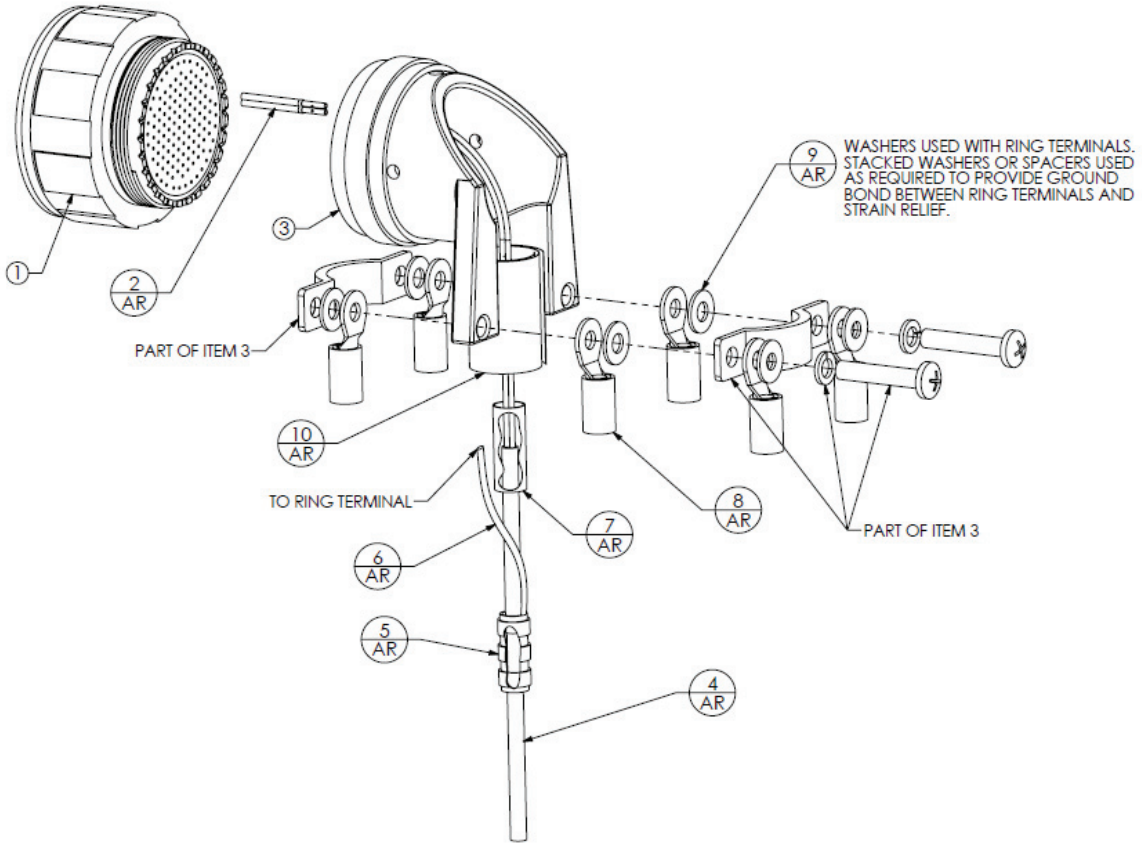


Figure 23-15 Circular Connector with Right Angle Saddle Clamp Strain Relief Install

(D38999/26 connector with AS85049/126S self-locking strain relief shown)
Note: "AR" denotes quantity "As Required" for the particular installation

24 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™ avionics installation.

Connector references JXXX(X) and PXXX(X) are used throughout this section and in Section 25 through Section 30. 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). However GDU™ 4XX display connectors on the LRU are designated as P4X0X.

24.1 GAD 27 (Flaps/Lights/Trim Controller)

24.1.1 J271 Connector

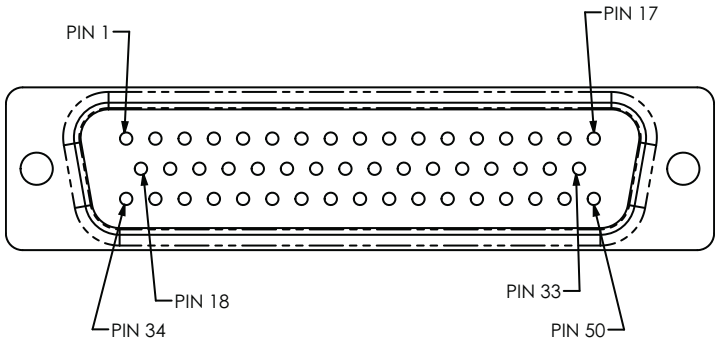


Figure 24-1 J271 on GAD 27, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN HI	I/O
2	CAN LO	I/O
3	CAN TERMINATE	--
4	SIGNAL GROUND	--
5	RESERVED	--
6	RESERVED	--
7	GAD 27 POWER IN	In
8	GAD 27 POWER GND	--
9	DISCRETE IN 1**	In
10	DISCRETE IN 2**	In
11	DISCRETE IN 3**	In
12	DISCRETE IN 4**	In
13	DISCRETE IN 5**	In
14	DISCRETE IN 6**	In
15	DISCRETE IN 7**	In

*Indicates Active Low
**Can be configured as Active High or Active Low

Pin	Pin Name	I/O
16	MOTOR DISCONNECT*	In
17	RESERVED	--
18	FLAP UP 1 SWITCH/ABSOLUTE FLAP POSTION 1*	In
19	FLAP DOWN 1 SWITCH/ABSOLUTE FLAP POSTION 2*	In
20	FLAP UP 2 SWITCH/ABSOLUTE FLAP POSTION 3*	In
21	FLAP DOWN 2 SWITCH/ABSOLUTE FLAP POSTION 4*	In
22	FLAP LIMIT UP*	In
23	FLAP LIMIT DOWN*	In
24	PILOT PITCH TRIM UP*	In
25	PILOT PITCH TRIM DN*	In
26	COPILOT PITCH TRIM UP*	In
27	COPILOT PITCH TRIM DN*	In
28	PILOT ROLL TRIM L*	In
29	PILOT ROLL TRIM R*	In
30	COPILOT ROLL TRIM L*	In
31	COPILOT ROLL TRIM R*	In
32	YAW TRIM L*	In
33	YAW TRIM R*	In
34	LIGHT 1 SWITCH*	In
35	LIGHT 2 SWITCH*	In
36	ALTERNATING FLASH ON*	In
37	+12V OUTPUT	Out
38	LIGHTING BUS GROUND	--
39	LIGHTING CONTROL IN 1	In
40	LIGHTING CONTROL IN 2	In
41	LIGHTING CONTROL IN 3	In
42	DC LIGHTING 1	Out
43	DC LIGHTING 2	Out
44	DC LIGHTING 3	Out
45	PWM LIGHTING 1	Out
46	PWM LIGHTING 2	Out
47	PWM LIGHTING 3	Out
48	DISCRETE IN 8**	In
49	DISCRETE IN 9**	In
50	RESERVED	--

*Indicates Active Low

**Can be configured as Active High or Active Low

24.1.2 J272 Connector

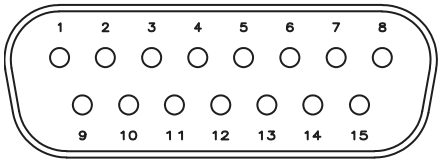


Figure 24-2 J272 on GAD 27, as viewed looking at connector on unit

Pin	Pin Name	FUNCTION	I/O
1	PITCH TRIM POWER IN	INPUT POWER FOR TRIM MOTOR, 5 A FUSE REQUIRED	In
2	PITCH TRIM POWER GND	GROUND RETURN FOR TRIM MOTOR, GROUND WIRE REQUIRED FOR EACH AXIS USED	--
3	ROLL TRIM POWER IN	INPUT POWER FOR TRIM MOTOR, 5 A FUSE REQUIRED	In
4	ROLL TRIM POWER GND	GROUND RETURN FOR TRIM MOTOR, GROUND WIRE REQUIRED FOR EACH AXIS USED	--
5	YAW TRIM POWER IN	INPUT POWER FOR TRIM MOTOR, 5 A FUSE REQUIRED	In
6	YAW TRIM POWER GND	GROUND RETURN FOR TRIM MOTOR, GROUND WIRE REQUIRED FOR EACH AXIS USED	--
7	RESERVED	N/A	--
8	RESERVED	N/A	--
9	ROLL TRIM OUT 1	5 A POWER OUTPUTS TO DRIVE MOTOR LEFT OR RIGHT	Out
10	ROLL TRIM OUT 2		Out
11	PITCH TRIM OUT 1	5 A POWER OUTPUTS TO DRIVE MOTOR UP OR DOWN	Out
12	PITCH TRIM OUT 2		Out
13	YAW TRIM OUT 1	5 A POWER OUTPUTS TO DRIVE MOTOR LEFT OR RIGHT	Out
14	YAW TRIM OUT 2		Out
15	RESERVED	N/A	--

24.1.3 Terminal Block (TB273) Connector

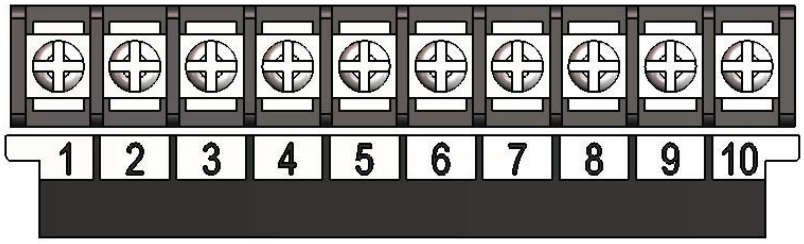


Figure 24-3 TB273 on GAD 27, as viewed looking at connector on unit

Pin	Pin Name	FUNCTION	I/O
1	KEEP ALIVE POWER IN	INPUT POWER FOR “KEEP ALIVE” BUS (+5VDC INPUT MIN.)	In
2	KEEP ALIVE POWER VOUT	OUTPUT POWER FOR “KEEP ALIVE” BUS (GREATER OF +12VDC OR INPUT POWER, 3.5 A OUTPUT MAX.)	Out
3	LIGHT 1 POWER	INPUT FOR LIGHT 1 (FUSE TO LESSER OF 10 A OR ACTUAL LIGHT RATING)	In
4	LIGHT 2 POWER	INPUT FOR LIGHT 2 (FUSE TO LESSER OF 10 A OR ACTUAL LIGHT RATING)	In
5	FLAP POWER IN	INPUT FOR FLAP MOTOR (FUSE TO LESSER OF 10 A OR ACTUAL FLAP MOTOR RATING)	In
6	FLAP POWER GROUND	GROUND RETURN FOR FLAP MOTOR CURRENT, MUST HAVE DEDICATED GROUND WIRE	--
7	FLAP POWER OUT 1	10 A POWER OUTPUTS TO DRIVE MOTOR UP OR DOWN	Out
8	FLAP POWER OUT 2		Out
9	LIGHT 1 OUTPUT	10 A ACTIVE HIGH POWER OUTPUT FOR LIGHT 1	Out
10	LIGHT 2 OUTPUT	10 A ACTIVE HIGH POWER OUTPUT FOR LIGHT 2	Out

NOTE

Keep Alive Power In (Pin 1, TB273) can be used as a second power input for the GAD 27.

NOTE

The Keep Alive Power VOut output is a short term voltage stabilizer intended to keep essential avionics online during engine start. This output is not intended to be the only source of power for any LRU.

24.1.4 Power

GAD 27 POWER IN (+14V only) is the GAD 27 unit power input and is internally diode OR'd with the Keep Alive bus (TB273) to provide power redundancy.

Pin Name	Connector	Pin	I/O
GAD 27 POWER IN	J271	7	In
GAD 27 POWER GND	J271	8	--

24.1.5 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Pin 3 is used to terminate the CAN bus (only if a CAN termination adapter is not used as shown in Section 2.3.1.3.3). To terminate the CAN bus at the GAD 27 short the pins (2 and 3) together. Refer to Section 2.3.1.3.2 for details on configuring and terminating the CAN bus. The CAN bus on J271 is used for communications between G3X LRUs.

Pin Name	Connector	Pin	I/O
CAN HI	J271	1	I/O
CAN LO	J271	2	I/O
CAN TERMINATE	J271	3	--

24.1.6 Discrete Inputs

The GAD 27 has 9 discrete inputs that can be configured as Active Low or Active High. The GAD 27 discrete inputs conform to the following specification:

Low: Vin < 3.5 VDC, or Rin < 375 Ω
High: Vin > 8 VDC, or Rin > 100k Ω

Note that a floating (disconnected) input on Discrete Inputs 1-7 will be treated as High, while a floating input on Discrete Inputs 8-9 will be treated as Low.

Pin Name	Connector	Pin	I/O
DISCRETE IN 1	J271	9	In
DISCRETE IN 2	J271	10	In
DISCRETE IN 3	J271	11	In
DISCRETE IN 4	J271	12	In
DISCRETE IN 5	J271	13	In
DISCRETE IN 6	J271	14	In
DISCRETE IN 7	J271	15	In
DISCRETE IN 8	J271	48	In
DISCRETE IN 9	J271	49	In

24.1.7 Flap Inputs

The GAD 27 has 4 active low Flap discrete inputs that allow for manual control of flap motors. Flap Limit Up and Flap Limit Down switches (optional) can be used to indicate point of maximum travel. A GEA™ 24 engine interface module or GSU 73 must be used to monitor a flap position sensor if predefined positions are to be used.

These active-low discrete inputs conform to the following specification:
Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active)
High: Vin > 8 VDC, or Rin > 100k Ω (input inactive)

The Flap Configuration page (Section 31.4.14) allows the four flap discrete inputs to be defined in two ways. In Relative Position mode, the switch up/switch down flap motion is relative to the last position and there are optional speed constraints on partial/full flap deployment. When an installation is configured for both pilot/copilot switches, pilot switches (#1 switches) take priority over copilot switches when they disagree unless pilot switches are both inactive. In Absolute Position mode, the flaps move to one of four absolute positions in response to an active low on the flap discrete inputs, and there are no speed constraints.

The GAD 27 wiring examples in Figure 25-2.2 p. 2, Figure 25-2.3 p. 1, Figure 25-2.3 p. 2, Figure 25-2.3 p. 3 show one example of a Relative Position installation and three examples of Absolute Position installations.

Relative Flap Position Inputs

Pin Name	Connector	Pin	I/O
FLAP UP 1 SWITCH	J271	18	In
FLAP DOWN 1 SWITCH	J271	19	In
FLAP UP 2 SWITCH	J271	20	In
FLAP DOWN 2 SWITCH	J271	21	In
FLAP LIMIT UP	J271	22	In
FLAP LIMIT DOWN	J271	23	In

Absolute Flap Position Inputs

Pin Name	Connector	Pin	I/O
ABSOLUTE POSITION 1	J271	18	In
ABSOLUTE POSITION 2	J271	19	In
ABSOLUTE POSITION 3	J271	20	In
ABSOLUTE POSITION 4	J271	21	In
FLAP LIMIT UP	J271	22	In
FLAP LIMIT DOWN	J271	23	In

24.1.8 Lighting Bus

The GAD 27 can monitor from 1 to 3 lighting bus control inputs, supply up to 3 DC lighting outputs, and up to 3 PWM lighting outputs. The +12V OUTPUT pin can be used to provide supply voltage for potentiometer inputs used to vary the lighting bus outputs. The DC Lighting outputs provide a reference voltage only, 10mA max, and do not power lights. Attempting to source more than 10 mA of current from these DC reference outputs may damage them.

The DC Lighting outputs are a variable DC voltage (output voltage is based on the lighting control input voltage) that is used to vary the brightness of the lighting.

The PWM lighting outputs (pins 45, 46, 47) are active low, and can sink a maximum of 500 mA average current. The pulse width modulation (PWM) of the output signal (square wave) is varied to control the brightness of the lighting.

Lighting Bus Inputs

Pin Name	Connector	Pin	I/O
LIGHTING BUS GROUND	J271	38	--
LIGHTING CONTROL IN 1	J271	39	In
LIGHTING CONTROL IN 2	J271	40	In
LIGHTING CONTROL IN 3	J271	41	In

Lighting Bus Outputs

Pin Name	Connector	Pin	I/O
+12V OUTPUT	J271	37	Out
LIGHTING BUS GROUND	J271	38	--
DC LIGHTING 1	J271	42	Out
DC LIGHTING 2	J271	43	Out
DC LIGHTING 3	J271	44	Out
PWM LIGHTING 1	J271	45	Out
PWM LIGHTING 2	J271	46	Out
PWM LIGHTING 3	J271	47	Out

24.1.9 External Lighting Discrete Inputs

The GAD 27 has 3 active-low discrete lighting inputs. The Light 1 and Light 2 inputs can be connected to cockpit switches to control the operation of the two supported aircraft external lights. Typically these inputs are used to control one or two landing lights, or a pair of separate landing and taxi lights.

The Alternating Flash On input can optionally be used to support a cockpit switch to control the flashing behavior of the aircraft's external lights. If this input is not connected, the external lights may still be set to flash automatically based on airspeed (see Section 31.4.33).

These active-low discrete inputs conform to the following specification:

Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active)

High: Vin > 8 VDC, or Rin> 100k Ω (input inactive)

Pin Name	Connector	Pin	I/O
LIGHT 2 SWITCH	J271	34	In
LIGHT 1 SWITCH	J271	35	In
ALTERNATING FLASH ON	J271	36	In

24.1.10 Motor Disconnect Input

Motor Disconnect is an active low discrete input, that when active, interrupts trim and flap movement. Connecting this input to a switch is not required, the unit will operate normally when the switch is either inactive or the input is not used.

NOTE

When Motor Disconnect is active, all trim will be reflected as inhibited in the system status menu.

The Motor Disconnect input is an active-low discrete input that conforms to the following specification:

Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active, motor movement inhibited)

High: Vin >8 VDC, or Rin > 100k Ω (input inactive, motor movement allowed)

Pin Name	Connector	Pin	I/O
MOTOR DISCONNECT	J271	16	In

24.1.11 Pitch Trim Inputs

The GAD 27 has 4 active low Pitch discrete inputs that allow for manual control of pitch trim motors. Pilot switches take priority over copilot switches when they disagree unless pilot switches are both inactive. Copilot trim switches are optional.

These active-low discrete inputs conform to the following specification:
Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active)
High: Vin > 8 VDC, or Rin > 100k Ω (input inactive)

Pin Name	Connector	Pin	I/O
PILOT PITCH TRIM UP	J271	24	In
PILOT PITCH TRIM DN	J271	25	In
COPILOT PITCH TRIM UP	J271	26	In
COPILOT PITCH TRIM DN	J271	27	In

24.1.12 Roll Trim Inputs

The GAD 27 has 4 active low Roll discrete inputs. Pilot switches take priority over copilot switches when they disagree unless pilot switches are both inactive. Copilot trim switches are optional.

These active-low discrete inputs conform to the following specification:
Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active)
High: Vin > 8 VDC, or Rin > 100k Ω (input inactive)

Pin Name	Connector	Pin	I/O
PILOT ROLL TRIM L	J271	28	In
PILOT ROLL TRIM R	J271	29	In
COPILOT ROLL TRIM L	J271	30	In
COPILOT ROLL TRIM R	J271	31	In

24.1.13 Yaw Trim Inputs

The GAD 27 has 2 active low Yaw discrete inputs.

These active-low discrete inputs conform to the following specification:
Low: Vin < 3.5 VDC, or Rin < 375 Ω (input active)
High: Vin > 8 VDC, or Rin > 100k Ω (input inactive

Pin Name	Connector	Pin	I/O
YAW TRIM L	J271	32	In
YAW TRIM R	J271	33	In

24.2 GAD 29/29B/29C/29D (ARINC 429 Adapter)

NOTE

References to the GAD 29 throughout this manual apply equally to the GAD 29C.
References to the GAD 29B throughout this manual apply equally to the GAD 29D.

24.2.1 J291 Connector

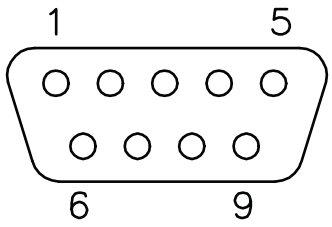


Figure 24-4 J291 on GAD 29/29B/29C/29D, as viewed looking at connector on unit

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	--

24.2.2 J292 Connector

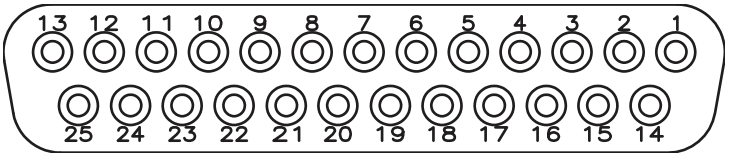


Figure 24-5 J292 on GAD 29/29B/29C/29D, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	RESERVED	--
	AC REFERENCE HI*	In
2	RESERVED	--
	AC REFERENCE LO*	In
3	RESERVED	--
	HDG/CRS VALID*	Out
4	ARINC RX 4B	In
5	ARINC RX 3B	In
6	ARINC TX 2B	Out
7		
8	RESERVED	--
	HEADING ERROR HI*	Out
9	CAN TERM 1	--
10	ARINC RX 2B	In
11	ARINC RX 1B	In
12	ARINC TX 1B	Out
13		
14	GROUND	--
	HEADING ERROR LO*	In
15	RESERVED	--
	COURSE ERROR HI*	Out
16	ARINC RX 4A	In
17	ARINC RX 3A	In
18	ARINC TX 2A	Out
19		
20	GROUND	--
	COURSE ERROR LO*	In
21	CAN TERM 2	--
22	ARINC RX 2A	In
23	ARINC RX 1A	In

*GAD 29B/29D only

Pin	Pin Name	I/O
24	ARINC TX 1A	Out
25		

*GAD 29B/29D only

24.2.3 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	--

24.2.4 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	J292	ARINC TX 1A	Out
25	J292		
12	J292	ARINC TX 1B	Out
13	J292		
22	J292	ARINC RX 2A	In
10	J292	ARINC RX 2B	In
18	J292	ARINC TX 2A	Out
19	J292		
6	J292	ARINC TX 2B	Out
7	J292		
17	J292	ARINC RX 3A	In
5	J292	ARINC RX 3B	In
16	J292	ARINC RX 4A	In
4	J292	ARINC RX 4B	In

24.2.5 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 29/29B/29C/29D 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 J291 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	--

24.2.6 Autopilot Heading/Course (GAD 29B/29D only)

The GAD 29B/29D can provide analog heading and course error outputs to non-Garmin analog autopilots. In the case of an AC autopilot, the GAD 29B/29D has an AC REFERENCE signal input.

Pin Name	Connector	Pin	I/O
AC REFERENCE HI	J292	1	In
AC REFERENCE LO	J292	2	In
HDG/CRS VALID	J292	3	Out
HEADING ERROR HI	J292	8	Out
HEADING ERROR LO	J292	14	In
COURSE ERROR HI	J292	15	Out
COURSE ERROR LO	J292	20	Out

24.3 GCO™ 14

24.3.1 P1000 Connector

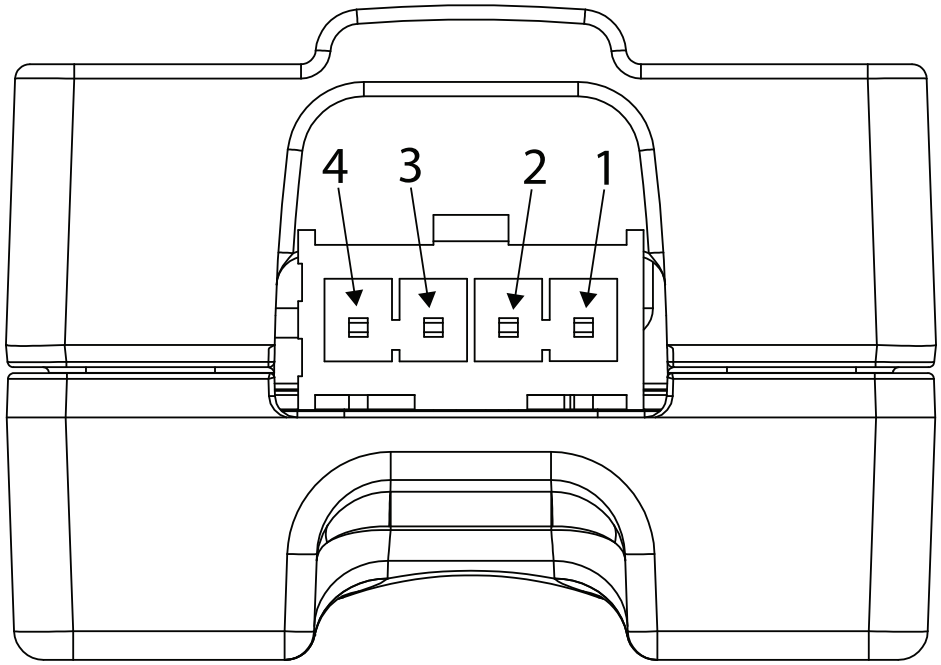


Figure 24-6 GCO 14 Connector Layout

Table 24-1. P1000 Connector Pins

Pin	Pin Name	Color	I/O
1	GROUND	BLACK	--
2	CLOCK	WHITE	I/O
3	DATA	YELLOW	I/O
4	+3.3V	RED	IN

24.4 GDU 4XX (Display Unit)

24.4.1 P4501/4601/4701 (P4X01) Connector

The P4501/4601/4701 connector (referred to as P4X01 connector in this section) can be used for connections to the GSU 25 when mounting the GSU 25 to the back of the GDU 4XX (Figure 7-8). This mounting method may not be recommended for all installations, contact Garmin for details before using this method.

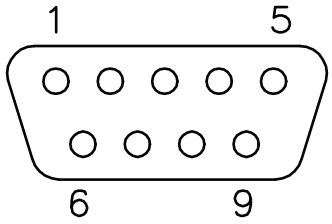


Figure 24-7 P4X01 on GDU 4XX, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN BUS HI	I/O
2	CAN BUS LO	I/O
3	RESERVED	--
4	RS-232 TX	Out
5	RS-232 RX	In
6	GND	--
7	PWR 1	--
8	PWR 2	--
9	GND	--

NOTE

It is recommended to connect the serial port from the GSU 25 (use the GSU 25 designated as #1 in a multiple GSU 25 installation) to the P4X01 connector regardless of mounting method used for the GSU 25 per Figure 24-8. Connector kit 010-11825-20 which includes a 9 pin connector, pins, and metal backshell may be used for the P4X01 connections.

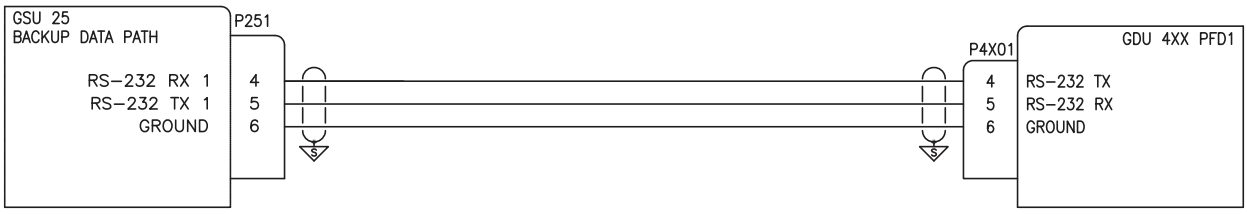


Figure 24-8 GDU 4XX to GSU 25 Backup Data Path Connections

24.4.2 P4502/4602/4702 (P4X02) Connector

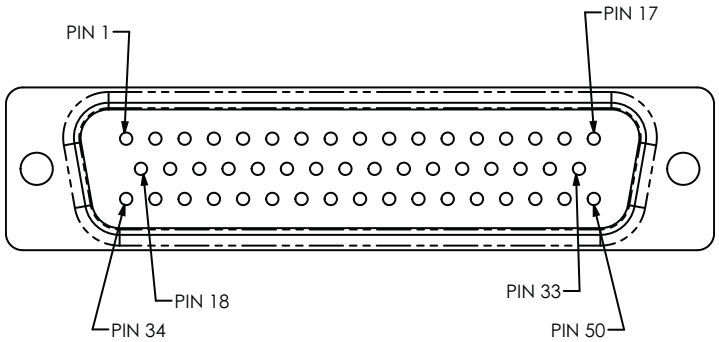


Figure 24-9 View of P4X02 Connector from Back of Unit

Pin	Pin Name	I/O
1	MONO AUDIO OUT HI	Out
2	STEREO AUDIO OUT LO	--
3	STEREO AUDIO OUT LEFT	Out
4	SPARE	--
5	SPARE	--
6	DO NOT USE	--
7	DO NOT USE	--
8	DO NOT USE	--
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 (3.3V VERY LOW CURRENT)	Out
18	MONO AUDIO OUT LO	--
19	STEREO AUDIO OUT RIGHT	Out
20	STEREO AUDIO OUT LO	--
21	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	In
22	RESERVED FOR FUTURE DEVELOPMENT, DO NOT USE	In

*Indicates Active Low

Pin	Pin Name	I/O
23	RS-232 IN 4	In
24	RS-232 IN 5	In
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	CDU SYSTEM ID PROGRAM* 5	In
39	CDU SYSTEM ID PROGRAM* 6	In
40	RS-232 OUT 4	Out
41	RS-232 OUT 5	Out
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

24.4.3 P4503/4603/4703 (PX03) Connector

Do not use P4X03, this connector is reserved for future development.

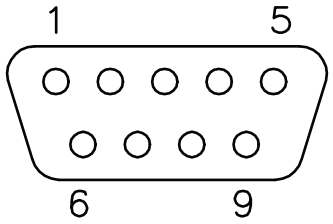


Figure 24-10 View of P4X03 Connector from Back of Unit

Pin	Pin Name	I/O
1	CAN BUS HI	I/O
2	CAN BUS LO	I/O
3	RESERVED	--
4	RESERVED	--
5	RESERVED	--
6	RESERVED	--
7	RESERVED	--
8	RESERVED	--
9	RESERVED	--

24.4.4 Video Input



Figure 24-11 View of Video Input BNC Connector from Back of Unit

The GDU 4XX supports the following composite video input formats:

- NTSC “National Television Standards Committee” (J,M,4.43)
- PAL “Phase Alternating Line” (B,D,G,H,I,M,N,Nc,60)
- SECAM “Sequential Color with Memory” (B,D,G,K,K1,L)

Composite video is a one-wire format with intensity, color, and timing information transferred together. Video signals are transferred using a 75 Ω coaxial cable (see the following recommended cable types.)

- M17/94-RG179, PIC Wire & Cable p/n V75268 or V76261,
- M17/94-RG179, Electronic Cable Specialists (ECS) p/n 442501 or equivalent

NOTE

Particular attention must be taken in routing the coaxial cable through the aircraft to avoid potential radiated interference sources in addition to minimizing the cable bend radii. Concerns about interference sources may necessitate the use of coaxial cable with a higher noise rejection rating.

NTSC (M) (also called RS-170A), is the most common video format supported by the GDU 4XX. NTSC has the following characteristics:

- 59.94 Hz vertical interlaced refresh rate
- 15.75 kHz horizontal line frequency
- 525 scan lines
- 29.97 frame per second update rate
- Luminance or luma (black and white) also called “monochrome NTSC” or RS-170, is the standard black and white format which contains both image and timing information.
- Chrominance or chroma (color) encoding system

24.4.5 Aircraft Power

The GDU 4XX 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. Use 22 AWG wire (min) for all power and ground connections.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P4X02	32	In
AIRCRAFT POWER 2	P4X02	31	In
POWER GROUND	P4X02	15	--
POWER GROUND	P4X02	16	--

24.4.6 Mode Selections, GDU System ID Program Pins

In a single-display system, configure the display as PFD1. In a system with multiple displays, one display must be configured as PFD1, and the other displays may be configured using any of the following combinations:

- Single-display system: PFD1
- Two-display system: PFD1 + MFD1, or PFD1 + PFD2
- Three-display system: PFD1 + MFD1 + PFD2, or PFD1 + MFD1 + MFD2
- Four-display system: PFD1 + MFD1 + PFD2 + MFD2
- Five-display system: PFD1 + MFD1 + PFD2 + MFD2 + either PFD3 or MFD3
- Six-display system: PFD1 + MFD1 + PFD2 + MFD2 + PFD3 + MFD3
- G3X Touch™ avionics systems (only) can be configured to disable all ADAHRS LRUs, this allows all displays to function as MFDs (no PFD displays)

In a multi-display system, each display will automatically change to reversionary mode if certain other displays are not detected:

- PFD1 will change to reversionary mode if MFD1 is not present
- PFD2 will change to reversionary mode if MFD2 is installed but not present, or otherwise will follow the behavior of MFD1
- PFD3 will change to reversionary mode if MFD3 is installed but not present, or otherwise will follow the behavior of PFD2
- MFD1 will change to reversionary mode if PFD1 is not present
- MFD2 will change to reversionary mode if PFD2 is installed but not present, or otherwise will follow the behavior of MFD1
- MFD3 will change to reversionary mode if no PFD is present

A GDU 4XX can also 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. Other displays in the system will not be affected by manually placing a display into reversionary mode. See the G3X Touch Pilot's Guide for further information about reversionary mode.

Configure the GDU 4XX units per the following tables.

A GDU 4XX 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 4XX in Demo mode, which is for in-store demonstration use only, **never ground pin 42 in an aircraft installation**.

CDU SYSTEM ID PROGRAM* 1, P4X02 Pin 10	CDU SYSTEM ID PROGRAM* 2, P4X02 Pin 9	CDU SYSTEM ID PROGRAM* 5, P4X02 Pin 38	CDU SYSTEM ID PROGRAM* 6, P4X02 Pin 39	GDU Mode
Open	Open	X	X	MFD1
Ground	Open	X	X	PFD1
Open	Ground	X	X	PFD2
Ground	Ground	Open	Open	MFD2
Ground	Ground	Ground	Open	MFD3
Ground	Ground	Open	Ground	PFD3

CDU SYSTEM ID PROGRAM* 3 P4X02 Pin 25	GDU Mode
Open	Auto Reversionary
Ground	Forced Reversionary

CDU SYSTEM ID PROGRAM* 4 P4X02 Pin 42	GDU Mode
Open	Normal Operation
Ground	Demo Mode

24.4.7 Configuration Module

Connect the configuration module to the PFD1 unit; do not connect a config module to PFD2, MFD1 or MFD2.

Pin Name	Connector	Pin	I/O
CONFIG MODULE POWER OUT (3.3V, very low current)	P4X02	17	Out
CONFIG MODULE CLOCK	P4X02	33	I/O
CONFIG MODULE GROUND	P4X02	49	--
CONFIG MODULE DATA	P4X02	50	I/O

24.4.8 Serial Data

24.4.8.1 RS-232

5 Channels of RS-232 I/O data.

Pin Name	Connector	Pin	I/O
RS-232 IN 1	P4X02	47	In
RS-232 OUT 1	P4X02	48	Out
RS-232 IN 2	P4X02	14	In
RS-232 OUT 2	P4X02	30	Out
RS-232 IN 3	P4X02	29	In
RS-232 OUT 3	P4X02	13	Out
RS-232 IN 4	P4X02	23	In
RS-232 OUT 4	P4X02	40	Out
RS-232 IN 5	P4X02	24	In
RS-232 OUT 5	PX02	41	Out

24.4.8.2 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 2.3.1.3.3 for details.

Pin Name	Connector	Pin	I/O
CAN BUS HI	PX02	46	I/O
CAN BUS LO	P4X02	45	I/O
CAN BUS TERMINATION	P4X02	28	--

24.4.9 Lighting

The GDU 4XX display and keys can be configured to track 28 VDC or 14 VDC lighting busses using these inputs. These inputs are reference voltage inputs (not power inputs) with a high impedance of ~100 kΩ for pin 43 and ~200 kΩ for pin 26. This backlight level reference signal may be supplied with something as simple as a 10K potentiometer connected to power and ground (drawing 1 mA @ 14 VDC). The center tap on this potentiometer is connected to one of the pins (43 or 26) in the following table. For providing this reference signal to more than one device, a commercially available regulated backlight voltage reference is recommended.

Pin Name	Connector	Pin	I/O
14V LIGHTING BUS HI	P4X02	43	In
28V LIGHTING BUS HI	P4X02	26	In

24.4.10 Audio

24.4.10.1 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	P4X02	1	Out
MONO AUDIO OUT LO	P4X02	18	--

24.4.11 Stereo Audio

The stereo audio output provides SiriusXM® 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 31.4.20 for instructions regarding the sound config page.

Pin Name	Connector	Pin	I/O
STEREO AUDIO OUT LEFT	P4X02	3	Out
STEREO AUDIO OUT LO*	P4X02	20	--
STEREO AUDIO OUT RIGHT	P4X02	19	Out
STEREO AUDIO OUT LO*	P4X02	2	--

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

24.5 GEA 24 (EIS Interface)

24.5.1 J241 Connector

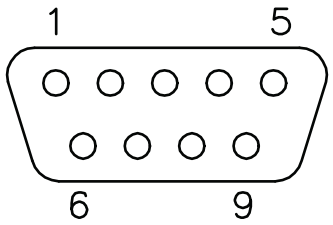


Figure 24-12 J241 on GEA 24, as viewed looking at connector on unit

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

24.5.2 J242 Connector

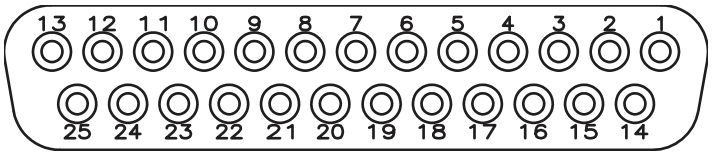


Figure 24-13 J242 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	RESERVED	--
2	CHT6 LO / CHT 2 RESISTIVE LO / TEMP 4 LO*	In
3	EGT6 LO / TEMP 6 LO*	In
4	CHT5 LO / CHT 1 RESISTIVE LO / TEMP 3 LO*	In
5	EGT5 LO / TEMP 5 LO IN*	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 / TEMP 4 HI*	In
15	EGT6 HI / TEMP 6 HI*	In
16	CHT5 / CHT 1 RESISTIVE HI / TEMP 3 HI*	In
17	EGT5 HI / TEMP 5 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

*GDU 4XX only (applies only to function following the last “/”)

24.5.3 J243 Connector

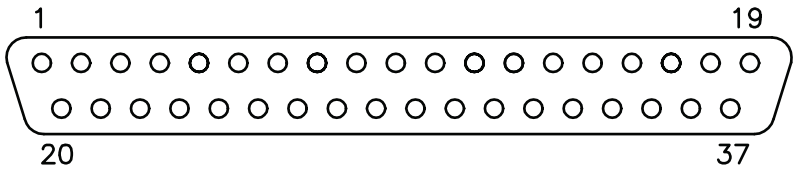


Figure 24-14 J243 on GEA 24, as viewed looking at connector on unit

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	GP 7 / TEMP 2 LO	In
29	GP 7 / TEMP 2 HI	In
30	GP 6 / TEMP 1 LO	In

Pin	Pin Name	I/O
31	GP 6 / 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

24.5.4 J244 Connector

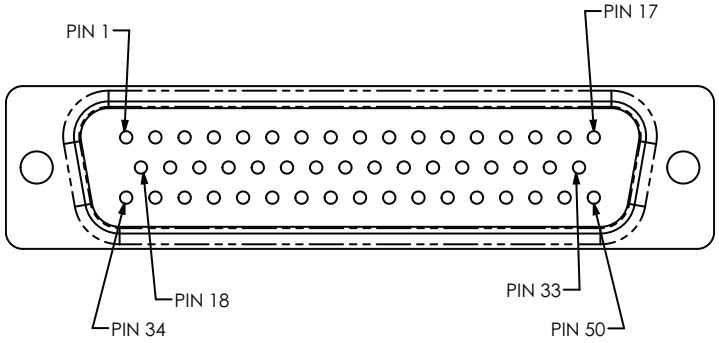


Figure 24-15 J244 on GEA 24, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	SYSTEM ID 1A*	In
2	SYSTEM ID1B / GND	--
3	RESERVED	--
4	RESERVED	--
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	GP 3 / FUEL QTY 3 HI / +5V 3	Out
12	GP 3 / FUEL QTY 3	In
13	GP 3 / FUEL QTY 3 LO / GND	--
14	GP 4 / FUEL QTY 4 HI / +5V 4	Out
15	GP 4 / FUEL QTY 4	In
16	GP 4 FUEL 4 QTY LO / GND	--

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

Pin	Pin Name	I/O
17	FADEC_CAN2_H	I/O
18	GP 1 HI / +5V	Out
19	GP 1	In
20	GP 1 LO / GND	--
21	GP 2 HI / +5V	Out
22	GP 2	In
23	GP 2 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	GP HI / +5V	Out
31	GP 5	In
32	GP 5 LO / GND	--
33	FADEC_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	FADEC_CAN3_HI (GEA 24B ONLY, 010-02770-00)	In
49	FADEC_CAN3_LO (GEA 24B ONLY, 010-02770-00)	In
50	GP +12V	Out

*Indicates Active Low

**Can be configured as active high or active low

24.5.5 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 Appendix H.4.19.3.2 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	--

24.5.6 CAN Bus

All 3 data buses conform to the BOSCH standard for Controller Area Network 2.0-B. The busses comply with ISO 11898. Refer to Section 2.3.1.3.3 for details on configuring and terminating the CAN bus. The CAN bus on J241 shall be used for communications between G3X LRUs. The FADEC CAN2 and FADEC CAN3 (GEA 24B only) bus connections on J244 shall be used to communicate with FADEC engine controllers and shall not be connected to other G3X LRUs. The FADEC CAN2 and FADEC CAN3 buses are not terminated at the unit, refer to the interconnect diagrams for how to terminate the FADEC CAN2 and FADEC CAN3 buses if used. Using the FADEC CAN3 input provides for greater system redundancy in the case of an ECU lane failure.

Pin Name	Connector	Pin	I/O
CAN HI	J241	1	I/O
CAN LO	J241	2	I/O
FADEC_CAN2_HI	J244	17	I/O
FADEC_CAN2 LO	J244	33	I/O
FADEC_CAN3_HI (GEA 24B ONLY, 010-02770-00)	J244	48	I/O
FADEC_CAN3 LO (GEA 24B ONLY, 010-02770-00)	J244	49	I/O

24.5.7 RS-232

The RS-232 channel can optionally be connected to a GDU display to provide a redundant path for EIS data.

Pin Name	Connector	Pin	I/O
RS-232 RX	J241	4	In
RS-232 TX	J241	5	Out

24.5.8 Digital Inputs

GEA 24 digital inputs are capable of sensing either an AC voltage with a peak to peak value of greater than 1 V, or an open collector type digital input. These inputs are configured by the GDU, refer to Appendix H.4.19 (for GDU 37X systems) and Section 31.4.32 (for GDU 4XX systems)

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
FUEL QTY 2	J244	9	In

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

24.5.9 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 Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems).

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

Active: Vin < 3.5 VDC, or Rin < 375 Ω

Inactive: Vin > 8 VDC, or Rin > 100 kΩ

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

Active: Vin > 8 VDC, or Rin > 100 kΩ

Inactive: Vin < 3.5 VDC, or Rin < 375 Ω

The GP1-GP7 inputs and the RPM2 input may also be used as additional discrete inputs. If GP6 or GP7 are used for this purpose, the corresponding GP6 LO or GP7 LO pin must also be connected to ground (see Section 24.5.12).

The GP1-GP7 inputs may also be used as additional discrete inputs. When configured as an Active Low discrete input, the GP1-GP7 inputs require an additional pull-up resistor, as shown in Figure 27-2.2.

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

24.5.10 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 Section 27 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

If two EIS LRUs are configured, use annunciator outputs on EIS LRU#1 only.

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

24.5.11 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 Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems).

CAUTION

For installations with GEA 24(010-01042-00) LRU's, that are currently using fuel quantity sensors assigned to a resistive input on any Fuel Input, it is recommended to install 2 - 2.2 kΩ resistors in series as shown in Section 27. This is important for composite and tube-and-fabric airframes, to improve the grounding path. The additional resistors are optional for metal aircraft, and either wiring method presented is sufficient. When in-line resistors are installed, use "Voltage" configuration setting, if in-line resistors are not installed, use "Resistive" configuration setting. It is not recommended to install these resistors in a GEA24B (010-02770-00) installation, although they are acceptable if already present.

NOTE

Refer to Section 33.2.5 for information regarding swapping GEA 24 and GEA 24B units.

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	--
GP 3 / FUEL QTY 3 HI / +5V 3	J244	11	Out
GP 3 / FUEL QTY 3	J244	12	In
GP 3 / FUEL QTY 3 LO / GND	J244	13	--
GP 4 / FUEL QTY 4 HI / +5V 4	J244	14	Out
GP 4 / FUEL QTY 4	J244	15	In
GP 4 / FUEL QTY 4 LO / GND	J244	16	--

24.5.12 GP (General Purpose) Inputs

These inputs are configured by the GDU (refer to Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems) and are capable of reading any voltage up to 40 Vdc. The GEA 24 has 7 general purpose inputs, labeled GP 1 through 7, each of these are paired together.

When using the GP6 and GP7 inputs for general-purpose voltage sensing (Hall-effect sensors), including position sensors and user-defined analog parameters, the corresponding GP6 LO or GP7 LO pin must be connected to ground. The GP1-GP7 inputs may also be used as additional discrete inputs. When configured as an Active Low discrete input, the GP1-GP7 inputs require an additional pull-up resistor, as shown in Figure 27-2.2.

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
GP 1	J244	19	In
GP1 LO / GND	J244	20	--
GP2 HI / +5V	J244	21	Out
GP 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	--
GP 3 /FUEL QTY 3 HI / +5V 3	J244	11	Out
GP 3 / FUEL QTY 3	J244	12	In
GP 3 / FUEL QTY 3 LO / GND	J244	13	--
GP 4 / FUEL QTY 4 HI / +5V 4	J244	14	Out
GP 4 / FUEL QTY 4	J244	15	In
GP 4 / FUEL QTY 4 LO / GND	J244	16	--
GP 5 HI / +5V	J244	30	Out
GP 5	J244	31	In
GP 5 LO / GND	J244	32	--
GP +12V	J244	50	Out
GP 6 / TEMP 1 HI	J243	31	In
GP 6 / TEMP 1 LO	J243	30	In
GP 7 / TEMP 2 HI	J243	29	In
GP 7 / TEMP 2 LO	J243	28	In

Pin Name	Connector	Pin	I/O
GP +5V	J243	26	Out
GP GND	J243	27	--

24.5.13 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 Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems).

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

24.5.14 Voltage Inputs

The two bus voltage inputs are capable of accepting voltages of up to 40 Vdc. These inputs are configured by the GDU (Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems).

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

24.5.15 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

24.5.16 System ID

Pins 1 and 2 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. If two GEA 24s are installed, connect pins 1 and 2 on the second GEA 24 together in order to configure it as the EIS #2 LRU.

When using two GEA 24 units to monitor a single engine with more than 6 cylinders, connect cylinders 1-6 to the CHT/EGT 1-6 inputs on GEA 24 #1, and cylinders 7-12 to the CHT/EGT 1-6 inputs on GEA 24 #2.

When using two GEA 24 units to monitor twin engines (or a larger than normal single engine), connect pins 1 and 2 on the second GEA 24 to configure it as the EIS #2 LRU.

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

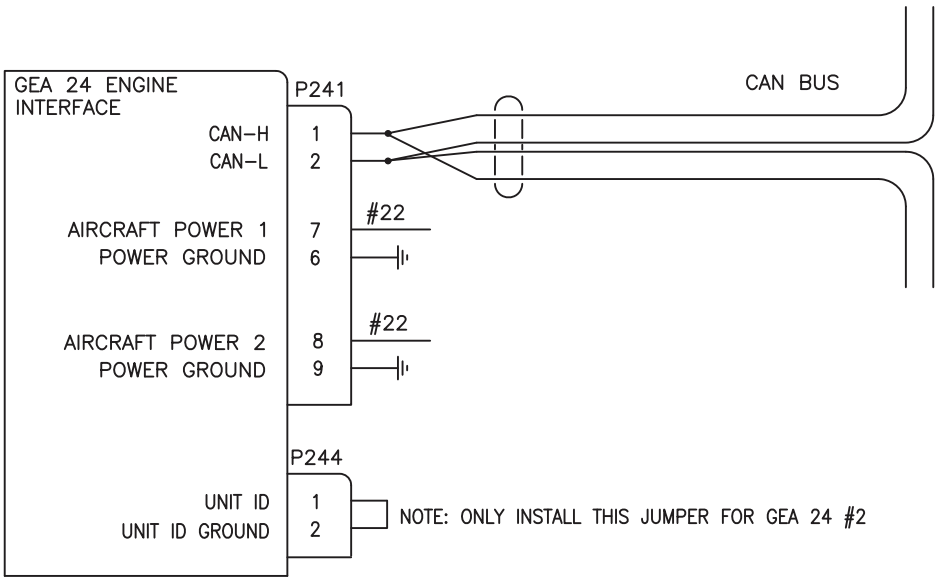


Figure 24-16 GEA 24 EIS #2 Configuration

24.5.17 Temperature Inputs

GDU 4XX Systems:

Some thermocouple inputs are multi-purpose capable and have several configuration options. CHT5/CHT6, GP 6/GP 7, TEMP 1/TEMP 2/TEMP 3/TEMP 4, and Oil Temp can be used for resistive based temperature sensors. TEMP 3/4 are unavailable if CHT 5/6 are in use for CHT. TEMP 5/6 are unavailable if EGT 5/6 are in use for EGT. TEMP 5/6 support thermocouples only. These inputs are configured by the GDU (refer to Section 31.4.32).

GDU 3XX Systems:

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 Appendix H.4.19).

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 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 / TEMP 3 HI*	J242	16	In
CHT5 LO / CHT 1 RESISTIVE LO / TEMP 3 LO*	J242	4	In
CHT6 HI / CHT 2 RESISTIVE HI / TEMP 4 HI*	J242	14	In
CHT6 LO / CHT 2 RESISTIVE LO / TEMP 4 LO*	J242	2	In
EGT1 HI	J242	25	In
EGT1 LO	J242	13	In
EGT2 HI	J242	23	In
EGT2 LO	J242	11	In
EGT3 HI	J242	21	In
EGT3 LO	J242	9	In
EGT4 HI	J242	19	In

**GDU 4XX only (applies only to function following the last "/")

Pin Name	Connector	Pin	I/O
EGT4 LO	J242	7	In
EGT5 HI / TEMP 5 HI*	J242	17	In
EGT5 LO / TEMP 5 LO*	J242	5	In
EGT6 HI / TEMP 6 HI*	J242	15	In
EGT6 LO / TEMP 6 LO IN*	J242	3	In
GP 6 / TEMP 1 HI	J243	31	In
GP 6 / TEMP 1 LO	J243	30	In
GP 7 / TEMP 2 HI	J243	29	In
GP 7 / TEMP 2 LO	J243	28	In
OIL TEMP HI	J243	33	In
OIL TEMP LO	J243	32	In

**GDU 4XX only (applies only to function following the last “/”)

NOTE

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

24.5.18 Transducer 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
GP 3 / FUEL QYT 3 HI / +5V 3	J244	11	Out
GP 4 / FUEL QTY 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
GP 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

24.6 GHA 15 Height Advisor

24.6.1 J2001

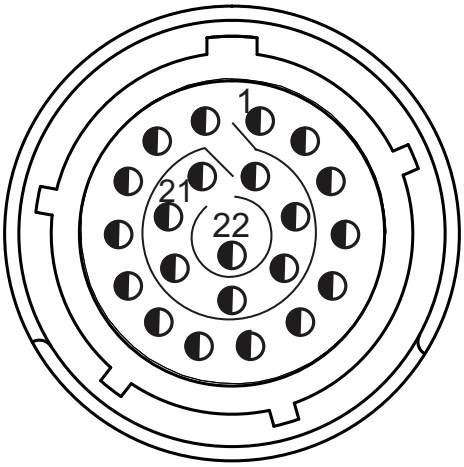


Figure 24-17 View of J2001 connector, from front of unit

Pin	Pin Name	I/O
1	POWER GROUND	--
2	RESERVED	--
3	RESERVED	--
4	RESERVED	--
5	RESERVED	--
6	RESERVED	--
7	CAN BUS LO	I/O
8	CAN BUS HI	I/O
9	USBO DP	I/O
10	USBO DM	I/O
11	RESERVED	--
12	RESERVED	--
13	RESERVED	--
14	AIRCRAFT POWER	IN
15	RESERVED	--
16	RESERVED	--
17	N/C	--
18	CAN BUS TERM	OUT
19	USB VBUS	IN
20	SIGNAL GROUND	--
21	RESERVED	--
22	SIGNAL GROUND	--

24.6.2 Power Functions

24.6.2.1 Aircraft Power

The GHA™ 15 height advisor provides an aircraft power input which accepts 14/28 VDC.

Table 24-2 Aircraft Power

Pin Name	Pin	I/O
AIRCRAFT POWER	14	In
POWER GROUND	1	--

24.6.3 CAN Bus

The GHA 15 provides a CAN Bus. The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B and ISO 11898.

Table 24-3 CAN Bus

Pin Name	Pin	I/O
CAN BUS LO	7	I/O
CAN BUS HI	8	I/O
CAN BUS TERM	18	Out

24.6.4 USB

The GHA 15 provides a standard Universal Serial Bus (USB) interface for unit diagnostic purposes. The USB connection is not required for normal installations. The interface is compatible with the Universal Serial Bus Version 2.0 standard for operation as a “high-speed” device.

Table 24-4 USB Connections

Pin Name	Pin	I/O
USBO DP**	9	I/O
USBO DM**	10	I/O
USB VBUS**	19	In
SIGNAL GROUND	20	--

**Signals have ESD (Electrostatic Discharge) protection, but no lightning protection.
USB Type B Receptacle pigtail cable must be wired directly to J2001.

24.7 GI 260 (AOA Indicator)

24.7.1 Pigtail Connections

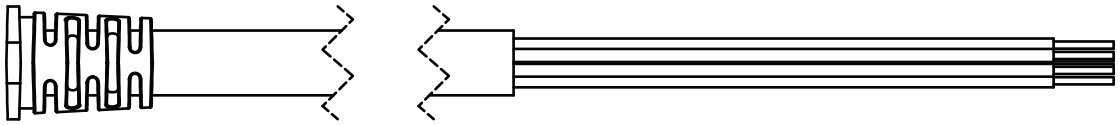


Figure 24-18 GI 260 Pigtail Harness

Pin Name	Wire Color	I/O
AIRCRAFT POWER	RED	IN
POWER GROUND	BLACK	--
CAN HI	BLUE	I/O
CAN LO	VIOLET	I/O
SHIELD GND	BLACK HEAT SHRINK	--
RS-232 RX	YELLOW	IN
RS-232 TX	BROWN	OUT
DC LIGHTING BUS	GRAY	IN
RESERVED	WHITE	--
RESERVED	GREEN	--
AUDIO SHIELD	BLACK HEAT SHRINK	--

24.7.2 Power

AIRCRAFT POWER 1 and POWER GROUND are connected to a 14/28 VDC supply..

Pin Name	Wire Color	I/O
AIRCRAFT POWER 1	RED	In
POWER GROUND	BLACK	--

24.7.3 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Refer to Section 2.3.1.3.2 for details on wiring the CAN bus. Using the CAN Bus is the preferred data interconnect for the GI 260 in a G3X system.

Pin Name	Wire Color	I/O
CAN HI	BLUE	I/O
CAN LO	VIOLET	$\overline{\text{I/O}}$

24.7.4 RS-232 CHANNEL

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. This channel is not used in typical G3X installations.

Pin Name	Wire Color	I/O
RS-232 RX	YELLOW	IN
RS-232 TX	BROWN	OUT

24.7.5 Lighting

The GI 260 display brightness can track either a 28 VDC or 14 VDC lighting bus using these inputs. If left unconnected, unit will use a photocell to adjust lighting.

Pin Name	Wire Color	I/O
DC LIGHTING BUS	GRAY	IN

24.8 GMC 305 (AFCS Mode Controller)

24.8.1 J3051 Connector

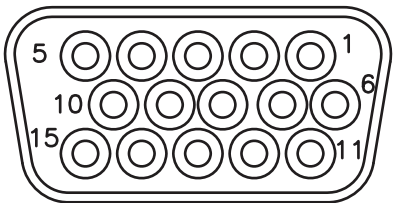


Figure 24-19 J3051 on GMC 305, as viewed looking at connector on unit

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	--

24.8.2 Power

This section covers the power input requirements. The GMC 305 is compatible with 14V and 28V systems. 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	--

24.8.3 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 display. RS-232 channel 2 should be connected to the GSA 28 roll servo RS-232 port in a Garmin autopilot system (see Figure 25-1.7).

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	--

24.8.4 Lighting

The GMC 305 supports two internal backlighting buses, one for the mode (indicator) lights above the buttons, and one for the button text, panel text, and knob backlighting.

Mode Indicator Backlighting - The lighting level for the mode (indicator) lights (triangles) above the buttons is controlled by the photocell only, and is not affected by the lighting bus input (pins 11 & 12). This makes sure the mode selection lights on the panel are always visible (and are independent of the externally applied lighting bus).

Button Text, Panel Text, and Knob Backlighting - The GMC 305 can be installed to use either the built-in photocell or the 14V lighting bus input for backlight control of the button text, panel text, and knob backlighting. The photocell controls all backlighting when the lighting bus input is below 1.4VDC (or unconnected). If the lighting bus input voltage is greater than 1.4VDC, the GMC 305 uses the lighting bus input voltage (1.4VDC-14.0VDC range) as a reference voltage (not power source) to adjust the backlighting for these items.

Most installations use the photocell backlighting (as it works well in most conditions) and leave pins 11 and 12 unconnected.

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

*Connect to power ground if pin 11 is used

24.9 GMC 307 (AFCS Mode Controller)

24.9.1 J3071 Connector

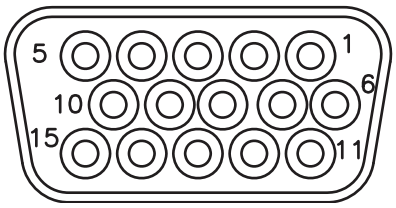


Figure 24-20 J3071 on GMC 307, as viewed looking at connector on unit

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	--

24.9.2 Power

This section covers the power input requirements. The GMC 307 is compatible with 14V and 28V systems. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J3071	7	In
AIRCRAFT POWER 2	J3071	9	In
POWER GROUND	J3071	5	--
POWER GROUND	J3071	15	--

24.9.3 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 display. RS-232 channel 2 should be connected to the GSA 28 roll servo RS-232 port in a Garmin autopilot system (see Figure 25-1.7).

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	J3071	1	Out
RS-232 IN 1	J3071	2	In
RS-232 OUT 2	J3071	3	Out
RS-232 IN 2	J3071	4	In
SIGNAL GROUND	J3071	6	--
SIGNAL GROUND	J3071	8	--

24.9.4 Lighting

The GMC 307 supports two internal backlighting buses, one for the mode (indicator) lights above the buttons, and one for the button text, panel text, and knob backlighting.

Mode Indicator Backlighting - The lighting level for the mode (indicator) lights (triangles) above the buttons is controlled by the photocell only, and is not affected by the lighting bus input (pins 11 and 12). This makes sure the mode selection lights on the panel are always visible (and are independent of the externally applied lighting bus).

Button Text, Panel Text, and Knob Backlighting - The GMC 307 can be installed to use either the built-in photocell or the 14V lighting bus input for backlight control of the button text, panel text, and knob backlighting. The photocell controls all backlighting when the lighting bus input is below 1.4VDC (or unconnected). If the lighting bus input voltage is greater than 1.4VDC, the GMC 307 uses the lighting bus input voltage (1.4VDC-14.0VDC range) as a reference voltage (not power source) to adjust the backlighting for these items.

Most installations use the photocell backlighting (as it works well in most conditions) and leave pins 11 and 12 unconnected.

Pin Name	Connector	Pin	I/O
LIGHTING BUS HI	J3071	11	In
LIGHTING BUS LO*	J3071	12	In

*Connect to power ground if pin 11 is used

24.10GMC 507 (AFCS Mode Controller)

24.10.1 J7001 Connector

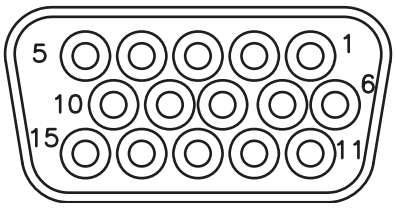


Figure 24-21 J7001 on GMC 507, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	UNIT ID 1	In
2	UNIT ID 2	In
3	CAN HI	I/O
4	CAN LO	I/O
5	RESERVED	--
6	CAN BUS TERM 2	--
7	AIRCRAFT POWER 1	In
8	CAN BUS TERM 1	--
9	AIRCRAFT POWER 2	In
10	TO/GA DISCRETE IN	In
11	LIGHTING BUS HI	In
12	RESERVED	--
13	RESERVED	--
14	RESERVED	--
15	POWER GROUND	--

24.10.2 Power

This section covers the power input requirements. The GMC 507 is compatible with 14V and 28V systems. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J7001	7	In
AIRCRAFT POWER 2	J7001	9	In
POWER GROUND	J7001	15	--

24.10.3 CAN Bus

The G3X CAN bus conforms to the BOSCH standard for Controller Area Network 2.0-B and ISO 11898. See Section 2.3.1.3 for details. To enable the internal CAN terminator when the GMC 507 is installed at one of the two ends of the CAN bus, a wire must be installed to short pin 6 to pin 8.

Pin Name	Connector	Pin	I/O
CAN HI	J7001	3	I/O
CAN LO	J7001	4	I/O
CAN BUS TERM 1	J7001	8	--
CAN BUS TERM 2	J7001	6	--

24.10.4 Lighting

The GMC 507 supports two internal backlighting buses, one for the mode (indicator) lights above the buttons, and one for the button text, panel text, and knob backlighting.

Mode Indicator Backlighting - The lighting level for the mode lights (indicator triangles) above the buttons is controlled by the photocell only, and is not affected by the lighting bus input (pins 11 and 12). This makes sure the mode selection lights on the panel are always visible (and are independent of the externally applied lighting bus).

Button Text, Panel Text, and Knob Backlighting - The GMC 507 can be installed to use either the built-in photocell or the 14V lighting bus input for backlight control of the button text, panel text, and knob backlighting. The photocell controls all backlighting when the lighting bus input is below 1.4VDC (or unconnected). If the lighting bus input voltage is greater than 1.4VDC, the GMC 507 uses the lighting bus input voltage (1.4VDC-28.0VDC range) as a reference voltage (not power source) to adjust the backlighting for these items.

Pin Name	Connector	Pin	I/O
LIGHTING BUS HI	J7001	11	In

24.10.5 TO/GA Discrete In

Provides an active low discrete input which may optionally be connected to a TO/GA button, see Figure 25-1.8.

Pin Name	Connector	Pin	I/O
TO/GA DISCRETE IN	J7001	10	In

24.10.6 Unit ID

Leave pins 1 and 2 open to configure as GMC 507 #1. Strap pins 1 and 2 together to configure as GMC 507 #2. GMC 507 #2 will act as a remote controller only, monitoring is turned off and the AP disconnect and TO/GA inputs are left unconnected.

Pin Name	Connector	Pin	I/O
UNIT ID 1	J7001	1	In
UNIT ID 2	J7001	2	In

24.11 GMU 11 (Magnetometer)

24.11.1 J441 Connector

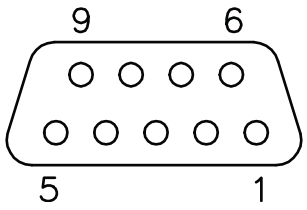


Figure 24-22 J111 on GMU 11, as viewed looking at connector on unit

Pin	Pin Name	I/O
1	CAN BUS HI	I/O
2	CAN BUS LO	I/O
3	UNIT ID	IN
4	RESERVED	--
5	RESERVED	--
6	SIGNAL GROUND	--
7	AIRCRAFT POWER 1	IN
8	AIRCRAFT POWER 2	IN
9	POWER GROUND	--

24.11.2 Power Function

NOTE

The GMU 11 must be powered from aircraft power. Do not connect the GMU 11 to the magnetometer power output pins on the GSU 25 (these pins are intended for use only with the GMU 22).

The GMU 11 is compatible with 14V and 28V systems. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J111	7	In
AIRCRAFT POWER 2	J111	8	In
POWER GROUND	J111	9	--

24.11.2.1 Unit ID

Install a jumper connecting pin 3 to pin 6 to configure unit as Magnetometer #2.

Pin Name	Connector	Pin	I/O
UNIT ID	J111	3	IN
SIGNAL GROUND	J111	6	--

24.11.2.2 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Refer to Section 2.3.1.3 for details on wiring the CAN bus.

Pin Name	Connector	Pin	I/O
CAN BUS HI	J111	1	I/O
CAN BUS LO	J111	2	I/O

24.12 GMU 22 (Magnetometer)

24.12.1 J441 Connector

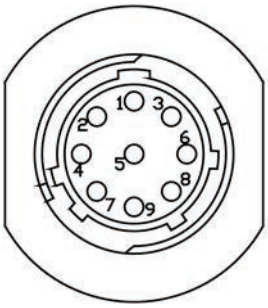


Figure 24-23 J441 on GMU 22, as viewed looking at connector on unit

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

24.12.2 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	--

24.12.3 Serial Data

24.12.3.1 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

24.12.3.2 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

24.13 GPS 20A (WAAS GPS Position Source)

24.13.1 J201 Connector

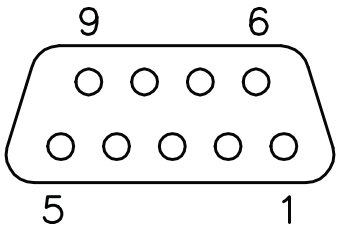


Figure 24-24 J201 on GPS 20A, as viewed looking at connector on unit

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

24.13.2 Power Function

This section covers the power input requirements. The GPS 20A is compatible with 14V and 28V systems. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are “diode ORed” to provide power redundancy.

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	J201	7	In
AIRCRAFT POWER 2	J201	8	In
POWER GROUND	J201	9	--

24.13.3 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Refer to Section 2.3.1.3 for details on wiring the CAN bus. Using the CAN Bus is the preferred data interconnect for the GPS 20A in a G3X system.

Pin Name	Connector	Pin	I/O
CAN-H	J201	1	I/O
CAN-L	J201	2	$\overline{\text{I/O}}$

24.13.4 RS-232 CHANNEL

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 TX 1 is always configured to provide Garmin ADS-B+ data (at 9600 baud), to be used by a Mode S Extended Squitter (ES) transponder.

RS-232 TX 2 is always configured to provide NMEA 0183 data out at 9600 baud, 1 start bit, 1 stop bit, 8 data bits, and no parity. The supported NMEA sentences are GPRMC, GPGGA, GPGSA, GPGSV, GPVTG, and PGRMT.

See Figure 25-2.11 for wiring information. .

Pin Name	Connector	Pin	I/O
RS-232 RX 1	J201	4	In
RS-232 TX 1	J201	5	Out
RS-232 TX 2	J201	3	Out

24.14 GSA 28 (Autopilot Servo)

24.14.1 J281 Connector

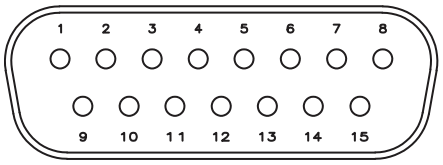


Figure 24-25 J281 on GSA 28, as viewed looking at connector on unit

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	CWS/DISCONNECT	In

24.14.2 Power Function

Supply voltage (14/28Vdc) inputs.

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

24.14.3 CWS/Disconnect

CWS/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 CWS/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
CWS/DISCONNECT	J281	15	In

24.14.4 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	--

24.14.5 ID STRAP

The ID Strap inputs are used to configure the GSA 28 as a roll, roll trim, pitch, pitch trim, 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

Roll Trim: Jumper wire installed from pin 5 to pin 8 and from pin 6 to 7

Pitch Trim: Jumper wire installed from pin 7 to pin 8

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

24.14.6 RS-232

Pins 7 and 8 (TX and RX) connect to the GMC 30X 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

24.14.7 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

24.15 GSU 25 (AHRS/Air Data Sensor Unit)

24.15.1 J251

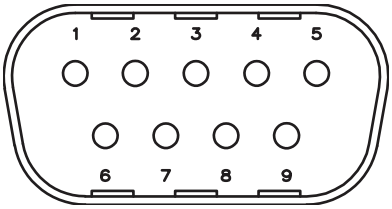


Figure 24-26 J251 on GSU 25, as viewed looking at connector on unit

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	--

24.15.1.1 J252

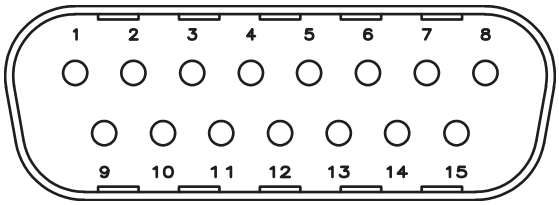


Figure 24-27 J252 on GSU 25, as viewed looking at connector on unit

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

24.15.2 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.

NOTE

The GSU 25 magnetometer power output pin is intended for use only with the GMU 22. Do not connect the GMU 11 or any other device to this pin.

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 using pins 6 & 7.

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

24.15.3 Serial Data

24.15.3.1 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 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. Primary transponder connection is made to ADAHRS 1. A second transponder connection to ADAHRS 2 can be made for redundancy of this datapath.

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

24.15.3.2 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	12	In
RS-485 RX B	J252	13	In

24.15.3.3 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	--

24.15.4 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 19-2 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

24.15.5 Unit ID

Refer to Figure 25-1.6 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)

24.16 GTP 59 (Temperature Probe)

The GTP 59 has one three-wire interface cable as shown in Figure 24-28. Wire color designations are shown in Figure 24-29

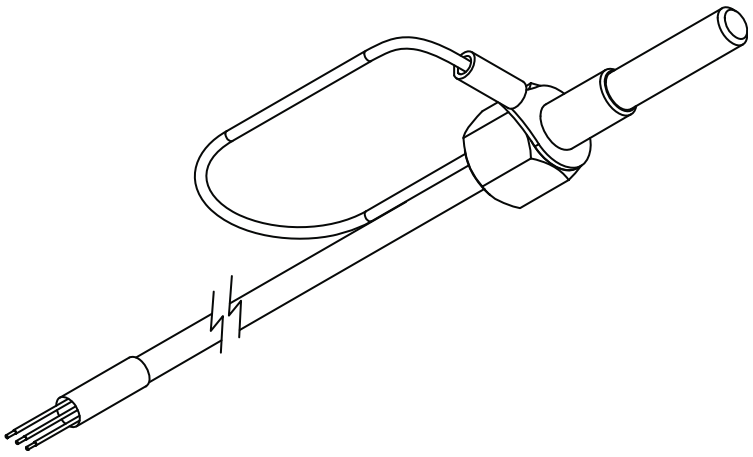


Figure 24-28 GTP 59

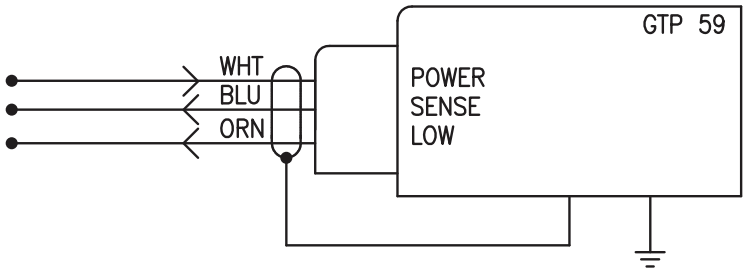


Figure 24-29 GTP 59 Wire Color Designations

24.17 GTR 20 (VHF Communications Radio)

24.17.1 J2001 Connector

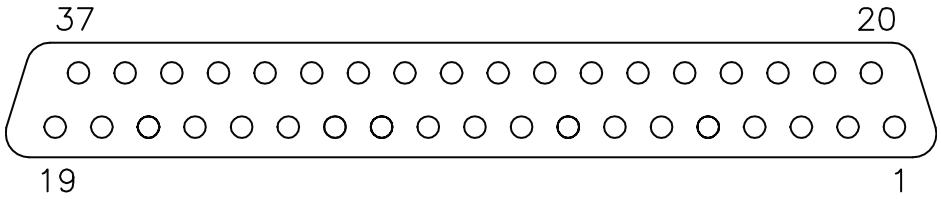


Figure 24-30 J2001 Looking at rear of unit

Table 24-5 J2001 Connector

Pin	Pin Name	I/O
1	AIRCRAFT POWER	In
2	DISC 1*	In
3	RESERVED	--
4	TX INTERLOCK OUT	Out
5	TX INTERLOCK IN*	In
6	CAN BUS LO	--
7	CAN BUS HI	--
8	ID IN	In
9	AUX MONO IN 2	In
10	RECEIVER AUDIO OUT HI	Out
11	COPILOT HS RIGHT	Out
12	COPILOT HS LEFT	Out
13	PILOT HS RIGHT	Out
14	PILOT HS LEFT	Out
15	COPILOT PTT*	In
16	COPILOT MIC IN	In
17	PILOT MIC IN	In
18	MUSIC IN RIGHT	In
19	MUSIC IN LEFT	In
20	AIRCRAFT GROUND	--
21	SPARE	--
22	DISC 2*	In
23	RESERVED	--
24	RESERVED	--
25	CAN TERM B	--
26	CAN TERM A	--
27	ID LO	--
28	AUX 2 LO	--
29	RECEIVER AUDIO LO	--

*Indicates Active Low

Table 24-5 J2001 Connector

Pin	Pin Name	I/O
30	COPILOT HS LO	--
31	AUX 1 LO	--
32	AUX MONO IN 1	In
33	PILOT HS LO	--
34	COPILOT MIC LO	--
35	PILOT PTT*	In
36	PILOT MIC LO	--
37	MUSIC LO	In

*Indicates Active Low

24.17.2 Power

Pins 1 & 20 supply power to the GTR 20. Refer to drawings in Section 25 for power and ground wire gauges.

Pin Name	Pin	I/O
AIRCRAFT POWER	1	In
AIRCRAFT GROUND	20	--

24.17.3 CAN Bus

The CAN Bus conforms to the BOSCH standard for Controller Area Network 2.0-B, and complies with ISO 11898. Pins 25 and 26 are used to terminate the CAN bus. To terminate the CAN bus at the GTR 20, short the pins (25 and 26) together. Refer to Section 2.3.1.3 for details on configuring and terminating the CAN bus. The CAN bus on J2001 shall be used for communications between G3X LRUs.

Pin Name	Pin	I/O
CAN BUS LO	6	I/O
CAN BUS HI	7	I/O
CAN TERM B	25	--
CAN TERM A	26	--

24.17.4 Unit ID

Refer to drawings in Section 25 for ID connections.

Pin Name	Pin	I/O
ID IN	8	In
ID LO	27	--

24.17.5 MIC Audio

PILOT MIC IN and COPILOT MIC IN are standard carbon or dynamic MIC inputs with integrated preamps providing minimum 20 mVrms into a 150 Ω AC load.

PILOT MIC IN and COPILOT MIC IN are set in the factory so that 150 mVrms modulates the transmitter to 90% nominally at 1000 Hz. The microphone gain adjustment is made through Configuration Mode.

Pin Name	Pin	I/O
PILOT MIC IN	17	In
PILOT MIC LO	36	--
COPILOT MIC IN	16	In
COPILOT MIC LO	34	--

24.17.6 Aux Mono Audio

Auxiliary audio mono audio inputs have a nominal input impedance of 600 Ω, max. rated input level is 5 Vrms.

Pin Name	Pin	I/O
AUX MONO IN 1	32	In
AUX 1 LO	31	--
AUX MONO IN 2	9	In
AUX 2 LO	28	--

24.17.7 Headset Audio

Headset audio outputs

Pin Name	Pin	I/O
PILOT HS RIGHT	13	Out
PILOT HS LEFT	14	Out
PILOT HS LO	33	--
COPILOT HS RIGHT	11	Out
COPILOT HS LEFT	12	Out
COPILOT HS LO	30	--

24.17.8 Music Inputs

The music inputs are noise rejecting and have a nominal input impedance of 600 Ω. The max. rated input level is 1.5 Vrms. The MUSIC LO must be connected to the music source along with MUSIC RIGHT and MUSIC LEFT. If MUSIC LO is not connected, music volume will be low (or inaudible), noisy, and distorted.

Pin Name	Pin	I/O
MUSIC IN RIGHT	18	In
MUSIC IN LEFT	19	In
MUSIC LO	37	--

24.17.9 Receiver Audio

RECEIVER AUDIO OUT is a 40 mW audio output that is intended to drive a recording device or an audio panel.

RECEIVER AUDIO OUT supplies 40 mW (4.9 Vrms) into a 600Ω load, and is generally connected to the audio panel (if used). This output can also drive a recording device. When driving a recording device the output level will typically need to be reduced. The output level is controlled through configuration mode.

RECEIVER AUDIO OUT is the summation of the receiver audio, COM sidetone audio, intercom audio, and AUX audio.

Pin Name	Pin	I/O
RECEIVER AUDIO OUT HI	10	Out
RECEIVER AUDIO LO	29	--

24.17.10 Pilot/Copilot PTT Inputs

When pulled low, these inputs allow the audio that is present on the PILOT/COPILOT MIC IN to be transmitted over the radio.

Active-Low discrete inputs are considered active if either the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 Ω.

These inputs are considered inactive if the voltage to ground is 6.5-33 VDC or the resistance to ground is >100 kΩ.

Pin Name	Pin	I/O
PILOT PTT*	35	In
COPILOT PTT*	15	In

*Indicates Active Low

24.17.11 TX Interlock

TX Interlock Out is an active low output that indicates that this radio's (GTR 20) COM is transmitting. Connect to another COM's TX Interlock input. TX INTERLOCK OUT will sink 20mA of current and will output a voltage of 1V or less.

TX Interlock In is an active low input that desenses (protects) the COM receiver when another COM is transmitting.

TX Interlock In is considered active if either the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 Ω.

TX Interlock In is considered inactive if the voltage to ground is 6.5-33 VDC or the resistance to ground is >100 kΩ.

NOTE

The Transmit Interlock status will report as active in the System Information screen when this input is pulled low.

NOTE

Headset shorts will be detected when ear and/or mic inputs are shorted to each other or ground. This will be displayed in the System Information screen, and reported as Left channel shorted, or Right channel shorted.

Pin Name	Pin	I/O
TX INTERLOCK OUT	4	Out
TX INTERLOCK IN*	5	In

*Indicates Active Low

24.17.12 Discrete Inputs

These discrete inputs are active low and are configurable.

See Section 31.4.27 when configuring the GTR 20 as the intercom, the configuration options are: None, Frequency Swap, Pilot Intercom Key, and Copilot Intercom Key. When configuring the GTR 20, but not as the intercom, the options are: None and Frequency Swap (Section 31.4.27).

Active-Low discrete inputs are considered active if either the voltage to ground is ≤3.5 VDC or the resistance to ground is ≤375 W.

These inputs are considered inactive if the voltage to ground is 6.5-33 VDC or the resistance to ground is >100 kW.

Pin Name	Pin	I/O
DISC 1*	2	In
DISC 2*	22	In

*Indicates Active Low

24.18 GTX 23 (Mode S Transponder)

24.18.1 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.

24.18.2 J2301 Connector

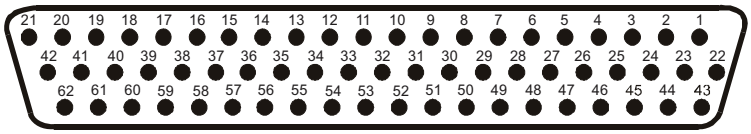


Figure 24-31. J2301 on GTX 23, as viewed looking at connector on unit

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	--

*Denotes active low (ground to activate)

Pin	Pin Name	I/O
30	ARINC 429 OUT 2 A	Out
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)

24.18.3 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	--

24.18.4 Discrete Functions

24.18.4.1 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

24.18.4.2 Discrete 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

24.18.5 Serial Data Electrical Characteristics

24.18.5.1 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 3 RS-232 port on ADAHRS 1.

For installations that enable ADS-B, RS-232 input channel 2 should be connected to a GNS™ 4XXW/5XXW-series WAAS enabled receiver or a GTN™ 6XX/7XX touchscreen avionics. 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 Section 25 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	--

24.18.5.2 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/GTN 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	--

25 G3X™ AVIONICS W/GSU 25 AND/OR GAD 29 INTERCONNECT DRAWINGS

FIGURE **PAGE**

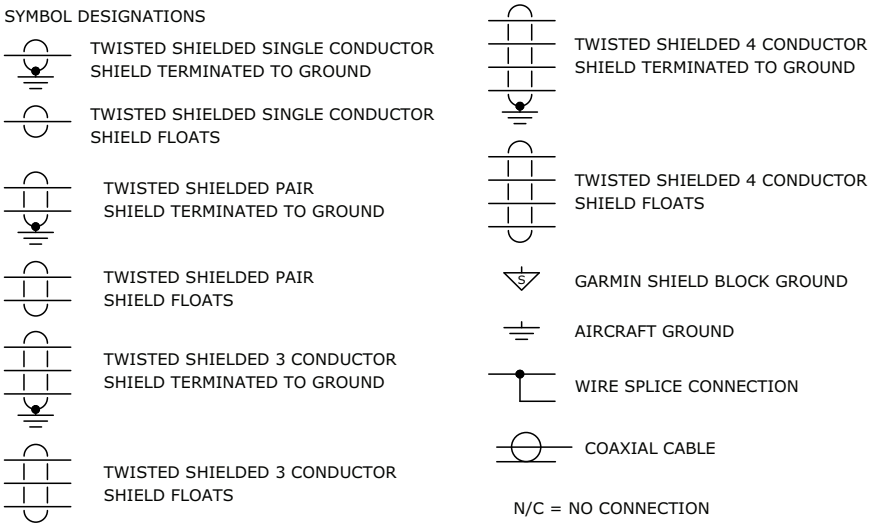
Core Interconnect Notes for Section 25.1 3 25-3
GDU/GMU 22/GSU 25 Interconnect Drawing 25-4
GDU/GMU 11/GSU 25 Interconnect Drawing 25-5
Power, Backup Power (4 AH), and Antennas Interconnect Drawing 25-6
Power, Backup Power (3 AH/6 AH), and Antennas Interconnect Drawing 25-7
GMU 22/GSU 25/GTP 59/GI 260 Interconnect Drawing 25-8
GMC 30X/GSA 28 Interconnect Drawing 25-9
GMC 507/GSA 28 Interconnect Drawing 25-10
GSA 28 Roll and Pitch Trim Interconnect Drawing 25-11
GSA 28 - Trim Motor and Switch Interconnect Drawing 25-12
GSA 28 - Trim Servo Switch Interconnect Drawing 25-13
GEA 24/GSU 25 - GDU 37X/4XX Backup Data Path Interconnect Drawing 25-14
External Interconnect Drawing Notes for Section 25.2 25-15
GAD 27 Interconnect Example (page 1 of 5) 25-16
GAD 27 Interconnect Example (page 2 of 5) 25-17
GAD 27 Interconnect Example (page 3 of 5) 25-18
GAD 27 Interconnect Backlighting Example (page 4 of 5) 25-19
GAD 27 Interconnect Keep-Alive Example (page 5 of 5) 25-20
GAD 27 Flap Switch Example, 3 Position (page 1 of 3) 25-21
GAD 27 Flap Switch Example, Push Button (page 2 of 3) 25-22
GAD 27 Flap Switch Example, Rotary (page 3 of 3) 25-23
GDL 39/GDL 39R Interconnect/Configuration Example 25-24
GDL 5XR Interconnect/Configuration Example 25-25
GDU 37X/4XX - External LRU Interconnect Examples (page 1 of 2) 25-26
GDU 37X/4XX - External LRU Interconnect Examples (page 2 of 2) 25-27
Single GNC 355 Interconnect/Configuration Example 25-28
Single GNS 430(W)/530(W) Interconnect/Configuration Example 25-29
Dual GNS 430(W)/530(W) Interconnect/Configuration Example 25-30
GNS 480 Interconnect/Configuration Example 25-31
GSU 25 - GTX 23ES Transponder Interconnect/Config Example 25-32
GSU 25 - GTX 32/327/328/330 Interconnect/Configuration Example 25-33
GSU 25 - GTX 345/345R/45R Interconnect/Configuration Example 25-34
GSU 25 - GTX 345/345R/45R ADS-B Position Source Options 25-35
GSU 25 - GTX 345/345R/45R, GPS 175/GNC 355 Interconnect Example 25-36
GSU 25 - GTX 335/35R Interconnect/Configuration Example 25-37

GSU 25 - GNX 375/GDU 4XX Interconnect/Configuration Example 25-38
GSU 25 - GPS 175/GDU 4XX Interconnect/Configuration Example..... 25-39
Single GTN 6XX/7XX Interconnect/Configuration Example..... 25-40
Dual GTN 6XX/7XX Interconnect/Configuration Example 25-41
GNC 300XL/GDU 4XX Interconnect/Configuration Example 25-42
GDU 4XX v8.50 Interconnect/Configuration Example 25- 43
Non-Garmin Auto Pilot Interconnect/Configuration Example..... 25-44
Non-Garmin Auto Pilot Interconnect/Configuration Example w/GMC 30X..... 25-45
GDU 37X/4XX Audio to GMA 240/245 or GTR 20/200 Interconnect/Configuration Example 25-46
GDU 4XX Audio to GMA 342/GMA 345 Interconnect/Configuration Example 25-47
WX-500/Lightning Detector Interconnect/Configuration Example..... 25-48
GSU 25/GDU4XX/GI 275 Interconnect Example 25-49
GHA 15 Interconnect Example..... 25-50
GDU4XX - GNC 215/GTR 205 Interconnect Example..... 25-51
GCO™ 14 Display Interconnect Example 25-52

25.1 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. NOTE REMOVED
8. INSTALLATION INFORMATION IS PROVIDED FOR CONFIGURATION MODULES AND THERMOCOUPLES IN SECTION 21, FOR GMU 22 IN SECTION 13, AND FOR THE GTP 59 IN SECTION 17.
9. IN A 2 DISPLAY INSTALLATION, THE SECOND DISPLAY CAN BE CONNECTED AS SHOWN.
10. OPTIONAL INTERFACE.
11. THE GDU 46X/37X CAN BE CONFIGURED TO ACCEPT A 14V OR 28V LIGHTING BUS INPUT. SEE SECTION 29 FOR CONFIGURATION.
12. ONLY ONE GDU 46X/37X GPS ANTENNA CONNECTION IS REQUIRED FOR THE G3X SYSTEM. ADDITIONAL ANTENNAS CAN BE ADDED FOR REDUNDANCY IF DESIRED. SEE SECTION 29 FOR DETAILS REGARDING GDU 46X/37X GPS ANTENNA CONFIGURATION.
13. NOTE REMOVED
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 GEA 24 TO PROVIDE THE PILOT WITH AN ANNUNCIATION WHEN THE BACK-UP BATTERY IS BEING UTILIZED. SEE SECTION 29 FOR MORE INFORMATION ON CONFIGURATION OF GEA 24 DISCRETE INPUTS.

Figure 25-1.1 Core Interconnect Notes for Section 25.1

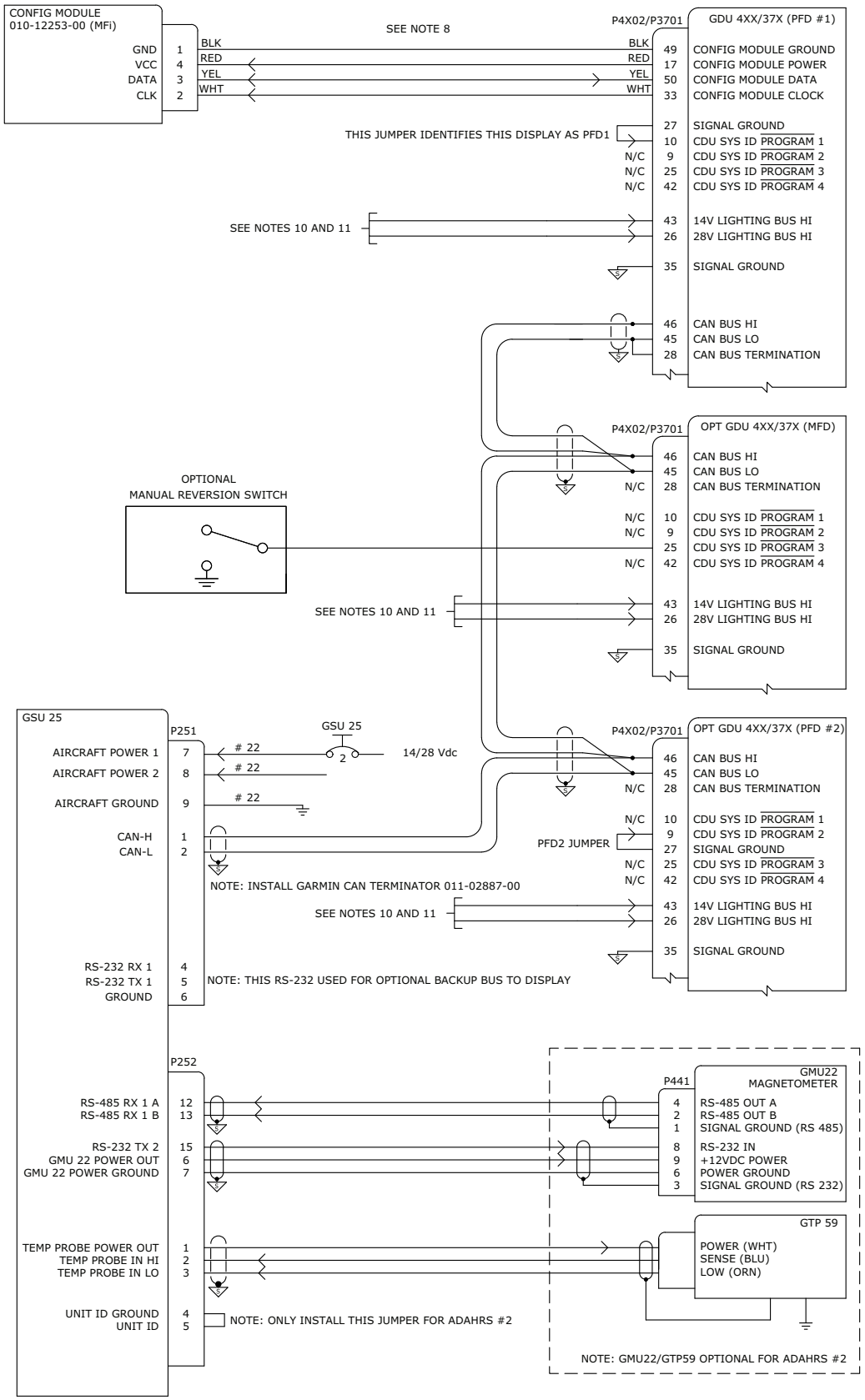


Figure 25-1.2 GDU/GMU 22/GSU 25 Interconnect Drawing

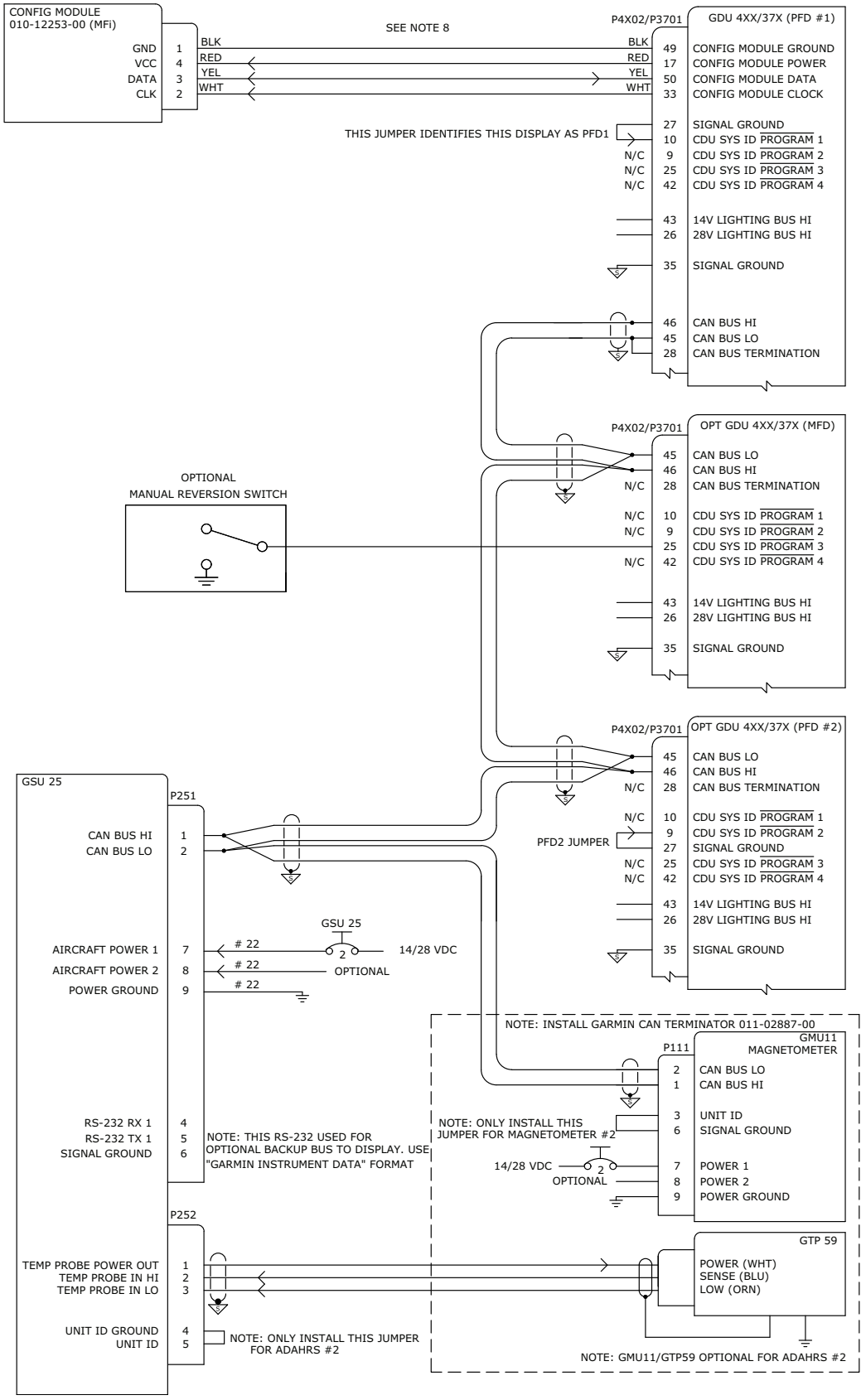


Figure 25-1.3 GDU/GMU 11/GSU 25 Interconnect Drawing

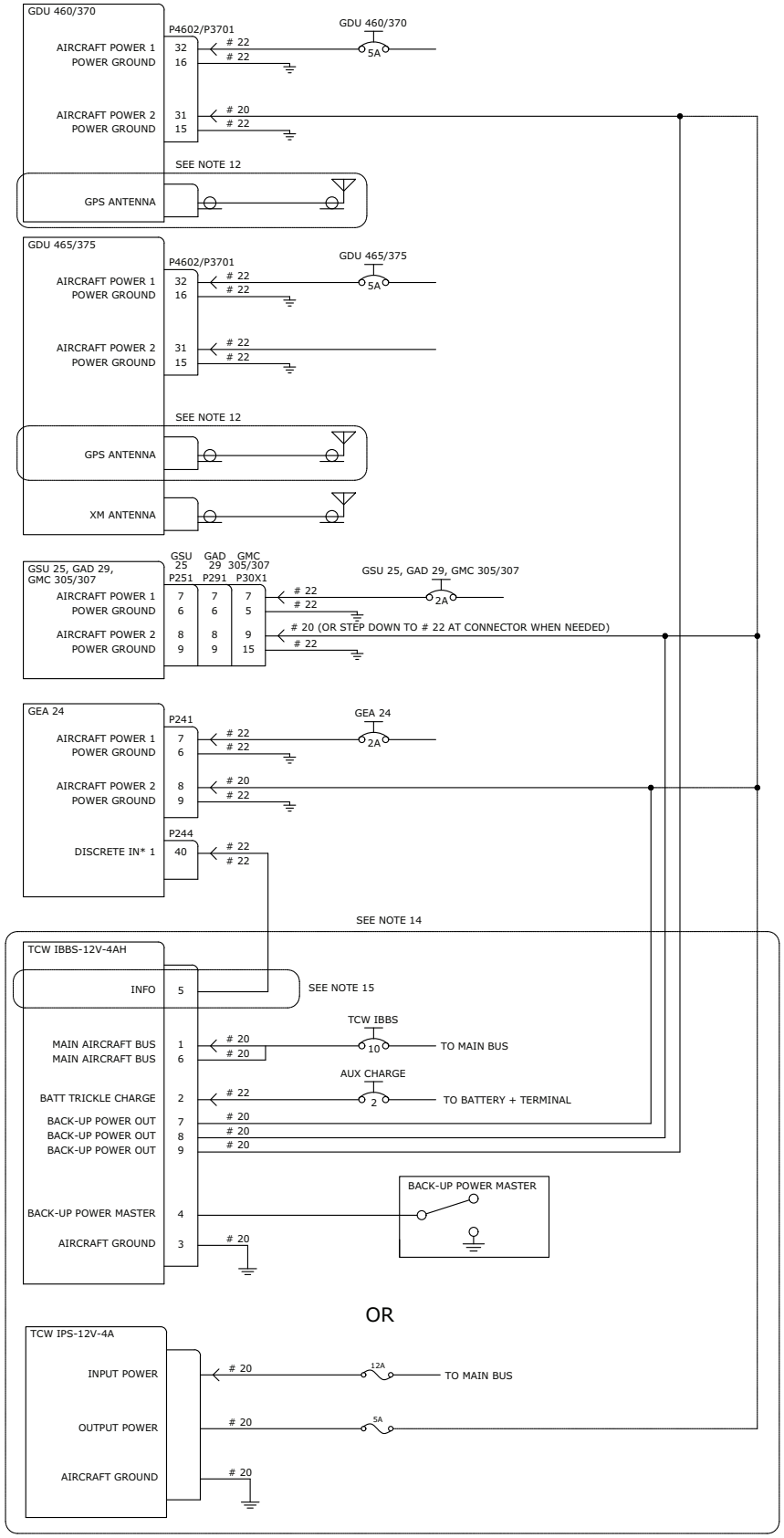


Figure 25-1.4 Power, Backup Power (4 AH), and Antennas Interconnect Drawing

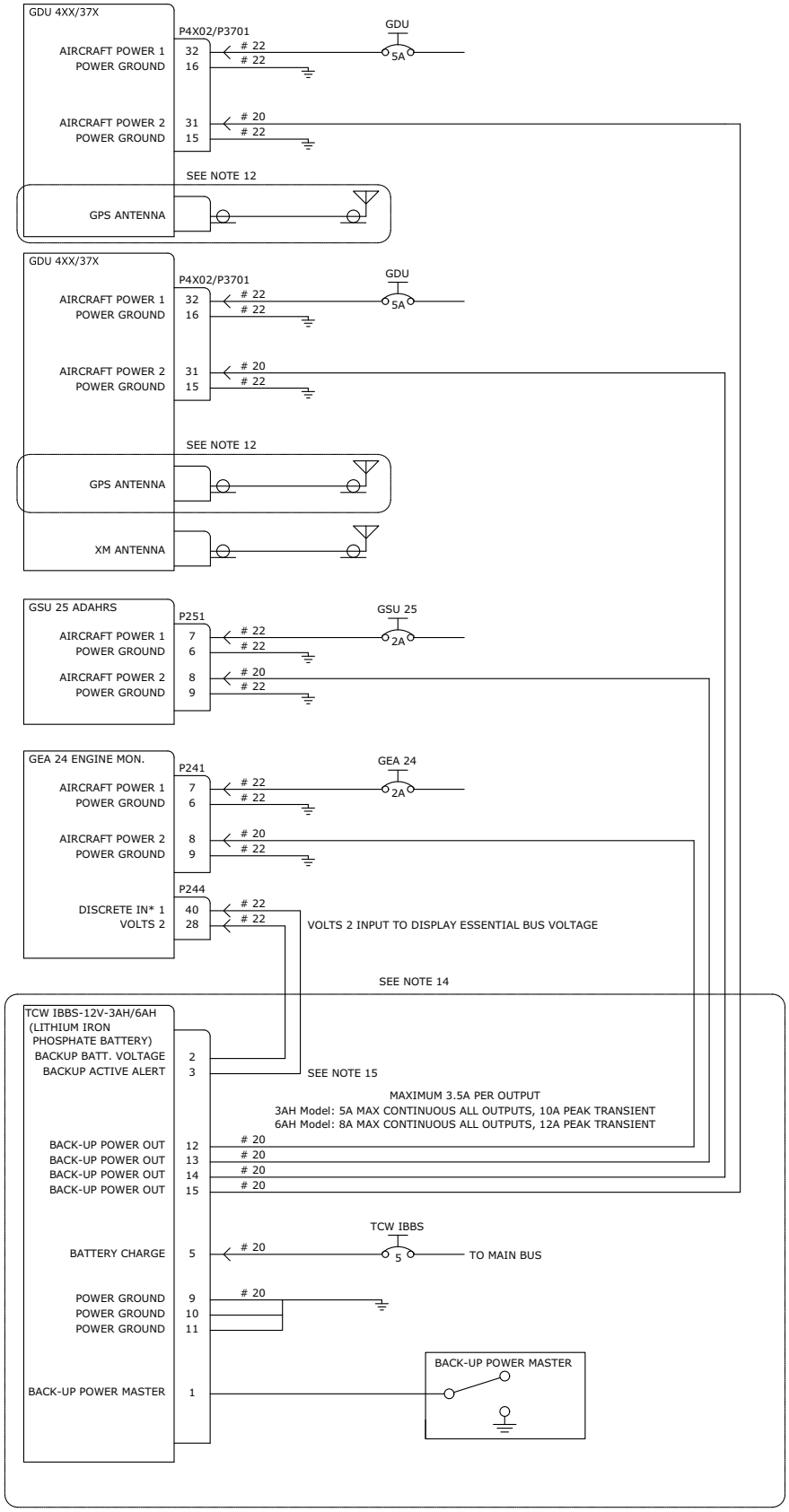
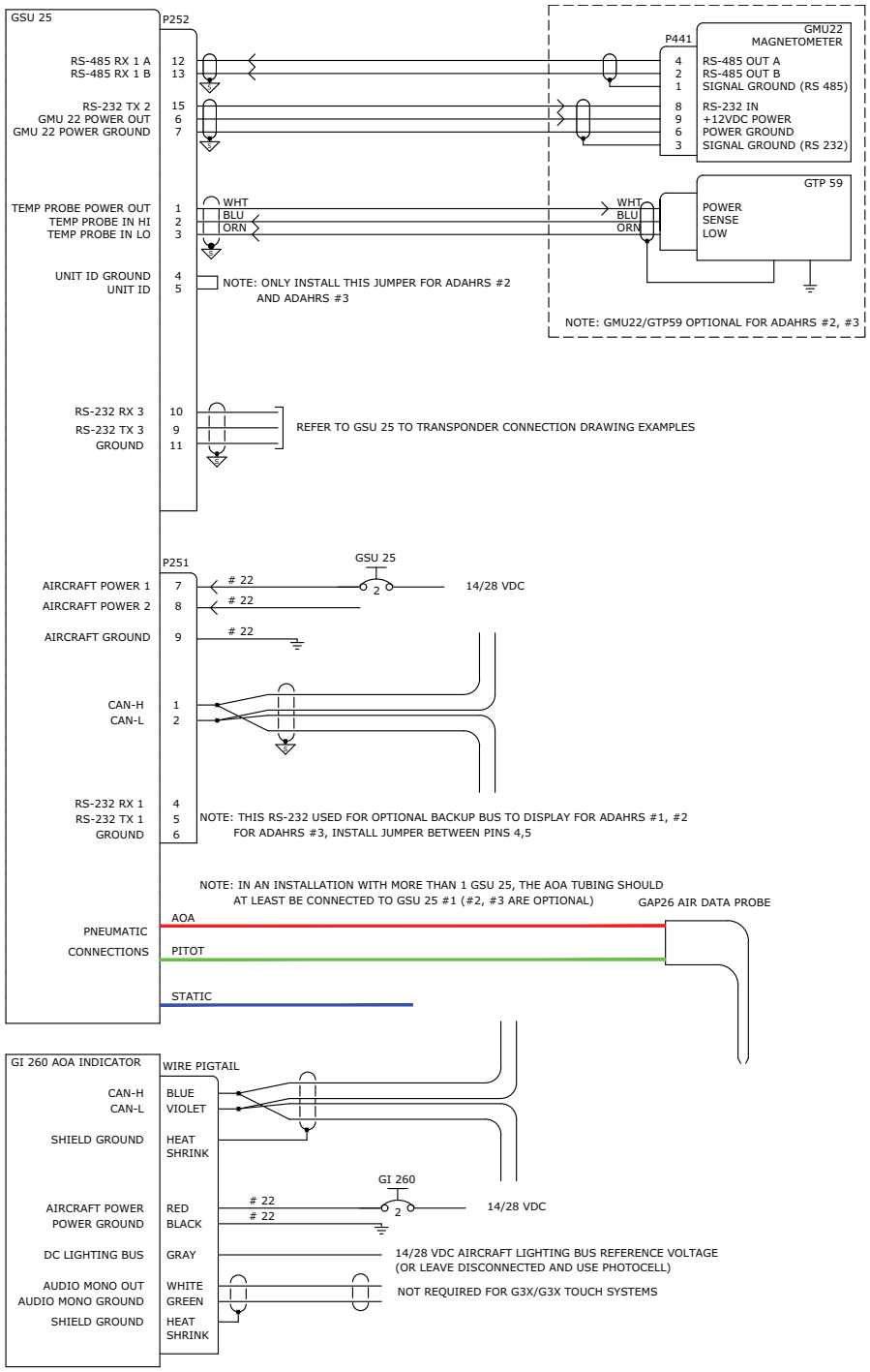


Figure 25-1.5 Power, Backup Power (3 AH/6 AH), and Antennas Interconnect Drawing



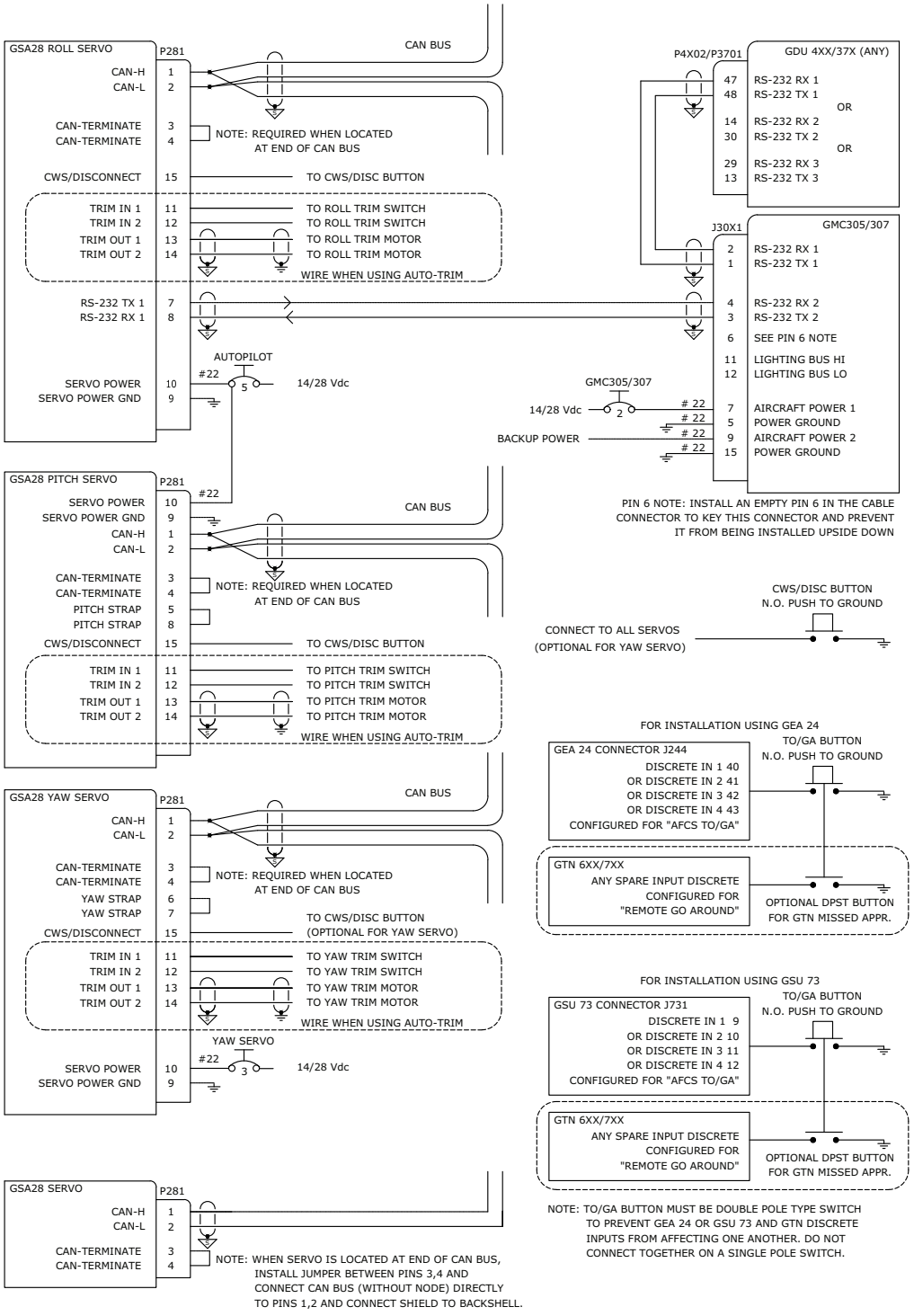
CONFIGURATION GUIDANCE

1. G3X

A. ON THE GDU 46X/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

B. IF USING THE GSU 25 RS-232 1 PORT AS A BACKUP BUS, ON THE GDU 46X/37X CONFIG MODE RS-232 CONFIGURATION PAGE
- SELECT "GARMIN INSTRUMENT DATA" FOR THE RS-232 PORT CONNECTED TO THE GSU 25

Figure 25-1.6 GMU 22/GSU 25/GTP 59/GI 260 Interconnect Drawing



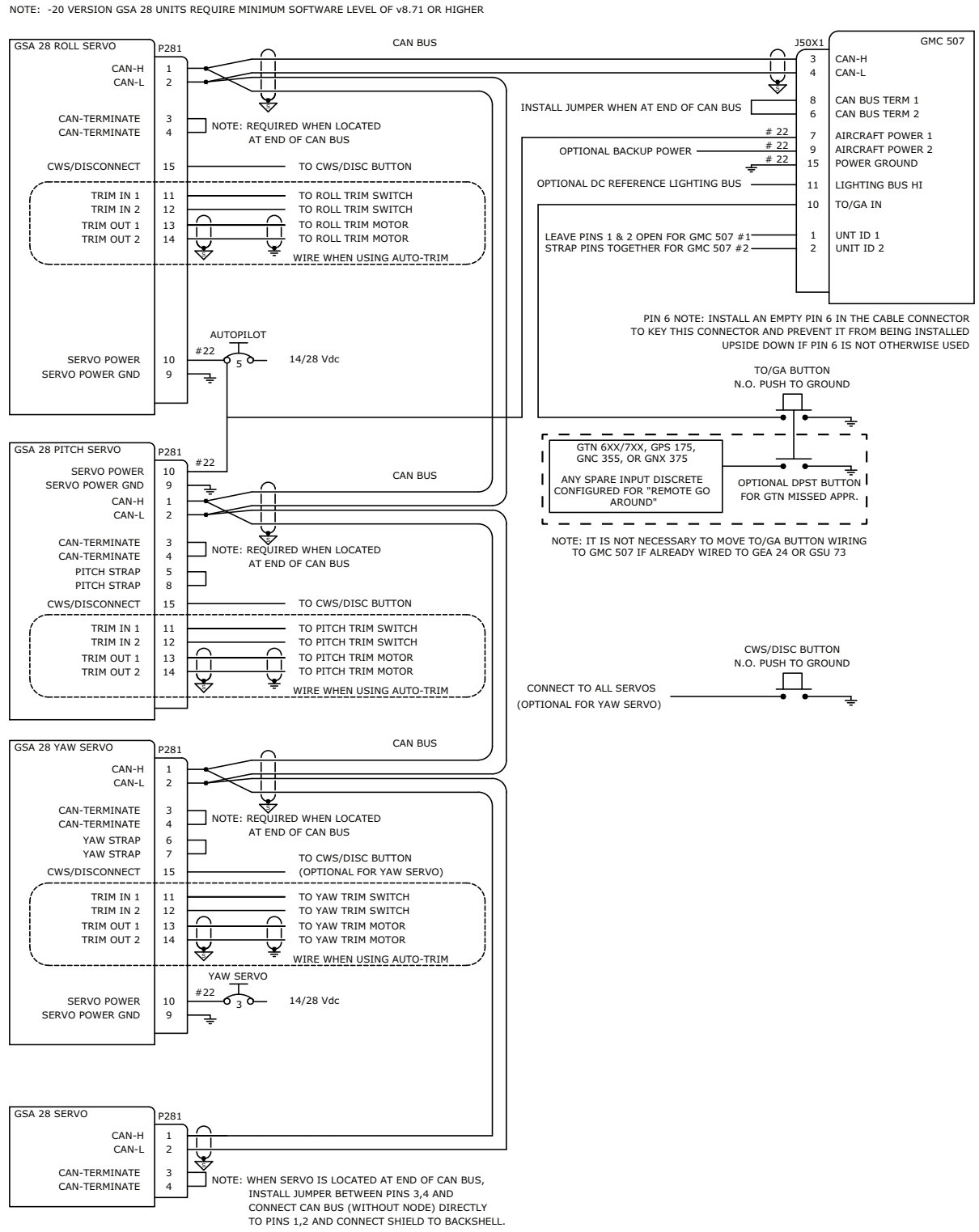
CONFIGURATION GUIDANCE

1. G3X

A. ON THE GDU 4XX/37X CONFIG MODE RS-232 PORT CONFIGURATION PAGE
- SET RS-232 PORT CONNECTED TO THE GMC TO "GARMIN INSTRUMENT DATA"

B. ON THE GDU 4XX/37X CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE
- SET AUTOPILOT SERVOS TO ONE OF FOLLOWING: "ROLL ONLY", "PITCH + ROLL", OR "PITCH + ROLL + YAW"

Figure 25-1.7 GMC 30X/GSA 28 Interconnect Drawing



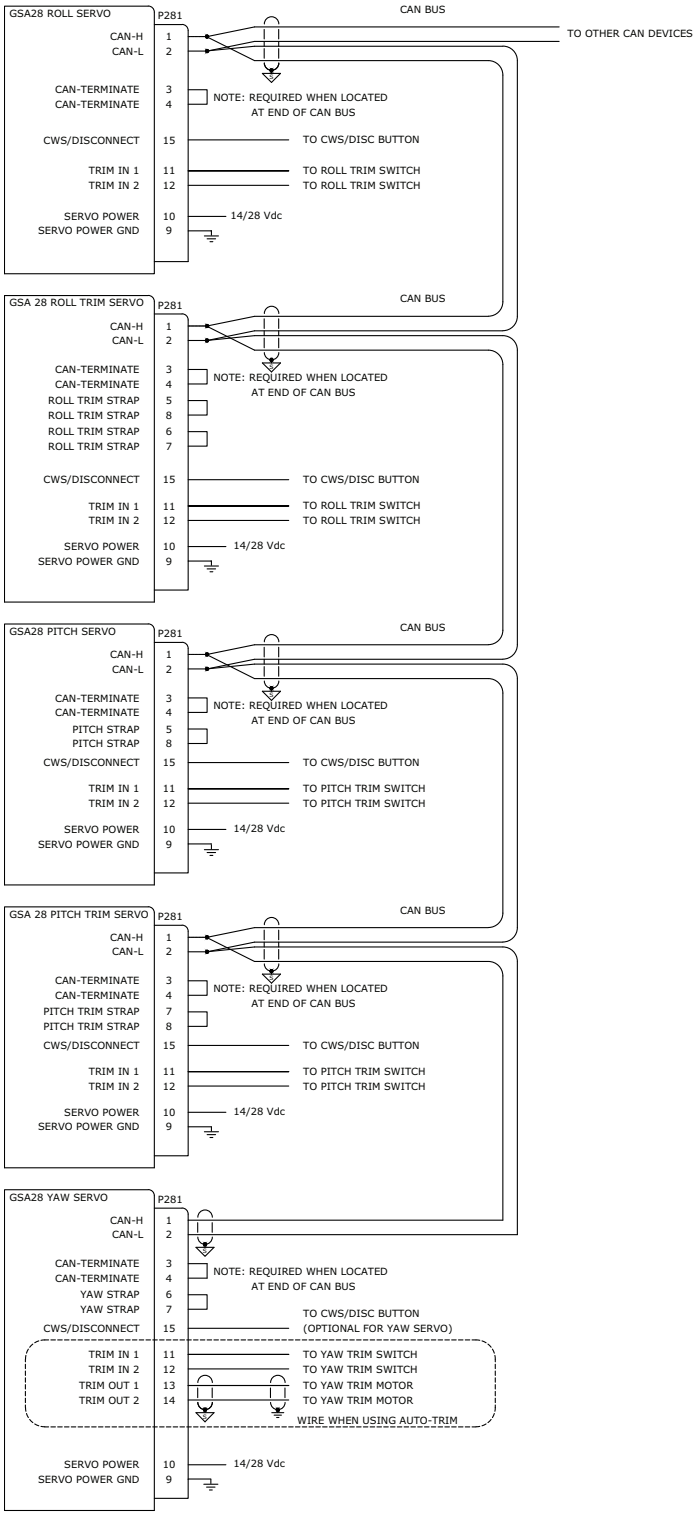
CONFIGURATION GUIDANCE

1. G3X

A. ON THE GDU 4XX/37X CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE

- SET AUTOPILOT SERVOS TO ONE OF FOLLOWING:
  "ROLL ONLY", "PITCH + ROLL", OR "PITCH + ROLL + YAW"

Figure 25-1.8 GMC 507/GSA 28 Interconnect Drawing



CONFIGURATION GUIDANCE

1. G3X TOUCH™ AVIONICS ONLY

A. ON THE GDU 4XX CONFIG MODE LRU EQUIPMENT CONFIGURATION PAGE

- SET AUTOPILOT SERVOS TO ONE OF FOLLOWING:"ROLL ONLY", "PITCH + ROLL", OR "PITCH + ROLL + YAW"
- ENABLE ROLL TRIM SERVO AND/OR PITCH TRIM SERVO ONLY IF GSA 28 SERVO IS BEING USED FOR ROLL OR PITCH TRIM. FOR DC TRIM MOTORS, LEAVE THESE TRIM SERVOS DISABLED.

Figure 25-1.9 GSA 28 Roll and Pitch Trim Interconnect Drawing

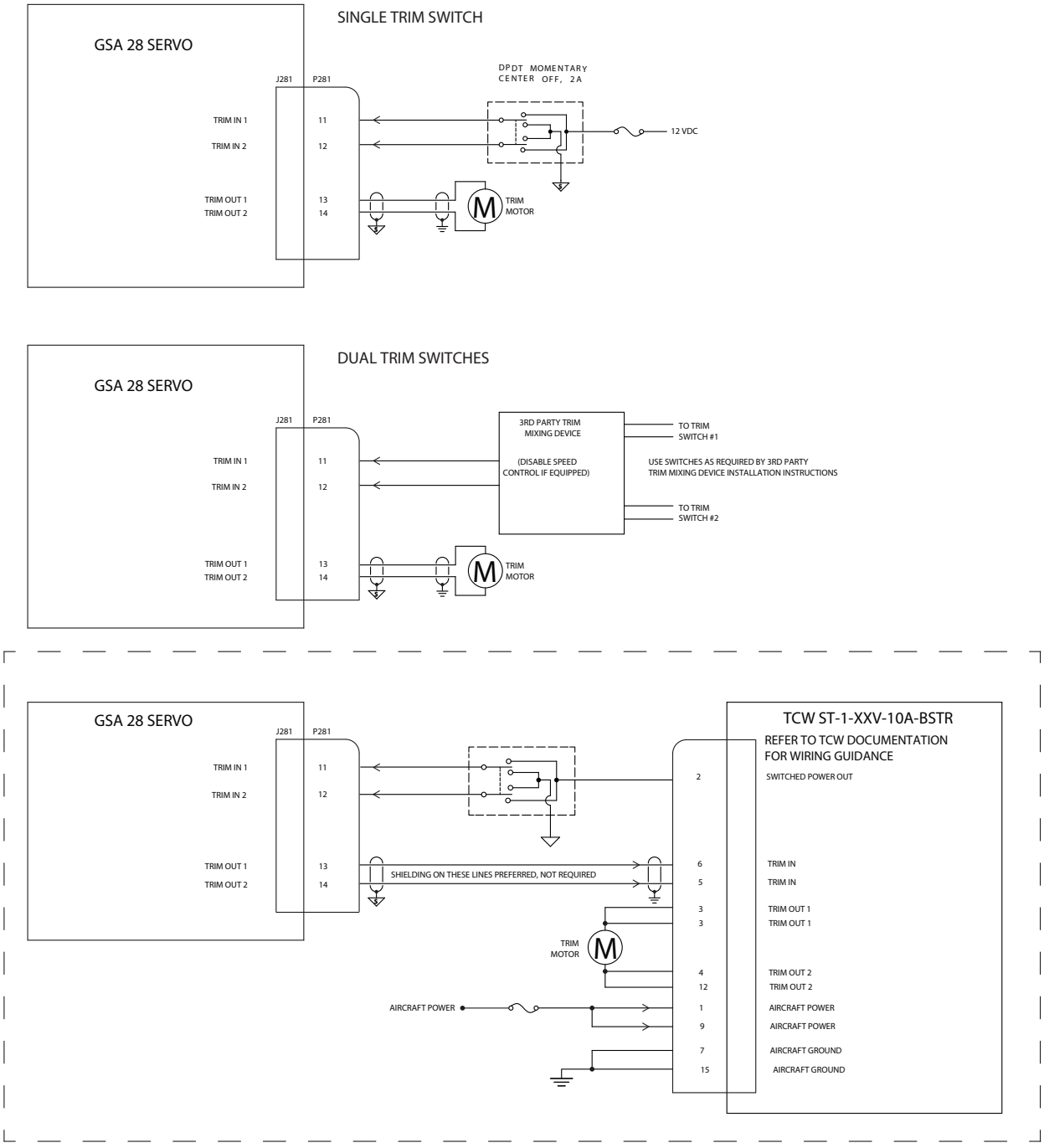


Figure 25-1.10 GSA 28 - Trim Motor and Switch Interconnect Drawing

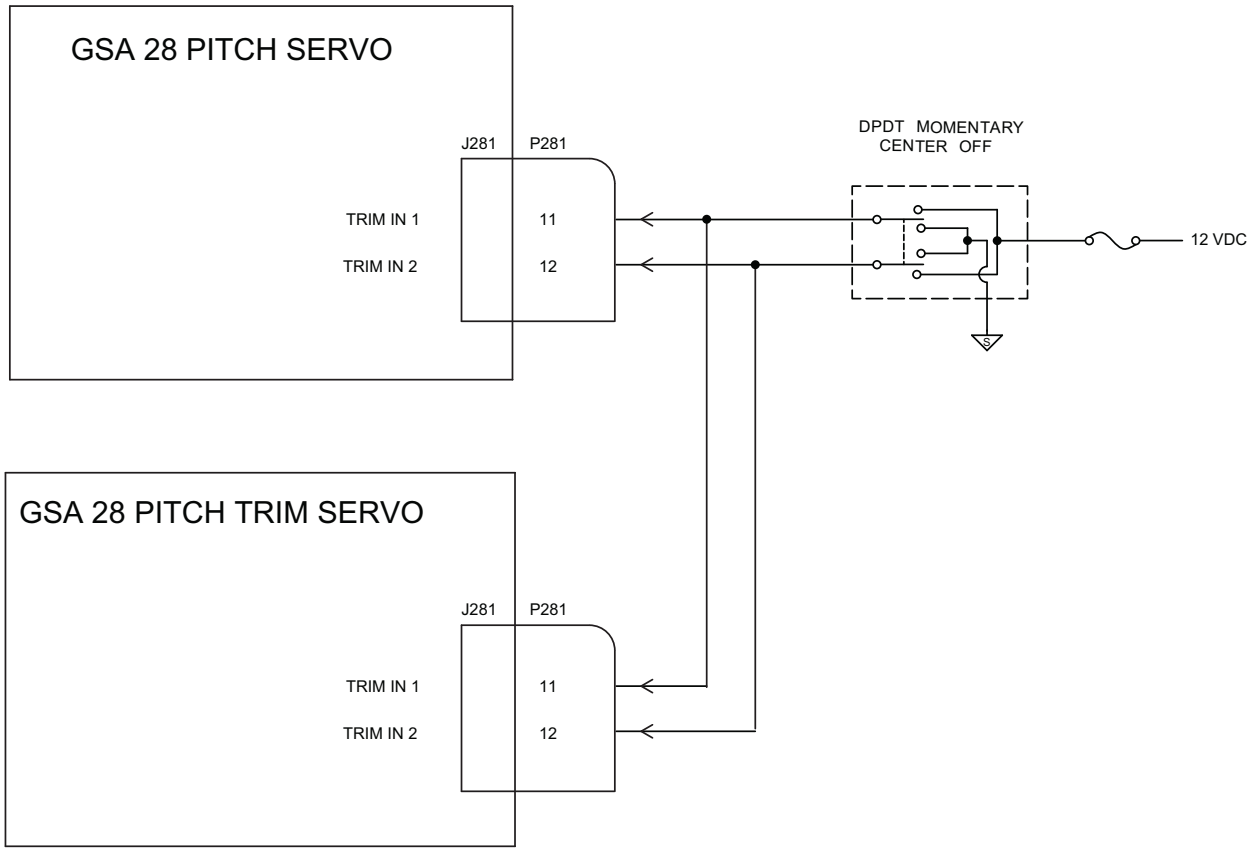
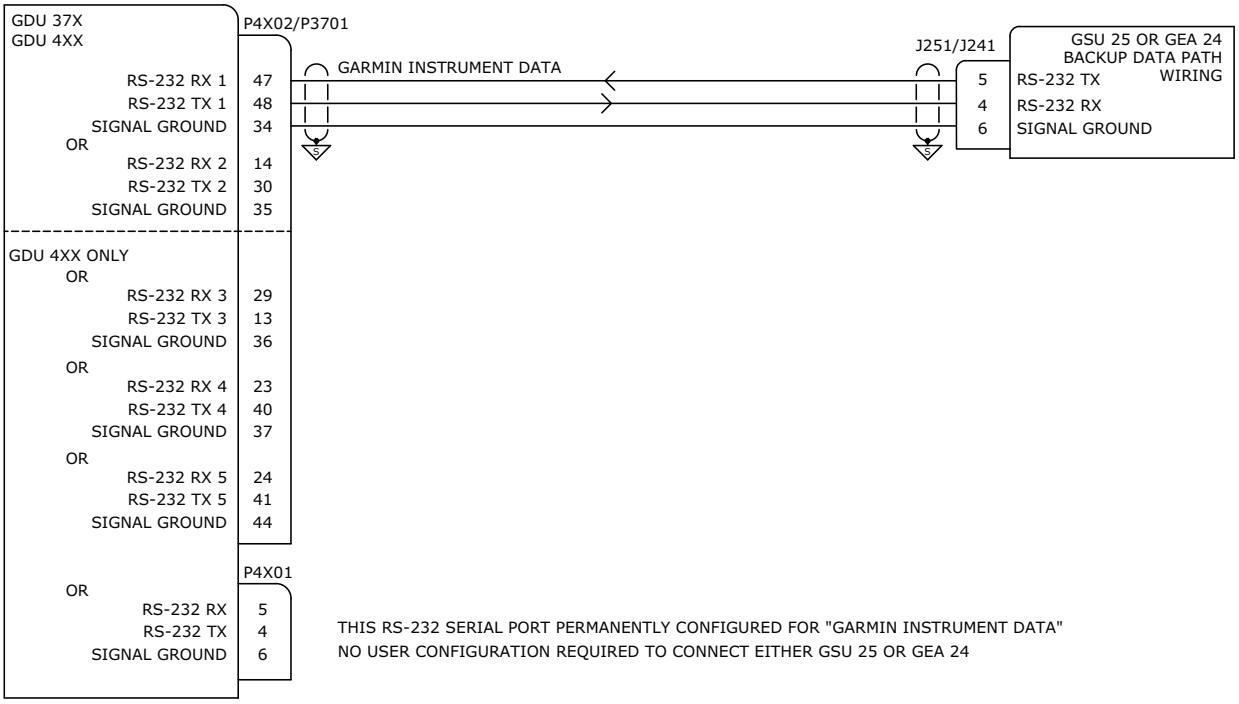


Figure 25-1.11 GSA 28 - Trim Servo Switch Interconnect Drawing



CONFIGURATION GUIDANCE

1. GDU 37X/4XX

A. CONFIGURE THE GDU RS-232 SERIAL PORT (1-5) TO WHICH THE GSU 25 OR GEA 24 BACKUP PORT IS CONNECTED TO "GARMIN INSTRUMENT DATA"

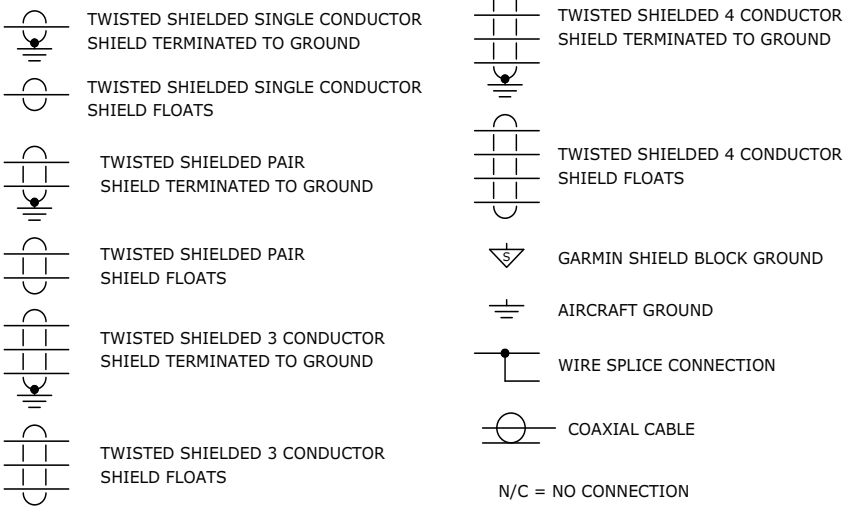
B. NO GSU 25 OR GEA 24 CONFIGURATION REQUIRED.

Figure 25-1.12 GEA 24/GSU 25 - GDU 37X/4XX Backup Data Path Interconnect Drawing

25.2 External Interconnect Drawings w/GSU 25

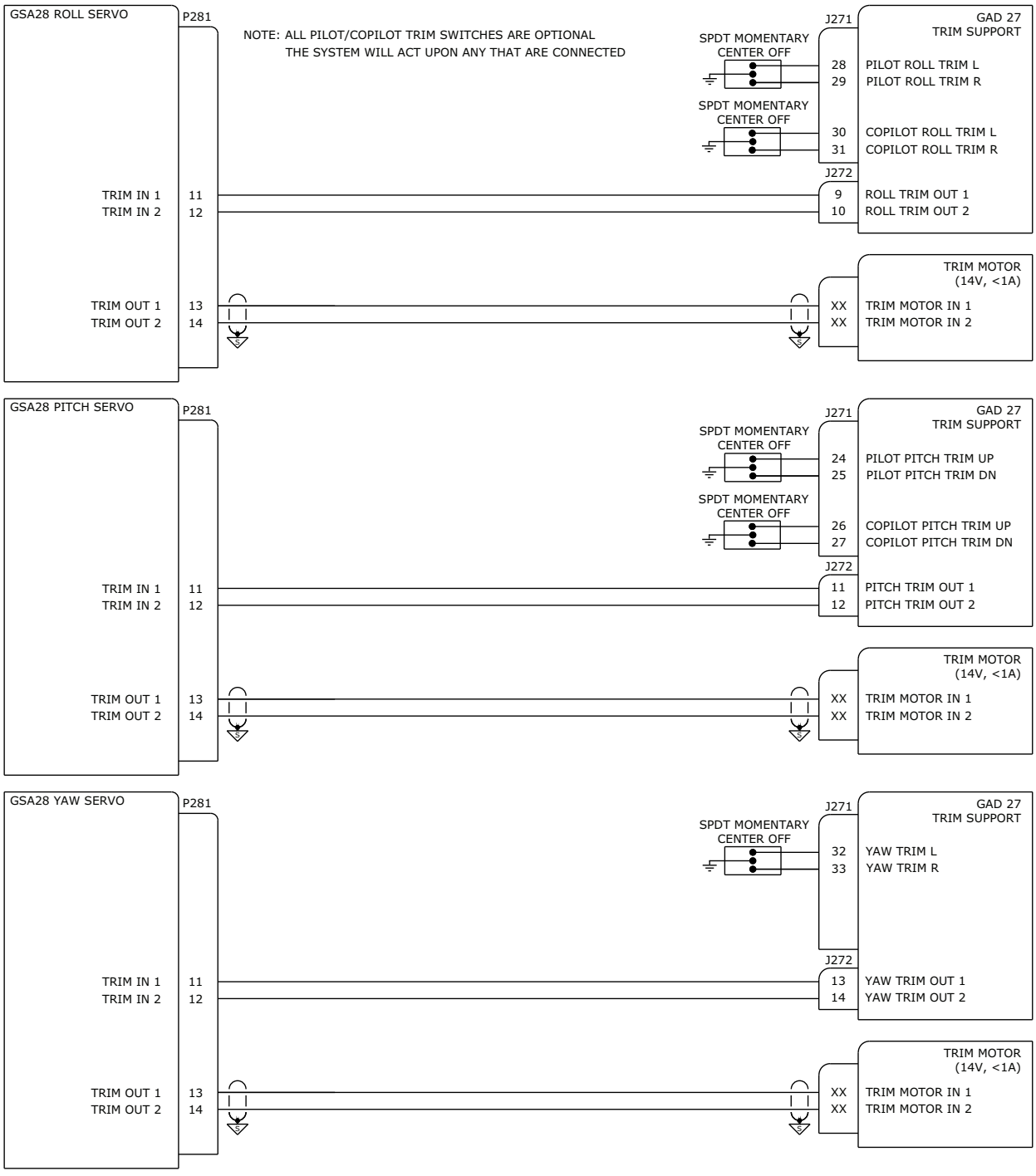
NOTES:

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. THE VP-X MUST BE CONNECTED TO THE MFD IN A MULTIPLE DISPLAY INSTALLATION.
8. CONNECTIONS FOR AUTOPILOT SERVOS, AP DISCONNECT AND OTHER AUTOPILOT FUNCTIONALITY NOT SHOWN. CONSULT AUTOPILOT VENDOR DOCUMENTATION FOR ADDITIONAL DETAILS.
9. REMOVED
10. THE GAD 29 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 240/245 IS SHOWN HERE FOR REFERENCE ONLY. OTHER INTERCOM/AUDIO PANEL PRODUCTS MAY BE COMPATIBLE WITH THE GDU 4XX/37X. THE ALERTS GENERATED BY THE GDU 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 ALERT OUTPUTS.
13. INSTALLING THE CROSSFILL CONNECTION WILL ALLOW FLIGHT PLAN SHARING BETWEEN TWO GNS 430(W)/530(W) UNITS (VIA RS-232) OR TWO GTN 6XX/7XX UNITS (VIA ETHERNET). THE G3X SYSTEM ALWAYS DISPLAYS FLIGHT PLAN INFORMATION FROM THE ACTIVE NAV SOURCE.
14. REMOVED
15. RS-232 ADS-B OUT FROM A GNS 400/500 SERIES WAAS UNIT WITH MAIN SOFTWARE VERSION 3.20 OR LATER OR A GTN 600/700 SERIES UNIT IS REQUIRED TO SUPPORT ADS-B TRANSMISSIONS. IF ADS-B TRANSMISSION FROM THE GTX 23 ES IS NOT REQUIRED, THIS CONNECTION IS NOT REQUIRED.
16. THE GTN 6XX/7XX UNITS RECEIVE ALTITUDE ENCODER DATA FROM THE 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 4XX/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 25-2.1 External Interconnect Drawing Notes for Section 25.2



CONFIGURATION GUIDANCE

1. G3X TOUCH

A. ON THE GDU 4XX CONFIG GAD 27 CONFIGURATION PAGES

- CONFIGURE GAD 27 INPUTS/OUTPUTS AS DESCRIBED IN OTHER SECTIONS

Figure 25-2.2 GAD 27 Interconnect Example (page 1 of 5)

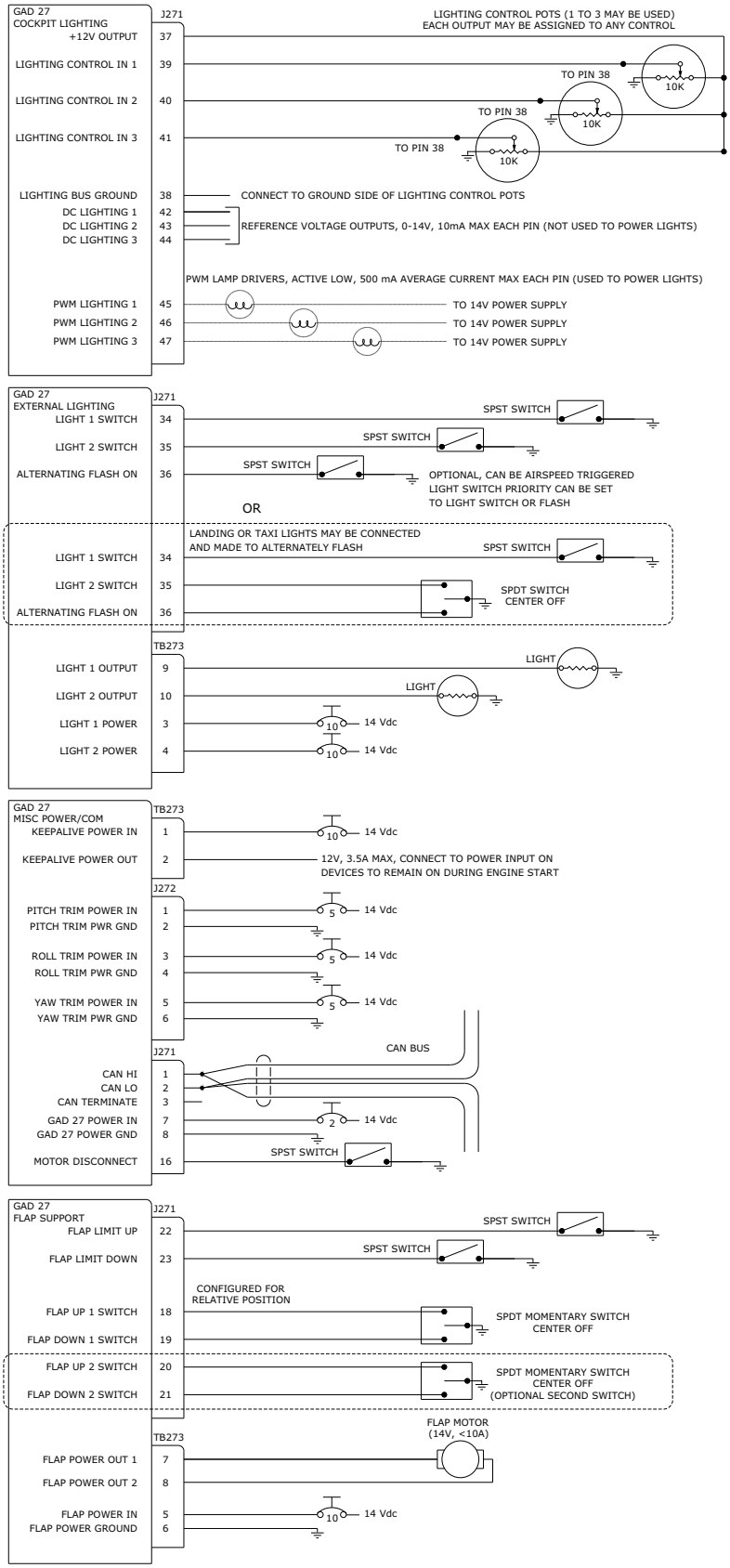


Figure 25-2.2 GAD 27 Interconnect Example (page 2 of 5)

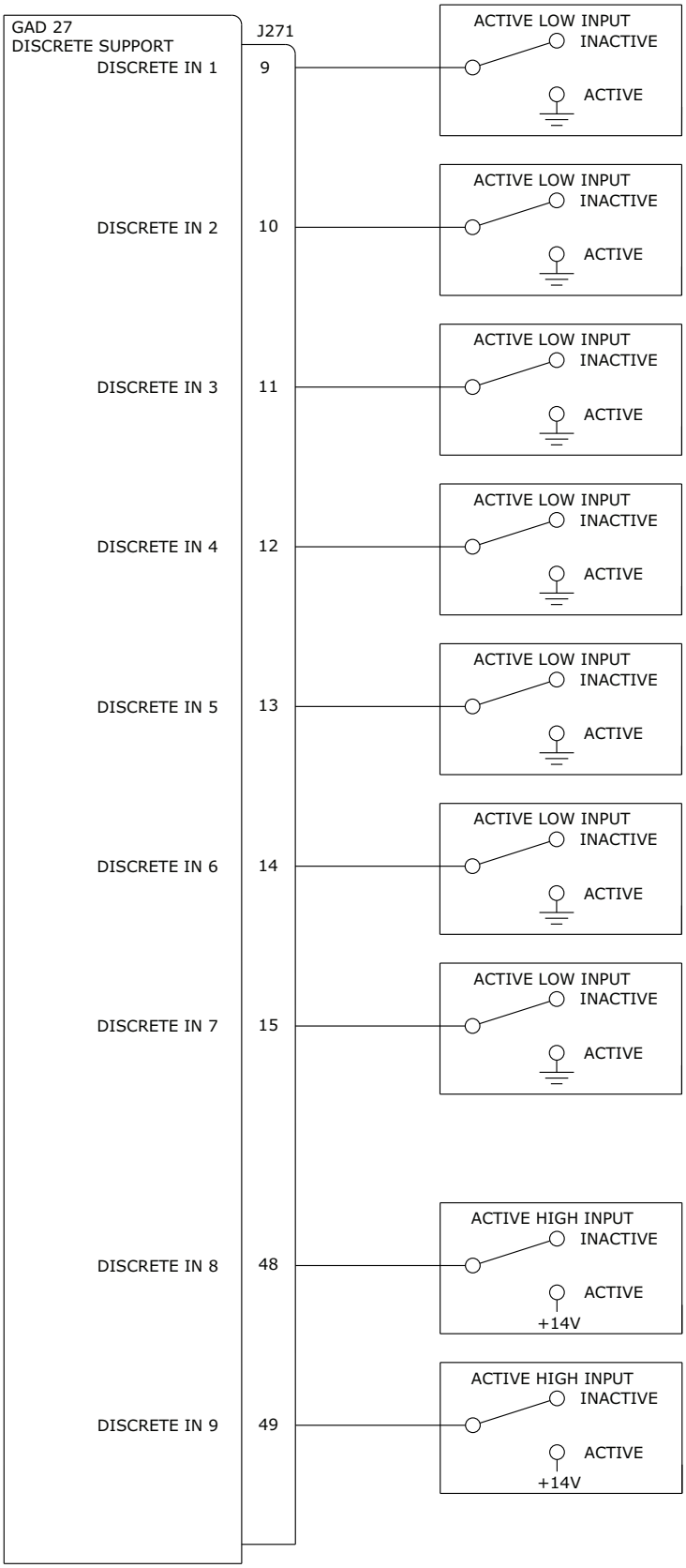


Figure 25-2.2 GAD 27 Interconnect Example (page 3 of 5)

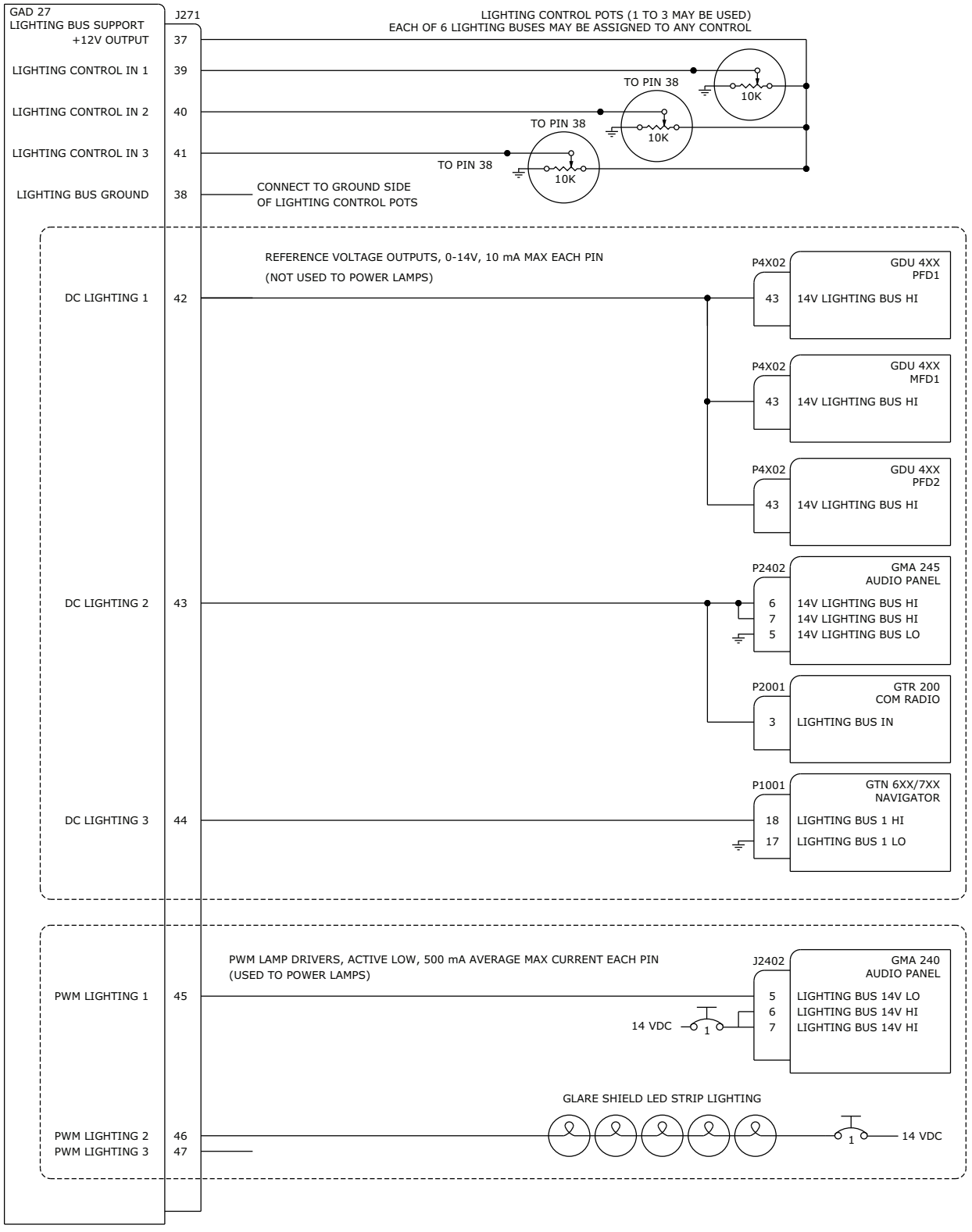


Figure 25-2.2 GAD 27 Interconnect Backlighting Example (page 4 of 5)

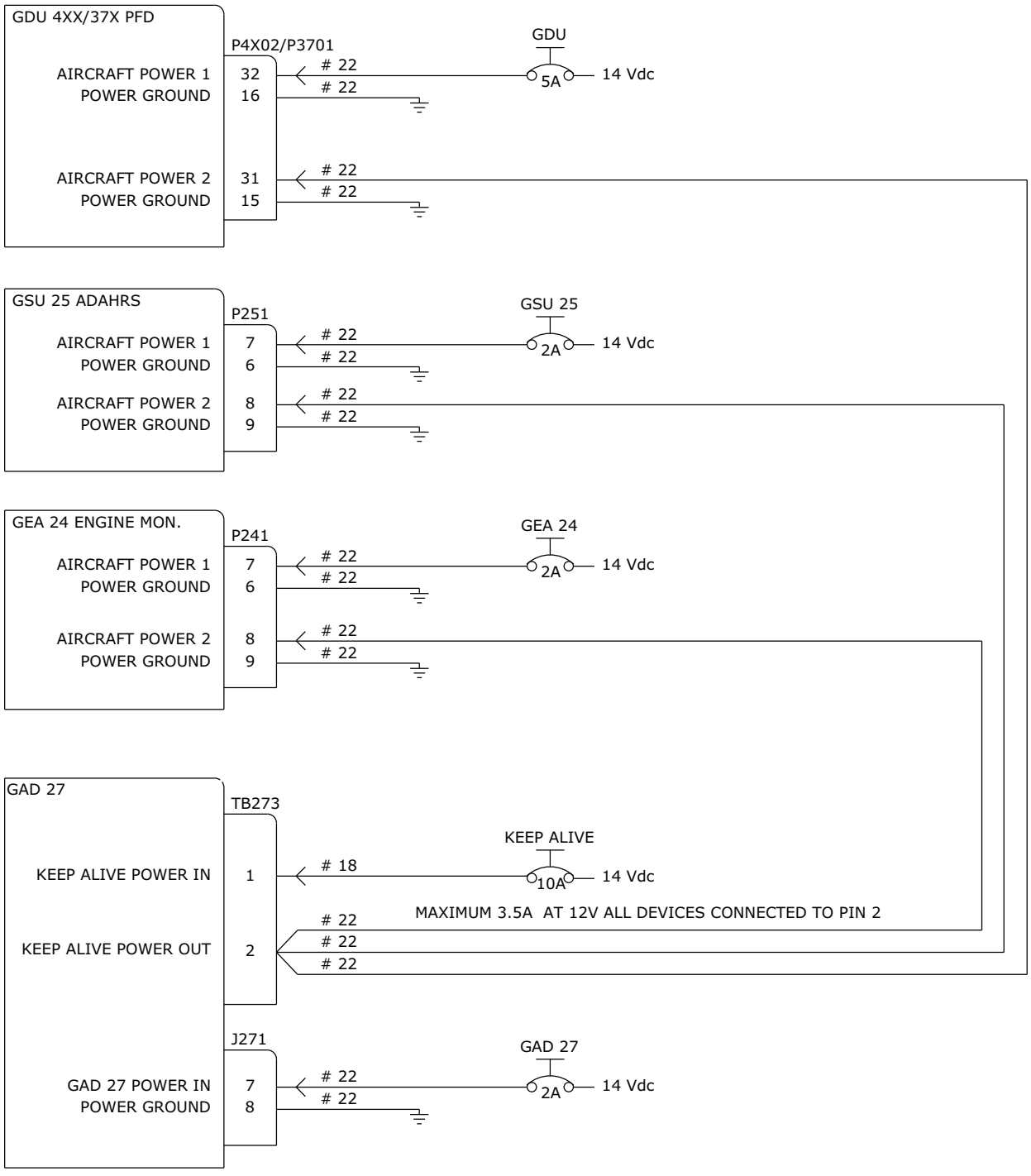


Figure 25-2.2 GAD 27 Interconnect Keep-Alive Example (page 5 of 5)

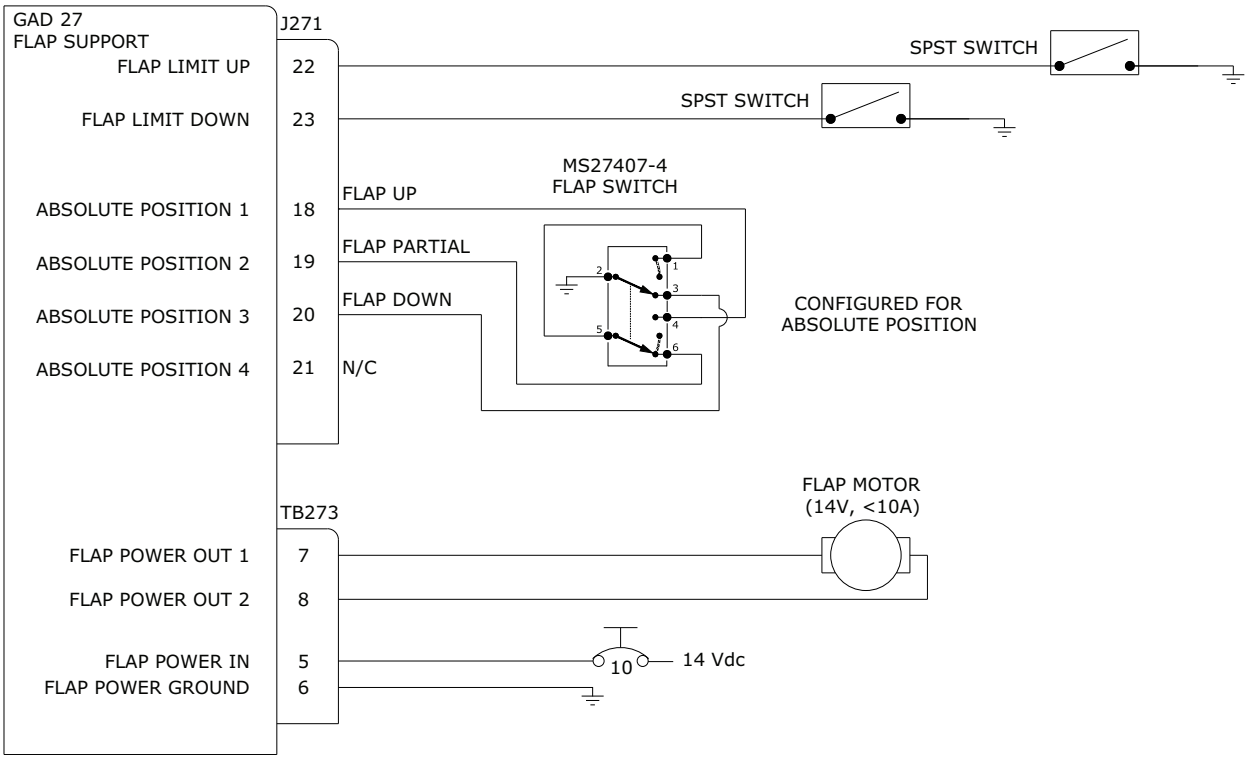


Figure 25-2.3 GAD 27 Flap Switch Example, 3 Position (page 1 of 3)

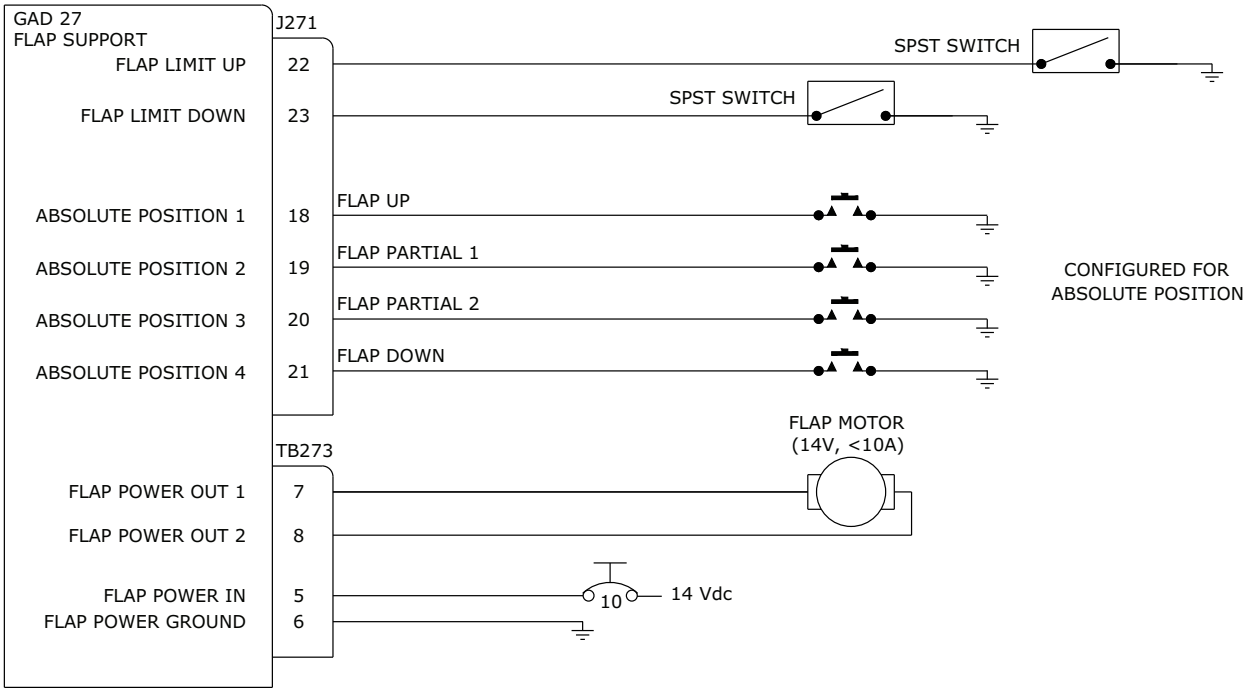


Figure 25-2.3 GAD 27 Flap Switch Example, Push Button (page 2 of 3)

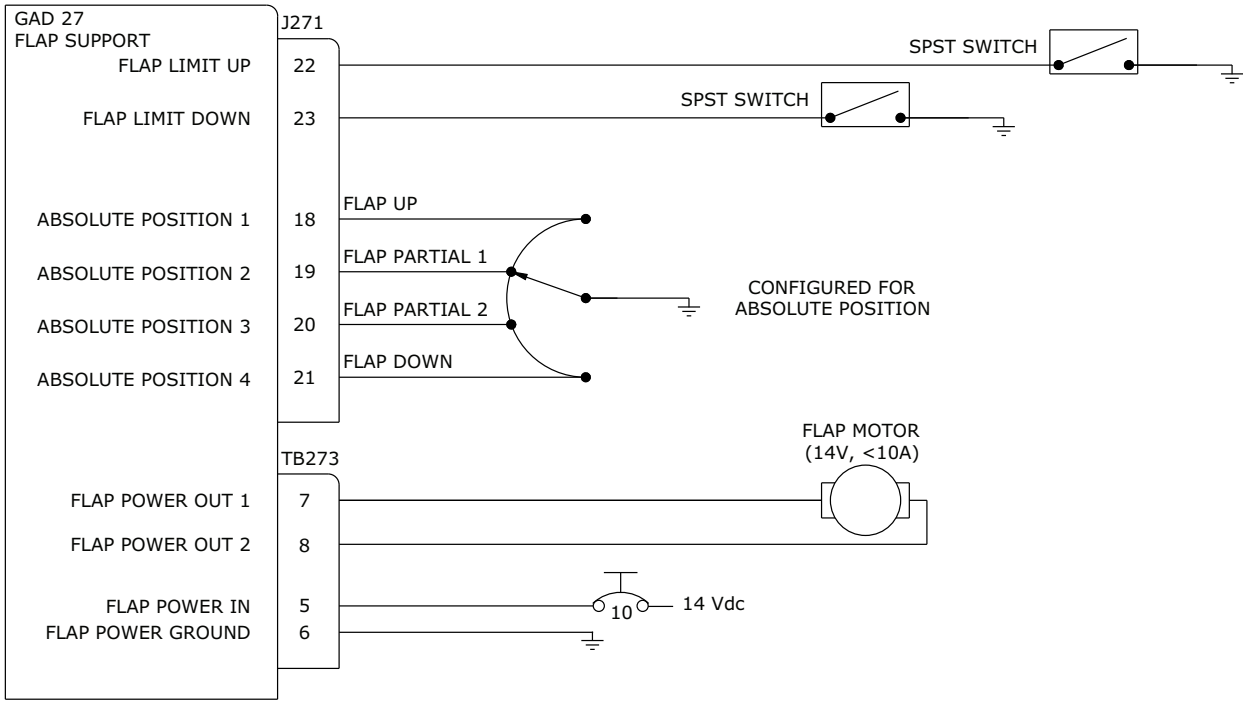
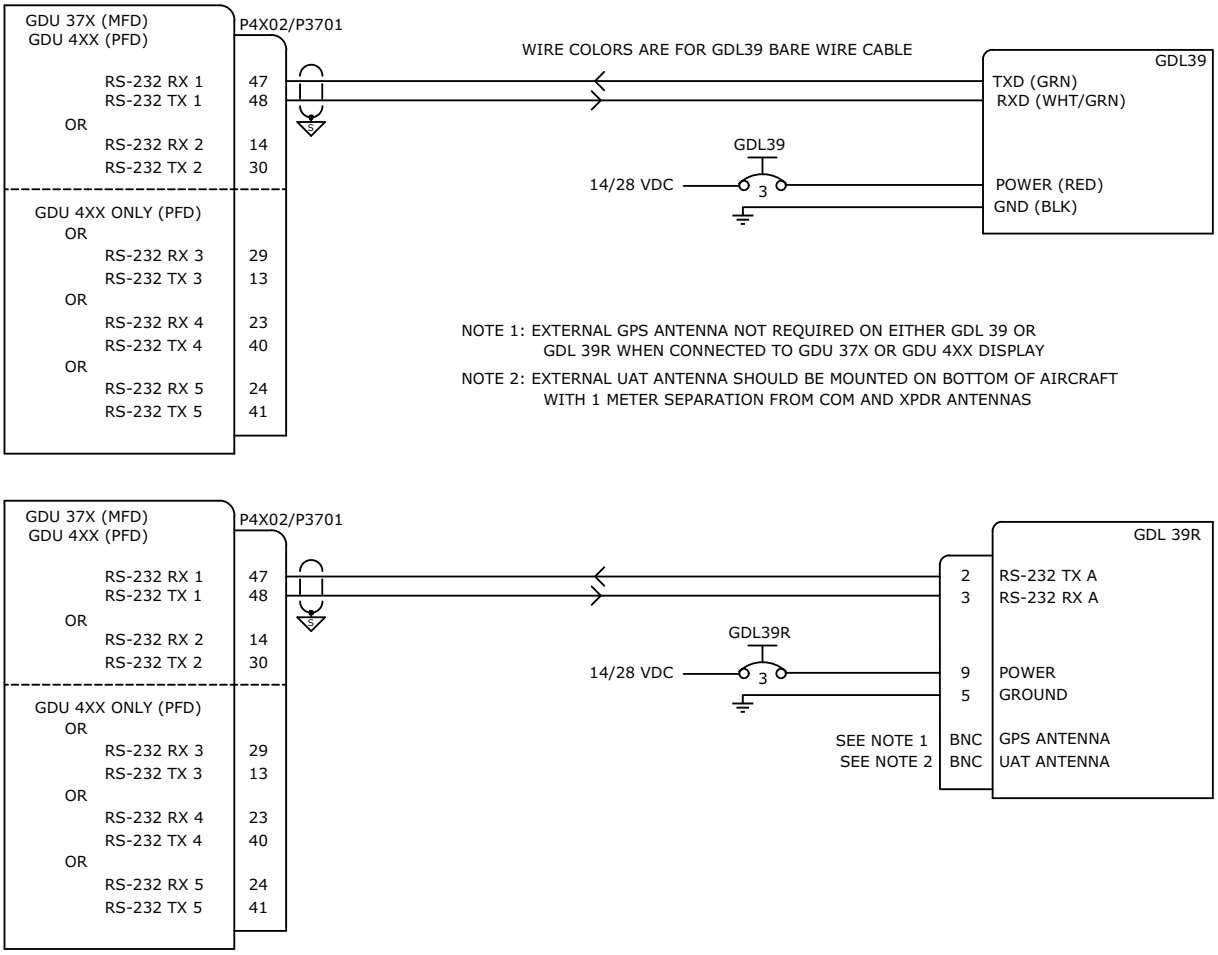


Figure 25-2.3 GAD 27 Flap Switch Example, Rotary (page 3 of 3)



CONFIGURATION GUIDANCE

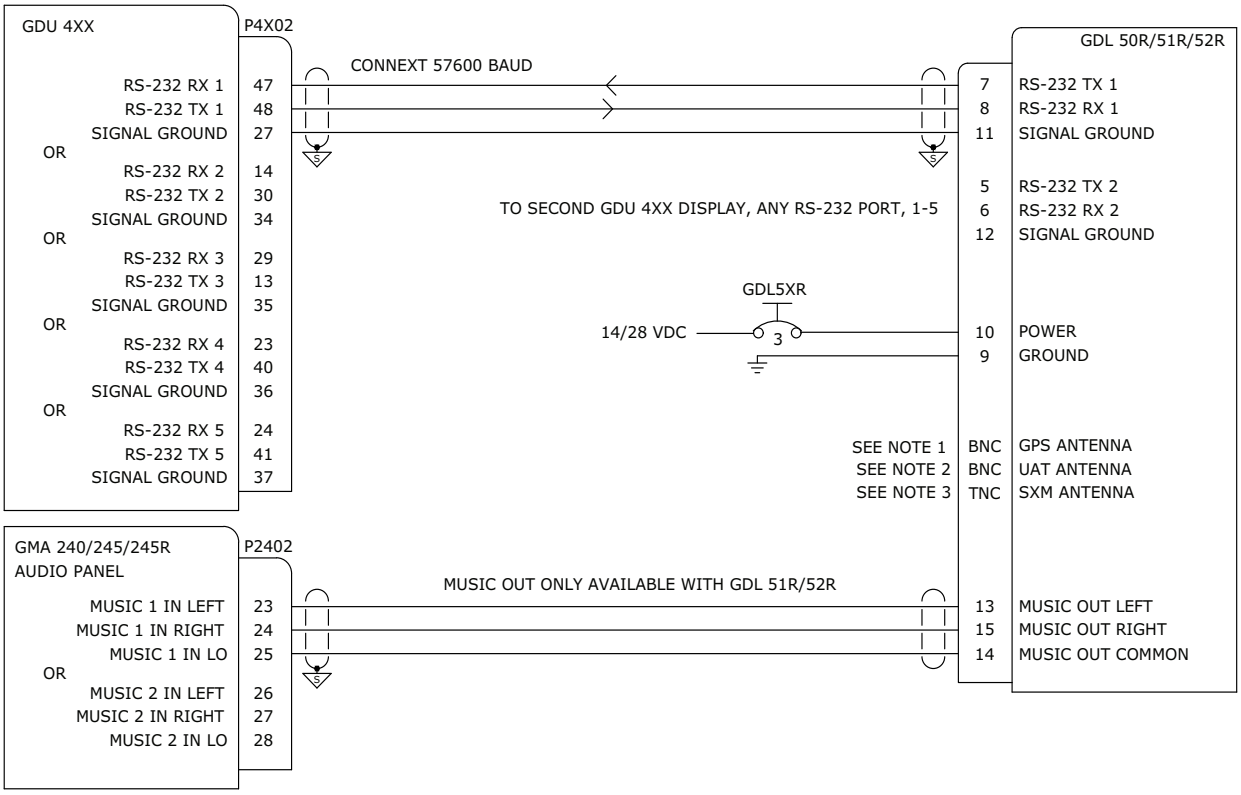
1. G3X

A. THE GDL39/GDL39R MUST BE CONNECTED TO RS-232 PORT 1 OR PORT 2 ON THE GDU 37X, BUT MAY BE CONNECTED TO RS-232 PORTS 1-5 ON THE GDU 4XX

B. ON THE GDU 4XX/37X CONFIG MODE RS-232 CONFIGURATION PAGE
- SET RS-232 PORT CONNECTED TO GDL39/GDL39R TO "GARMIN DATA TRANSFER"
- A GREEN CHECK MARK WILL APPEAR BESIDE THIS RS-232 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 4XX/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 25-2.4 GDL 39/GDL 39R Interconnect/Configuration Example



NOTE 1: EXTERNAL GPS ANTENNA NOT REQUIRED WHEN CONNECTED TO GDU 4XX DISPLAY

NOTE 2: EXTERNAL UAT ANTENNA SHOULD BE MOUNTED ON BOTTOM OF AIRCRAFT WITH 1 METER SEPARATION FROM COM AND XPDR ANTENNAS

NOTE 3: SXM ANTENNA SHOULD BE LOCATED ON GLARE SHIELD (GA26XM, GA24TNC) OR TOP OF AIRCRAFT (GA55/55A/57X)

CONFIGURATION GUIDANCE

1. GDU 4XX WITH GDL 50R/51R/52R

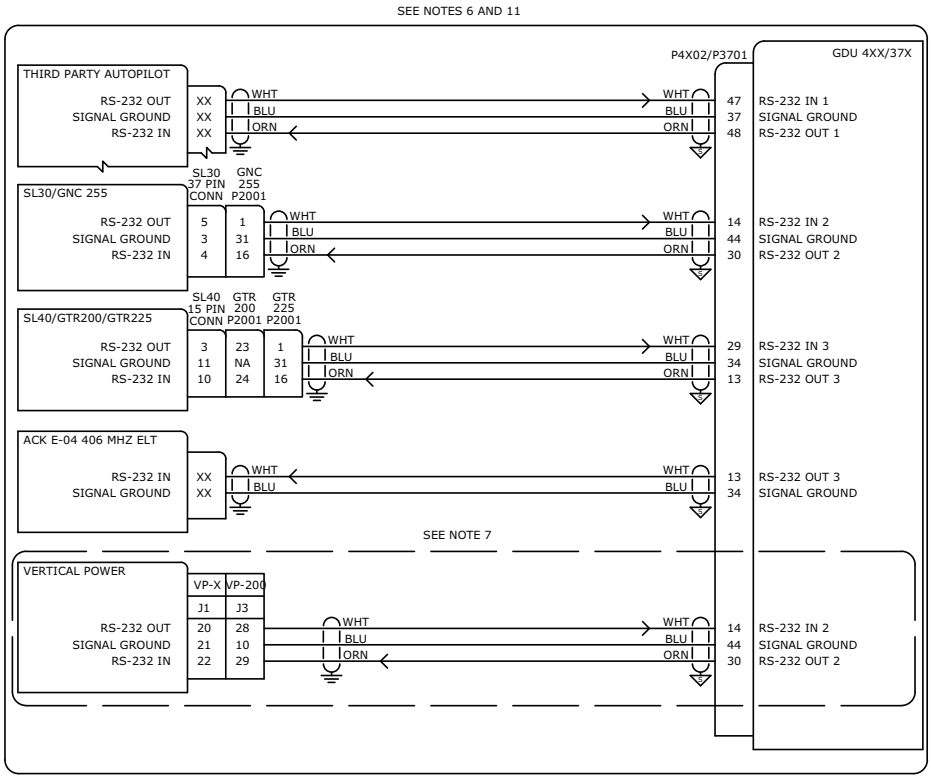
A. THE GDL 50R/51R/52R MAY BE CONNECTED TO SERIAL (RS-232) PORT 1-5 ON THE GDU 4XX AND EITHER OR BOTH SERIAL PORTS ON THE GDL 50R/51R/52R MAY BE CONNECTED TO A GDU 4XX AS SHOWN ABOVE

B. ON THE GDU 4XX RS-232 INTERFACE SETUP PAGE

- SET SERIAL PORT CONNECTED TO GDL50R/51R/52R TO "CONNEXT 57600 BAUD"
- A GREEN CHECK MARK IS SHOWN NEXT TO THE CONNECTION WHEN COMMUNICATION IS ESTABLISHED WITH THE GDL50R/51R/52R.

Figure 25-2.5 GDL 5XR Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 4XX(W)/5XX(W) SERIES PRODUCTS FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION



CONFIGURATION GUIDANCE

1. GDU 4XX/37X TO SL40, GTR 200, OR GTR 225

A. ON THE GDU 4XX/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 4XX/37X RS-232 CHANNEL FORMAT TO "GARMIN VHF COMM"

B. NO SL40 OR GTR 200 CONFIGURATION REQUIRED

C. CONFIGURE GTR 225 SERIAL PORT IO MODE TO "NMEA" ON SYS CONFIGURATION PAGE

2. GDU 4XX/37X TO SL30 OR GNC 255

A. ON THE GDU 4XX/37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 4XX/37X RS-232 CHANNEL FORMAT TO "GARMIN VHF NAV/COMM"

B. ON THE SL30 NAV SETUP PAGES
- SET INDICATOR HEAD TYPE TO "SERIAL"

C. ON THE GNC 255 CONFIGURATION PAGES
- SET CDI INDICATOR TYPE TO "SERIAL" ON NAV CONFIGURATION PAGE
- SET SERIAL PORT IO MODE TO "NMEA" ON SYS CONFIGURATION PAGE

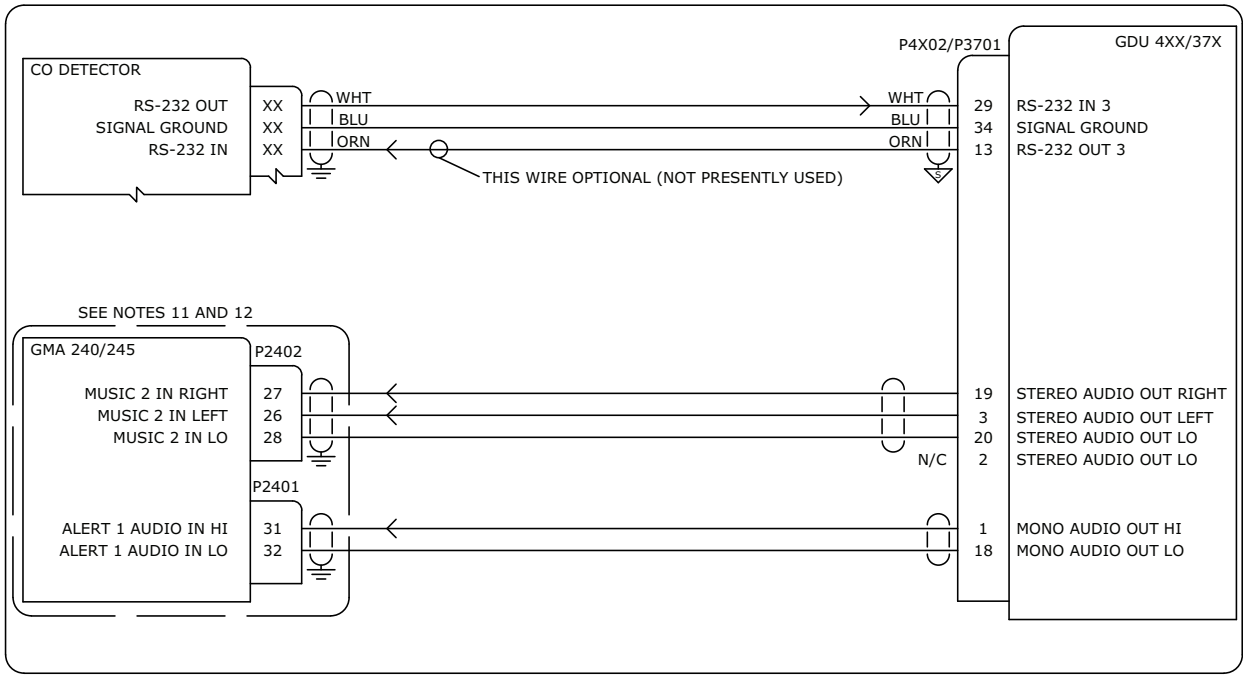
3. GDU 4XX/37X TO VERTICAL POWER VP-X OR VP-200

A. ON THE GDU 4XX/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 4XX/37X RS-232 CHANNEL FORMAT TO "VERTICAL POWER"

B. ON THE GDU 4XX VERTICAL POWER CONFIG PAGE (CAN BE FOUND IN ENGINE & AIRFRAME CONFIG MENU) OR 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 25-2.6 GDU 37X/4XX - External LRU Interconnect Examples (page 1 of 2)



CONFIGURATION GUIDANCE

1. GDU 4XX/37X TO CO DETECTOR

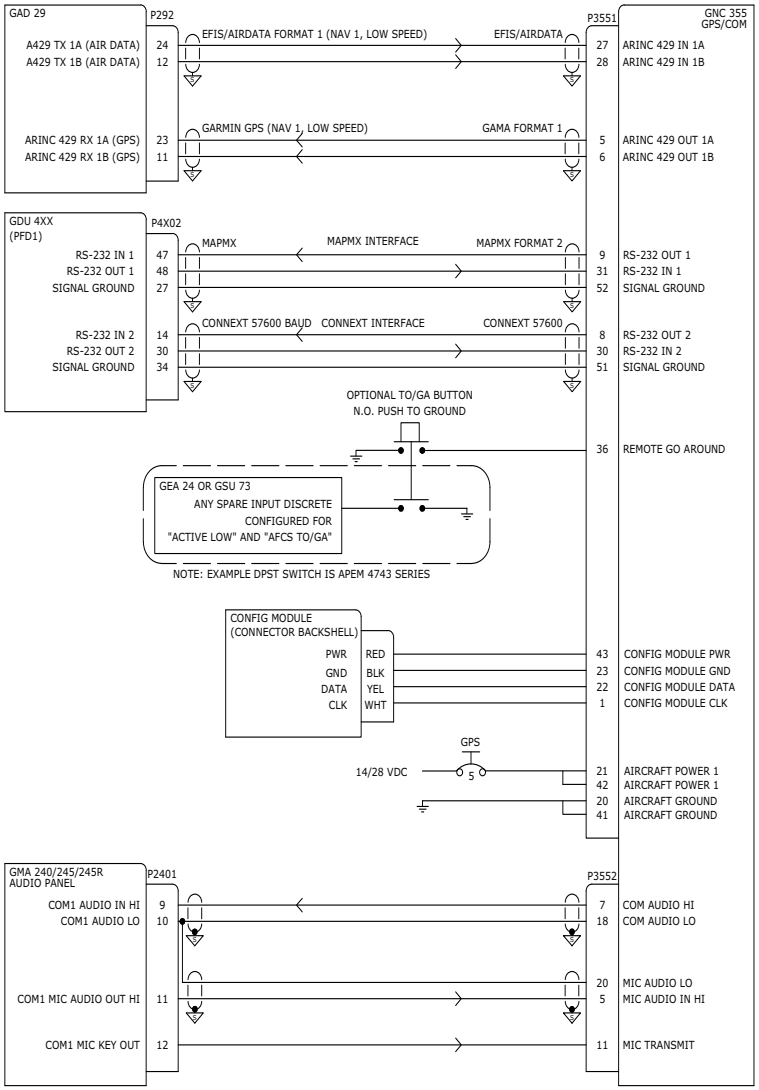
A. ON THE GDU 4XX/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED RS-232 CHANNEL FORMAT TO "CO DETECTOR"

B. CHECK CO DETECTOR MANUAL FOR ANY SETUP REQUIRED

Figure 25-2.6 GDU 37X/4XX - External LRU Interconnect Examples (page 2 of 2)

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNC 355 PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNC 355 PRODUCT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION



CONFIGURATION GUIDANCE

1. GNC 355

A. ON THE ARINC 429 CONFIG PAGE
- SET IN 1 SPEED TO "LOW"
- SET IN 1 DATA TO "EFIS/AIRDATA"
- 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 1 INPUT/OUTPUT TO "MAPMX FORMAT 2"
- SET CHNL 2 INPUT/OUTPUT TO "CONNEXT 57600"

C. ON THE MAIN INDICATOR (ANALOG) CONFIG PAGE
- SET SELECTED COURSE TO "ALLOWED"

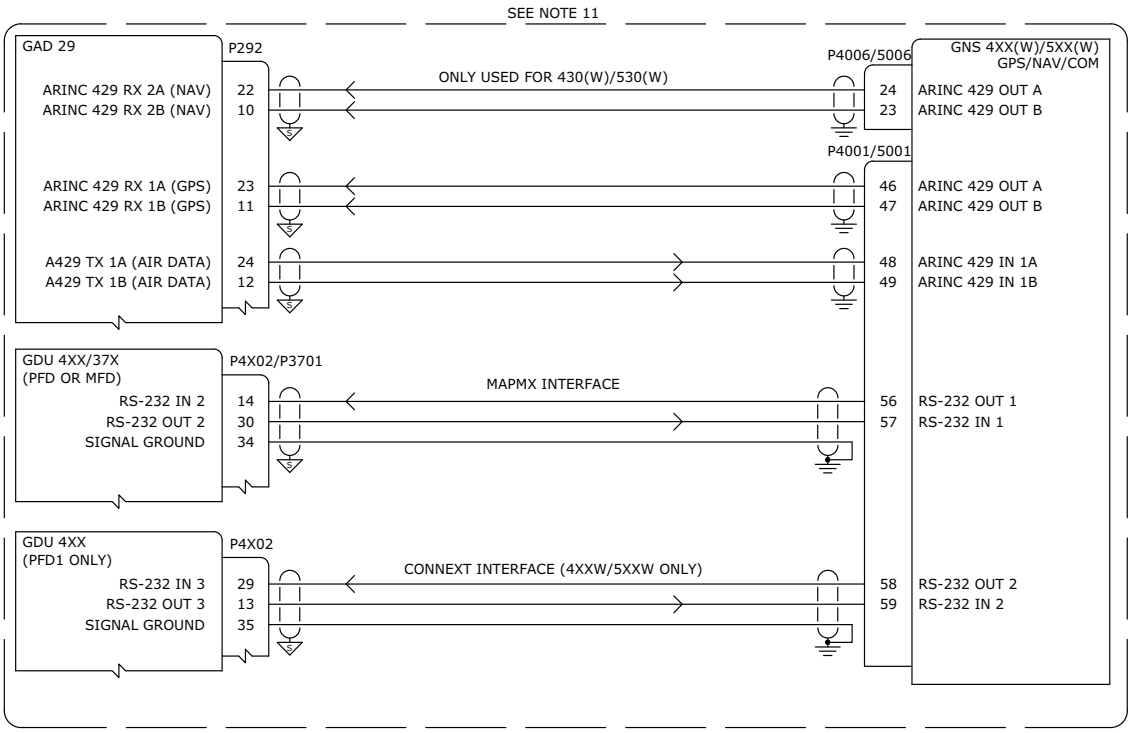
2. G3X

A. ON THE GDU 4XX RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"

B. ON THE GDU 4XX RS-232 CONFIG MODE PAGE WHEN CONNEXT® COMPUTER APPLICATION IS USED
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "CONNEXT 57600 BAUD"

Figure 25-2.7 Single GNC 355 Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 4XX(W)/5XX(W) SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 4XX(W)/5XX(W) SERIES PRODUCTS FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GNS 4XX(W)/5XX(W)

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)
- SET CHNL 2 INPUT/OUTPUT TO "CONNEXT" WHEN CONNEXT IS USED

C. ON THE MAIN CDI/OBS CONFIG PAGE (GNS 430(W)/530(W) ONLY)
- 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 (GNS 430(W)/530(W) ONLY)
- SET RX AND TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

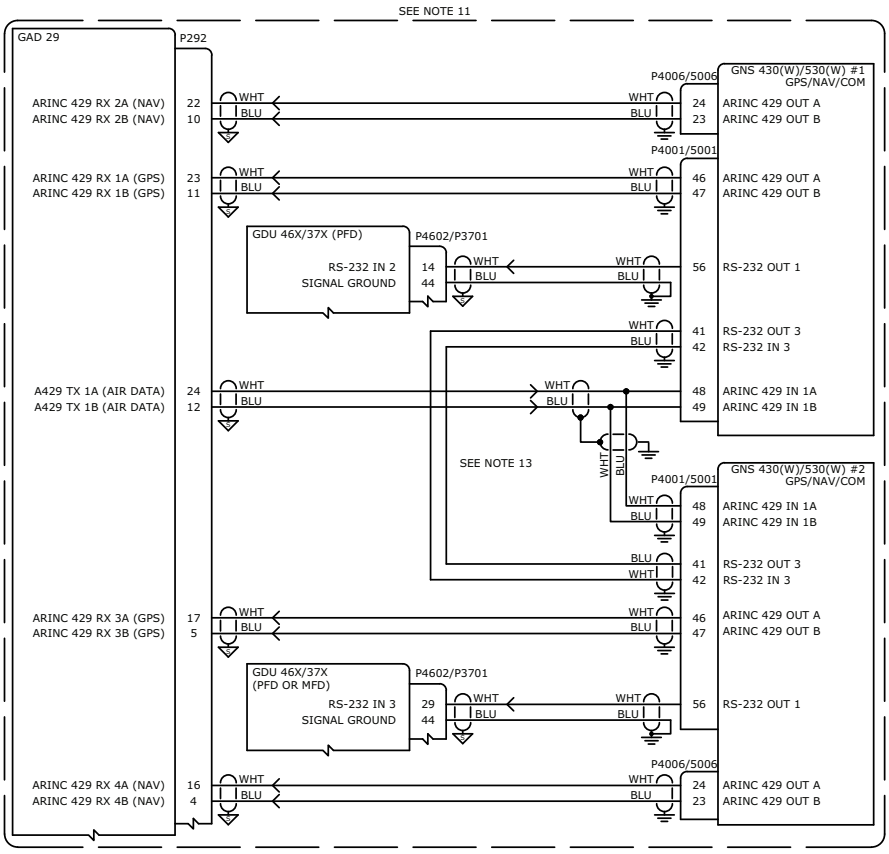
2. G3X

A. ON THE GDU 46X/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 46X/37X 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 FORMAT 1" 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" (GNS 430(W)/530(W) ONLY)

B. ON THE GDU 4XX RS-232 CONFIG MODE PAGE WHEN CONNEXT IS USED
- SET THE GDU 4XX (PFD) RS-232 CHANNEL TO "GARMIN INSTRUMENT DATA"

Figure 25-2.8 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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 4XX(W)/5XX(W) SERIES PRODUCTS FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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

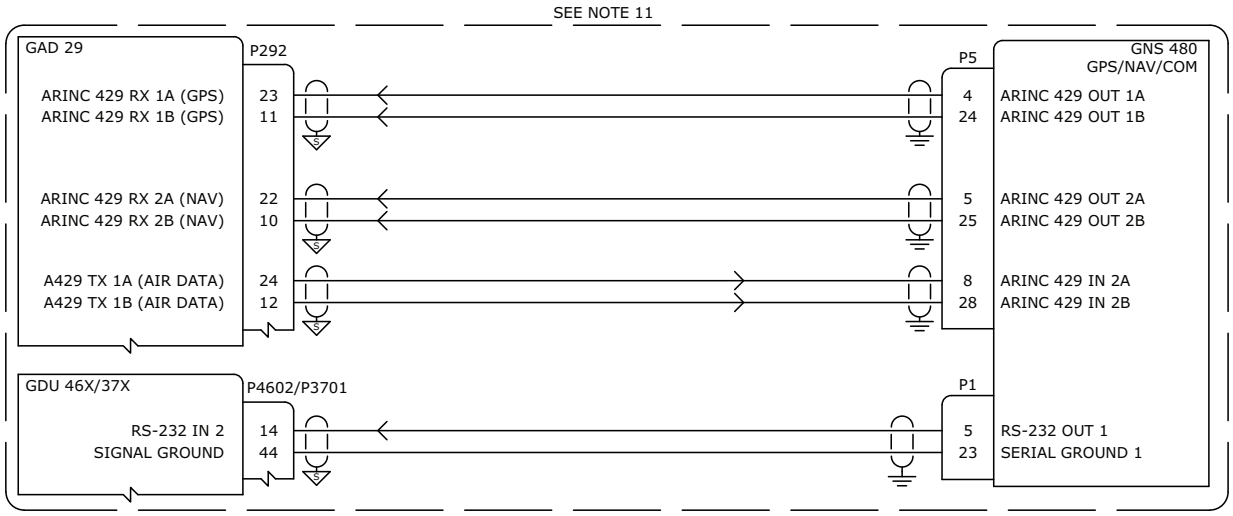
2. G3X

A. ON THE GDU 46X/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 46X/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 46X/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 FORMAT 1" 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 46X/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 25-2.9 Dual GNS 430(W)/530(W) Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNS 480 UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 480 FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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"

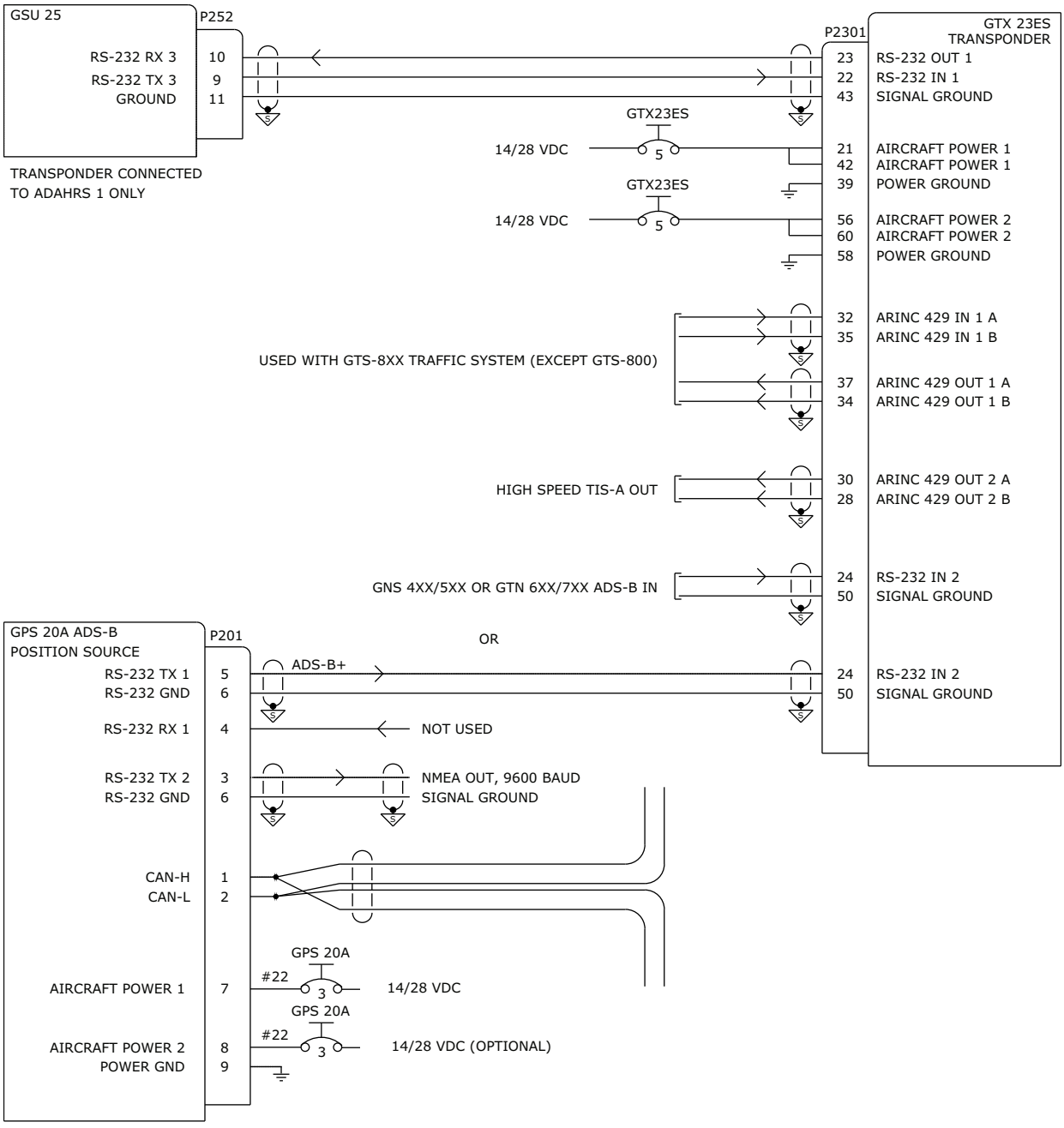
C. ON THE RESOLVER INTERFACE PAGE SET RESOLVER TO "NOT INSTALLED"

D. ON THE MISCELLANEOUS SETUP PAGE SET CDI SELECT TO "USE"

2. G3X

A. ON THE GDU 46X/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 46X/37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" 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 25-2.10 GNS 480 Interconnect/Configuration Example



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+" OR "ADS-B+ FORMAT 1"

2. GTX 23ES

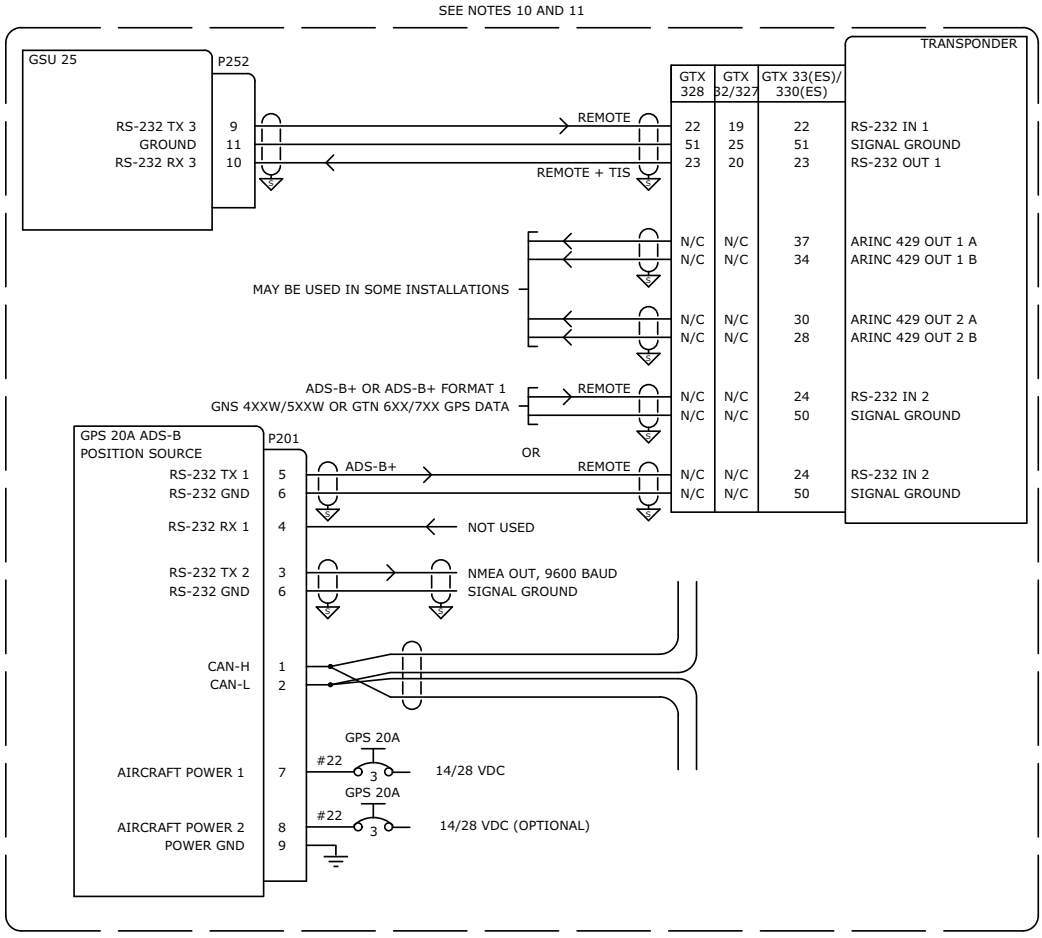
A. NO CONFIGURATION REQUIRED ON A429 AND RS-232 PORTS

3. GPS 20A

A. NO CONFIGURATION REQUIRED ON RS-232 PORTS

Figure 25-2.11 GSU 25 - GTX 23ES Transponder Interconnect/Config Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 33(ES), 327, 328, OR 330(ES) UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTX 33(ES), 327, 328, or 330(ES) UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GTX 327/328/330(ES)/33(ES)

A. ON THE GTX 327/328/330(ES)/33(ES) RS-232 CONFIG MODE PAGE
- SET CONNECTED GTX 327/328/330(ES) RS-232 INPUT FORMAT TO "REMOTE"
- SET CONNECTED GTX 330(ES) RS-232 OUTPUT FORMAT TO "REMOTE+TIS"

B. ON THE GTX 327/328/330(ES) SQUAT SWITCH CONFIG MODE PAGE
- SET THE SQUAT SWITCH FIELD TO "NO"

C. IF REMOTE CONTROL OF THE TRANSPONDER FROM THE GDU 46X/37X IS DESIRED
- ON THE GDU 46X/37X XPDR CONFIG MODE PAGE SET TRANSPONDER TYPE TO "GTX 327" OR "GTX 328" OR "GTX 330" OR "GTX 330ES" AS APPROPRIATE

D. NO GSU 25 CONFIGURATION REQUIRED

2. GTX 33(ES)

A. ON THE GDU 46X/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)

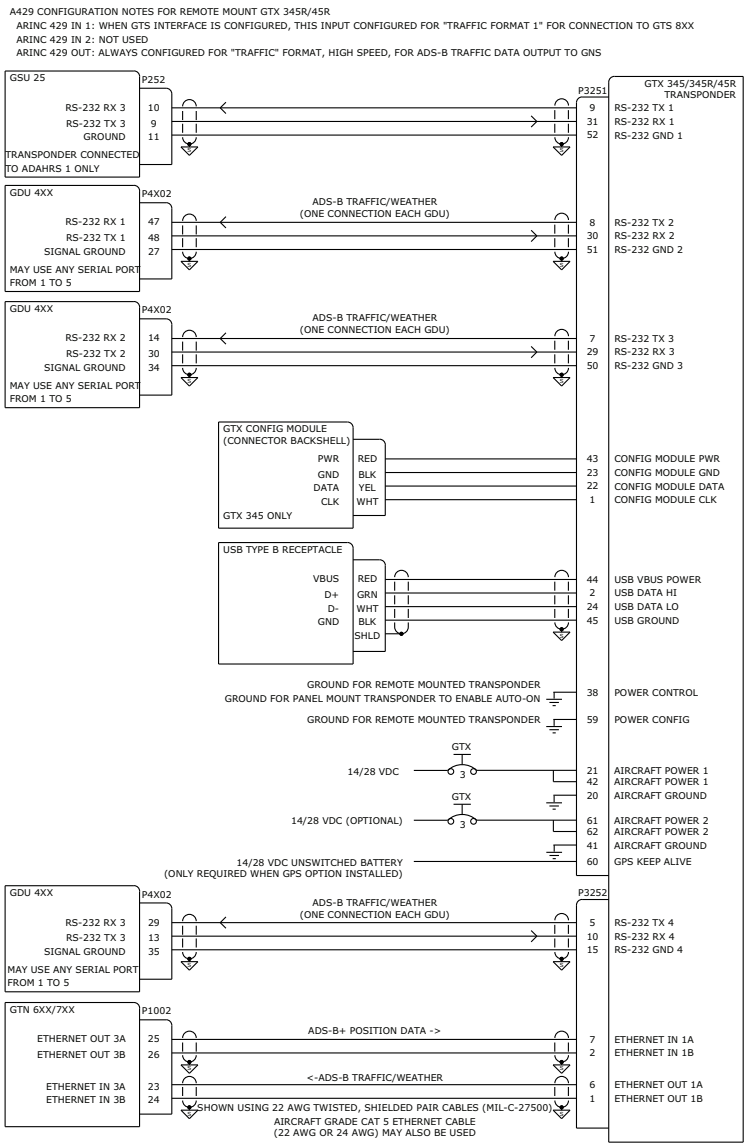
A. ON THE GTN/GNS RS-232 CONFIG MODE PAGE
- SET SET RS-232 OUTPUT FORMAT TO "ADS-B+" OR "ADS-B+ FORMAT 1" FOR RS-232 PORT CONNECTED TO TRANSPONDER RS-232 IN CHANNEL 2

B. ON THE GTX 33ES/330ES RS-232 CONFIG MODE PAGE
- SET SET RS-232 INPUT FORMAT TO "REMOTE" FOR RS-232 CHANNEL 2 CONNECTED TO GTN/GNS ADS-B+ OUTPUT

4. GPS 20A

A. NO CONFIGURATION REQUIRED ON RS-232 PORTS

Figure 25-2.12 GSU 25 - GTX 32/327/328/330 Interconnect/Configuration Example



CONFIGURATION GUIDANCE

1. GSU 25 WITH GTX 345 / 345R / 45R

A. NO CONFIGURATION REQUIRED FOR GSU 25 SERIAL PORT

B. ON THE GTX 345 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT RS-232 CH CONNECTED TO GSU 25 (NORMALLY 1)
- SET INPUT AND OUTPUT FORMAT TO "XPDR FMT 1"

2. GDU 4XX RECEIVING TRAFFIC/WEATHER FROM GTX 345 / 345R / X45R

A. THE GTX MAY BE CONNECTED TO ANY SERIAL (RS-232) PORT ON THE GDU 4XX FROM 1 TO 5. ONE CONNECTION ONLY PER GDU.

B. ON THE GDU 4XX RS-232 CONFIGURATION PAGE

- SET SERIAL PORT CONNECTED TO GTX TO "CONNEXT 57600 BAUD"

3. GTX 345 PANEL MOUNT TRANSPONDER

A. ON THE GTX 345 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT RS-232 CH CONNECTED TO EACH GDU 4XX
- SET INPUT AND OUTPUT FORMAT TO "CONNEXT FMT 1"

4. GTX X45R REMOTE MOUNT TRANSPONDER

A. ON GDU 4XX TRANSPONDER CONFIGURATION PAGE

- SELECT INSTALLED TRANSPONDER TYPE (E.G. GTX 345R)
- CONFIGURE HSDB DEVICES (GTN/GTS ENABLE/DISABLE)
- CONFIGURE TRANSPONDER SERIAL PORTS 2,3,4 FOR "CONNEXT FMT 1"
- CONFIGURE ALL ADS-B OUT DATA FIELDS

5. GTX X45R REMOTE MOUNT TRANSPONDER INSTALLED WITH GTN IN SYSTEM

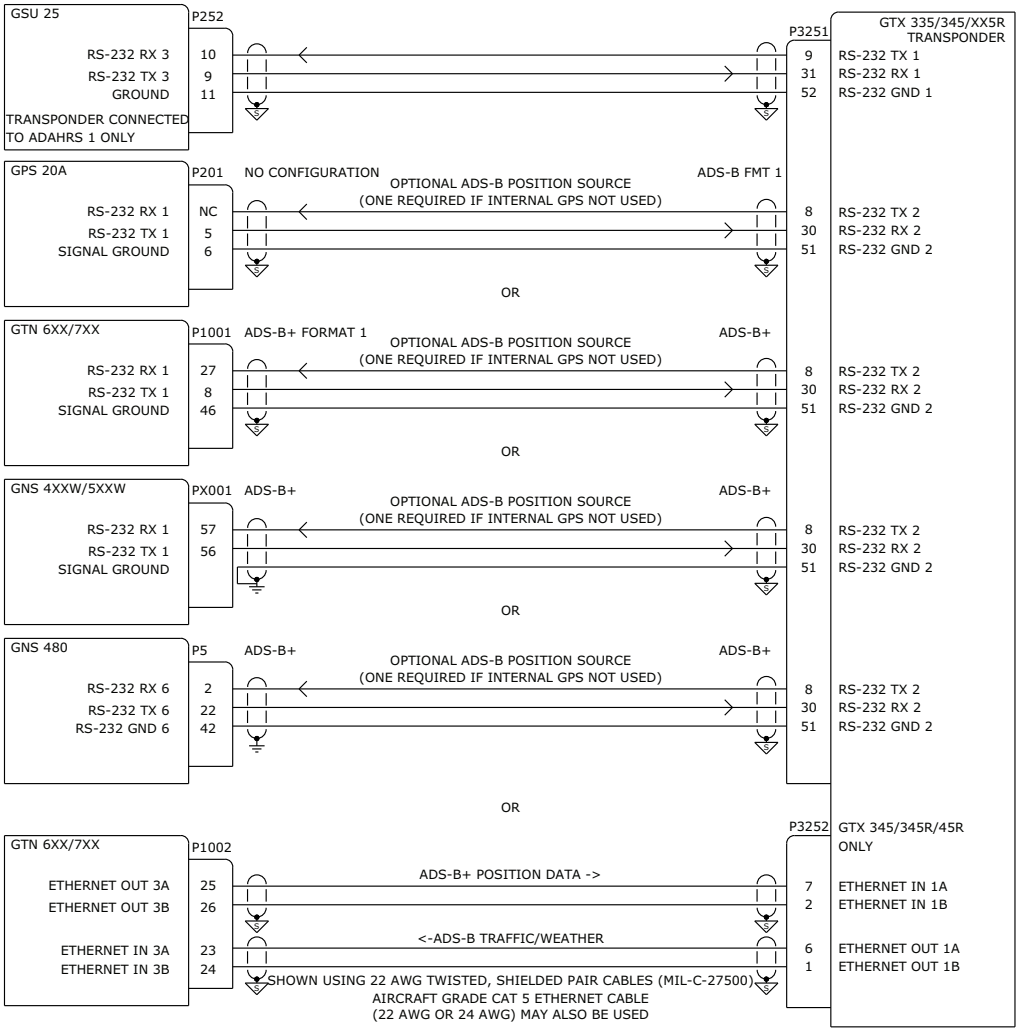
A. ON THE GTN INTERFACED EQUIPMENT PAGE

- SET ADS-B IN SOURCE TO "GTX #1"

B. ON THE PFD1 TRANSPONDER CONFIGURATION PAGE

- ENABLE "GTN" ON HSDB DEVICES FIELD

Figure 25-2.13 GSU 25 - GTX 345/345R/45R Interconnect/Configuration Example



ADS-B POSITION SOURCE CONFIGURATION GUIDANCE

1. GPS 20A POSITION SOURCE

A. NO CONFIGURATION REQUIRED FOR GPS 20A SERIAL PORT

2. GTN/GNS POSITION SOURCE

A. WHEN GTN IS CONNECTED TO A GTX 345R/45R USING ETHERNET, SELECT "GTN PRESENT" ON GDU 37X/4XX TRANSPONDER CONFIGURATION PAGE

B. ON THE GTN/GNS RS-232 CONFIGURATION PAGE

- SET SERIAL PORT OUTPUT CONNECTED TO GTX TO "ADS-B+" OR "ADS-B+ FORMAT 1"

3. GTX INTERNAL POSITION SOURCE

A. WHEN THE GTX HAS AN INTERNAL GPS POSTION SOURCE AND IS CONNECTED TO A GPS ANTENNA. DO NOT CONFIGURE ADDITIONAL ADS-B POSITION SOURCES. THE GTX WILL PRIORITIZE ITS INTERNAL GPS POSITION SOURCE.

4. GTX 335/345 PANEL MOUNT TRANSPONDER

A. ON THE GTX 335/345 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

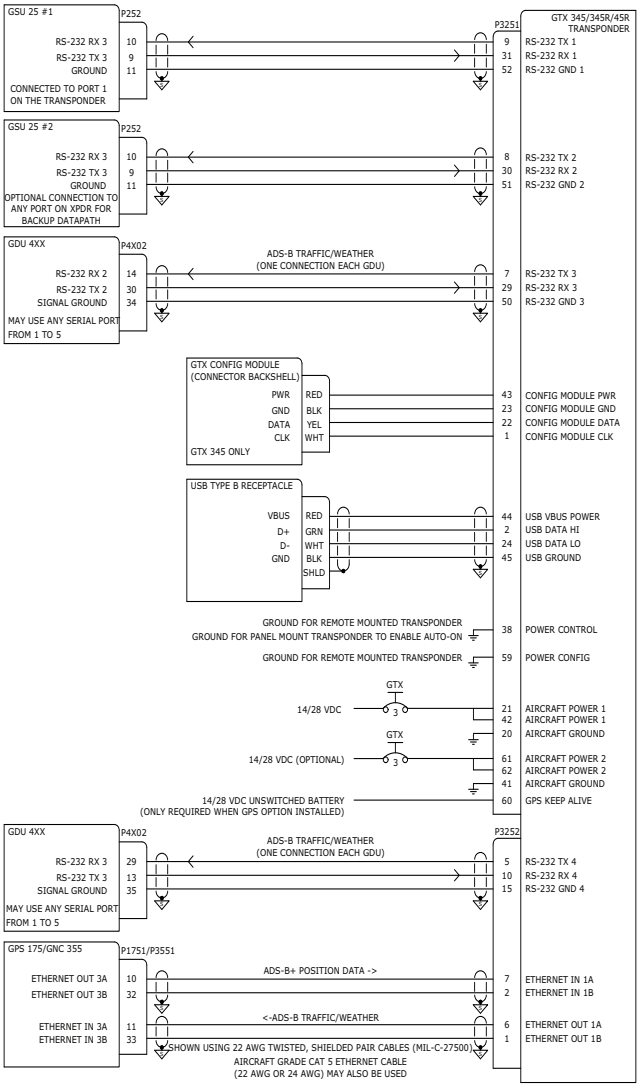
- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT RS-232 CH CONNECTED TO POSITION SOURCE
- SET INPUT FORMAT TO "ADS-B+"

5. GTX X35R/X45R REMOTE MOUNT TRANSPONDER

A. ON GDU 4XX TRANSPONDER CONFIGURATION PAGE

- SELECT INSTALLED TRANSPONDER TYPE (E.G. GTX 345R)
- CONFIGURE SERIAL PORT CONNECTED TO ADS-B POSITION SOURCE TO "ADS-B+"
- CONFIGURE HSDB DEVICES (GTN/GTS ENABLE/DISABLE)

Figure 25-2.14 GSU 25 - GTX 345/345R/45R ADS-B Position Source Options



CONFIGURATION GUIDANCE

1. GSU 25 WITH GTX 345 / 345R / 45R

A. NO CONFIGURATION REQUIRED FOR GSU 25 SERIAL PORTS

B. ON THE GTX 345 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT ALL RS-232 CHANNELS CONNECTED TO GSU 25
- SET INPUT AND OUTPUT FORMAT TO "XPDR FMT 1"

2. GDU 4XX RECEIVING TRAFFIC/WEATHER FROM GTX 345 / 345R / X45R

A. THE GTX MAY BE CONNECTED TO ANY SERIAL (RS-232) PORT ON THE GDU 4XX FROM 1 TO 5. ONE CONNECTION ONLY PER GDU.

B. ON THE GDU 4XX RS-232 CONFIGURATION PAGE

- SET SERIAL PORT CONNECTED TO GTX TO "CONNEXT 115200 BAUD"

3. GTX 345 PANEL MOUNT TRANSPONDER

A. ON THE GTX 345 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT RS-232 CH CONNECTED TO EACH GDU 4XX
- SET INPUT AND OUTPUT FORMAT TO "CONNEXT FORMAT 4"

4. GTX X45R REMOTE MOUNT TRANSPONDER

A. ON GDU 4XX TRANSPONDER CONFIGURATION PAGE

- SELECT INSTALLED TRANSPONDER TYPE (E.G. GTX 345R)
- CONFIGURE HSDB DEVICES (GTN/GTS ENABLE/DISABLE)
- CONFIGURE TRANSPONDER SERIAL PORTS 2,3,4 FOR "CONNEXT FORMAT 4" IF CONNECTED TO GDU
- CONFIGURE TRANSPONDER SERIAL PORT CONNECTED TO GSU 25 TO XPDR FMT 1
- CONFIGURE ALL ADS-B OUT DATA FIELDS

5. GTX X45R REMOTE MOUNT TRANSPONDER INSTALLED WITH GPS 175 OR GNC 355 IN SYSTEM

A. ON THE GPS 175 OR GNC 355 ADS-B SOURCE PAGE

- SET ADS-B IN SOURCE TO "GTX #1"

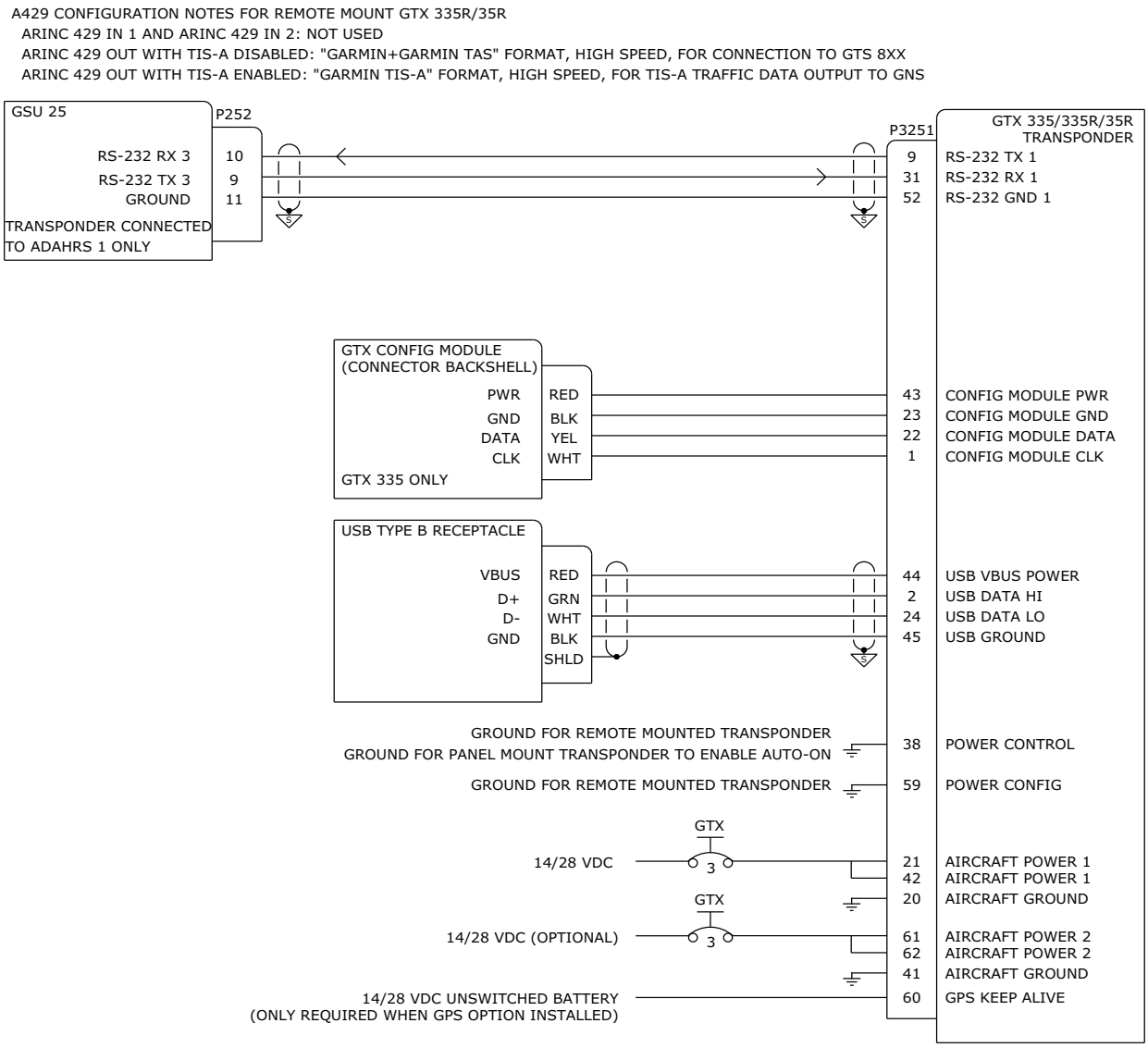
B. ON THE PFD1 TRANSPONDER CONFIGURATION PAGE

- ENABLE "GTN" ON HSDB DEVICES FIELD

6. GTX 345 PANEL MOUNT TRANSPONDER INSTALLED WITH GPS 175 OR GNC 355 IN SYSTEM

A. SET GPS 1 SRC TO "GTN 1"

Figure 25-2.15 GSU 25 - GTX 345/345R/45R, GPS 175/GNC 355 Interconnect Example



CONFIGURATION GUIDANCE

1. GSU 25 WITH GTX 335 / X35R

A. NO CONFIGURATION REQUIRED FOR GSU 25 SERIAL PORT

B. ON THE GTX 335 RS-232 SETUP PAGE (HOLD ON/ENT BUTTONS TO ENTER CONFIG)

- PRESS FUNC BUTTON TO REACH RS-232 SETUP PAGE
- SELECT RS-232 CH CONNECTED TO GSU 25 (NORMALLY 1)
- SET INPUT AND OUTPUT FORMAT TO "XPDR FMT 1"

C. FOR GTX X35R, NO CONFIGURATION REQUIRED FOR SERIAL PORT 1

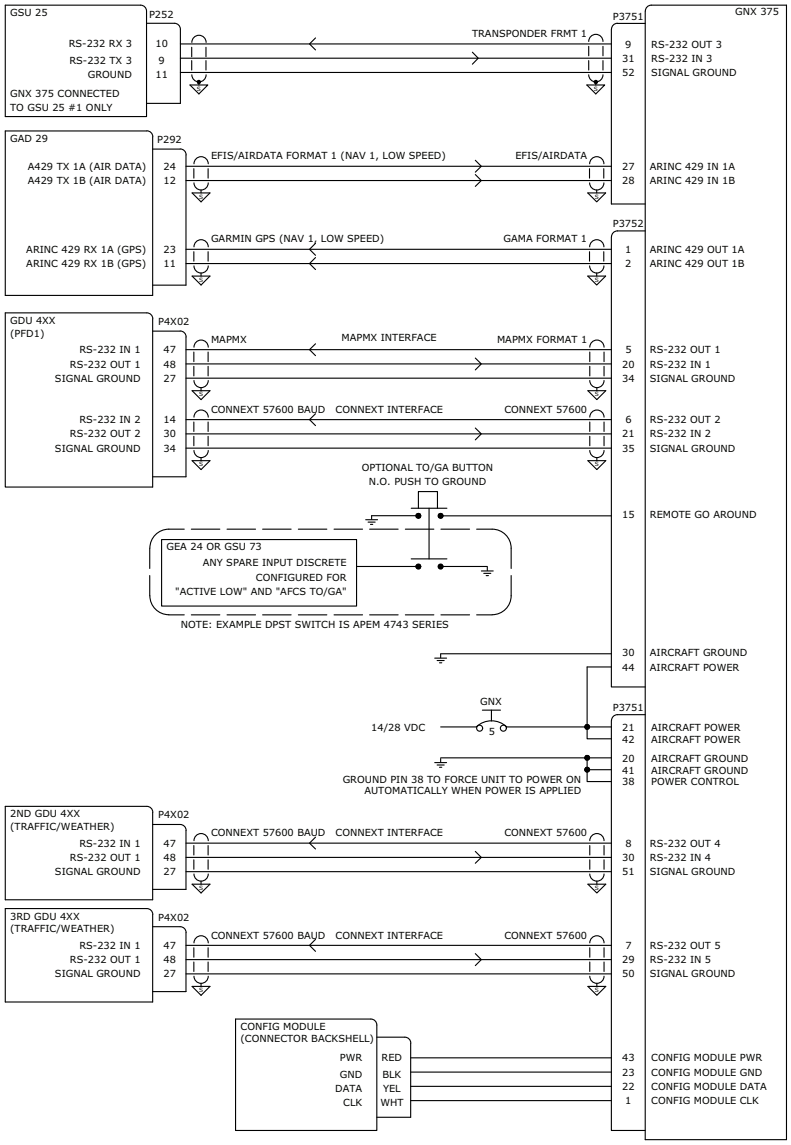
2. GTX X35R REMOTE MOUNT TRANSPONDER

A. ON GDU 37X/4XX TRANSPONDER CONFIGURATION PAGE

- SELECT INSTALLED TRANSPONDER TYPE (E.G. GTX 335R)
- CONFIGURE ALL ADS-B OUT DATA FIELDS

Figure 25-2.16 GSU 25 - GTX 335/35R Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GNX 375 UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNX 375 FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GNX375

A. ON THE ARINC 429 CONFIG PAGE
- SET IN 1 SPEED TO "LOW"
- SET IN 1 DATA TO "EFIS/AIRDATA"
- 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 1 INPUT/OUTPUT TO "MAPMX"
- SET CHNL 2 INPUT/OUTPUT TO "CONNEXT 57600"
- SET CHNL 3 INPUT/OUTPUT TO "TRANSPONDER FRMT 1"

C. ON THE MAIN INDICATOR (ANALOG) CONFIG PAGE
- SET SELECTED COURSE TO "ALLOWED"

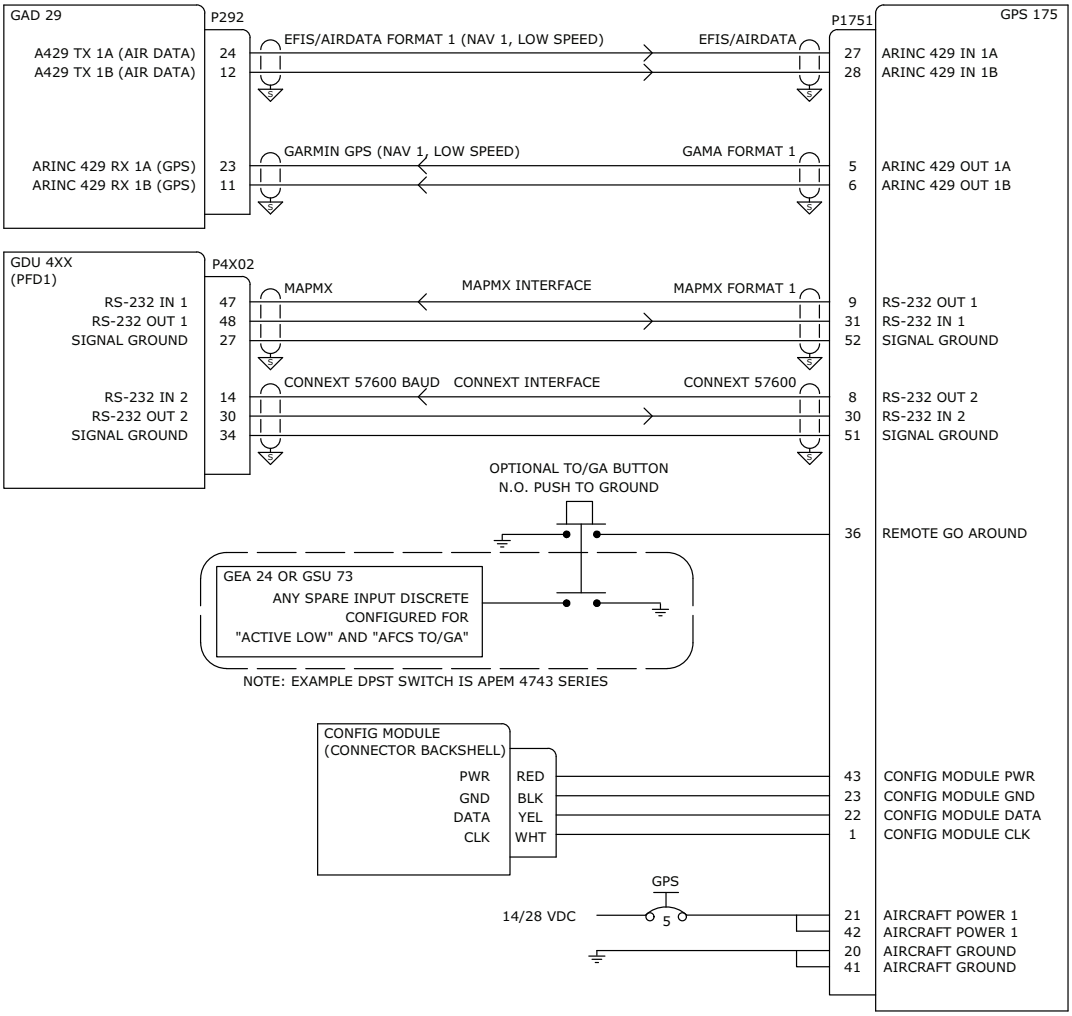
2. G3X

A. ON THE GDU 4XX RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"

B. ON THE GDU 4XX RS-232 CONFIG MODE PAGE WHEN CONNEXT IS USED
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "CONNEXT 57600 BAUD"

Figure 25-2.17 GSU 25 - GNX 375/GDU 4XX Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GPS 175 UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GPS 175 FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GPS175

A. ON THE ARINC 429 CONFIG PAGE
- SET IN 1 SPEED TO "LOW"
- SET IN 1 DATA TO "EFIS/AIRDATA"
- 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 1 INPUT/OUTPUT TO "MAPMX"
- SET CHNL 2 INPUT/OUTPUT TO "CONNEXT 57600"

C. ON THE MAIN INDICATOR (ANALOG) CONFIG PAGE
- SET SELECTED COURSE TO "ALLOWED"

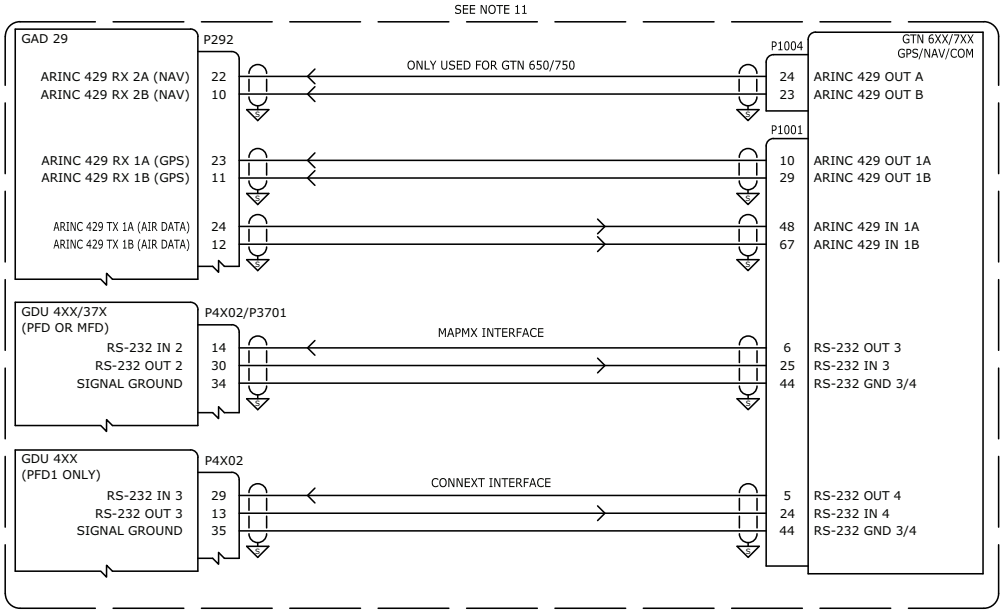
2. G3X

A. ON THE GDU 4XX RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" AND "NAV 1"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"

B. ON THE GDU 4XX RS-232 CONFIG MODE PAGE WHEN CONNEXT IS USED
- SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "CONNEXT 57600 BAUD"

Figure 25-2.18 GSU 25 - GPS 175/GDU 4XX Interconnect/Configuration Example

THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTN 6XX/7XX SERIES UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 "GDU FORMAT 2" (GTN V6.71 AND LATER)
- SET IN 1 DATA TO "EFIS FORMAT 2" WHEN “GDU FORMAT 2” IS NOT AVAILABLE
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 DATA TO "GARMIN 429" (GTN V6.50 AND LATER)
- SET OUT 1 DATA TO "GAMA FORMAT 1" WHEN "GARMIN 429" NOT AVAILABLE
- SET SDI TO "LNAV 1"

B. ON THE RS-232 CONFIG PAGE
- SET CHNL 3 INPUT TO "MAPMX FORMAT 2" WHEN THIS FORMAT IS AVAILABLE
- SET CHNL 3 OUTPUT TO "MAPMX" WHEN "MAPMX FORMAT 2" INPUT NOT AVAILABLE
- SET CHNL 4 INPUT/OUTPUT TO "CONNEXT FORMAT 2" WHEN CONNEXT IS USED

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 4XX/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 4XX/37X RS-232 CHANNEL TO "MAPMX"
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" 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"

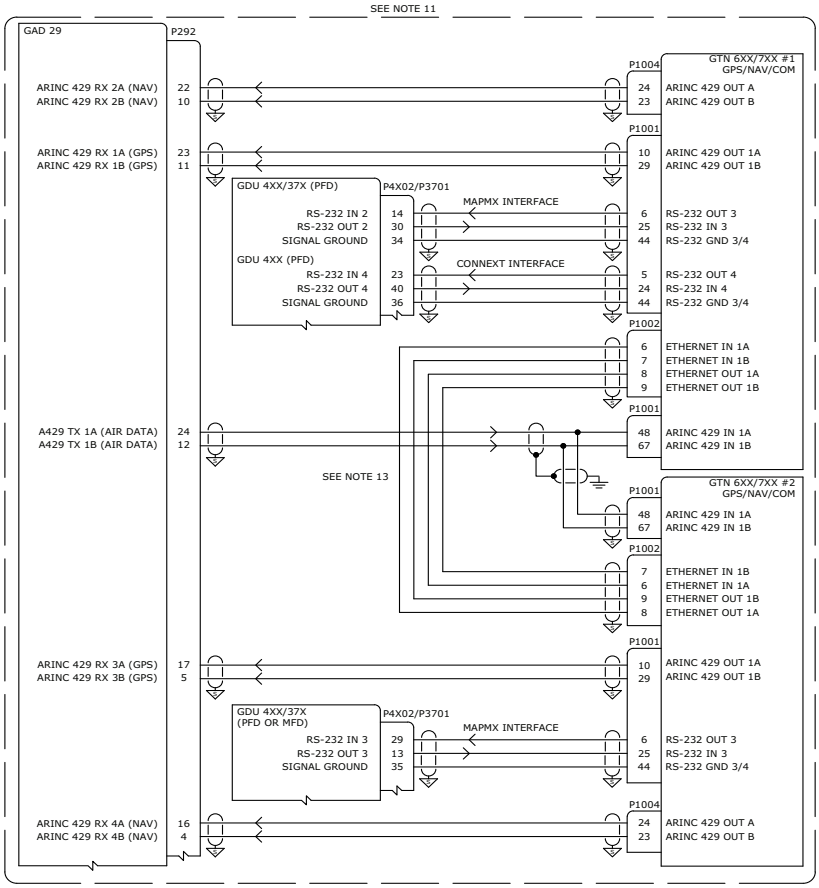
B. ON THE GDU 4XX RS-232 CONFIG MODE PAGE WHEN CONNEXT IS USED
- SET THE CONNECTED GDU 4XX (PFD) RS-232 CHANNEL TO "GTN CONNEXT 2"

NOTES:

1. BEGINNING WITH GTN V6.00 SOFTWARE, "MAPMX" FORMAT IS REPLACED WITH "MAPMX FORMAT 1" AND "MAPMX FORMAT 2" IS ADDED AS A BI-DIRECTIONAL INPUT/OUTPUT FORMAT USED FOR RADIO TUNING OF THE GTN COM RADIO.
2. BEGINNING WITH GTN SOFTWARE V6.71 (GTN Xi SOFTWARE V20.12), AND G3X TOUCH SOFTWARE V8.81, THE GTN ARINC 429 INPUT SETTING CAN BE CONFIGURED AS GDU FORMAT 2 IN PLACE OF EFIS FORMAT 2 TO ALLOW FUEL FLOW INFORMATION TO BE SENT FROM THE G3X TOUCH TO THE GTN. NO CONFIGURATION CHANGE REQUIRED FOR G3X TOUCH.
3. BEGINNING WITH GDU 4XX SOFTWARE V8.91, TRANSITION TO APPROACH MAY BE ENABLED ON THE GTN 6XX/7XX NAVIGATOR.

Figure 25-2.19 Single GTN 6XX/7XX Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTN 6XX/7XX SERIES UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 "GDU FORMAT 2" (GTN V6.71 AND LATER)
- SET IN 1 DATA TO "EFIS FORMAT 2" WHEN “GDU FORMAT 2” IS NOT AVAILABLE
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 DATA TO "GARMIN 429" (GTN V6.50 AND LATER)
- SET OUT 1 DATA TO "GAMA FORMAT 1" WHEN "GARMIN 429" NOT AVAILABLE
- 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 "MAPMX FORMAT 2" WHEN THIS FORMAT IS AVAILABLE
- SET CHNL 3 OUTPUT TO "MAPMX" WHEN "MAPMX FORMAT 2" INPUT NOT AVAILABLE
- SET CHNL 4 INPUT/OUTPUT TO "CONNEXT FORMAT 2" FOR GTN #1 WHEN USED

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"

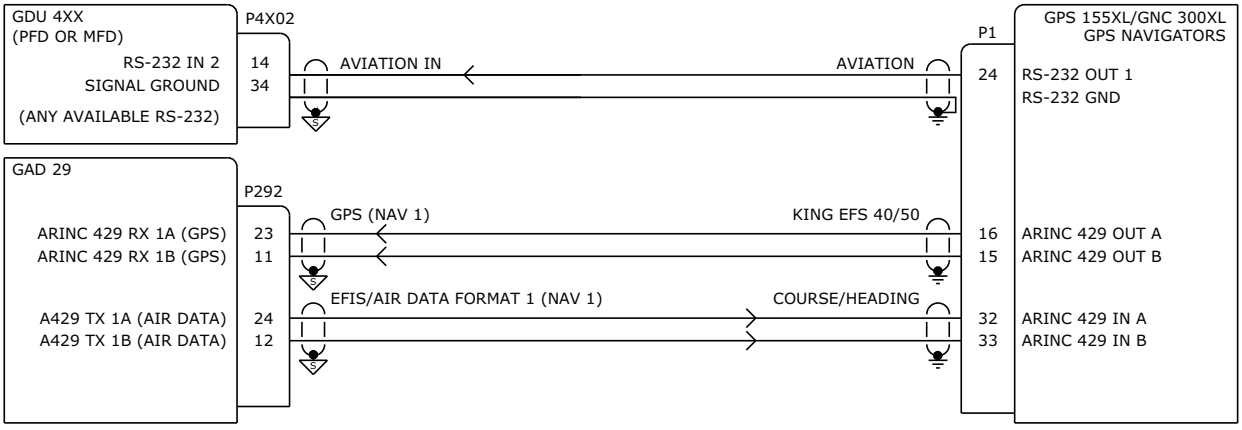
2. G3X

A. ON THE GDU 4XX/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 4XX/37X (PFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #1
- SET THE CONNECTED GDU 4XX/37X (PFD OR MFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #2
- SET THE CONNECTED GDU 4XX (PFD) RS-232 CHANNEL TO "GTN CONNEXT 2" WHEN USED
- SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" AND "NAV 1 + 2"
- SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GTN #1
- SET ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GTN #1
- SET ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GTN #2 (IF APPLICABLE)
- SET ARINC 429 RX 4 FORMAT TO "GARMIN VOR/ILS" AND "NAV 2" FOR GTN #2

IMPORTANT: GTN #1 AND #2 ARE DIFFERENTIATED IN THE G3X SYSTEM BY THE GDU 4XX/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.

NOTE 1: BEGINNING WITH GDU 4XX SOFTWARE V8.91, TRANSITION TO APPROACH MAY BE ENABLED ON THE GTN 6XX/7XX NAVIGATOR.

Figure 25-2.20 Dual GTN 6XX/7XX Interconnect/Configuration Example



CONFIGURATION GUIDANCE

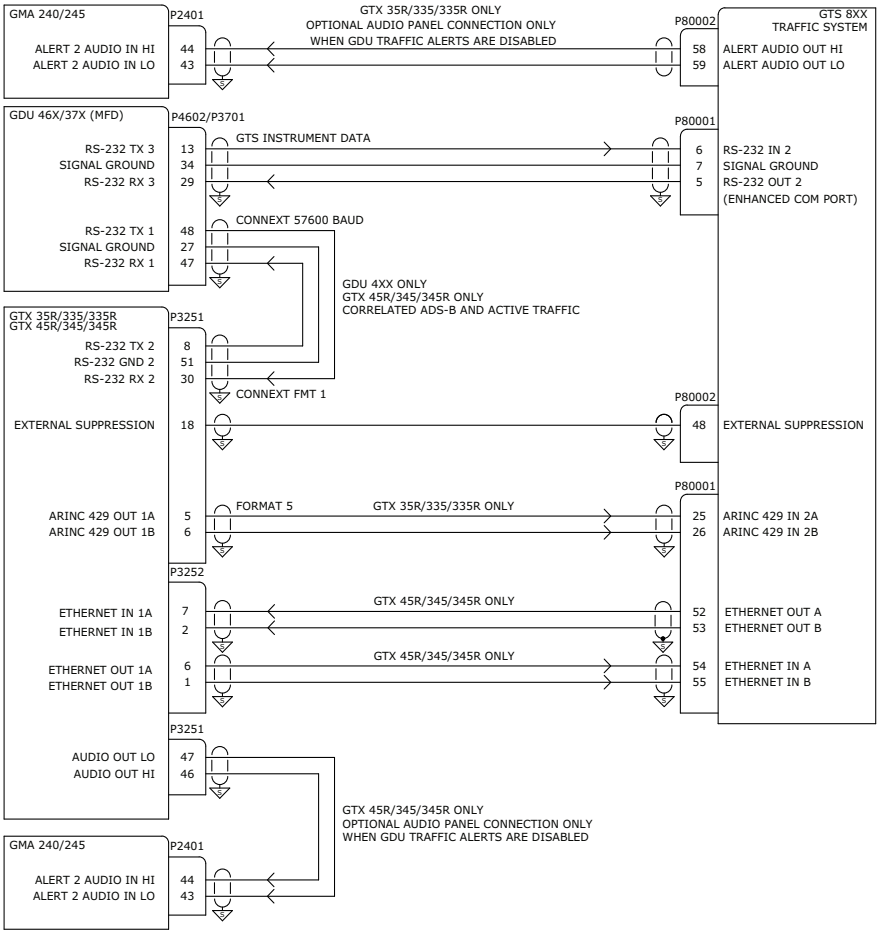
1. **GPS 155XL/GNC 300XL**
   A. ON THE CONFIG MODE ARINC 429 CONFIGURATION PAGE:
      - SET IN TO "COURSE/HEADING"
      - SET OUT TO "KING EFS 40/50"

   B. ON THE I/0 CHANNEL1 CONFIG PAGE
      - SET IN TO "OFF"
      - SET OUT TO "AVIATION"

2. **G3X TOUCH**
   A. ON THE GDU 4XX RS-232 AND ARINC 429 CONFIG MODE PAGES
      - SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "AVIATION IN"
      - SET ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA FORMAT 1" AND "NAV 1"
      - SET ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"

Figure 25-2.21 GNC 300XL/GDU 4XX Interconnect/Configuration Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTS 8XX TRAFFIC SYSTEM. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTS 8XX SERIES UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 (GTS 8X0 V4.10 AND LATER, GTS 8X5 V3.10 AND LATER)

1. GTS 8XX - ALL INSTALLATIONS

A. UNDER "TRAFFIC DISPLAY DESTINATION", SET "ENHANCED COM PORT" TO RS-232 PORT 2

B. ON CONFIGURATION PAGE SET "ADS-B RECEIVER" TO "ON" AND CHECK "ALLOW ADS-B IN STANDBY"

2. GTS 8XX INSTALLED WITH GTX 35R/335/335R TRANSPONDER

A. UNDER "TRANSPONDER 1 COMMUNICATION" SET A429 PRIMARY TX/RX TO TX/RX CHANNEL 2 AND SELECT "HIGH SPEED"

B. UNDER "GPS POSITION/VELOCITY/TIME SOURCE", SET A429 PRIMARY TO RX CHANNEL 2 AND SELECT "HIGH SPEED"

C. UNDER "BAROMETRIC ALTITUDE SOURCE", SET A429 PRIMARY TO RX CHANNEL 2 AND SELECT "HIGH SPEED"

D. UNDER "MAGNETIC HEADING SOURCE", SET A429 PRIMARY TO RX CHANNEL 2 AND SELECT "HIGH SPEED"

2. GDU 46X/37X (GDU 4XX V8.50 AND LATER)

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "GTS INSTRUMENT DATA"

B. ON THE GDU 46X/37X XPDR CONFIG MODE PAGE

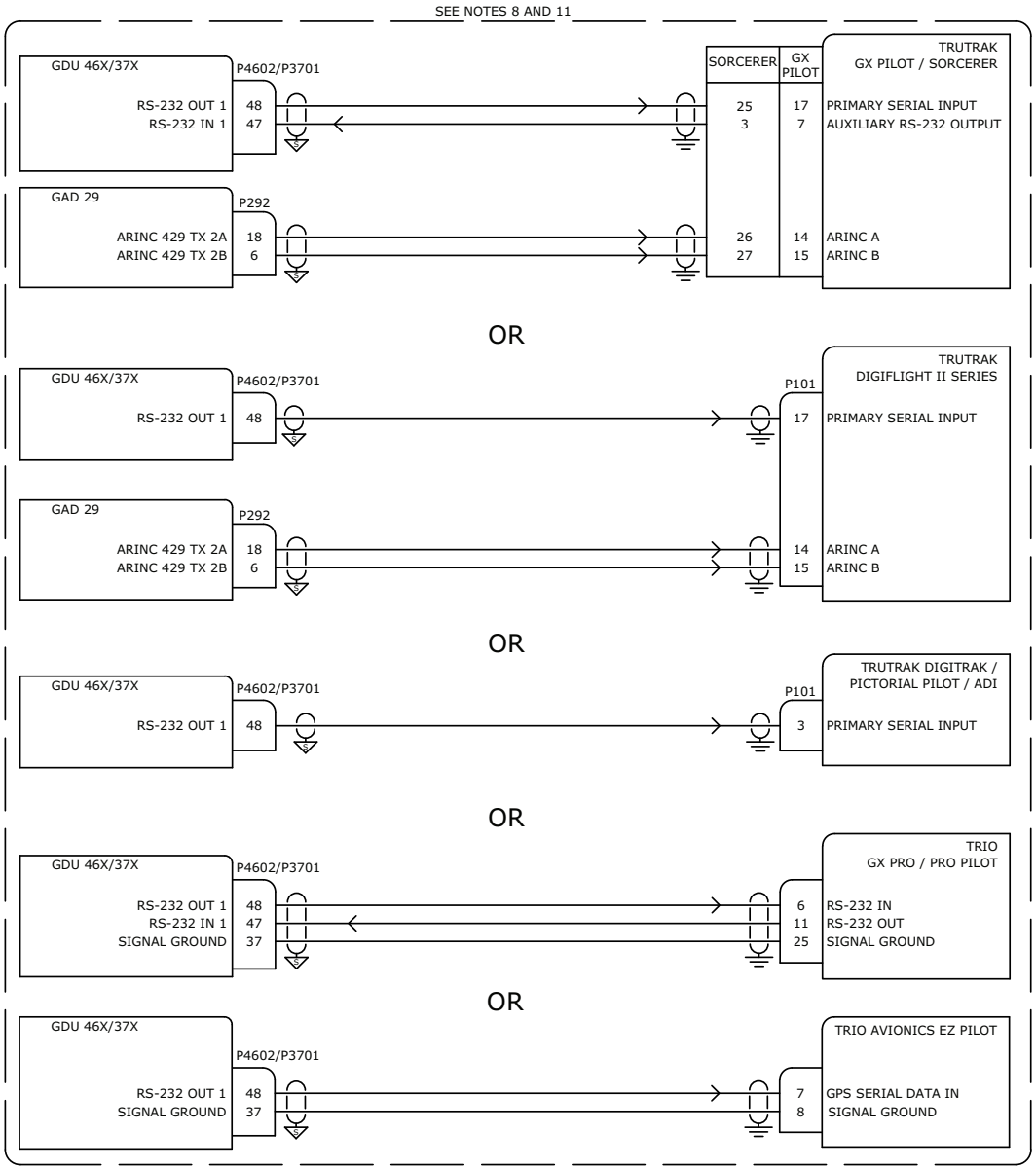
- IF A REMOTE TRANSPONDER IS CONFIGURED WHICH SUPPORTS TIS-A TRAFFIC, DISABLE THIS FEATURE

C. ON THE GDU 46X/37X SOUND CONFIG MODE PAGE

- SET "TRAFFIC AUDIO" AND "TRAFFIC N/A ALERT" TO "OFF" IF ONE OF THE TRAFFIC ALERT AUDIO CONNECTIONS TO THE AUDIO PANEL SHOWN ABOVE IS WIRED.

Figure 25-2.22 GDU 4XX v8.50 Interconnect/Configuration Example

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 46X/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET CONNECTED GDU 46X/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 46X/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
- SET ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

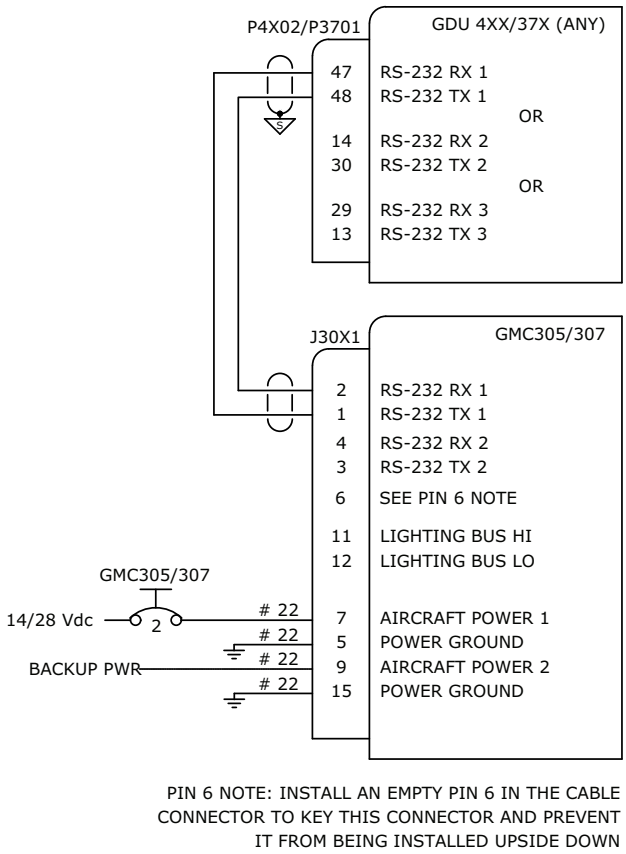
3. TRUTRAK DIGITRAK / PICTORIAL PILOT / ADI OR TRIO AVIONICS EZ PILOT

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "NMEA OUT"

4. TRIO GX PRO / PROPILOT

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"

Figure 25-2.23 Non-Garmin Auto Pilot Interconnect/Configuration Example



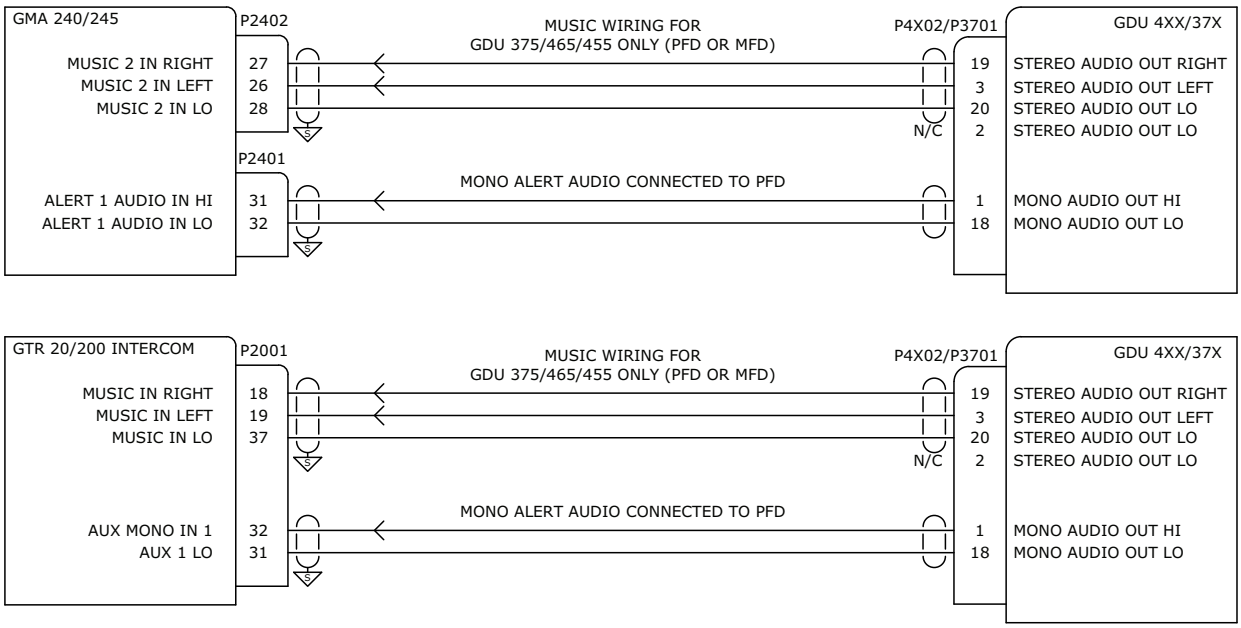
CONFIGURATION GUIDANCE

1. G3X

A. ON THE GDU 4XX/37X CONFIG MODE RS-232 PORT CONFIGURATION PAGE

- SET RS-232 PORT CONNECTED TO GMC TO "GARMIN INSTRUMENT DATA"

Figure 25-2.24 Non-Garmin Auto Pilot Interconnect/Configuration Example w/GMC 30X



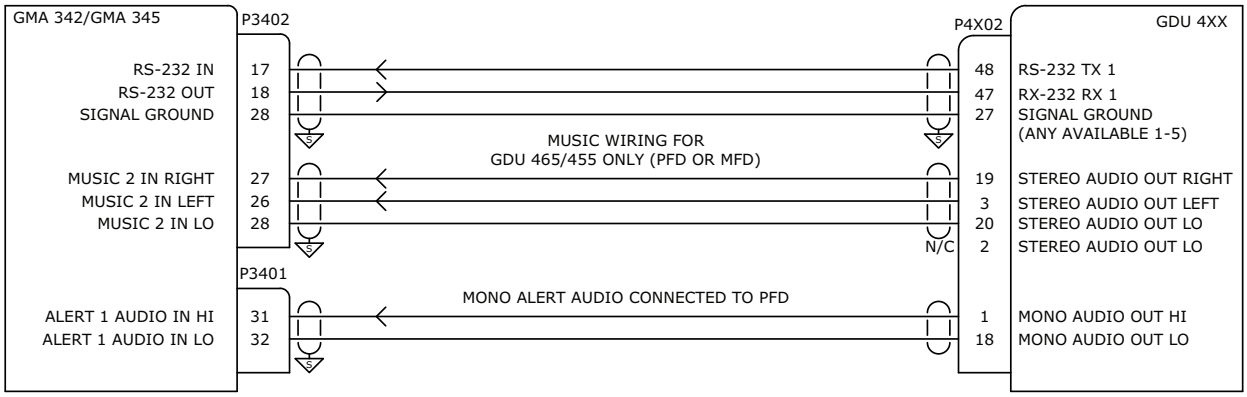
CONFIGURATION GUIDANCE

1. GDU 4XX/37X

A. ON THE GDU 4XX/37X SOUND CONFIGURATION PAGE

- SET THE ALERT SOURCE TO "PFD"
- SET THE ALERT OUTPUT TO "MONO ONLY"

Figure 25-2.25 GDU 37X/4XX Audio to GMA 240/245 or GTR 20/200 Interconnect/Configuration Example



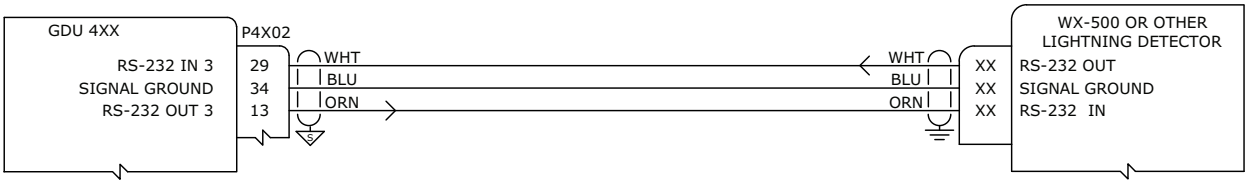
CONFIGURATION GUIDANCE

1. GDU 4XX

A. ON THE GDU 4XX SOUND CONFIGURATION PAGE
- SET THE ALERT SOURCE TO "PFD"
- SET THE ALERT OUTPUT TO "MONO ONLY"

B. ON THE GDU 4XX RS-232 CONFIGURATION PAGE
- SET THE RS-232 FORMAT TO "GARMIN INSTRUMENT DATA" FOR THE RS-232 PORT CONNECTED TO THE AUDIO PANEL

Figure 25-2.26 GDU 4XX Audio to GMA 342/GMA 345 Interconnect/Configuration Example



CONFIGURATION GUIDANCE

1. GDU 4XX TO LIGHTNING DETECTOR

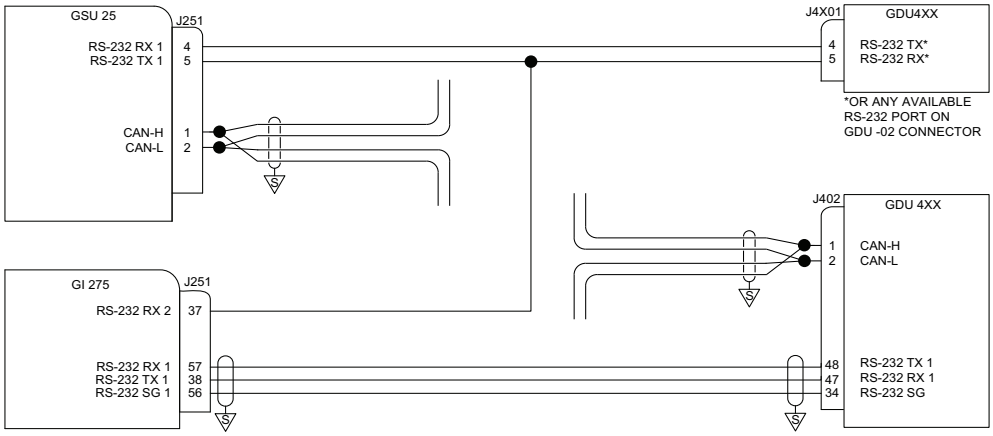
A. ON THE GDU 4XX RS-232 CONFIG MODE PAGE

- SET CONNECTED RS-232 CHANNEL FORMAT TO "LIGHTNING DETECTOR"

B. CHECK LIGHTNING DETECTOR MANUAL FOR ANY SETUP REQUIRED

Figure 25-2.27 WX-500/Lightning Detector Interconnect/Configuration Example

THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GI 275 SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GI 275 SERIES UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.

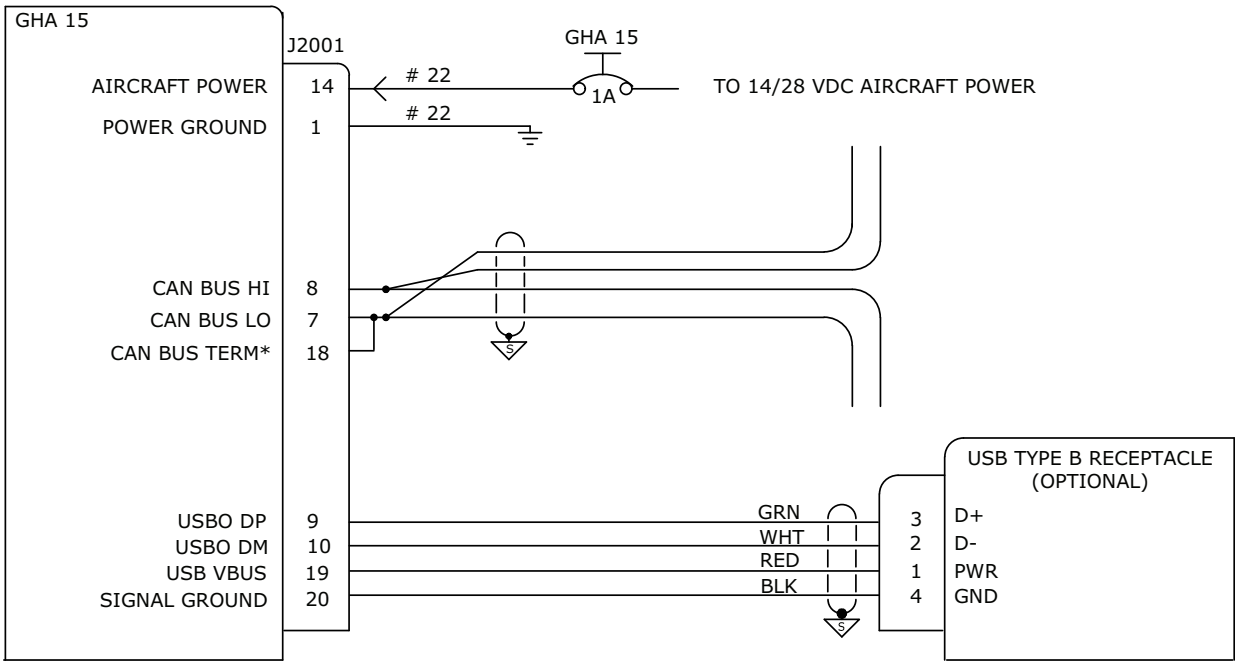


NOTE: A GI 275 CANNOT BE CONNECTED TO A G3X TOUCH SYSTEM IF A G5 IS PRESENT ON THE CAN BUS.

CONFIGURATION GUIDANCE

1. GI 275 (SW V2.53+ REQUIRED)
   - A. ON THE INTERFACES CONFIGURATION MENU
     - SET PFD SYNC TO THE CONNECTED RS-232 PORT
   - B. IN SETUP, AIRFRAME CONFIGURATION, SET ALTITUDE BUG TO ENABLED, SET AIRSPEED BUG TO DISABLED
   - C. IF CONNECTION TO GSU IS USED, UNDER INTERFACES:
     - SET AHRS to GSU 25, RS232 RX 2
     - SET ADC to GSU 25, RS232 RX 2
2. G3X TOUCH
   - A. ON THE GDU 4XX RS-232 CONFIG MODE PAGE
     - CONNECTION FROM GDU 4XX TO GI 275 IS REQUIRED. SET THE CONNECTED GDU 4XX RS-232 CHANNEL TO "GARMIN INSTRUMENT DATA"
     - CONNECTION FROM GSU 25 SERIAL PORT TO GI 275 IS OPTIONAL. IF THIS CONNECTION IS MADE, MISCOMPARISON ALERTS WILL BE DISPLAYED ON GI 275 IF THE G3X TOUCH ADAHRS AND THE GI 275 DISAGREE IN ATTTITUDE OR AIRSPEED. IF THIS CONNECTION IS NOT MADE, NO MISCOMPARISONS WILL BE MADE.
     - ANY RS-232 PORT ON THE GDU P4X01 OR P4X02 CONNECTOR CAN BE USED FOR EITHER CONNECTION. BOTH CONNECTIONS WILL BE SET TO "GARMIN INSTRUMENT DATA". IF P4X01 IS USED FOR EITHER CONNECTION, NO CONFIGURATION IS NECESSARY. IF P4X02 IS USED, SET TO GARMIN INSTRUMENT DATA

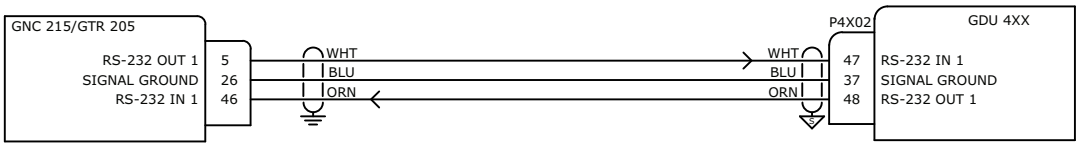
Figure 25-2.28 GSU 25/GDU4XX/GI 275 Interconnect Example



*IF GHA 15 IS NOT LOCATED AT EITHER EXTREME END OF THE CAN BUS, LEAVE PIN 18 (CAN BUS TERM) UNCONNECTED.

Figure 25-2.29 GHA 15 Interconnect Example

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTR 205/GNC 215 SERIES PRODUCTS. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTR 205/GNC 215 FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GDU 4XX/37X TO GTR 205

A. ON THE GDU 4XX/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 4XX/37X RS-232 CHANNEL FORMAT TO "GARMIN VHF COMM"

B. ON THE GTR 205 CONFIGURATION AGE
- SET SERIAL PORT IO MODE TO "NMEA 1"

2. GDU 4XX/37X TO GNC 215

A. ON THE GDU 4XX/37X COMM CONFIG MODE PAGE
- SET CONNECTED GDU 4XX/37X RS-232 CHANNEL FORMAT TO "GARMIN VHF NAV/COMM"

B. ON THE GNC 215 CONFIGURATION PAGE
- SET SERIAL PORT IO MODE TO "NMEA 1"

Figure 25-2.30 GDU4XX - GNC 215/GTR 205 Interconnect Example

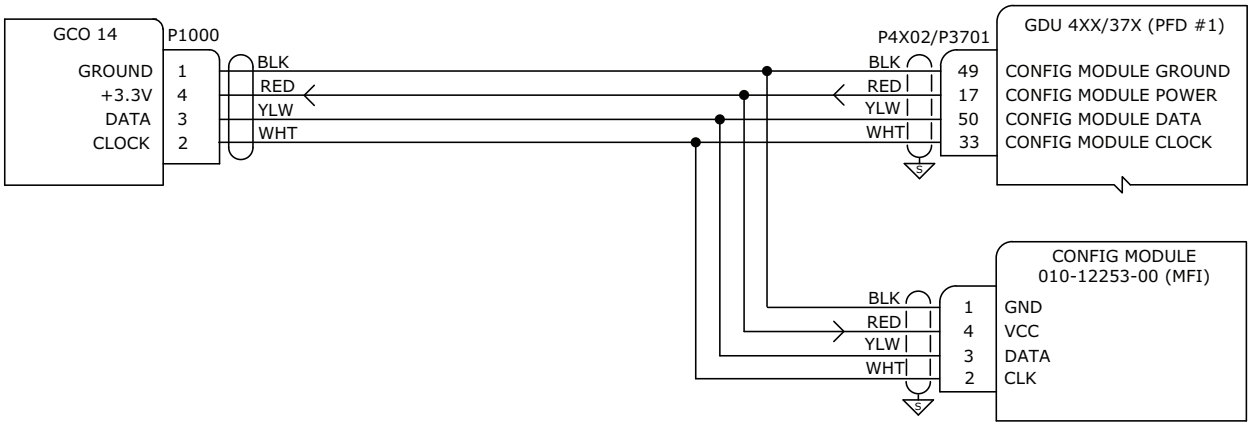


Figure 25-2.31 GCO™ 14 Display Interconnect Example

26 G3X™ AVIONICS W/GTR 20/205X(R) INTERCONNECT DRAWINGS

This section contains interconnect drawings for installing a GTR 20 unit(s) into a G3X system. GTR 200 units may also be installed into a G3X system, but may use different connections than the GTR 20. Use the interconnect drawings in the GTR 200 Installation Manual (190-01553-00) for installing a GTR 200 into a G3X system. Table 26-1 lists the interface methods that can/cannot be used for GTR 20/200 to G3X systems.

NOTE

The GTR 20 wiring diagrams in this section use only CAN connections, the GTR 200 Installation Manual shows both CAN and RS232 connections.

NOTE

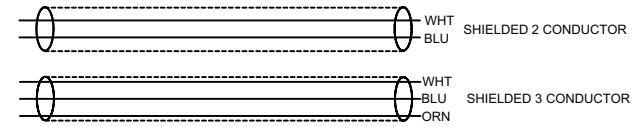
Figure 26-3.3 shows common GTR 205X interconnect examples. For more interconnect examples, refer to the GTR 205X/GTR 205XR Installation Manual (190-02766-21).

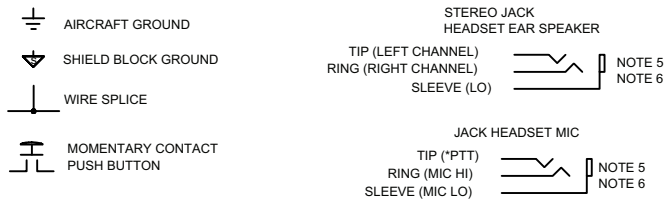
Table 26-1 GTR to GDU™ Display Interface Methods

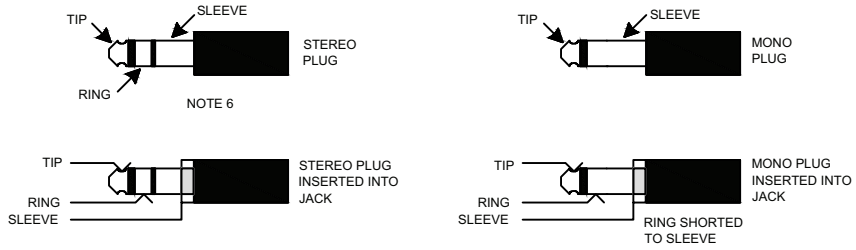
GTR	GDU 37X	GDU 4XX
GTR 20	None	CAN Only
GTR 200	RS-232 or CAN (CAN preferred)	CAN Only

26.1 Notes for Section 26 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 22 AWG MINIMUM. POWER AND GROUND WIRES MUST BE 20 AWG
4. SYMBOL DESIGNATIONS AND CONNECTOR GUIDANCE:

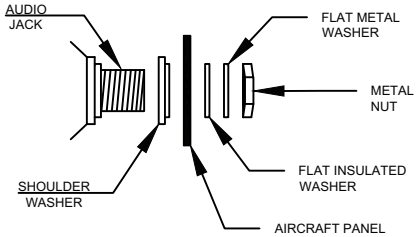






5. ISOLATE JACK SLEEVE (MOUNTING NUT AND NUT PLATE) FROM AIRCRAFT CHASSIS.

NOTE 5. AUDIO JACK ISOLATION DIAGRAM



6. THE HEADSET EAR SPEAKER SLEEVE DIAMETER IS LARGER THAN THE HEADSET MIC SLEEVE DIAMETER.
7. THE CONNECTION BETWEEN PTT AND THE MIC JACK TIP IS REQUIRED IF HAND MICS WILL BE USED. *DENOTES AN ACTIVE LOW SIGNAL.
8. THE FUNCTION OF *DISC1 AND *DISC2 ARE CONFIGURABLE. *DENOTES AN ACTIVE LOW SIGNAL.
9. SPARE AUDIO INPUT.
10. CONNECTING PINS 25 AND 26 ADDS A 120 OHM TERMINATION TO THE GTR 20 CAN BUS. CONNECT ONLY IF THE GTR 20 IS AT THE END OF THE CAN BUS.
11. IF TWO COM RADIOS ARE INSTALLED THIS INPUT AND OUTPUT CONNECTS TO THE OTHER COM RADIO. *TRANSMIT INTERLOCK IN TO *TRANSMIT INTERLOCK OUT AND *TRANSMIT INTERLOCK OUT TO *TRANSMIT INTERLOCK IN. *DENOTES AN ACTIVE LOW SIGNAL.
12. THIS OUTPUT CAN DRIVE A RECORDING DEVICE IF AN AUDIO PANEL IS NOT CONNECTED. A 3.5 MM JACK IS TYPICALLY USED. ISOLATE JACK SLEEVE (MOUNTING NUT AND NUT PLATE) FROM AIRCRAFT CHASSIS.
13. THE GTR 20 IS CONNECTED AS COM 2. *DENOTES AN ACTIVE LOW SIGNAL.
14. MONO ONLY HEADSET JACK CONNECTION DETAIL.
15. NO NOTE.
16. THE ID STRAP INPUT IS FOR SETTING UP THE GTR20 TO BE IDENTIFIED IN THE CAN BUS SYSTEM AS EITHER A COM 1 OR A COM 2 RADIO. FOR INSTALLATIONS WITH DUAL GTR 20 RADIOS LEAVE PIN 8 OPEN TO IDENTIFY THE GTR20 AS COM 1, AND CONNECT PIN 8 TO 27 ON THE SECOND GTR 20 TO IDENTIFY IT AS COM 2. FOR SINGLE INSTALLATIONS DO NOT CONNECT ANYTHING TO PIN 8 (LEAVE OPEN) TO IDENTIFY THE GTR20 AS COM 1.
17. THE ID STRAP INPUT IS FOR SETTING UP THE GTR 205X(R) TO BE IDENTIFIED IN THE CAN BUS SYSTEM AS EITHER A COM 1 OR A COM 2 RADIO. FOR INSTALLATIONS WITH DUAL GTR 205X(R) RADIOS, LEAVE PIN 14 OPEN TO IDENTIFY AS COM 1, AND CONNECT PIN 14 TO 35 ON THE SECOND GTR TO IDENTIFY IT AS COM 2. FOR SINGLE INSTALLATIONS, DO NOT CONNECT ANYTHING TO PIN 14 (LEAVE OPEN) TO IDENTIFY THE GTR AS COM 1.

Figure 26-1 Notes for Section 26 Interconnect Drawings

26.2 Single GTR 20 Interconnect Drawings

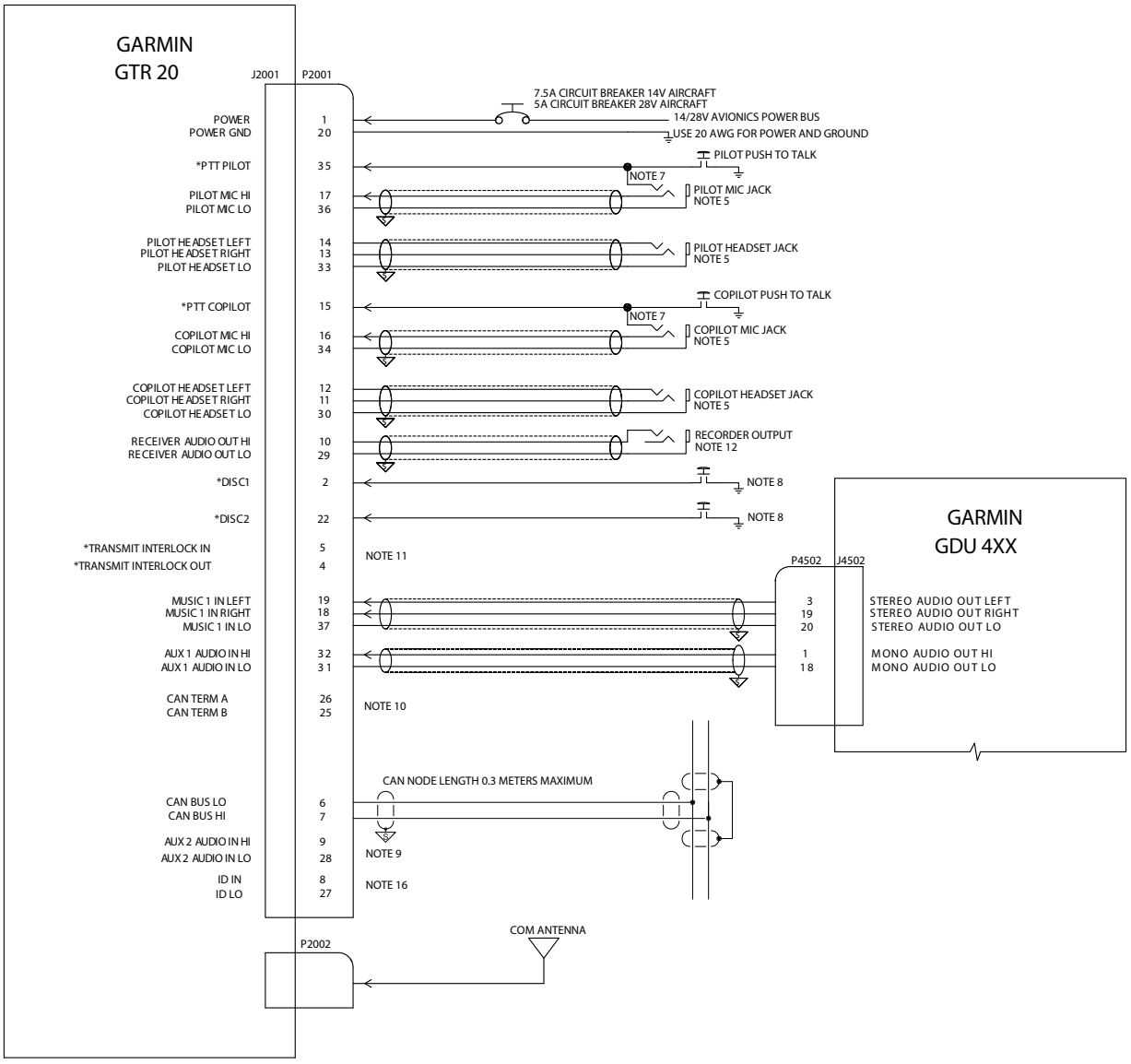


Figure 26-2.1 GTR 20/GDU 4XX Interconnect Drawing

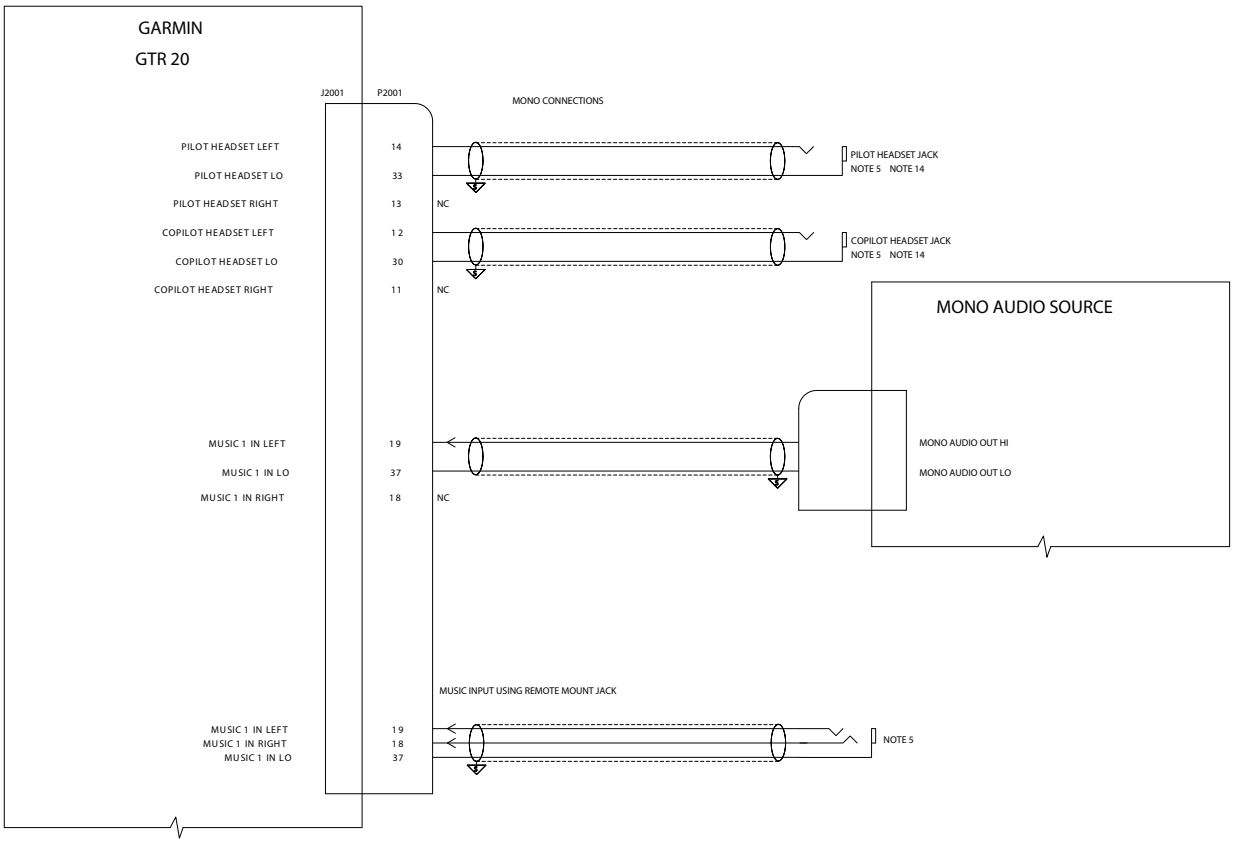


Figure 26-2.2 GTR 20/Mono Audio Source Interconnect Drawing

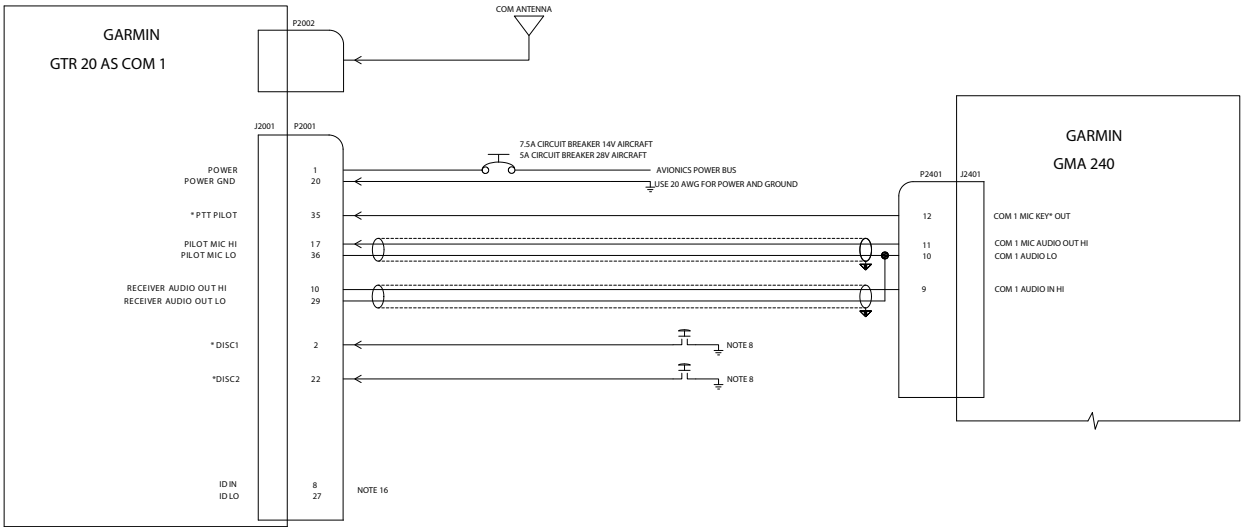


Figure 26-2.3 GTR 20/GMA™ Audio Panel 240 Interconnect Drawing

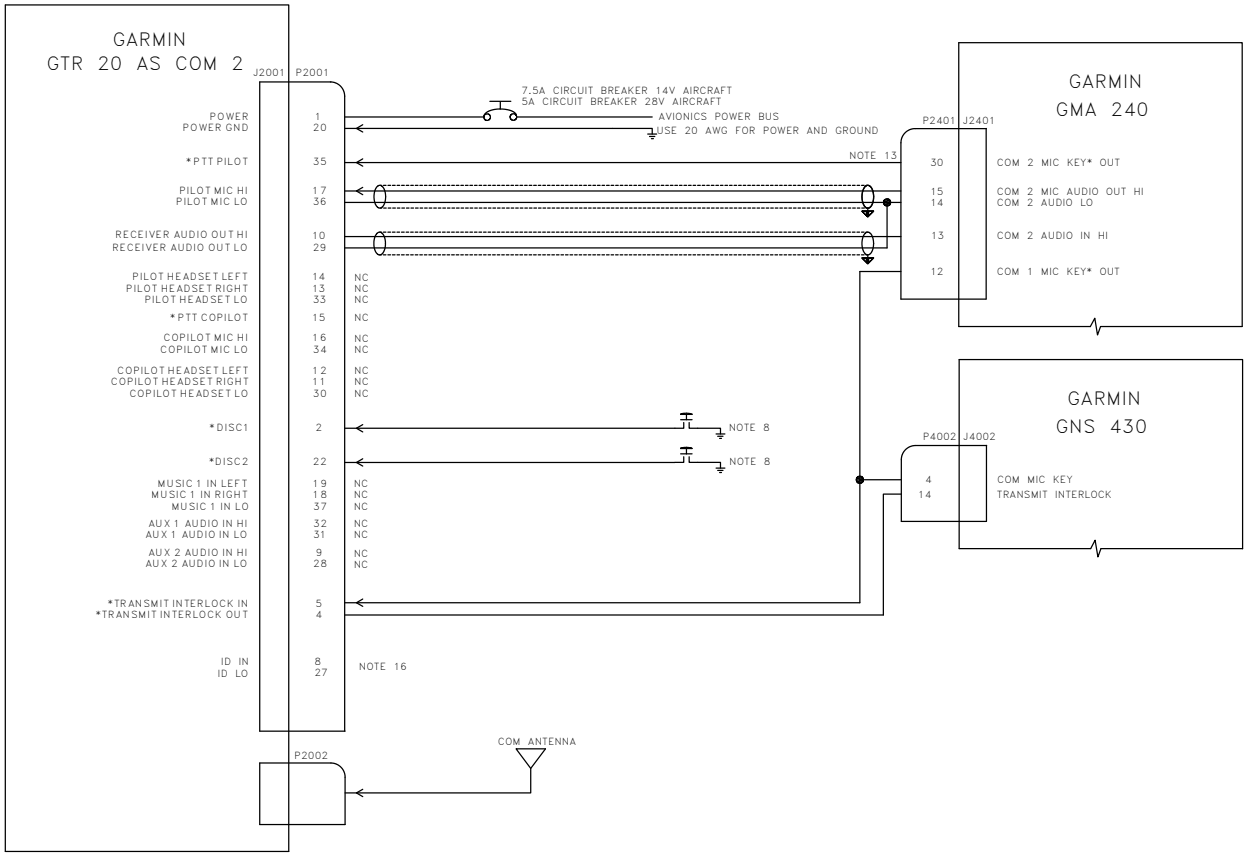


Figure 26-2.4 GTR 20/GMA 240/GNS™ 430 Interconnect Drawing

26.3 Dual GTR 20 Interconnect Drawings

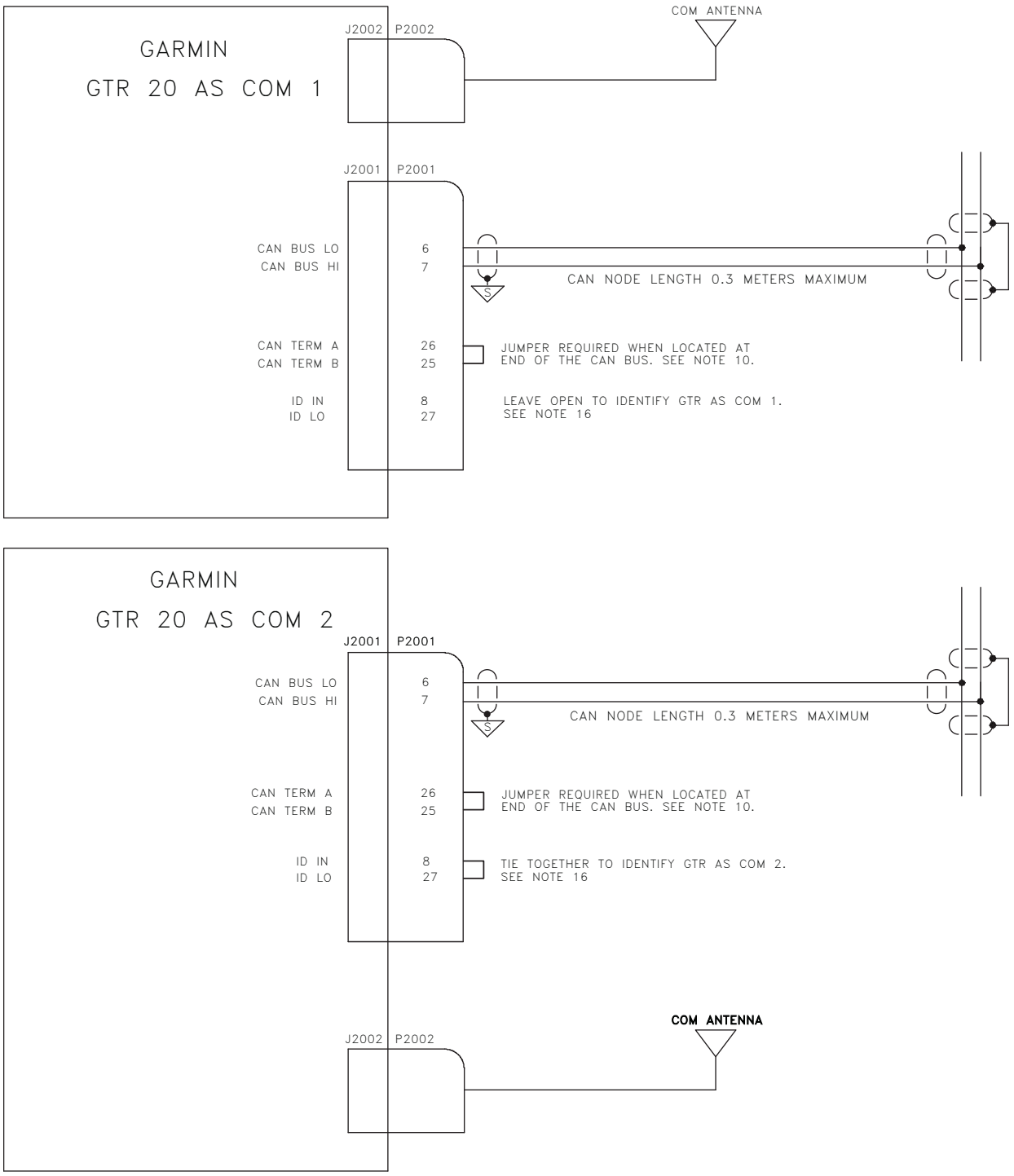


Figure 26-3.1 Dual GTR 20/CAN Bus Interconnect Drawing

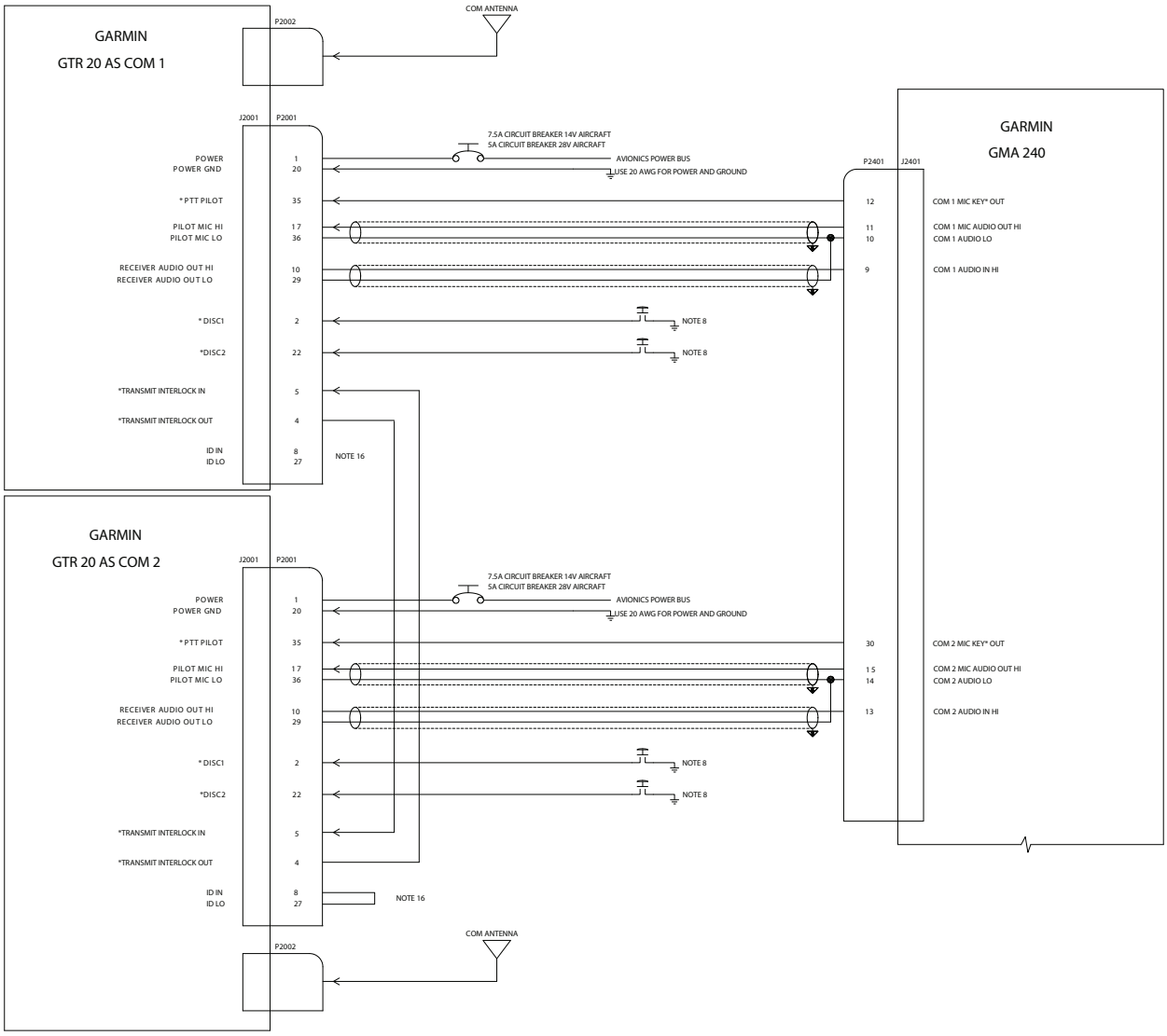


Figure 26-3.2 Dual GTR 20/GMA 240 Interconnect Drawing

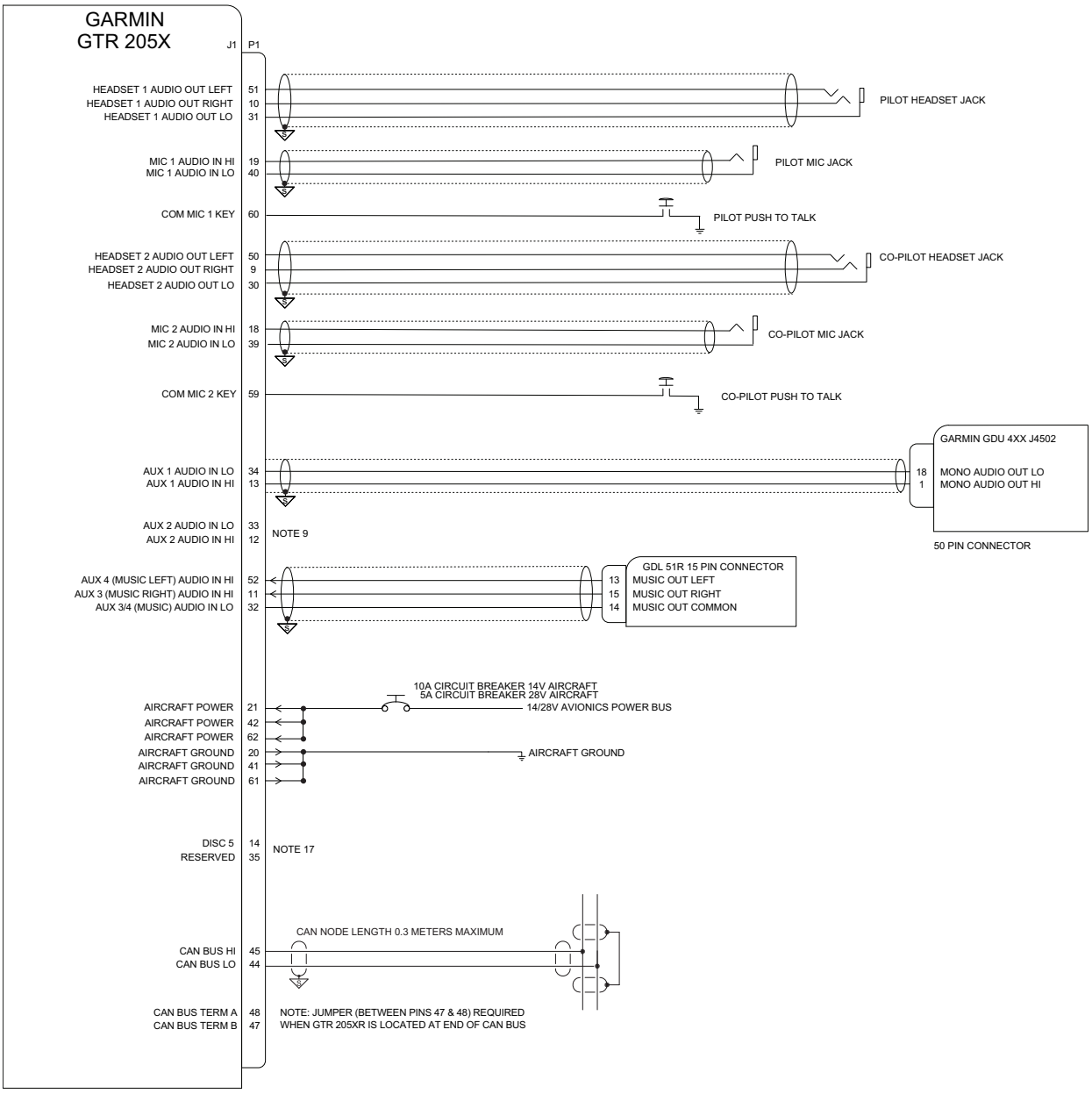
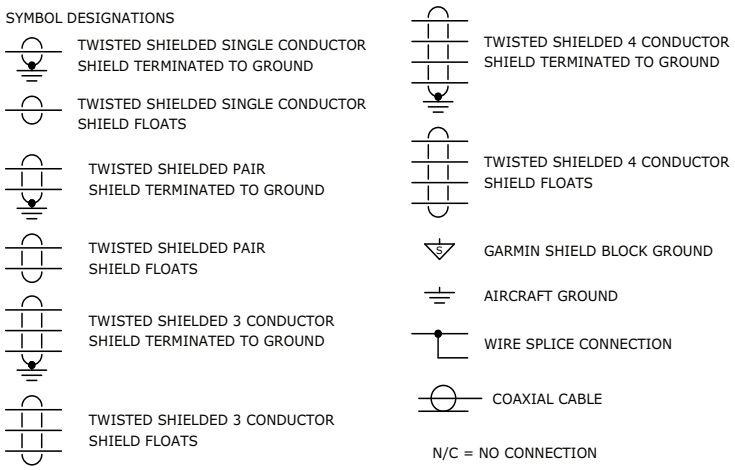


Figure 26-3.3 GTR 205X Interconnect Drawing

27 SENSOR WIRING EXAMPLES

27.1 Notes for Section 27 Drawings

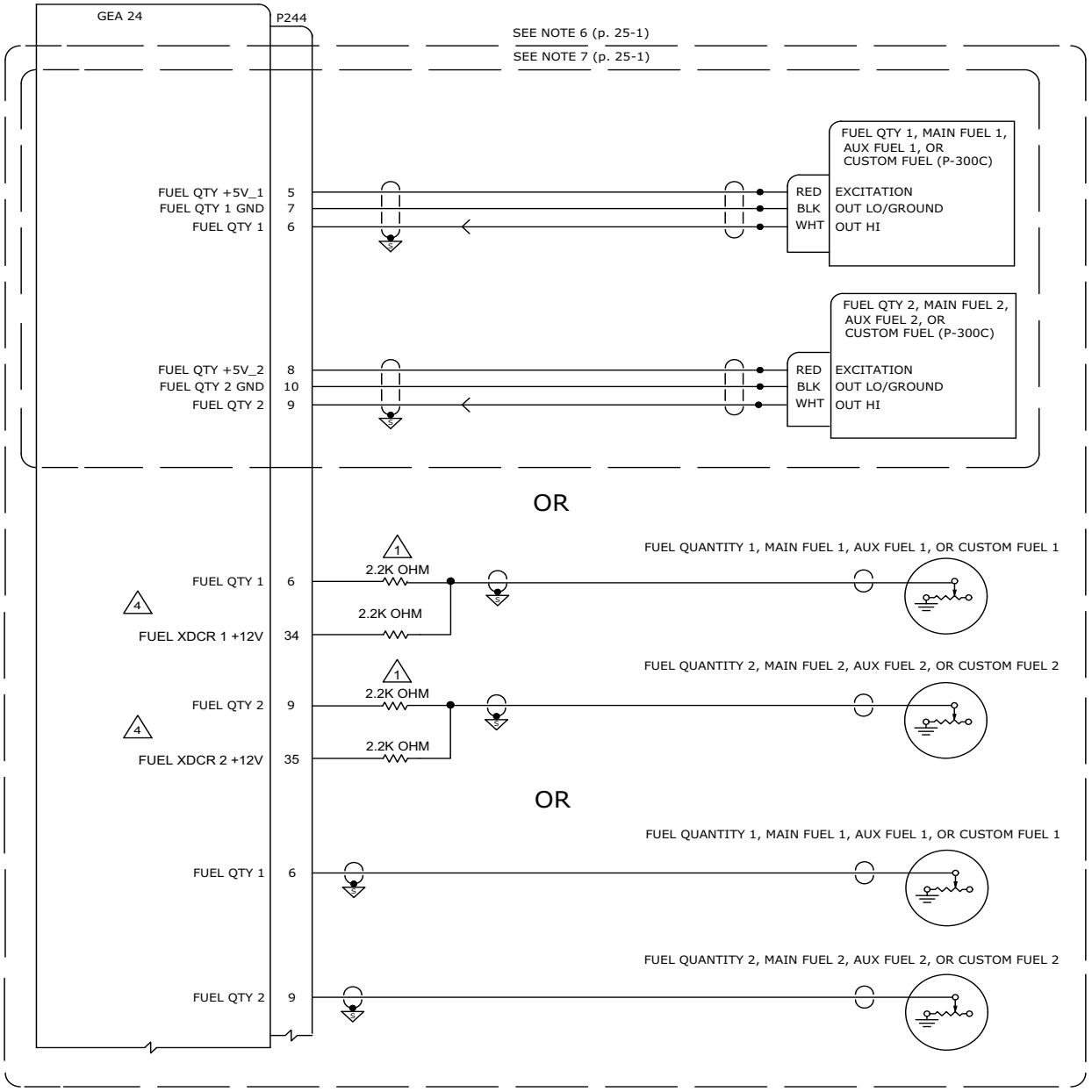
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS



5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE UNIT BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. UP TO 4 FUEL QUANTITY GAUGES CAN BE CONFIGURED.
7. EI P-300C CAPACITANCE TO FREQUENCY CONVERTERS CAN BE USED FOR MEASUREMENT OF CAPACITIVE FUEL QUANTITY.
8. IF FUEL 1 AND 2 CHANNELS ARE USED FOR RESISTIVE TYPE FUEL QUANTITY INPUTS, THE ASSOCIATED FUEL PULL UP PINS MUST BE WIRED TO THE +10V TRANSDUCER POWER OUTPUT AS SHOWN FOR PROPER OPERATION. FUEL PULL UP PINS SHOULD NOT BE USED IF INSTALLING THE SKYSPORTS OR WESTACH FUEL SENDERS. IF USING WESTACH SENDERS, VERIFY THE SPECIFIC MODEL USED IS COMPATIBLE WITH +12VDC AND PROVIDES A 0-5V OUTPUT.
9. THE CHANNELS USING FUEL 3 AND FUEL 4 AS PART OF THEIR INPUT NAME CAN BE CONFIGURED TO MEASURE A RESISTIVE TYPE FUEL QUANTITY SENSOR. RESISTORS MUST BE RATED TO A MINIMUM OF 1/4 WATT. EXTERNAL PULL UP RESISTORS SHOULD NOT BE USED IF INSTALLING THE SKYSPORTS FUEL PROBES. IF USING WESTACH SENDERS, VERIFY THE SPECIFIC MODEL USED IS COMPATIBLE WITH +12VDC AND PROVIDES A 0-5V OUTPUT.
10. THE CAP 2 / FUEL FLOW 2 CHANNEL CAN OPTIONALLY BE CONFIGURED TO MEASURE EI P-300C FUEL QUANTITY, OR CONFIGURED TO MEASURE RETURN LINE FUEL FLOW. IF A FUEL FLOW TRANSDUCER IS WIRED TO THIS INPUT THE MEASURED FUEL FLOW WILL BE SUBTRACTED FROM THE MEASURED FUEL FLOW 1 INPUT AS PART OF A DIFFERENTIAL FUEL FLOW CALCULATION.
11. THE CHANNELS USING GP (GENERAL PURPOSE) AS PART OF THEIR INPUT NAME CAN BE CONFIGURED TO MEASURE AMPS THROUGH A HALL EFFECT TRANSDUCER. THE CHANNEL WILL BE CONFIGURED TO EXPECT A 15.9 MV / AMP SIGNAL. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL GUIDANCE ON CONFIGURATION AND CALIBRATION OF A HALL EFFECT TRANSDUCER.
12. IF MEASURING BATTERY CURRENT, PLACE THE SHUNT BETWEEN THE BATTERY POSITIVE TERMINAL AND THE BATTERY CONTACTOR. IF MEASURING ALTERNATOR CURRENT, PLACE THE SHUNT BETWEEN THE ALTERNATOR B LEAD AND THE POWER DISTRIBUTION BUS.
13. WHEN USING A DISCRETE INPUT FOR ITEMS FOR DETECTING ITEMS SUCH AS CANOPY CLOSURE, IT IS RECOMMENDED TO USE THE GROUNDED STATE AS THE NORMAL SWITCH POSITION (E.G. CANOPY CLOSED) TO AVOID THE POSSIBILITY 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 GP INPUT.
15. THE USE OF "XX" AS A GROUND CONNECTION PIN NUMBER ON THIS DRAWING INDICATES THE SENSOR GROUND CAN BE TIED TO ANY SIGNAL GROUND OR TRANSDUCER LOW GROUND PIN ON THE GSU 73 J732 CONNECTOR. MULTIPLE SENSOR GROUNDS MAY NEED TO BE TIED TO A SINGLE GSU 73 GROUND PIN.
16. FOLLOW THIS WIRING GUIDANCE IF USING UMA PRESSURE TRANSDUCERS INSTEAD OF THE TRANSDUCERS PROVIDED IN THE GARMIN SENSOR KIT.
17. WHEN A DISCRETE OUTPUT IS ACTIVE, IT IS PULLED TO GROUND AND CAN SINK UP TO 20 MA OF CURRENT MAXIMUM. SEE THE G3X INSTALLATION MANUAL FOR ADDITIONAL DETAILS ON USE OF DISCRETE OUTPUTS.
18. WHEN USING THE GP6 AND GP7 INPUTS FOR GENERAL PURPOSE VOLTAGE SENSING, INCLUDING POSITION SENSORS AND USER-DEFINED ANALOG PARAMETERS, THE CORRESPONDING GP6 LO AND GP7 LO PIN MUST BE CONNECTED TO GROUND.

Figure 27-1 Notes for Sensor Wiring Example Drawings (for all Section 27 drawings)

27.2 Sensor Wiring Examples w/GEA™ 24 Engine Interface Module



NOTES

1. FUEL QUANTITY RESISTORS ARE RECOMMENDED TO BE A 2.2K OHM (+/-1%), MINIMUM POWER RATING OF 0.25W RESISTOR, RATED TO MAINTAIN RESISTANCE POWER RATING AT 70C, AND BE QUALIFIED TO MIL-R-10509. ALL RESISTORS ARE REQUIRED TO BE THE SAME PART NUMBER.
2. USE THESE INPUTS AS NECESSARY GIVEN AIRCRAFT CONFIGURATION.
3. MAY BE INTERFACED TO A SINGLE RESISTIVE PROBE, OR MULTIPLE RESISTIVE PROBES WIRED IN SERIES.
4. WHEN RESISTIVE FUEL PROBES ARE INSTALLED WITH INLINE RESISTORS, SET INPUT TO *VOLTAGE* IN FUEL INPUT CONFIGURATION MENU. IF RESISTORS ARE NOT INSTALLED, SET INPUT TO *RESISITIVE* IN FUEL INPUT CONFIGURATION MENU.

Figure 27-2.1 Page 1 of 3 Fuel Quantity and Fuel Flow Examples (w/GEA 24)

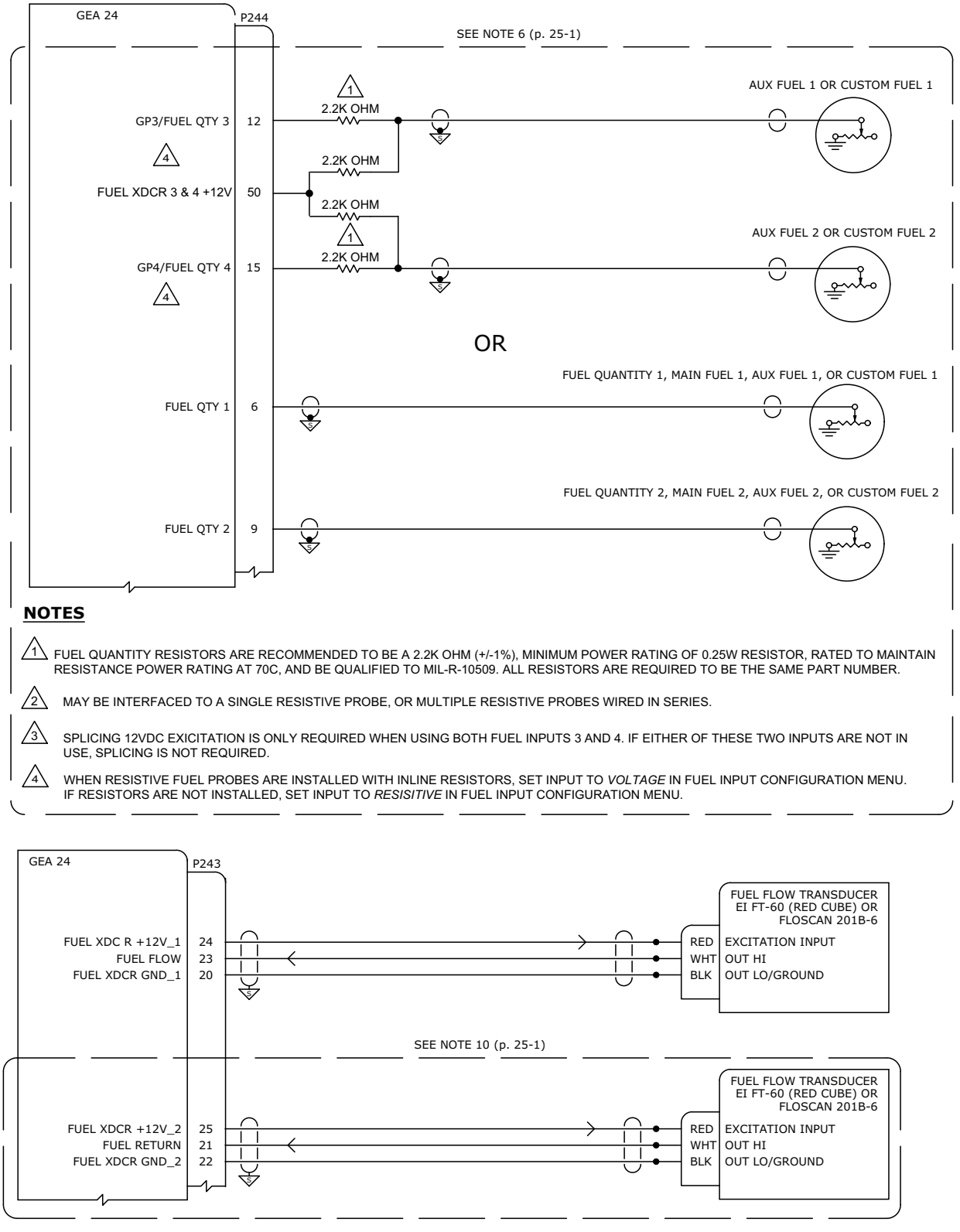
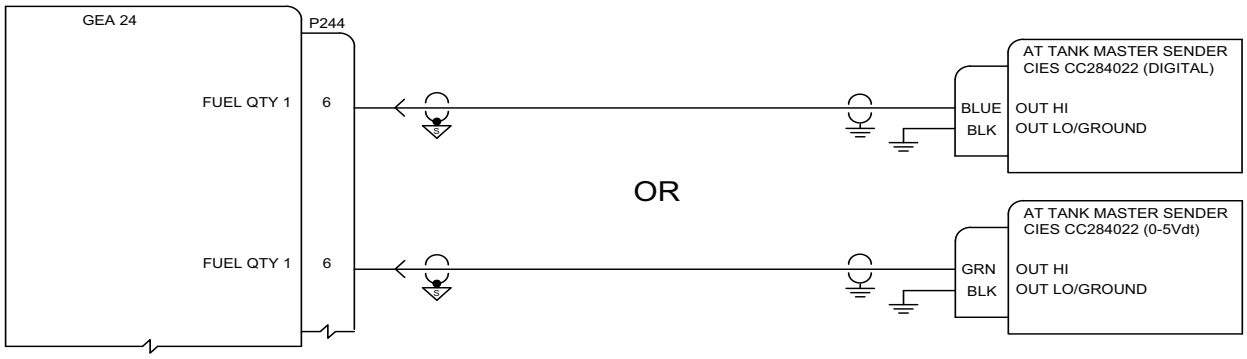


Figure 27-2.1 Page 2 of 3 Fuel Quantity and Fuel Flow Examples (w/GEA 24)



NOTE: SEE APPLICABLE CiES DOCUMENTATION FOR MULTIPLE PROBE AND POWER/GROUND WIRING INFO.

Figure 27-2.1 Page 3 of 3 Fuel Quantity and Fuel Flow Examples (w/GEA 24)

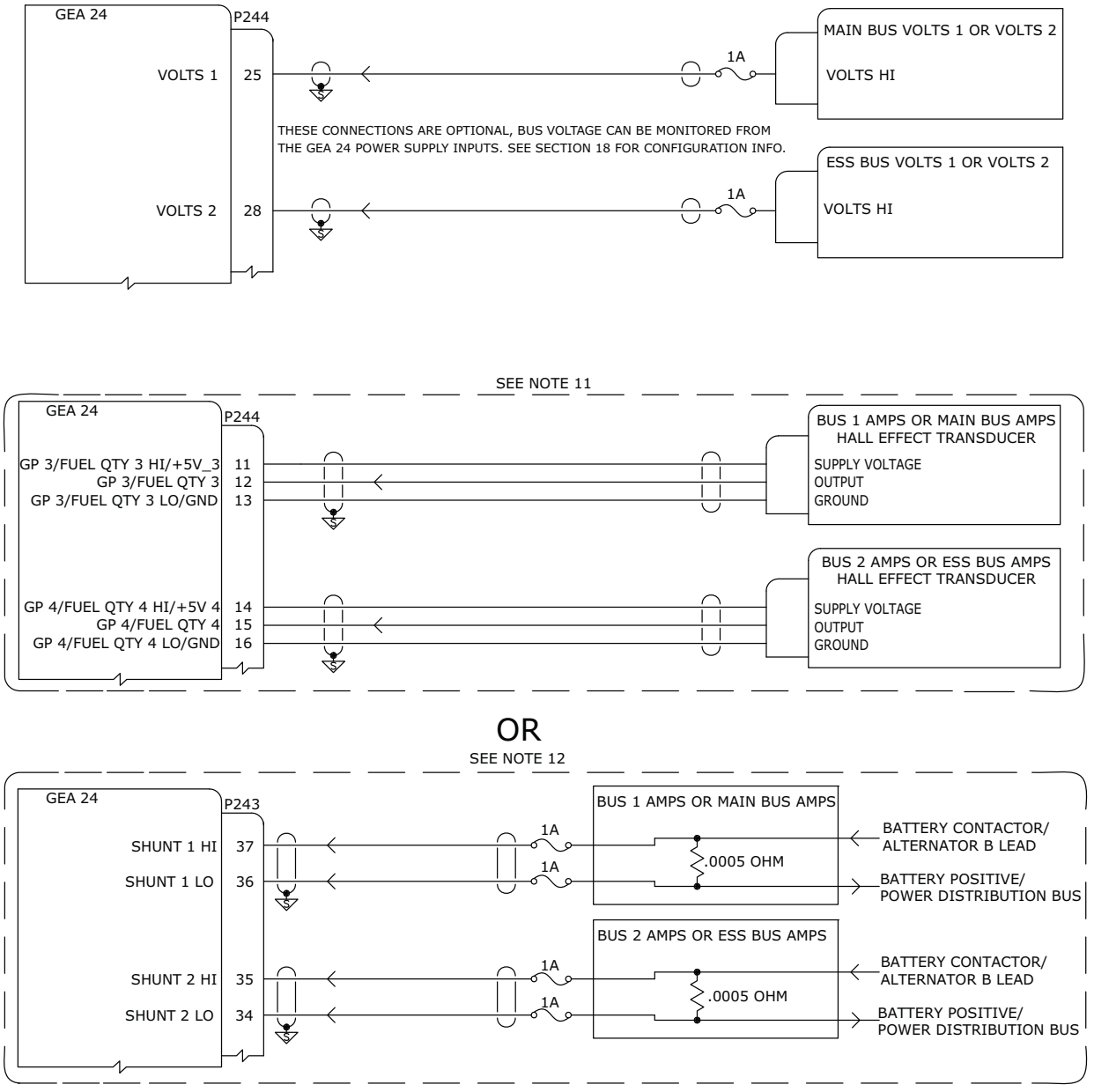


Figure 27-2.2 Page 1 of 2 Electrical and Discrete Input/Output Examples (w/GEA 24)

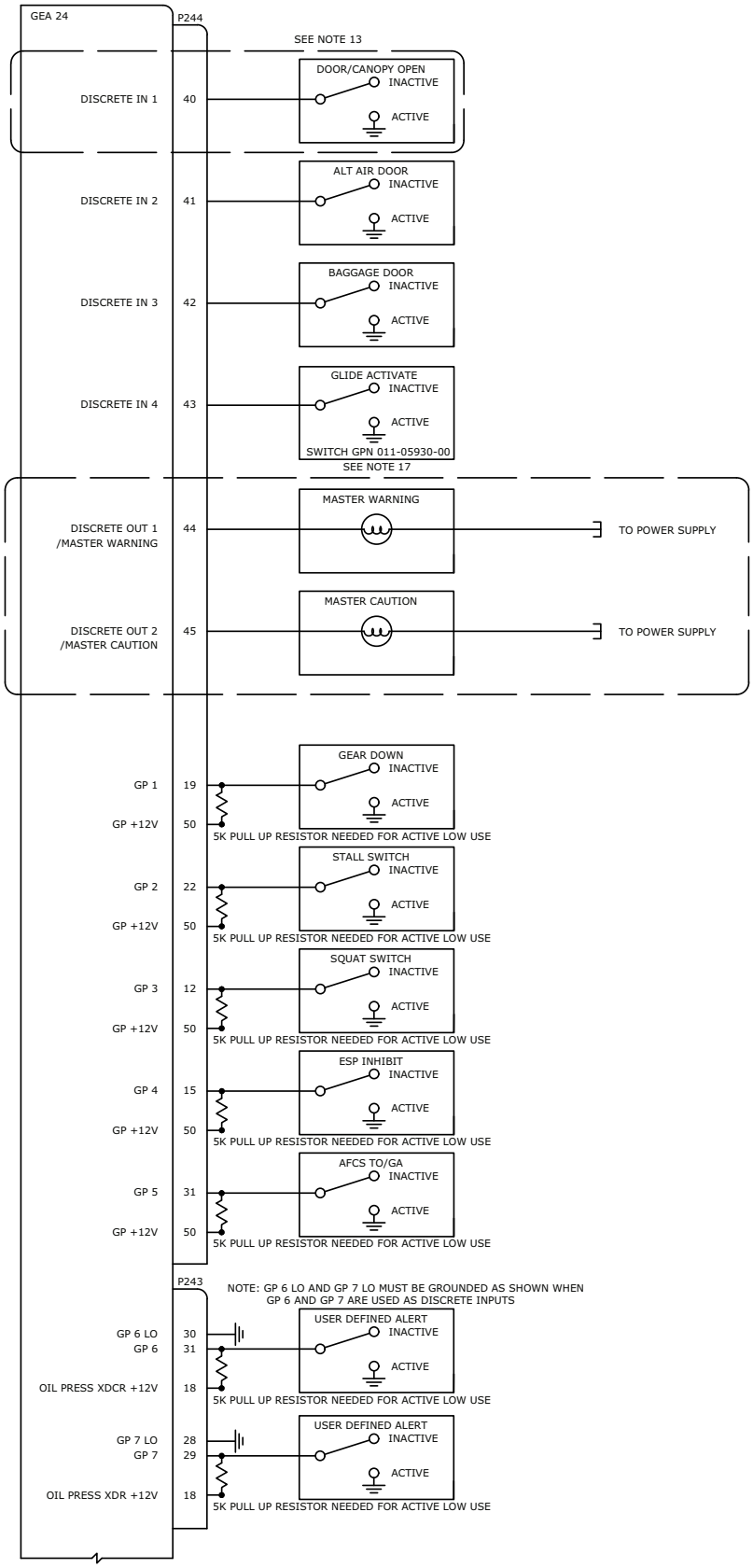


Figure 27-2.2 Page 2 of 2 Electrical and Discrete Input/Output Examples (w/GEA 24)

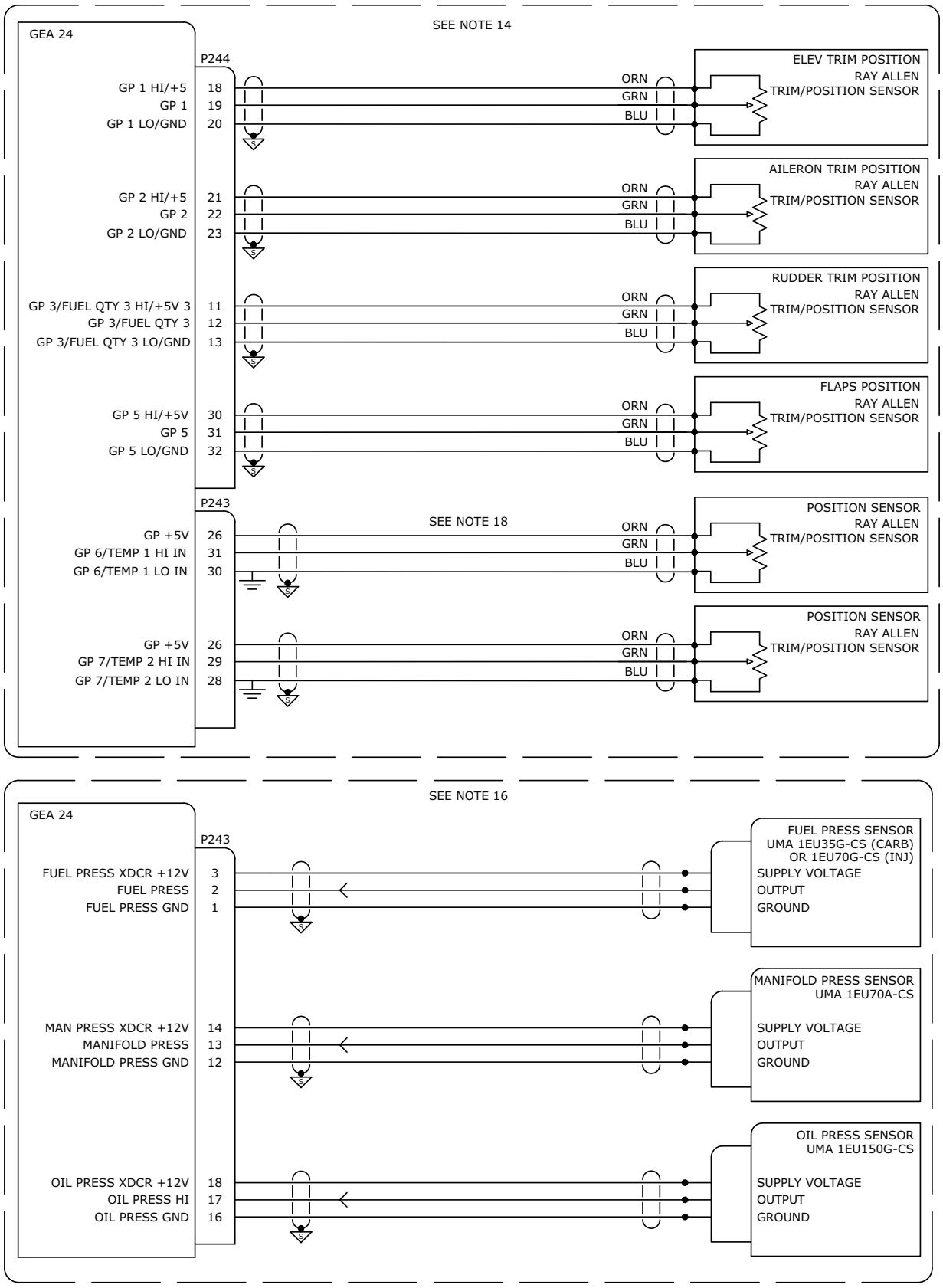


Figure 27-2.3 Flaps/Trim and UMA Pressure Transducer Examples (w/GEA 24)

27.3 Sensor Wiring Examples w/GSU 73

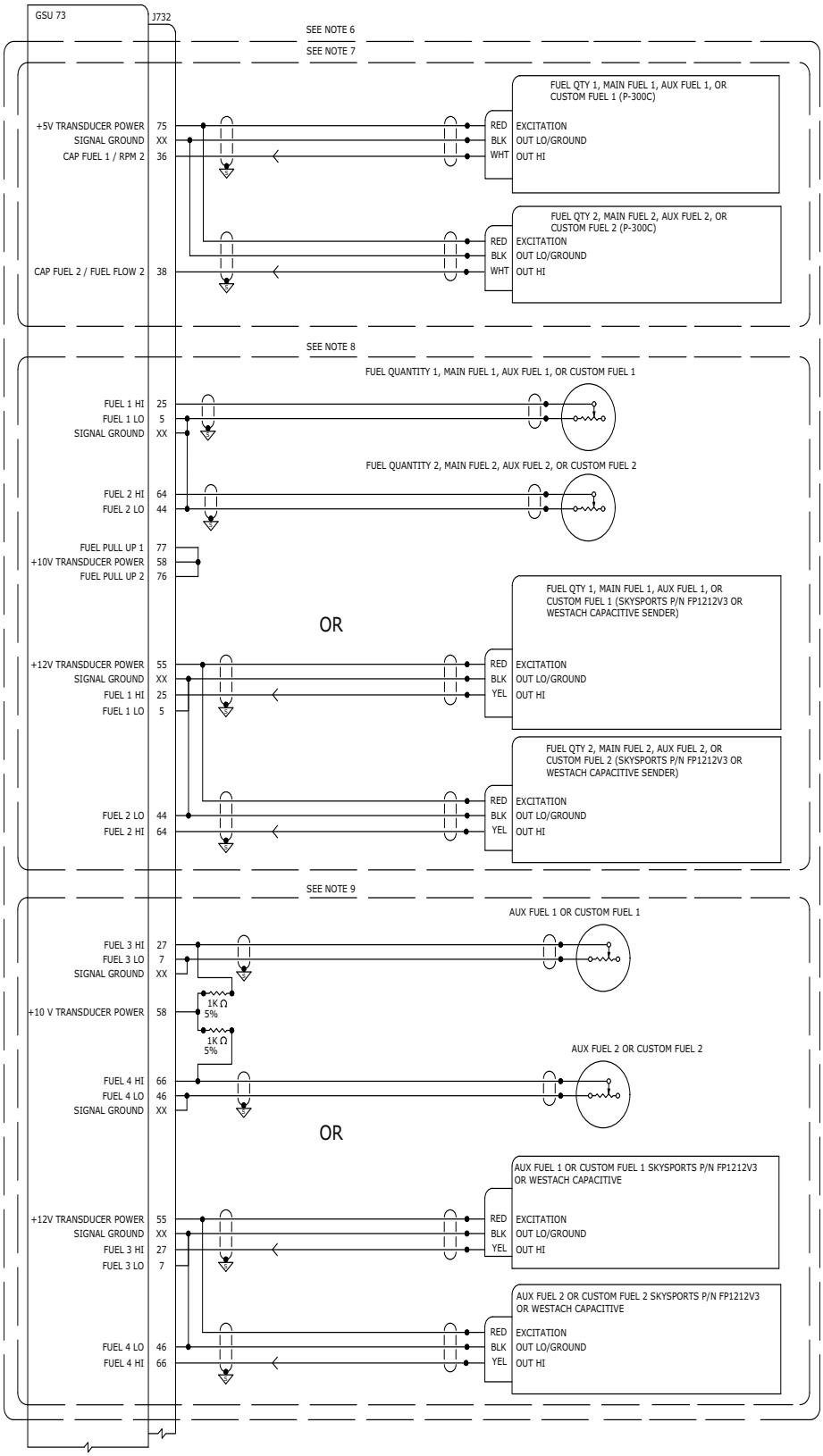


Figure 27-3.1 Page 1 of 2 Fuel Quantity and Fuel Flow Examples (w/GSU 73)

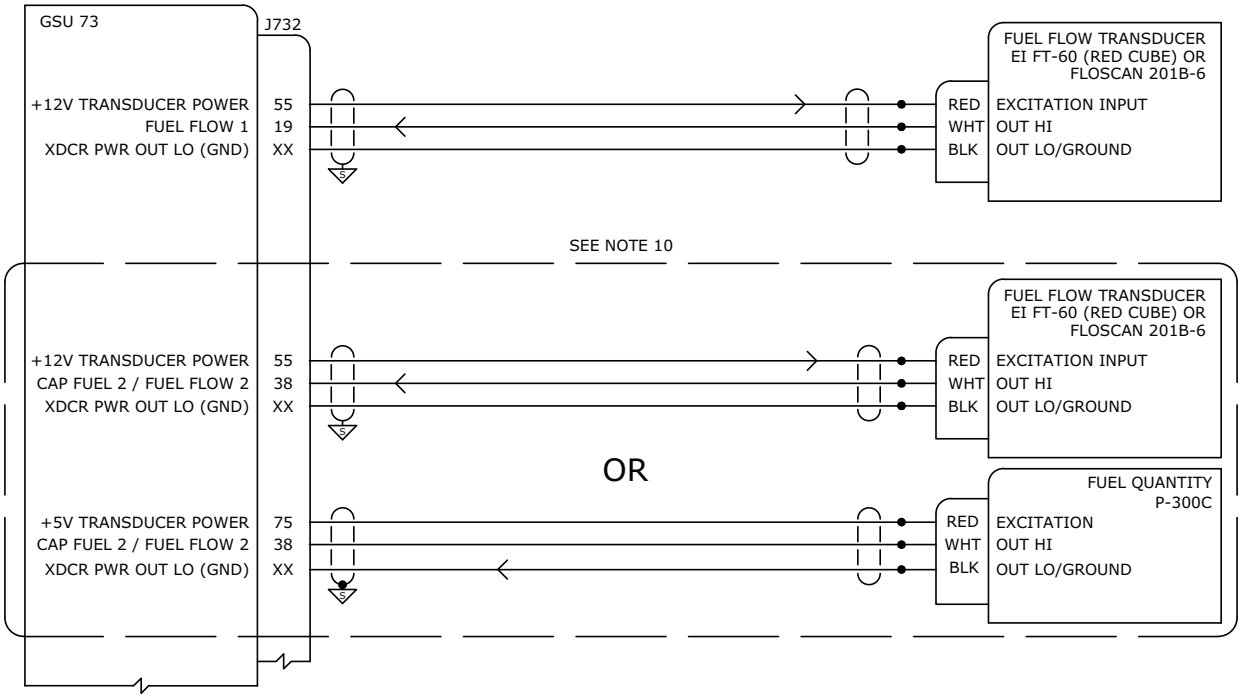


Figure 27-3.1 Page 2 of 2 Fuel Quantity and Fuel Flow Examples (w/GSU 73)

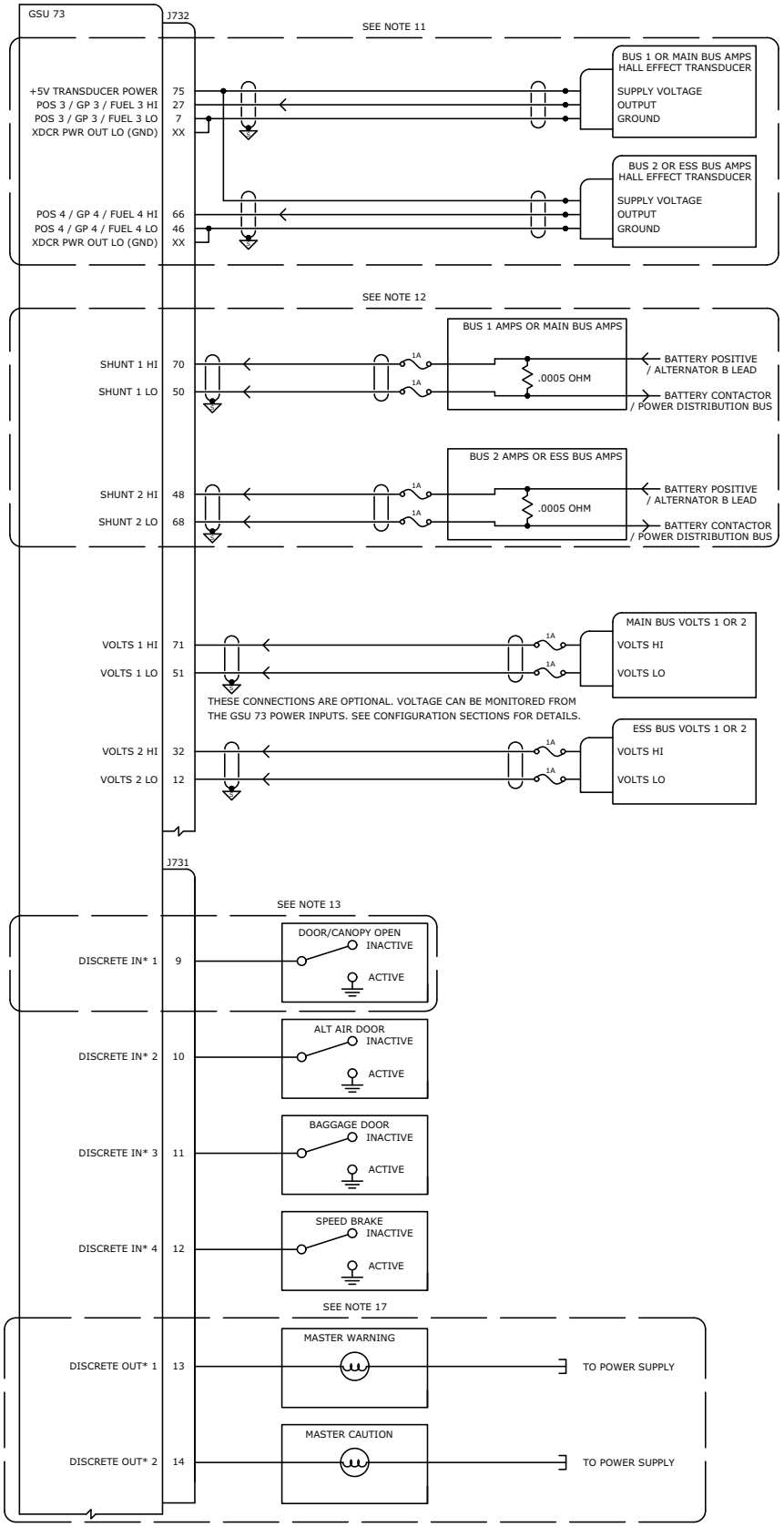


Figure 27-3.2 Electrical and Discrete Input/Output Examples (w/GSU 73)

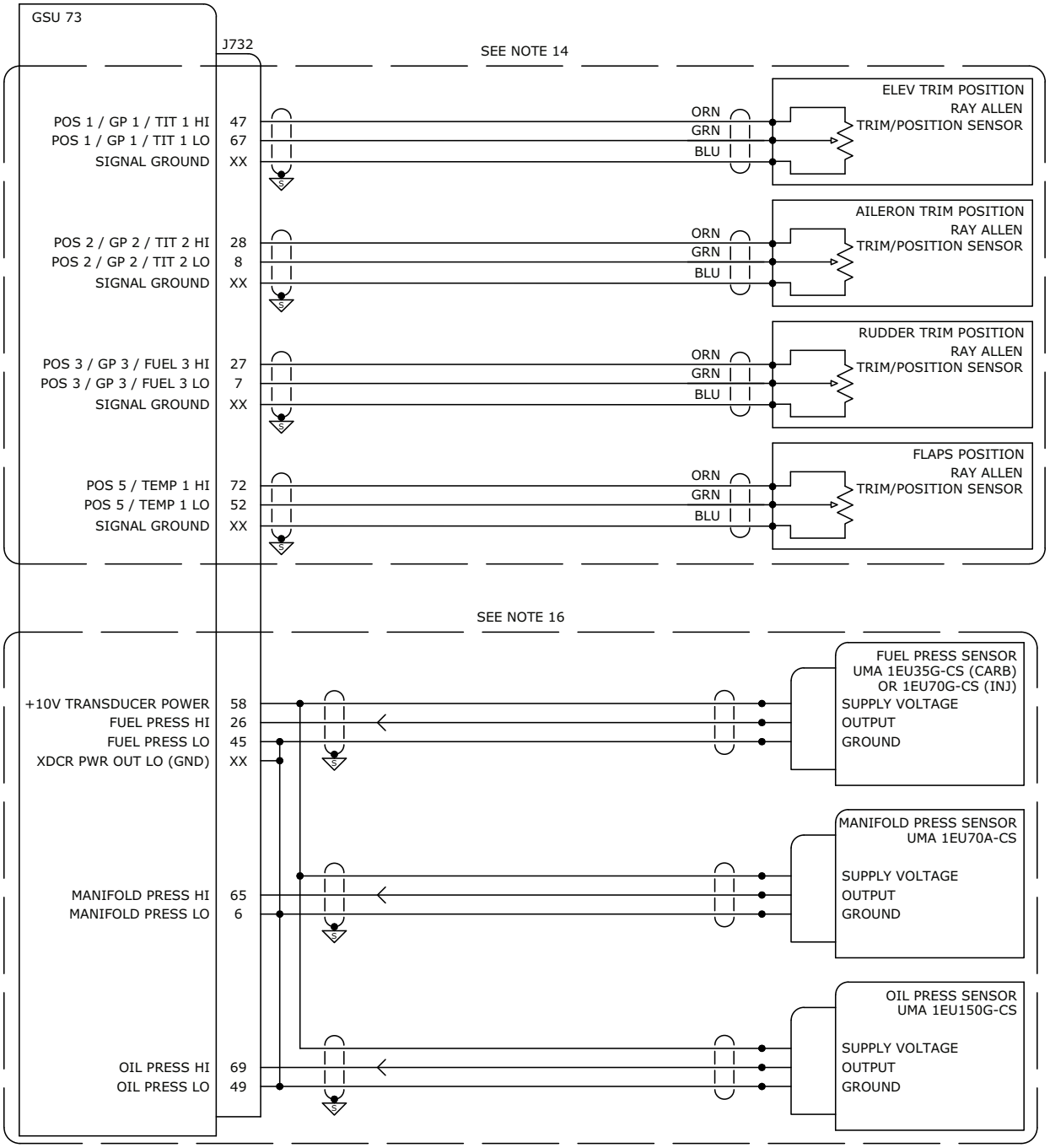


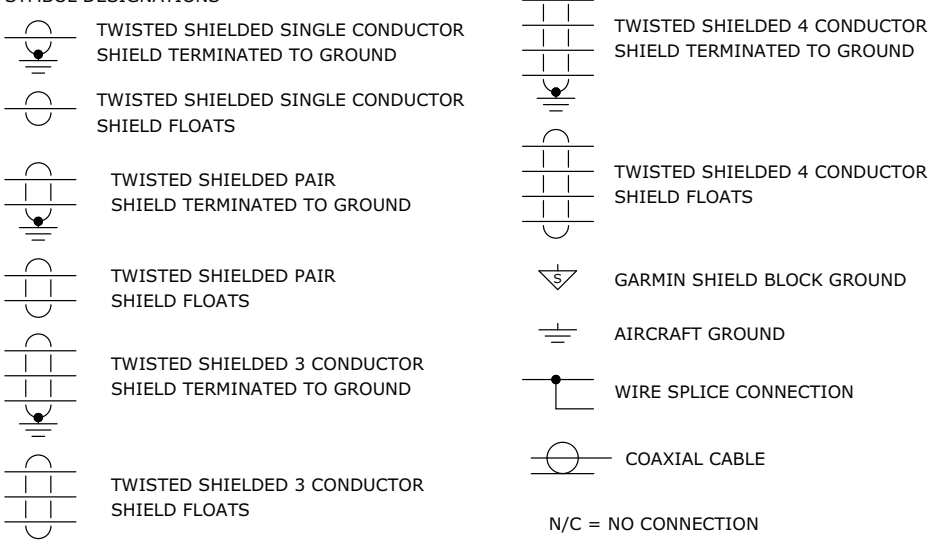
Figure 27-3.3 Flaps/Trim and UMA Pressure Transducer Examples (w/GSU 73)

28 LYCOMING/CONTINENTAL SENSOR WIRING EXAMPLES

28.1 Notes for Section 28 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



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 K00-00512-10 OR K00-00513-10.
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 K00-00512-10 OR K00-513-10.
13. TIT PROBES ONLY APPLICABLE TO TURBOCHARGED ENGINES.
14. ONLY APPLICABLE TO CARBURETED ENGINES.
15. LIGHT SPEED ENGINEERING PLASMA III "B" AND "C" MODELS REQUIRE A 2.2K PULL DOWN RESISTOR FOR PROPER OPERATION. PLASMA III "A" MODELS AND PLASMA II MODELS DO NOT REQUIRE A PULL DOWN RESISTOR FOR PROPER OPERATION. PLASMA III "B" AND "C" MODELS MODIFIED FOR OPEN COLLECTOR TACH OUTPUT ALSO DO NOT REQUIRE A PULL DOWN RESISTOR FOR PROPER OPERATION.

Figure 28-1 Notes for Lycoming/Continental Sensor Drawings (for all Section 28 drawings)

28.2 GEA™ 24 Engine Interface Module - Lycoming/Continental Sensor Drawings

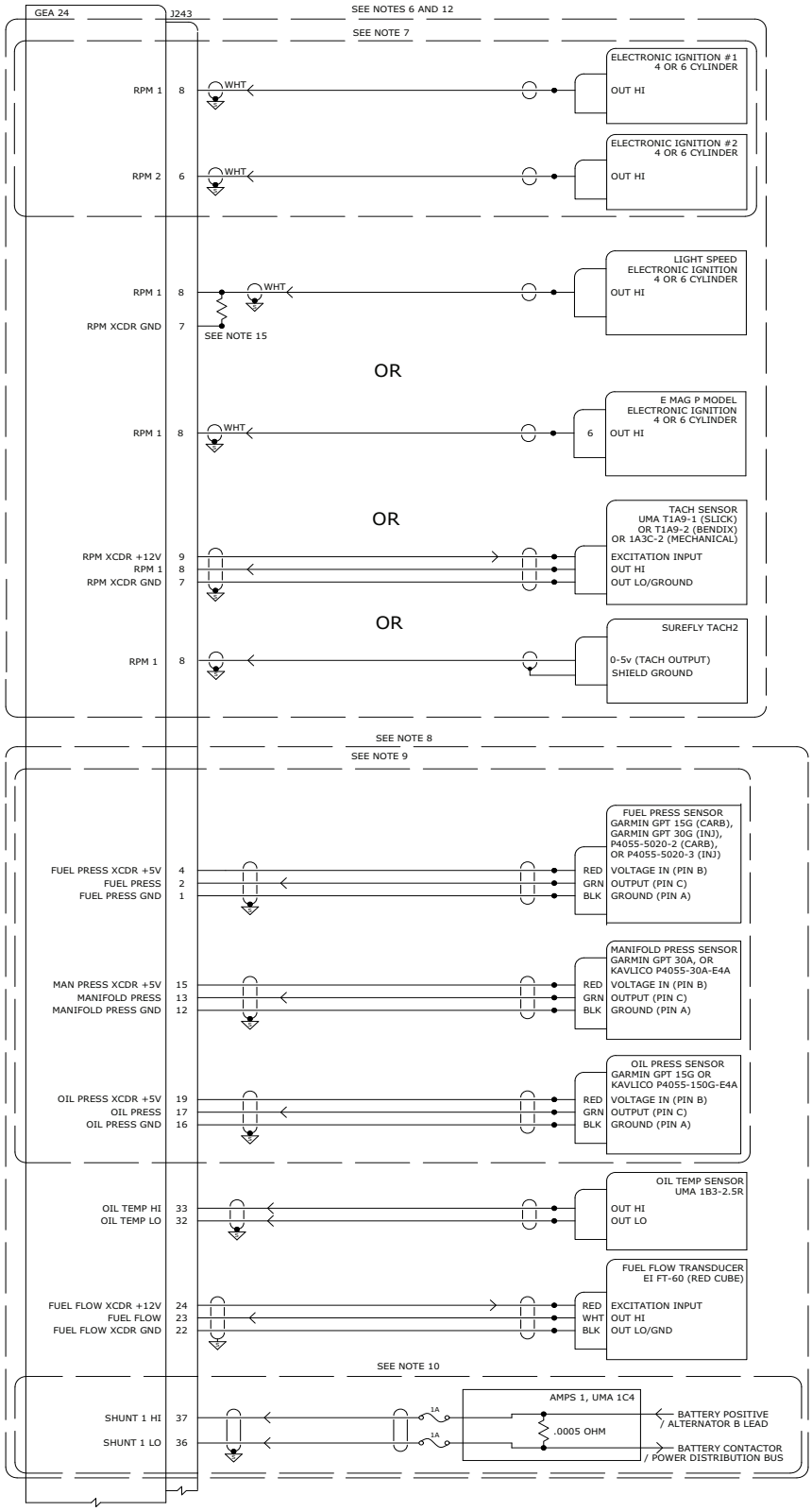


Figure 28-2 GEA 24 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 1 of 2

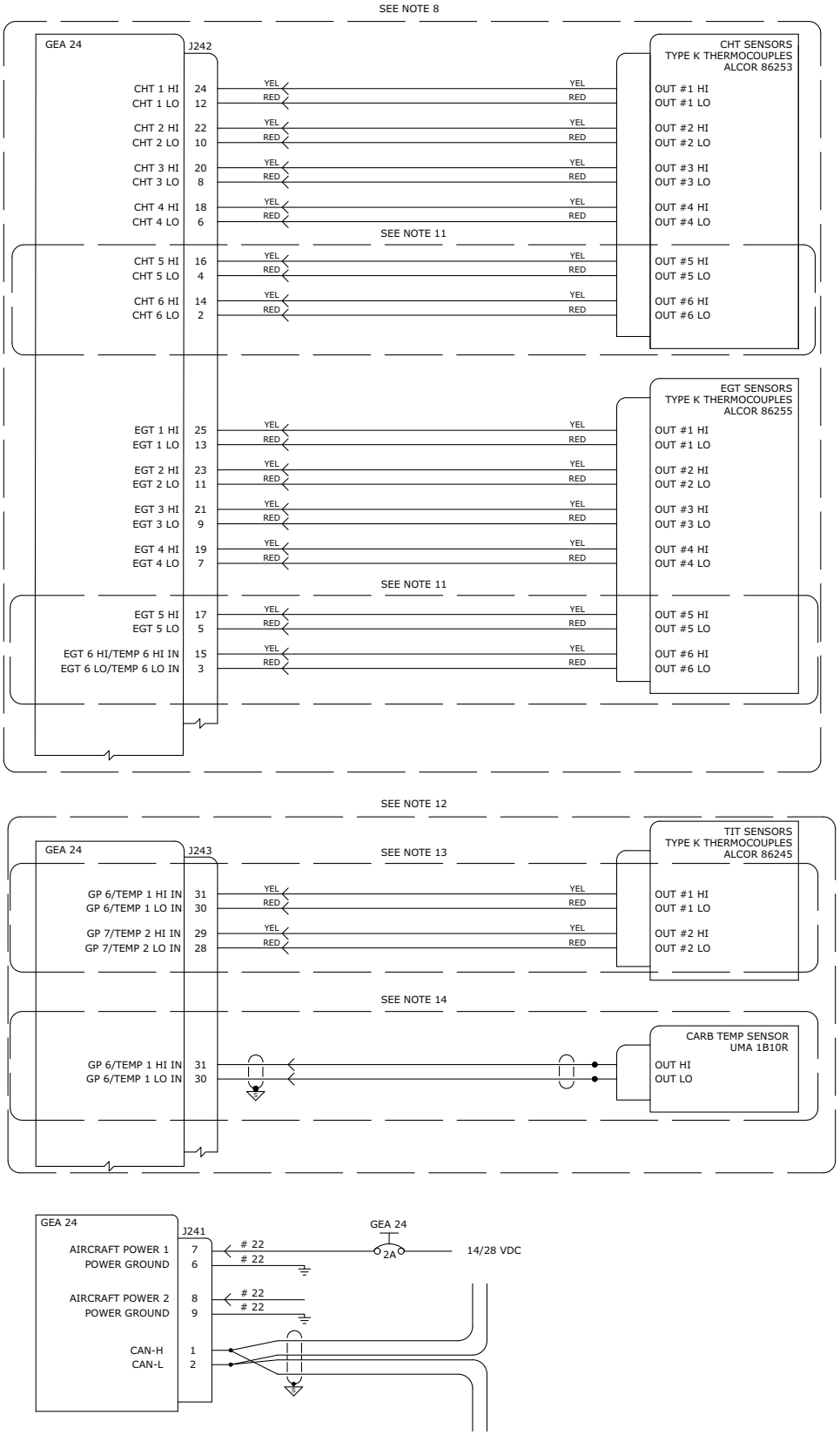
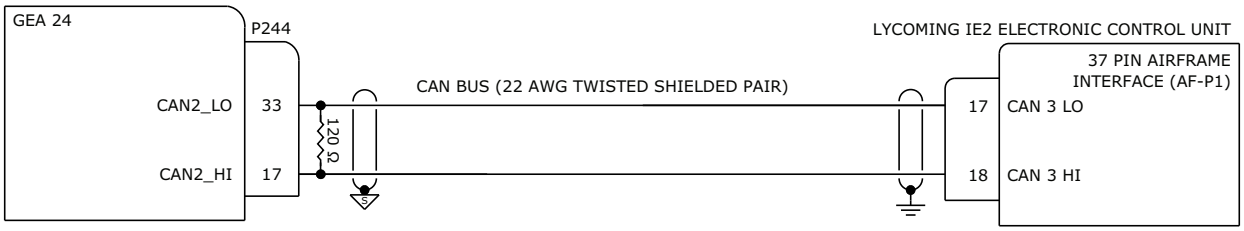


Figure 28-2 GEA 24 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 2 of 2



NOTES

1. WIRING GUIDANCE

A. INSTALL A 1/8 WATT, 5%, 120 OHM RESISTOR ACROSS THE CAN HI/LO PINS AT THE GEA 24 P244 CONNECTOR TO TERMINATE THE CAN BUS AT THAT END.

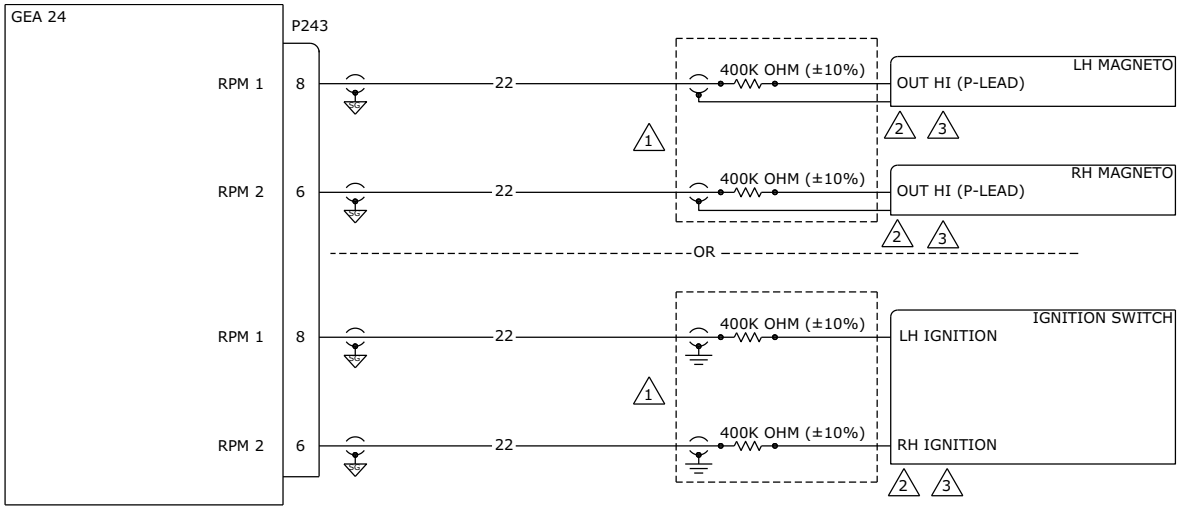
2. G3X™ AVIONICS CONFIGURATION GUIDANCE

A. NO CONFIGURATION REQUIRED ON GEA 24 TO ENABLE CAN BUS

B. ON THE ENGINE CONFIGURATION PAGE

- SET PROBE TYPE ON FADEC SUPPORTED ENGINE PARAMETERS TO "LYCOMING FADEC"

Figure 28-3 GEA 24 - Lycoming IE2 Electronic Control Unit



NOTES

1. SEE P-LEAD RESISTOR INSTALLATION FIGURE FOR DETAILED INSTALLATION OF RESISTOR.
2. CONNECT WIRE SHIELD TO THE GROUND STUD ON THE MAGNETO.
3. ONLY A GEA 24B OR A MOD LEVEL 2 GEA 24 CAN BE USED FOR P-LEAD RPM SENSING. THE MOD LEVEL STATUS CAN BE DETERMINED BY CHECKING THE SERIAL TAG ON THE UNIT.

Figure 28-4 GEA 24 - Lycoming P-Lead Resistor Wiring Example

28.3 GSU 73 - Lycoming/Continental Sensor Drawings

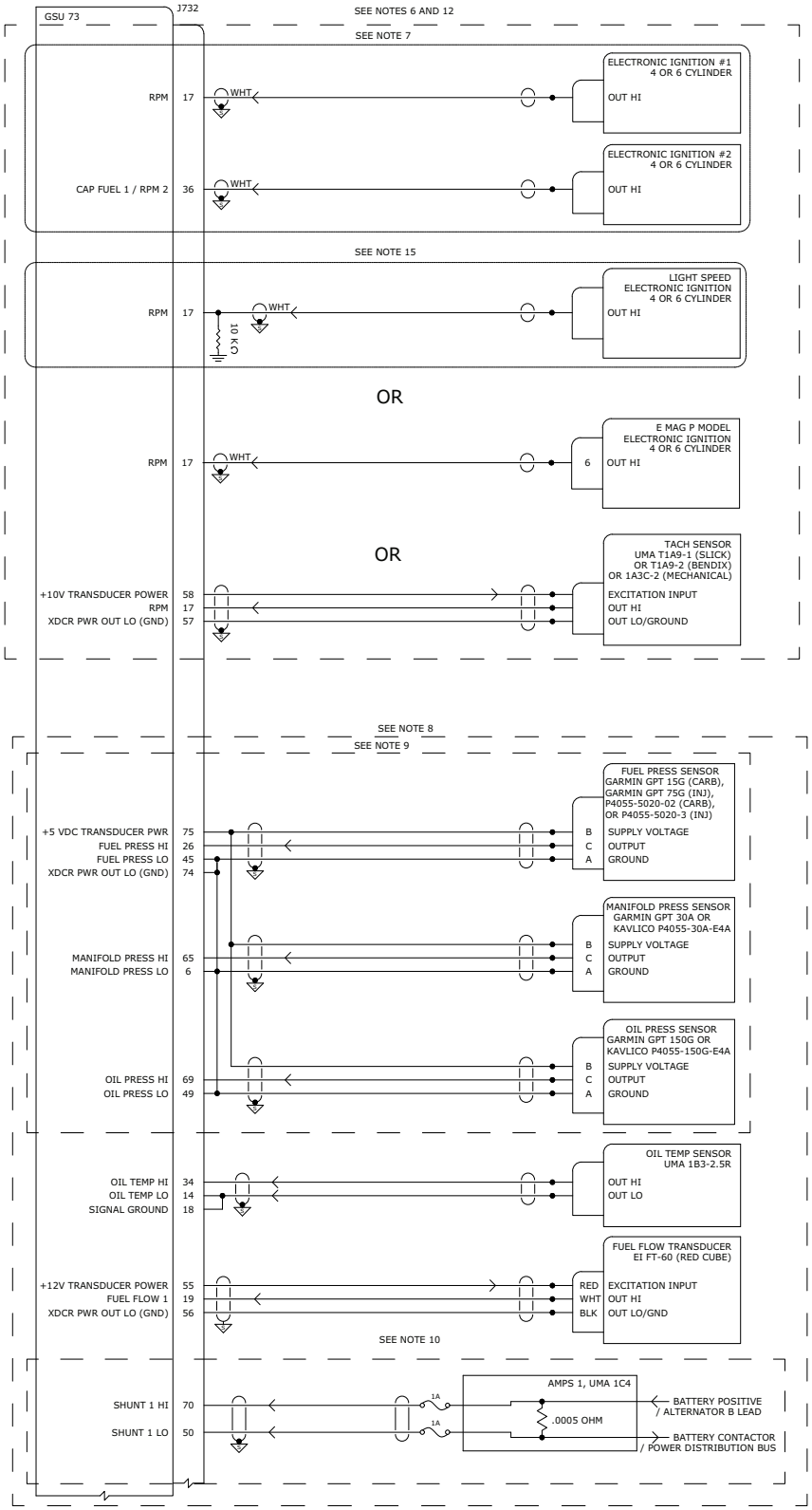


Figure 28-5 GSU 73 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 1 of 2

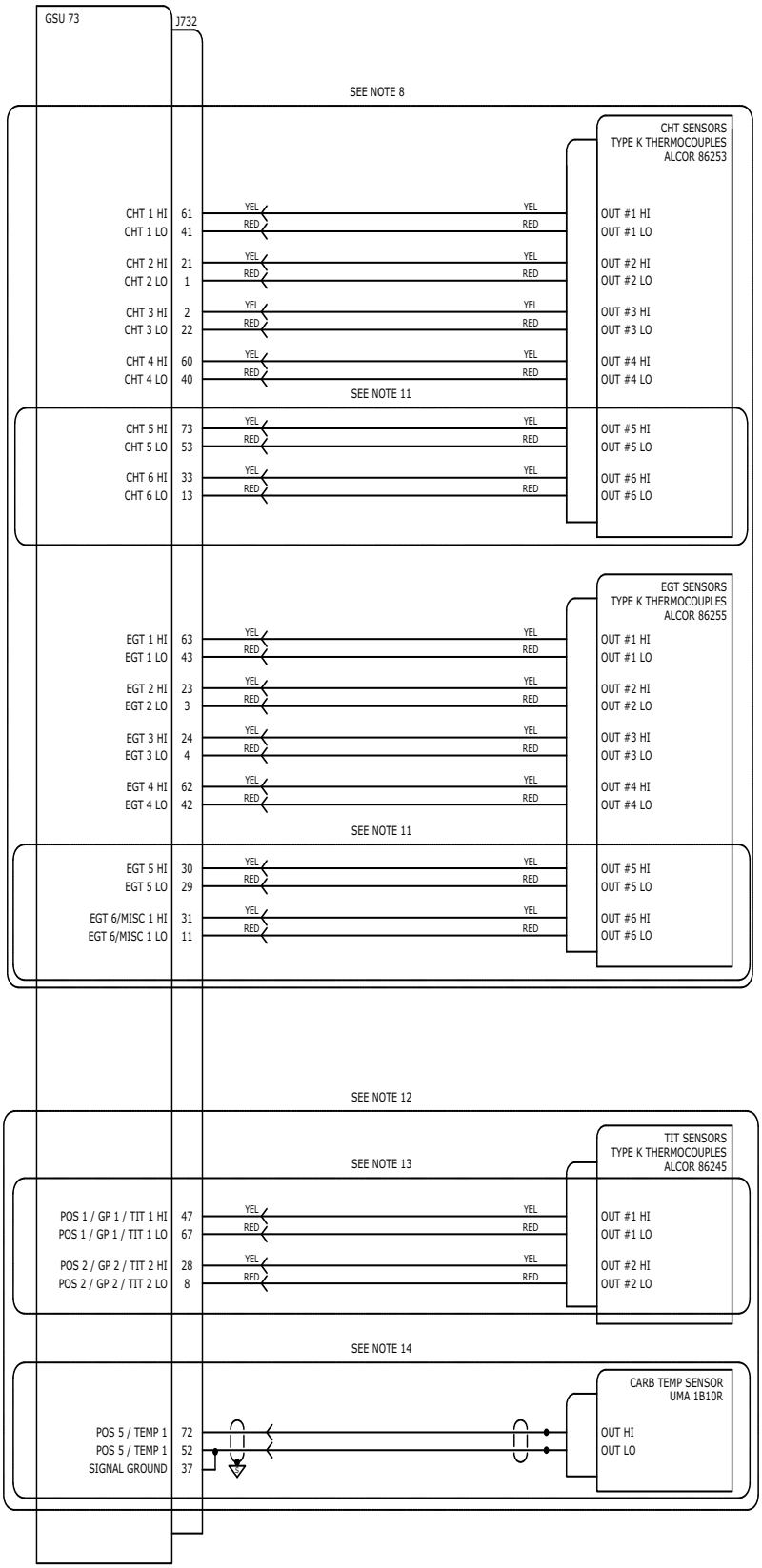


Figure 28-5 GSU 73 - 4/6 Cylinder Lycoming/Continental Sensor Wiring Examples, Page 2 of 2

29 ROTAX SENSOR WIRING EXAMPLES

29.1 Notes for Section 29 Drawings

NOTES:

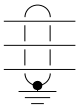
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM. MOST WIRES SHOULD USE 22 GAUGE.
4. SYMBOL DESIGNATIONS


TWISTED SHIELDED SINGLE CONDUCTOR
SHIELD TERMINATED TO GROUND

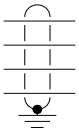

TWISTED SHIELDED SINGLE CONDUCTOR
SHIELD FLOATS

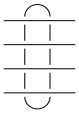

TWISTED SHIELDED PAIR
SHIELD TERMINATED TO GROUND


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. SENSORS SUPPLIED WITH THE ENGINE.
7. SENSORS SUPPLIED WITH THE GARMIN ROTAX 912 SENSOR KIT P/N K00-00514-00.
8. ROTAX P/N 456180, 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 P4055-5020-3 CAN BE PURCHASED THROUGH A GARMIN G3X™ AVIONICS DEALER (P/N 011-04202-20).
12. FOR RPM 1 INPUT USE GARMIN P/N 682-00012-00 ZENER DIODE, P/N 680-00006-D0 DIODE, AND P/N 902-A300R-F0 300 OHM 1% 1/2W RESISTOR AS SHOWN IN DIAGRAM BELOW. THESE 3 PARTS ARE INCLUDED IN KIT P/N 011-02348-00.
13. USE THE KAVLICO P4055-5020-2 (P/N 011-04020-10) FUEL PRESSURE SENSOR WITH THE ROTAX 912 ENGINE. USE THE UMA N1EU07D PRESSURE SENSOR WITH THE ROTAX 914 ENGINE.

Figure 29-1 Notes for Rotax 912/914 Sensor Drawings (for all Section 29 drawings)

29.2 GEA™ 24 Engine Interface Module - Rotax Sensor Drawings

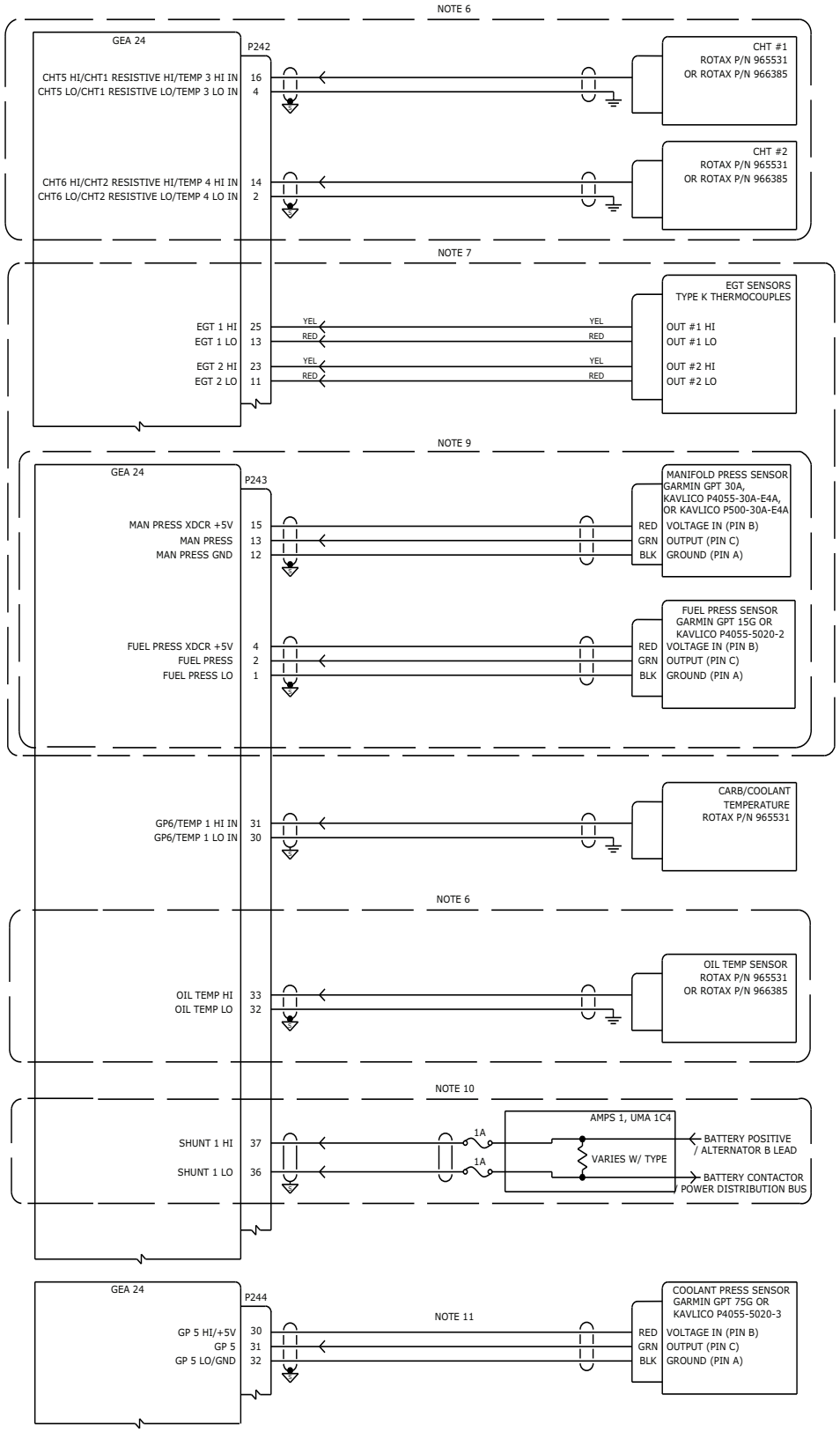


Figure 29-2.1 GEA 24 - Rotax 912/914/916 Sensor Wiring Examples, Page 1 of 2

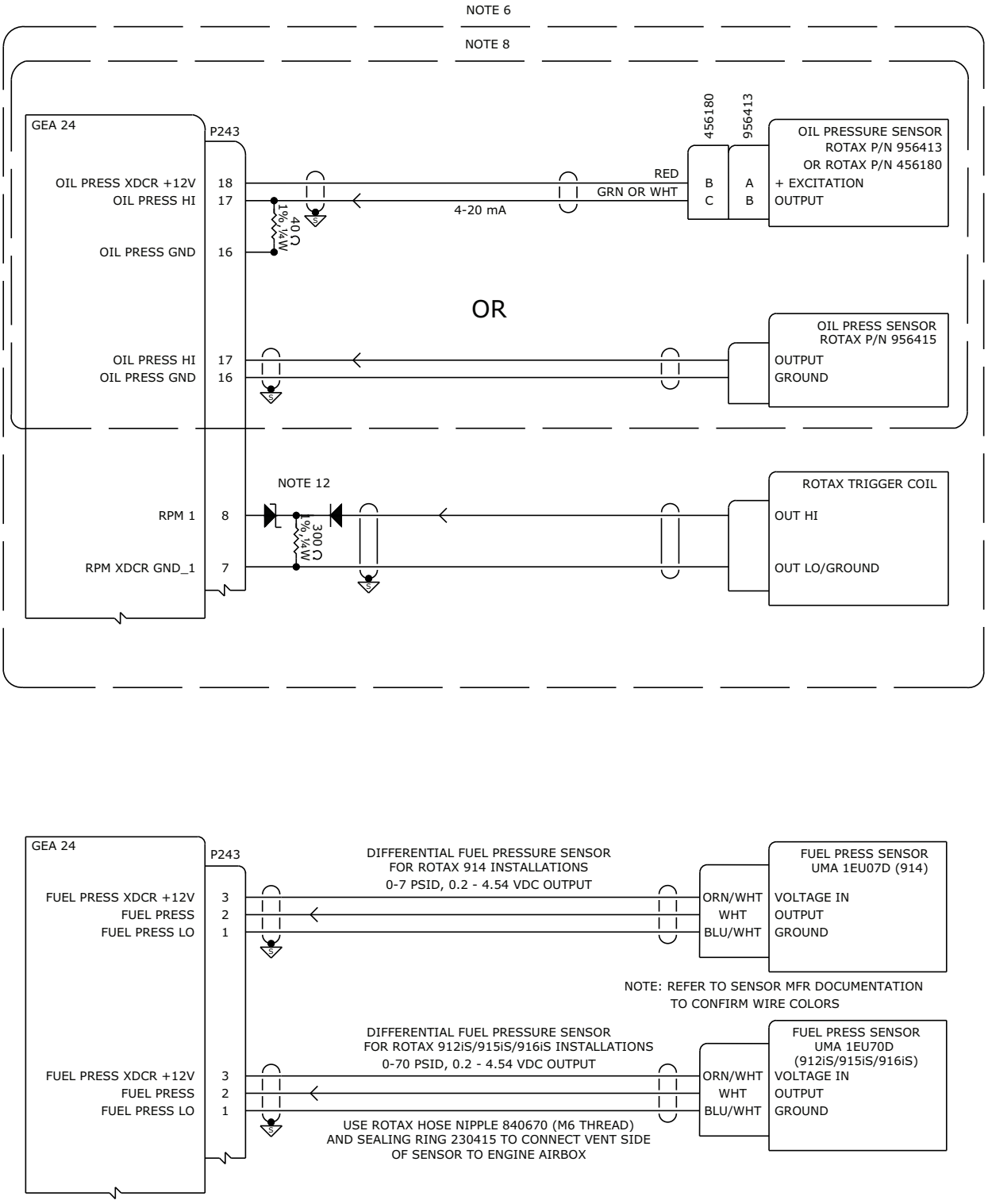
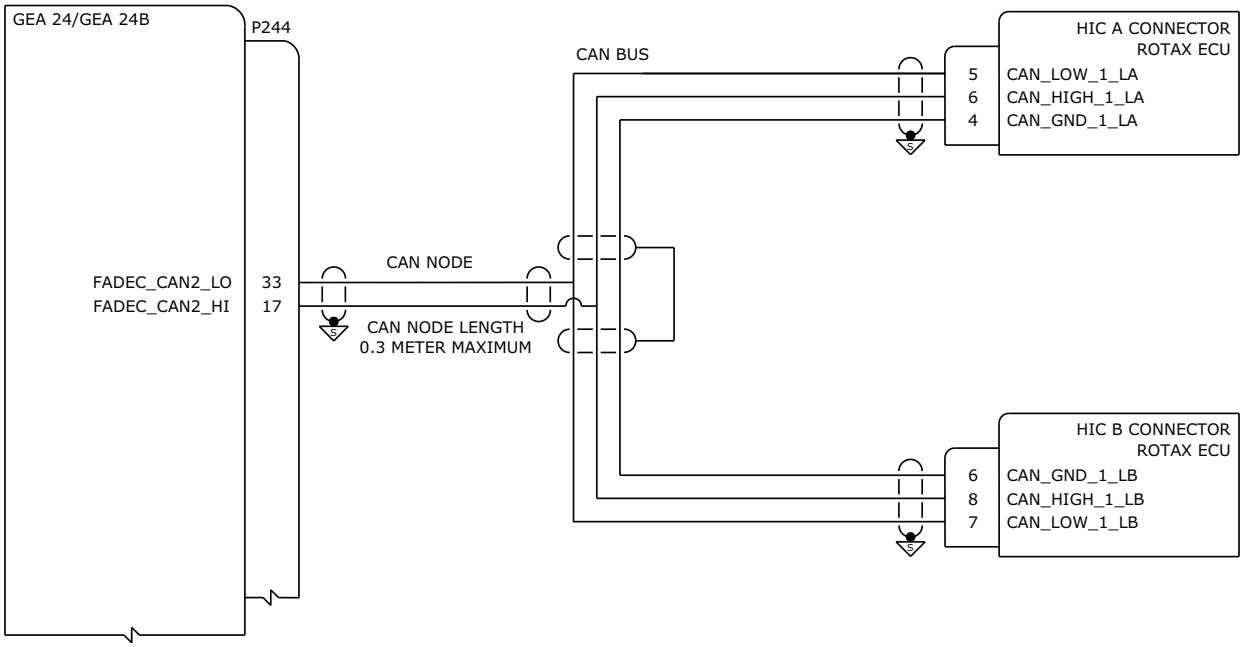


Figure 29-2.1 GEA 24 - Rotax 912/914/916 Sensor Wiring Examples, Page 2 of 2



NOTES

1. WIRING GUIDANCE

A. THE CAN BUS CONNECTING THE HIC A/B CONNECTORS IS TERMINATED INSIDE THESE CONNECTORS SO NO ADDITIONAL TERMINATION IS REQUIRED

B. NO TERMINATION REQUIRED ON THE CAN NODE CONNECTION TO THE GEA 24

C. THE ENGINE ECU DOES NOT PROVIDE DIFFERENTIAL FUEL PRESSURE DATA. GUIDANCE FOR ADDING A SENSOR TO MAKE THIS MEASUREMENT IS PROVIDED IN THE PRECEDING SECTION.

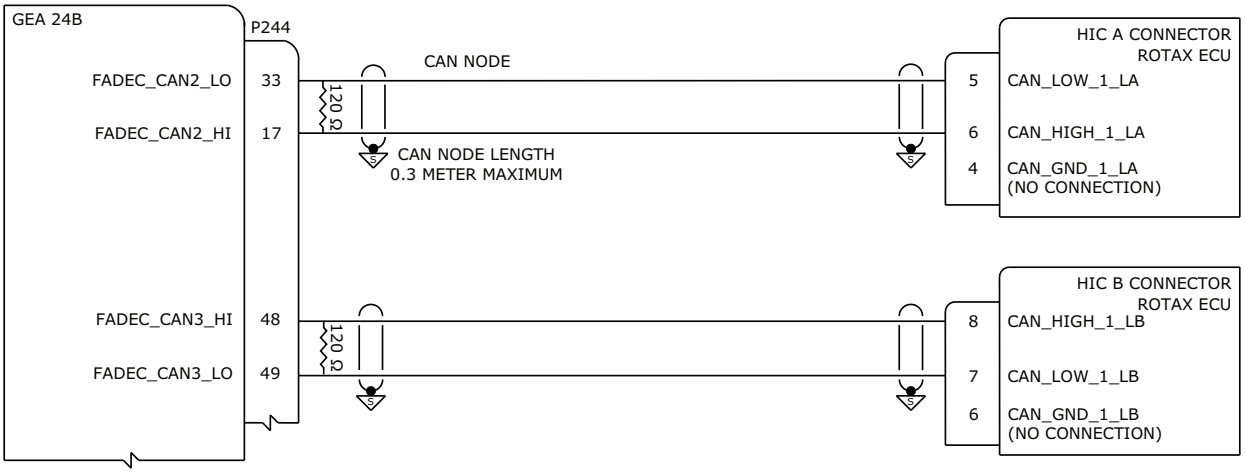
2. G3X CONFIGURATION GUIDANCE

A. NO CONFIGURATION REQUIRED ON GEA 24 TO ENABLE CAN BUS

B. ON THE ENGINE CONFIGURATION PAGE

- SET PROBE TYPE ON FADEC SUPPORTED ENGINE PARAMETERS TO "ROTAX FADEC"

Figure 29-2.2 GEA 24/24B - Rotax 912iS/915iS/916iS FADEC Wiring Example



NOTES

1. WIRING GUIDANCE

A. THE CAN BUS CONNECTING THE HIC A/B CONNECTORS IS TERMINATED INSIDE THESE CONNECTORS SO NO ADDITIONAL TERMINATION IS REQUIRED

B. 120 OHM TERMINATING RESISTORS REQUIRED TO BE INSTALLED BETWEEN CAN HI AND CAN LO AT THE GEA 24B CONNECTOR FOR BOTH CAN 2 AND CAN 3

C. THE ENGINE ECU DOES NOT PROVIDE DIFFERENTIAL FUEL PRESSURE DATA. GUIDANCE FOR ADDING A SENSOR TO MAKE THIS MEASUREMENT IS PROVIDED IN THE PRECEDING SECTION.

2. G3X CONFIGURATION GUIDANCE

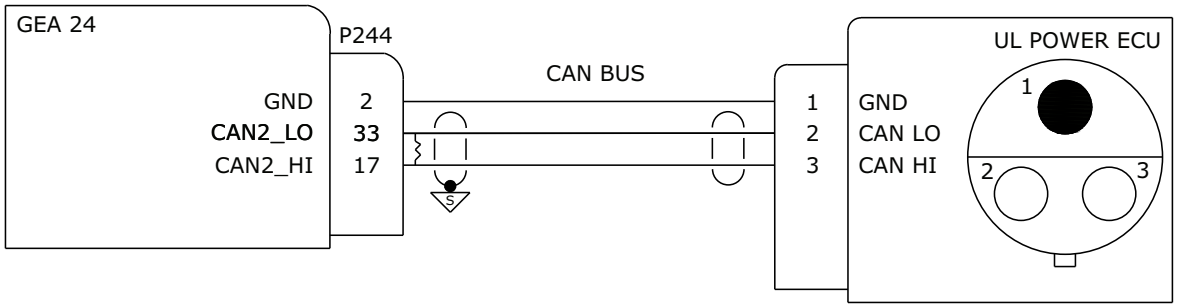
A. NO CONFIGURATION REQUIRED ON GEA 24 TO ENABLE CAN BUS

B. ON THE ENGINE CONFIGURATION PAGE

- SET PROBE TYPE ON FADEC SUPPORTED ENGINE PARAMETERS TO "ROTAX FADEC"

3. THIS WIRING METHOD IS ONLY POSSIBLE WITH GEA 24B. FOR GEA 24 INTERCONNECT REFER TO FIGURE 28-2.2

Figure 29-2.3 GEA 24B - Dual CAN Rotax 912iS/915iS/916iS FADEC Wiring Example



NOTES

1. WIRING GUIDANCE

A. ADD 120 OHM, 1/4W, 1% RESISTOR, AS SHOWN, TO THE WIRING HARNESS ACROSS CAN HI AND CAN LO AT THE GEA 24 END OF THE CAN BUS.

B. THE END OF THE CAN BUS AT THE UL POWER ECU REQUIRES AN ITT CANNON SURE SEAL PLUG CONNECTOR PART NUMBER 120-8552-101

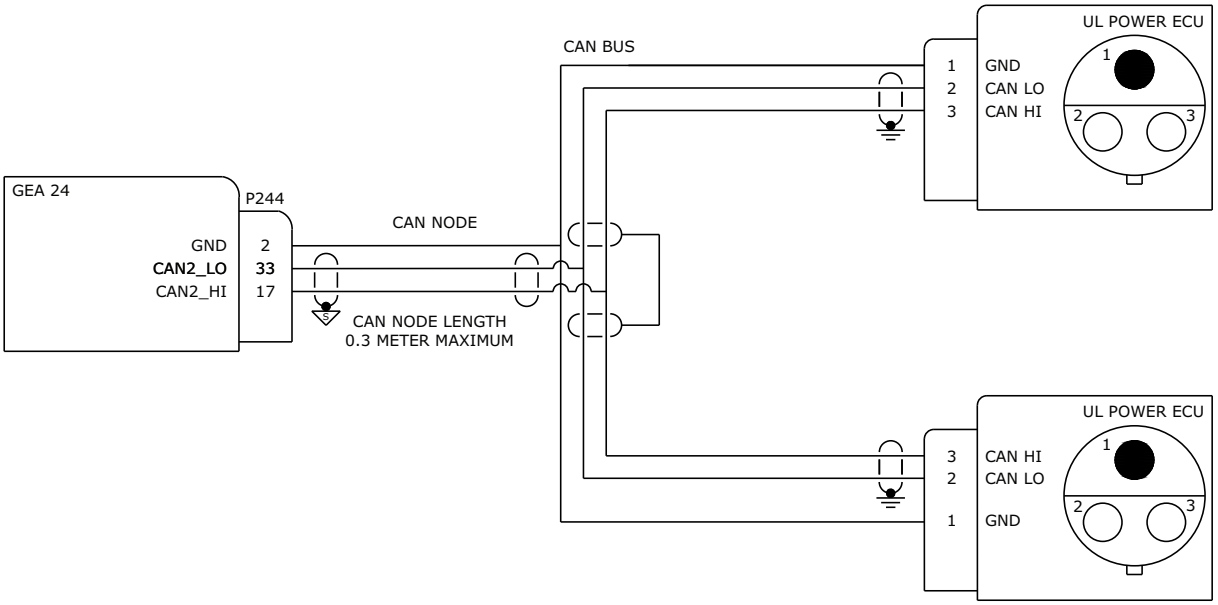
2. G3X CONFIGURATION GUIDANCE

A. NO CONFIGURATION REQUIRED ON GEA 24 TO ENABLE CAN BUS

B. ON THE ENGINE CONFIGURATION PAGE

- SET PROBE TYPE ON FADEC SUPPORTED ENGINE PARAMETERS TO "UL POWER FADEC"

Figure 29-2.4 GEA 24 - Single UL Power FADEC Wiring Example



NOTES

1. WIRING GUIDANCE

A. THE END OF THE CAN BUS AT THE UL POWER ECU REQUIRES AN ITT CANNON SURE SEAL PLUG CONNECTOR PART NUMBER 120-8552-101

2. G3X CONFIGURATION GUIDANCE

A. NO CONFIGURATION REQUIRED ON GEA 24 TO ENABLE CAN BUS

B. ON THE ENGINE CONFIGURATION PAGE

- SET PROBE TYPE ON FADEC SUPPORTED ENGINE PARAMETERS TO "UL POWER FADEC"

Figure 29-2.5 GEA 24 - Dual UL Power FADEC Wiring Example

29.3 GSU 73 - Rotax Sensor Drawings

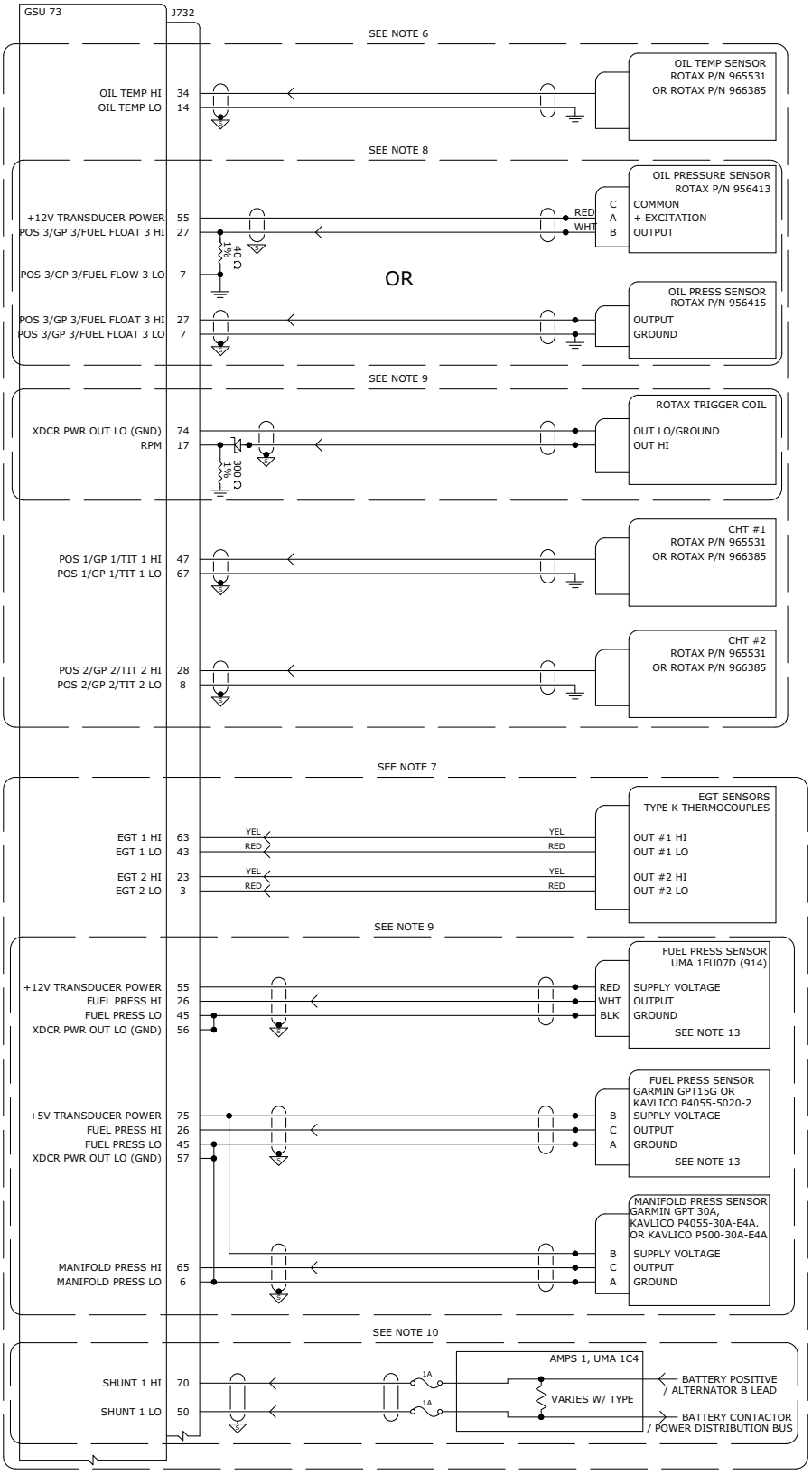


Figure 29-3 GSU 73 - Rotax 912/914 Sensor Wiring Examples, Page 1 of 2

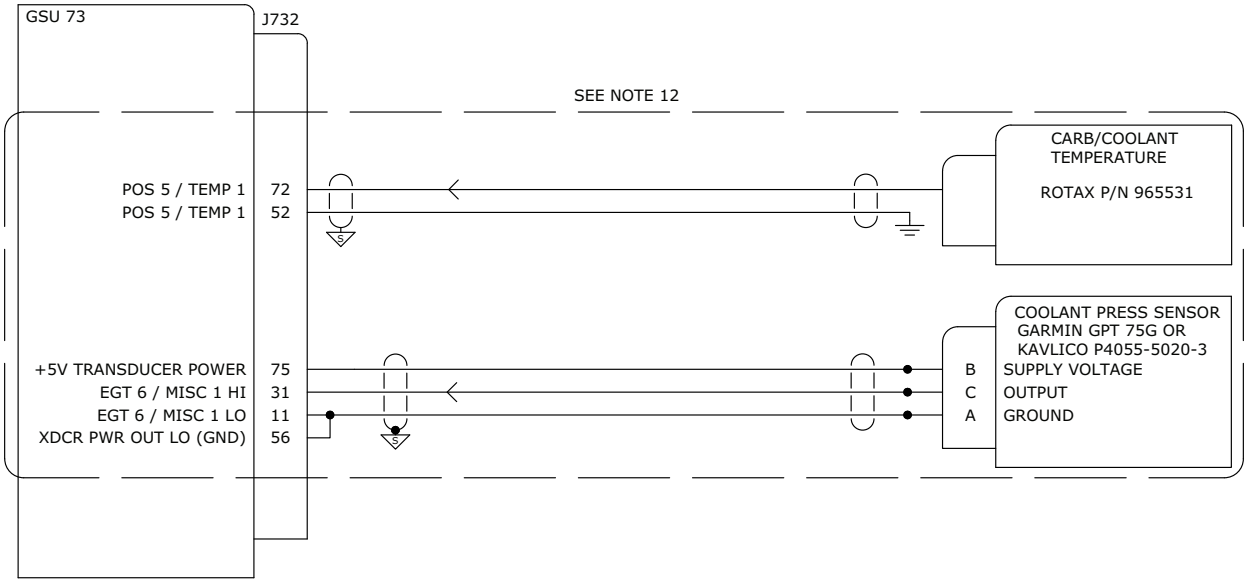


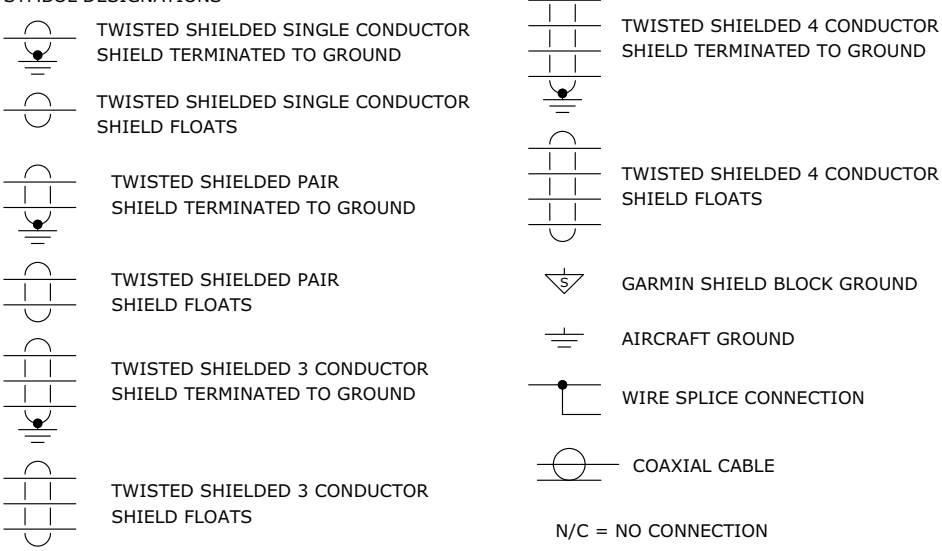
Figure 29-3 GSU 73 - Rotax 912/914 Sensor Wiring Examples, Page 2 of 2

30 JABIRU SENSOR WIRING EXAMPLES

30.1 Notes for Section 30 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



5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE UNIT BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. PINOUT SHOWN FOR PACKARD CONNECTOR SUPPLIED WITH KAVLICO PRESSURE TRANSDUCERS.
7. RESERVED.
8. IN THIS DOCUMENT, AN ASTERISK (*) IS USED FOR SIGNALS THAT ARE ACTIVE LOW (GROUND TO ACTIVATE). ON INSTALLATION WIRING DIAGRAMS, THE MORE TRADITIONAL $\overline{\text{OVERLINE}}$ SYMBOLOGY IS USED.
9. OPTIONAL INSTALLATION.
10. IF INSTALLING UNGROUNDED THERMOCOUPLES, THE LO SIDE MUST BE TAKEN TO A GEA/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 30-1 Notes for Jabiru Sensor Drawings (for all Section 30 drawings)

30.2 GEA™ 24 Engine Interface Module - Jabiru Sensor Drawings

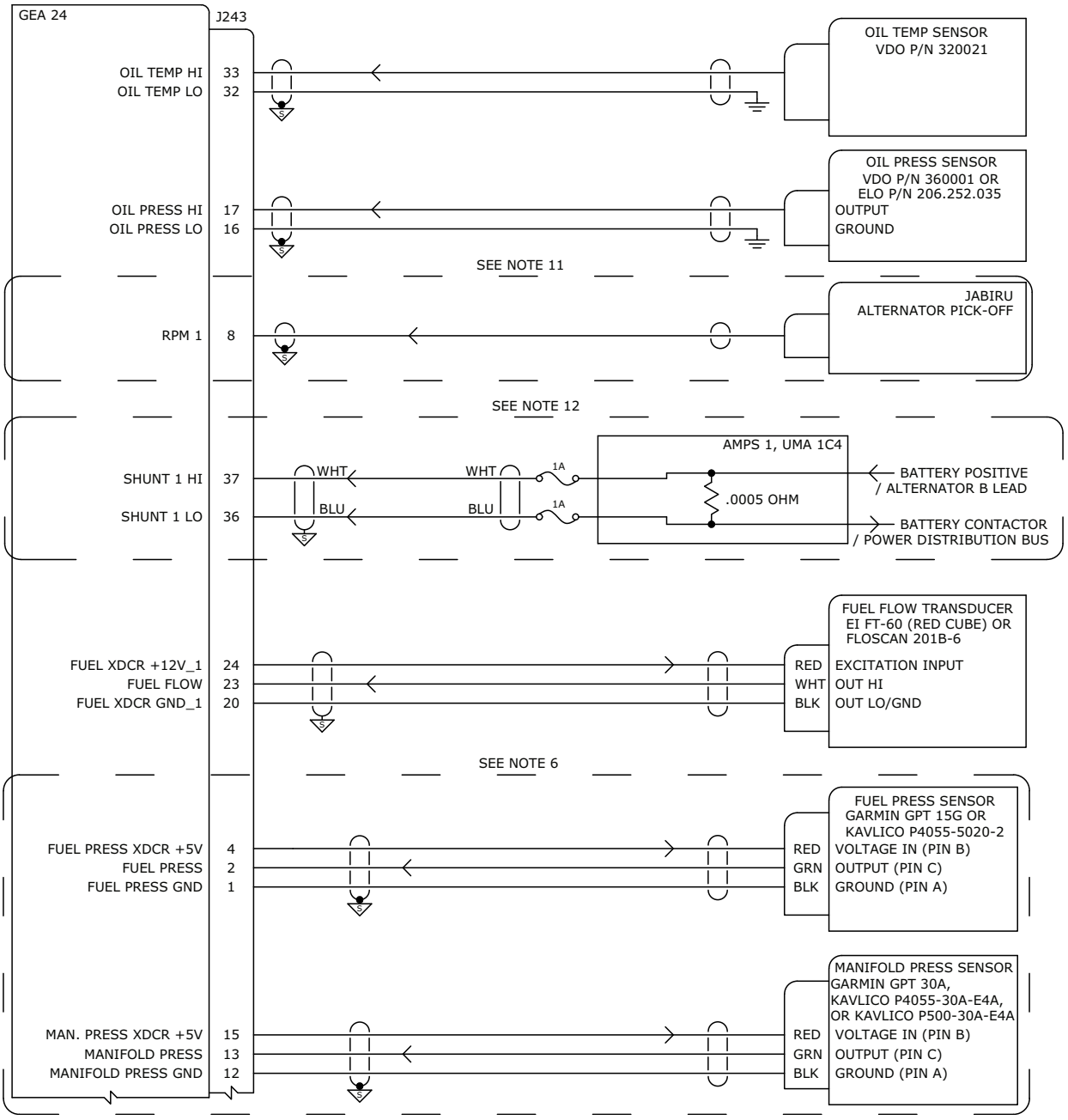


Figure 30-2 GEA 24 - Jabiru Sensor Wiring Examples, Page 1 of 2

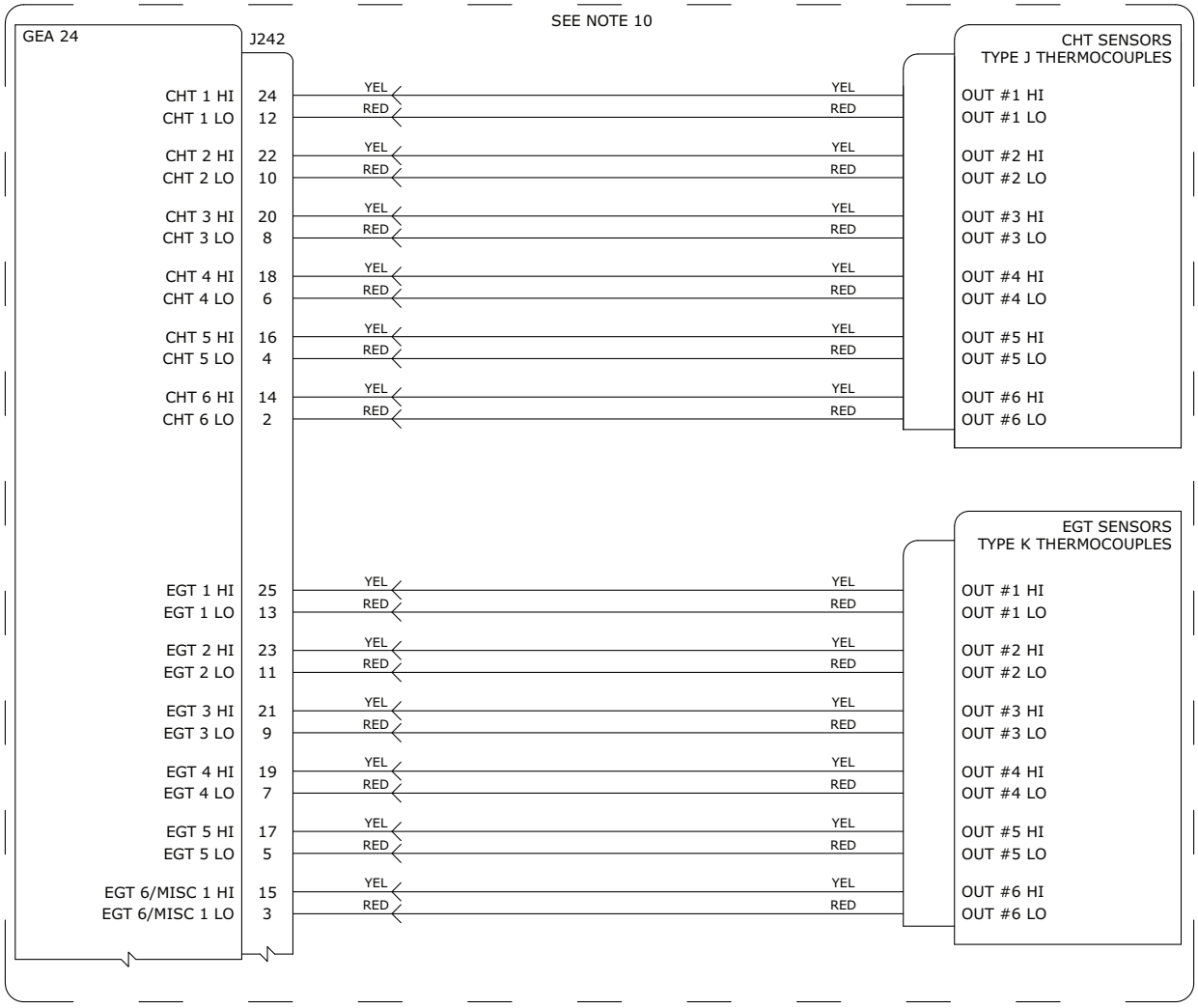


Figure 30-2 GEA 24 - Jabiru Sensor Wiring Examples, Page 2 of 2

30.3 GSU 73 - Jabiru Sensor Drawings

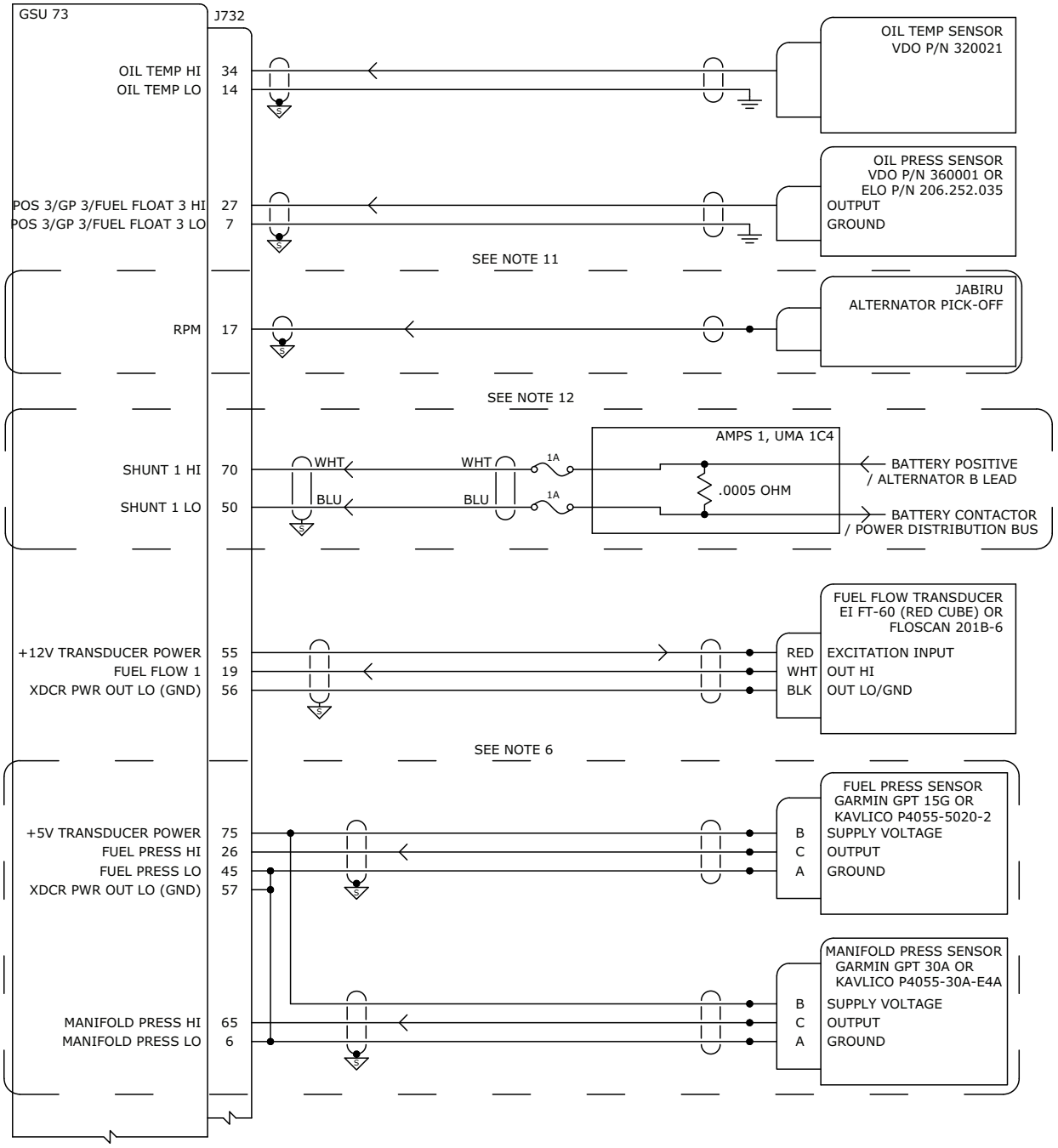


Figure 30-3 GSU 73 - Jabiru Sensor Wiring Examples, Page 1 of 2

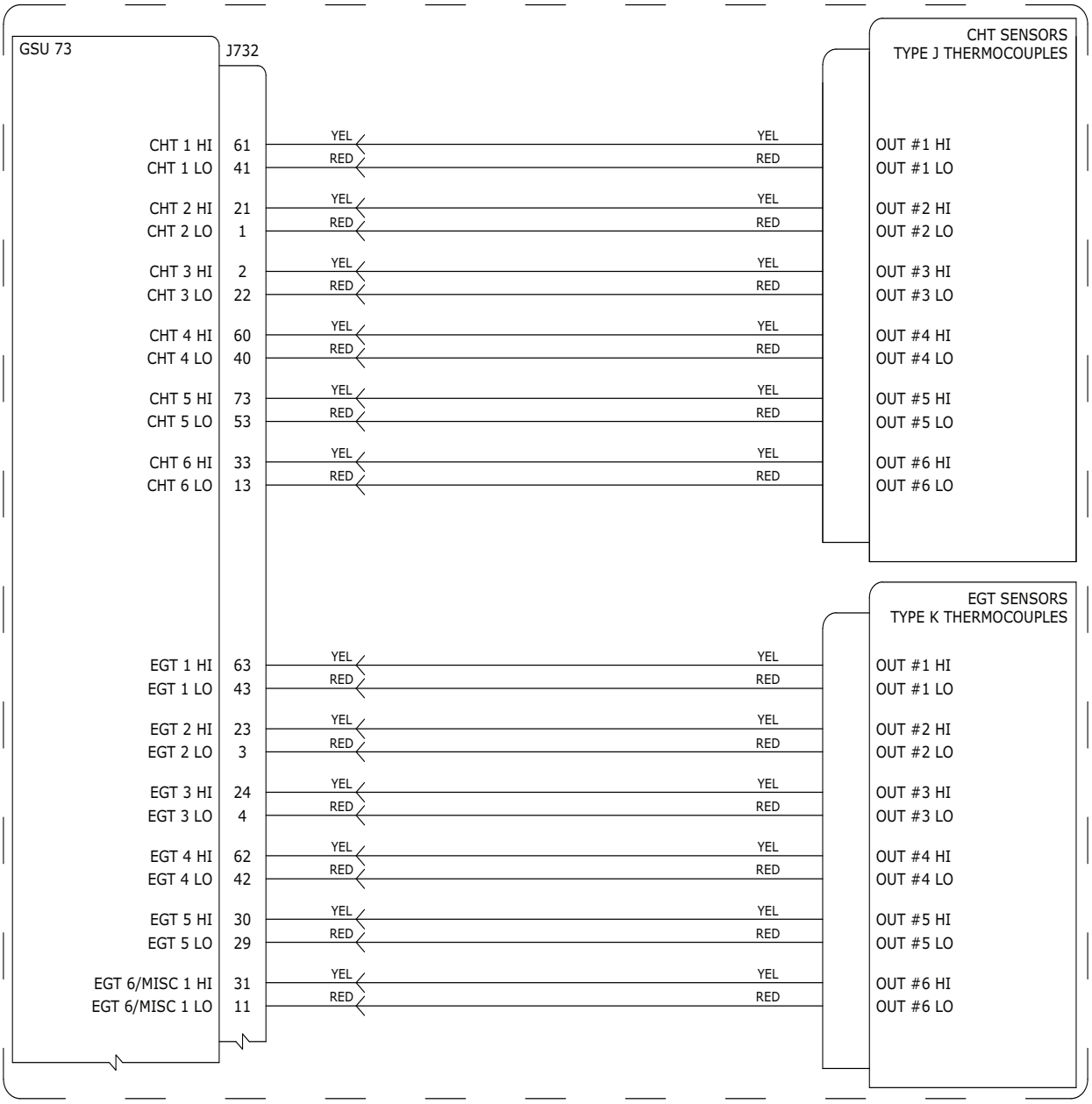


Figure 30-3 GSU 73 - Jabiru Sensor Wiring Examples, Page 2 of 2

31 GDU™ 4XX DISPLAY CONFIGURATION AND POST INSTALLATION CHECKOUT

The checkout procedures in this section are recommended to be performed after installing the G3X™ avionics. The calibration procedures are required to be performed after installing the G3X. It is assumed 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.

If replacing GDU 37X display(s) with GDU 4XX display(s), the following may be helpful in transferring some of the stored calibration data.

- As the data stored in the configuration module cannot be transferred from the GDU 37X displays to GDU 4XX displays, Garmin suggests recording GDU 37X stored calibration data such as V-speeds, RS-232 settings, ARINC 429 settings, engine gauge configuration, etc. to be used in the GDU 4XX. This is done by writing down the info or by storing screenshots.
- If reusing the GDU 37X configuration module, it should be erased (after recording stored info per above) by selecting it on the main config page, pressing the Menu key, and selecting the option to format the configuration module. Then re-enter the various settings (with changes as required to accommodate any updated wiring) per Section 31.4.
- The fuel level calibration can be backed up/restored by accessing the appropriate calibration page, pressing the Menu key, and selecting the option to read/write the calibration to/from the SD card (repeat for each tank) per Fuel Quantity Calibration Data Backup.
- If the ADAHRS LRUs (GMU 44/GSU 25/ GSU 73) are not being replaced or moved, the AHRS calibration will remained stored/valid, and does not need to be recalibrated.

NOTE

System Configuration settings must be verified for the specific build and installation following any software load or update.

NOTE

The procedures and screenshots in this section apply to the GDU 45X, GDU 46X, and GDU 470 units. Differences in appearance and layout of the screenshots may exist between the two models and may differ slightly from the actual displayed image on the GDU 4XX.

NOTE

Some procedures in this section require the GPS receiver is receiving sufficient satellite signal to compute a present position (Table 31-2). 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 the installer read this entire section before beginning the checkout procedure.

NOTE

Make sure that all GDU 4XX displays have been updated to the current software version before performing any post-installation configuration, checkout, or calibration steps, and before attempting to troubleshoot any issues. Using up-to-date software makes sure that all previous software improvements are available, and is the most effective first step after powering on the system. See Section 31.3.1 for information about updating GDU 4XX software.

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 make sure the wiring harness does not touch any moving part.

31.1 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

31.2 Configuration Mode

Some software loading and all configuration settings are performed in the configuration mode. To enter configuration mode, hold down the MENU key while powering on the GDU 4XX, the Configuration Mode page appears.

After all configuration changes have been made, use the Save & Reboot (Section 31.4.33) button to save all changes and return to normal mode.



Figure 31-1 Configuration Mode Page

31.3 Software Loading Procedure

Software loading is performed in normal mode. See the Garmin (G3X SW Page) website for instructions on downloading and installing current software. Section 31.3.3 describes the GDL® 39/39R/5XR data transceiver software load procedure.

NOTE

Perform software updates on the ground only, and remain on the ground while a software update is in progress (included in LRU software updates - see Section 31.3.2).

31.3.1 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 window will appear on the screen, use the Touch Panel or a Move Selector Knob to press YES to begin the update.



3. The unit will reboot, then GDU software update will begin automatically.
4. Make sure power is not removed while the update is being performed
5. The unit will reboot after the update is complete.

31.3.2 LRU Software Loading Procedure

G3X LRUs (except for GDU displays) connected using the CAN network will automatically receive software updates from the PFD1 display following a GDU software update. Progress of LRU software updates can be monitored using the System Information page. Functionality provided by an LRU will be unavailable during a software update, therefore all LRU software updates should be allowed to complete before flight after a GDU software update. The current LRU software versions included with a GDU software update can be found in the change notes on the software download page.

Problems loading LRU software updates are typically related to CAN network issues. See Section 2.3.1.3.6 for CAN bus troubleshooting guidance.

31.3.3 GDL 39/GDL 39R/GDL 5XR Software Update

GDL software updates are loaded through the GDU. After the steps in Section 31.3.1 have been completed, the GDU will identify the software version currently in use for the GDL and compare it to the GDL software version stored in internal GDU memory. If the current GDL software is different than the GDL software stored in GDU memory, the GDU will automatically begin updating the GDL. An "Updating..." indication for the GDL (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 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 causing it to be non-functional.



Figure 31-2 GDL 39 SW Update Status

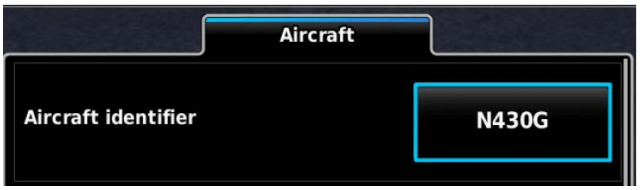
31.4 Configuration Pages

In configuration mode (Section 31.2), use the Touch Panel or a Move Selector Knob to select and view the various configuration pages. Selection of individual items on each configuration page are also made using the Touch Panel or a Move Selector Knob.

31.4.1 Data Entry Keyboard

To enter data into a data field:

1. Press the data field button on the Touch Panel (or select the data field with a Move Selector Knob).



2. Enter data using the pop-up keyboard using the Touch Panel or a Move Selector Knob (if needed, use the Backspace button to clear data).



3. When finished, press OK to enter data, or Cancel to retain previous data.

31.4.2 Data Entry Slider Bar

To change data in a field:

1. Press the data field button on the Touch Panel (or select the data field with a Move Selector Knob).
2. Press the "-" or "+" buttons to increase or decrease the setting.

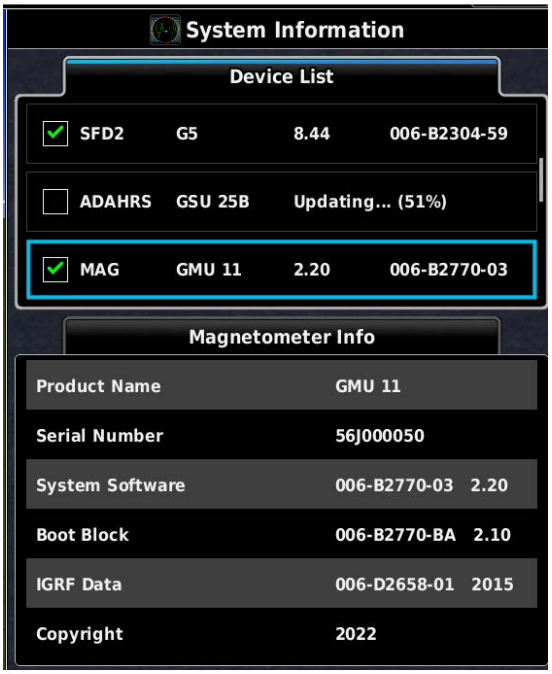


3. Press anywhere on the Touch Panel other than the slider bar (or the Back key) to return to the Configuration Page.

31.4.3 System Information Page

The System Page is used to display LRU specific information such as Software Version, Unit ID's, System ID's, and Database information for the various databases used by the GDU 4XX. This page has no user-selectable options. Faults are indicated by a Red X next to the affected LRU. The information presented in the System Information page can also be viewed in Normal mode via the Diagnostics Menu.

1. In configuration mode (Section 31.2), use the Touch Panel or a Move Selector Knob to select and view the System Information Page. The user may scroll the Device List box and the selected device's info by using the Touch Panel or a Move Selector Knob.
2. Press the Back key to return to the Configuration Mode page when finished (if desired).



NOTE

The System Information menu is also available in normal mode, in the Tools Menu.

31.4.4 System Options Page

The System Options Page is used to display the selections of System Type and Advanced User Setup options.

System Type - Selections are Non-Certified or Certified. Set to Non-Certified when not installed under STC.

Advanced User Setup - Selections are Enabled or Disabled. When enabled, the Autopilot setup and AOA calibration setup are available in normal mode. This option must be enabled for initial flight testing to setup the autopilot and AOA.



31.4.5 Configuration Files Page

NOTE

An SD card must be in the display's SD card slot for the Config Files page to be shown on the Configuration Mode page.

The Config File page is used to enable uploading and downloading of the G3X System configuration to an SD card. The configuration is written to the loader card in a format which can be uploaded to the system.

To export the configuration:

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Config Files Page.
2. Use the Touch Panel or a Move Selector Knob to select Menu.
3. Use the Touch Panel or a Move Selector Knob to select Export System Configuration.



NOTE

If restoring data to the system from a backup, all previously saved data (including calibration data) will be loaded.

NOTE

If saved configuration data is loaded into a different G3X Touch™ avionics system, the aircraft specific calibration data will not be overwritten.

To import the configuration:

1. Insert an SD card in the display with the .gcb configuration file placed in a folder named "config" within the "Garmin" folder on the SD card.
2. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Config Files Page.
3. Use the Touch Panel or a Move Selector Knob to select Import System Configuration.



31.4.6 LRU Configuration Page

The LRU configuration page is used to configure which optional Garmin 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 GTP 59 is connected to that GSU 25, configure ADAHRS 2 to "Enabled" and OAT 2 to “Disabled”. Only enable Magnetometer 2 if a second GMU 11 is installed.

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(s) should be used. Typically this should be left configured for EIS1 only, except in the case of a system that includes a GSU 73 and a GEA™ 24 engine interface module, the latter of which would be wired as EIS2. In a system that includes dual GEA 24 units used to monitor twin engines or large single engines, select "Use EIS 1+2" to enable the use of both EIS LRUs.

The “Garmin 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.

Enable Roll Trim Servo or Pitch Trim Servo only if a Garmin GSA 28 autopilot servo is installed as a dedicated trim motor. For this to be enabled, one GSA 28 must be installed per axis for primary autopilot control, a second GSA 28 would then be installed as a trim motor. If the primary autopilot servo is directly driving a 3rd party trim motor using pins 13 and 14 of the GSA 28, this field should be set to “Disabled”.

Enable Radio AGL only if a Garmin GHA 15 Height Advisor is installed. If an ARINC 429 Radar Altimeter is installed, leave this setting Disabled.

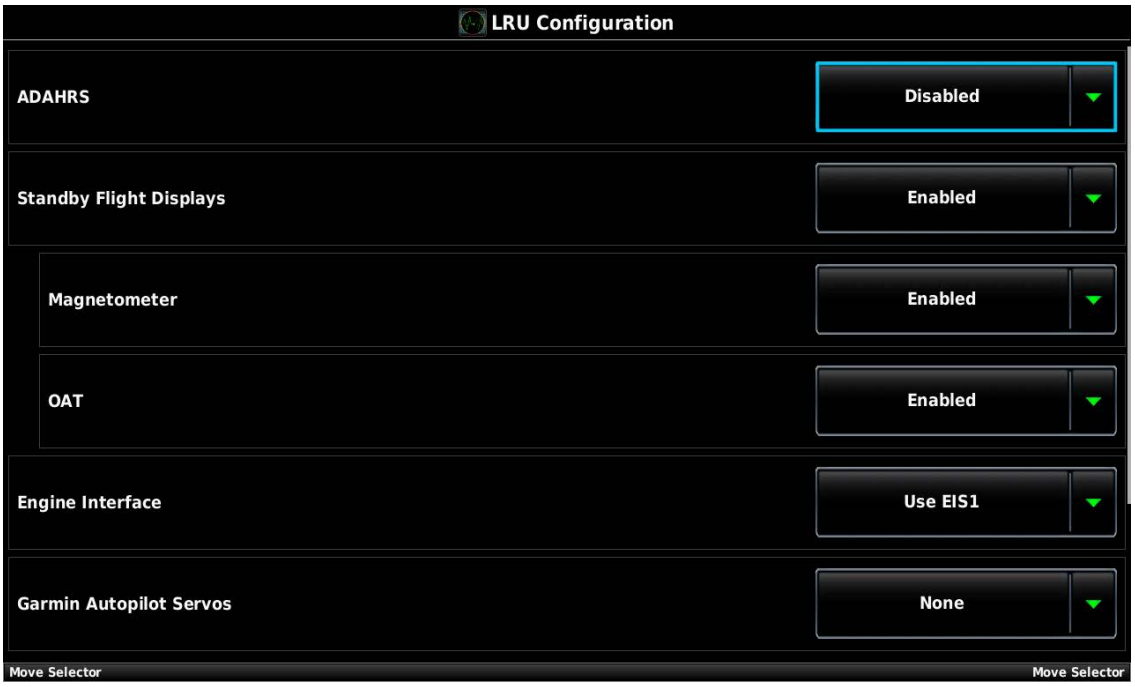
1. In configuration mode (Section 31.2), use the Touch Panel or a Move Selector Knob to select and view the LRU Page.
2. Use the Touch Panel or a Move Selector Knob to select, then enable or disable the listed LRUs.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

For configurations with no ADAHRS LRUs:

1. Set ADAHRS 1 to Disabled.
2. An option to enable/disable "Standby Flight Displays" is displayed.
3. Set "Standby Flight Displays" to enabled if there is a G5 (or multiple G5 units) installed in the G3X Touch system,
4. Configuration settings that are applicable only to systems with a source of attitude data (autopilot, etc) will be displayed.

NOTE

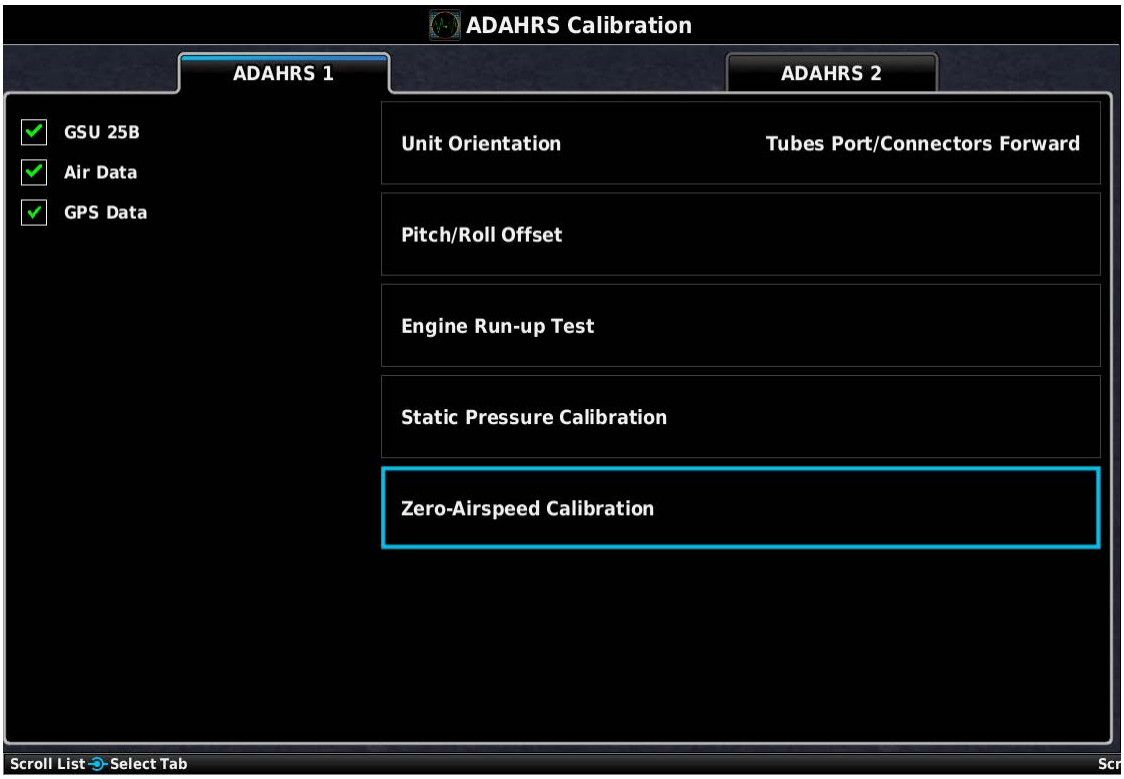
Electrical Control System must be enabled to display the Flaps, External Lights, and Cockpit Lighting configuration pages, as well as the GAD 27 tab on the Engine Information System Configuration page.



31.4.7 ADAHRS (Air Data Attitude/Heading Reference System) Calibration Page

The ADAHRS Calibration Page is used to perform post-installation calibration for both the GSU 25 and/or GSU 73 (as applicable).

1. To access the ADAHRS Calibration Page, power on PFD1 in configuration mode (Section 31.2). (this step can be skipped if PFD1 is already in configuration mode)
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.
3. The GSU 25, Air Data, and GPS Data checkboxes (Section) confirm operational status of these LRUs with a green check, no green check indicates no communication with LRU.
4. Press the Back key to return to the Configuration Mode page when finished (if desired).



See Section 31.3 (SW loading procedure) and the following sections (Post Installation Calibration Procedures) for further information regarding the ADAHRS Calibration Page.

After mechanical and electrical installation of the GSU 25/GSU 73 ADAHRS have been completed, before operation, a set of post-installation calibration procedures must be carried out.

The calibration procedures (31.4.7.1 – 31.4.7.4) may require that certain status boxes on the ADAHRS Calibration Page (configuration mode) indicate a positive state (green check marks) before starting the procedure. Table 31-2 and Table 31-3 list the status box requirements for each calibration procedure.

Table 31-1 describes the ADAHRS calibration procedures:

Table 31-1 Post Installation Calibration Procedure Summary for ADAHRS Page

Procedure Name	Procedure Description	Installations Requiring Procedure
Unit Orientation	Configure ADAHRS installation orientation	Required for all installations
Pitch/Roll Offset Compensation	Level Aircraft	Required for all installations
Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Required for all installations
ADAHRS Static Pressure Calibration	Altitude re-calibration	Only used when an ADAHRS has failed a periodic altimeter test
Zero-Airspeed Calibration	Airspeed Low End Noise Compensation	Only used when directed to by Garmin Aviation Product Support

For each ADAHRS Calibration Procedure, Table 31-2 lists the LRUs that require valid calibration data.

Table 31-2 Data Validity Requirements for ADAHRS Calibration Procedures

ADAHRS Calibration Procedure	Valid Status Required for GSU 25 Calibrations	Valid Status Required for GSU 73 Calibrations
ADAHRS Mounting Orientation Identification	None	None
Pitch/Roll Offset	None	GPS and Air Data
Engine Run-Up	None	GPS or Air Data
ADAHRS Static Pressure Calibration	None	None
Zero-Airspeed Calibration	None	N/A

Table 31-3 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table 31-2.

Table 31-3 Configuration Mode ADAHRS Calibration Page Status Boxes

Status Box	Valid Status
ADAHRS	ADAHRS LRU status valid
GPS Data	3D or 3D Differential GPS solution available.
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid

The ADAHRS Calibration Page status boxes referred to in Table 31-2 and Table 31-3 are shown in Figure 31-3.

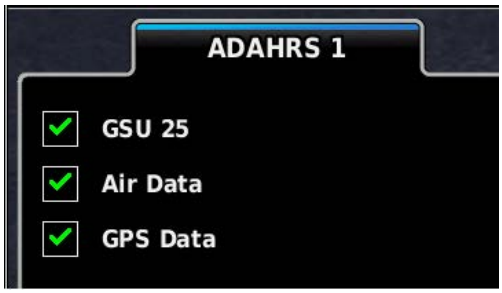
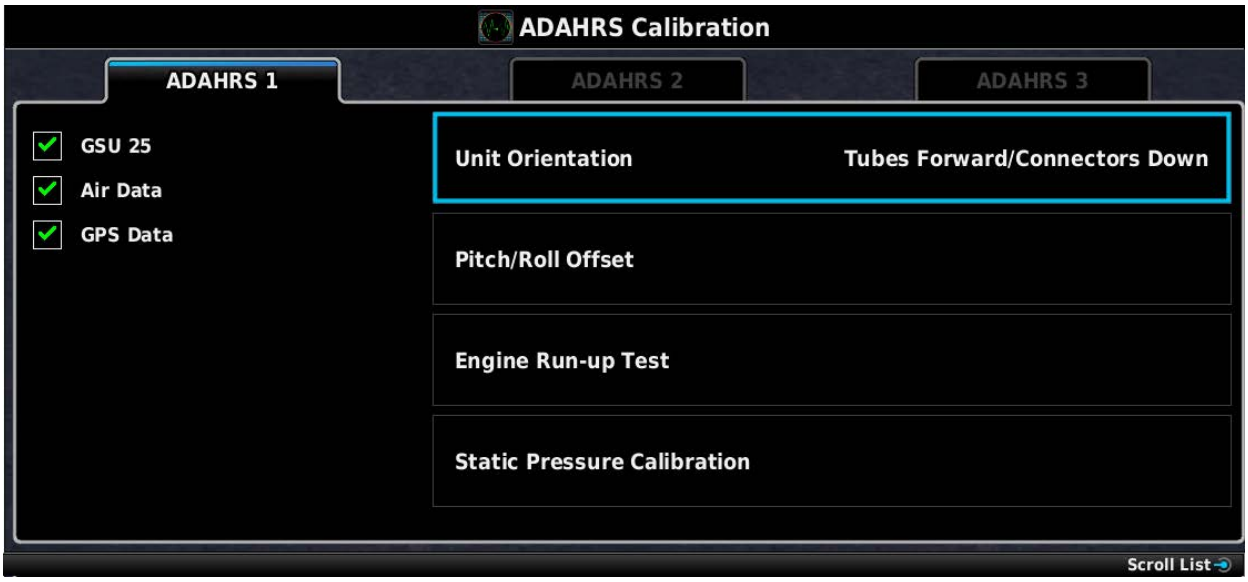


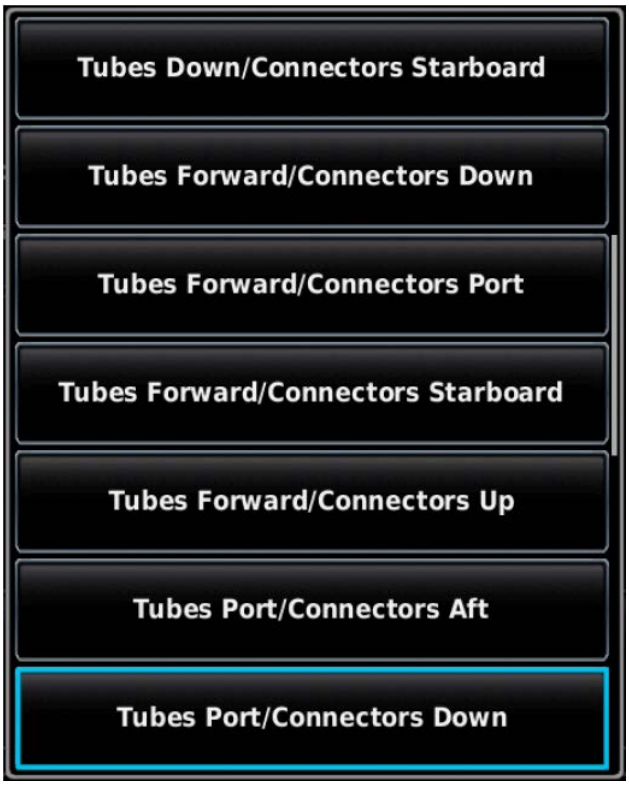
Figure 31-3 ADAHRS Status Boxes

31.4.7.1 ADAHRS UNIT ORIENTATION

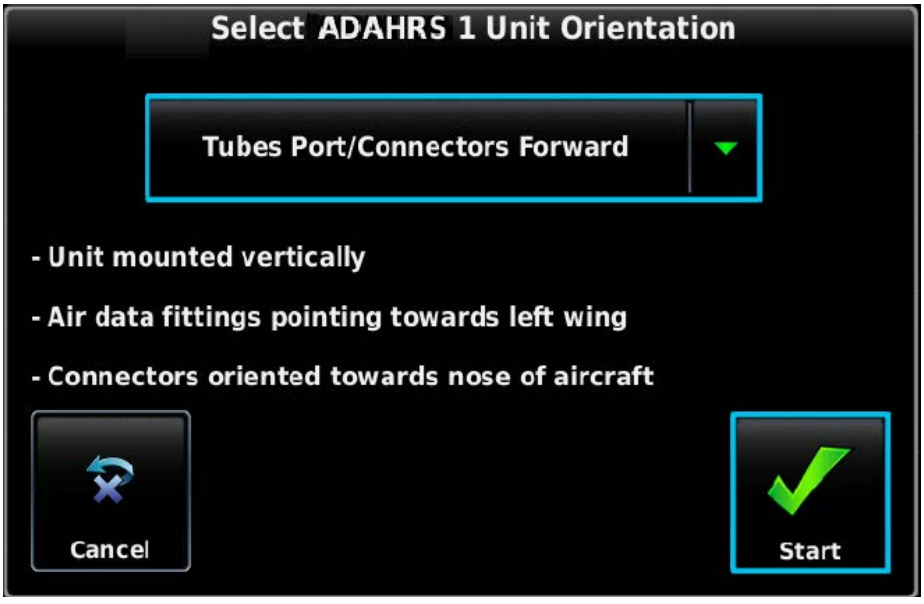
1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.
3. Use the Touch Panel or a Move Selector Knob to select the ADAHRS (1, 2, or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Unit Orientation.



5. For a G3X system using a GSU 73, refer to Figure F-8 to find the correct LRU orientation. Select the correct orientation from the pull-down list. For a GSU 25, proceed to the next step (6).
6. For a G3X system using a GSU 25, refer to Figure 18-6 and Figure 18-6 to find the correct LRU orientation, then select that orientation from the pull-down list.



7. Read the description of the selected orientation to make sure the proper orientation has been selected, then press the Start button to store the orientation.



31.4.7.2 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 before the calibration.

NOTE

The GSU 73 must be installed to be level 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 installed to be level 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).

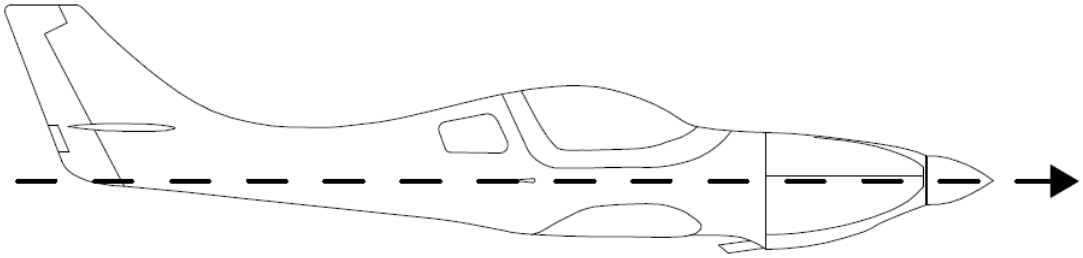
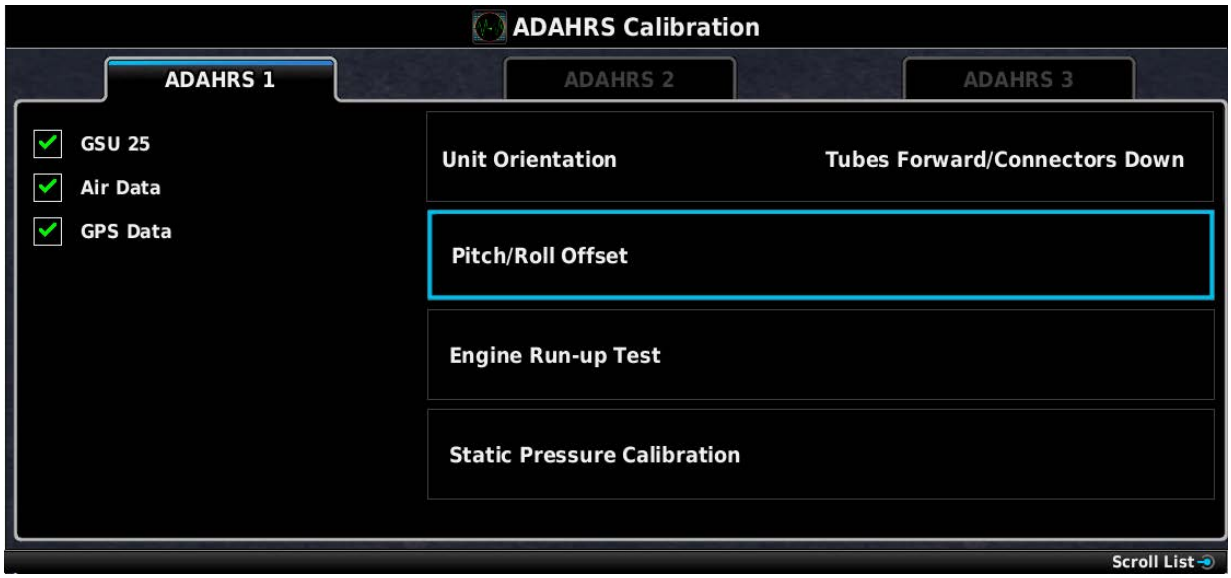


Figure 31-4 In-Flight Level Cruise Attitude

1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.

3. Make susre that all the required status boxes are checked (Table 31-2 and Table 31-3). Use the Touch Panel or a Move Selector Knob to select which ADAHRS (1, 2 or 3) is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Pitch/Roll Offset.



5. Make sure that aircraft and ADAHRS comply with all on-screen instructions, press the START button.

NOTE

Per the following figure, GSU 25 units must have the ADAHRS pitch and roll within 30 degrees of level, GSU 73 units must have the ADAHRS pitch and roll within 3.0 degrees of level.



6. “Pitch/roll offset calibration in progress” appears on the display along with calibration information. The GSU 25 pitch/roll offset procedure has a 30 second countdown timer that resets if the aircraft moves. The GSU 73 pitch/roll offset procedure completes in a few seconds.



7. When the calibration has completed “Success” or “Failure” will be displayed, press the DONE softkey to return to the ADAHRS Calibration screen.



The Magnetometer Calibration (Section 31.4.8.3) 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 Touch Pilot’s Guide,190-01754-00). 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 an additional ADAHRS is installed in the aircraft, or the mounting location of an existing AHRS is changed, the pitch/roll offset compensation procedure must be performed again for all installed AHRS units before moving the aircraft. This applies equally to all AHRS units, including the GSU 25, GSU 73, and G5 backup display.

31.4.7.2.1 Yaw Offset and Pitch/Roll Calibration with GMC 507 Installed

Perform the following procedures after the G3X/GMC 507 system is configured per Section 31.4.10.10.

1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. If the GMC 507 is installed in a panel that is perpendicular to the aircraft forward motion, skip to Step 6. If the GMC 507 is installed in a panel which is not perpendicular to the aircraft forward motion (i.e. in a canted panel), navigate to the Autopilot page group General tab and touch the value on the Mode Control Panel Yaw Offset row.
3. Follow the on-screen instructions.
4. Select the appropriate value of yaw offset.
5. When the value is entered, select Save to return to the Autopilot page group, General Tab.
6. Touch the Calibrate button on the Mode Control Panel Pitch/Row row.
7. Select Calibrate to start the calibration process.
8. When the process is complete, select Done to return to the Autopilot page group, General Tab.
9. Restart the G3X System in normal mode.

31.4.7.3 Engine Run-Up Vibration Test

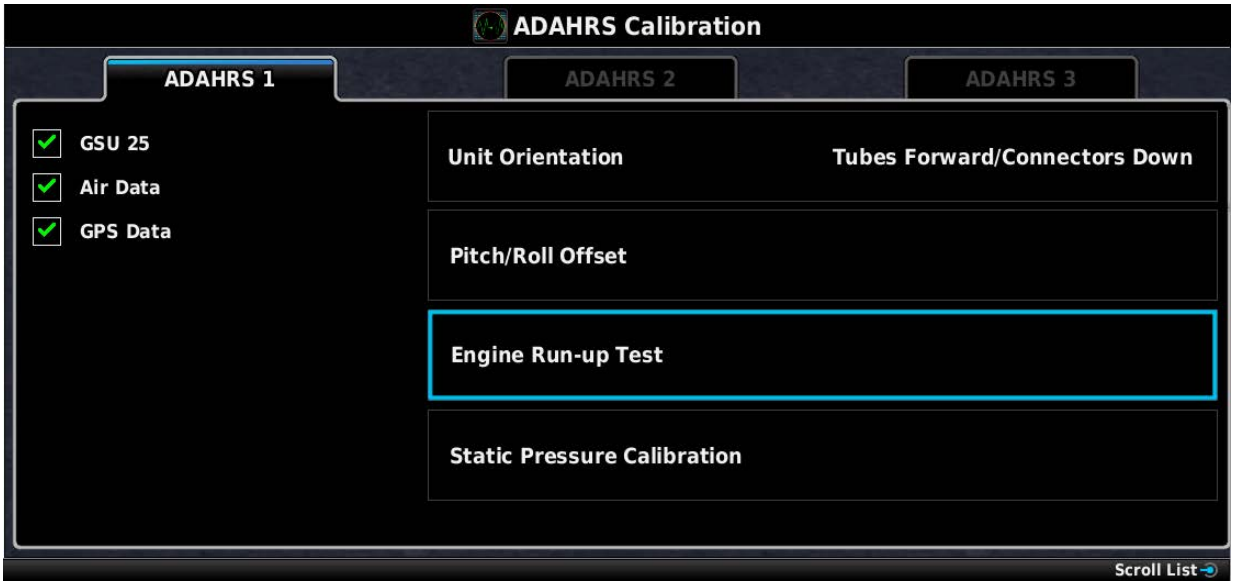
NOTE

The Engine Run-Up Vibration Test is required for all installations to validate the vibration characteristics of the installation. The ADAHRS Unit Orientation (Section 31.4.7.1) and Pitch/Roll Offset Compensation (Section 31.4.7.2) are not required before 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.

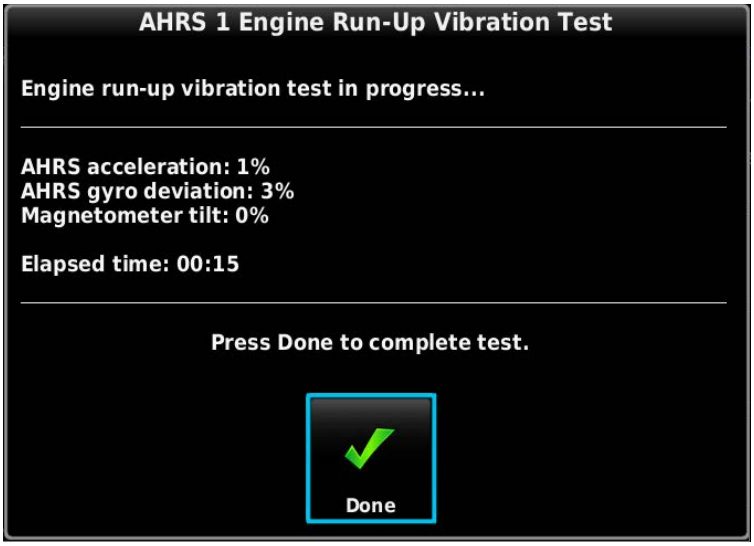
1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.
3. Make sure that all the required status boxes are checked (Table 31-2 and Table 31-3). Use the Touch Panel or a Move Selector Knob to select the ADAHRS (1, 2 or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Engine Run-up Test.



5. Make sure the aircraft has been properly positioned per the on-screen instructions, then press the Start button to begin the test.



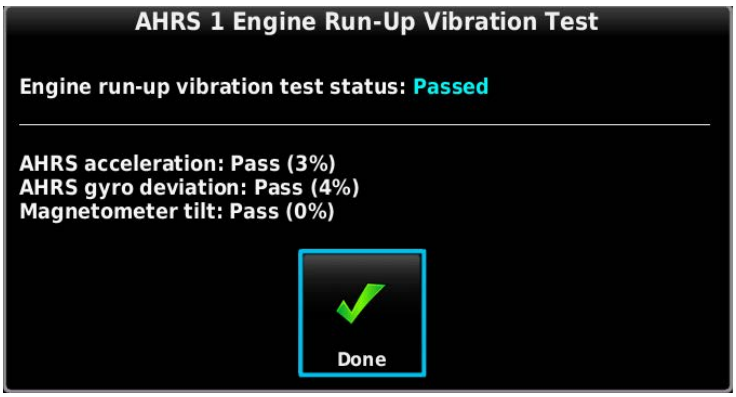
6. Gradually increase power from idle to full throttle and back to idle over the course of 1-2 minutes, the test data is displayed as the test progresses.



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. Make sure that test results indicate Passed, then press the Done button to return to the ADAHRS 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 magnetometer mechanical mounting with respect to airframe (see Section 15, Section 18, and Appendix F for applicable mounting requirements and instructions).

b) Vibration or motion of GSU 25/GSU 73 and/or GMU magnetometer caused by neighboring equipment and/or supports.

c) Mounting of GSU 25/GSU 73 at a location that is subject to severe vibrations (for example close to an engine mount).

d) Mounting screws and other hardware for GSU 25/GSU 73 and/or GMU magnetometer 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 magnetometer 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 the test would pass in calm conditions; an actual pass is required before the installation can be considered adequate.

31.4.7.4 ADAHRS Static Pressure Calibration

The ADAHRS Calibration page (configuration mode) has a selection for ADAHRS Static Pressure Calibration. This procedure is used to perform an altimeter re-calibration. The altitude pressure sensor used in any G3X ADAHRS unit is very low drift and does not typically require re-calibration.

NOTE

This calibration is only used when an ADAHRS fails a periodic altimeter test and should only rarely, if ever, be used.

The static pressure calibration requires the use of a pressure control system (test set) with an altitude accuracy of at least +/- 5 ft at sea level and +/- 20 ft at 30,000 ft. It is necessary to re-calibrate to sea level (0 ft), 10,000 ft, 20,000 ft, and optionally to 30,000 ft. The operator is allowed to finish the calibration at the end of the 20,000 ft calibration if the 30,000 ft calibration is not desired.

CAUTION

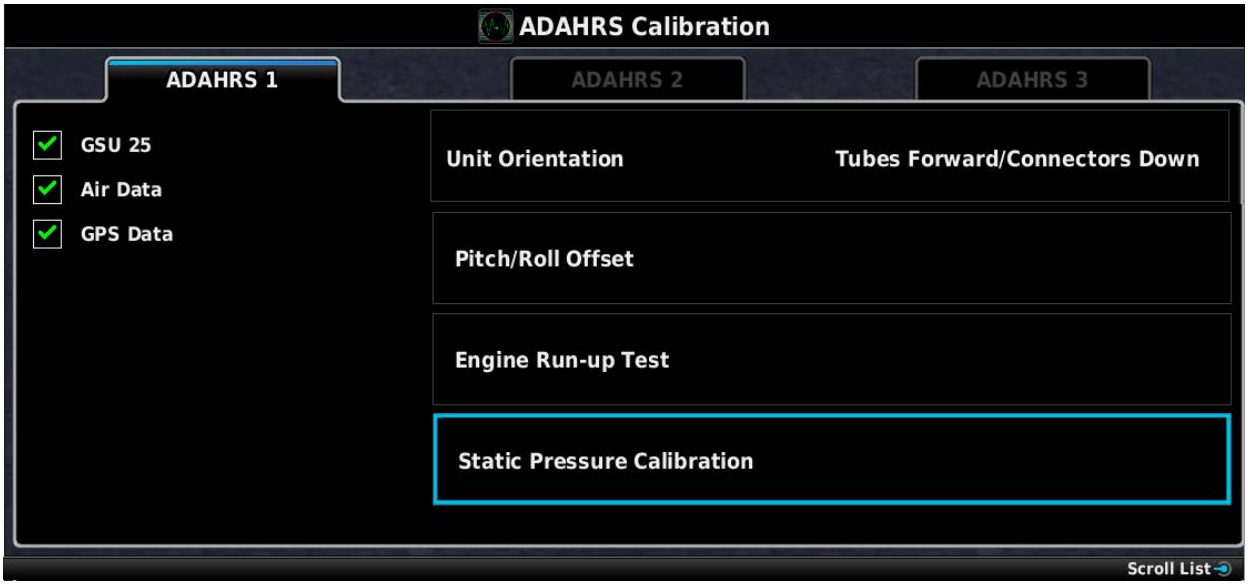
To avoid damaging the ADAHRS pressure sensors, the pitot, AOA (for GSU 25), and static ports must be connected to the test set.

It is acceptable to connect multiple pneumatic ports together. The AOA port should typically be connected to the static port so it is always exposed to the same pressure as the static port during the test.

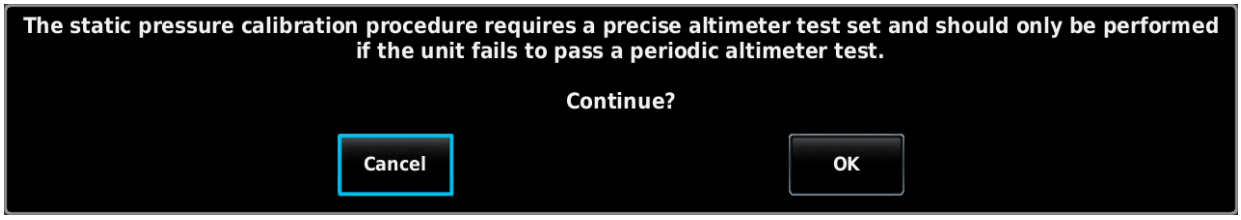
CAUTION

Leaving the AOA port disconnected and exposed to ambient pressure during the static pressure re-calibration will damage the AOA sensor.

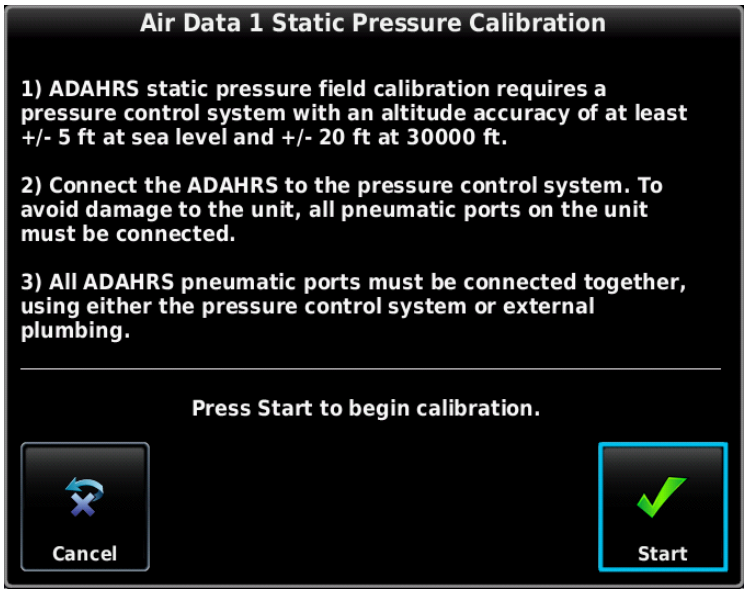
1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.
3. Use the Touch Panel or a Move Selector Knob to select the ADAHRS (1, 2 or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Static Pressure Calibration.



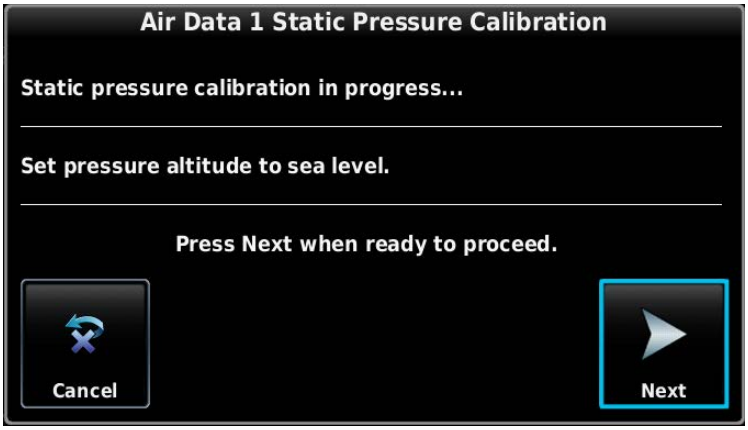
5. Use the Touch Panel or a Move Selector Knob to continue or cancel the calibration.



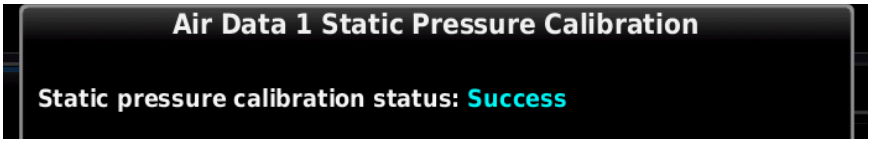
6. Make sure that all on-screen instructions have been complied with, then press the Start button to begin the calibration. Actual displayed image will be similar to following figure.



7. At each calibration point (sea level, 10K, 20K, and optionally 30K ft), the display will present a screen that allows time to establish the calibration pressure before continuing. For example, the following screen is presented when it is time to establish the static pressure equal to sea level. Press NEXT to continue and calibrate this pressure. Actual displayed image will be similar to following figure.



8. During the calibration at each pressure, the pressure must be held constant for 30 seconds for the calibration step to be successful. The calibration may be cancelled at any point should the test setup require adjustment before repeating.
9. When the static pressure calibration is complete, a status screen will show the procedure was successful. Actual displayed image will be similar to following figure.



31.4.7.5 Zero-Airspeed Calibration

The ADAHRS Calibration page (configuration mode) has a selection for ADAHRS Zero-Airspeed Calibration. This procedure is used to compensate for the noise present in the airspeed sensor while stationary. The airspeed pressure sensor used in any G3X ADAHRS unit is very low drift and does not typically require re-calibration.

NOTE

Only perform this procedure in coordination with Aviation Product Support.

Test Procedure:

1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the ADAHRS Calibration Page.
3. Use the Touch Panel or a Move Selector Knob to select the ADAHRS (1, 2 or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Zero-Airspeed Calibration

NOTE

Remove any covers from the pitot tube and static ports before initiating this procedure.

NOTE

Ensure the aircraft is indoors and stationary, in a location where it is not affected by wind or direct breeze.

5. Use the Touch Panel or a Move Selector Knob to select Start, to begin the calibration procedure.
6. When the display reports the procedure has been Successfully competed, select DONE.

CAUTION

Completing the Zero-Airspeed calibration may impact the performance of AOA. After completing the Zero Airspeed Calibration procedure, review AOA performance and repeat AOA calibration as needed.

31.4.8 Magnetometer Calibration Page

After mechanical and electrical installation of the GMU Magnetometer(s) have been completed, before operation, a set of post-installation calibration procedures must be carried out on the Magnetometer Calibration page.

The calibration procedures (31.4.8.1 – 31.4.8.3) may require that certain status boxes on the Magnetometer Calibration Page (configuration mode) indicate a positive state (green check marks) before starting the procedure. Table 31-2 and Table 31-3 list the status box requirements for each calibration procedure.

Table 31-4 describes the Magnetometer calibration procedures.

Table 31-4 Post Install Cal Procedure Summary for Magnetometer Calibration Page

Procedure Name	Procedure Description	Installations Requiring Procedure
Unit Orientation	Configure magnetometer installation orientation	Required for all GMU 11 installations
Magnetic Interference Test	Validate no magnetic interference with GMU magnetometer	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 magnetometer. Such changes include, but are not limited to, wiring, shielding or grounding changes to any light, strobe, beacon or other electrical device located near or in the same wing as the GMU magnetometer. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU magnetometer. Such changes include, but are not limited to, addition, removal or modification of ferrous or electrically conductive materials located near or in the same wing as the GMU magnetometer unit. Garmin recommends this test be performed at least once every 12 months.
Magnetometer Calibration	Compass Rose Taxi Maneuver	Required for all installations. This calibration must be performed after every Pitch/Roll Offset Compensation and following a removal or replacement of the GMU unit, or degaussing of the area near the GMU location.

For each Calibration Procedure, Table 31-5 lists the LRUs that require valid calibration data.

Table 31-5 Data Validity Requirements for Magnetometer Calibration Procedures

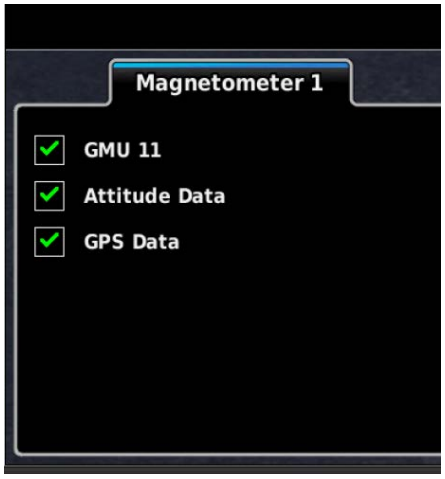
Magnetometer Calibration Procedure	Valid Status Required for GSU 25 and GMU Calibration	Valid Status Required for GSU 73 and GMU Calibration
GMU 11 Mounting Orientation Identification (if applicable)	None	None (GMU 11 is not supported by GSU 73)
Magnetometer Interference Test	None	GPS or Air Data
Magnetometer Calibration	GPS	Air Data and GPS

Table 31-6 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table 31-5.

Table 31-6 Configuration Mode Magnetometer Page Status Boxes

Status Box	Valid Status
Magnetometer	Magnetometer LRU status valid
GPS Data	3D or 3D Differential GPS solution available
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid.
Attitude (if applicable)	Magnetometer is receiving valid attitude data from ADAHRS

The Magnetometer Configuration Page status boxes referred to in Table 31-5 and Table 31-6 are shown in the following figure.



If removal and replacement of a GMU magnetometer unit is required after post-installation calibration has been completed, the GMU 22 mounting rack or GMU magnetometer must not be moved. If the mounting screws that secure the GSU 25/GSU 73 unit or the GMU magnetometer mounting rack are loosened for any reason, post-installation calibration procedures, ADAHRS Unit Orientation (Section 31.4.7.1), Pitch/Roll Offset Compensation (Section 31.4.7.2), ADAHRS Static Pressure Calibration (Section 31.4.7.4), and GMU 11 Orientation (Section 31.4.8.1) must be repeated before the aircraft can be

returned to service.

Any GMU magnetometer removal or replacement requires repeating the Magnetometer Calibration (Section 31.4.8.3).

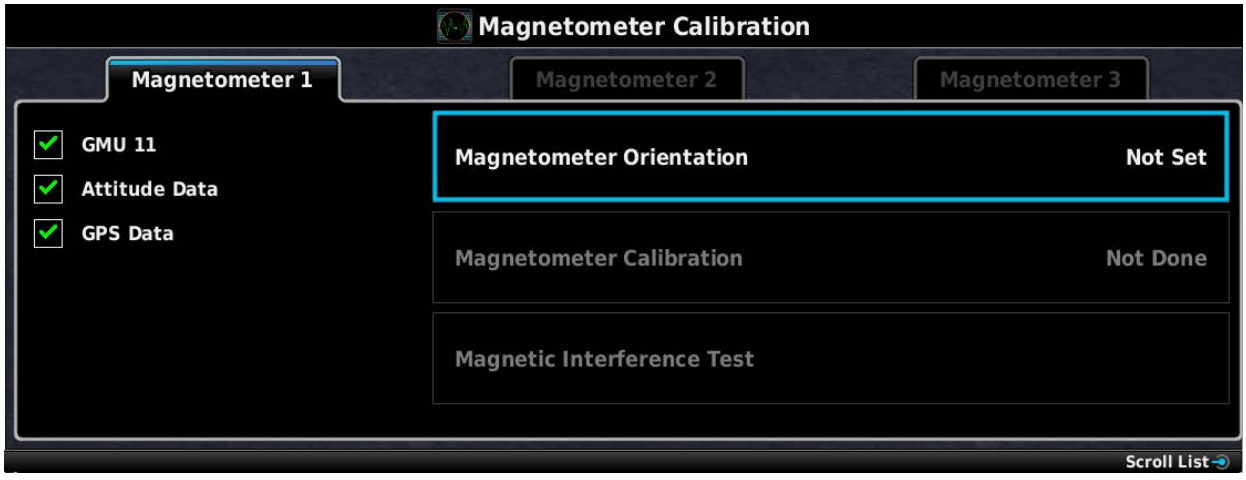
A repeat of the Pitch/Roll Offset Compensation (Section 31.4.7.2) requires a repeat of the Magnetometer Calibration (Section 31.4.8.3).

The addition, removal, or modification of components that are ferrous, or otherwise magnetic, within 10.0 feet of the GMU magnetometer location after the Magnetometer Interference Test (Section 31.4.8.2) or Magnetometer Calibration (Section 31.4.8.3) were completed requires a repeat of both procedures.

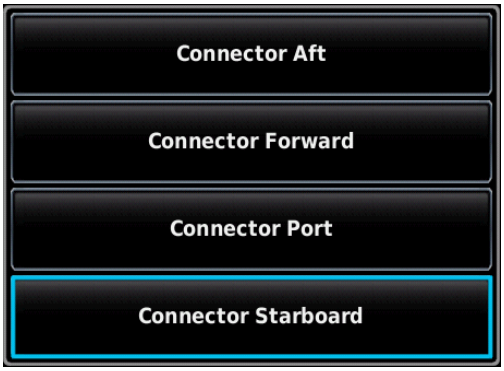
Furthermore, electrical changes to the installation that affect components within 10.0 feet of the GMU magnetometer after the Magnetometer Calibration (Section 31.4.8.3) and Magnetometer Interference Test (Section 31.4.8.2) were completed will require a repeat of the magnetometer interference test. If new magnetic interference is detected, it must be resolved, then the Magnetometer Calibration (Section 31.4.8.3) must be repeated. Wiring or grounding changes associated with a device located in the vicinity of the GMU magnetometer is a good example of such a change.

31.4.8.1 UNIT ORIENTATION (GMU 11 Only)

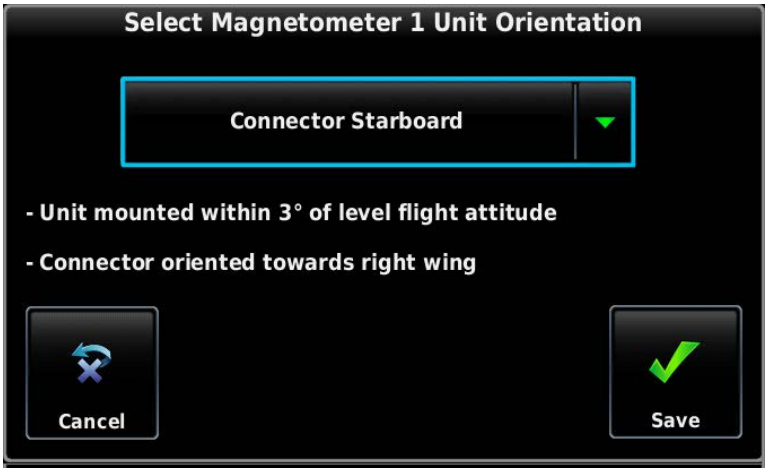
1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the Magnetometer Calibration Page.
3. Use the Touch Panel or a Move Selector Knob to select the Magnetometer 1, 2, or 3 tab designated for the GMU 11.
4. Use the Touch Panel or a Move Selector Knob to select Unit Orientation.



5. Find the correct GMU 11 orientation, then select that orientation from the pull-down list.



6. Read the description of the selected orientation to make sure the proper orientation has been selected, then press the Save button to store the orientation.



31.4.8.2 Magnetic Interference Test

NOTE

The Magnetic Interference Test 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 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 magnetometer unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU magnetometer. 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 magnetometer unit. This procedure validates that no electronic device is interfering with the operation of the GMU magnetometer which directly impacts the determination of attitude and heading by the GSU 25/GSU 73 AHRS. The ADAHRS Unit Orientation (Section 31.4.7.1) and Pitch/Roll Offset Compensation (Section 31.4.7.2) are not required before execution of this procedure.

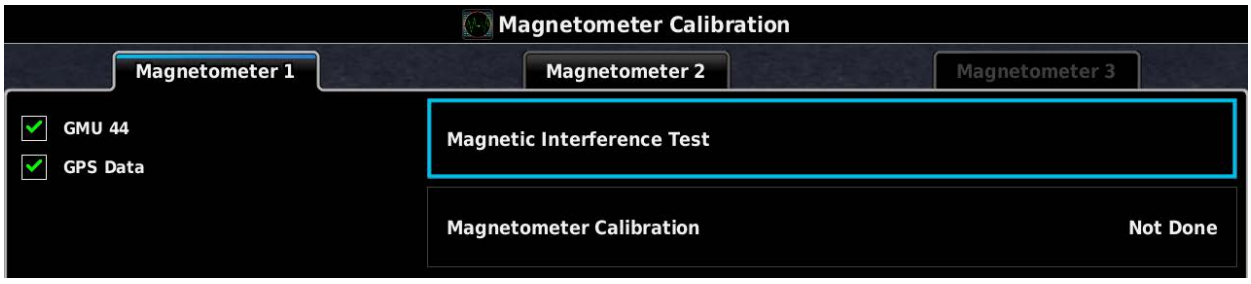
CAUTION

The real time display shown 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.

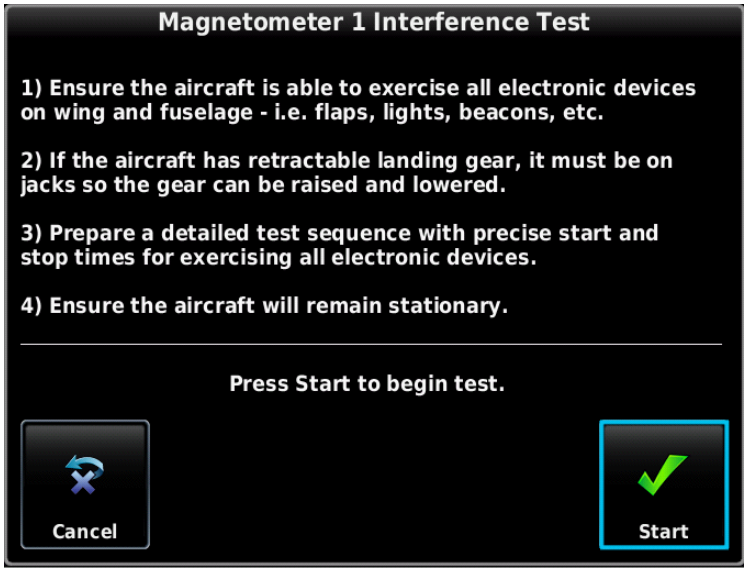
NOTE

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

1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the Magnetometer Calibration Page.
3. Make sure that all the required status boxes are checked (Table 31-2 and Table 31-3). Use the Touch Panel or a Move Selector Knob to select the ADAHRS (1, 2 or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Magnetic Interference Test.



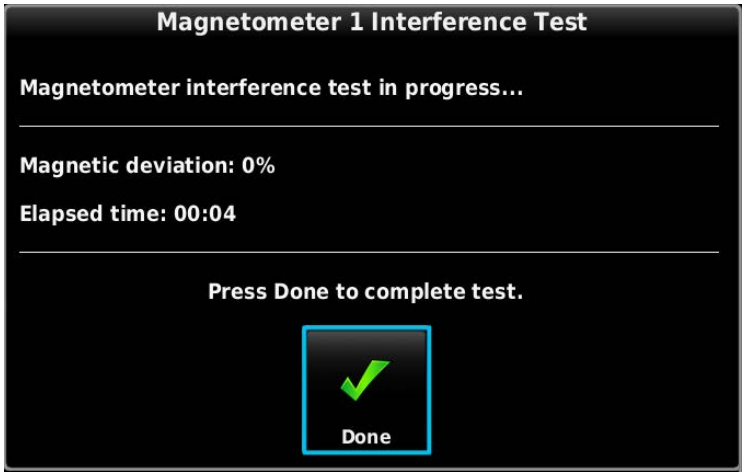
5. Make sure the aircraft has been properly prepared per the on-screen instructions. See Table 31-7 for a sample test sequence. Press the Start button to begin the test.



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. Make sure 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 Magnetometer Page.

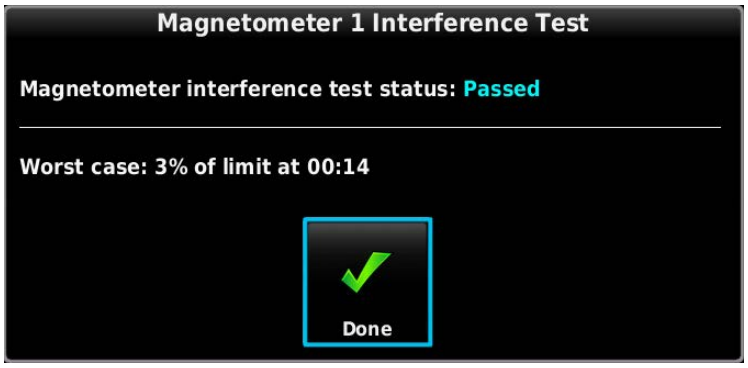


Table 31-7 Magnetometer Interference Test Sequence Example

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

31.4.8.3 Magnetometer Calibration

NOTE

The Pitch/Roll Offset Compensation (Section 31.4.7.2) must be successfully completed before performing the Magnetometer Calibration.

NOTE

The Magnetometer Calibration 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 ADAHRS cannot be guaranteed if this calibration is not performed at a magnetically clean location.

Taxi the aircraft to a site that has been determined to be free of magnetic disturbances. Make sure 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 make sure 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 31-5.

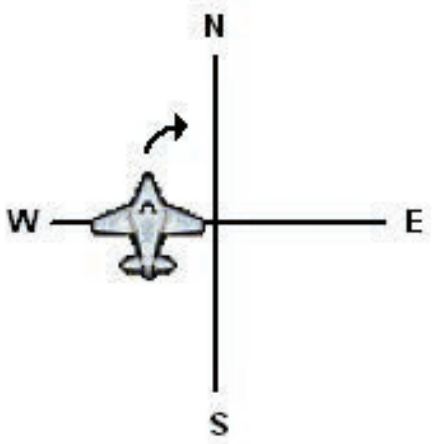
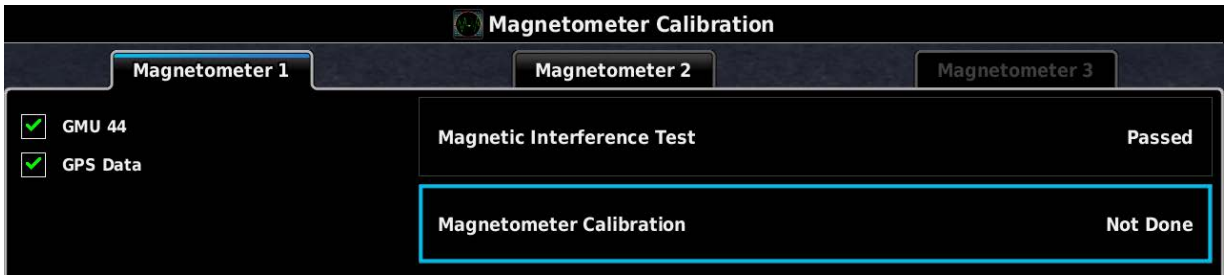


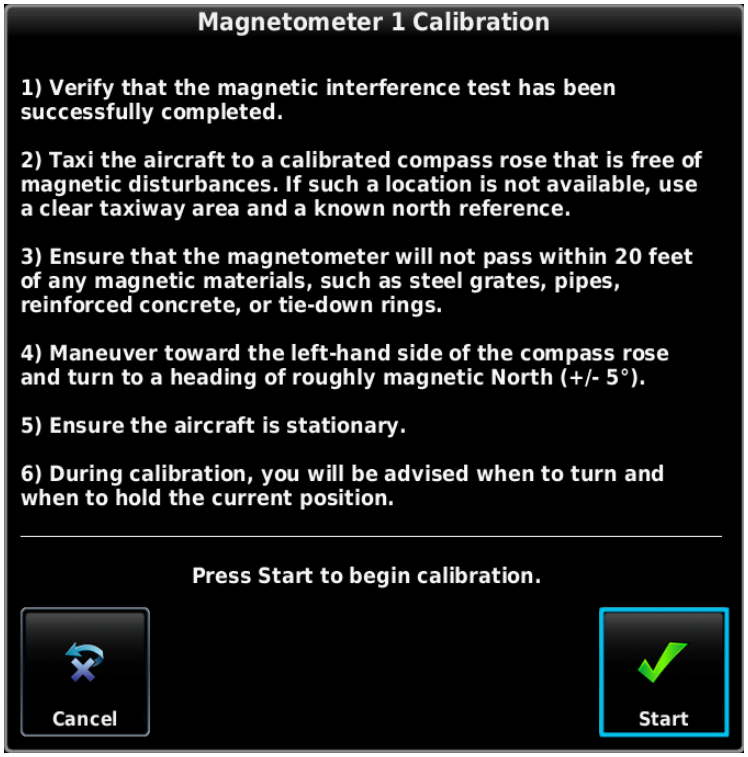
Figure 31-5 Aircraft Alignment

With the aircraft stationary, initiate the GSU 25/GSU 73 ADAHRS magnetometer calibration procedure as follows:

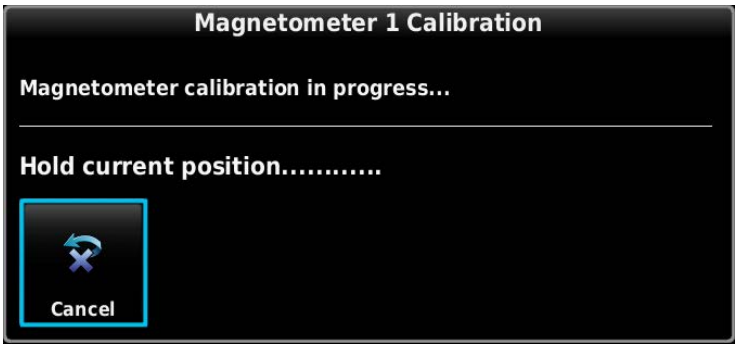
1. Power on PFD1 in configuration mode (Section 31.2), this step can be skipped if PFD1 is already in configuration mode.
2. Use the Touch Panel or a Move Selector Knob to select the Magnetometer Calibration Page.
3. Make sure that all the required status boxes are checked (Table 31-2 and Table 31-3). Use the Touch Panel or a Move Selector Knob to select the magnetometer (1, 2 or 3) that is being configured.
4. Use the Touch Panel or a Move Selector Knob to select Magnetometer Calibration Test.



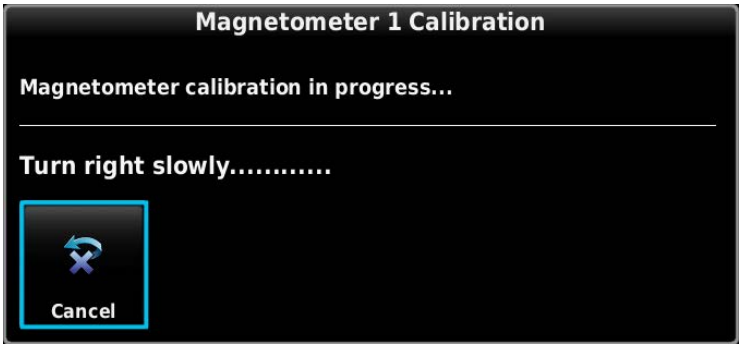
5. Make sure that all on-screen instructions have been complied with, then press the Start button to begin the calibration.



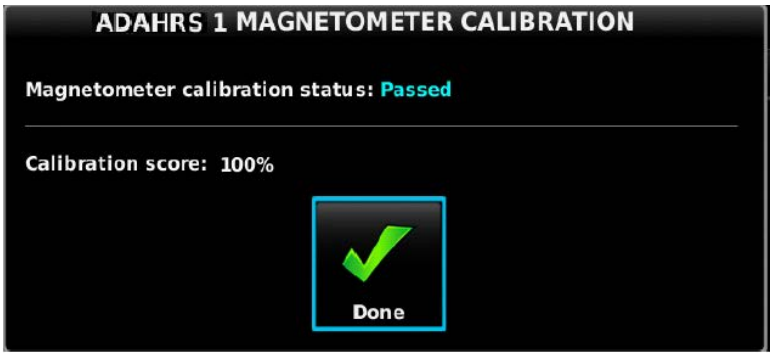
6. Follow the on-screen instructions, the dots at the end of the text will be removed as the test progresses.



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, Make sure that a Calibration Status of "Passed" is displayed, press the Done button to return to the Magnetometer Calibration 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.

31.4.9 AOA (Angle of Attack) Configuration Page

The AOA Configuration page is accessible only when an AOA input is enabled on the LRU Configuration page (Section 31.4.6).

The AOA calibrations must be performed in-flight and the calibration procedures cannot be performed using this configuration mode page.

Figure 31-6 reflects the ability to calibrate AOA to compensate for flap position. This requires the installer to perform the calibration procedure twice, which creates two AOA calibration curves. The installer will calibrate AOA once with the flaps fully retracted (Flaps Up Calibration curve), and once with the flaps fully deployed (Flaps Down Calibration curve). The system will only reference one of the calibration curves at a time, determined by the position of the flaps. As this function is dependent upon the system's knowledge of flap position, either a dedicated discrete input programmed to the FLAPS DOWN preset (see Section 31.4.32.26), or the configuration of a flap position sensor is required.

NOTE

In the absence of a configured flap position sensor, or dedicated Flaps Down discrete input, only a single set of calibration points will be available.

If a discrete input is being used to determine flap position, the Flaps Down Calibration curve is referenced by the AOA indicator when the discrete input is active, and the Flaps Up Calibration curve is referenced when the discrete input is inactive.

If a flap position sensor is used, the system will use the Flaps Down Calibration curve when flaps are extended beyond the position corresponding to halfway between full flap extension and full flap retraction, or according to the Flap Position Threshold setting outlined below.

If for any reason, the flap position sensor information is not available to the system, due to a system fault or otherwise, the G3X Touch will revert to referencing the Flaps Up Calibration curve and a CAS message will be annunciated to the pilot - AOA NO FLAPS.

The settings tab in this menu contains 3 options:

1. Enable AOA Above - Airspeed above which AOA information will appear to the pilot.
2. Disable AOA on Ground Below - Airspeed below which AOA information will be removed from display to the pilot.
3. Flap Position Threshold - Determines the percentage of flap deployment at which the system will reference the appropriate flaps up/flaps down curve. If the installer prefers the system to reference the flaps down curve before flaps reach half way deployed, they would lower the flap position threshold from the default 50% value.

NOTE

For systems that include a flap position sensor or Flaps Down discrete input, calibration of the Flaps Down Configuration curve is optional. If the Flaps Down Calibration curve is not completed, the Flaps Up Calibration curve will always be referenced, regardless of flap position. If an installer decides against calibrating the flaps down curve, it is important that all Flaps Down Calibration points are left uncalibrated.

1. In configuration mode (Section 31.2), use the Touch Panel or a Move Selector Knob to select and view the AOA Configuration Page.
2. Use the Touch Panel or a Move Selector Knob to make the desired changes.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

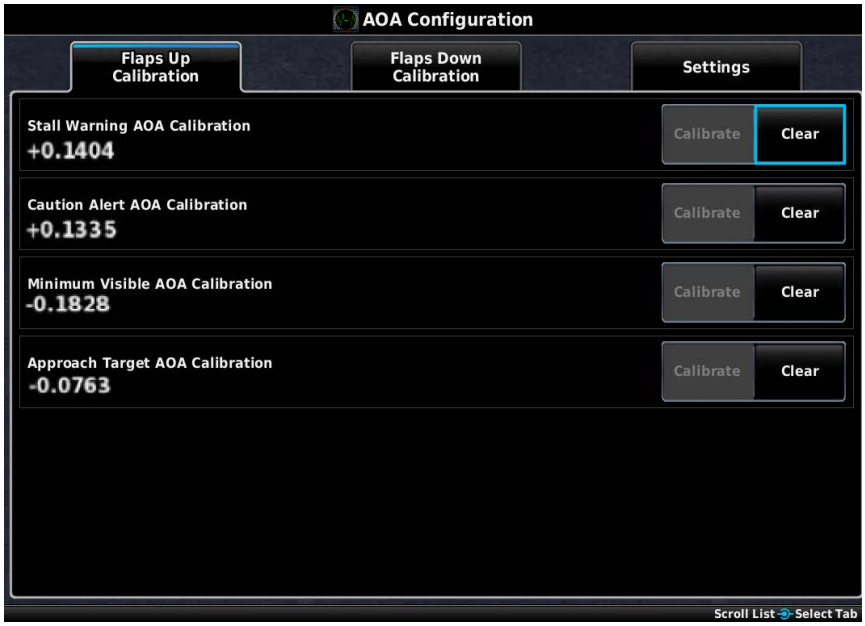


Figure 31-6 AOA Configuration Page

31.4.9.1 AOA Calibration (Performed In-flight)

Installations that include a GAP 26 and which have AOA enabled require that an AOA calibration be performed to enable AOA functionality. The AOA calibration is used to find the four AOA settings shown in Figure 31-7. These calibrations must be done while in flight. The AOA Setup page (Figure 31-9) 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 31.4.6, and Advanced User Setup is enabled on the System Options Page, see Section 31.4.4).

NOTE

In the absence of a configured flap position sensor, or dedicated Flaps Down discrete input, only a single calibration curve will be available.

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, make sure the aircraft is clear of all traffic and at a safe altitude for stall recovery.

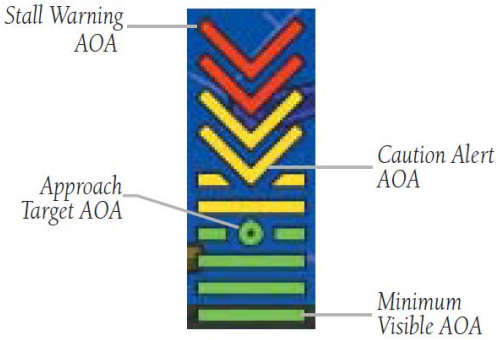


Figure 31-7 Angle of Attack (AOA) Display

AOA is the angle between the aircraft's wing and the oncoming airflow (see Figure 31-8). 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 critical value can vary with flap position, to compensate for this the AOA system can be calibrated twice, once with the flaps fully retracted, and once with the flaps fully deployed. 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.

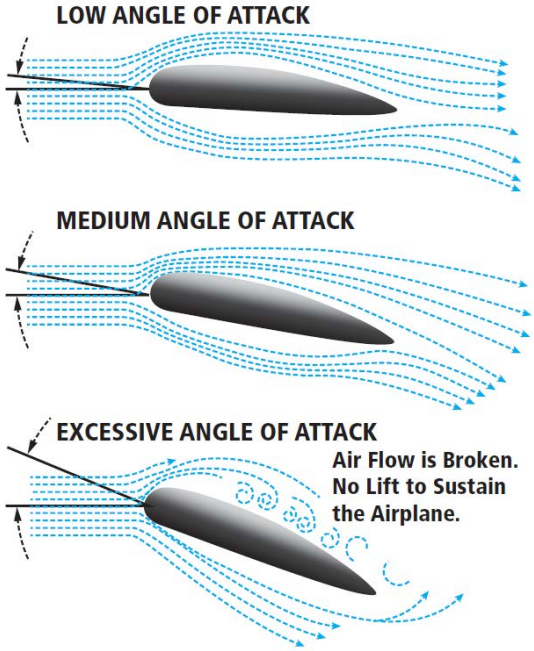


Figure 31-8 Angle of Attack (AOA) Illustration

31.4.9.2 AOA Calibration Procedure (Normal Mode Only)

Perform the following procedures in this section. 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 calibrations 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 31-9).
- 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 31-9).



Figure 31-9 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 Touch Panel or a Move Selector Knob to select the Setup button.



3. Use the Touch Panel or a Move Selector Knob to select the Angle of Attack button.
4. Use the Touch Panel or a Move Selector Knob to make the desired selections.
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, press the CLR button.



6. Three required calibration points (Minimum Visible AOA Calibration, Caution Alert AOA Calibration, Stall Warning AOA Calibration) are captured during the calibration procedure, in addition to one optional calibration (Approach Target AOA Calibration, if desired) point. It is recommended to capture each calibration point in the following sequence. Attempting to calibrate them out of order may result in a failed calibration.

Recommended Order of Calibration:

1. Minimum Visible AOA Calibration (Required)
2. Caution Alert AOA Calibration (Required)
3. Stall Warning AOA Calibration (Required)
4. Approach Target AOA Calibration (Optional)

31.4.9.3 Calibration Procedure For Aircraft With A Single AOA Calibration Curve

NOTE

Installers should use this procedure for aircraft that will only calibrate a single AOA calibration curve. If an installer intends to calibrate two AOA calibration curves, to compensate for flap position, use the procedure described in Section 31.4.9.4.

Minimum Visible AOA Calibration

This procedure sets the AOA value for the bottom of the AOA gauge green arc (Figure 31-10), which is also the AOA value at which the gauge will first appear on the PFD. Perform the Flaps Up 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.

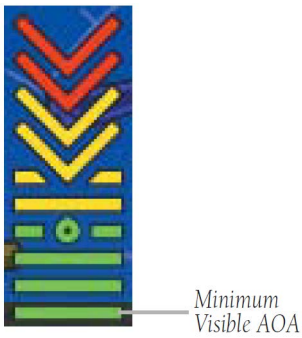


Figure 31-10 Minimum Visible AOA

1. If dual curve AOA calibration is available, make sure the appropriate Flaps Up Calibration tab is highlighted. Select the Calibrate button in the Minimum Visible AOA Calibration field.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Follow the onscreen instructions, then press the Done button when finished.



4. Verify the calibration is successful, then press the Done button when finished.



5. Proceed to Caution Alert AOA Calibration.

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.

Caution Alert AOA Calibration

This procedure sets the AOA value for the bottom of the yellow "chevron" section of the AOA gauge (Figure 31-11), which is also the AOA value at which the audible stall warning sound will begin to intermittently play, dependent upon configuration (see AOA Alert Mode, Section 31.4.20). Perform this calibration while flying the aircraft at an AOA below the aircraft's stall AOA (1.1 x stall speed is suggested).

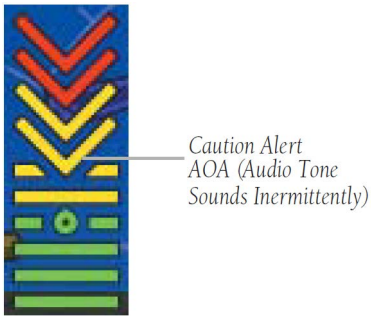


Figure 31-11 Caution Alert AOA

1. If dual curve AOA calibration is available, ensure the appropriate Flaps Up Calibration tab is highlighted. Select the Caution Alert AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Calibrate button when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done softkey when finished.



5. Proceed to Stall Warning AOA Calibration.

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.

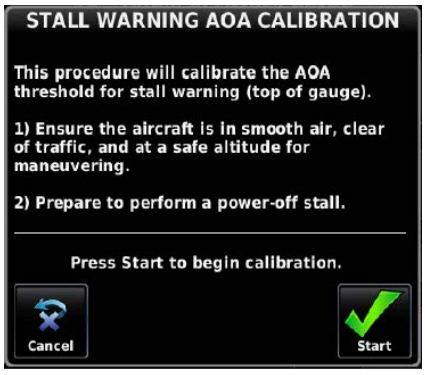
Stall Warning AOA Calibration

This procedure sets the AOA value for the top of the red "chevron" section of the AOA gauge (Figure 31-12), which is also the AOA value at which the audible stall warning sound will play continuously (just before stall break is suggested).



Figure 31-12 Stall Warning AOA

1. If dual curve AOA calibration is available, make sure the appropriate Flaps Up Calibration tab is highlighted. Select the Stall Warning AOA calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Done button when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done button when finished.



5. Repeat the Stall Warning AOA calibration using a different flap setting, if desired.
6. If desired, proceed to Approach Target AOA Calibration (Optional). If the Approach Target AOA Calibration procedure is not desired, the AOA Calibration Procedure is complete.

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 31-13). To be valid, the approach target AOA must be between the minimum visible (green) and caution alert (yellow chevron) AOA points. Dependent upon configuration, audible AOA alerts may begin at this calibration point (see AOA Alert Mode, Section 31.4.20).

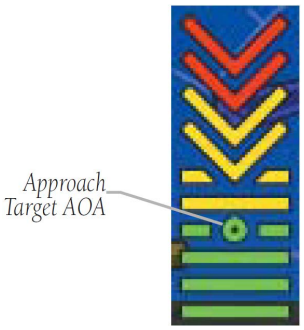
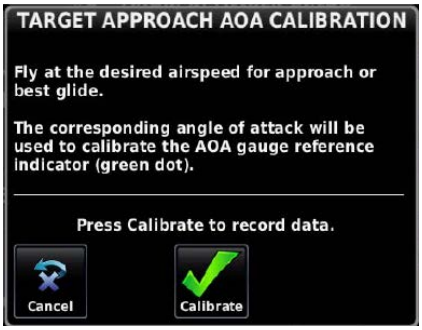


Figure 31-13 Approach Target AOA

1. If dual curve AOA calibration is available, ensure the appropriate Flaps Up Calibration tab is highlighted. Select the Approach Target AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Calibrate button when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done button when finished.



5. This completes the AOA calibration procedure.'

31.4.9.4 Procedure for Dual AOA Curve Calibration

For aircraft with a Flaps Down Calibration Curve available, an identical set of the 4 previously described calibration points will be available under the Flaps Down calibration tab. These calibration points are optional, however if any one of them is calibrated, all 3 required calibration points (Minimum Visible AOA Calibration, Caution Alert AOA Calibration, Stall Warning AOA Calibration) must be completed. Approach Target AOA Calibration can optionally be completed for the Flaps Down configuration.

NOTE

For systems that include a flap position sensor or Flaps Down discrete input, calibration of the flaps down configuration curve is optional. If an installer decides against calibrating the Flaps Down Curve, it is important that all Flaps Down Calibration points are left uncalibrated. Use of the procedure outlined in Section 31.4.9.3 is advised for these aircraft.

Part 1 - Calibration of AOA with Flaps Retracted

Minimum Visible AOA Calibration

This procedure sets the AOA value for the bottom of the AOA gauge green arc (Figure 31-14), which is also the AOA value at which the gauge will first appear on the PFD.

Perform the Flaps Up calibration while flying the aircraft at an AOA somewhat higher than a n ormal cruise flight (1.5 x stall speed in the Flaps Up configuration is suggested) to avoid nuisance frequent appearances of the AOA gauge.

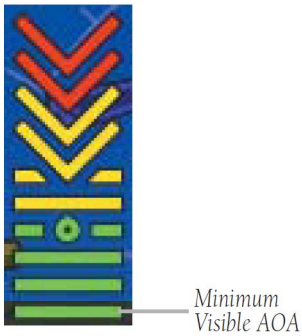
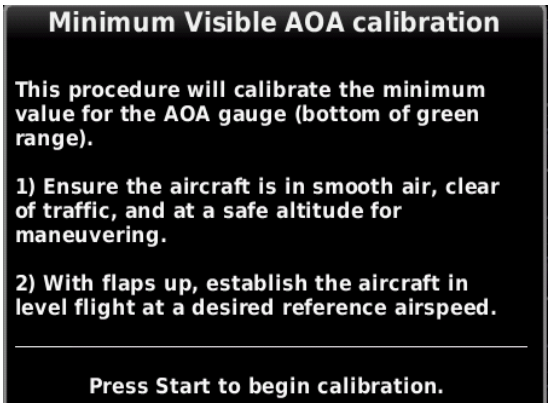
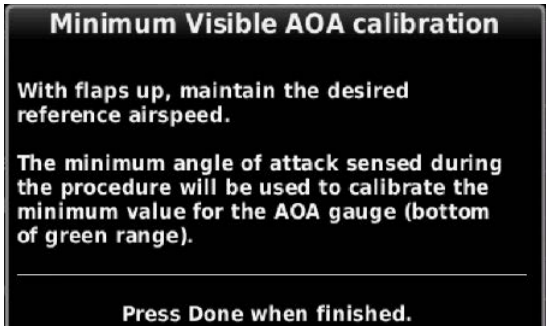


Figure 31-14 Minimum Visible AOA

1. Ensure the appropriate Flaps Up Calibration tab is highlighted at the top of the menu. Select the Calibrate button in the Minimum Visible AOA Calibration field.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Follow the onscreen instructions, then press the Done button when finished.



4. Verify the calibration is successful, then press the Done button when finished.



5. Proceed to Caution Alert AOA Calibration.

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.

Caution Alert AOA Calibration

This procedure sets the AOA value for the bottom of the yellow "chevron" section of the AOA gauge (Figure 31-15), which is also the AOA value at which the audible stall warning sound will begin to intermittently play, dependent upon configuration (see AOA Alert Mode, Section 31.4.20). Perform this calibration while flying the aircraft at an AOA below the aircraft's stall AOA (1.1 x stall speed in the Flaps Up configuration is suggested).

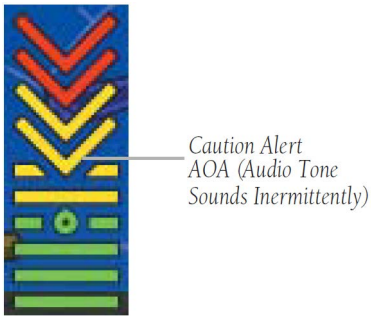
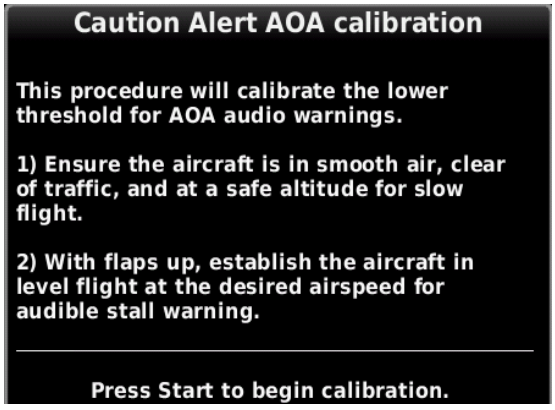
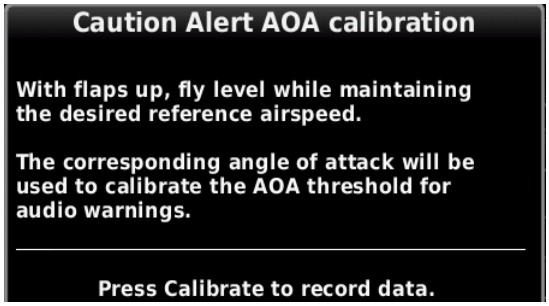


Figure 31-15 Caution Alert AOA

1. Ensure the appropriate Flaps Up Calibration tab is highlighted. Select the Caution Alert AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Calibrate button when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done softkey when finished.



5. Proceed to Stall Warning AOA Calibration.

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.

Stall Warning AOA Calibration

This procedure sets the AOA value for the top of the red "chevron" section of the AOA gauge (Figure 31-16), which is also the AOA value at which the audible stall warning sound will play continuously (just before stall break is suggested).

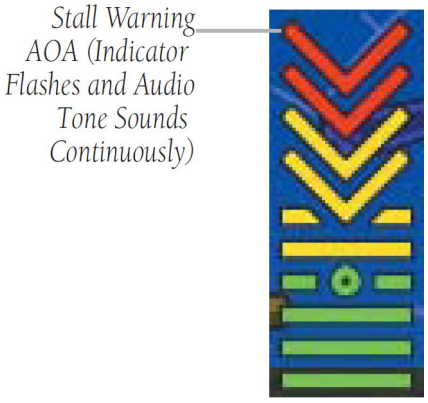
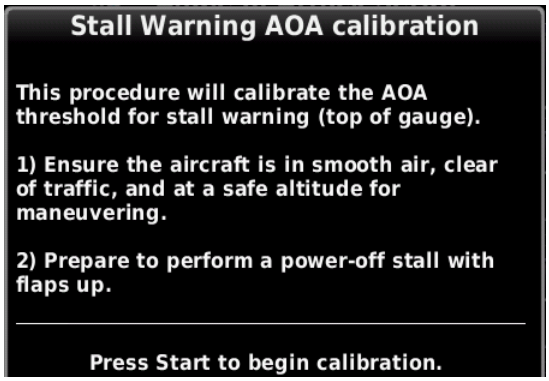
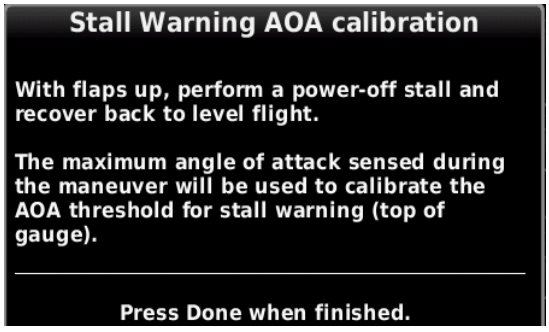


Figure 31-16 Stall Warning AOA

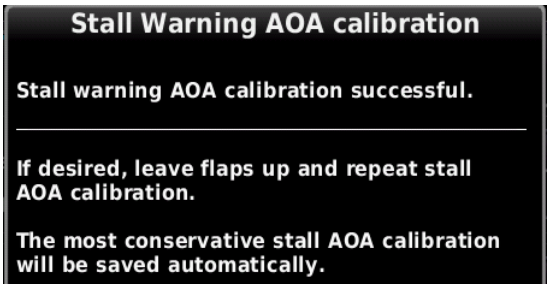
1. Make sure the appropriate Flaps Up Calibration tab is highlighted. Select the Stall Warning AOA calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Done button when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done button when finished.



5. If desired, proceed to Approach Target AOA Calibration (Optional). If the Approach Target AOACalibration procedure is not desired, the AOA Calibration Procedure is complete.

Approach Target AOA Calibration (Optional)

This procedure sets a specific point (1.3 x stall speed in the Flaps Down configuration 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 31-17). To be valid, the approach target AOA must be between the minimum visible (green) and caution alert (yellow chevron) AOA points. Dependent upon configuration, audible AOA alerts may begin at this calibration point (see AOA Alert Mode, Section 31.4.20).

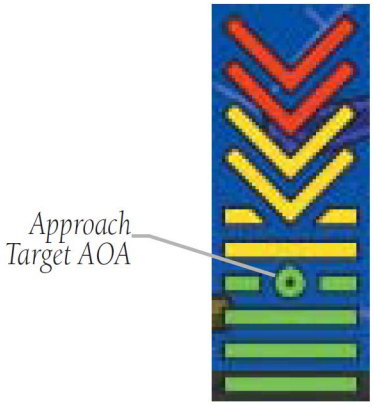
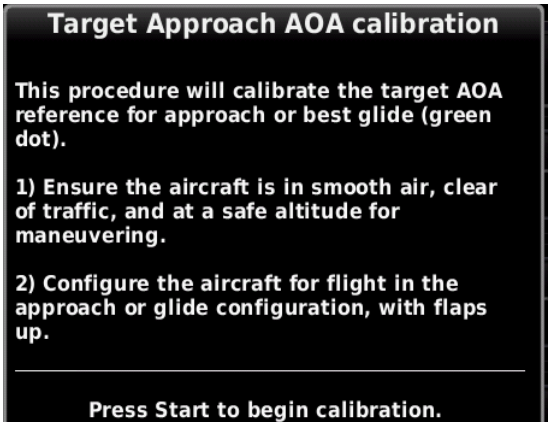


Figure 31-17 Approach Target AOA

1. Ensure the appropriate Flaps Up Calibration tab is highlighted. Select the Approach Target AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Calibrate button when in compliance with the onscreen instructions.

Part II - Calibration of AOA with Flaps Extended

Minimum Visible AOA Calibration

This procedure sets the AOA value for the bottom of the AOA gauge green arc (Figure 30-10), which is also the AOA value at which the gauge will first appear on the PFD.

Perform the Flaps Down calibration while flying the aircraft at an AOA that results in a safe margin below Vfe (1.5 x stall speed in the Flaps Down configuration is suggested, if possible) to avoid nuisance frequent appearances of the AOA gauge.

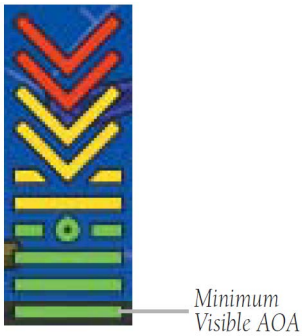
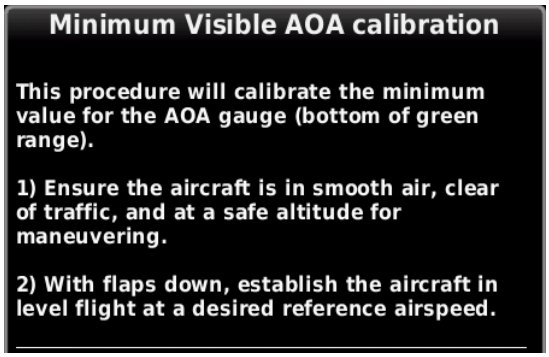


Figure 31-18 Minimum Visible AOA

1. Use the Touch Panel or a Move Selector Knob to select the Calibrate button in the Minimum Visible AOA Calibration field.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Follow the onscreen instructions, then press the Done button when finished.
4. Verify the calibration is successful, then press the Done button when finished.
5. Proceed to Caution Alert AOA Calibration.

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.

Caution Alert AOA Calibration

This procedure sets the AOA value for the bottom of the yellow "chevron" section of the AOA gauge (Figure 31-19), 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).

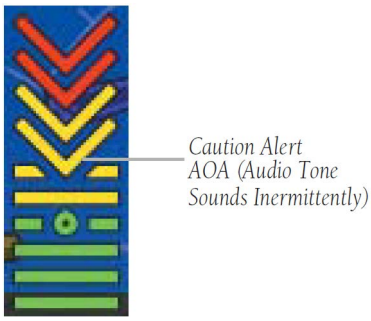
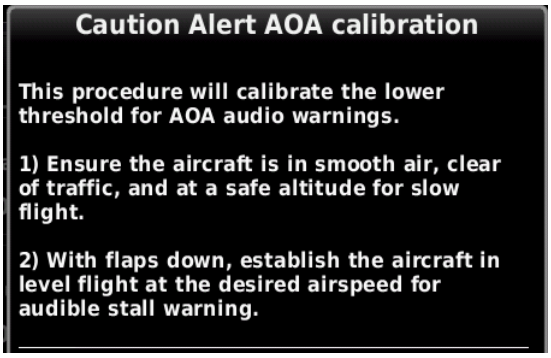


Figure 31-19 Caution Alert AOA

1. Use the Touch Panel or a Move Selector Knob to select the Caution Alert AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Calibrate button when in compliance with the onscreen instructions.
4. Verify the calibration is successful, then press the Done softkey when finished.
5. Proceed to Stall Warning AOA Calibration.

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.

Stall Warning AOA Calibration

This procedure sets the AOA value for the top of the red "chevron" section of the AOA gauge (Figure 31-20), which is also the AOA value at which the audible stall warning sound will play continuously (just before stall break is suggested).

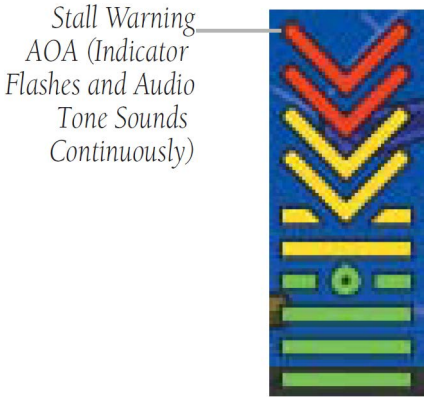
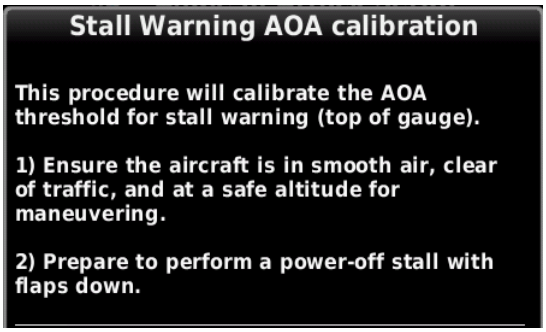


Figure 31-20 Stall Warning AOA

1. Use the Touch Panel or a Move Selector Knob to select the Calibrated Stall Warning AOA calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



3. Press the Done button when in compliance with the onscreen instructions.
4. Verify the calibration is successful, then press the Done button when finished.
5. If desired, proceed to Approach Target AOA Calibration (Optional). If the Approach Target AOA Calibration procedure is not desired, the AOA Calibration Procedure is complete.

Approach Target AOA Calibration (Optional)

This procedure sets a specific point (1.3 x stall speed in the Flaps Down configuration 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 30-13). To be valid, the approach target AOA must be between the minimum visible (green) and caution alert (yellow chevron) AOA points.

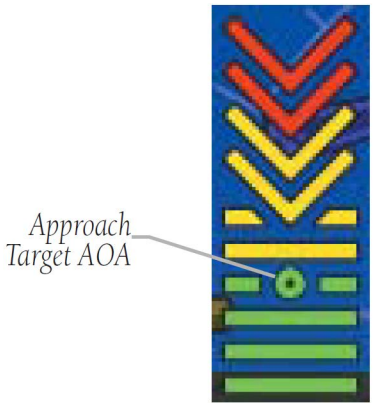
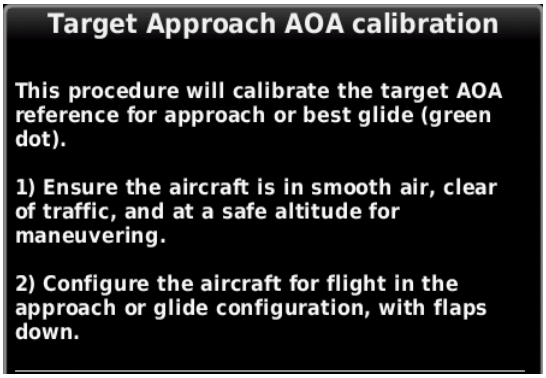


Figure 31-21 Approach Target AOA

1. Use the Touch Panel or a Move Selector Knob to select the Approach Target AOA Calibration field, then press the Calibrate button.
2. Follow the onscreen instructions, then press the Start button to begin the calibration.



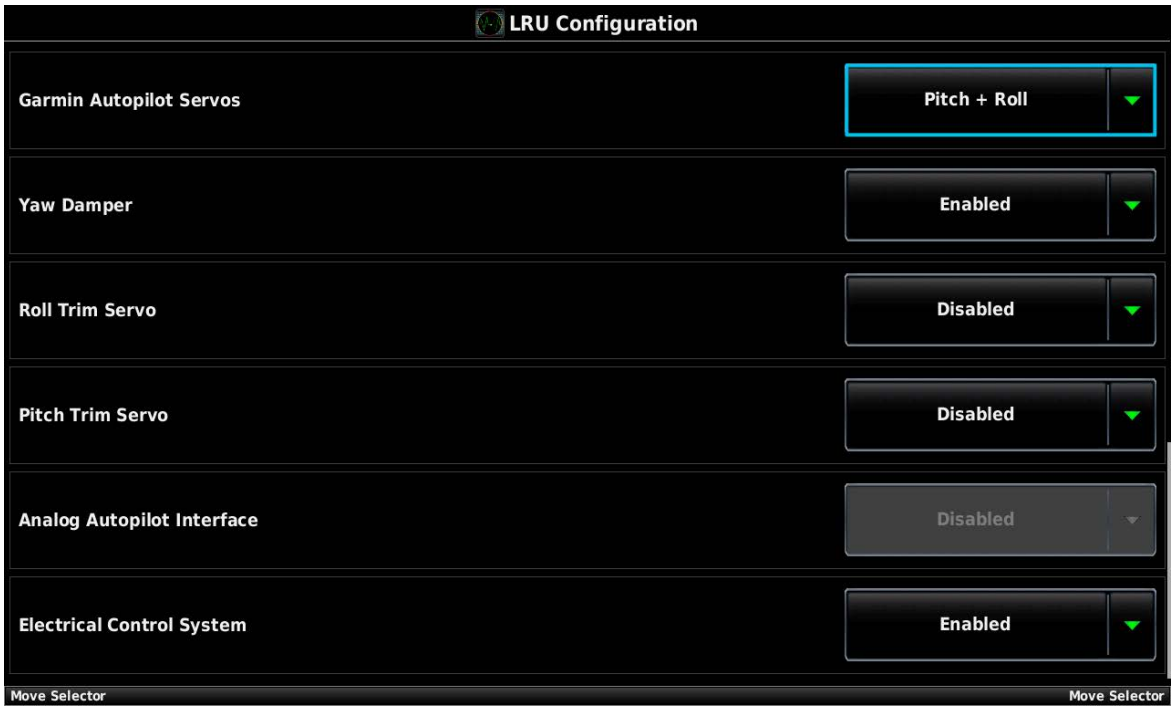
3. Press the Calibrate button when in compliance with the onscreen instructions.
4. Verify the calibration is successful, then press the Done button when finished.
5. This completes the AOA calibration procedure.

31.4.10 Autopilot LRU Configuration Page

31.4.10.1 Autopilot LRU Configuration for Garmin Autopilot Servos

This section details configuring the Autopilot LRU Configuration Page for an autopilot using Garmin GSA 28 servos.

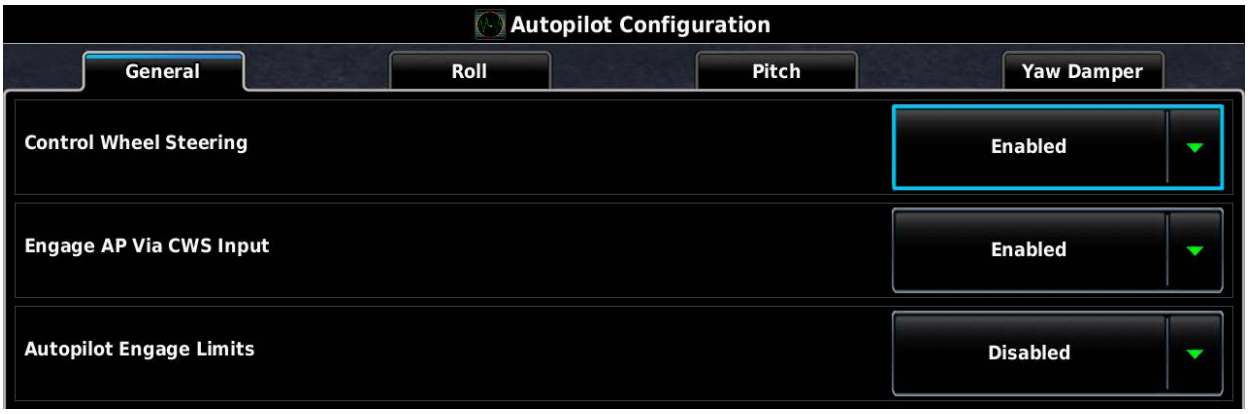
1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the LRU Configuration Page.
2. Use the Touch Panel or a Move Selector Knob to select Autopilot.
3. Select Roll Only or Pitch + Roll in the Garmin Autopilot Servos field.
4. Enable the Yaw Damper if a yaw damper servo is installed.
5. Enable the Roll Trim Servo only if an additional Garmin GSA 28 autopilot servo is installed and dedicated to providing the roll trim servo function. For this to be enabled, install one GSA 28 to control the roll axis and install a separate GSA 28 servo to connect to the manual trim system and perform the roll trim function. If the primary roll servo is directly driving a 3rd party roll trim motor using pins 13 and 14 of the GSA 28, this field should be set to “Disabled”.
6. Enable the Pitch Trim Servo only if an additional Garmin GSA 28 autopilot servo is installed and dedicated to providing the pitch trim servo function. For this to be enabled, install one GSA 28 to control the pitch axis and install a separate GSA 28 servo to connect to the manual trim system and perform the pitch trim function. If the primary pitch servo is directly driving a 3rd party pitch trim motor using pins 13 and 14 of the GSA 28, this field should be set to “Disabled”.



31.4.10.2 Autopilot Configuration Page for the Garmin Autopilot

This section details the autopilot configuration.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Autopilot Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. To return to stored default settings, or to display advanced settings, press the Menu key, then press the desired button on the popup window.



4. Select Yes or No to restore default settings.



5. Press the Back key to return to the Configuration Mode page when finished (if desired).

31.4.10.3 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 before completing the first flight with the GSA 28.

1. Verify the flight controls can move from stop to stop without binding or interference. Check the GSA 28 output mechanism and added linkage do not come in contact with any part of the airframe while traveling through its full range of motion.
   - If using a pushrod linkage, verify the servo crank arm and pushrod cannot experience an over-center condition when the flight controls are moved through their full range of travel. Consult Section 17.5 to verify complete servo pushrod installation requirements.
   - Per Figure 31-22 if using a bridle cable and capstan, verify the cable is wrapped around the capstan the required number of turns, the ball is in the center of travel when the flight controls are in the neutral position, and the ball cannot exit the capstan groove when the flight controls are moved through their full range of travel. Consult Section 17.5 to verify complete servo capstan installation requirements.



Figure 31-22 360º and 540º Cable Wrap Examples

2. Verify 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. Make sure 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 CWS/DISCONNECT wire is correctly wired and tested.
6. If powering the servo through a "pullable" circuit breaker (recommended), make sure 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.

31.4.10.4 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. The autopilot system is also capable of managing the trim control for an axis, either through driving an external DC trim motor, or through an additional separate GSA 28 servo. 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.

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.

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 the basic pitch mode performance must be properly adjusted before changing settings that adjust the vertical speed and airspeed based modes.

NOTE

Make sure 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.

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.

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

Make sure 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 Damper 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.

Trim Control

The GSA 28 autopilot servos can be used to control the trim system in an aircraft. In some installations, the autopilot servo(s) will drive external 3rd party trim motor(s) using a variable voltage output signal from the GSA 28 servo(s). In other installations, separate GSA 28 servo(s) dedicated to this purpose may directly control the trim system with no 3rd party trim motor(s) being used.

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 in the air, the servos can adjust the trim control to minimize the force on the primary controls. This helps make sure the aircraft will be properly trimmed when the autopilot is later disengaged.

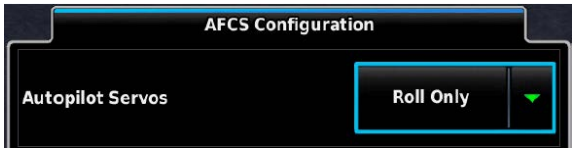
During the flight test phase, the trim system is configured and set up after the primary autopilot performance has been properly configured. This is done so the pilot can focus on properly adjusting the performance of the primary autopilot system without having the auto-trim functionality interfere.

31.4.10.5 Step by Step On-Ground Setup

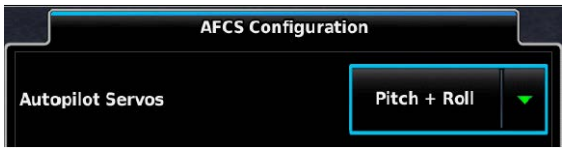
Servo Wiring Checkout

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”.

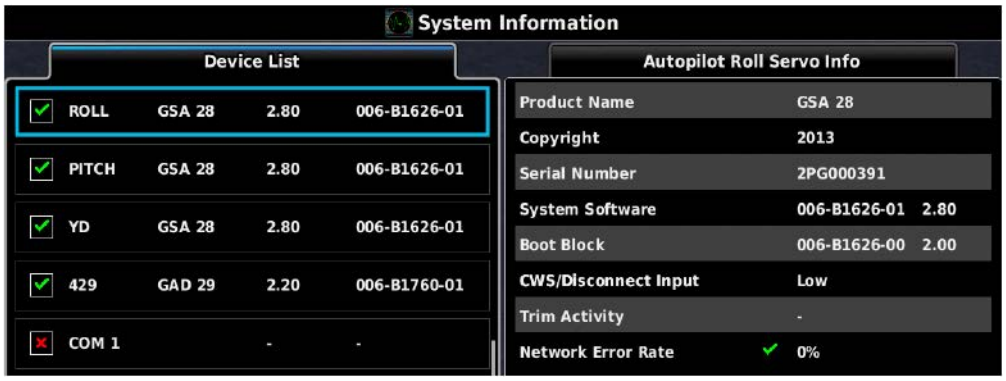


4. Go to the System Information page in configuration mode and verify the Roll, Pitch, and Yaw servos are properly communicating with the system indicated by a green check box.

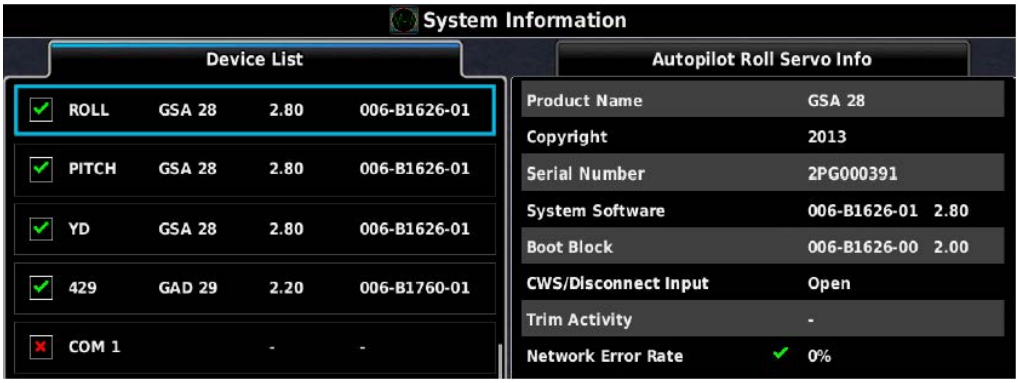


5. Go to the System Information page in configuration mode and verify the CWS/Disconnect Input is properly wired for each servo.

   a) CWS/Disconnect Input should display “Low” when the autopilot disconnect button is pressed.

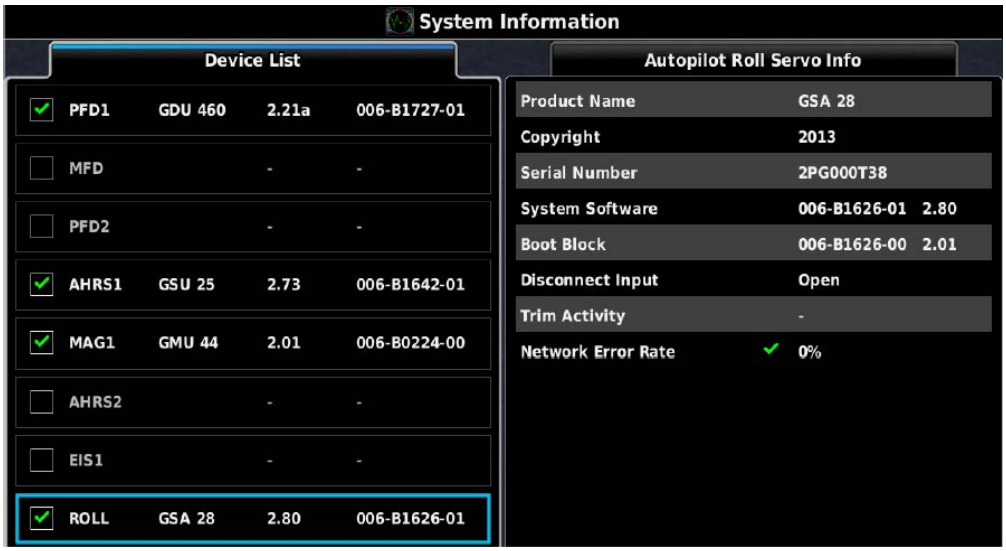


   b) CWS/Disconnect Input should display “Open” when the autopilot disconnect button is NOT pressed.

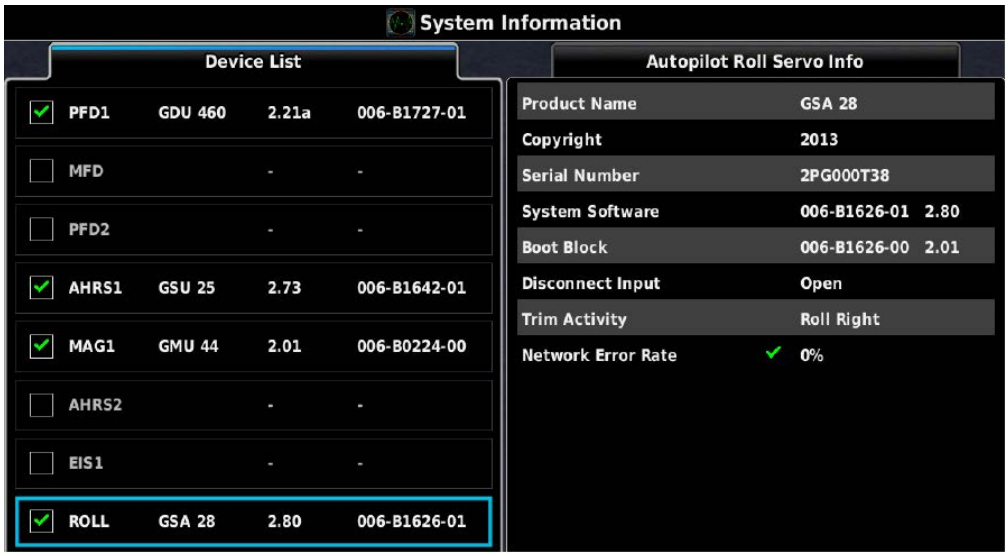


   c) The system will compare the CWS/Disconnect input from all servos, press and hold the autopilot disconnect button for at least 5 seconds to verify there are no SYNC faults.

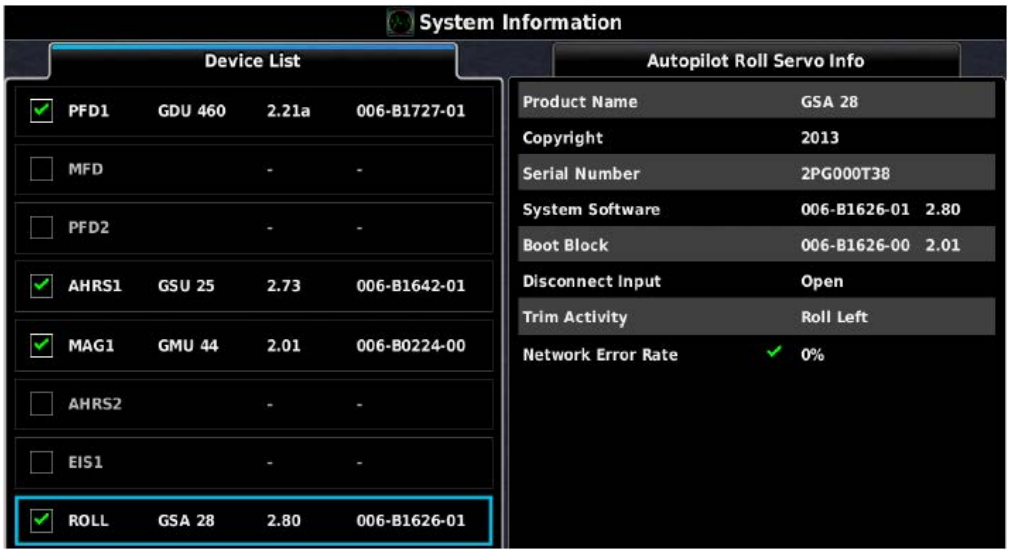
6. Go to the System Information page in configuration mode and verify the proper Trim Activity is displayed if the Roll servo is connected to an auxiliary trim motor.
   a) Center the aileron trim switch to input no TRIM command. Verify the aileron trim switch is not moving. Verify that Trim Activity for the Roll servo is properly displaying "-" for no 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 that Trim Activity for the Roll servo is properly displaying "Roll Right".



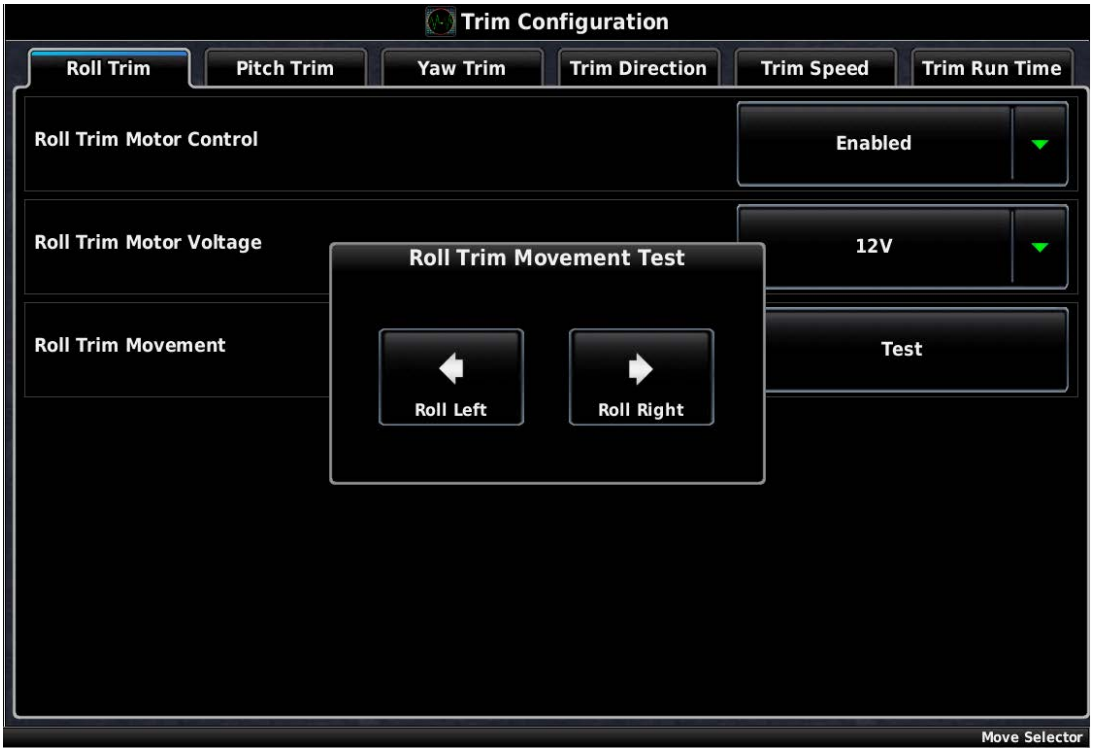
c) Use the aileron trim switch to input a roll left TRIM command. Verify the aileron trim switch properly moves for roll left trim. Verify that Trim Activity for the Roll servo is properly displaying “Roll Left”.



d) If the aileron trim response is reversed, go to the Trim Configuration page and change the Roll Trim Motor Direction to Reverse, then repeat step all of step 6.

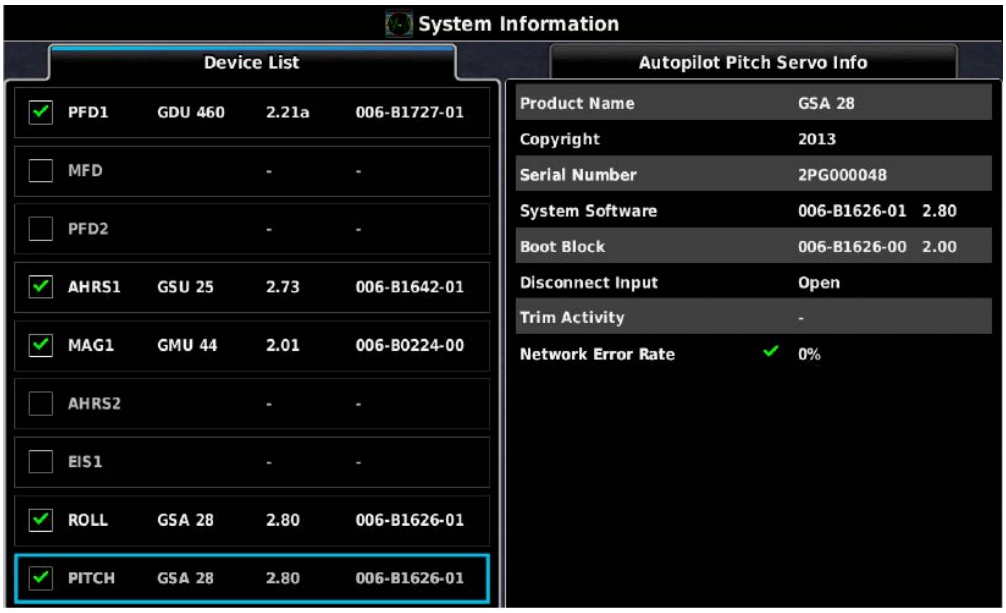


e) On the Trim Configuration page, verify the electric trim motor responds in the proper directions by pressing the Test button, then using the Roll Left and Roll Right buttons on the Roll Trim Movement Test popup window.

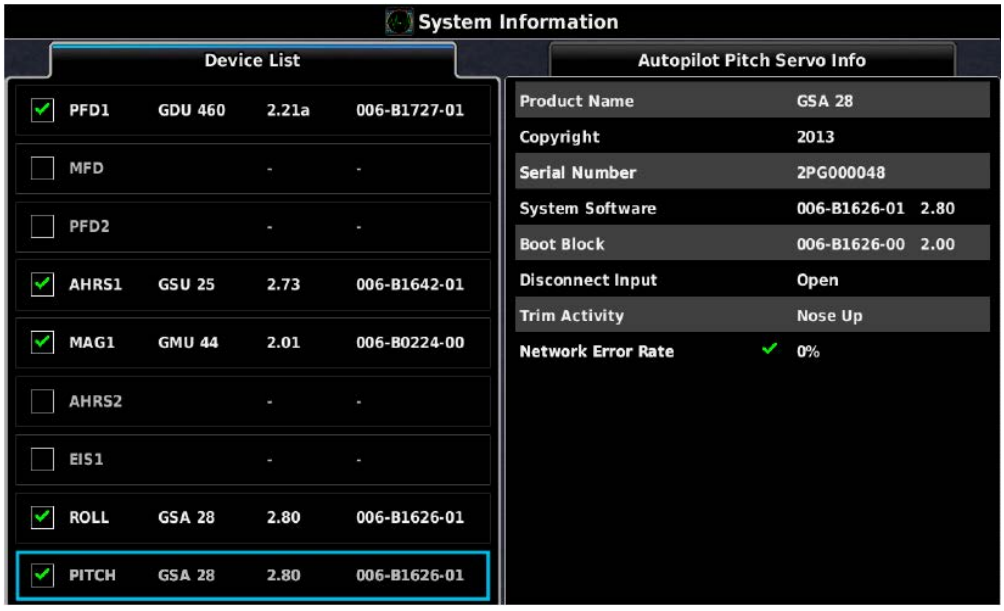


7. Go to the System Information page in configuration mode and verify the correct Trim Activity is displayed if the Pitch servo is connected to an auxiliary trim motor.

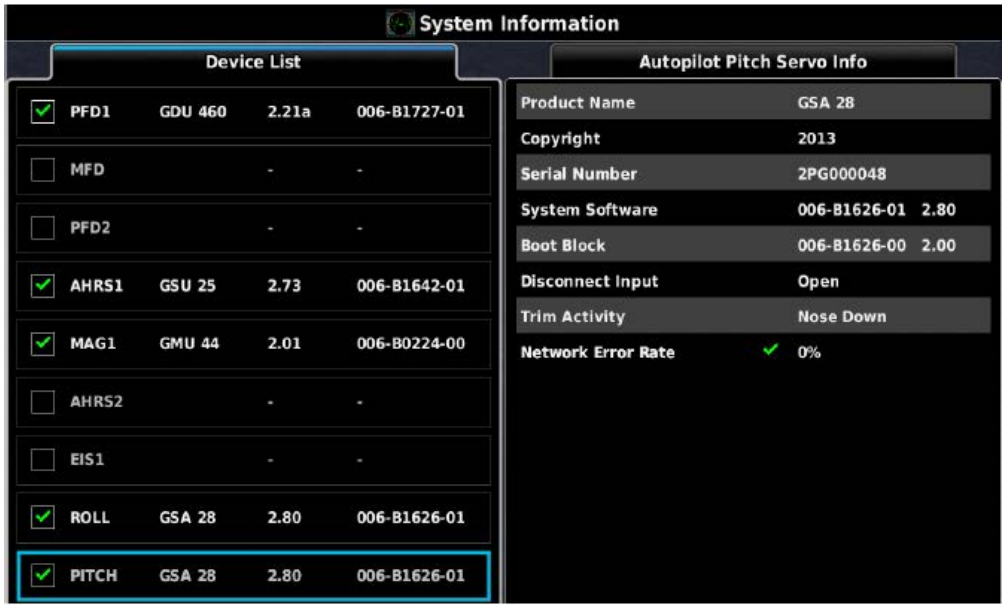
   a) Center the elevator trim switch to input no Trim command. Verify the elevator trim switch is not moving. Verify that Trim Activity for the Pitch servo is properly displaying "-" for no activity.



   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 Trim Activity for the Pitch servo is properly indicating "Nose Up".



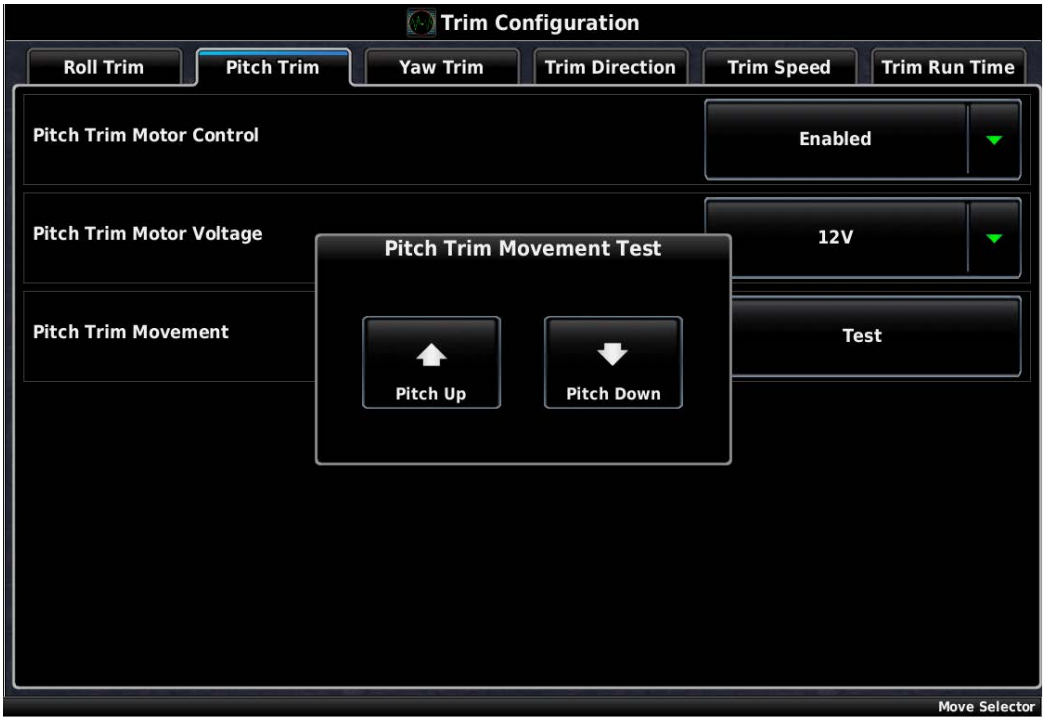
c) Use the elevator trim switch to input a nose down Trim command. Verify the elevator trim switch properly moves for nose down trim. Verify the Trim Activity for the Pitch servo is properly indicating “Nose Down”.



d) If the elevator trim response is reversed, go to the Trim Configuration page and change the Pitch Trim Motor Direction to Reverse, then repeat step all of step 7.

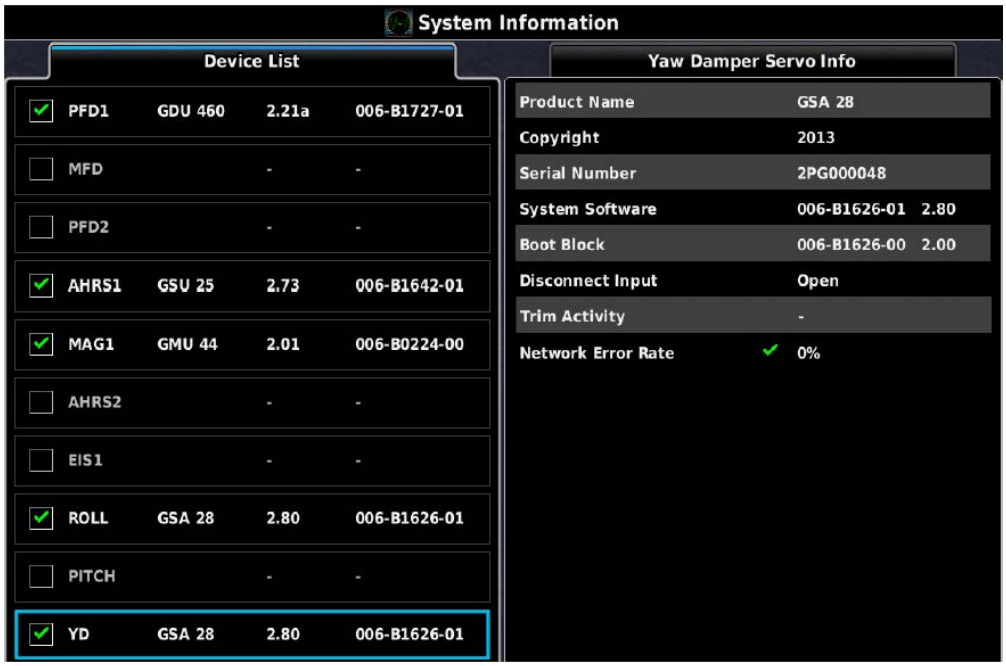


e) On the Trim Configuration page, verify the electric trim motor responds in the proper directions by pressing the Test button, then using the Pitch Up and Pitch Down buttons on the Pitch Trim Movement Test popup window.

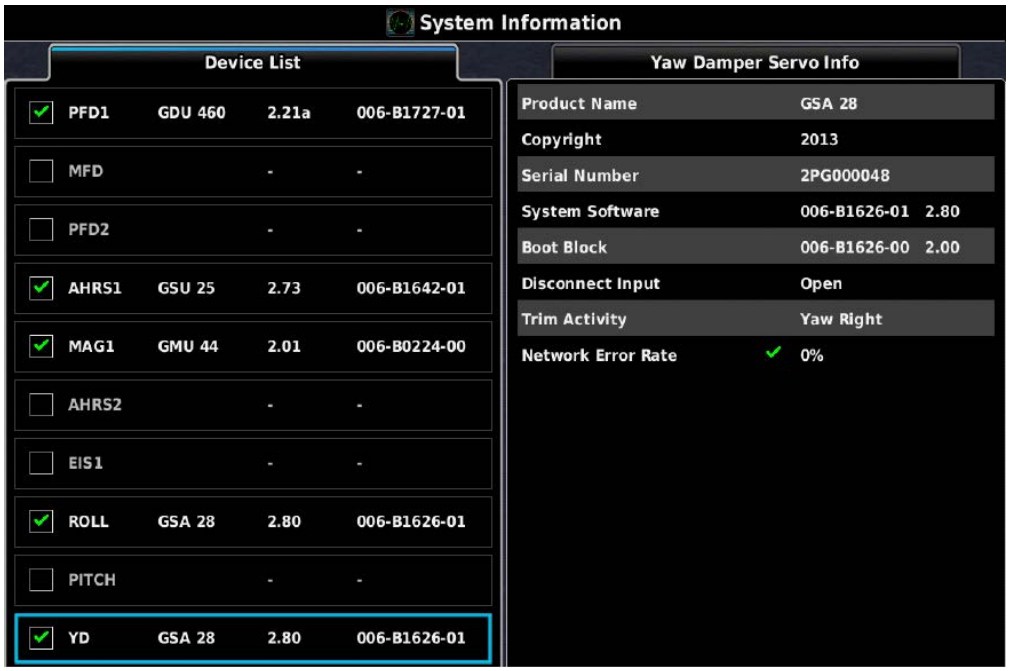


8. Go to the System Information page in configuration mode and verify the proper Trim Activity is displayed if the Yaw servo is connected to an auxiliary trim motor.

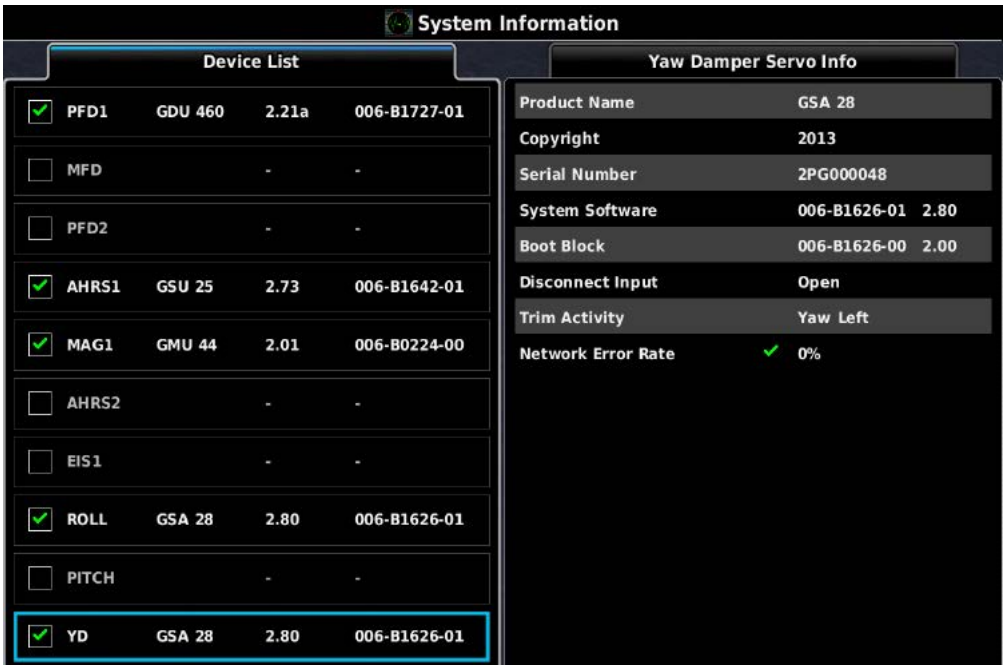
   a) Center the aircraft rudder trim switch to input no Trim command. Verify the rudder trim switch is not moving. Verify that Trim Activity for the Yaw servo is properly displaying "-" for no trim activity.



   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 Trim Activity for the Yaw servo is properly indicating "Yaw Right".



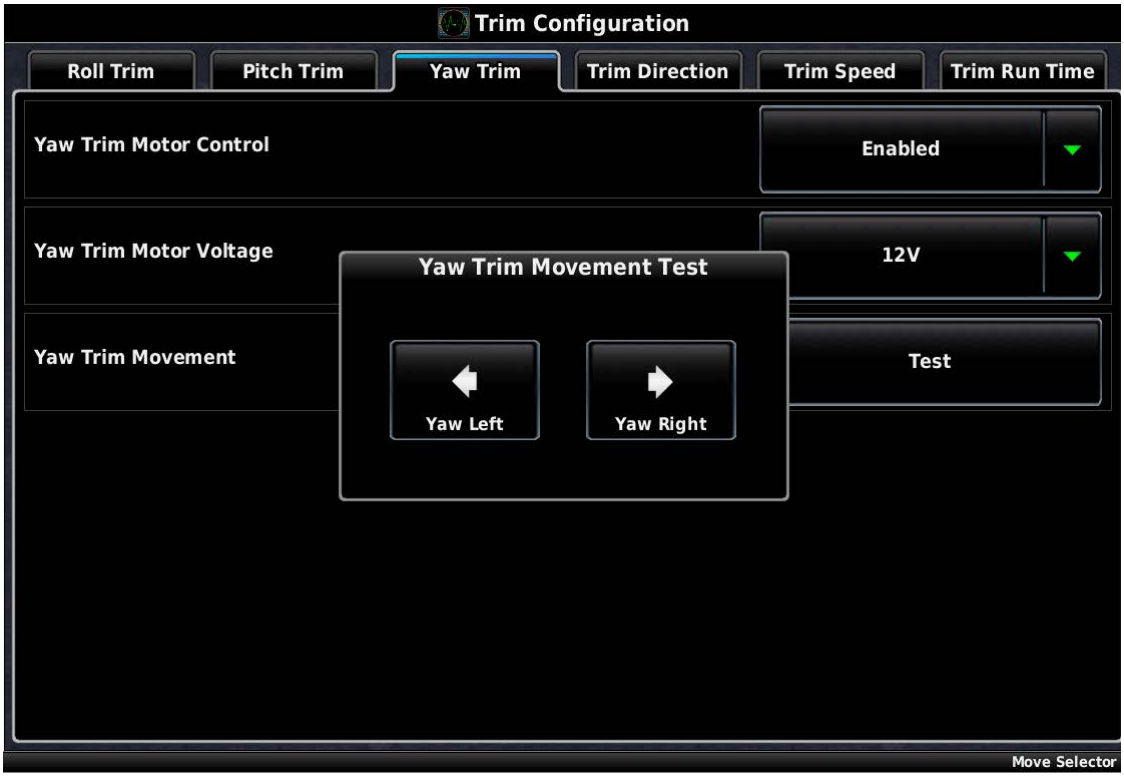
c) Use the rudder trim switch to input a yaw left Trim command. Verify the rudder trim switch properly moves for yaw left trim. Verify the Trim Activity for the Yaw servo is properly indicating “Yaw Left”.



d) If the rudder trim response is reversed, go to the Trim Configuration page and change the Yaw Trim Motor Direction to Reverse, then repeat step all of step 8.



e) On the Trim Configuration page, verify the electric trim motor responds in the proper directions by pressing the Yaw Left and Yaw Right buttons on the Yaw Trim Movement Test popup window.



9. Go to the Autopilot Configuration page and navigate to the Roll Tab 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.

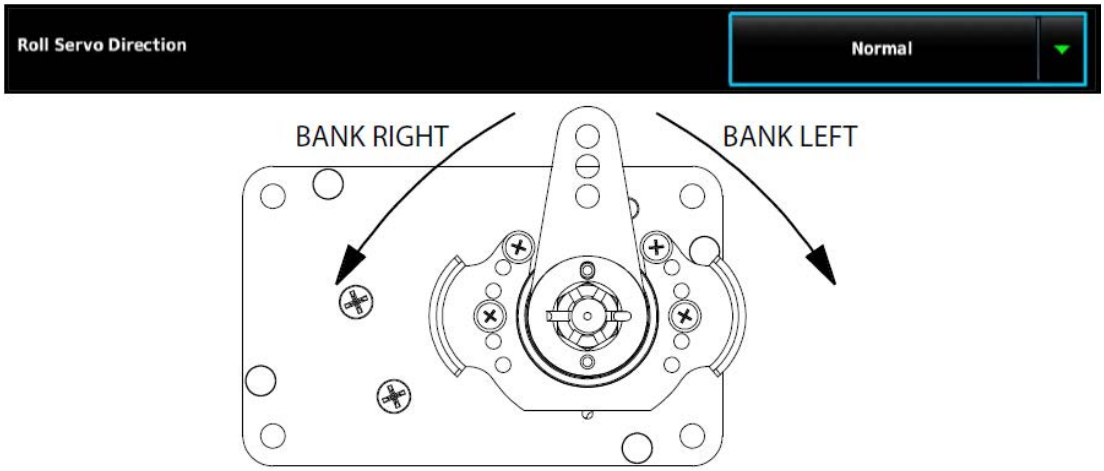


Figure 31-23 Normal Roll Servo Direction

   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.

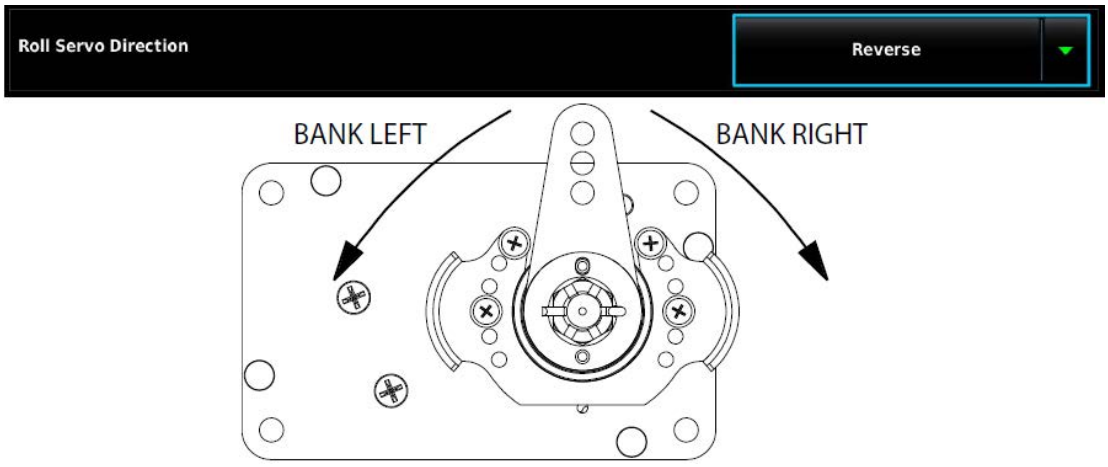


Figure 31-24 Reversed Roll Servo Direction

10. Go to the Autopilot Configuration page and navigate to the Pitch Tab 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.

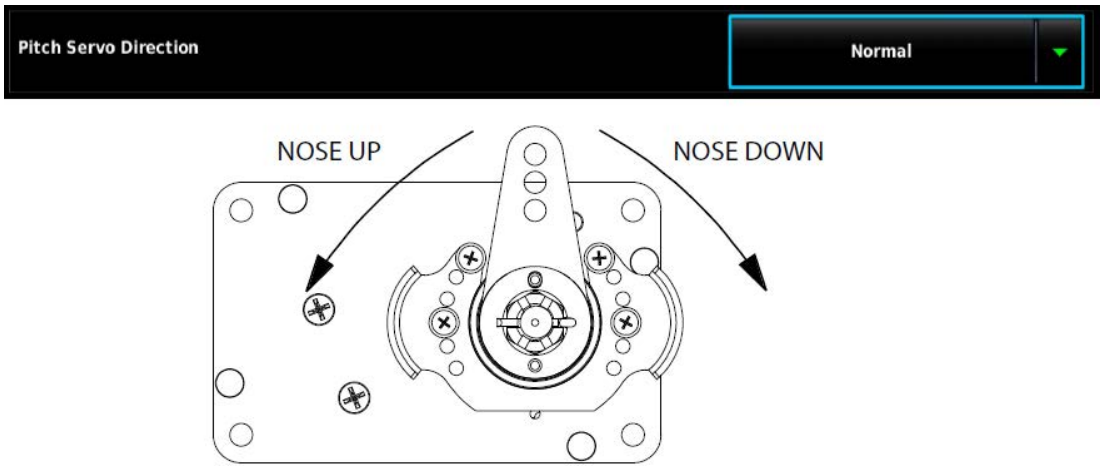


Figure 31-25 Normal Pitch Servo Direction

    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.

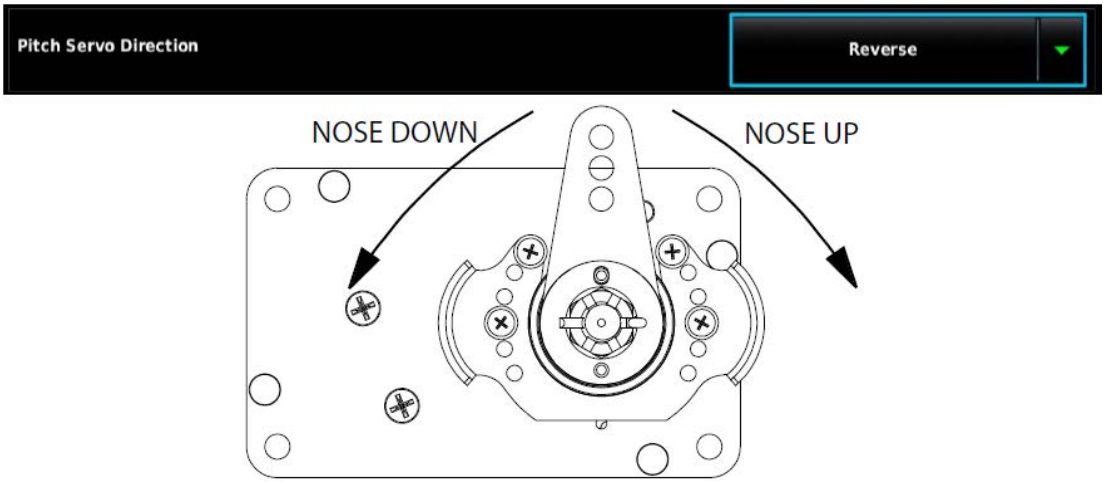


Figure 31-26 Reversed Pitch Servo Direction

11. Go to the Autopilot Configuration page and navigate to the Yaw Damper Tab to configure the servo direction.

    a) The Yaw Damper 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.

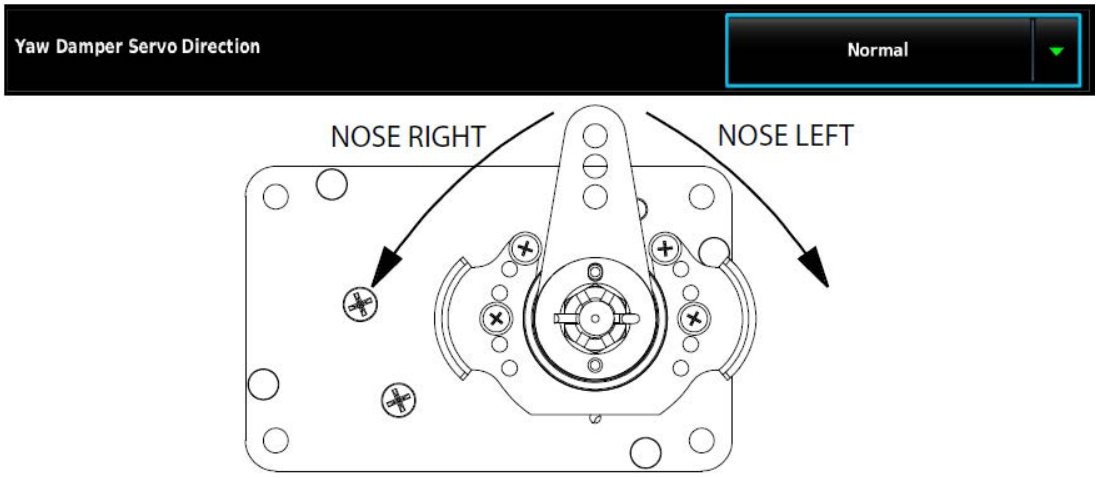


Figure 31-27 Normal Yaw Damper Direction

    b) The Yaw Damper 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.

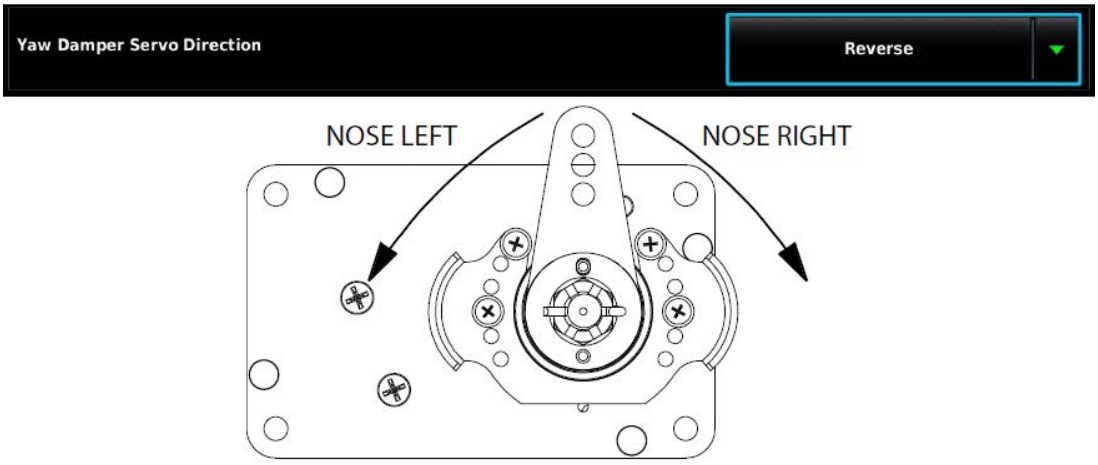


Figure 31-28 Reversed Yaw Damper Direction

12. Go to the Trim Configuration page 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.

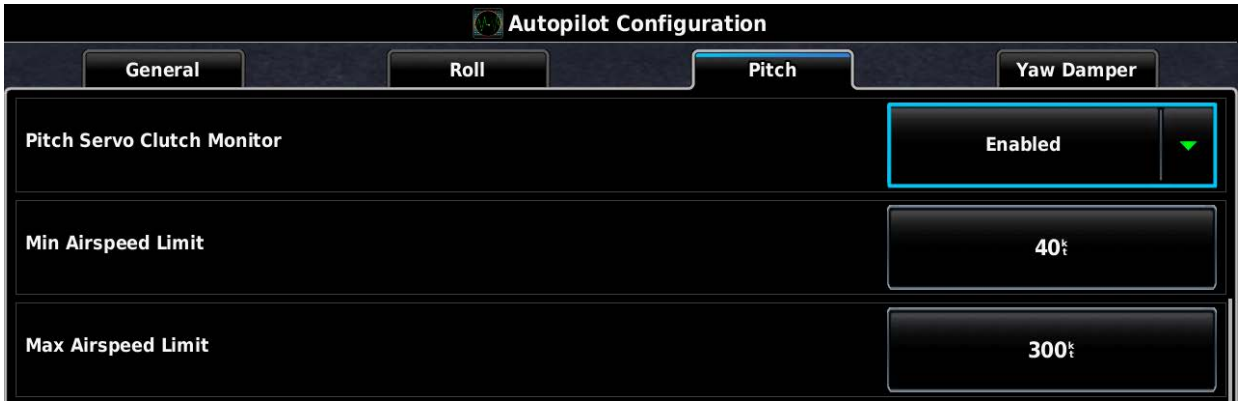


a) By disabling the TRIM MOTOR CONTROL, this will disable auto-trim and airspeed scheduled trim, but the pilot can still control trim in the aircraft using the normal manual electric trim inputs. Auto-trim and airspeed scheduled trim will be setup later in the autopilot setup procedure.

13. Go to the Autopilot Configuration page 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.



31.4.10.6 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.

NOTE

The following procedure can be performed using either the GMC Mode Controller controls or the available mode controls on the AP control page of the PFD.

1. Leave the autopilot disengaged and verify the controls can be manipulated smoothly with no control system binding.
2. Press the AP button to engage the autopilot in ROLL and PITCH modes, then press HDG to engage HDG mode laterally.
3. Command a nose down, left bank (per the following).
   a) Press the Heading knob on the PFD to center the HDG bug
   b) Turn the Heading knob on the PFD counter-clockwise to command a left turn
   c) Use the Nose Down button or the wheel on the GMC Mode Controller to command a pitch down
4. 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.

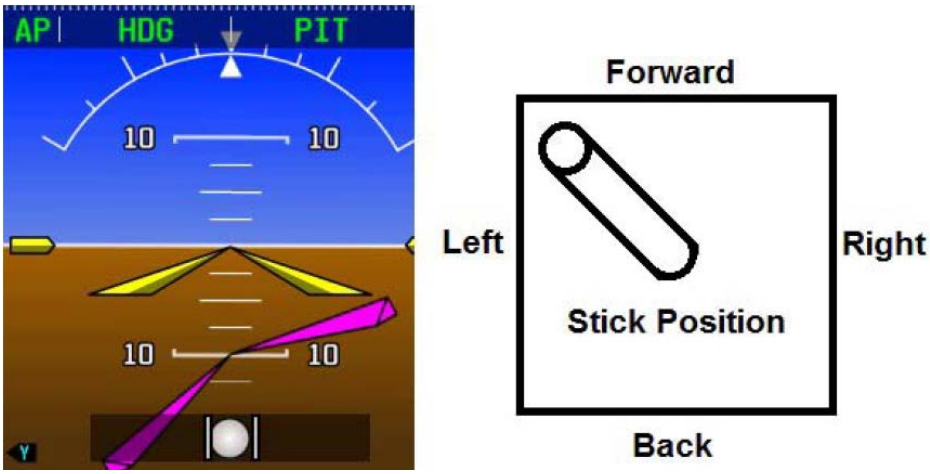


Figure 31-29 Nose Down, Left Bank

5. Press the AP button to engage the autopilot in HDG/PIT modes, then press HDG to engage HDG mode laterally.
6. Command a nose down, right bank (per the following).
   a) Press the Heading knob on the PFD to center the HDG bug
   b) Turn the Heading knob on the PFD clockwise to command a right turn
   c) Use the Nose Down button or the wheel on the GMC Mode Controller to command a pitch down
7. Verify the stick properly moves toward the nose and toward the right wing smoothly with no control system binding.

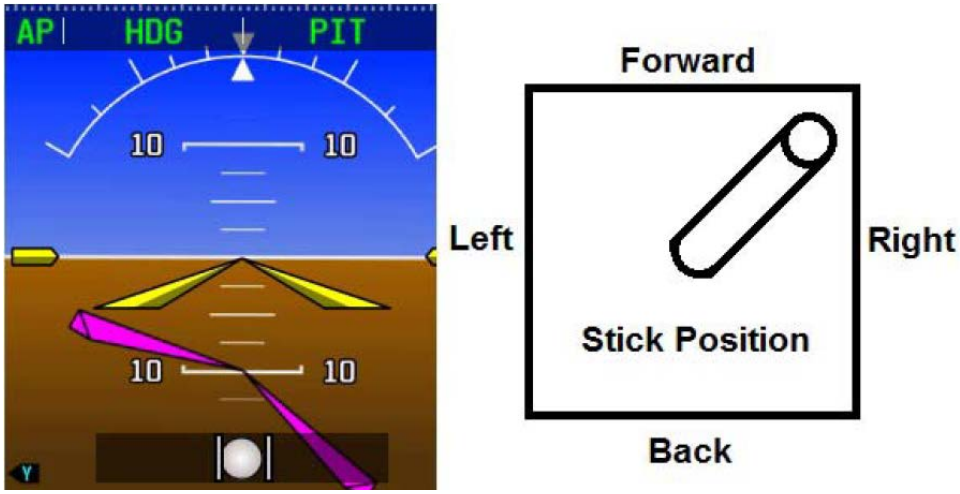


Figure 31-30 Nose Down, Right Bank

8. Press the AP button to engage the autopilot in HDG/PIT modes, then press HDG to engage HDG mode laterally.
9. Command a nose up, right bank (per the following).
   a) Press the Heading knob on the PFD to center the HDG bug
   b) Turn the Heading knob on the PFD clockwise to command a right turn
   c) Use the Nose Up button or the wheel on the GMC Mode Controller to command a pitch up
10. Verify the stick properly moves toward the tail and toward the right wing smoothly with no control system binding.

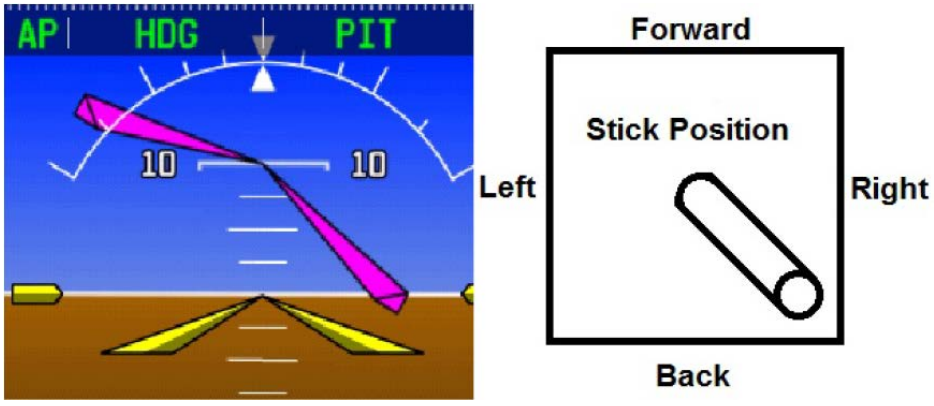


Figure 31-31 Nose Up, Right Bank

11. Press the AP button to engage the autopilot in HDG/PIT modes, then press HDG to engage HDG mode laterally.
12. Command a nose up, left bank (per the following).
    a) Press the Heading knob on the PFD to center the HDG bug
    b) Turn the Heading knob on the PFD counter-clockwise to command a left turn
    c) Use the Nose Up button or the wheel on the GMC Mode Controller to command a pitch up
13. Verify the stick properly moves toward the tail and toward the left wing smoothly with no control system binding.

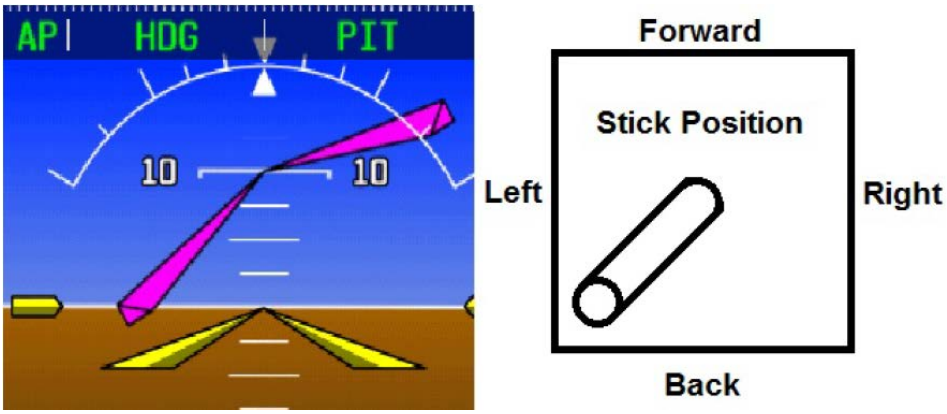
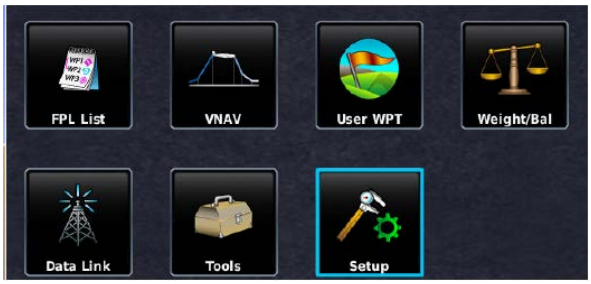
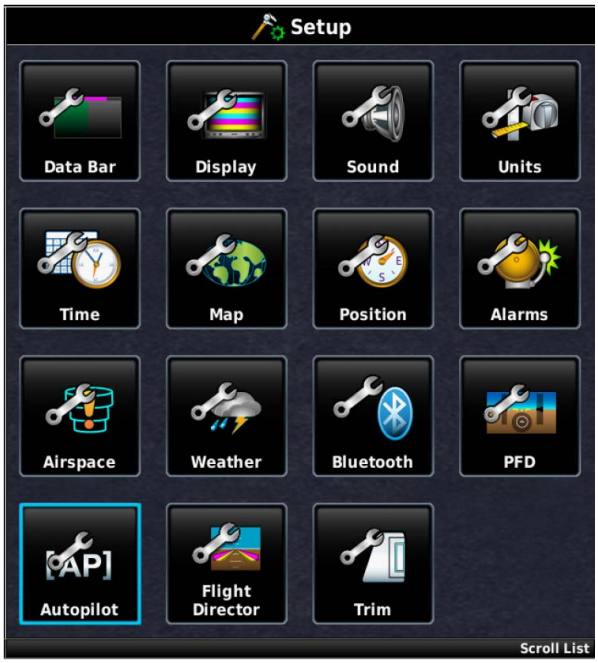


Figure 31-32 Nose Up, Left Bank

14. If the stick position does not move in the correct direction, correct the roll and pitch servo directions documented in Servo Wiring Checkout Step 9 and Step 10.
15. 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 the MENU key two times on the GDU to enter the MAIN MENU page.
    b) Press the Setup button.



c) Press the Autopilot button.



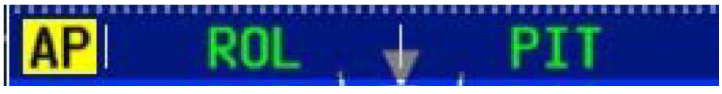
d) Select the Roll Tab and set the Max Torque.



e) Select the Pitch Tab and set the Max Torque.



16. Engage the autopilot and verify it 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.

31.4.10.7 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. Press the YD button on the AFCS control page of the PFD.
    a) With a GMC Mode Controller:
        i. Press the YD button on the GMC Mode Controller



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 the rear fuselage is moving):

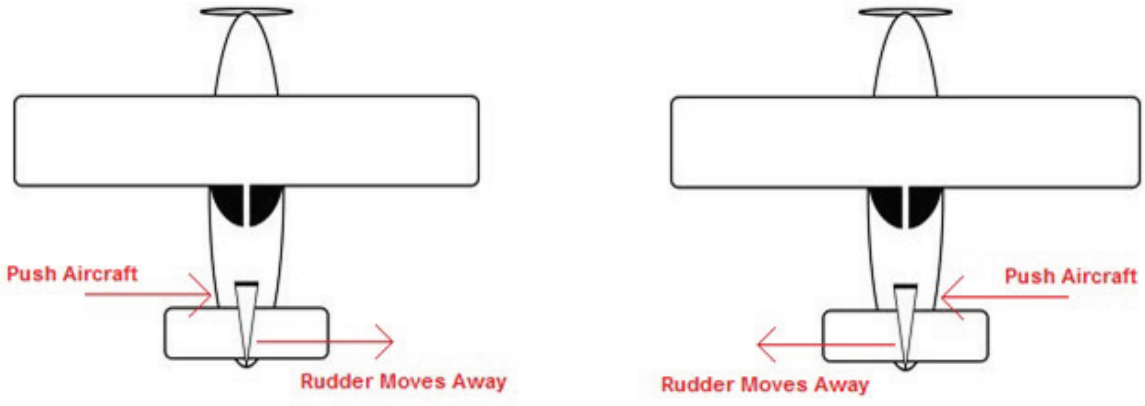


Figure 31-33 Rudder direction

    a) If the rudder does not move the correct direction, correct the yaw servo direction documented in Servo Wiring Checkout 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 the MENU key two times on the GDU to enter the Main Menu page.
   b) Press the Setup button.



   c) Press the Autopilot button.



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.

31.4.10.8 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 GSA 28 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 to 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)

NOTE

If desired, in the following procedures the advanced/expert settings can be accessed from the Autopilot Setup page by pressing Menu, then selecting SHOW ADVANCED SETTINGS. Then press MENU again and select SHOW EXPERT SETTINGS.

Roll Tab

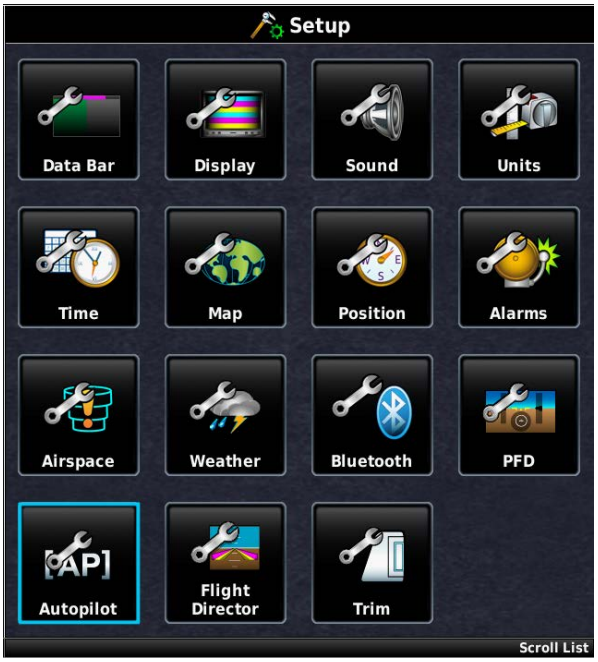
1. Use the Autopilot Setup page to adjust the Roll Servo gain setting
   a) Engage the autopilot in ROL/PIT mode with the aircraft approximately level
      i. With no GMC Mode Controller:
         1.Press, hold, and release the CWS/DISCONNECT button to engage the AP
      ii. With a GMC Mode Controller
         1.Press the AP button on the GMC Mode Controller to engage the AP
         2.Press the YD button on the GMC Mode Controller to DISENGAGE the YD



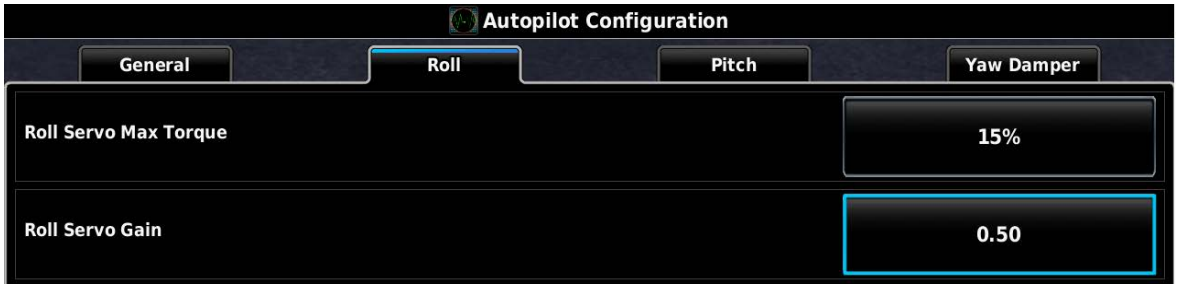
   b) Press the MENU key two times on the GDU to enter the Main Menu page.
   c) Press the Setup button.



d) Press the Autopilot button.



e) Select the Roll Tab and highlight the Roll Servo Gain entry.



f) Adjust the servo gain so 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 Tab has additional expert settings that can be adjusted to achieve the desired lateral mode performance. These settings are detailed in Section 31.4.10.10 and should only be adjusted after studying the description to properly understand their effect on the roll servo. See preceding note to access the expert settings.

Pitch Tab

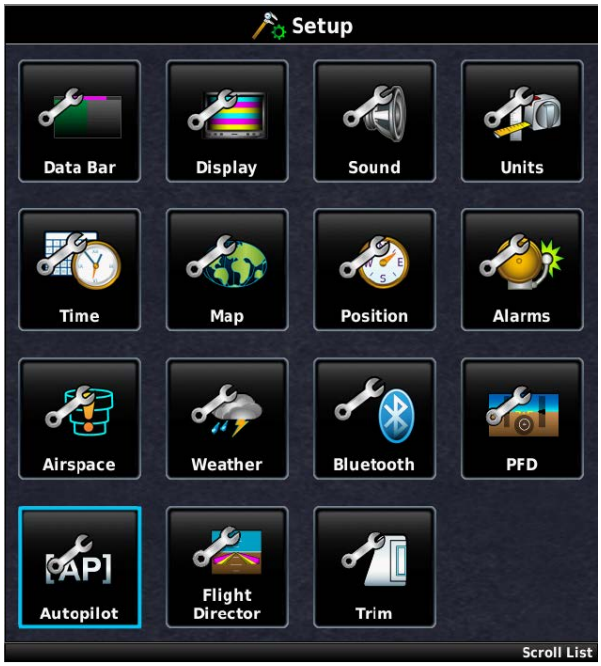
1. Use the Autopilot Setup page to adjust the Pitch Servo Gain setting
   a) Engage the autopilot in ROL/PIT mode with the aircraft approximately level
      i. With no GMC Mode Controller:
         1.Press, hold, and release the CWS/DISCONNECT button to engage the AP
      ii. With a GMC Mode Controller:
         1.Press the AP button on the GMC Mode Controller to engage the AP
         2.Press the YD button on the GMC Mode Controller to DISENGAGE the YD



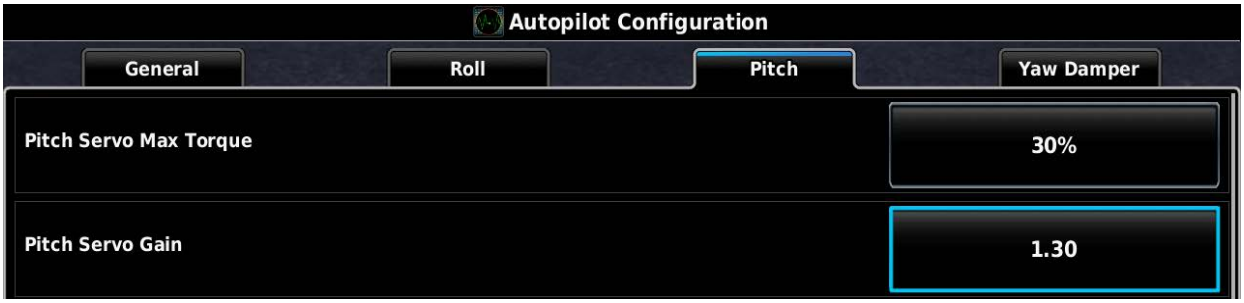
   b) Press the MENU key two times on the GDU to enter the Main Menu page.
   c) Press the Setup button.



   d) Press the Autopilot button.



e) Select Pitch Tab and highlight the Pitch Servo Gain entry.



f) Adjust the servo gain so 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

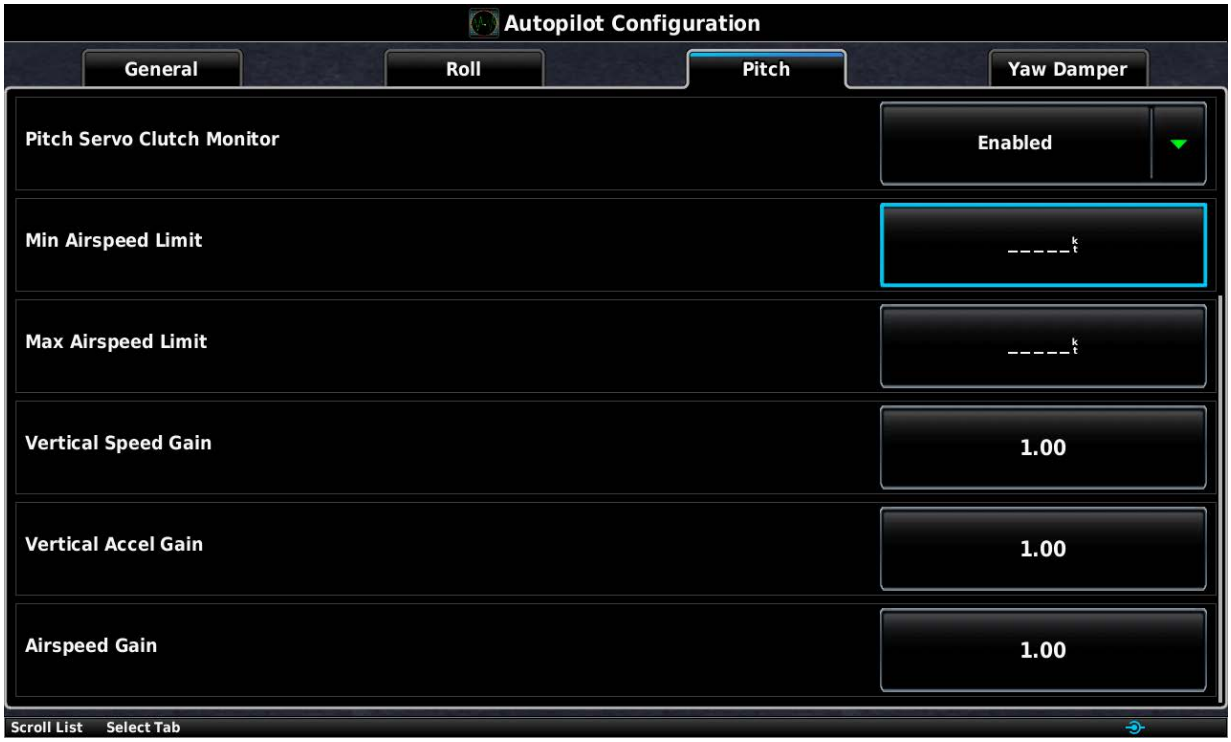
ii. Release controls and monitor autopilot response and closure back to commanded pitch

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 tab has additional expert settings that can be adjusted to achieve the desired vertical mode performance. These settings are detailed in Section 31.4.10.10 and should only be adjusted after studying the description to properly understand their effect on the pitch servo. See preceding note to access the expert settings.

The following pitch settings should be configured only after the pitch/roll servo max torque and servo gains have been set per the preceding pages.



NOTE

It is important to make sure of proper autopilot response in PIT mode before proceeding to adjust other autopilot pitch axis gains and modes (including ALT and VS modes).

The **min/max airspeed** fields set the min/max limits of autopilot vertical authority. The autopilot will limit the pitch control to stay within the min/max airspeed limits.

The **vertical speed gain** is one of the most important gains in the system since it controls the behavior of the VNAV, ALT, and VS modes and also largely determines how well the plane flies LPV and ILS approaches.

The **vertical speed gain** is adjusted in a very similar manner to the pitch servo gain. Engage the autopilot in ROL/VS modes in level flight (vertical speed approximately zero).

Adjust the **vertical speed gain** so the aircraft properly responds to the VS guidance from the flight director.

1. Overpower the autopilot to fly away from the current flight director commanded vertical speed.
2. Release controls and monitor autopilot response and closure back to the commanded vertical speed.
3. Set the **vertical speed gain** higher to make the autopilot more aggressive if it feels "lazy" or not as responsive as desired.
4. Set the **vertical speed gain** lower to make the autopilot less aggressive if the control is too "harsh" or more responsive than desired.

The **vertical accel gain** can often be left set at 1.00, but can be used to improve altitude captures when climbing or descending in VS or VNAV mode.

1. Climb to an altitude target in VS mode and note the altitude capture.
2. Set the **vertical accel gain** higher if the aircraft objectionably overshoots the altitude target before leveling off at the correct altitude.
3. Set the **vertical accel gain** lower if the aircraft objectionably undershoots the altitude target before leveling off at the correct altitude.

Similar to the vertical speed gain and vertical accel gain, the airspeed gain and airspeed accel gain can be used to improve airspeed hold performance when needed.

The yaw servo has additional advanced and expert settings that can be adjusted to achieve the desired yaw damping performance. These settings are detailed in Section 31.4.10.10 and should only be adjusted after studying the description to properly understand their effect on the yaw servo. See preceding note to access the advanced/expert settings.

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 GSA 28 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.

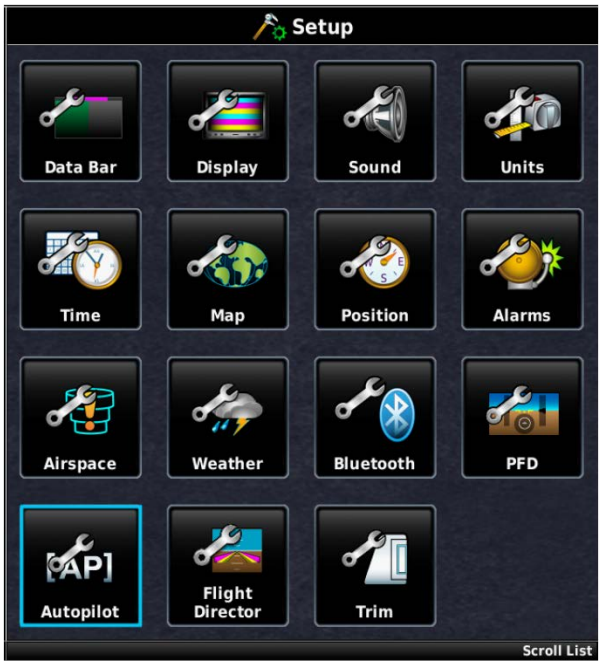
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- 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 the MENU key two times on the GDU to enter the Main Menu page.
   b) Press the SETUP button.



c) Press the Autopilot button.



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



e) Adjust the servo gain so 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 Mode Controller

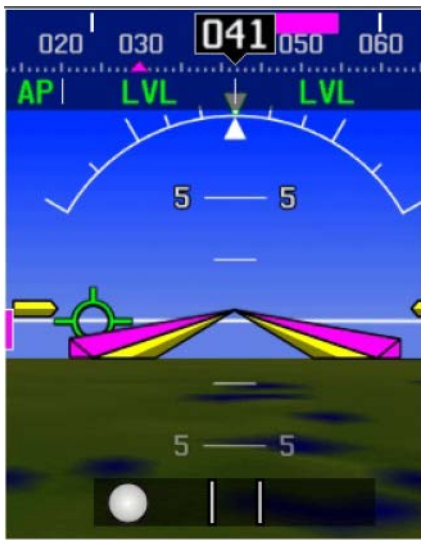
1. Press the LVL button on the GMC Mode Controller to engage the AP in LVL mode

2. Press the YD button on the GMC Mode Controller to disengage the YD

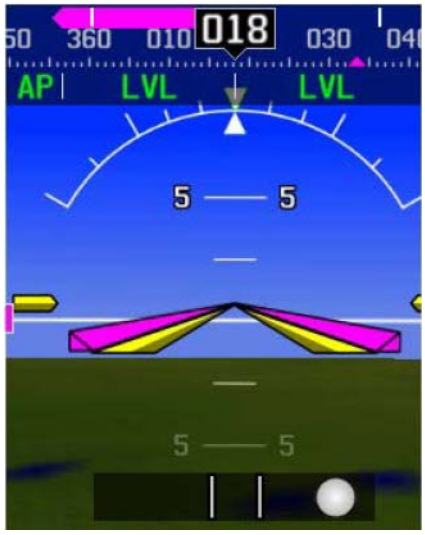


iii. Fly a yaw doublet and engage the YD as the ball swings through the center

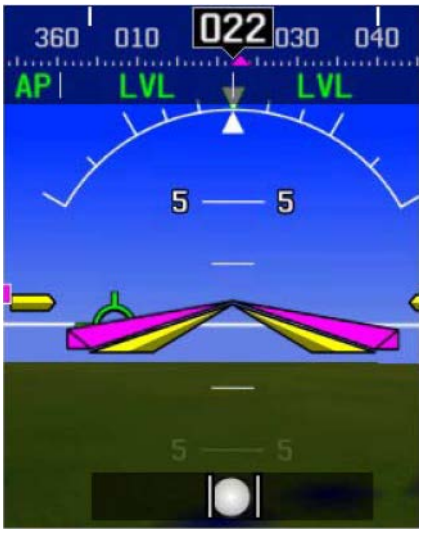
1.Right foot rudder to swing ball left



2.Left foot rudder to swing ball back right



3. Engage YD by pressing the YD button on the GMC Mode Controller 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

The yaw servo has additional advanced and expert settings that can be adjusted to achieve the desired yaw damping performance. These settings are detailed in Section 31.4.10.10 and should only be adjusted after studying the description to properly understand their effect on the yaw servo. See preceding note to access the advanced/expert settings.

31.4.10.9 In Air Setup

The next phase of setting up the Garmin GSA 28 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 GSA 28 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.

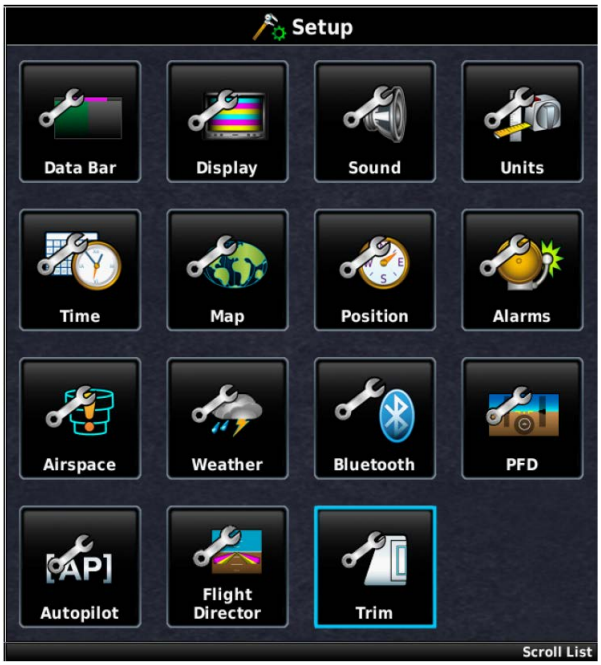
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- 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)

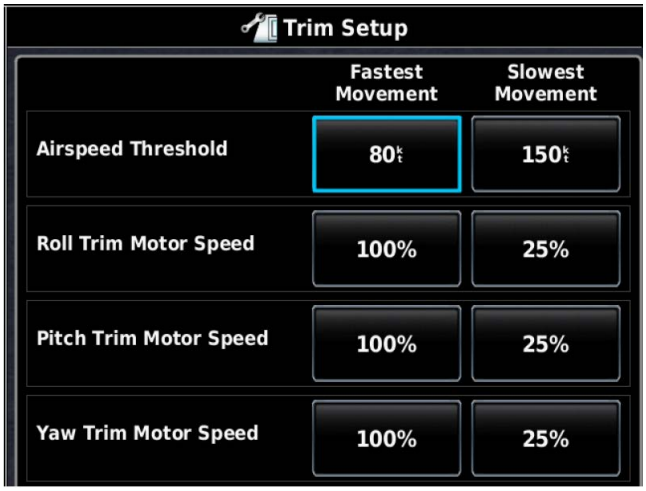
1. Use the Autopilot Setup page to adjust the Trim Motor Speed to get the desired manual electric trim response.
   a) Press the MENU key two times on the GDU to enter the Main Menu page.
   b) Press the Setup button.



c) Press the Trim button.



d) Select the Trim Setup 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

31.4.10.10 Detailed Autopilot Configuration Page Options

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

General Tab, Autopilot Configuration Page

These selections are made in configuration mode using the Autopilot Configuration page.

Table 31-8 General Tab, 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 Mode Controller AP button or the softkeys on the PFD display.
Autopilot Engage Limits	When engagement limits are enabled, the autopilot may only be engaged within the following ranges: Pitch 50° nose up to 50° nose down Roll ±75° If the above pitch or roll limits are exceeded while the autopilot is engaged and while Autopilot Engagement Limits are enabled, the autopilot will disconnect. Engaging the autopilot outside of its command limits, but within its engagement limits, will cause the autopilot to return the aircraft within command limits.

Table 31-8 General Tab, Autopilot Configuration Settings

Configuration Setting	Description
Flight Control System Monitors	Enables flight control system monitoring against the internal AHRS of a GMC 507 Autopilot controller. This is an additional set of monitors that have the ability to disconnect the autopilot based upon a range of defined flight parameters. If this setting is enabled, the installer will need to enter a value for yaw offset of the GMC 507 LRU, as well as perform a pitch/roll offset calibration as outlined in Section 31.4.7.2.1

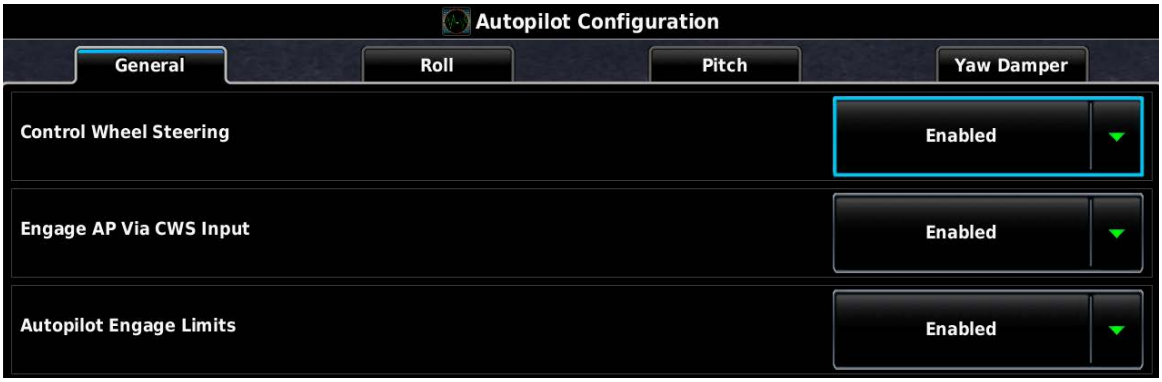


Figure 31-34 General Autopilot Configuration Page

Roll Tab, Autopilot 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 Autopilot Configuration page and the roll servo setup screen in the autopilot setup menu in normal mode.

Table 31-9 Roll Tab, Autopilot Configuration Settings

Configuration Setting	Description
Roll Servo 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.
Roll 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.
Roll 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.
Roll Servo 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 the user can reset clutch monitor faults by pressing the RESET softkey on the Roll Tab configuration page in configuration mode if an invalid stuck clutch failure occurs.
Roll 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.

Table 31-9 Roll Tab, Autopilot Configuration Settings

Configuration Setting	Description
Roll Correction Time (Expert Setting)	Roll Correction Time is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 1.00.
Roll Airspeed Gain Schedule (Expert Setting)	Roll Airspeed Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000.
Roll Altitude Gain Schedule (Expert Setting)	Roll Altitude Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000

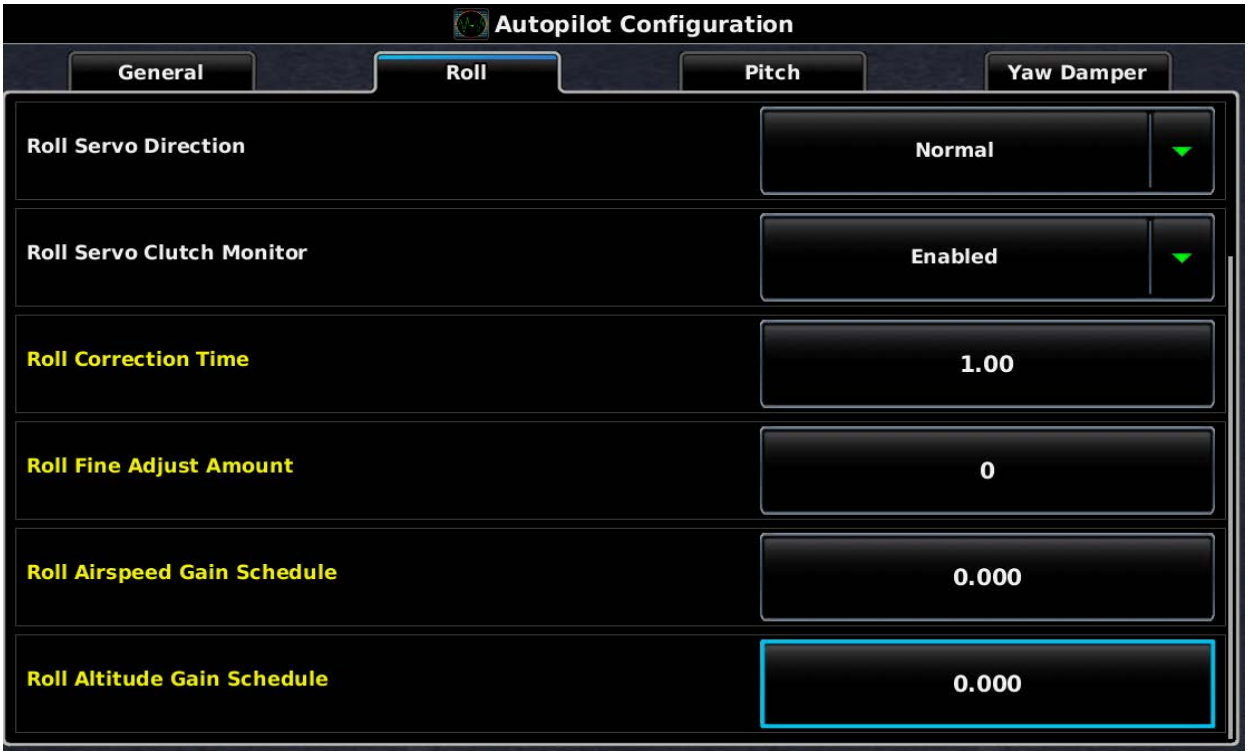


Figure 31-35 Roll Tab, Autopilot Configuration Page

Pitch Tab, Autopilot Configuration

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

Table 31-10 Pitch Tab, Autopilot Configuration Settings

Configuration Setting	Description
Pitch Servo 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.
Pitch 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.
Pitch 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.
Pitch Servo 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 the user can reset clutch monitor faults by pressing the RESET softkey on the Pitch Tab configuration page in configuration mode if an invalid stuck clutch failure occurs.

Table 31-10 Pitch Tab, Autopilot Configuration Settings

Configuration Setting	Description
Pitch Fine Adjust Amount (expert setting)	The GSA 28 pitch servo is capable of making very small adjustments to fine tune the elevator 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.
Pitch Fine Adjust Time (expert setting)	The GSA 28 pitch servo is capable of making very small adjustments to fine tune the elevator 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.
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	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	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 decreased if the aircraft is appears to back off from the desired vertical speed target when closing on the bug.

Table 31-10 Pitch Tab, Autopilot Configuration Settings

Configuration Setting	Description
Airspeed Gain (expert 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 decreased if the aircraft is appears to back off from the desired airspeed target when closing on the bug.
Airspeed Track Gain	The GSA 28 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.
Pitch Servo Control Mode (Expert Setting)	Pitch Servo Control mode is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is Normal.
Pitch Correction Time (Expert Setting)	Pitch Correction Time is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 1.00.
Pitch Airspeed Gain Schedule (Expert Setting)	Pitch Airspeed Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000.
Pitch Altitude Gain Schedule (Expert Setting)	Pitch Altitude Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000.
Vertical Speed Inertial Gain (Expert Setting)	Vertical Speed Inertial Gain is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.00.

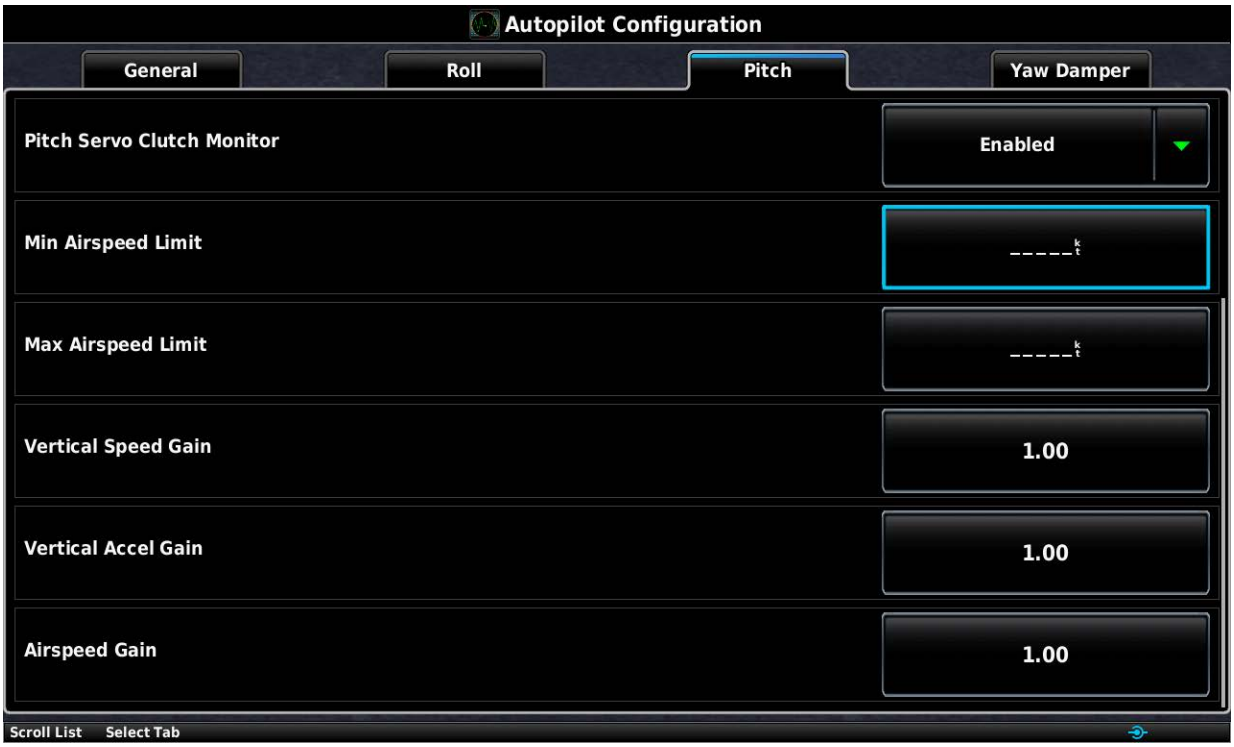


Figure 31-36 Pitch Tab, Autopilot Configuration Page

Yaw Damper Tab, Autopilot 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 Autopilot Configuration page, and the yaw damper setup screen in the autopilot setup menu in normal mode.

Table 31-11 Yaw Damper Autopilot Configuration Settings

Configuration Setting	Description
Yaw Damper 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.
Yaw Damper 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.
Yaw Damper 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.
Yaw Damper 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 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.

Table 31-11 Yaw Damper Autopilot Configuration Settings

Configuration Setting	Description
Ball Centering Gain (expert 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.
Yaw 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.
Yaw 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.
Yaw Airspeed Gain Schedule (Expert Setting)	Yaw Airspeed Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000.
Yaw Altitude Gain Schedule (Expert Setting)	Yaw Altitude Gain Schedule is an expert level setting, and should not be modified outside of an internal Garmin autopilot program or per a Garmin STC, the default value is 0.000.

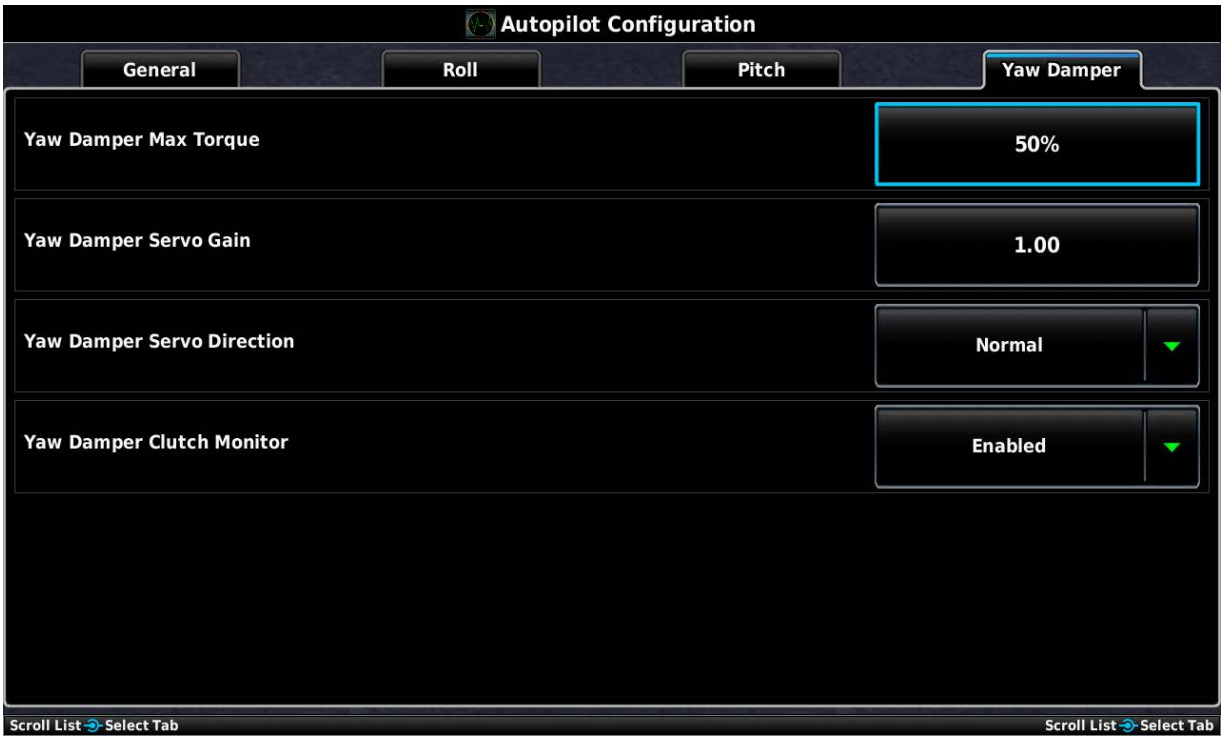


Figure 31-37 Yaw Damper Tab, Autopilot Configuration Page

31.4.10.11 Analog Autopilot Configuration Page

The Analog Autopilot Configuration Page allows configuration for installations using a GAD 29B data converter to interface to a non-Garmin autopilot.

Wiring guidance for analog autopilot installations is available in Appendix B of the G3X Touch EFIS Part 23 AML STC Installation Manual, 190-02472-01.

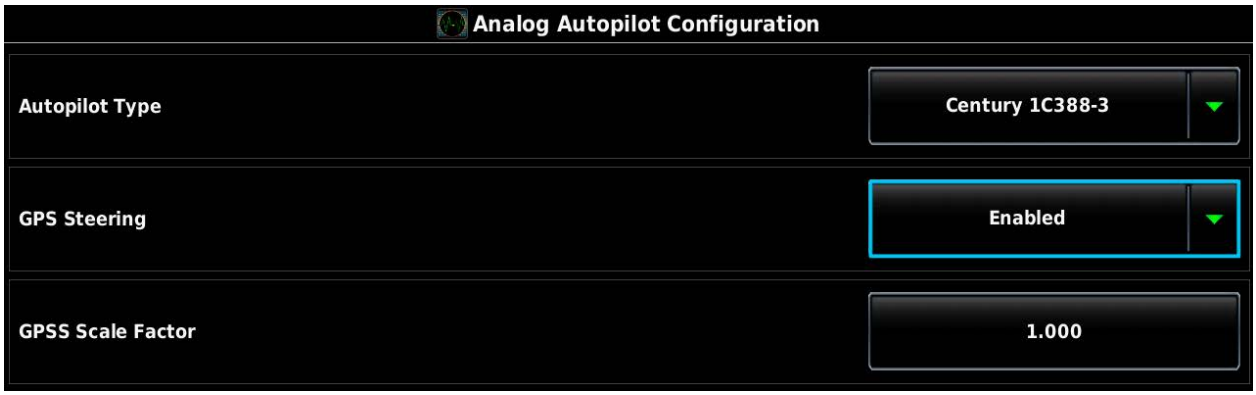


Figure 31-38 Analog Autopilot Configuration Page

The two following screenshots show the available configuration settings for Custom Configuration. The settings are described in Table 31-12.

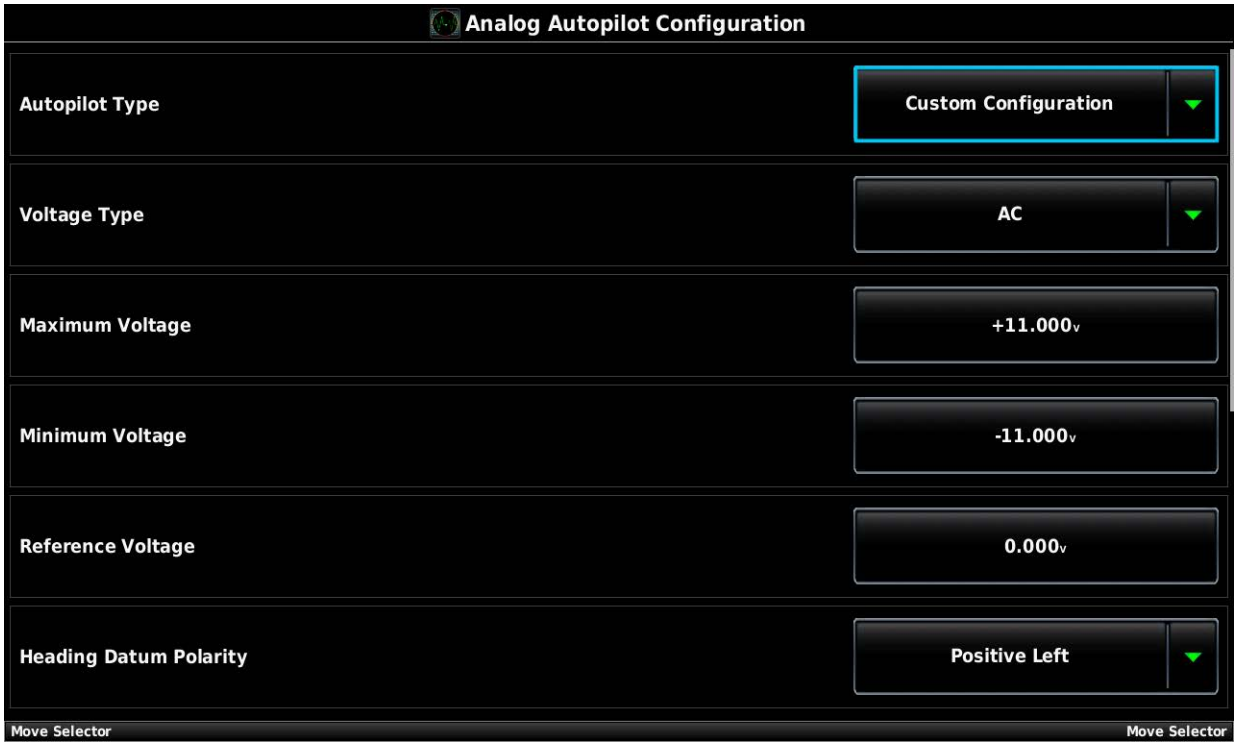


Figure 31-39 Analog Autopilot Configuration Page, Custom Config Screen (upper)

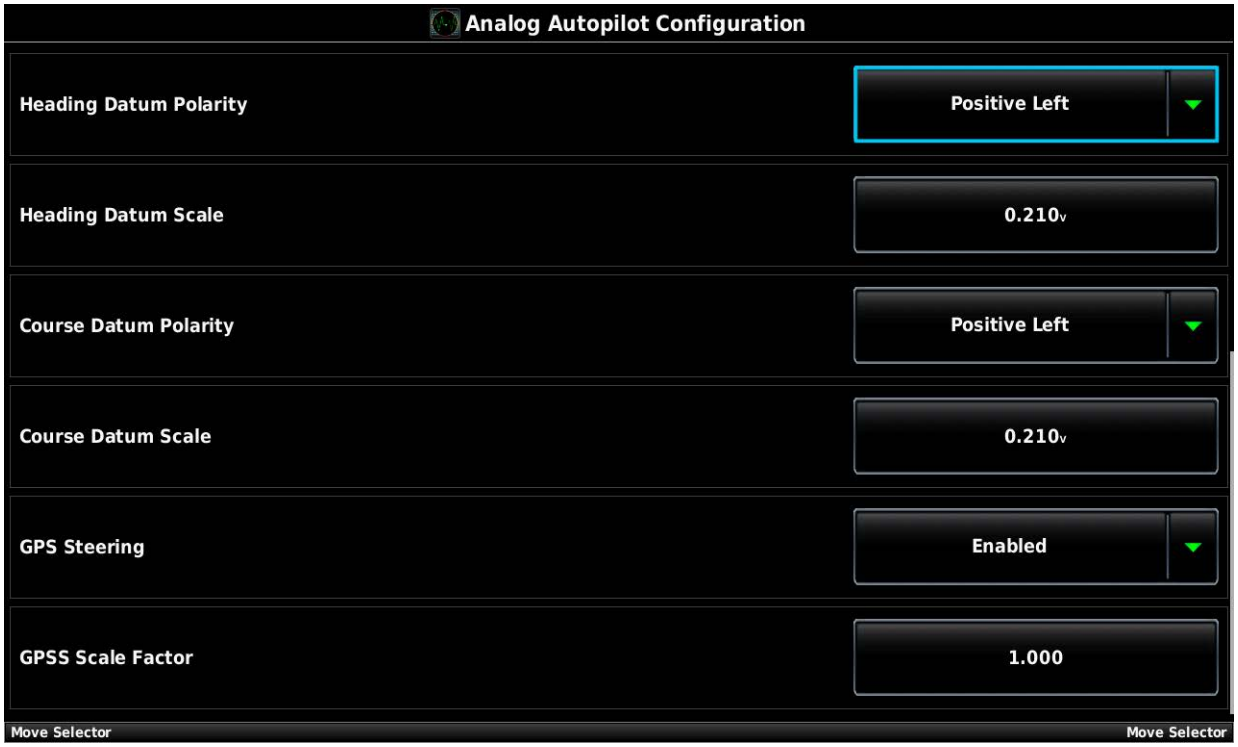


Figure 31-40 Analog Autopilot Configuration Page, Custom Config Screen (lower)

Table 31-12 Analog Autopilot Configuration Settings

Configuration Setting	Description
Autopilot Type	Select from one of the available pre-configured autopliot types or choose a custom configuration.
Voltage Type*	Sets the voltage type of analog autopilot. Options are AC or DC.
Maximum Voltage*	Sets the maximum voltage of HDG and CRS error outputs.
Minimum Voltage*	Sets the minimum voltage of HDG and CRS error outputs.
Reference Voltage*	Selects the voltage offset with no HDG/CRS error.
Heading Datum Polarity*	Sets the direction of autopilot turn represented by positive HDG error voltage. Options are Positive Left or Positive Righ.t
Heading Datum Scale*	Sets the volts per degree of error (V/deg) for HDG error.
Course Datum Polarity*	Sets the direction of autopilot turn represented by positive CRS error voltage. Options are Positive Left or Positive Righ.t
Course Datum Scale*	Sets the volts per degree of error (V/deg) for CRS error.
GPS Steering	Sets enablement of GPS Steering. Options are Enable or Disabled..
GPSS Scale Factor	Sets the GPSS Scale Factor from 0.1 to 5.0. Use the default value of 1.0 unless the roll steering needs to be more or less aggressive for the autopilot to track the course line

*Setting only available in Custom configuration

Non-Garmin Autopilot Systems

Non-Garmin autopilots listed in Table 31-13 are compatible with the G3X Touch system.

Table 31-13 Compatible Equipment – Autopilots

MFR	Model	Data Format	G3X Configuration Setting	Interfacing Equipment Configuration Information
Century	1C388*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	1C388M*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388M" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	1C388C*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388C" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	1C388MC*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388MC" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	1C388-2*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388-2" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	1C388-3*	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 1C388-3" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	2000	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 2000" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	21	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 21" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	31	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 31" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	41	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century 41" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	IV	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Century IV" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	

Table 31-13 Compatible Equipment – Autopilots

MFR	Model	Data Format	G3X Configuration Setting	Interfacing Equipment Configuration Information
Cessna	300 IFCS 400 IFCS 800 IFCS	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Cessna 300 (AC)", "Cessna 400 (AC)" or "Cessna 800 (AC)" – as applicable. **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	300B IFCS 400B IFCS 800B IFCS	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Cessna 300 (DC)", "Cessna 400 (DC)" or "Cessna 800 (DC)" – as applicable. . **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
Honeywell /Bendix King	KAP 100	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KAP 100" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KAP 140	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KAP 140" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KAP 150	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KAP 150" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KAP 200	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KAP 200" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KFC 150	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KFC 150" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KFC 200	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KFC 200" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	KFC 225	Analog, ARINC 429 GPSS	Analog Autopilot Configuration Page: **Autopilot Type:** "Bendix King KFC 225"	

Table 31-13 Compatible Equipment – Autopilots

MFR	Model	Data Format	G3X Configuration Setting	Interfacing Equipment Configuration Information
S-TEC	System 20	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 20" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 30	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 30" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 40	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 40" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 50	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 50" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 55	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 55" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 55X	Analog, Discrete, ARINC 429	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 55X"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 60	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 60" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
	System 65	Analog, Discrete	Analog Autopilot Configuration Page: **Autopilot Type:** "S-Tec System 65" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	Must be configured to operate with KI-525 (KCS-55) heading system.
Piper	Autocontrol III/IIIB	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Piper AutoControl" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	
	Altimatic III/ IIIB-1/IIIC	Analog	Analog Autopilot Configuration Page: **Autopilot Type:** "Piper Altimatic" **GPS Steering:** "Enabled" **GPSS Scale Factor:** "1.000"	

31.4.11 Flight Director Configuration Page

The Flight Director Page allows configuration of certain options for the flight director. This page will only appear in installations that include a Garmin autopilot.

1. In configuration mode (Section 31.2), use the Touch Screen or a Move Selector Knob to select the Flight Director Configuration page.
2. Use the Touch Screen or a Move Selector Knob to select the desired configurable item and make the desired change. Then press the OK Key to select the next item.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

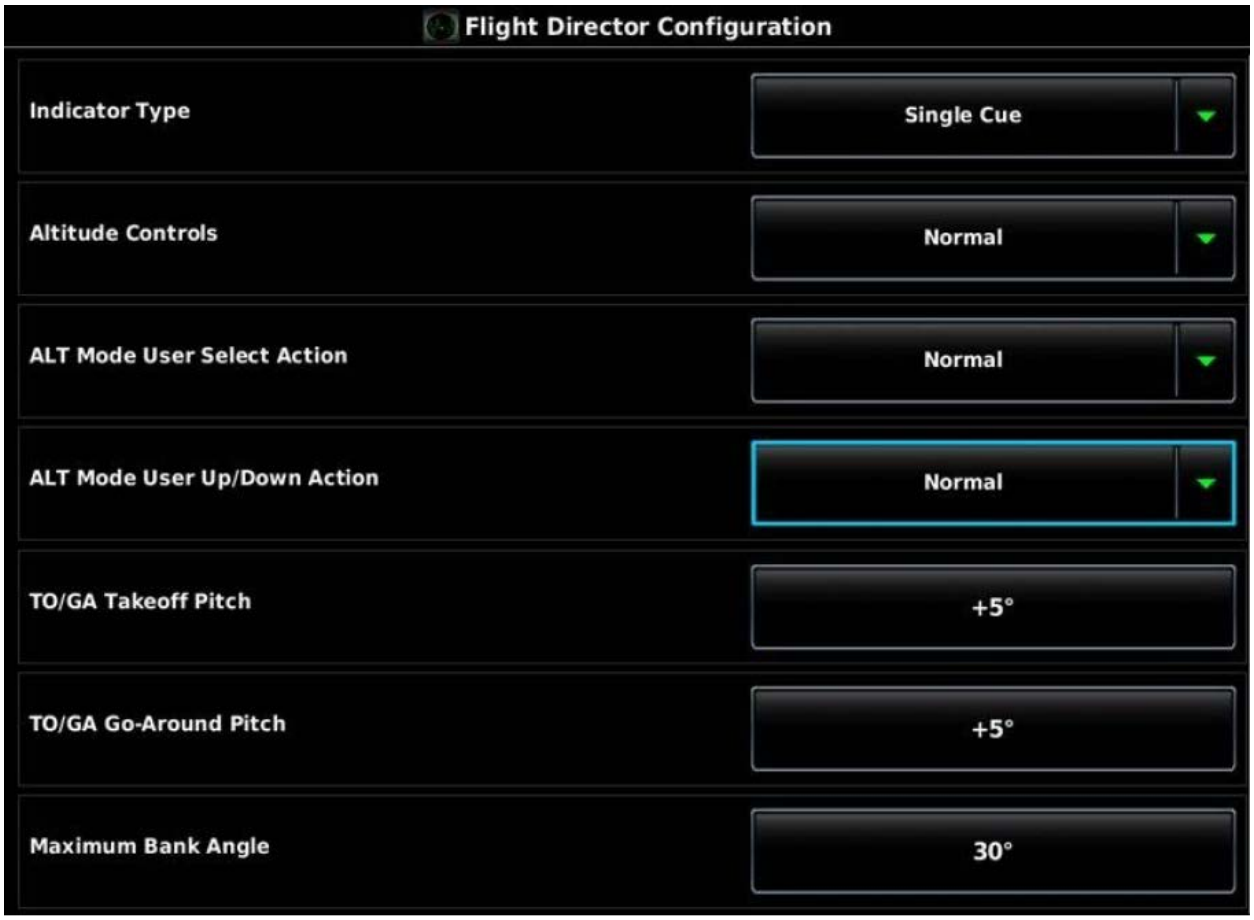


Figure 31-41 Flight Director Configuration Page

Indicator Type–Controls whether the flight director command indicator on the PFD uses a single-cue or dual-cue presentation.

TO/GA Takeoff Pitch and **TO/GA Go-Around Pitch**–These fields allow customization of the pitch attitude targets 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. These fields will appear only if a discrete input is configured for the AFCS TO/GA function.

Maximum Bank Angle–Used to limit the maximum roll attitude commanded by the flight director for aircraft that have unusual attitude limitations. This setting should not be adjusted from the default of 30° except for very high performance aircraft that have bank angle limitations at high speeds.

Altitude Controls–Select Normal (default) or Simplified. Selecting Simplified results in a simpler set of behaviors for altitude hold mode. See the G3X Touch Pilot's Guide for additional details.



Figure 31-42 Altitude Controls, Normal

When Altitude Controls is set to Normal, the following two selections (ALT Mode User Select Action and ALT Mode User Up/Down Action) appear, see Figure 31-42:

ALT Mode User Select Action–Select Normal or Sync Selected Altitude. This setting controls the actions that occur when the user selects altitude hold mode by pressing the ALT key on the GMC Mode Controller, or the ALT button on the display. When set to Sync Selected Altitude, the selected altitude (altitude bug) will be automatically set to the current aircraft altitude when the user selects altitude hold mode manually by pressing the ALT key on the GMC Mode Controller or the ALT button/softkey on the display. See the G3X Touch Pilot's Guide for additional details.

ALT Mode User Up/Down Action–Select Normal or Select VS (vertical speed) Mode. This setting controls the actions that occur when the flight director is in altitude hold (ALT) mode and the user moves the pitch wheel on the GMC Mode Controller, or the up/down buttons on the display. When set to Select VS Mode, moving the pitch wheel on the GMC Mode Controller, or the on-screen buttons results in a change to VS mode for a climb or descent to a new altitude. See the G3X Touch Pilot's Guide for further details.



Figure 31-43 Default Vertical Speed

When Altitude Controls is set to Simplified, the ALT Mode User Select Action and ALT Mode User Up/Down Action fields do not appear, but the Default Vertical Speed fields do appear as shown in Figure 31-44.

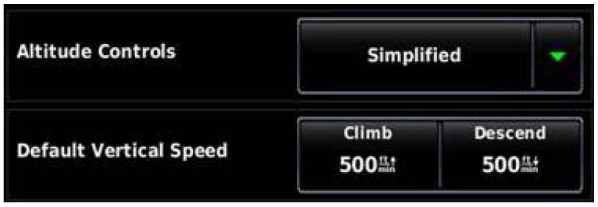


Figure 31-44 Altitude Controls, Simplified

31.4.12 ESP™-X™ Corrective Technology Configuration Page

This page allows configuration of certain options for the ESP™ (Electronic Stability and Protection) function. It will only appear in installations that include an autopilot with Garmin servos. ESP is an optionally enabled feature that is intended to assist the pilot in maintaining the aircraft in a stable flight condition. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, airspeed) beyond the normal flight parameters. Enhanced stability for each condition provides a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude or high airspeed. As the aircraft deviates further from the normal attitude and/or airspeed, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range.

See the G3X Touch Pilot's Guide (190-01754-00) for details of ESP operation. ESP is configured on the Electronic Stability Configuration page in Configuration Mode per the following procedure.

1. In configuration mode (Section 31.2), use the Touch Screen or a Move Selector Knob to select the ESP Configuration page.
2. Use the Touch Screen or a Move Selector Knob to select the desired configurable item and make the desired change. Then press the OK Key to select the next item.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

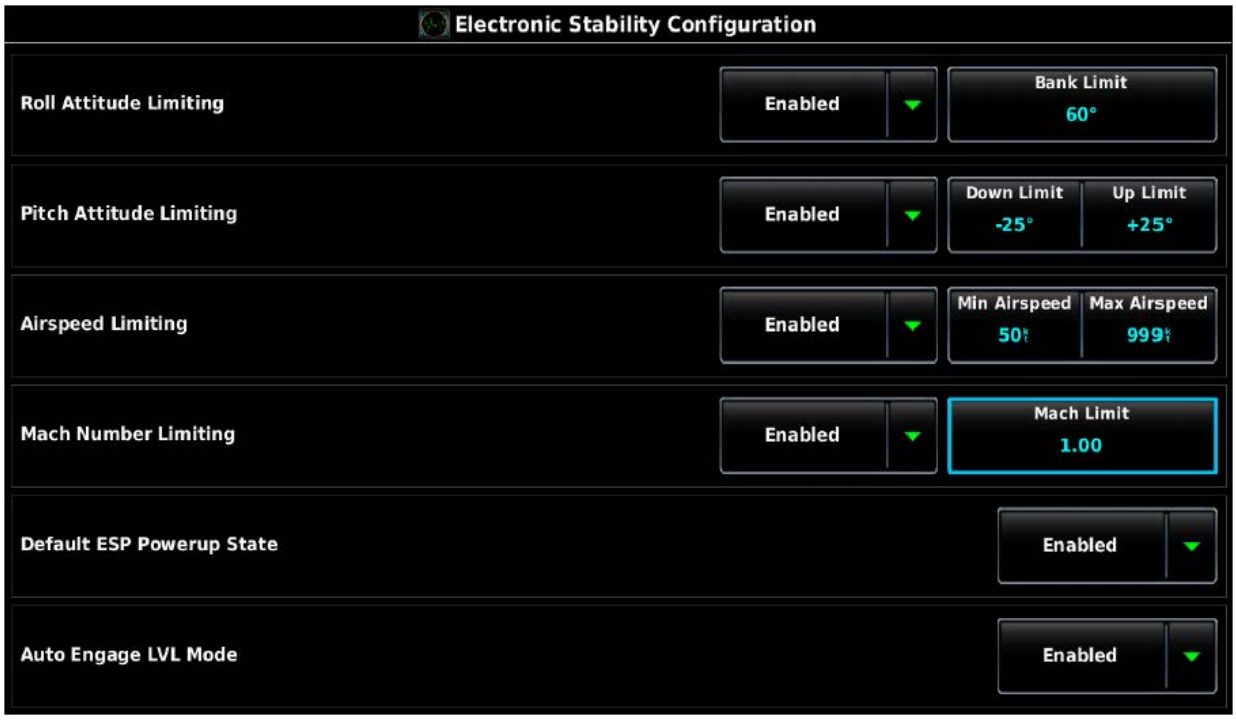


Figure 31-45 Electronic Stability Configuration Page

Roll Attitude Limiting–Select Enabled or Disabled (all other fields remain blank when Disabled). Enter desired Bank Limit of aircraft (range 45°to 60° right and left), this limit will appear as Guardrails on the PFD.

Pitch Attitude Limiting–Select Enabled or Disabled. Enter desired Pitch Limit of aircraft. Allowable range of -10°to -25° for Down Limit, and +10° to +25° for Up Limit (default settings are -15° and +20° respectively).

Airspeed Limiting–Allowable range of settings are 50 kt minimum airspeed to 999 kt maximum airspeed.

NOTE

The minimum airspeed setting should be set to a value lower than the minimum airspeed that is anticipated during approach while above 200 ft AGL.

Mach Number Limiting–Select Enabled or Disabled. Enter desired Mach Limit of aircraft. This field does not appear unless an MMO (maximum operating mach) value is entered on the Aircraft Configuration page. Allowable range of settings are from 0.10 mach minimum to 1.0 mach maximum (default setting is 0.5).

Default ESP Powerup State–Select Enabled or Disabled. Setting determines whether the ESP is functioning upon powerup. If disabled, ESP can still be enabled in normal operating mode.

NOTE

ESP can also be inhibited with an optional external toggle switch connected to a discrete input. See ESP Inhibit information in Section 29.4.23.2.2 and interconnect example in Figure 27-2.2 page 2.

Auto Engage LVL Mode–Select Enabled or Disabled. When enabled, the autopilot will engage with the flight director in Level Mode to bring the aircraft into level flight if ESP has been engaged for more than 10 seconds of a 20 second time period.

31.4.13 Trim Configuration Page

The GSA 28 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 in the air, the servos can adjust the trim control to minimize the force on the primary controls. This helps make sure 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.

The G3X Touch system supports DC trim motors driven directly from pins 13, 14 of the GSA 28, or GSA 28 trim servos which operate independently on the CAN bus without connections to the GSA 28 pitch/roll servos. This section provides specific configuration guidance for DC trim motors connected to the GSA 28 servos, however, the configuration parameters are similar for the other less common method of using GSA 28 trim servos.

NOTE

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

NOTE

Available trim configuration items can change depending on whether trim control is enabled for a DC motor or a Garmin servo LRU (second GSA 28), and whether the electrical control system LRU is enabled.



Figure 31-46 Roll Trim Tab, Trim Configuration Page (ECS enabled)

31.4.13.1 Roll Trim Tab, Trim Configuration

The installer needs to make the following roll trim configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode using the Trim Configuration page.

NOTE

The displayed rows of the Roll Trim tab configuration options will vary depending upon system configuration.



Figure 31-47 Roll Trim Tab, Trim Configuration Page Example

Table 31-14 Roll Trim Configuration Settings

Configuration Setting	Description
Roll Trim Motor Control	The GSA 28 roll servo has the ability to control an auxiliary roll trim motor. The Roll Trim Motor Control should be enabled if the GSA 28 roll servo was connected to an auxiliary trim motor. The Roll Trim Motor Control should be disabled if the GSA 28 roll servo was not connected to an auxiliary trim motor.
Roll Trim Motor Direction	The GSA 28 servo has a configurable trim motor direction. Select Normal or Reversed setting depending on which is required for proper trim motor movement when using aircraft trim motor switches on the ground with the autopilot disengaged (servos powered).
Roll Trim Motor Voltage	The GSA 28 servo can drive DC trim motors at either 12V or 24V. Select the appropriate trim motor voltage for the installation.
Roll Auto Trim Minimum Speed (expert setting)	The Roll Auto Trim Minimum speed can be set from 0% to 100%, but is normally left at the default setting.

Table 31-14 Roll Trim Configuration Settings

Configuration Setting	Description
Roll Trim Max Run Time (configuration mode only)	The GSA 28 servos can limit the maximum continuous run time of the trim motor to help prevent the potential for a trim runaway situation. The Roll Trim Max Run Time setting is the maximum amount of time the trim motor will run continuously when a manual electric trim input is detected. If the maximum time is exceeded, the pilot must release the Manual Electric Trim (MET) control and then reassert it to continue running trim. If the maximum trim motor run time is set to "No Limit", the electric trim motor will run indefinitely as long as the manual trim input switch is held. This item has no effect on auto trim.
Roll Trim Switch Direction	If a GAD 27 is installed and used for trim switch mixing, this setting changes the interpretation of GAD 27 switch inputs.

31.4.13.2 Pitch Trim Tab, Trim Configuration

The installer needs to make the following pitch trim configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode using the Trim Configuration page.

NOTE

The displayed rows of the Pitch Trim tab configuration options will vary depending upon system configuration.



Figure 31-48 Pitch Trim Tab, Trim Configuration Page Example

Table 31-15 Pitch Trim Configuration Settings

Configuration Setting	Description
Pitch Trim Motor Control	The GSA 28 pitch servo has the ability to control an auxiliary pitch trim motor. The Pitch Trim Motor Control should be enabled if the GSA 28 pitch servo was connected to an auxiliary trim motor. The Pitch Trim Motor Control should be disabled if the GSA 28 pitch servo was not connected to an auxiliary trim motor.
Pitch Trim Motor Direction	The GSA 28 servo has a configurable trim motor direction. Select Normal or Reversed setting depending on which is required for proper trim motor movement when using aircraft trim motor switches on the ground with the autopilot disengaged (servos powered).
Pitch Trim Motor Voltage	The GSA 28 servo can drive DC trim motors at either 12V or 24V. Select the appropriate trim motor voltage for the installation.
Pitch Auto Trim Minimum Speed (expert setting)	The Pitch Auto Trim Minimum speed can be set from 0% to 100%, but is normally left at the default setting.

Table 31-15 Pitch Trim Configuration Settings

Configuration Setting	Description
Pitch Trim Max Run Time (configuration mode only)	The GSA 28 servos can limit the maximum continuous run time of the pitch trim motor to help prevent the potential for a trim runaway situation. The Pitch Trim Max Run Time setting is the maximum amount of time the trim motor will run continuously when a manual electric trim input is detected. If the maximum time is exceeded, the pilot must release the Manual Electric Trim (MET) control and then reassert it to continue running trim. If the maximum trim motor run time is set to "No Limit", the electric trim motor will run indefinitely as long as the manual trim input switch is held. This item has no effect on auto trim.
Pitch Trim Airspeed Source	Airspeed trim scheduling can be set to reference true airspeed or indicated airspeed.
Pitch Trim Switch Direction	If a GAD 27 is installed and used for trim switch mixing, this setting changes the interpretation of GAD 27 switch inputs.

31.4.13.3 Yaw Trim Tab, Trim Configuration

The installer needs to make the following yaw trim configuration selections when setting up the GSA 28 based autopilot system. These selections are made in configuration mode using the Trim Configuration page.

NOTE

The displayed rows of the Yaw Trim tab configuration options will vary depending upon system configuration.



Figure 31-49 Yaw Trim Tab, Trim Configuration Page Example

Table 31-16 Yaw Trim Configuration Settings

Configuration Setting	Description
Yaw Trim Motor Control (configuration mode only)	The GSA 28 yaw trim servo has the ability to control an auxiliary rudder trim motor. The Yaw Trim Motor Control should be enabled if the GSA 28 yaw trim servo was connected to an auxiliary trim motor. The Yaw Trim Motor Control should be disabled if the GSA 28 yaw trim servo was not connected to an auxiliary trim motor.
Yaw Trim Motor Direction (configuration mode only)	The GSA 28 servo has a configurable trim motor direction. Select Normal or Reversed setting depending on which is required for proper trim motor movement when using aircraft trim motor switches on the ground with the autopilot disengaged (servos powered).
Yaw Trim Motor Voltage (configuration mode only)	The GSA 28 servo can drive DC trim motors at either 12V or 24V. Select the appropriate trim motor voltage for the installation.
Yaw Auto Trim Minimum Speed (expert setting)	The Yaw Auto Trim Minimum speed can be set from 0% to 100%, but is normally left at the default setting

Table 31-16 Yaw Trim Configuration Settings

Configuration Setting	Description
Yaw Trim Max Run Time (configuration mode only)	The GSA 28 servos can limit the maximum continuous run time of the trim motor to help prevent the potential for a trim runaway situation. The Yaw Trim Max Run Time setting is the maximum amount of time the trim motor will run continuously when a manual electric trim input is detected. If the maximum time is exceeded, the pilot must release the Manual Electric Trim (MET) control and then reassert it to continue running trim. If the maximum trim motor run time is set to "No Limit", the electric trim motor will run indefinitely as long as the manual trim input switch is held. This item has no effect on auto trim.
Yaw Trim Switch Direction	If a GAD 27 is installed and used for trim switch mixing, this setting changes the interpretation of GAD 27 switch inputs.

31.4.13.4 Trim Speed Tab, Trim Configuration

The installer needs to make the following trim speed configuration selections when setting up the GSA 28 based trim system. These selections are made in configuration mode using the Trim Configuration page.

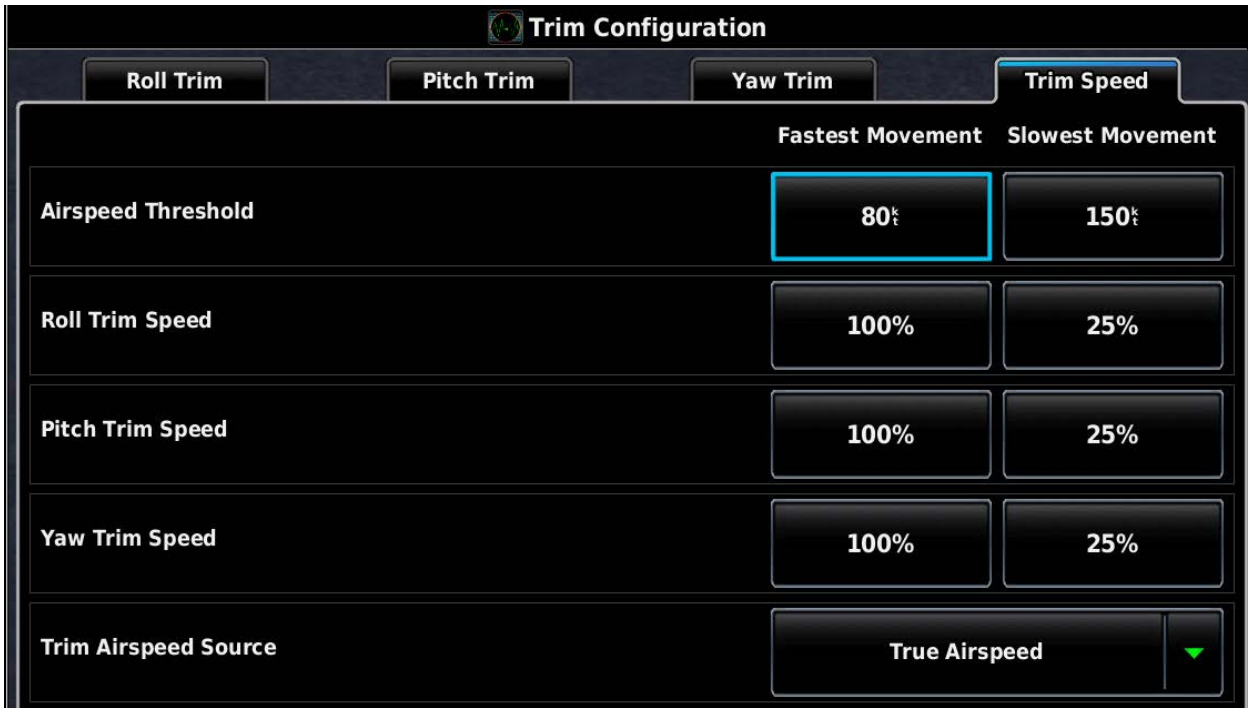


Figure 31-50 Trim Speed Tab, Trim Configuration Page

Table 31-17 Trim Speed Tab, Trim 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 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.

Table 31-17 Trim Speed Tab, Trim Configuration Settings

Configuration Setting	Description
Pitch Trim 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 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.
Trim Airspeed Source	Airspeed trim scheduling can be set to reference or indicated airspeed.

31.4.13.5 Step by Step Trim System Setup

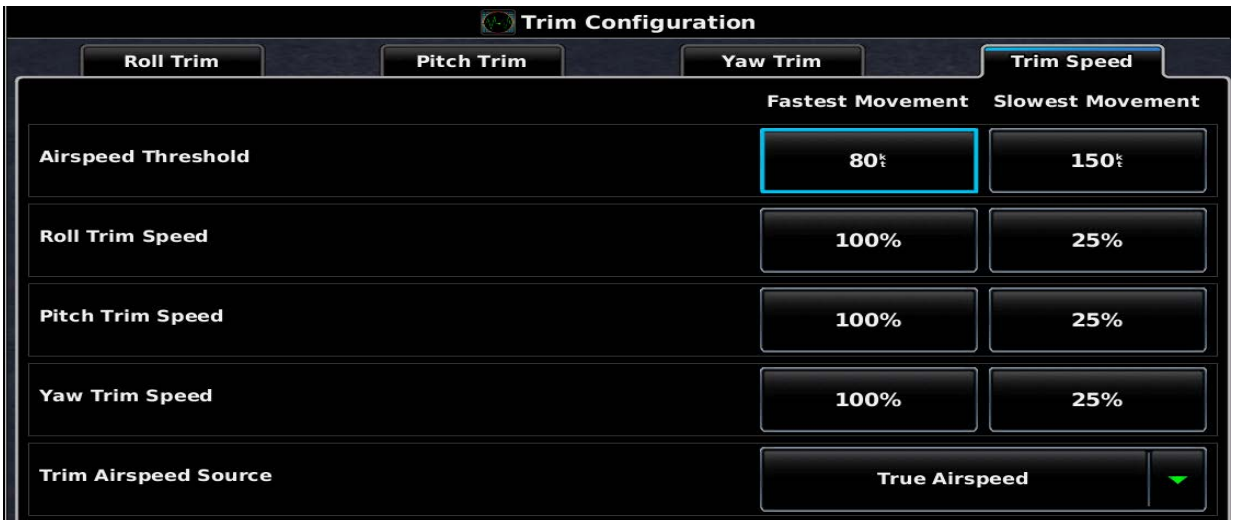
On-ground Setup

After setting up and testing the GSA 28 based autopilot and yaw damper systems, the pilot can configure the trim system.

1. Go to the Trim Configuration page and enable the Trim Motor Control for all servos that are connected to auxiliary trim motors.



2. Select the Trim Speed tab of the Trim Configuration 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 31.4.10.5 Steps 6, 7, & 8.

31.4.14 Flaps Configuration Page

The Flaps Configuration Page contains the following three items:
Flap Switch Mode -

a. In Absolute Position mode, the flaps move to one of four absolute positions in response to an active low on the flap discrete inputs, and there are no speed constraints.
b. In Relative Position mode, the switch up/switch down flap motion is relative to the last position and there are optional speed constraints on partial/full flap deployment.

Full Flap Max Airspeed - Enter maximum airspeed for full flap deployment. (Relative Position mode only)

Partial Flap Max Airspeed - Enter maximum airspeed for partial flap deployment, entry must be greater than the full flap maximum airspeed. (Relative Position mode only)

The airspeed values are only used in conjunction with the flap control and appear only when the GAD 27 is present. These values do not affect airspeed display.

The GAD 27 flap wiring examples in Figure 25-2.2 p. 2, Figure 25-2.3 p. 1, Figure 25-2.3 p. 2, Figure 25-2.3 p. 3 provide one example of a Relative Position flap switch installation and three examples of Absolute Position flap switch installation.

NOTE

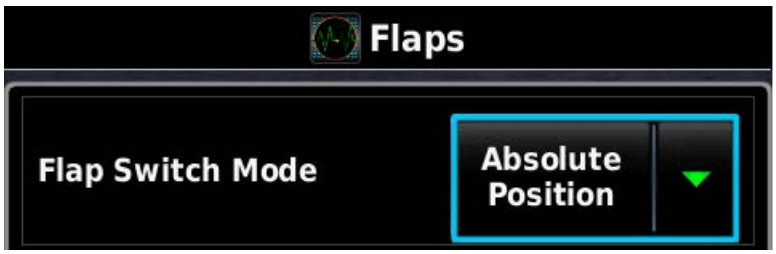
Electrical Control System must be enabled on the LRU Configuration Page in order to display the Flaps Configuration Page.

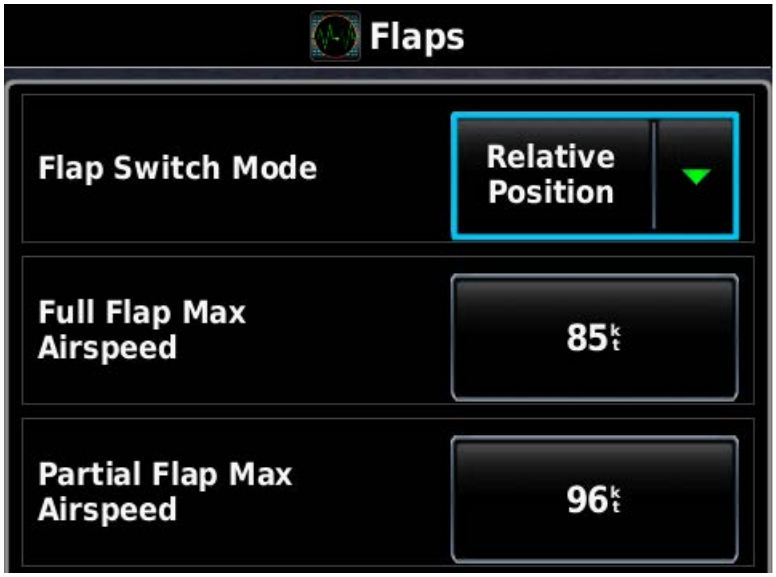
NOTE

There must be intermediate flap positions configured (more than only 0 and Full) for the partial flap maximum airspeed selection to be available.

NOTE

Automatic flap movement is not supported in configuration mode. Hold the flap switch for 1 second or longer (Relative Position) or use the screen controls on the flap position sensor calibration page (Absolute Position) to perform manual flap movement.




Flaps
Flap Switch Mode
Relative Position
Full Flap Max Airspeed
85kt
Partial Flap Max Airspeed
96kt

31.4.15 Aircraft 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.

1. In configuration mode, use the Touch Screen or a Move Selector Knob to select the Aircraft Configuration Page.
2. Use the Touch Screen or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).



Aircraft Tab

Aircraft identifier–The aircraft identifier is used in the data log file and on the Flight Log page.

Map symbol–The aircraft symbol that is displayed on the Map page can be selected from different vehicles that are stored internally to the unit. Additional vehicles may be downloaded from www.garmin.com/vehicles.

NOTE

To use a downloaded .srf aircraft symbol, create a 'Vehicle' directory on the SD card(s), then copy the .srf file to the new 'vehicle' directory. 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.

Aircraft Type–Determines whether the aircraft is a fixed-wing airplane or rotorcraft, and whether it has a pressurized cabin.

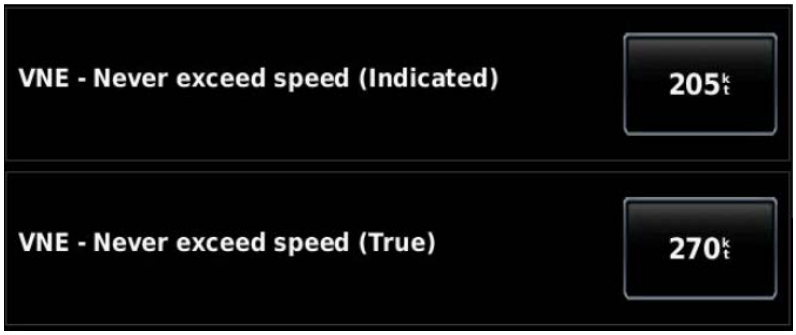
Flight Planning fields–The flight planning fields adjust the default values (fuel flow and cruise speed) used in normal mode for flight planning calculations (ETE, Leg Fuel, etc.).

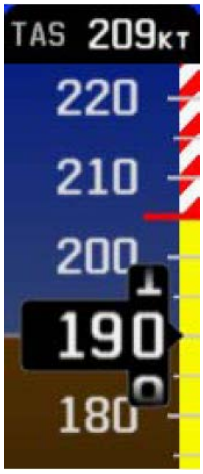
Takeoff Safe Altitude–Altitude threshold (AGL) for takeoff safe altitude alert.

Reference Speeds Tab

Reference Speeds–The aircraft Vspeeds can be entered using the Touch Screen or a Move Selector Knob. 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.

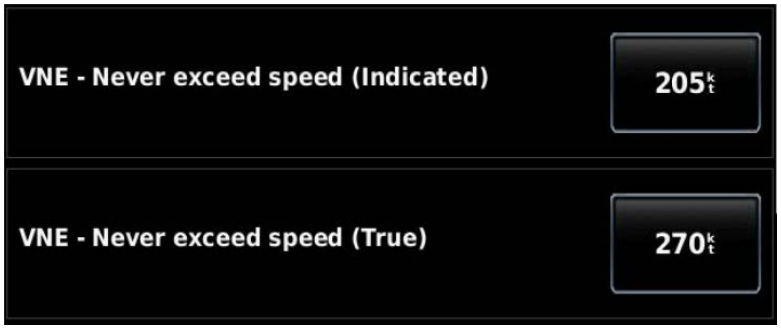
The aircraft's maximum speed limit can be configured in three different ways. All aircraft have a maximum indicated airspeed limit (VNE) which is configured using the VNE - Indicated field. This airspeed is marked on the PFD airspeed tape with a red line, and does not change with altitude. In this example, the value for VNE has been entered as 205 knots indicated airspeed. The aircraft is below the never-exceed speed any time its indicated airspeed is below 205 knots.

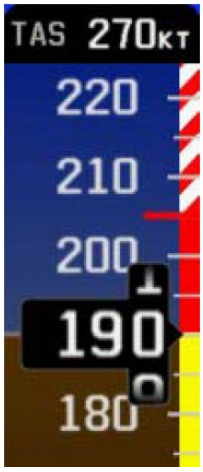




For certain aircraft types, maximum airspeed is additionally limited by true airspeed (TAS). A secondary airspeed limit expressed as true airspeed may optionally be configured using the VNE - True field. This airspeed is marked on the PFD airspeed tape with a second red color band, which shows the equivalent indicated airspeed at which the aircraft's true airspeed will exceed the configured true airspeed limit value. At low altitudes where true and indicated airspeed are similar, the PFD airspeed tape will show only the indicated VNE limit. At higher altitudes where true airspeed increases, a second red color band will begin to appear on the PFD airspeed tape to indicate the point where the aircraft will exceed the true airspeed limit at the current pressure altitude.

In this example, the aircraft's VNE values have been configured as 205 knots indicated airspeed, and 270 knots true airspeed. At high altitudes, the aircraft can reach the true airspeed limit even if its indicated airspeed is below the normal indicated VNE "red line". The second red band on the PFD airspeed tape alerts the pilot to this condition.

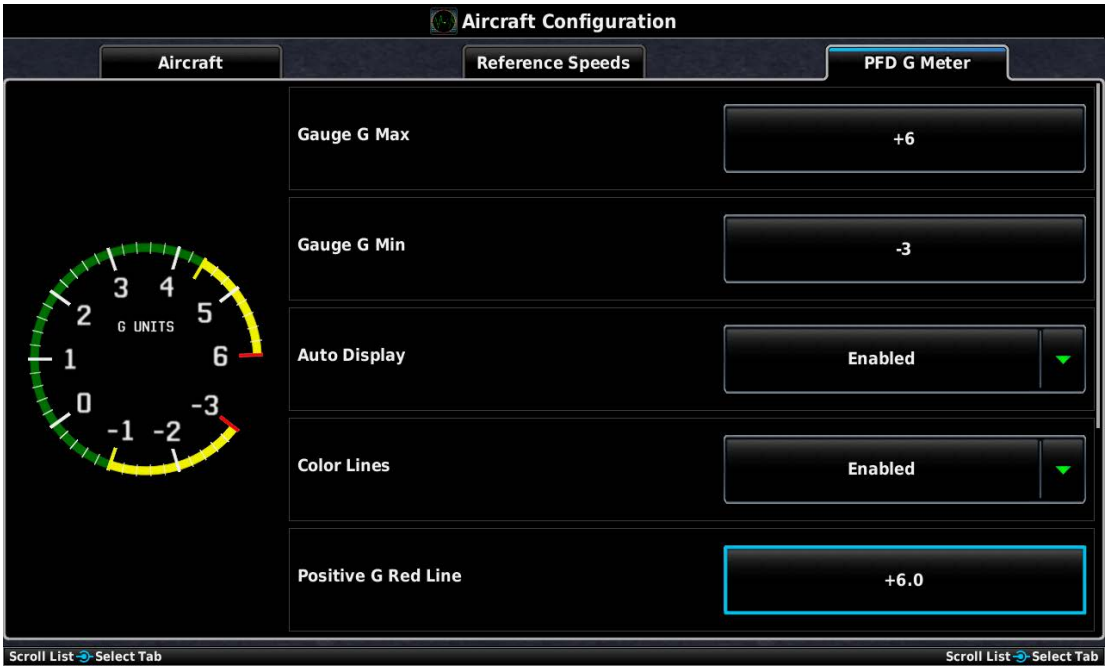




A third way to configure the aircraft's maximum airspeed limit is to enter a value for Maximum Operating Mach Number (MMO, see Section 31.4.12). As with TAS-based VNE, the value for MMO will be displayed on the PFD airspeed tape using a second red band that shows the equivalent indicated airspeed at which the aircraft's Mach number will exceed the configured maximum Mach number. At high altitudes, the aircraft can reach the maximum Mach limit even if its indicated airspeed is below the normal indicated VNE "red line". The second red band on the PFD airspeed tape alerts the pilot to this condition.

PFD G Meter Tab

The G-meter may be displayed at any time on the PFD Setup page. Not entering any values, or clearing the values, disables the G-Meter entirely.



Gauge G Max–The Gauge G Max field allows for setting the maximum G values displayed on the PFD G-meter.

Gauge G Min–The Gauge G Min field allows for setting the minimum G values displayed on the PFD G-meter.

Auto Display–The Auto Display setting (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)

Color Lines–When set to Enabled, this option allows the green, red, and yellow bands and the red and yellow radial markings to appear on the G-Meter.

Positive G Red Line–This sets the point at which the red line appears for positive G values displayed on the PFD G-meter.

Positive G Yellow Line–This sets the point at which the yellow line appears for positive G values displayed on the PFD G-meter.

Negative G Yellow Line–This sets the point at which the yellow line appears for negative G values displayed on the PFD G-meter.

Negative G Red Line–This sets the point at which the red line appears for negative G values displayed on the PFD G-meter.

31.4.16 Weight & Balance Configuration Page

Configuring the Weight & Balance function is optional. The Weight & Balance Configuration Page allows setting the weight and balance parameters including the loading envelope 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 4XX can calculate the total weight, moment, and center of gravity (CG).

CAUTION

It is the installer's responsibility to verify the accuracy of the data/values entered and the resulting envelope graph depicted on the weight and balance configuration page.

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 aircraft weight and balance documentation for the airplane, which notes the weight limitations, balance, fore/aft CG limits and loading envelope. Compare those figures to the values calculated by the GDU 4XX.

The Loading Envelope - Weight vs CG window contains fields for the entry of minimum and maximum aircraft weight, and the minimum and maximum CG location.

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.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Weight & Balance Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

31.4.16.1 Loading Envelope - Weight vs CG

The G3X Touch EFIS allows for Simple and Advanced envelope types to be used.



Simple Envelope Type: Allows for a basic loading envelope using minimum and maximum center of gravity and weights for a particular aircraft. The Loading Limits window contains fields for the entry of minimum and maximum aircraft weight, and the minimum and maximum CG location.

Advanced Envelope Type: Allows for a more complex weight vs. CG loading graph that mirrors the loading envelope graph on the aircraft's weight and balance documentation. When Advanced is selected the loading window changes to Loading Envelope – Weight vs. CG.

NOTE

Enter as many stations as required to accommodate various aircraft loading and seating configurations.

To edit the envelope in Advanced envelope type mode, select Edit Envelope. The Display Options tab will be displayed.

Display Options Tab: Allows for configuring the display of the envelope as desired. Up to four loading envelopes may be entered. Select data and add the category under name as desired. If the aircraft is certified in two categories, one would be entered under Envelope Number 1 and the other under Envelope Number 2.



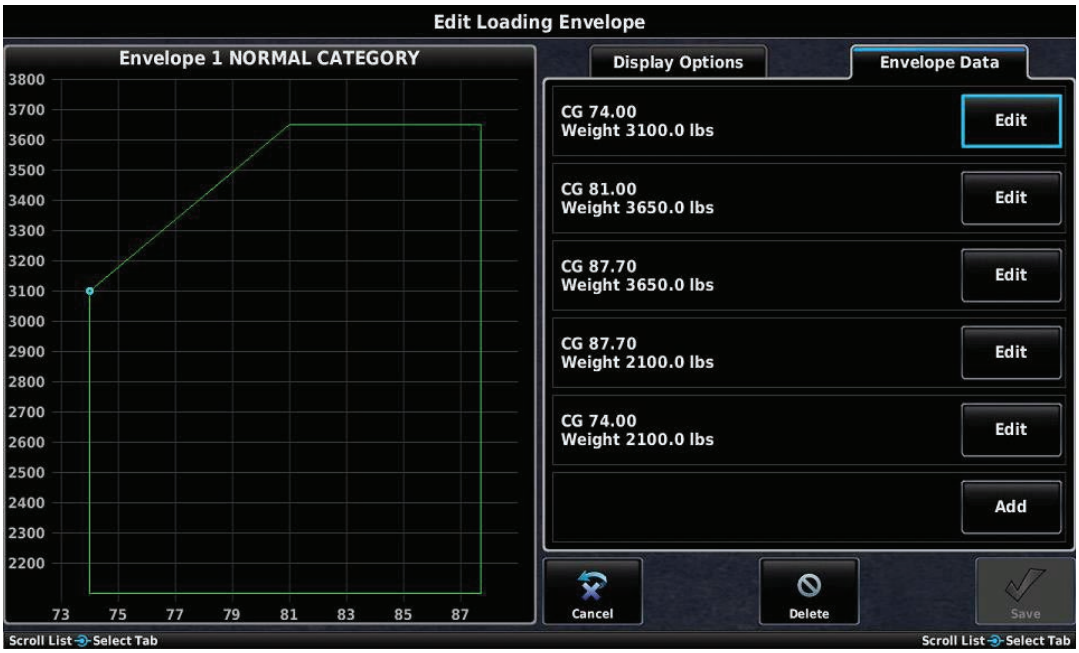
Envelope Data Tab: The values must be entered in sequential order, clockwise or counterclockwise around the outline of the envelope, using the values on the aircraft weight and balance documentation loading envelope graph. Input data as necessary and select Save to return to the Weight and Balance Configuration page.

NOTE

If the aircraft weight and balance documentation loading graph is provided as a Moment vs. Weight envelope, calculate the CG for each point on the envelope to configure it for the G3X.

CAUTION

Do not use the Weight & Balance function if unsure how to properly configure the envelope and verify it is correct.



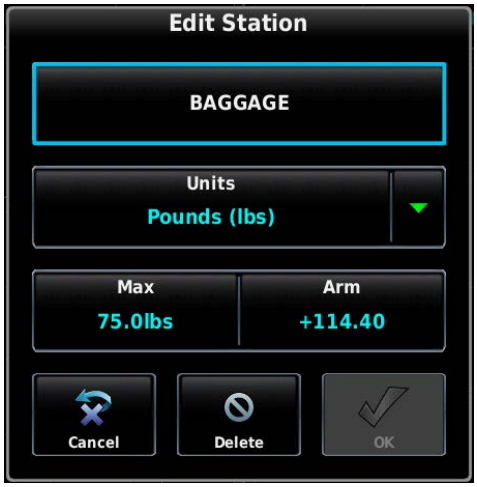
31.4.16.2 Stations Window

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 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.

1. Enter the aircraft's Empty CG Arm and Empty Weight on the stations tab.



2. To create a new station, press the Add button, enter the name, units, max weight, and arm, then select the OK Button.



3. To edit or delete a station, press the Edit Button. Press the Delete button (if desired) to delete the station.

31.4.17 Units Configuration Page

The Units Configuration Page allows selection of the desired displayed units for the listed items in the Units Configuration window. The settings accessed on this page include:

Distance	Ground Speed	Air Speed
Direction display	Air Temperature	Engine Temperature
Altitude	Vertical Speed	Baro Pressure
Fluid Pressure	Fluid Volume	Weight
Power	Fuel Economy	Fuel Flow
Fuel Calculator		

1. In configuration mode, use Touch Panel or a Move Selector Knob to select the Units Configuration Page.

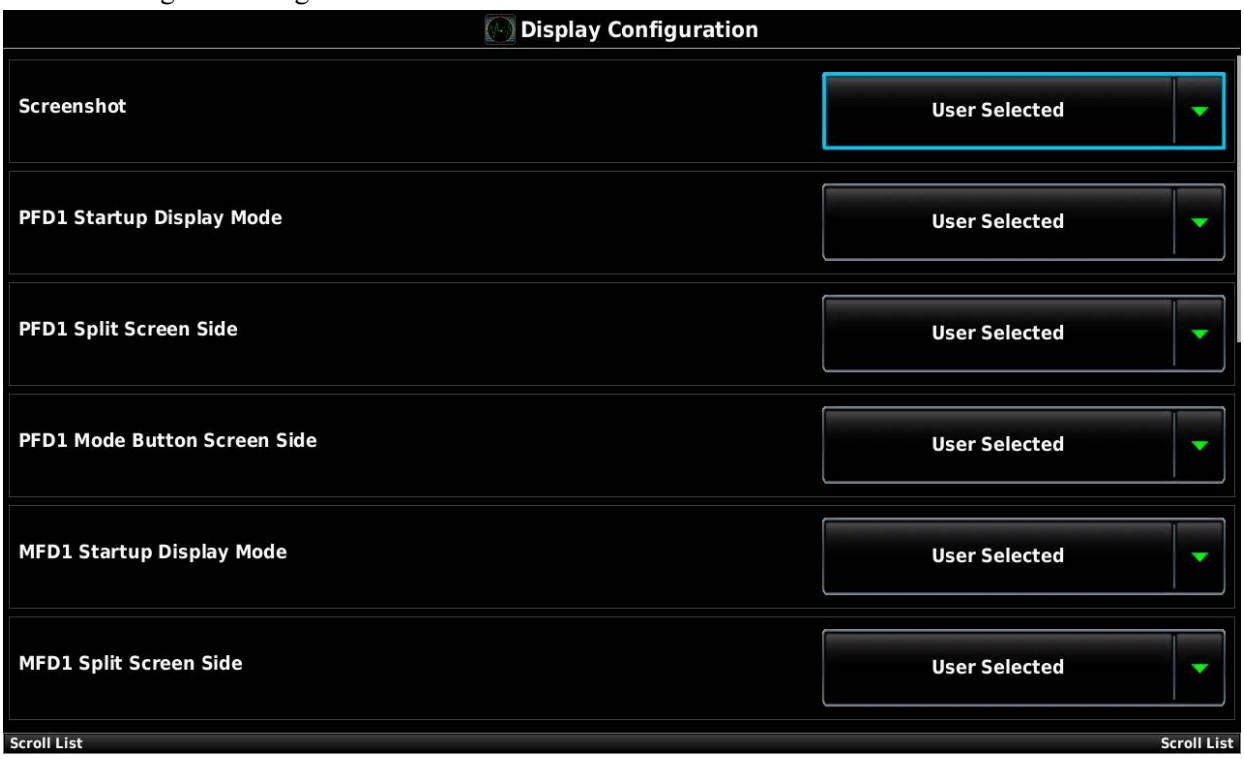


2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

31.4.18 Display Configuration Page

The Display Configuration Page allows setting the parameters for display backlight and display options configuration.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Display Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

Screenshot– This function allows a 'screenshot' of the current display to be stored to an SD card.

Enabled–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. A banner message will appear to indicate the success/ failure of the screenshot (for example, a failure results when an SD card is not inserted).

Disabled–Default setting

User Selected–When enabled, the user can enable or disable the Screenshot function in normal mode.

PFD1 (or PFD2) Startup Display Mode–

NOTE

The following references to MFD1 or PFD1 also apply to MFD 2, MFD 3, PFD 2, and PFD3.

Controls the screen layout that PFD1 assumes upon applying power. The user may then toggle between full-screen and split modes on the "Full/Split" mode button on the top corner of data bar.

User Selected (default setting)–Allows changing PFD1 layout in normal mode from the Display Setup page in the main menu. The associated User Selected setting used by the Display Setup page (in normal mode) lists the setting as PFD Startup Mode. Selecting any setting other than User Selected disallows the selection of PFD Startup Mode on the Display Setup page.

Auto–PFD1 turns on as a full-screen PFD display (when in a multi-display system and not in reversionary mode). Display location is then user-selectable.

Split Screen–PFD1 turns on in split-screen mode. Display location is then user-selectable.

PFD1 Split Screen Side–Controls where the side multi-function pane is displayed on PFD1 when split screen is selected. (Applies to GDU 460 only).

User Selected (default setting)–Allows the pilot/user to select the desired location in normal mode from the Display Setup page on the main menu.

Left–The multi-function pane will be displayed on the left side of the screen when split screen is selected.

Right–The multi-function pane will be displayed on the right side of the screen when split screen is selected.

PFD1 Mode Button Screen Side–Controls where the split/full screen mode button is displayed on PFD1.

User Selected (default setting)–Allows the pilot/user to select the desired location of the split/full screen mode button in normal mode from the Data Bar page on the main menu.

Auto–When set to Auto, the system automatically places the split/full screen mode button on either the left or right corner of the data bar, and the selection cannot be change by the user/pilot.

Left–The split/full screen mode button will be displayed on the upper loft corner of the data bar.

Right–The split/full screen mode button will be displayed on the upper loft corner of the data bar.

MFD1 Startup Display Mode–Controls the screen layout that MFD1 assumes during start. The user may then toggle between full-screen and split modes using the "Full/Split" mode button on the top corner of data bar.

User Selected (default setting)–Allows changing MFD1 layout in normal mode from the Display Setup page in the main menu. The associated User Selected setting used by the Display Setup page (in normal mode) lists the setting as MFD Startup Mode. Selecting any setting other than User Selected disallows the selection of MFD Startup Mode on the Display Setup page.

Auto–MFD1 turns on as a full-screen MFD display (when in a multi-display system and not in reversionary mode). Display location is then user-selectable.

Split Screen–MFD1 turns on in split-screen mode. Display location is then user-selectable.

MFD1 Split Screen Side–Controls where the side multi-function pane is displayed on MFD1 when split screen is selected. (Not applicable to GDU 470; the multi-function pane will default to the lower half of the screen.)

User Selected (default setting)–Allows the pilot/user to select the desired location in normal mode from the Display Setup page on the main menu.

Left–The multi-function pane will be displayed on the left side of the screen when split screen is selected.

Right–The multi-function pane will be displayed on the right side of the screen when split screen is selected.

MFD1 Mode Button Screen Side–Controls where the split/full screen mode button is displayed on MFD1. (Applicable to GDU 460 when configured as an MFD.)

User Selected (default setting)–Allows the pilot/user to select the desired location in normal mode from the Display Setup page on the main menu.

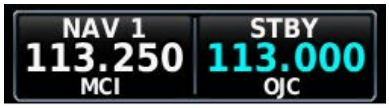
Auto–When set to Auto, the system automatically places the split/full screen mode button on either the left or right corner of the data bar, and the selection cannot be change by the user/pilot.

Left–The split/full screen mode button will be displayed on the upper loft corner of the data bar.

Right–The split/full screen mode button will be displayed on the upper loft corner of the data bar.

NAV Radio Controls–Allows selection of two versions of the displayed NAV buttons.

Normal (default setting)–The NAV radio's active and standby frequencies are displayed in two adjacent windows. This setting applies to all NAV radios displayed on the screen.



Minimized–The NAV radio's active and standby frequencies are displayed as stacked in one window. This setting applies to all NAV radios displayed on the screen.



Toggle Split Screen Layout With BACK Key–Controls if the Back key/button can be used to switch between split or full screen modes.

User Selected (default setting)–Allows the pilot/user to select/change if the Back key can be used to switch back and forth from full to split screen modes.

Enabled–Enables the Back key to be used to toggle between full and split screen modes. In this setting the split/full mode button may also be used.

Disabled–Disables the Back key from being used to toggle between full and split screen modes. With this setting the split/full mode button must be used to toggle between the full and split screen modes.

COM Radio Control - Allows selection of two versions of the displayed COM buttons.

Normal (default setting)–The COM radio's active and standby frequencies are displayed in two adjacent windows.

Minimized–The NAV radio's active and standby frequencies are displayed as stacked in one window.

EIS/Engine Page Layout–There are 3 options, User Select, Combined, and Separate. User Select allows the pilot to toggle between Combined and Separate from normal mode, in the Display options.

When EIS/Engine Page Layout is set to:

- Combined - the EIS display is dynamic, when the supplemental ENG tab is opened on the MFD side of the display, the EIS display changes layout.
- Separate - the EIS display will not change, regardless of the presence of the ENG tab on the MFD side of the screen.



Figure 31-51 EIS Display (shown in normal full PFD mode)



Figure 31-52 EIS Display w/ENG Tab in Combined setting

The EIS Display is dynamic, it changes layout when the ENG tab is opened (Figure 31-52). The EIS Display changes layout automatically based on the ENG menu.



Figure 31-53 EIS Display Set to Separate

EIS Display as displayed (Figure 31-53) when set to Separate. In this mode, the EIS Display does not change layout.

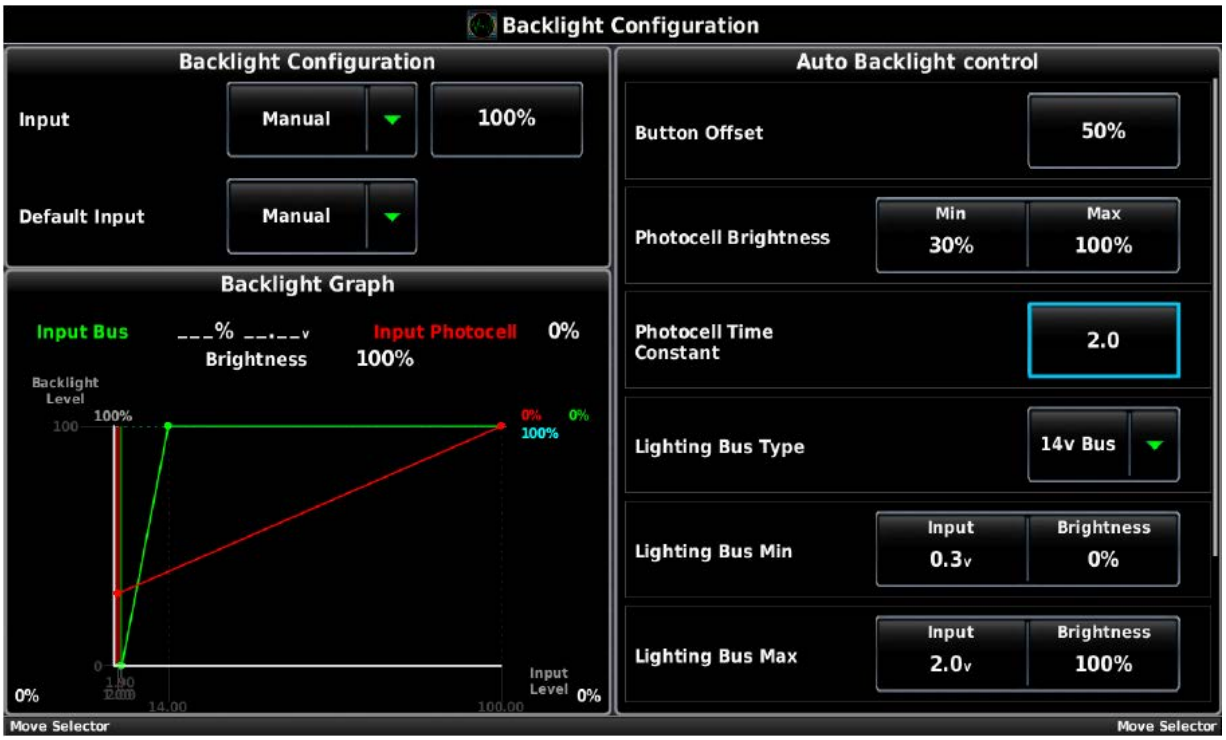
EIS Layout Size - If the vertical engine bar is not being forced to use the wide width to accommodate the configured contents (e.g. multi-engine gauges) the "EIS Layout Size" option allows the user to select the size of the vertical engine bar on each display. This can be set to Auto, or User Selected. If set to User Selected, the width of the vertical engine bar can be modified in the Display Settings menu in normal mode.

Database Info Startup Location - Determines which GDU(s) will show the database info/disclaimer page at startup. Possible values are like other similar items: User Selected, PFD, MFD or Both.

31.4.19 Backlight Configuration Page

The Backlight Configuration Page allows setting the parameters for display backlight and display options configuration.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Backlight Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

Backlight Configuration:

Backlight Input Source–Can be set to Manual, Photocell, or Lighting Bus. If set to manual, the backlight intensity (display brightness) can be set from 0-100%.

Default Input–Can be set to Manual, Photocell, or Lighting Bus. This controls the backlight mode that will be active each time the system is powered on

Backlight 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.

Input Level–Displays the current lighting bus voltage

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

Auto Backlight Control:

Button Offset–Adjusts the bezel backlight to be brighter than display backlight. Bezel lighting appears dimmer than display lighting when set to the same brightness level. Bezel backlight can brightened by raising the Button Offset value.

Photocell Brightness–Sets the minimum and maximum brightness of the display backlight based on the photocell output.

Photocell Time Constant–Adjusts the speed (in seconds) so the brightness level responds to changes in the photocell output.

Lighting Bus Type–Can be set to 14v Bus or 28v Bus. Bezel keys and display lighting are controlled by the input voltage on pin 43 (0-14 VDC) or pin 26 (0-28 VDC).

Lighting Bus Min–Sets the minimum brightness of the display backlight based on the lighting bus input.

Lighting Bus Max–Sets the maximum brightness of the display backlight based on the lighting bus input.

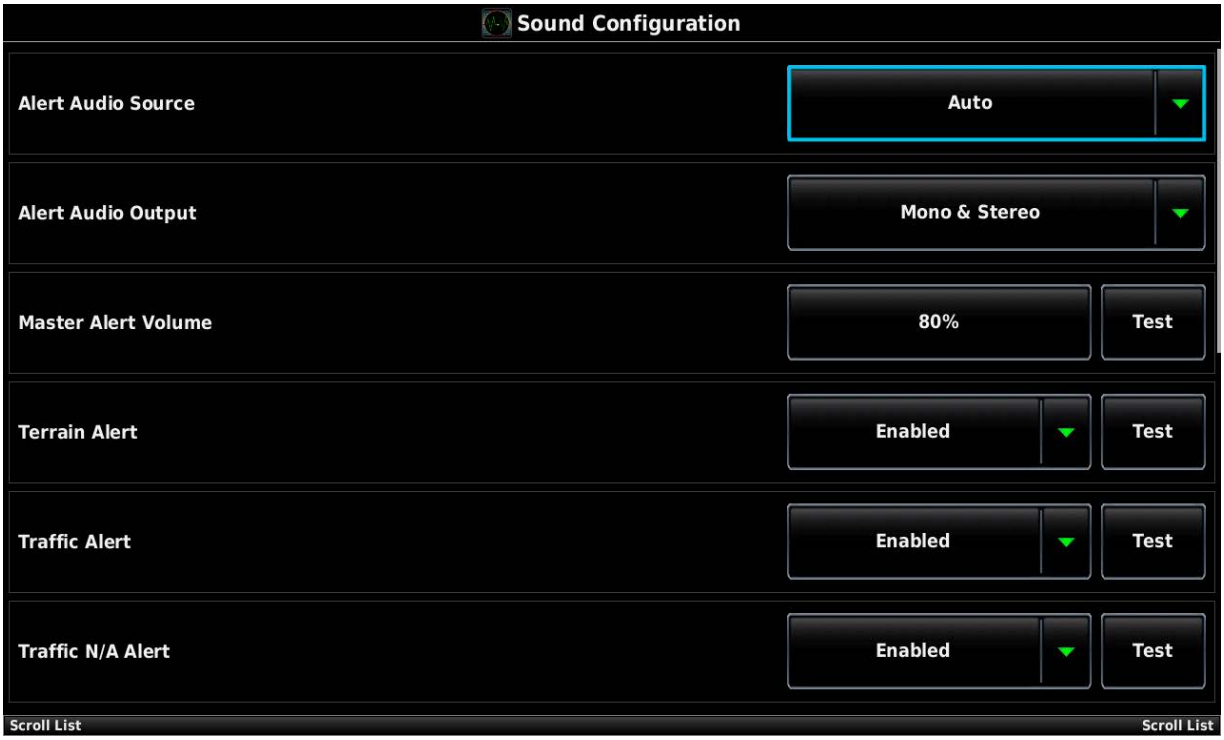
Lighting Bus Time Constant–Adjusts the speed (in seconds) so the brightness level responds to changes in the input level.

Lighting Bus Off Threshold–Sets the lighting bus off threshold input level. At the threshold level, the backlighting is turned on per the Lighting Bus Min setting. Below the threshold level, the backlighting defaults to using the photocell. If the value is set to 0 V, the value will be ignored and the display brightness will remain at the Lighting Bus Min level for any input level between 0 V and the Min Brightness level.

31.4.20 Sound Configuration Page

The Sound Configuration Page allows setting the parameters for various alert and message tones. Test buttons are provided to test audio volume and configuration.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Sound Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired selection.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

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

Alert Audio Source–If more than one GDU 4XX is installed, an Alert Source field will appear on the SOUND Configuration page. The Alert Source item may be configured so a single specific GDU always outputs alert audio. Or, the Alert Source item may be configured to "Auto", which will cause whichever display is present to output alert audio, in the following priority order: PFD1, PFD2, MFD1, MFD2, PFD3, MFD3.

Alert Audio 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. If set to Stereo Only, alert tones and messages will be output only on the Stereo output.

Master Alert Volume–Controls the volume level (0%-100%) of all audio alerts that do not have their own volume setting, including autopilot, flight director, terrain, traffic, and CAS messages.

Terrain Audio–Enables/disables terrain awareness audio alerts.

Traffic Audio–Enables/disables Traffic Audio alerts.

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

VNE Alert–Enables/Disables VNE exceedance audio alert.

AFCS Attention Tones–Enables/disables AFCS attention tones.

AOA Alert–Enables/disables AOA Alert tone. Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

Altitude Alert–Enables/disables the Altitude Alert tone. Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

AOA Alert Mode - When set to *Stall Awareness*, the system will audibly alert the pilot when the AOA indicator enters the caution range and will beep progressively faster as AOA is increased towards a stall. A constant tone indicates a stall. When set to *Approach + Stall Awareness*, the pilot is audibly alerted in the same manner, however the alerts begin when at or above the approach target calibration point and increase progressively faster until a constant tone is reached at the point of stall.

Message Tone–Controls the volume level (settings 1-10, or OFF) of message tones (Airspace Advisory Messages, Approaching VNAV Target Altitude Message, etc.). Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

Minimums Alert–Enables/disables the Altitude Minimums tone. Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

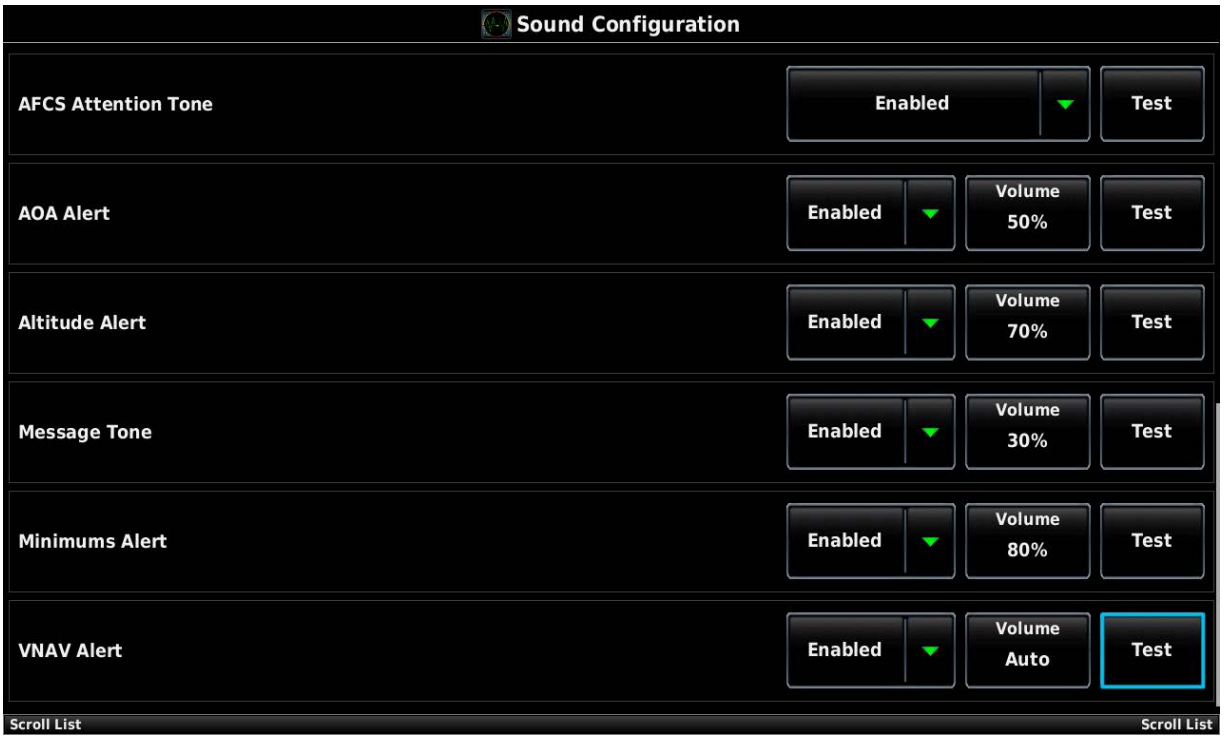
Miscompare Alert - Enables/Disables ADAHRS Miscompare Audio Alerts.

Takeoff Alert–Enable/disables takeoff safe altitude alert. Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

VNAV Alert–Enables/disables VNAV TOD proximity alert. Volume can be individually set for this alert by touching *Volume*. The far left position of the volume slider sets the volume to AUTO. If set to AUTO, the volume will be slaved to the *Master Alert Volume*.

Radio AGL Alert - Audio alerts can be configured to provide callouts for various altitude ranges, or disabled entirely. Selecting "All" will play all available Radio or Radar altitude callout alerts.

Engine/Airframe Alert Mode - Tone Only/Tone + Voice. If Tone + Voice is selected, a spoken audio clip will be played when certain engine/airframe CAS messages are generated.


Sound Configuration
AFCS Attention Tone
Enabled
Test
AOA Alert
Enabled
Volume
50%
Test
Altitude Alert
Enabled
Volume
70%
Test
Message Tone
Enabled
Volume
30%
Test
Minimums Alert
Enabled
Volume
80%
Test
VNAV Alert
Enabled
Volume
Auto
Test
Scroll List
Scroll List

31.4.21 RS-232 Configuration Page

The RS-232 Configuration Page allows configuration of the RS-232 ports on the GDU 4XX displays.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the RS-232 Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).



Each connected GDU 4XX has five configurable RS-232 (PFD 1, MFD1, PFD2, MFD2, PFD 3, and MFD3) channels. Use the Touch Panel or a Move Selector Knob to select the desired RS-232 channel, 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 30X)

GTS™ Traffic System Instrument Data - This setting is used exclusively to communicate with GTS series products.

Connext® Connected Cockpit 38400 baud (GTN™ touchscreen avionics Connext 2) - Used for connecting a GDU 4XX display to a GTN 6XX/7XX for performing Connext functions, such as flight plan transfer.

Connext 57600 baud - This setting is used with a wired connection to the GTX™ 345/45R when configured for Connext Format 1, the GDL 5X, the GPS 175, the GNX 375, and the GNC 355.

Connext 115200 baud - This setting is used with a wired connection to the GTX™ 345/45R transponder when configured for Connext Format 4 configuration setting.

Garmin HSDB - Used for connecting to compatible Garmin LRUs (e.g. GTS 8XX, see Section 25.2 and Appendix G.2)

Garmin VHF Comm - Outputs frequency tuning data to an SL40, GTR 200, or GTR 225 comm radio, and receives radio status data for on-screen radio display.

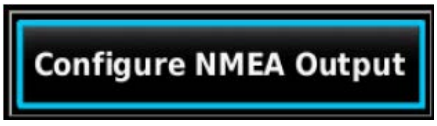
Garmin VHF Nav/Comm - Outputs frequency tuning and VOR radial selection data to an SL30 or GNC® 255 VHF Nav/Comm radio. Receives lateral/vertical NAV deviation signals and radio status data for on-screen radio display.

Aviation Out - Primarily used to provide GPS data to ELT units. Can also be used to send data to a portable GPS unit.

Fuel Flow Out - Variant of the Shadin Format which can be used to provide data to a GTN, GNS, etc.

Fuel/Airdata Out - Variant of the Shadin Format which can be used to provide data to a GTN, GNS, etc.

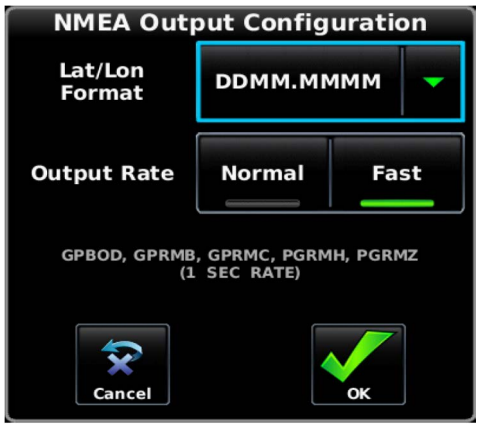
NMEA Out - Supports the output of standard NMEA 0183 version 3.01 data at user selectable baud rate of either 4800 or 9600. The GDU outputs data from the selected GPS source (internal GPS or external GPS1/ GPS2) using NMEA sentences.
A setting that allows switching the NMEA output between "Normal" and "Fast" speeds is accessed by pressing the MENU Key on the Comm Page (at least one output must be set to NMEA Out) which enables a Configure NMEA Output button to appear.



Pressing this button displays a pop-up window 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.

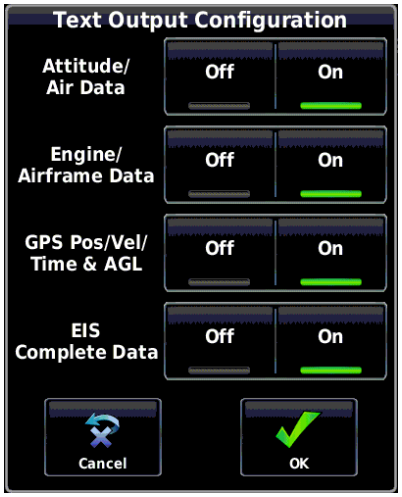
Fast (every second): GPBOD, GPRMB, GPRMC, PGRMH, PGRMZ

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 Configure Text Output button to appear when the Menu key is pressed (while on the COM Configuration Page). Pressing this button displays a pop-up menu that allows setting four selections (Attitude/Air Data, Engine/Airframe Data, GPS Position/Velocity, and EIS Complete Data) to On or Off. The On setting allows the output of Text Data as described in Appendix C.





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 - Receives flight plan and navigation data from a Garmin IFR GPS navigator, and optionally outputs frequency tuning data and receives radio status data for on-screen radio display. 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).

GTX 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 Section 25.2 or Appendix G.2), 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 Section 25.2 or Appendix G.2), it is not necessary to select TIS-A In, as the transponder data is received through the ADAHRS 1 LRU.

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 Section 25.2 and Appendix G.2.

Note the following when configuring the communication settings:

- Each GNS™ 4XX/5XX receiver, GNS 480, or GTN 6XX/7XX series unit must be connected to a MapMX/Aviation RS-232 input on one of the GDU 4XX units (in addition to the ARINC 429 connection(s)). ARINC 429 data input from a GNS 4XX/5XX, GNS 480, or GTN 6XX/7XX series unit will be ignored unless a corresponding MapMX/Aviation RS-232 input is also configured.
- When connecting two GNS 4XX/5XX, GNS 480, or GTN 6XX/7XX 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 through the GDU.

CO Detector - Receives data from a third-party carbon monoxide detector. Refer to the G3X Touch Pilot's Guide for further information.

Lightning Detector - Receives lightning strike data and transmits heading data to a third-party lightning detector.

NOTE

Some panel-mount GPS navigators and NAV/COM radios do not transmit RS-232 data when they are in configuration mode. To verify RS-232 connections, make sure these units are operating in normal mode.

Garmin GDL 90 Traffic - Receives traffic data from a Garmin GDL 90 ADS-B receiver.

31.4.22 ARINC 429 Configuration Page

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.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the ARINC 429 Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

ARINC 429 Outputs:

EFIS/Airdata–Outputs EFIS and air data labels to a panel-mount GPS navigator (GTN/GNS). A second selection is used to find 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
205	Mach Number	206	Indicated Airspeed	210	True Airspeed
211	Total Air Temperature	212	Vertical Speed	213	Static Air Temperature
235	Baro Setting (BCD)	244	Fuel Flow	244P	Fuel Mass Flow
247	Total Fuel Quantity	247P	Fuel Mass	320	Magnetic Heading
332	Lateral Acceleration	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 panel-mount GPS navigator (GTN/GNS). A second selection is used to find if the GPS input is from NAV 1 or NAV 2.

Garmin VOR/ILS–Receives VOR/ILS labels from a panel-mount GPS navigator (GTN/GNS) with VOR/ILS NAV receiver. A second selection is used to find if the GPS input is from NAV 1 or NAV 2.

Radar Altimeter - Receives Radar Altimeter ARINC 429 labels 164 and 165.

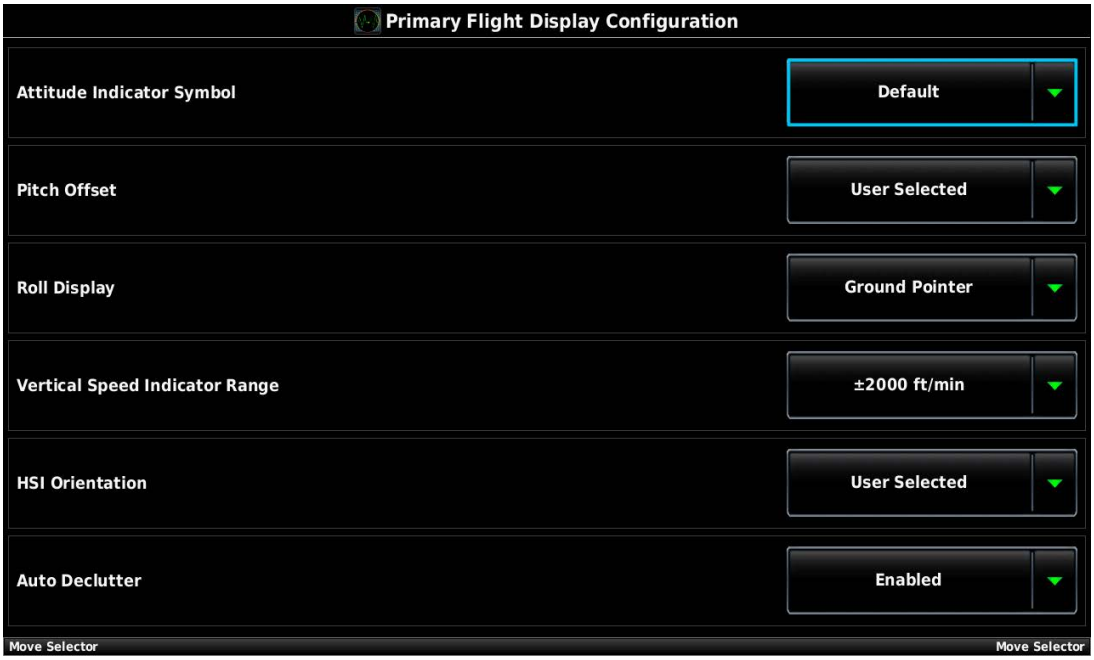
NOTE

Some panel-mount GPS navigators and NAV/COM radios do not transmit ARINC 429 data when they are in configuration mode. To verify ARINC 429 connections, make sure these units are operating in normal mode.

31.4.23 PFD Configuration Page

The configuration options for the Primary Flight Display Configuration Page are detailed in this section.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the PFD Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

Attitude Indicator Symbol - Allows the selection of 4 different PFD attitude symbols (shown in Figure 31-54).

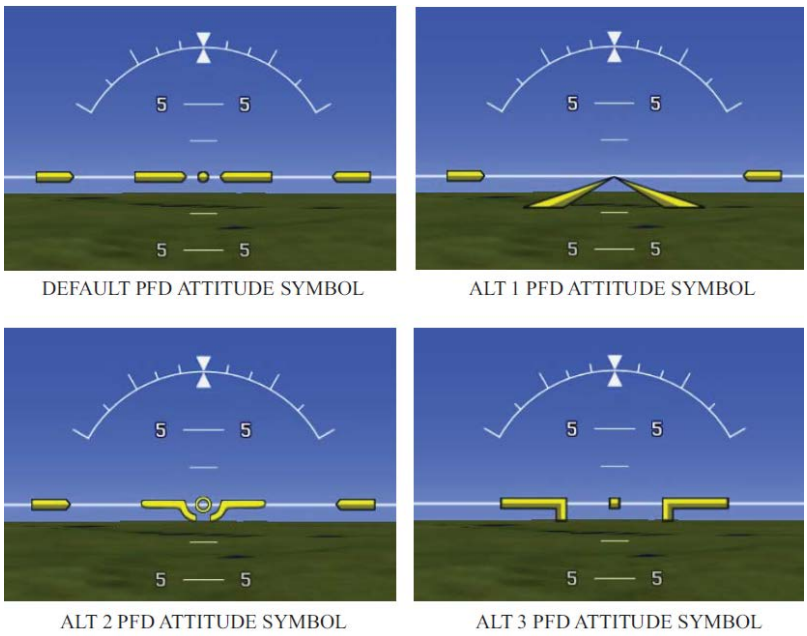


Figure 31-54 PFD Attitude Symbols

Pitch Offset–Allows the pitch offset to be Disabled or User Selected (default). When disabled, the pitch offset is not able to be changed as a user setting.

Roll Display–Allows setting the Roll Display to either Ground Pointer or Sky Pointer.The Ground Pointer configuration displays both the roll arc and the pitch ladder anchored to the horizon and the roll pointer beneath the roll arc pointing to the present roll angle. The Sky Pointer configuration displays the pitch ladder moving with the horizon, but the roll arc remains fixed and centered in the display. The roll pointer beneath the roll arc moves with the horizon and in the opposite direction of aircraft roll.

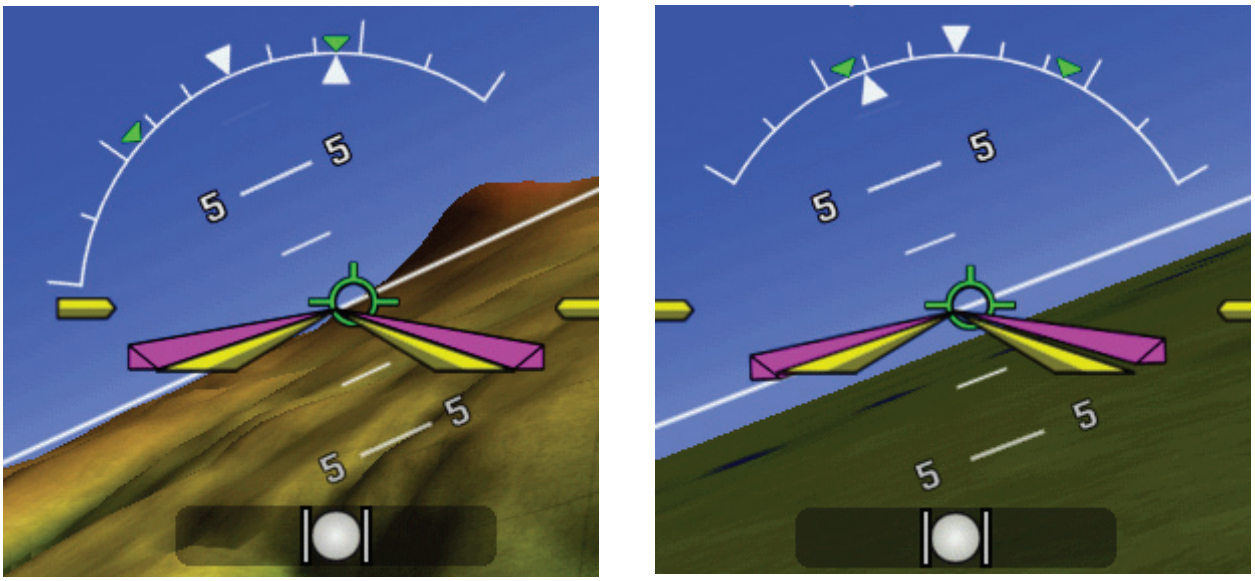


Figure 31-55 Roll Display Symbols

Vertical Speed Indicator Range–Allows the range of the vertical speed tape to set to +/- 2,000 fpm, +/- 3,000 fpm, or +/- 4,000 fpm.

Lateral Deviation Reverse Sensing Compensation–When set to Enabled, the lateral deviation indicator on the PFD will reverse CDI indications when aircraft heading is more than 107° left or right from the selected course.

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 Touch Pilot's Guide (190-0174-00) for more info.

Heading Bug Auto Sync Mode–Requires installation of an autopilot. When set to Enabled, the selected heading bug can optionally be automatically synchronized to the current aircraft heading when the autopilot is being used for navigation (see G3X Pilot's Guide for more information).

Trim/Flap Position Display–Allows installer to hide or show trim and flap indications on the PFD. If set to User Selected, the pilot can toggle these indications on and off in normal mode.

Miscompare Monitoring (see Figure 31-56)– Selecting ADAHRS + SFD will enable Miscompare (differences in heading, attitude, airspeed, etc.) Monitoring between an SFD (Standby Flight Display, consisting of one or more G5 units) and an ADAHRS LRU (GSU 25 or GSU 73).

In a system with a single ADAHRS LRU, selecting ADAHRS + SFD will enable the system to constantly perform Miscompare Monitoring between the standby flight display and the ADAHRS. In a system with multiple ADAHRS LRUs, selecting ADAHRS + SFD will enable the system to perform Miscompare

Monitoring only if the system performance degrades to the equivalent of a single ADAHRS (due to the loss of all other ADAHRS LRUs).

When an miscompare condition between SFD and ADAHRS is detected, a CAS message will be displayed characterizing the miscompare condition. If an attitude miscompare is detected, ESP will be inhibited and the CAS message "ESP INHIBIT" will be displayed. The autopilot will remain usable during this condition.

If an airspeed miscompare is detected, airspeed ESP protection will be inhibited, and the CAS message "NO ASPD ESP" will be displayed. Other ESP protection modes will operate normally.



Figure 31-56 Miscompare Monitoring Settings

Auto Declutter - Determines whether non-essential information will be removed from the PFD display when the aircraft is in an unusual attitude. Set to “Disable” to retain all information on the PFD during aerobatic maneuvers.

Baro Setting Reminder - Provides CAS message when aircraft is determined to be on ground and baro altitude diverges from field elevation by more than 100 feet.

31.4.24 GPS Configuration Page

GPS Receiver Configuration

The GPS Receiver Configuration 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.

'No GPS Antenna Connected' may also be selected if a GPS 20A is used for GPS position. A GPS 20A provides GPS data to the GDU(s), so the GDU(s) do not require being connected to a GPS antenna.

NOTE

For installations w/out a GPS 20A, 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 4XX/5XX, GNS 480, or GTN 6XX/7XX series unit, see Section 25.2 or Appendix G.2). Accuracy will be degraded when using an external GPS navigator.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the GPS Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

GPS Flight Plan Configuration

If an external GPS navigator (see Section 2.5.1) 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).



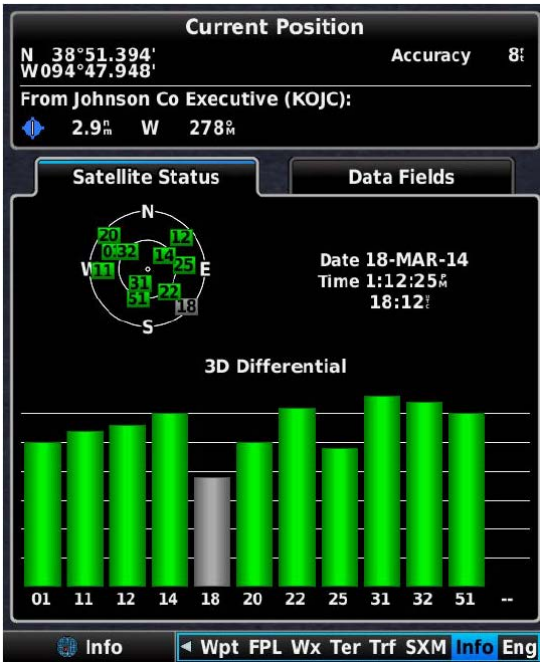
31.4.24.1 GDU 4XX Test Procedure

GPS Receiver Signal Acquisition Test:

1. Power on unit (normal mode) and use the Touch Panel or a Move Selector Knob to select the Info Page.



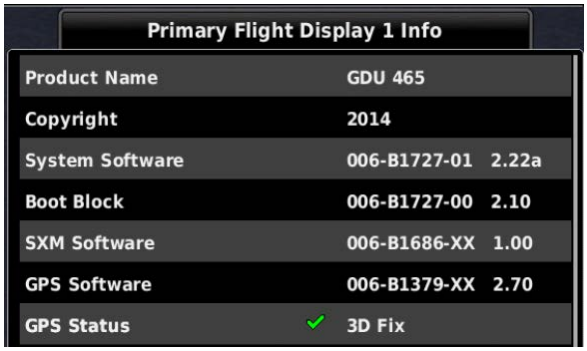
2. Verify the GPS receiver is functional and able to calculate its present position.



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. After the preceding signal acquisition test has been completed successfully, perform the following steps:

1. Power on the unit in configuration mode and use the Touch Panel or a Move Selector Knob to view GPS Status on the System Information Page.

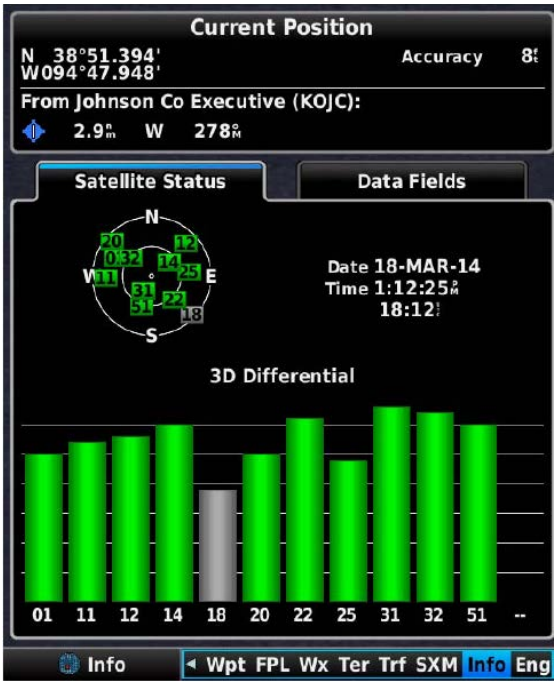


2. Monitor GPS status on the Main Page. Possible GPS status indications include:
   - No Antenna
   - Searching the Sky
   - AutoLocate® global positioning indicator
   - Acquiring
   - Lost GPS Fix
   - No GPS Fix
   - 2D GPS Fix
   - 2D Differential
   - 3D GPS Fix*
   - 3D Differential*

   *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 4XX 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.



31.4.25 Navigation Configuration Page

Smart Glide™ engine-out navigation - Enables/Disables Smart Glide in a G3X Touch installation. This selection will not be present if either Vg or Sink Rate at Vg are not entered in the Aircraft Menu.

NOTE

If enabling Smart Glide on a G3X Touch system that is installed with a GTN XI series navigator, Smart Glide should remain disabled in the GTN Xi configuration menu. All Smart Glide configuration is to be handled through the G3X Touch.

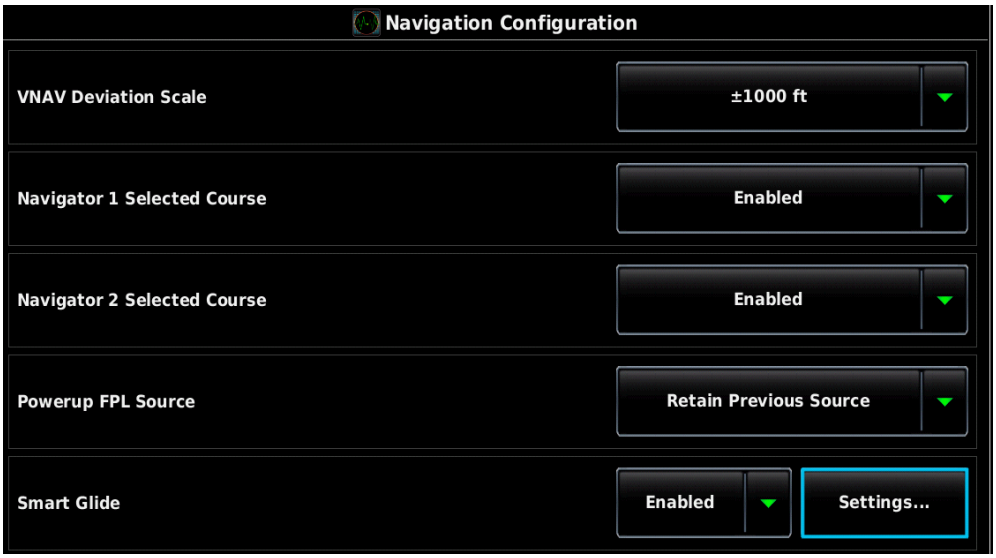
Smart Glide Settings:

- Runway Surface - Select that runway surface type the aircraft is capable of using.
- Minimum Runway Length – The minimum runway length the aircraft is capable of using.
- Circling Direction - Can be set to always initiate left or right hand turns during a glide descent. If left set to Auto, the system will choose the appropriate traffic direction if that information is available for a specific airport. If that information is not available, traffic direction will be determined based upon the orientation of the aircraft to the runway approach end.

VNAV Deviation Scale–Selects the range of distance represented on the VNAV Deviation Scale. Available selections are +/-500 ft and +/-1000 ft.

External Navigator Selected Course–Determines whether the display(s) can control the selected course for an external navigator. Available selections are Enable or Disabled. When Enabled, the G3X Touch can set the selected course (using the G5/GDU). Set to Disabled only if the navigator is connected to an external mechanical CDI/HSI.

The G3X Touch Internal GPS navigator can always be used to set the selected OBS course, regardless of configuration settings.



31.4.26 Audio Panel Configuration Page

The G3X Touch system supports interfacing to compatible Garmin audio panel LRUs. The configuration of the GMA™ 245 audio panel (panel mount), GMA 245R (remote), GMA 342, and GMA 345 are supported on this page. Table 31-18 lists and describes the available audio panel configuration settings.

NOTE

The GMA 342 or GMA 345 contains a limited interface to the G3X Touch. When interfaced to the GDU 4XX, the selected COM is displayed in the data bar and the marker beacon OMI annunciations are displayed on the PFD.

Table 31-18 Audio Panel Configuration Settings

Selection	Description
Audio Panel Type	Used to select the audio panel type as: None - No audio panel is configured. GMA 245 - Configures the GMA 245 panel mount audio panel. GMA 245R - Configures the GMA 245R remote audio panel. GMA 342 - Configures the GMA 342 panel mount audio panel. GMA 345 - Configures the GMA 345 panel mount audio panel.
On-Screen Controls (GMA 245 only)	The GDU audio panel controls may be accessed by either the audio panel controls on the data bar or the “Audio Panel” button on the GDU’s normal mode main menu. Allows removing the audio panel controls from the GDU data bar for the GMA 245 since the audio panel may be controlled using the actual audio panel. Not available for the GMA 245R since the GDU is the only means to control and see the state of the audio panel. Sets the visibility of the audio panel controls on the GDU data bar as: Hide - The audio panel controls are hidden on the data bar. Show - The audio panel controls are displayed on the data bar. Note that regardless of this selection, the “Audio Panel” button is always displayed on the GDU normal mode main menu to allow controlling the audio panel using GDU controls.

Table 31-18 Audio Panel Configuration Settings

Selection	Description
COM 1/MIC 1 COM 2/MIC 2	Allows the selection of monitoring COM, and MIC for transmitting, for the COM radios. Note that both COMs may be selected for monitoring simultaneously, but only one COM may be selected for transmitting. **Indicator Type** Sets the MIC and COM indicators of the audio panel controls on the GDU data bar as: Arrow - Appears as triangle to point to the selected radio on the data bar. For example, this implies COM 1 is on the left and COM 2 is on the right.  Square - Displays selected COM radio without implying the radio's location.  Enabled/Disabled (COM 2 only, GMA 245R only) - Used to enable (show) or disable (hide) the audio panel page's COM 2 controls when COM 2 is not configured using the COM Radio configuration page. Note that this is not an option with the GMA 245 since COM 2 is always displayed on the actual audio panel.
NAV 1 NAV 2	Allows the selection of monitoring the navigation radios when the NAV radio is enabled using the "Enabled/Disabled" selection. **Title** Used to set the titles of the NAV radios on the audio panel page when the NAV radio is enabled using the "Enabled/Disabled" selection. Enabled/Disabled (GMA 245R only) - Used to enable (show) or disable (hide) the audio panel page NAV controls.
AUX 1 AUX 2 AUX 3	Allows the selection of monitoring the auxiliary radios when the AUX radio is enabled using the "Enabled/Disabled" selection. **Title** Used to set the titles of the AUX radio controls on the audio panel page when the AUX radio is enabled using the "Enabled/Disabled" selection. **Volume -** Used to set the volumes for the AUX radios when the AUX radio is enabled using the "Enabled/Disabled" selection. Enabled/Disabled (GMA 245R only) - Used to enable (show) or disable (hide) the audio panel page AUX controls.

Table 31-18 Audio Panel Configuration Settings

Selection	Description
Master Squelch	Used to set the audio panel master squelch level from 0% (open, audio is always heard) 100% (squelched, no audio). Master squelch functions to prevent low level noise from being passed to the headset ear speakers, this is known as “squelching” or muting the audio. To “break” or “open” squelch means that enough audio signal is present the signal is passed through and can be heard. Increasing this setting increases the signal level required to break/ open squelch. If needed, adjust the master squelch level so the audio background noise is muted. This setting only applies to radio audio inputs (i.e. COMs, NAVs, and AUXs) and alert inputs. This setting does not affect intercom.
Alert (1-4) Volume	Used to set the audio panel alert volumes for alerts 1–4.
Pilot Intercom Volume (GMA 245R only)	Used to set the volume for the pilot intercom. Note that pilot intercom volume can also be set in normal mode
Copilot Intercom Volume (GMA 245R only)	Used to set the volume for the copilot intercom. Note that copilot intercom volume can also be set in normal mode
Passengers Intercom (GMA 245R only)	Used to set the volume for the passenger intercom when the passenger intercom is enabled using the “Enabled/Disabled” selection. Note that on the audio panel page, intercom volume controls are only present for the GMA 245R. For the GMA 245, intercom volume is controlled using the knobs on the actual audio panel. Enabled/Disabled - Used to enable (show) or disable (hide) the audio panel page passenger intercom controls.
Active COM Rx Monitor Mute	Select Enabled to mute the monitored COM radio when audio from the COM selected for transmission is heard.
Radio Mutes Intercom	Select Enabled to mute intercom audio when audio from the COM selected for transmission is heard.
Alerts Mutes Music	Select Enabled to mute music when alert audio is heard.
Music During Pilot ISO	Select Enabled to allow pilot and copilot to hear selected music when PILOT or CREW isolation mode is active.
Cockpit Noise Level	Select Enabled to reduce intercom background noise in very high noise cockpit environments.

Table 31-18 Audio Panel Configuration Settings

Selection	Description
Radio 3D Audio	3D Audio is useful when multiple audio sources are present. 3D audio processing creates the illusion that each audio source is coming from a unique location or seat position by using different responses in each ear. Because this feature uses different signals for left and right channels, it requires wiring for stereo intercom and stereo headsets. If 3D audio is activated when mono headsets are in use, the listener will still hear all audio sources; however, there is no benefit from location separation. When set to Enabled with a single COM selected, the listener hears the audio source at the 12 o'clock position. If both COMs are selected, the listener hears COM 1 at 11 o'clock and COM 2 at the 1 o'clock position.
Intercom 3D Audio	Select Enabled to allow the listener to hear others in the intercom positioned relative to their seating location.
Speaker	Turns the speaker on/off when the speaker is enabled using the "Enabled/Disabled" selection. **Volume** Sets the volume for the speaker when the speaker is enabled using the "Enabled/Disabled" selection. **Enabled/Disabled (GMA 245R only)** Enable (show) or disable (hide) the audio panel page speaker control.
Music 1 Title Music 2 Title (GMA 245 only) Music 1 Music 2 (GMA 245R only)	**Title** Used to set the titles of the music source selections on the audio panel page when the music source is enabled using the "Enabled/Disabled" selection. **Enabled/Disabled (GMA 245R only)** Enable (show) or disable (hide) the audio panel page music controls.

31.4.27 COM Radio Configuration Page

The GDU 4XX supports on-screen control of up to two VHF communication radios (COM1 and COM2). The Connection setting informs the system how each of the two supported com radios is connected. Select None if on-screen radio control for a particular radio is not desired or no radio is installed. Network Radio LRU 1 and Network Radio LRU 2 settings support Garmin radio LRUs that are connected through the CAN bus, (GTR 20 and GTR 200) see Table 31-19.

If an RS-232 format that supports remote com radio data has previously been configured, additional RS-232 connection methods will appear in the list (for example, PFD1 RS-232 2). On-screen com radio control is supported by the following RS-232 formats: Garmin VHF Comm, Garmin VHF Nav/Com, and MapMX. The specific radio functionality that can be controlled using an RS-232 connection depends on the features supported by the software version used by the com radio (Table 31-19).

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the COM Radio Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).



The Connection and Active Frequency selections are displayed when any type of communication radio is connected, these selections are described as follows:

Connection - Used to select which connection the communication radio is connected to.

Active Frequency - Displays the active frequency currently tuned on the selected communication radio.

Table 31-19 COM Radio Supported Functions

Garmin COM Radio	Connection to GDU 4XX	COM Radio SW Version	G3X Touch Interface Functions Supported					
			Display Active & Standy COM Frequencies	Tune Standby COM Frequency	Swap COM Frequencies	Change COM Volume	Toggle COM Squelch	Toggle MON Mode
SL30/ SL40	RS-232	All	X	X				
GTR 20	CAN Network	All	X	X	X	X	X	X
GTR 200	CAN Network	All	X	X	X		X	X
	RS-232	All	X	X	X		X	X
GTR 225/ GNC 255	RS-232	2.10 or Higher	X	X	X	X	X	X
		Other Versions		X				
GTN 635/ GTN 650/ GTN 750	RS-232	6.00 or higher	X	X	X	X	X	X
		Other Versions						
GTN Xi	RS-232	All	X	X	X	X	X	X
GNC 215/ GTR 205	RS-232	All	X	X	X	X	X	X
GNC 355	RS-232	All	X	X	X	X	X	X
GNS 4XX/ GNS 5XX	N/A	N/A						
GTR 205X/ GTR 205XR	CAN Network	All	X	X	X	X	X	X

31.4.27.1 GTR 20 Communication Radio Configuration

For installations using the GTR 20 communication radio, the available options are described in the following text.

COM Volume - Used to set the received audio volume.

Emergency Volume - Used to set the COM radio volume that will be used if the GTR 20 has automatically tuned the emergency frequency as a result of losing communication with the G3X system.

Transmit Sidetone - Used to set the volume of the sidetone audio during transmit.

Microphone Gain - Increases or decreases the percent of transmitted modulation which affects the volume of the received signal, also affects own transmit sidetone.

RF Squelch - Used to set the received signal level required to break squelch. Increasing this setting increases the signal level required to break squelch. Receiver squelch can be set from 0-10, a setting of 0 (default) represents the factory calibration.

MON Mode On Swap - Setting to Preserve MON will keep the Monitor feature ON when pressing the Frequency Transfer Key. Setting to Disable MON will turn off the Monitor feature when the Frequency Transfer Key is pressed.

Discrete Input 1/2 - Used to configure the operation of the discrete inputs per the following listed options:

- Disabled - Discrete input is disabled
- Pilot ICS Key - Discrete input activates the pilot ICS function. Auto squelch and manual squelch are overridden when the Pilot ICS Key is asserted.
- Copilot ICS Key - Discrete input activates the copilot ICS function. Auto squelch and manual squelch are overridden by Copilot ICS Key selection.
- Frequency Swap - Discrete input activates the frequency swap function (a beep tone is sounded). If the discrete input is active for more than two seconds, the emergency frequency will be tuned.
- Toggle MON Mode - Discrete input toggles the state of the MON function

Internal Intercom - Used to enable or disable the internal intercom. The internal intercom is intended for use in aircraft where the GTR 20 is the radio and there is no separate audio panel or intercom. The internal intercom must be disabled when used with a separate audio panel or intercom, and/or in a dual-radio installation. If the communication radio's internal intercom is enabled, the following additional options are available.

Intercom 3D Audio - When enabled, this option makes the audio sound as if the pilot and copilot are sitting side by side. The Pilot 3D Position option is then used to select which side of the airplane the pilot sits on for the purposes of the simulated 3D effect.

Pilot 3D Position - Select Pilot on Left or Pilot on Right to select pilot location. When Pilot on Right is selected, the copilot is positioned to the left of the pilot for 3D audio processing. The Pilot 3D Position selection only appears if Intercom 3D Audio is enabled.

Cockpit Noise Level - For very high noise cockpit environments select the High Noise setting, otherwise select Normal.

Audio Out Gain - When the intercom is enabled, RECEIVER AUDIO OUT will output everything the pilot hears in the headset ear speakers with the exception of music audio. If RECEIVER AUDIO OUT is used as the source of audio to a recording device then adjust the AUDIO OUT GAIN setting for desired audio level at the recording device.

AUX 1/2 Input Volume - If AUX1 or AUX2 inputs are used, these settings allow adjusting the sensitivity of the AUX inputs.

AUX 1/2 Input Squelch - AUX SQ prevents low level noise from being passed to the headset ear speakers. Adjust the AUX SQ level so the audio background noise is muted. Note that adjusting the AUX SQ to a high level may squelch the desired audio.

AUX 1/2 Mutes Music - These settings when enabled, will mute the music input if AUX1 or AUX2 input levels are sufficient to break aux squelch.

31.4.28 NAV Radio Configuration Page

For installations using a NAV radio, the available options are described in the following text.

None - (Default setting) Select this setting if installation includes no NAV radios.

NAV 1 - Used to configure the installed NAV radio as NAV 1.

NAV 2 - Used to configure the installed NAV radio as NAV 2.

NAV 1 +2 - Used to configure the installed NAV radios as NAV 1 and NAV 2.



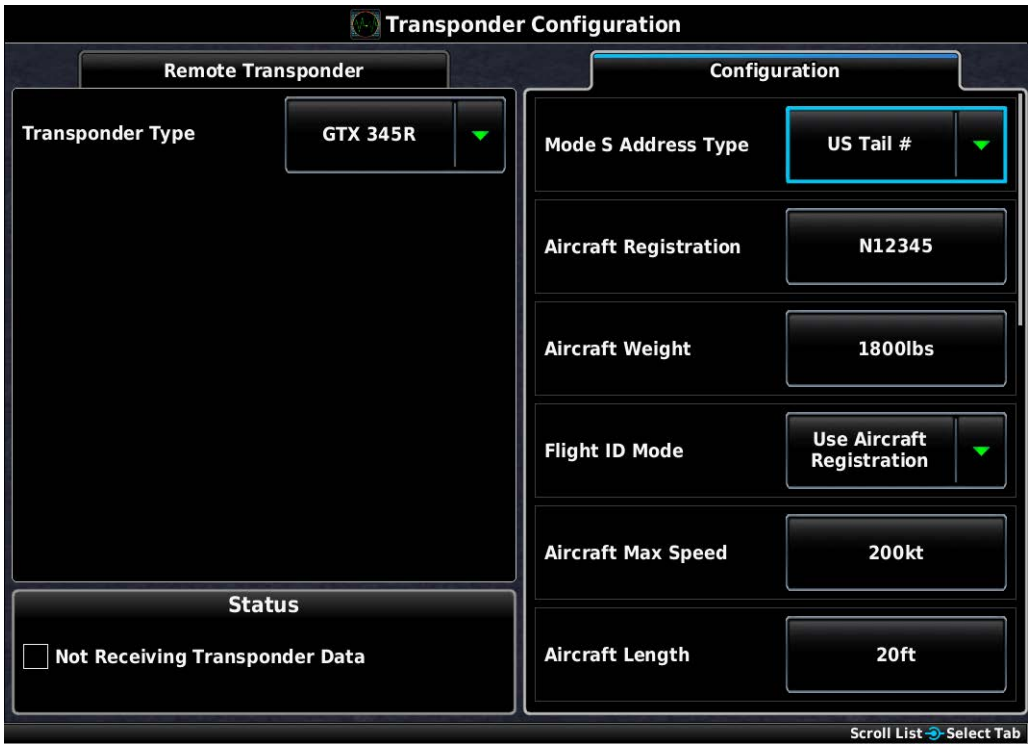
To enable NAV Tuning on a GDU 4XX (PFD1), in Configuration mode:

1. On the RS-232 Configuration Page, configure an RS-232 port to "Garmin VHF Nav/Comm" or "MapMX" format for a supported radio.
2. On the ARINC 429 Configuration Page, configure an ARINC 429 input to "Garmin VOR/ILS" format for a supported NAV radio.
3. On the NAV Radio Configuration Page, configure which NAV Radio Sources are expected in Normal mode (NAV1, NAV2, or NAV1 + 2) as explained above.

31.4.29 Transponder Configuration Page

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

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Transponder Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the applicable Transponder Type.
3. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
4. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
5. Press the Back key to return to the Configuration Mode page when finished (if desired).

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

Mode S Address Type: 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.

Mode S Address: Enter the applicable Mode S Address

Aircraft Registration: Enter the applicable Aircraft Registration number

Flight ID Mode: 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. Can also be set to Use Aircraft Registration if US Tail # was selected as the Mode S Address Type.

Flight ID: If flight ID Mode is set to Other, this field appears to allow entry of Flight ID.

Aircraft Max Speed: Enter aircraft maximum speed.

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.

Enhanced Surveillance: GTX 23/23ES/33/33ES only. 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).

Antenna Diversity: GTX 335D, GTX335DR, GTX 345D, GTX345DR only. When set to ENABLED, dual transponder antennas are active.

Antenna Cable Loss - GTX 335D, GTX335DR, GTX 345D, GTX345DR only. Cable loss across antenna cables to each antenna in a diversity installation, top and bottom.

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.

HSDB Devices: This field is only available when Transponder Type is configured for a GTX 345, 345R, or 45R. Used to select which device(s) the GTX will communicate with (GTN and/or GTS) by HSDB.

RS-232 Ports 2-4: GTX 35R/45R/335R/345R units only.

The available selections are:

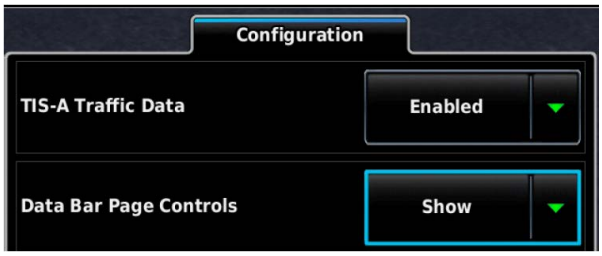
Selection	Description
None	GTX RS-232 port not used
ADS-B+ Format 1	GPS position input from a TSO GPS source (9600 baud)
ADS-B+ Format 2	GPS position input from a TSO GPS source (38400 baud)
Connext Format 1 (GTX X45 only)	Connext weather and traffic data for a G3X Touch system
Connext Format 3 (GTX X45 only)	Connext weather and traffic data for a Flight Stream 110/210
Connext Format 4 (GTX X45 only)	Connext weather and traffic data for a G3X Touch system. Connext Format 4 is a higher baud rate version of Connext Format 1. Must use GDU serial setting of Connext 115200 for compatability
GNS (GTX X45 only)	Weather data to / GPS position input from a GNS

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.

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 Receive Capability: UAT should be enabled (green indicator) if the aircraft is equipped with a receiver that provides ADS-B In capability using the 978 MHz UAT frequency, such as the GDL 39/5XR.

1090ES should be enable (green indicator) if the aircraft is equipped with a receiver that provides ADS-B In capability using the 1090 MHz frequency, such as the GDL 39/5XR.

Position Integrity: Refers to the integrity level of the separate TSO WAAS GPS input that can be connected to the transponder. Set to 1E-7 when a certified GNS/GTN/GPS unit or GPS 20A is providing ADS-B Out+ to the transponder. Set to "VFR GPS" if none of these devices (certified GNS/GTN/GPS unit or GPS 20A) are connected to the transponder.

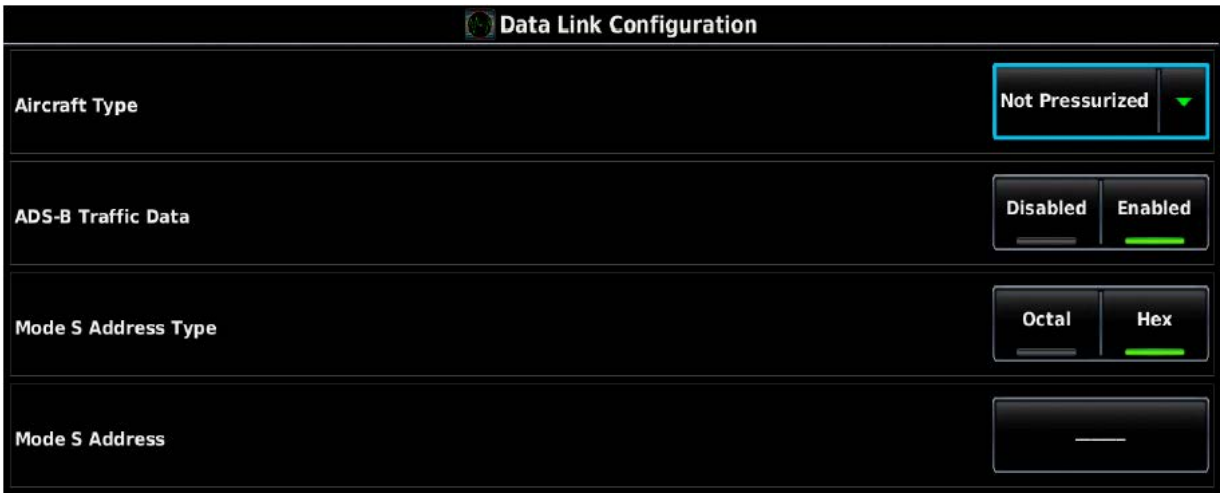
NOTE

A "Configuration Error" indication is most commonly the result of one or more items on the transponder configuration page which have been left un-configured. For proper transponder operation, all items on this page must be properly configured.

31.4.30 Data Link Configuration Page

The Data Link Configuration Page is only displayed when the unit is configured to communicate with and has successfully communicated with a GDL 39/5XR (see Section 25.2) 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.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Data Link Configuration Page.

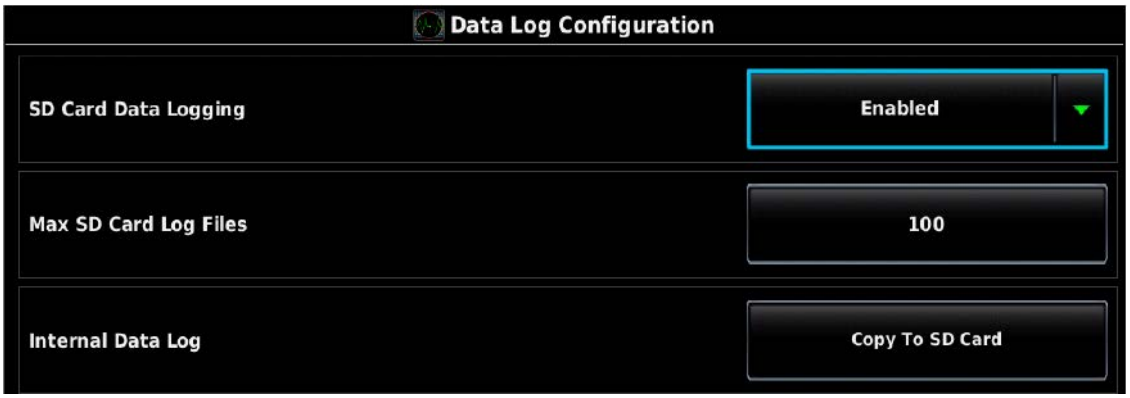


2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
4. Press the Back key to return to the Configuration Mode page when finished (if desired).

31.4.31 Data Log Configuration Page

The Data Log 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.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Data Log Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select Enabled or Disabled for SD Card Data Logging. Use Max SD Card Log Files to set the maximum number of log files to be stored (press the Clear button to display "----", this setting will store an unlimited number of files.
3. Press the Back key to return to the Configuration Mode page when finished (if desired).

The Data Log Configuration page also allows the user to export the internally stored flight data to the "fdr_log" folder on an SD card. If the Internal Data log "Copy To SD Card" button is pressed, the high frequency internally stored flight data will be exported to the SD card if one is inserted into the card slot. These files can be opened in Excel for viewing.

1. In configuration mode, use the Touch Panel or Move Selector Knob to select Data Log Configuration Page.
2. Use the Touch Panel or a Move Selector Knob to select Copy To SD Card Data.



3. Wait for the system to finish exporting the data to the SD card (text will change to "Export Complete"), press Cancel to terminate if desired.



4. Press the Back key to return to the Configuration Mode page when finished (if desired).

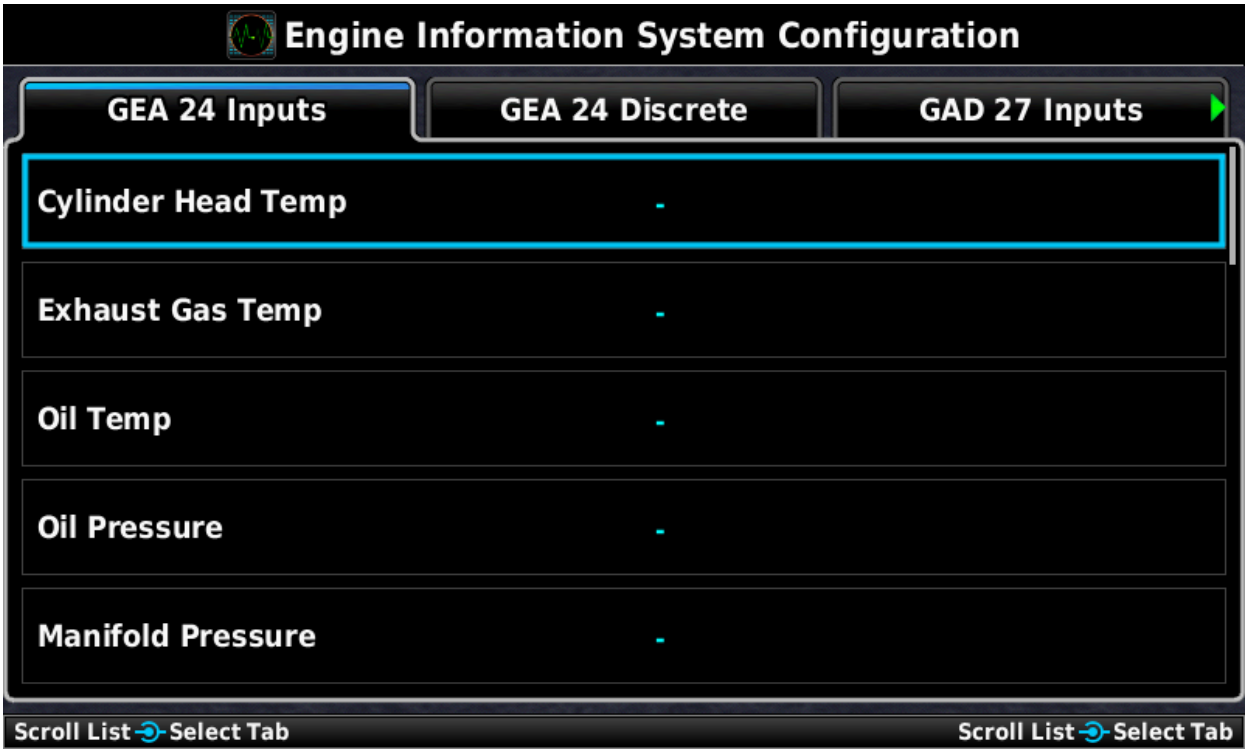
31.4.32 Engine and Airframe Configuration Page

The Engine Information System Configuration section of the Engine and Airframe Configuration Page allows enabling/disabling and customization of the engine/airframe input options that make up the EIS display and the Engine Page.

NOTE

The GAD 27 Inputs tab will only be displayed if the Electrical Control System is enabled from the LRU Configuration Page.

1. In configuration mode, use the Touch Panel or a Move Selector Knob to select the Engine Configuration Page.



2. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change.
3. Use the Touch Panel or a Move Selector Knob to select the desired configurable item and make the desired change(s) (Sections 31.4.32.3 - 31.4.32.35).
4. Enter data (where applicable) using the Keyboard (Section 31.4.1) or Slider Bar (Section 31.4.2).
5. Press the Back key to return to the Configuration Mode page when finished (if desired).

31.4.32.1 Engine/Airframe Sensors

Each of the sensors must be correctly installed (Section 22) and configured before use. The Engine inputs being monitored are displayed as gauges on the EIS display (Figure 31-57) and also on the Engine Page.

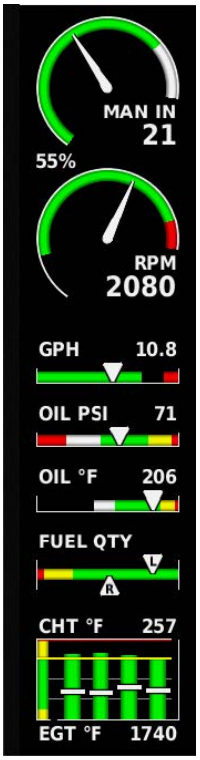


Figure 31-57 EIS Display (Engine Bar)

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).

RPM Oil Temperature Oil Pressure Fuel Quantity

Other gauges will be displayed as space permits based on a pre-defined priority and user selections. Making use of "Text Only" EIS gauges greatly increases the amount of information that can be displayed on the EIS strip. Refer to Section 31.4.32.3 for information about configuring the visibility of optional gauges on the EIS display.

31.4.32.2 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 Engine Page. A list of analog, digital, and discrete inputs appropriate for the connected EIS LRU type (GEA 24, Figure 31-58 or GSU 73, Figure 31-61) will be displayed.

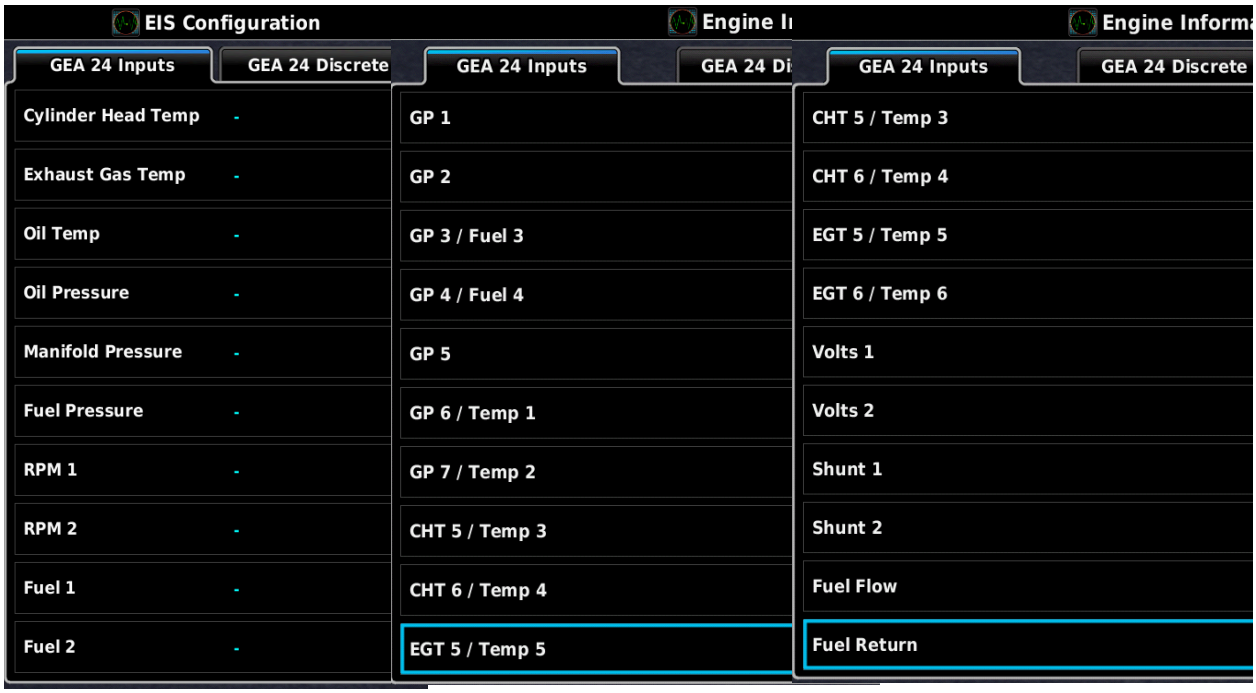


Figure 31-58 GEA 24 Engine/Airframe Input Configuration Page



Figure 31-59 GAD 27 Engine/Airframe Input Configuration Page

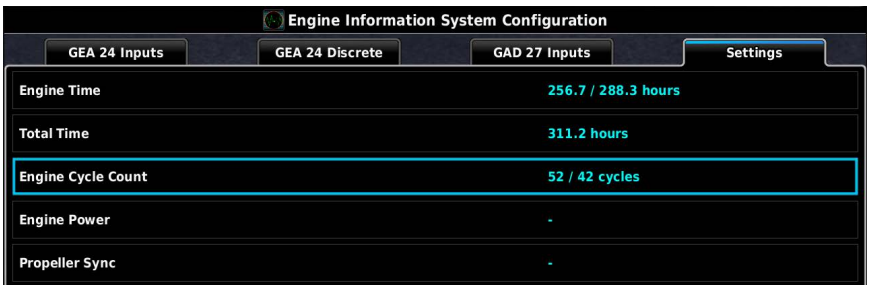


Figure 31-60 EIS Configuration Settings Page



Figure 31-61 GSU 73 Engine/Airframe Input Configuration Page

NOTE

For certain 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 EIS Input Calibration for calibration information, Engine Time Configuration, and Total Airframe Time Configuration information.

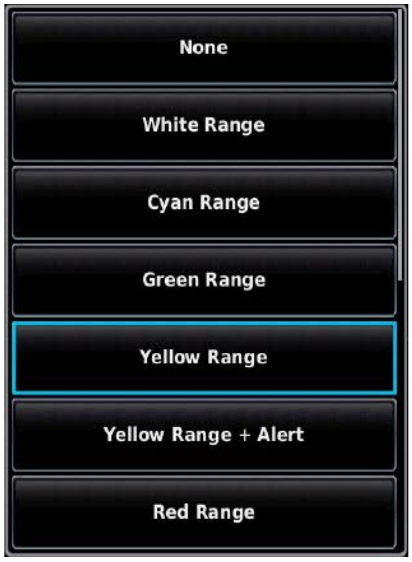
31.4.32.3 EIS Configuration Options

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 Inputs, 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.

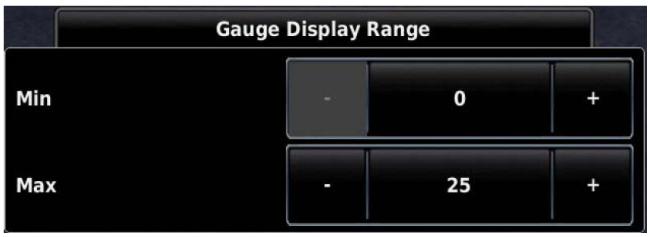
Gauge Markings – Used to select the desired color displayed on the applicable gauge. The Yellow Range + Alert settings will issue a CAS (Crew Alerting System) on-screen alert anytime the value is within that range. The Red Range + Alert settings will issue a CAS audible and on-screen alert anytime the value is within that range. The Invisible Range + Alert setting will issue a CAS message anytime the required thresholds are met (see Section 31.4.32.27 for advanced gauge configuration options). 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
White Line	Cyan Line	Green Line	Yellow Line
Red Line	Invisible Range	Invisible Range + Alert	

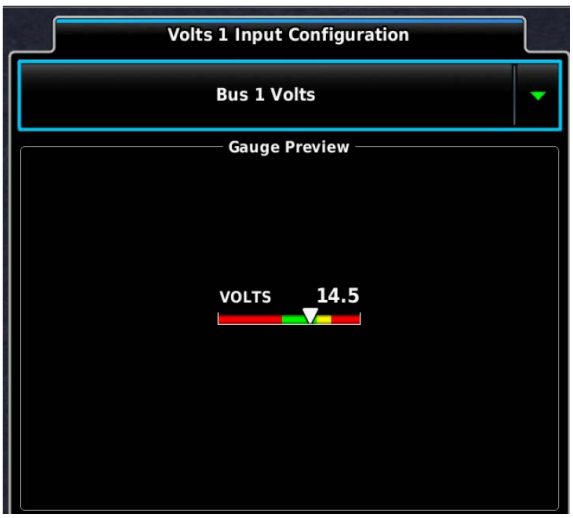




Gauge Display Range – The Gauge Display Range allows for setting the minimum and maximum values of each gauge.



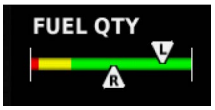
The below Gauge Preview of the Volts 1 Input Configuration page shows an example of the Gauge Display Range and Gauge Markings settings and the resultant gauge.



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 Engine Page).

When two fuel gauges with the same gauge ranges are configured, the gauges can be displayed in either of two formats:

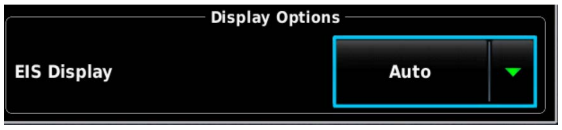
- Normal: Displays both fuel gauges on a single bar graph with pointers on top and bottom of the gauge (shown below).



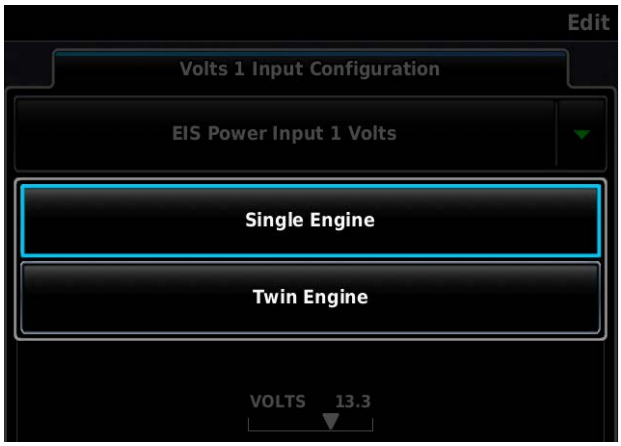
- Separate: Displays each fuel gauge as a separate shorter bar graph with a digital display for each tank (shown below). This option widens the EIS display.



EIS Display – The Hide setting removes the item from the EIS display, although the item will be displayed on the Engine page. The Auto setting displays items based upon hierarchy and the availability of EIS display space. If a particular gauge is not visible on the EIS display, other gauges may be set to "Hide" in order to allow the desired gauge to appear instead. The "Text Only" setting allows for a text based gauge to be assigned to the item, increasing available room on the EIS strip. *RPM cannot be displayed in the Text Only format.



Twin-Engine Configuration – If two EIS LRUs are configured, each engine-related parameter can be configured as either "Single Engine" or "Twin Engine". If "Single Engine" is selected, data for that parameter will be acquired from EIS LRU #1, and displayed using a normal gauge. If "Twin Engine" is selected, data for that parameter will be acquired from both EIS LRU #1 and #2, and presented on the display using a dual gauge. The gauges for both engines will use the same configuration. Airframe-related parameters such as fuel quantity or trim/flap position do not support twin-engine display, i.e. these parameters are supported on EIS LRU #1 only.



EIS Input Calibration - Some EIS inputs require calibration to convert from raw input values (typically voltage or frequency) to calibrated values for display. The most frequently used page for EIS input calibration allows the installer to specify a calibration curve from a series of raw and calibrated values.



Figure 31-62 Engine Input Calibration Page (Example)

In general, the procedure for calibrating EIS inputs is as follows:

1. From the EIS input configuration page, press the Calibrate button to display the Calibration Page.
2. Enter values for Calibrated Value and Input Voltage (or Input Frequency, for digital inputs).
3. Press the Store Calibration Point button to add a calibration point.
4. Press the Save button to and exit the calibration page.
5. On the EIS input configuration page, press the Save button to store calibration data.

The greater number of calibration points that are used, the more accurate the calibration will be. A yellow line on the graph indicates potentially incorrect/invalid calibration.

Refer to the following sections for additional information about EIS input calibration:

- Fuel Quantity Section 31.4.32.12
- Trim/Flap Position Section 31.4.32.16
- Bus Voltage Section 31.4.32.14
- Current Section 31.4.32.15
- Custom EIS Inputs Section 31.4.32.25

NOTE

User-defined ("Custom") EIS inputs requiring calibration will display "---" in place of the number if the input value exceeds the limits of the installer-defined calibration. This can be avoided by entering calibration points that exceed the expected input range.

31.4.32.4 RPM

The following sensors can be configured for the RPM 1 input on the GEA 24, or the RPM input on the GSU 73:

- 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)
- Jabiru Alternator RPM (6 pulses per revolution)
- JPI 4208XX - Magneto Port RPM Sender (4- or 6- cylinder)
- Rotax Trigger Coil RPM
- UMA 1A3C Mechanical RPM Sender
- UMA T1A9 Magneto Port RPM Sender (4- or 6-cylinder)
- Custom Sensor

NOTE

External components are required when using the Rotax Trigger Coil configuration with the GSU 73 (see Figure 29.3).

NOTE

Magneto P-Lead is an option for RPM, as MOD Level 2 GEA 24 or any GEA 24B units are capable of being connected to a magneto P-Lead. If interfacing to a magneto, a series resistor must be included as shown in Figure 28-4. Only a MOD Level 2 GEA 24 can be connected to a P-Lead. Do not connect MOD Level 1 or MOD Level 0 units to a P-Lead. The MOD Level status can be determined by checking the serial tag on the unit. If a P-Lead is connected to a non-MOD Level 2 GEA, an "Engine Interface 1 configuration error" System Message will be generated, and configuration status will be reported to be in error in the system information menu.

NOTE

Surefly TACH2 Module can be used like a P-Lead input when a Surefly Ignition Module is installed. Magneto P-Lead would be selected, and 1 pulse/rev is used for 4 cylinder engines, while 1.5 pulse/rev is used for 6 cylinder engines.

Custom: These options allows the installer to enter up to 8 points of frequency-to-RPM calibration, using any RPM sensor that has a known frequency output. The custom RPM configurations accept frequency values up to either 500 Hz or 1 kHz; the lower-frequency configuration is better suited to noisy RPM signals. Custom RPM configurations also support engine speed that display in percent instead of RPM. Refer to pin description in Section 25 for supported digital signal characteristics.

NOTE

The Sandia ST26 tach converter is required to support turbine engine RPM.

FADEC: The GEA 24 can be configured to monitor RPM data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- Lycoming (iE2)
- ULPower

31.4.32.5 RPM 2

A second RPM input is provided (RPM 2 input on the GEA 24, CAP FUEL 1 / RPM 2 on the GSU 73).

For piston engines, a second RPM input from an electronic ignition system can be configured. 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.

For turbine engines, select one of the "Custom" configurations to display a second RPM gauge. Refer to pin description in Section 25 for supported digital signal characteristics.

NOTE

.The Sandia ST26 tach converter is required to support turbine engine RPM.

31.4.32.6 Manifold Pressure

The following sensors can be configured for the Manifold Pressure input on the GEA 24 or GSU 73:

- Garmin GPT 30A (0-30 PSI or 0-61” Hg)
- Kavlico P500-30A (0-30 PSI or 0-61” Hg)
- Kavlico P4055-30A (0-30 PSI or 0-61” Hg)
- Kavlico P4055-5020-1
- UMA 1EU50A (5-50” Hg)
- UMA 1EU70A (5-70” Hg)
- Custom Sensor

Engine Torque: This input provides for display of torque for turbine engine applications using common torque pressure sensors. This input allows the use of a Garmin oil pressure sensor, or if "Engine Torque (Custom)" is selected the installer can enter up to 8 points of voltage-to-torque calibration.

Custom: This option allows the installer to enter up to 8 points of voltage-to-pressure calibration. See pin description in Section 24 for allowable input voltage range.

FADEC: The GEA 24 can be configured to monitor manifold pressure data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- Lycoming (iE2)
- ULPower

The GEA 24 Manifold Pressure input is also used to measure engine torque for turbine engine applications. Refer to Section 31.4.32.17 for information.

31.4.32.7 Oil Pressure

The following sensors can be configured for the Oil Pressure input on the GEA 24 or GSU 73:

- Garmin GPT 150G (0-150 PSI)
- Beech 102-389017
- Kavlico P4055-150G (0-150 PSI)
- Kavlico P4055-5020-4
- UMA 1EU150G (0-150 PSI)
- Rotax 456180
- Rotax 664365
- Rotax 956413
- Rotax 956415
- Jabiru (VDO 360-003 or similar 0-5 Bar pressure sensor)
- Custom sensor

NOTE

For the GSU 73, Rotax and Jabiru oil pressure sensors should be connected to a general purpose (GP) input instead of the Oil Pressure input.

NOTE

The Rotax 456180 and 956413 oil pressure sensors require an external resistor for proper functioning (see Figure 31.2 for GEA 24 and Figure 31.3 for GSU 73).

Custom: This option allows the installer to enter up to 8 points of voltage-to-pressure calibration. See pin description in Section 24 for allowable input voltage range.

FADEC: The GEA 24 can be configured to monitor oil pressure data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- Lycoming (iE2)
- ULPower

31.4.32.8 Oil Temperature

The following sensors can be configured for the Oil Temperature input on the GEA 24 or GSU 73:

- UMA 1B3-2.5R RTD
- Rotax 965531
- Rotax 966385
- Jabiru VDO 320-021 thermistor
- MS28034 / MIL-T-7990 RTD
- Thermistor (any VDO or similar 50-150°C thermistor)
- Type K Thermocouple

FADEC: The GEA 24 can be configured to monitor oil temperature data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- Lycoming (iE2)
- ULPower

31.4.32.9 CHT (Cylinder Head Temperature)

The following sensors can be configured for the CHT inputs on the GEA 24 or GSU 73:

- Type J thermocouple
- Type K thermocouple
- Rotax 965531
- Rotax 966385
- Thermistor (any VDO or similar 50-150°C thermistor)

NOTE

For the GEA 24, thermistor CHT sensors (including Rotax CHT sensors) are connected to different input pins (see Section 29.2)

NOTE

For the GSU 73, thermistor CHT sensors (including Rotax CHT sensors) are connected to general purpose (GP) input pins (see Section 29.3).

FADEC: The GEA 24 can be configured to monitor cylinder head temperature data from the following FADEC interfaces:

- Lycoming (iE2)
- ULPower

If two EIS LRUs are configured, up to 6 cylinders may be configured for a twin-engine application, or up to 12 cylinders for a single engine. In a single-engine application, cylinders 1-6 are connected to CHT 1-6 on EIS LRU #1, and cylinders 7-12 are connected to CHT 1-6 on EIS LRU #2.

NOTE

The CHT 5/6 inputs on the GEA 24 have multiple functions. If CHT configuration is set to 5 or 6 cylinder engine, the TEMP3/4 inputs are unavailable, as those sensor presets use the same pins and CHT inputs takes precedence.

31.4.32.10 Exhaust Gas Temperature (EGT)

The EGT inputs on the GEA 24 and GSU 73 support configuration of Type K thermocouples.

If Lean Assist using EGT is desired, change the Lean Assist setting to "Enabled". (see Lean Assist for more information).

NOTE

The EGT 6/MISC PRESS input on the GSU 73 has multiple functions. The GSU 73 EGT 6/MISC PRESS input is unavailable for other uses if assigned as an EGT input in the EGT Configuration menu.

FADEC: The GEA 24 can be configured to monitor exhaust gas temperature data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- Lycoming (iE2)
- ULPower

If two EIS LRUs are configured, up to 6 cylinders may be configured for a twin-engine application, or up to 12 cylinders for a single engine. In a single-engine application, cylinders 1-6 are connected to EGT 1-6 on EIS LRU #1, and cylinders 7-12 are connected to EGT 1-6 on EIS LRU #2.

NOTE

The EGT 5/6 inputs on the GEA 24 have multiple functions. If EGT configuration is set to 5 or 6 cylinder engine, the TEMP5/6 inputs are unavailable, as those sensor presets use the same pins and EGT inputs takes precedence.

31.4.32.11 Fuel Pressure

The following sensors can be configured for the Fuel Pressure input on the GEA 24 or GSU 73:

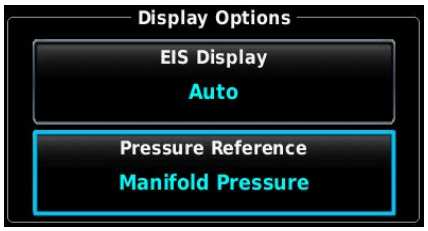
- Garmin GPT 15G (0-15 PSI, for carbureted engines)
- Kavlico P4055-5020-2 (0-15 PSI, for most carbureted engines)
- Garmin GPT 75G (0-75 PSI, for fuel-injected engines)
- Kavlico P4055-5020-3 (0-75 PSI, for most fuel-injected engines)
- Kavlico P4055-75G (0-75 PSI, for most fuel-injected engines)
- Kavlico P500-75A (0-75 PSI absolute, for Rotax engines requiring absolute fuel pressure measurements)
- Rotax 664365
- UMA 1EU07D (0-7 PSI differential, for some turbocharged carbureted engines such as the Rotax 914)
- UMA 1EU35G (0-35 PSI, for most carbureted engines)
- UMA 1EU70G (0-70 PSI, for most fuel-injected engines)
- UMA 1EU70D (0-70 PSI differential, for some fuel-injected engines such as the Rotax 912iS/ 915iS/916iS)
- UMA 1EM2K (0-2500 PSI, for certain turbine engines)
- Custom sensor

Custom: This option allows the installer to enter up to 8 points of voltage-to-pressure calibration. See pin description in Section 24 for allowable input voltage range.

FADEC: The GEA 24 can be configured to monitor fuel pressure data from the following FADEC interfaces:

- Rotax FADEC (SCU)
- Lycoming (iE2)
- ULPower

Rotax FADEC engines (912iS/915iS/916iS) that require fuel pressure to be measured relative to manifold pressure may use a differential pressure sensor such as the UMA 1EU70D. Alternatively, these installations may use a single-input gauge pressure sensor and change the configuration of the "Pressure Reference" item to "Manifold Pressure". This does not apply to installations which include the RS Flight Systems SCU 9iS propeller speed controller and select 'Rotax FADEC (SCU)' for the sensor.



31.4.32.12 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).

NOTE

When in-line resistors are installed as shown in Section 27, use "Voltage" configuration setting, if in-line resistors are not installed, use "Resistive" configuration setting.

NOTE

Refer to Section 33.2.5 for information regarding swapping GEA 24 and GEA 24B units.

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

If the CUSTOM FUEL setting is used in place, the installer can specify the gauge name that is displayed for that input.

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 27-3.1).

The analog and digital fuel quantity inputs require calibration (see Section).

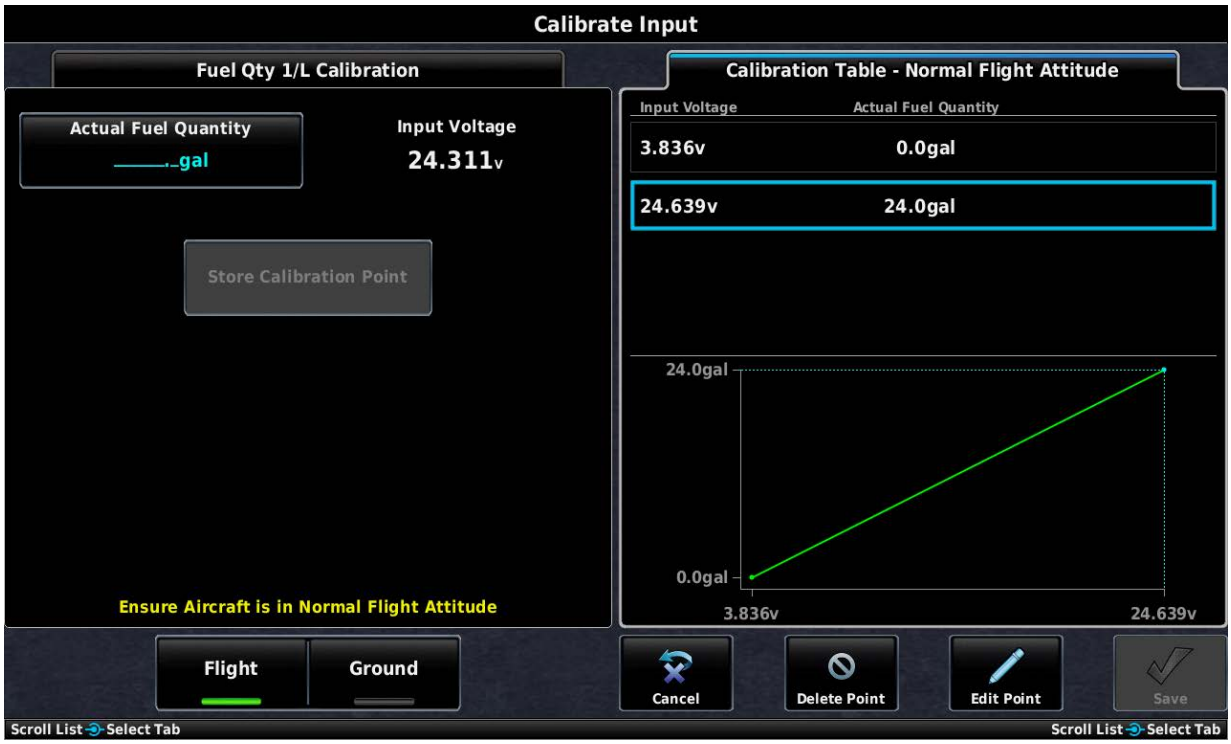
NOTE

Note: After performing fuel quantity calibration, it is advised to back up the calibration data to an SD card (see Section). Changing the configuration for a fuel quantity input may reset calibration data.

31.4.32.12.1 Fuel Quantity Calibration

The process for calibrating fuel quantity inputs is similar to the process described in Section 31.4.32.25, except the raw sensor values are read directly from the sensors instead of being entered manually by the installer. This allows precise calibration based on incrementally filling the tank with a known quantity of fuel during the calibration procedure.

Two fuel calibration curves are supported, 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.



Buttons 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 available when the normal flight attitude calibration data has been entered, the 'GROUND' button 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 button 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. Press the Calibrate button.
7. Repeat this process until the fuel tank is full.

The installer 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.

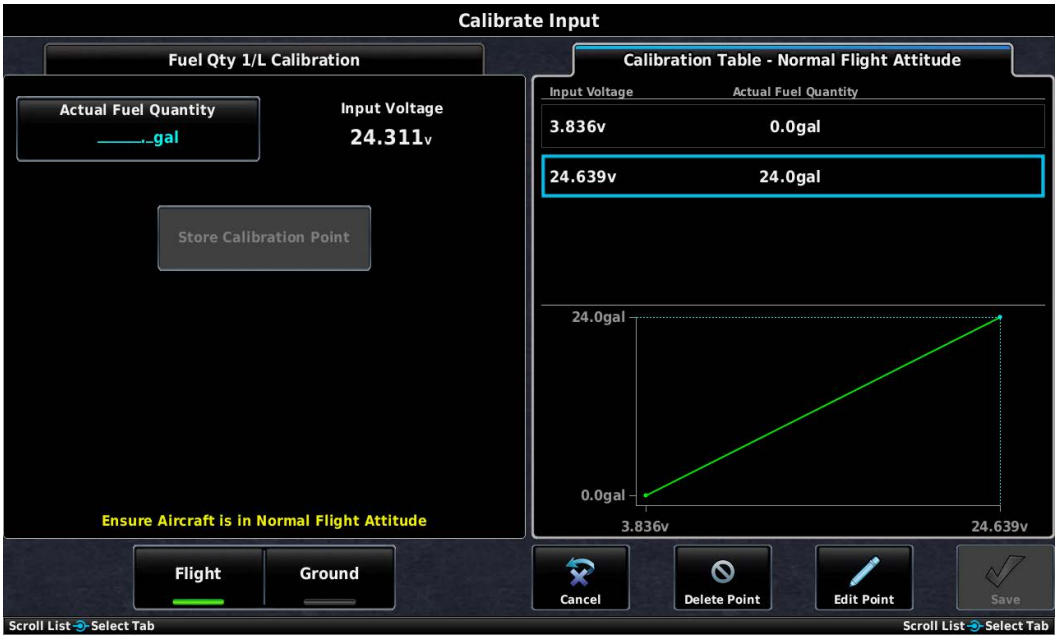
Fuel quantity inputs configured for digital sensing are calibrated in the same manner except the resulting frequency (in kHz) from the sensor is displayed instead of the voltage. Frequencies up to 50 kHz are supported.



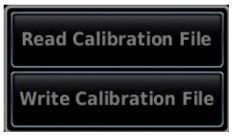
To delete a calibration value, highlight the desired data point in the list and press the Delete Button.



To modify an existing fuel quantity calibration point, highlight the desired data point in the list, and press the Edit button. From this menu, the fuel quantity value for a recorded raw voltage or frequency value can be changed. This can be used if an error is made when entering a data point during the calibration.



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.

31.4.32.13 Fuel Flow

The following sensors can be configured for the Fuel Flow input on the GEA 24 or GSU 73:

- Electronics International FT-60 (0-70 gph)
- Electronics International FT-90 (0-125 gph)
- Electronics International FT-120 (0-250 gph)
- Floscan 201B-6
- Floscan 231
- Custom sensor

The fuel flow input requires calibration of the K-factor (pulses per gallon) (see Section 22.3.10.1). The Custom configuration option supports any fuel flow sensor with a maximum output frequency of up to 5 kHz.

FADEC: The GEA 24 can be configured to monitor fuel flow data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- ULPower

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).

31.4.32.13.1 Fuel Flow Calibration

The Fuel Flow input requires calibration as detailed below.



K-Factor – Enter the 'K' factor (pulses per gallon) for the fuel flow sensor (Section 22.3.10.1).

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].

For differential fuel flow installations (when a return flow meter is used) the K-factor adjustment applies to the normal (forward) flow sensor only. The K-factor must be adjusted until the displayed Net Fuel Flow equals the Forward Flow minus the Return Flow (see preceding figure).

31.4.32.13.2 Fuel Calculator Configuration

The Fuel Calculator calibration page can be found under the Settings tab at the top of the Engine & Airframe menu. Refer to the Pilot's Guide for information on operation of the fuel calculator.

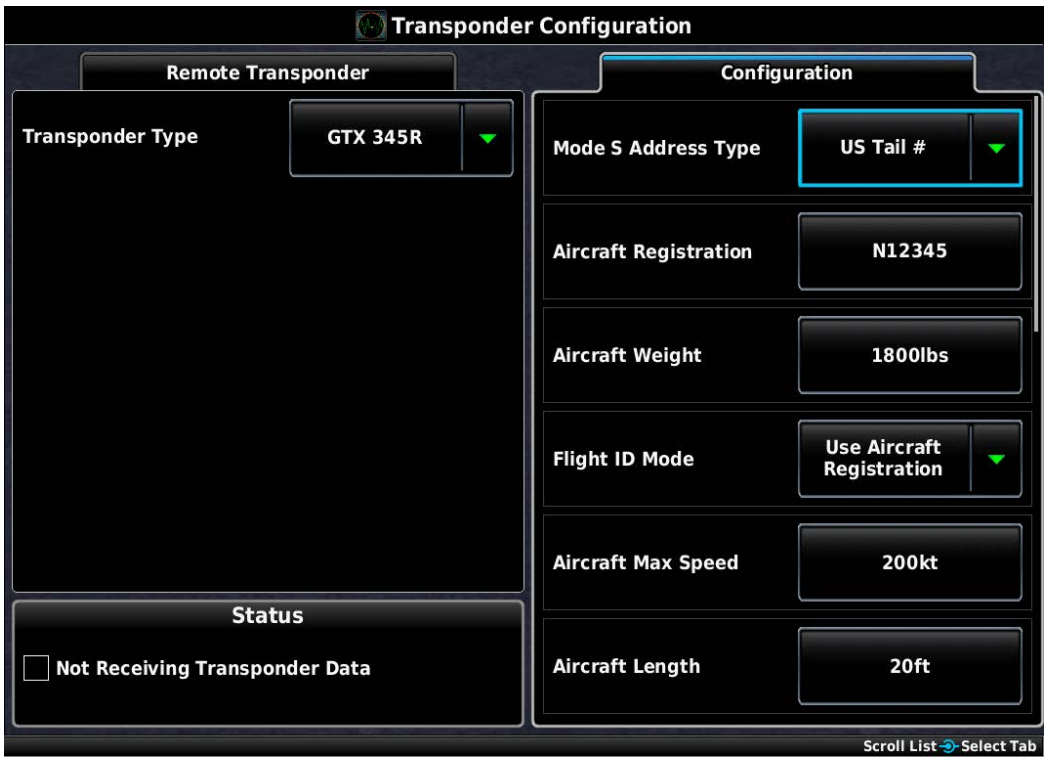
Full Fuel – Sets the Full Fuel quantity for the fuel computer. Set according to the fuel tank capacity (set to zero if not used).

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 – Used to determine when to display the fuel quantity reminder, when Preflight Reminder is set to "After Fill". When power is applied, the current fuel quantity is compared 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, the system will assume that fuel has been added and will display a reminder page prompting the pilot to confirm the quantity of fuel on board.

Preflight Reminder – This setting determines how the fuel quantity should be confirmed upon system start:

- Always – A reminder page prompting the pilot to confirm the quantity of fuel on board will be displayed before every flight.
- After Fill – A reminder page is displayed if indicated fuel quantity has increased by more than the configured threshold amount since the last flight.
- Disabled – Fuel quantity reminder is never displayed.



31.4.32.14 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", or set to “Custom Volts 1”, which allows the installer to define the displayed gauge name. VOLTS 2 can be configured either as "Bus 2", "Aux Bus", “Essential Bus”, “Backup Battery” or “Custom Volts 2”, which allows the installer to define the displayed gauge name. 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 input of the GEA 24. Bus1, Main Bus, or Custom can be chosen as the gauge label for the EIS Power Input 1 selection. Bus 2, Aux Bus, Essential Bus, Backup Battery and custom can be chose as the gauge label for the EIS Power Input 2 Selection.

Vertical Power: Vertical Power inputs are configured from the Vertical Power Tab within the Engine & Airframe configuration menu. See Section 31.4.32.36 Vertical Power VP-X for more information.

FADEC: The GEA 24 can be configured to monitor ECU bus voltage from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS – both Lane A and Lane B can be selected on Volts 1/2 respectively)
- ULPower
- Lycoming

Additional bus voltages (more than 2 buses) may be monitored using custom configuration and calibration of general purpose (GP) inputs, by setting the GP input to “Custom Analog (Volts)”. See Section 31.4.32.25 for further information.

31.4.32.15 Electrical 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. Several additional Hall effect sensors can be connected to spare GP inputs using the "Custom Analog (Hall Effect Amps)" setting, if more than 2 current readings are desired.

Shunt Sensors: Shunt sensors are connected to the SHUNT 1 and SHUNT 2 inputs on the GEA 24 and GSU 73 (see Figure 27-2.2 and Figure 27-3.1). The SHUNT 1 input can be configured to display either "Bus 1 Amps" or "Main Bus Amps" or set to “Custom Amps 1”, which allows the installer to define the displayed gauge name. The SHUNT 2 input can be configured to display either "Bus 2 Amps" or "Essential Bus Amps", or set to “Custom Amps 2”, which allows the installer to define the displayed gauge name..

Hall Effect Sensors: Hall effect current sensors are connected to the GEA 24 or GSU 73 general purpose (GP) inputs (see Figure 27-2.2 and Figure 27-3.1). Hall effect sensors can optionally be calibrated to adjust for installation differences (see Section 31.4.32.15.1). The supported configurations for Hall effect current sensors on GP inputs are similar to those supported for shunt current sensors:

- Bus 1 Amps (Hall Effect)
- Bus 2 Amps (Hall Effect)
- Main Bus Amps (Hall Effect)
- Essential Bus Amps (Hall Effect)
- Alternator Amps (Hall Effect)
- Battery Amps (Hall Effect)
- Custom Amps (Hall Effect)
- Custom Alternator Amps (Hall Effect)

Vertical Power: Vertical Power current inputs are configured from the Vertical Power Tab within the Engine & Airframe configuration menu. See Section 31.4.32.36 Vertical Power VP-X for more information.

31.4.32.15.1 Electrical Current Calibration

The two electrical current inputs can be calibrated (if desired) as detailed below.

Scale Factor – Either Multiplier or milliVolts per Amp (mV/Amp) can be selected, For most installations, the Multiplier setting will remain set to the default (1.00) value. A typical use for the Multiplier setting 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. The mV/Amp setting is useful when using a current sensor (either shunt or Hall effect) where the sensor response is specified in mV/A.

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.



31.4.32.16 Trim/Flap Position Input

The GEA 24 and GSU 73 each have multiple GP (general purpose) inputs. Each GP input can be used with a resistive (potentiometer) sensor to monitor the following position measurements:

- Elevator Trim
- Aileron Trim
- Rudder Trim
- Flap Position

All GP inputs require calibration (see section Section 31.4.32.16.1).

NOTE

The GEA 24 GP 6 and GP 7 inputs require the LO side of the input to be connected to ground. See Section 27.2 for wiring details.

Vertical Power: When using a Vertical Power unit, trim and flap positions will automatically be displayed. Connecting, configuring, and calibrating the GP inputs is not required when the position sensors are connected to a Vertical Power unit.

31.4.32.16.1 Trim/Flap Position Input Calibration

The process for calibrating trim/flap position inputs is similar to the process described in Section 31.4.32.25, except the raw sensor values are read directly from the position sensors instead of being entered manually by the installer. This allows precise calibration based on moving the control surfaces to known positions during the calibration procedure.

To calibrate trim/flap position inputs:

1. From the GP input configuration page, press the Calibrate button to display the Calibration Page.

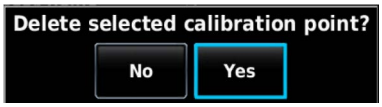


2. Position the control surface to match the trim position (up/left, neutral, down/right) displayed on the calibration page, or position the flap to the desired position. Note that if the Flap Switch Mode is configured for Absolute Position instead of Relative Position, the flaps will be moved by the Flap Up/Flap Down buttons shown on the Flap Position Calibration page.
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. Press the Calibrate button to add a calibration point.
5. Press the Save button to store calibration data.
6. Repeat this process for each of the Trim/Flap Positions.

NOTE

Flap position values (up to 4 Absolute/8 Relative) should coincide with the angle of the flap position as expressed in degrees (-90° – +90°) or percent (-100% to +100%).

To delete a calibration value, highlight the desired data in the list, and press the Delete button.



31.4.32.17 Engine Torque

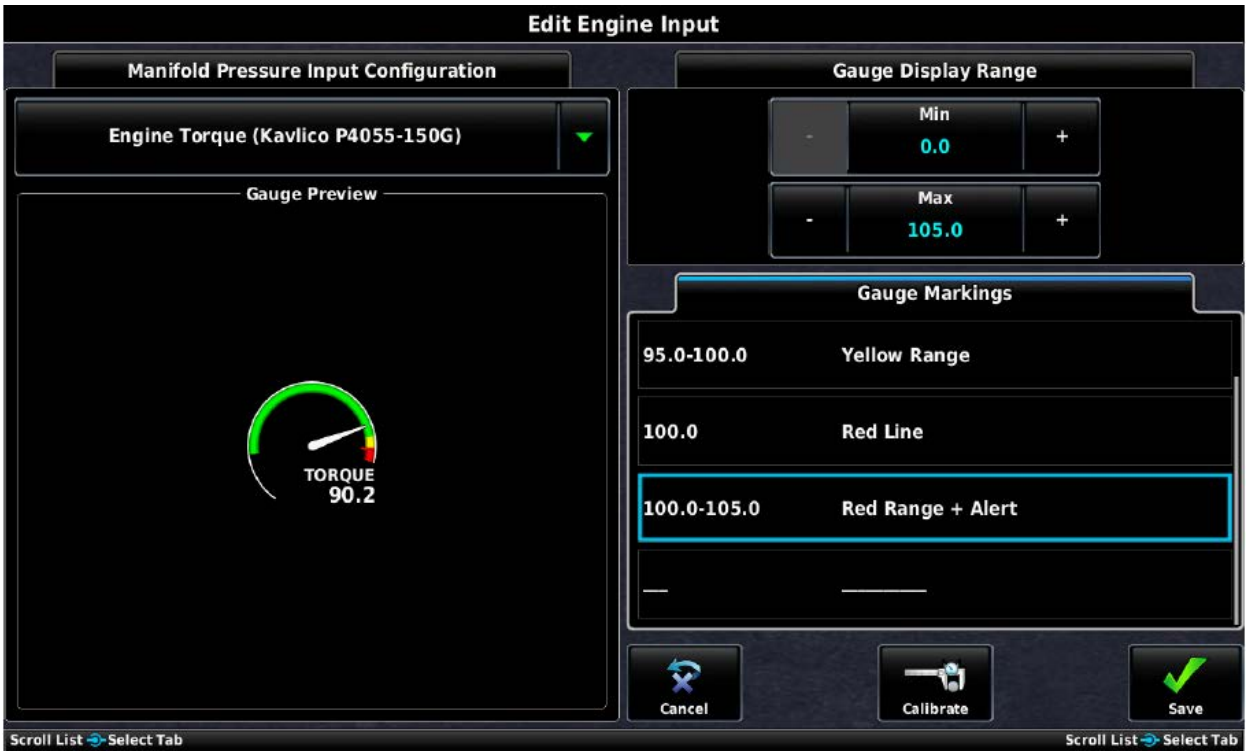
For turbine engines, the GEA 24 Manifold Pressure input can be used to measure engine torque. Typically this takes the form of a pressure measurement that is converted to a torque display using installer-provided calibration.

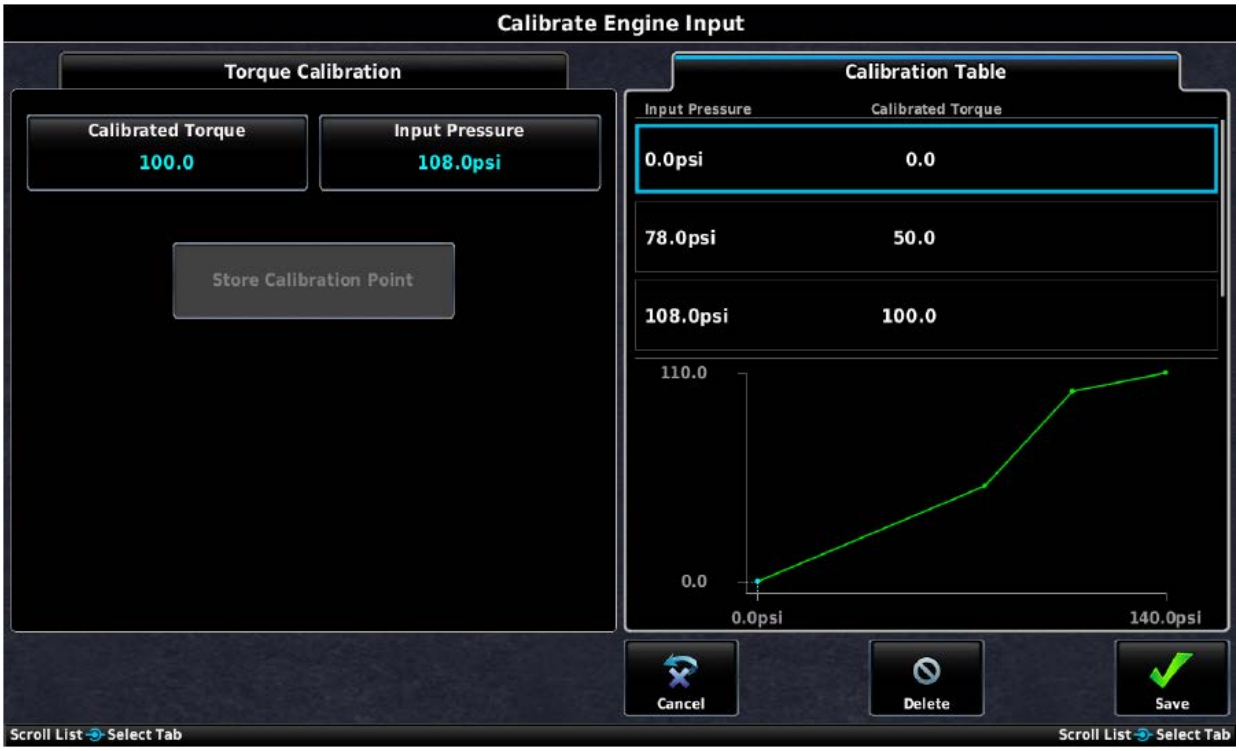
The following standard pressure sensors can be configured for measuring turbine engine torque on the GEA 24 Manifold Pressure input:

- Garmin GPT 150G
- Kavlico P4055-150G (0-150 PSI)
- Custom sensor

If a standard pressure sensor is configured, the installer can to enter up to 8 points of pressure-to-torque calibration. For other sensor types, select “Engine Torque (Custom)” and enter up to 8 points of voltage-to-torque calibration. Refer to pin description in Section 25 for allowable input voltage range.

The following two screenshots are an example of an installer-defined torque gauge. In this example, a Pavlico P4055-150G pressure sensor is used. The gauge spans from 0 to 108 psi with green, yellow, red , and a red + alert range.





31.4.32.18 Carburetor Temperature

The following sensors can be configured to monitor carburetor temperature on the GEA 24 Temp 1-6:

- UMA 1B10R RTD (or any Pt100-type RTD sensor)
- Rotax 965531
- Rotax 966385
- Thermistor (any VDO or similar 50-150°C thermistor
- Type K Thermocouple
- MS28034/MIL-T-7990 RTD

NOTE

GEA 24 TEMP 5/6 support thermocouple sensors only.

31.4.32.19 Manifold Air Temperature

FADEC: The GEA 24 can be configured to monitor manifold air temperature data from the following FADEC interfaces:

- Rotax (912iS/915iS/916iS)
- UL Power

31.4.32.20 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 in addition to the TEMP 1-6 inputs on the GEA 24. If Lean Assist using TIT is desired, change the Lean Assist setting to "Enabled". (see Lean Assist for more information).

For turbine engine applications, the TIT 1 or TIT 2 input can alternatively be configured to monitor a single Turbine Interstate Temperature (ITT) or Turbine Outlet Temperature (TOT).

31.4.32.21 Coolant Temperature

The following sensors can be configured to monitor coolant temperature on the GEA 24 Temp 1-6:

- Rotax 965531
- Rotax 966385
- Thermistor (any VDO or similar 50-150°C thermistor)

NOTE

TEMP 5/6 on GEA 24 support thermocouples only.

FADEC: The GEA 24 can be configured to monitor coolant temperature data from the Rotax 912iS/915iS/916iS FADEC interface.

31.4.32.22 Coolant Pressure

The following sensors can be configured to monitor coolant pressure on any GEA 24 GP input or on GSU 73 MISC PRESS inputs:

- Garmin GPT 75G
- Kavlico P4055-5020-3 (0-75 PSI)
- Custom sensor

Custom: This option allows the installer to enter up to 8 points of voltage-to-pressure calibration. See pin description in Section 25 for allowable input voltage range.

31.4.32.23 Custom Pressure

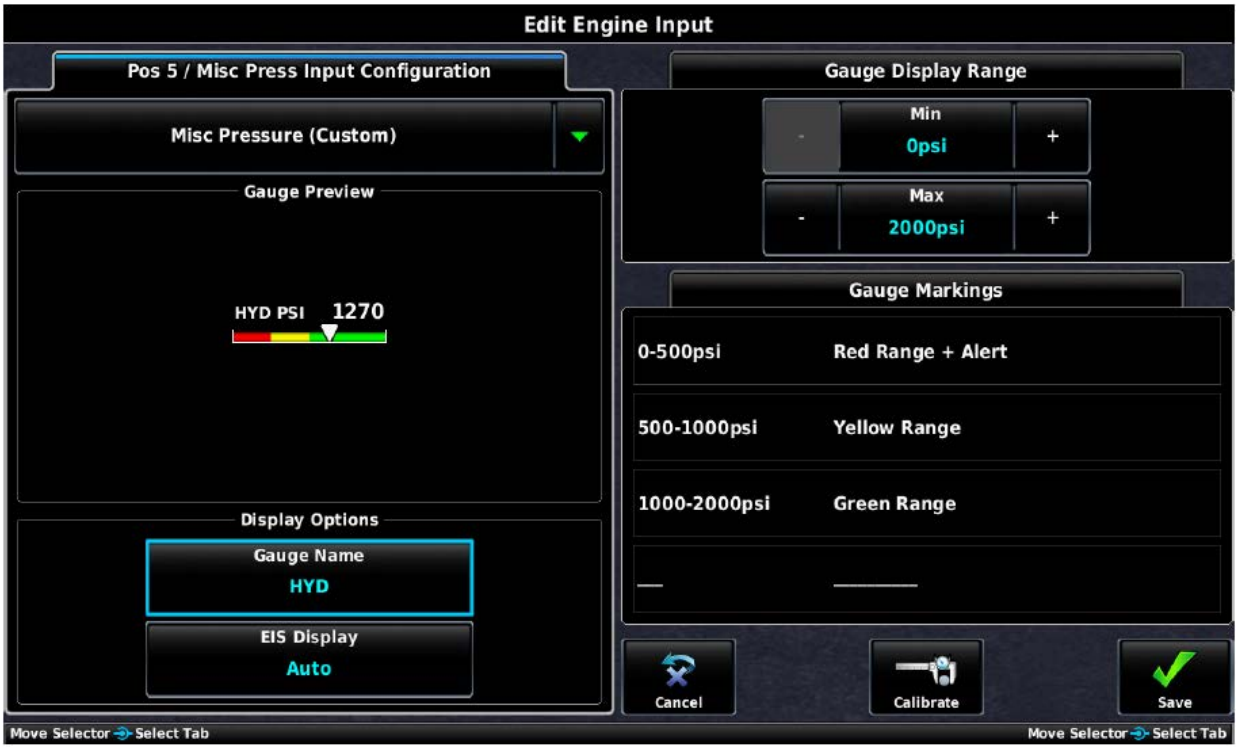
The GEA 24 (any GP input, 1-7) and GSU 73 MISC PRESS inputs allow the monitoring of installer-defined pressure measurements, using the following sensor configurations:

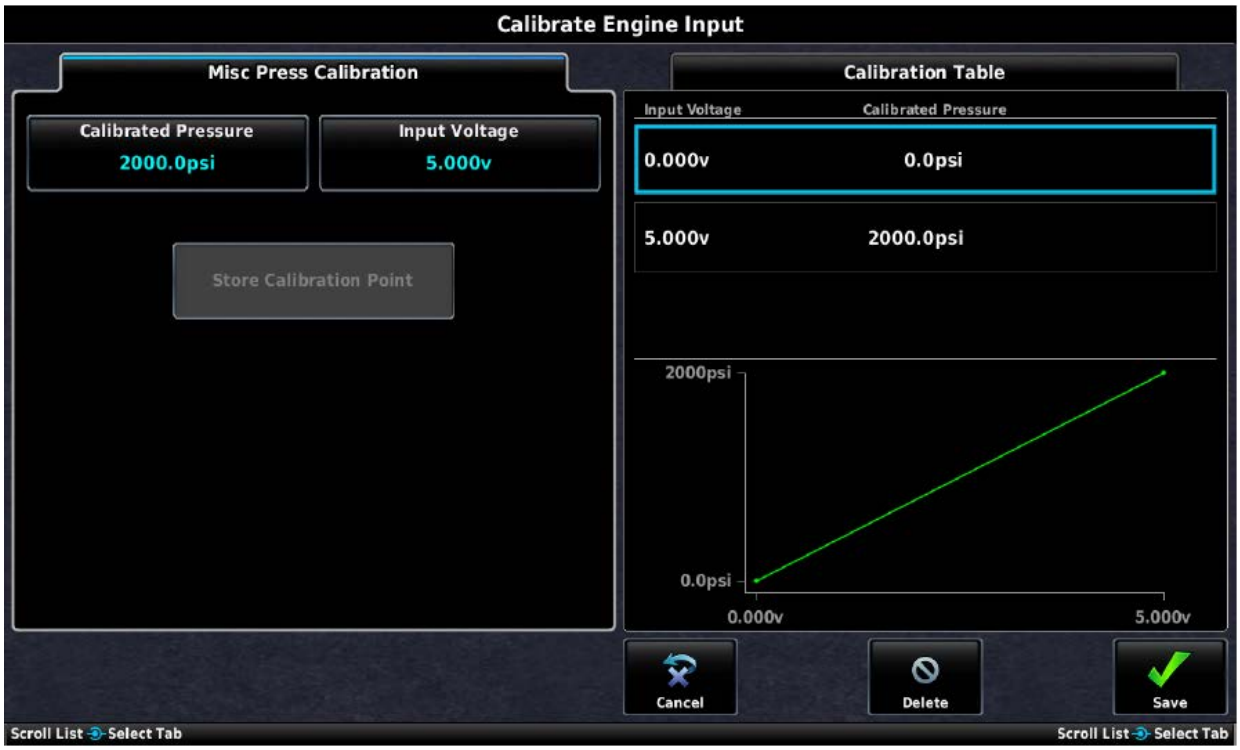
- Garmin GPT 75G
- Kavlico P4055-5020-3 (0-75 PSI)
- Garmin GPT 150G
- Kavlico P4055-150G (0-150 PSI)
- UMA 1EM2k
- Custom sensor

These inputs allow the display of arbitrary pressure measurements, including hydraulic pressure, and allow the installer to specify the name of the gauge.
Custom: This option allows the installer to enter up to 8 points of voltage-to-pressure calibration. See pin description in Section 25 for allowable input voltage range..

Example - Custom Hydraulic Pressure Gauge

The following two screenshots are an example of an installer-defined hydraulic pressure gauge. In this example the gauge spans from 0 to 2000 psi with green, yellow, and red + alert ranges. This example would connect a 0-5V, 0-2000 PSI sensor to the MISC PRESS input.





31.4.32.24 Custom Temperature

The GEA 24 (TEMP 1-6) and GSU 73 MISC TEMP inputs allow the monitoring of installer-defined temperature measurements, using the following sensor configurations:

- Type J Thermocouple
- Type K Thermocouple
- MS28034 / MIL-T-7990 RTD
- UMA 1BxR RTD (or any Pt100-type RTD)
- Thermistor (any 50-150°C thermistor such as the Rotax 965531 or VDO 320-XXX series)

These inputs allow the display of arbitrary temperature measurements, and allow the installer to specify the name of the gauge.

NOTE

TEMP 5/6 support thermocouple sensors only.

31.4.32.25 Custom Analog Measurements

The GEA 24 and GSU 73 general purpose (GP) inputs allow the monitoring of installer-defined analog parameters, which may be used for a variety of purposes. Selecting "Custom Analog" for a GPS input allows the installer to enter up to 8 points of voltage-to-numeric calibration, as well as specifying the name of the gauge

The values displayed for Custom Analog gauges are "unitless", which allows the GP inputs to display a calibrated value for any compatible analog voltage measurement. This includes O2 sensors, timing advance, additional bus voltage inputs, additional bus current inputs and other applications with compatible voltage levels. See pin description in Section 25 for allowable input voltage range.

NOTE

The GEA 24 GP 6 and GP 7 inputs require the LO side of the input to be connected to ground. See Figure 27-2.2 for wiring details.

Example - Custom Electronic Ignition Advance Gauge – The following two screenshots are an example of an installer-defined engine gauge used to display the timing advance for an electronic ignition which outputs 0.01 V/deg. In this example the gauge spans from 0 to 45 degrees of timing advance with tick marks at 20 degrees and 40 degrees.





Vertical Power: When using a Vertical Power unit, trim and flap positions will automatically be displayed. Connecting, configuring, and calibrating the GP inputs is not required when the position sensors are connected to a Vertical Power unit.

31.4.32.26 Discrete Inputs

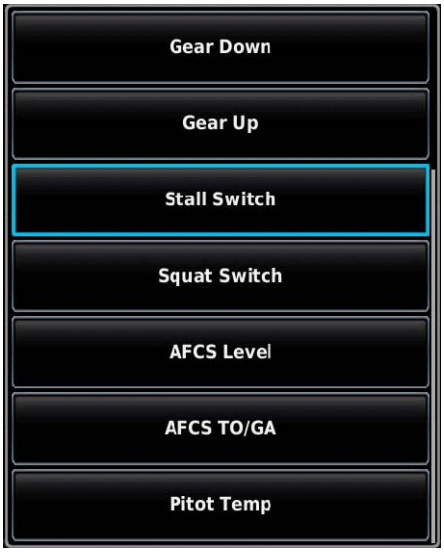
Discrete inputs can be connected to a variety of external switches or voltage signals and used to generate system alerts or control other system functions. For instance, a discrete input could be configured to generate an audible alert and a CAS (Crew Alerting System) message on the PFD display when an external switch is closed. Discrete inputs can also be used to trigger certain specific actions, as described below.

The GEA 24 and GSU 73 support up to four dedicated discrete inputs (Discrete 1 through 4). The GAD 27 supports an additional nine discrete inputs The seven general purpose (GP) inputs and the RPM2 input on the GEA 24 may also be configured as additional discrete inputs.

NOTE

The GEA 24 GP 6 and GP 7 inputs require the LO side of the input to be connected to ground. See Figure 27-2.2 for wiring details.

If two EIS LRUs are configured, the four discrete inputs on EIS LRU #2 may be separately configured, providing four additional discrete input possibilities. The GP inputs on EIS LRU #2 are not available to be used as additional discrete inputs.



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 24.5.9 and Appendix F.5.5.1 for the specific voltage levels used for discrete input sensing on the GEA 24 and GSU 73 (Section 24.1.6).

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:

- 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 red alert will generate an audible warning tone.
- AFCS Level - Used in conjunction with the autopilot to activate LVL mode. This input should be connected to a momentary pushbutton.
- 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.
- 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. If a Logic Signal is selected to be associated with this input using the Alert Mode setting, the state of the selected Logic Signal will be used in place of engine power and airborne state.
- COM Freq Swap - Used with a GMA 245/245R audio panel and a connected COM radio to swap the active and standby frequencies on the currently selected COM. The audio panel's selected microphone channel is used to find which radio receives the frequency swap command.
- Door Closed - Same as Canopy Closed except alert text is DOOR OPEN. If a Logic Signal is selected to be associated with this input using the Alert Mode setting, the state of the selected Logic Signal will be used in place of engine power and airborne state.
- ESP Inhibit - Used with a switch that activates the input. When in the active state (select active high or active low), the ESP (Electronic Stability and Protection) function is disabled. See Section 31.4.12 for ESP configuration details.
- Event Marker - When activated, the Flight Data Log records a number 1 in the Event Marker Column. This input should be connected to a momentary pushbutton.
- User Timer - Remote control for the user timer. A momentary switch activation will start/stop the user timer. Press and hold the switch to reset the timer.
- Master Annunciator Reset - Acknowledges all warning and caution CAS messages.
- Master Caution Reset - Acknowledges all caution CAS messages.
- Master Warning Reset - Acknowledges all warning CAS messages.
- 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. When the aircraft's indicated airspeed is greater than VFE, VLE, or VLO (whichever is lowest) the CHECK GEAR alert message will not appear. For turbine engine applications, the CHECK GEAR alert message will not appear when engine torque is greater than the bottom of the lowest green color band on the torque gauge.
- Gear Up - Used with a switch that activates the input when the aircraft's landing gear is retracted. This can be used in conjunction with a Gear Down input to indicate additional conditions. If inputs for both Gear Up and Gear Down are configured, and neither input is active, a red GEAR UNSAFE alert message appears. If the Gear Up and Gear Down inputs are both active simultaneously, a yellow GEAR FAULT indication is displayed on the PFD.

- Gear Up (Amphib) - Same as the preceding Gear Up configuration, except it also displays a blue GEAR UP message on the PFD when the gear is confirmed up. This is intended for use in amphibious aircraft that desire a positive indication of both gear-up and gear-down states.
- Pitot Temp - Will display a PITOT TEMP caution message on the PFD if the outside air temperature is below approximately 5°C (41°F) and the input is not active. Configure for Active Low when used with the regulated GAP 26 (-20 version). See also GAP 26 Alert Configuration (following).
- Glide Activate - Can be used as an additional means to activate Smart Glide, by using a dedicated panel mounted switch. This input should be connected to a momentary pushbutton. A Garmin Smart Glide switch can optionally be used to activate this input (Garmin p/n 011-05930-00).
- Speed Brake - Used with a switch that activates the input when the aircraft's speed brake is fully retracted (closed). A white SPEED BRAKE message will appear on the PFD if the Speed Brake discrete input is not active. If engine power is increased, such as if the speed brake is deployed during takeoff or climb, the SPEED BRAKE message will flash red and a tone will sound. If the aircraft has a maximum airspeed limit for speed brake deployment, it can be configured as a custom reference speed with the label "VSB" (see Section 31.4.14). Regardless of engine power setting, if the Speed Brake input is not active and the aircraft's indicated airspeed exceeds VSB, the SPEED BRAKE message will flash red and a tone will sound. If a Logic Signal is selected to be associated with this input using the Alert Mode setting, the state of the selected Logic Signal will be used in place of engine power and airborne state.
- 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.
- Stall Switch - When the input is active, a red flashing STALL message appears on the PFD and a warning tone sounds continuously. (Audible stall warning tones are inhibited when the aircraft is on the ground.)
- Marker Beacon (Inner) - Supports external Marker Beacon Receiver, provides PFD lamp indication.
- Marker Beacon (Middle) - Supports external Marker Beacon Receiver, provides PFD lamp indication.
- Marker Beacon (Outer) - Supports external Marker Beacon Receiver, provides PFD lamp indication.
- Radar Alt Inhibit - Inhibits radar altimeter or Radio AGL audible callouts. Inhibit condition is reset on a subsequent power cycle.
- Flaps Down - Can be configured only in installations that do not have a flap position sensor. This can be used as an input to the AOA system to dictate which calibration curve is active. It will also generate a caution-level CAS message when the aircraft exceeds Vfe with the flaps down. If a Logic Signal is selected to be associated with this input using the Alert Mode setting, the state of the selected Logic Signal will be used in place of the default airspeed threshold.
- Terrain Alert Inhibit - A secondary way to activate user-inhibit of terrain alerts. See G3X Touch Pilot’s Guide for more information.
- Traffic Alert Inhibit - A secondary way to activate user-inhibit of traffic alerts. See G3X Touch Pilot’s Guide for more information.
- Crew Isolate - This setting remotely toggles the crew isolation function of a connected GMA 245.
- Pilot Isolate - This setting remotely toggles the pilot isolation function of a connected GMA 245.

31.4.32.26.1 GAP 26 Alert Configuration (-20 version of GAP 26 only)

If the discrete output (bare blue wire) from the control box is connected to one of the EIS discrete input pins on the GEA 24 or GSU 73, the status of the GAP 26 heater can be displayed in one of three ways (following), depending on user preference:

1. The discrete input configuration shown in Figure 31-63 will result in a green "PITOT HEAT" indication that will appear on the PFD any time the GAP 26 heater is powered and the probe temperature is above approximately 25° C (77° F). If pitot heat is powered off or inoperative, the green "PITOT HEAT" indication will not appear.

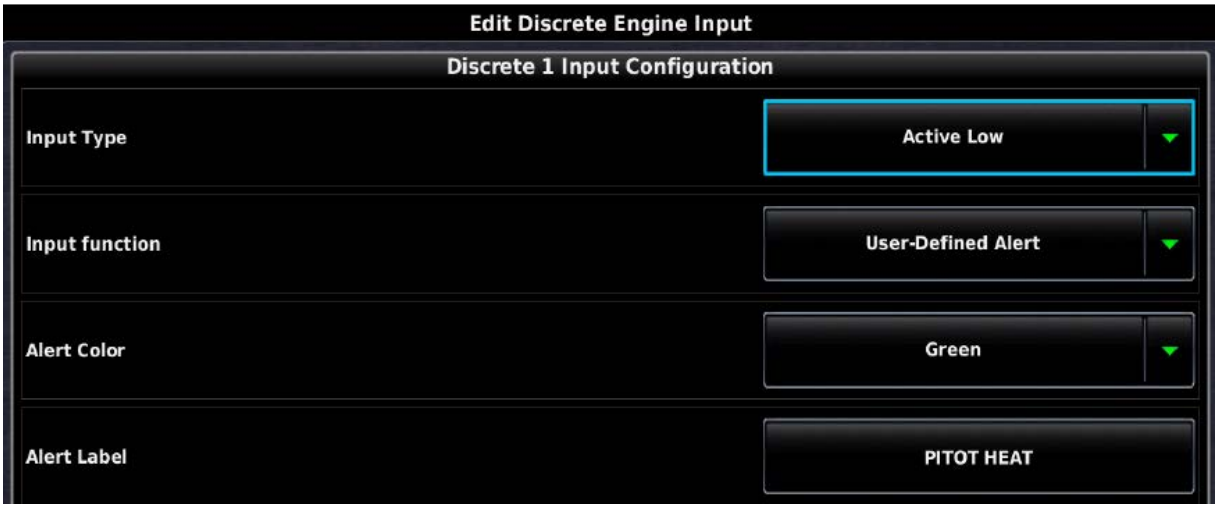


Figure 31-63 GAP 26 Alert Configuration

2. The discrete input configuration shown in Figure 31-64 will result in a yellow "PITOT TEMP" alert that will appear on the PFD any time the GAP 26 heater is powered off, or if it is powered on but the probe temperature is below approximately 25° C (77° F). If pitot heat is powered and the probe temperature is sufficiently high, the yellow "PITOT TEMP" alert will not appear.



Figure 31-64 Configuration #2

3. The discrete input configuration shown in Figure 31-65 will result in a yellow "PITOT TEMP" alert that will appear on the PFD similar to Configuration #2, with additional logic that automatically prevents the yellow "PITOT TEMP" alert from appearing if the outside air temperature is above approximately 5° C (41° F). This configuration provides the same indication as Configuration #2, but hides the pitot temperature alert when flying in warmer weather conditions.

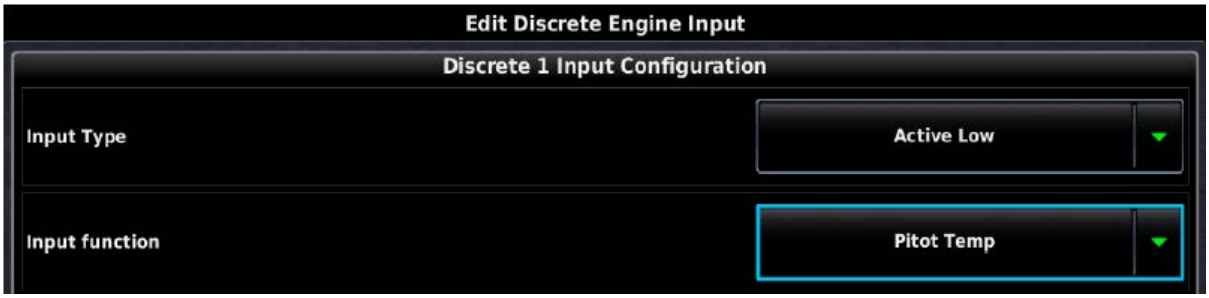


Figure 31-65 Configuration #3

31.4.32.27 Advanced Gauge Configuration

The ability to support dynamic gauge range markings and alerts is supported through the use of engine/airframe logic signals, which are used to allow one engine/airframe parameter to affect the behavior of another, or even to affect itself. A logic signal is a simple binary value, which can be in one of two states: "set" (1) or "clear" (0), based on the real-time sensor input value of the associated gauge. Up to 10 logic signals are supported, numbered 1 through 10. When editing a gauge range marking or discrete input, the Mode setting is used to configure how it interacts with logic signals (see Figure 31-66).

An individual gauge range marking can be configured to set a particular logic signal, which will cause that logic signal to be set any time the gauge value is within that range. This includes support for "Invisible" gauge range markings that do not appear on the screen and exist only to set a logic signal. If multiple gauge range markings are configured to set the same logic signal, the state of that logic signal will involve a logical OR operation.

NOTE

If a logic signal is not associated with a gauge marking parameter, it will automatically default to the "set" state (if the configured requirements for speed, altitude, and time delay are met).



Figure 31-66 Edit Gauge Marking - Logic Signal Set By Invisible Range

A gauge range marking can also be configured to be dependent upon the set/clear state of a particular logic signal, and will only appear when that logic signal is either set or cleared (see Figure 31-67). A gauge range marking that produces an alert will not do so if it is hidden.



Figure 31-67 Edit Gauge Marking - Required Logic Signal States

When editing the gauge configuration for an EIS input, an asterisk displayed alongside a range marking indicates that it uses logic signals (see Figure 31-68).



Figure 31-68 Gauge Markings List Showing Use Of Logic Signals

Similarly, discrete inputs can be configured either to set a logic signal (See Figure 31-69), or require a specific logic signal state in order to produce an alert (see Figure 31-70). This includes support for "Invisible" discrete inputs, which do not generate an alert and exist only to set a logic signal.

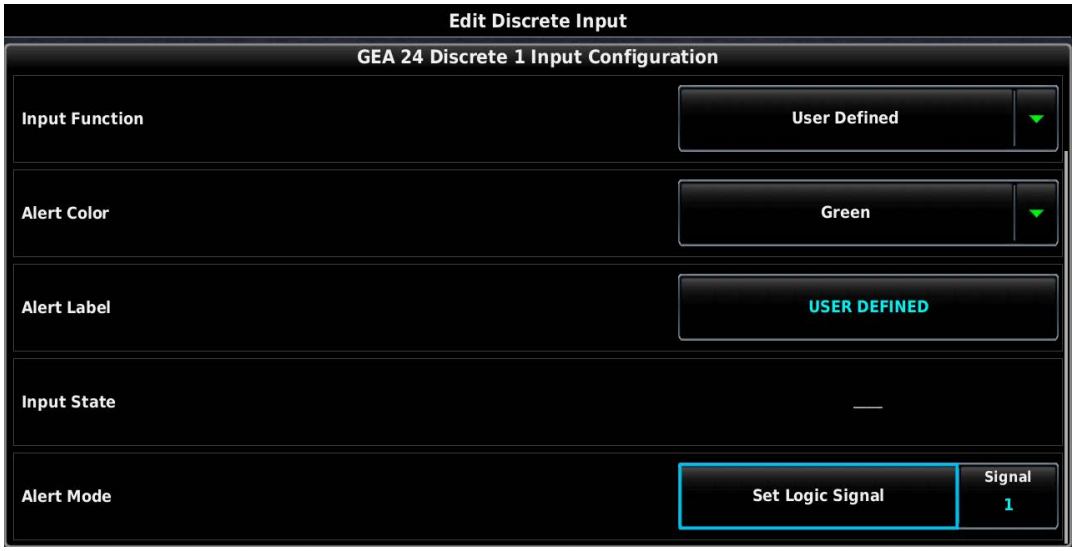


Figure 31-69 Logic Signal Set By Discrete Input

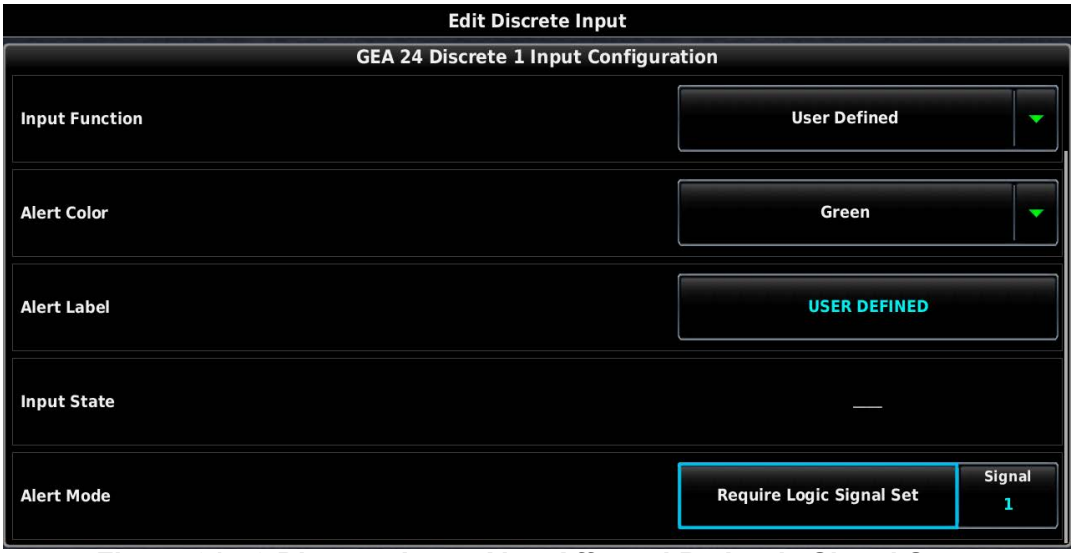


Figure 31-70 Discrete Input Alert Affected By Logic Signal State

The behavior of each logic signal can be further customized through the Settings tab of the EIS Configuration page (see Figure 31-71 and Figure 31-72). Each logic signal can have an optional delay that affects how quickly it will transition to the "set" or "clear" state, from 0 (no delay) to 1 hour (3600 seconds). Each logic signal can also optionally be configured to be set only when airspeed and/or altitude is above or below a threshold.

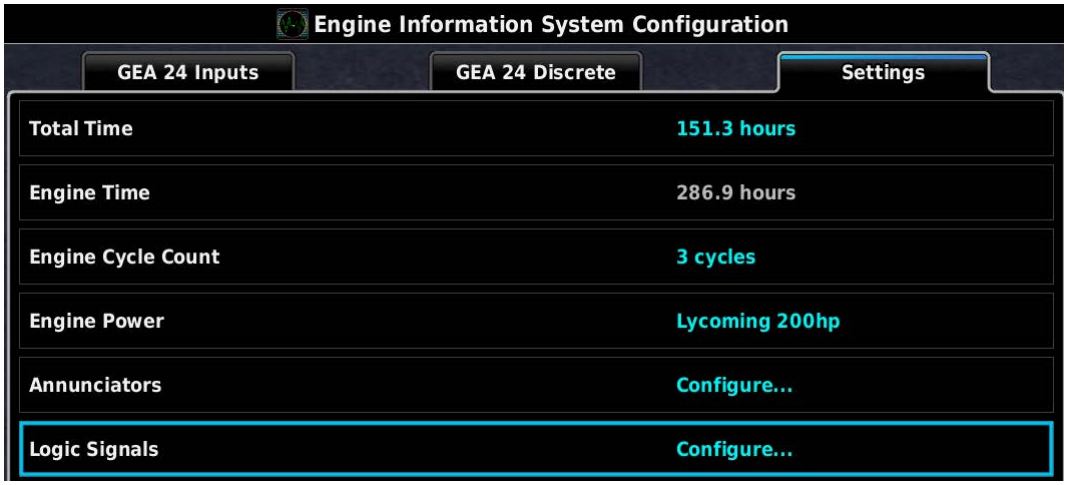


Figure 31-71 Logic Signal Configuration

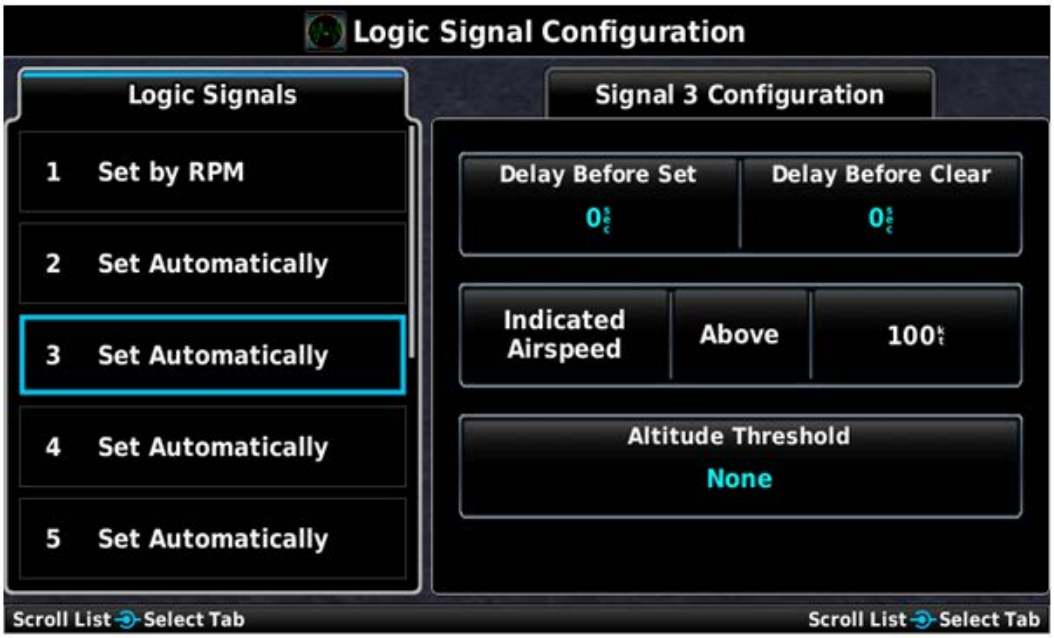


Figure 31-72 Logic Signal Configuration

Through the use of logic signals, complex behaviors can be generated, including:

- Oil pressure alerts that are inhibited below a specific engine RPM
- Engine RPM limits that change based on oil temperature
- Alerts for prohibited combinations of engine RPM and manifold pressure
- Gauge range markings that appear only when a discrete input is active
- Discrete inputs that generate an alert only when another gauge is within a certain range
- Engine temperature limits that change after engine start or at high altitude
- Engine RPM or manifold pressure limits that change after a period of time ("5-minute takeoff power")
- Alerts for incorrect flap position based on airspeed
- Alerts for incorrect trim position prior to takeoff

See Appendix I for Advanced Gauge Configuration examples.

To assist with logic signal configuration, a diagnostic page showing the current state of each configured logic signal is provided (see Figure 31-73). To access logic signal diagnostics from config mode or from the main menu in normal mode, select Diagnostics > Logic Signals.



Figure 31-73 Logic Signal Diagnostics Page

31.4.32.28 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 27-2.2 and Figure 27-3.2 for guidance on wiring indicator lamps to the annunciator output pins.

If two EIS LRUs are configured, connect indicator lamps to EIS LRU #1 only.

The Annunciator Configuration page, accessible from the Settings tab of the EIS Configuration page allows for additional customization of external annunciator behavior.



Figure 31-74 Annunciator Configuration

The Alert Flash setting determines whether un-acknowledged warning alerts (flashing red) will cause the Master Warning annunciator output to flash. Selecting Disabled will prevent the Master Warning annunciator from flashing.

The Alert Persist item determines whether the Master Warning annunciator will remain illuminated after a warning alert (red) has been acknowledged. Selecting Disabled will cause the Master Warning annunciator to extinguish when there are no un-acknowledged warning (flashing red) alerts. Note that setting Alert Persist to Disabled will effectively inhibit the operation of the Master Caution annunciator, as caution-level alerts do not flash.

The Test button performs the same function as the Annunciator Test button on the System Info page, and can be used to test annunciator lamp wiring.

If "press to reset" behavior is desired for the external annunciator lamps, momentary pushbuttons may be used in conjunction with any available discrete inputs to acknowledge on-screen alerts and extinguish one or both annunciator lamps. This capability can be used independently of the above settings. See Section 31.4.32.26 for information about connecting and configuring discrete inputs.

31.4.32.29 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, including FADEC engines.

31.4.32.30 Normalized Mode

Normalized Mode can be configured for both CHT and EGT if an equal number of CHT and EGT probes are connected. If there is a dissimilar number of CHT and EGT sensors, Normalized Mode can only be configured for EGT. When this configuration setting is enabled, a button appears next to the CHT/EGT graph to toggle Normalized Mode on and off. When Normalized Mode is activated, the vertical scaling of each CHT/EGT bar is adjusted so the bars appear "level" when the temperature is equal to the initial temperature at activation. See the G3X Touch Pilot’s Guide for more information on Normalized Mode.

31.4.32.30.1CHT (Cylinder Head Temperature)

If Normalize Mode for CHT is desired, change the Normalize Mode setting to "Enabled". (see Normalized Mode for more information, Section 31.4.32.30).

31.4.32.30.2Exhaust Gas Temperature (EGT)

If Normalize Mode for EGT is desired, change the Normalize Mode setting to "Enabled". (see Normalized Mode for more information, Section 31.4.32.30).

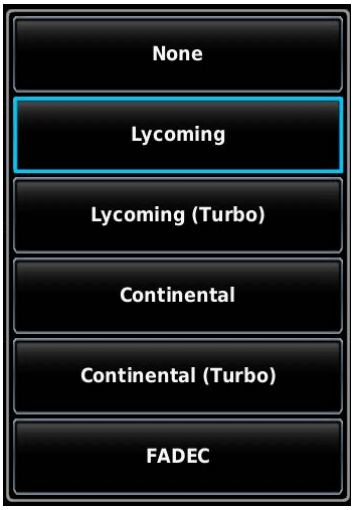
31.4.32.31 Engine Power

Estimated engine power can be calculated for Lycoming and Continental engines, using inputs from RPM, manifold pressure, and fuel flow sensors (all three are 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.

To display engine power data or related status information from a FADEC engine, select "FADEC" for the engine type. Not all FADEC types provide engine power information; some other FADEC types provide general power status (for example, an Economy mode indication) but not a percentage.



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

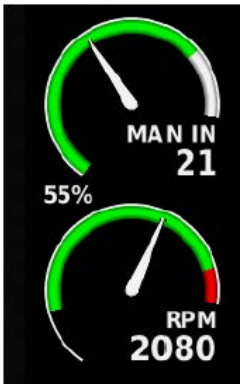


Figure 31-75 Engine Power Display

With a Rotax 912iS/915iS/916iS FADEC engine, if Engine Power is configured for "FADEC" and the aircraft is on the ground with the engine stopped, the EIS display and Engine page will display the FADEC throttle position to assist in engine starting. This is shown as a percentage of maximum throttle position, preceded by a 'T'.

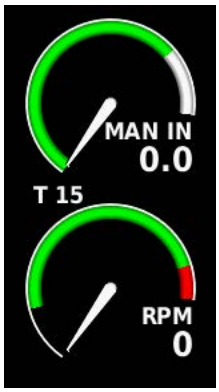


Figure 31-76 Rotax FADEC Throttle Position Display

31.4.32.32 Engine Time Configuration

Engine Time – Engine Time records the total operating time of the engine, in hours, when Record Mode is set to Fixed Rate or Variable Rate. Engine time will be recorded whenever engine RPM exceeds the value specified in the Minimum Recording RPM field.

When Fixed Rate is selected, engine time will increase by 1 hour if the engine is run for 1 hour at any RPM above the Minimum Recording RPM.

When Variable Rate is selected, the Standard Recording RPM field determines the engine speed at which engine time increments at 1 hour per hour. Engine RPMs greater than the Standard RPM value will cause engine time to increase faster, and slower RPMs will cause engine time to increase more slowly. For example, if Standard Recording RPM is set to 2300, engine time will increase by 1 hour if the engine is run for 1 hour at 2300 RPM, and the recorded engine time will increment by approximately 0.9 hours if the engine is run for 1 hour at 2100 RPM. This type of engine time recording is typical for piston engine applications because it mimics the way a mechanical tachometer records engine time (also called tach time).

The Maximum Recording RPM item sets an upper limit on the RPM readings used to calculate engine time. This can be used to prevent spurious RPM signals from adversely affecting recorded engine time and should always be set higher than the redline RPM.

For turbine engine applications, only the RPM1 value affects engine time recording.



NOTE

The Engine Time item is disabled when certain FADEC engines are configured. For installations where engine time data is provided by the FADEC interface, engine hours provided by the FADEC will be displayed.

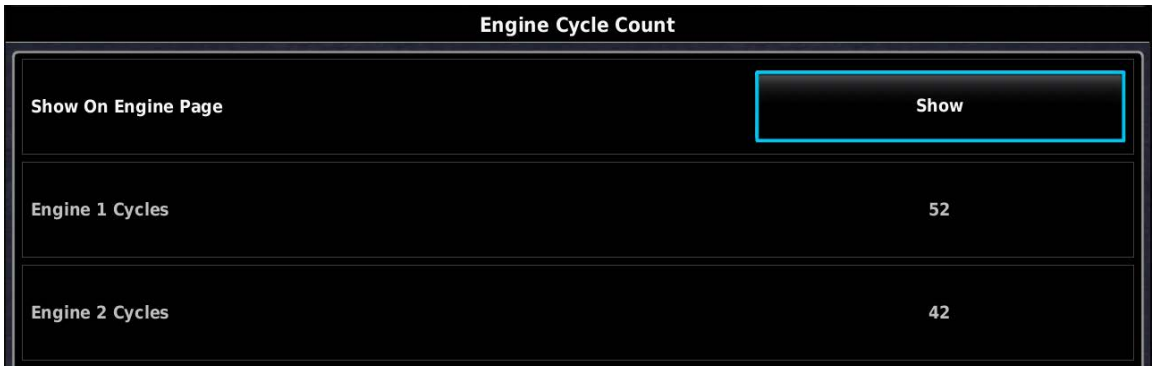
To set Engine Time:

1. In configuration mode, select Engine, then scroll down the list using the inner right knob (or use touch screen) to highlight Engine Time.
2. Press the Engine Time Bar.
3. Select Menu, Enable Time Editing (to enable editing of Engine Time field).
4. Edit Current Hours and Select Save.

31.4.32.33 Engine Cycle Count Configuration

Engine Cycle Count - Engine Cycle Count records the number of engine cycles. This feature is available and displayed only when the Engine Time Record Mode (Section 31.4.32.32) is not Disabled. An engine cycle is defined as the following sequence: start the engine, takeoff, land, stop the engine. Multiple takeoffs and landings between one engine start and stop will only accumulate one engine cycle. An aircraft configured for multiple engines will have a cycle count for each engine.

Selecting the Engine Cycle Count field from the Engine Information System Configuration page opens the Engine Cycle Count configuration page. The Show On Engine Page field determines whether the engine cycle count is displayed on the engine page in Normal mode. This field may be set to Show or Hide. There is also a field to show the current cycle count for each engine configured for the aircraft.



To set Engine Cycle Count:

1. In configuration mode, select Engine & Airframe, select the Settings tab and then select Engine Cycle Count.
2. Press the display's Menu button and then press the Enable Cycle Editing soft button. This turns the engine cycle counts into button fields.
3. Press the Engine Cycle field and enter the desired cycle count using the popup number pad. Press Enter or Cancel.
4. Press Save or Cancel.

31.4.32.34 Total Airframe Time Configuration

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 be changed by the user, see the following procedure.

The Record Mode selections are listed in Table 31-20.

Table 31-20 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 RPM1 value indicates engine is running



To set Total Time:

1. In configuration mode, select Engine, then scroll down the list using the inner right knob (or use touch screen) to highlight Total Time.
2. Press the Total Time Bar.
3. Select Menu, Enable Time Editing (to enable editing of Total Time field).
4. Edit Current Hours and Select Save.

31.4.32.35 Propeller Sync Configuration

If two EIS LRUs are configured, and RPM is configured for twin-engine display, a graphical propeller sync indicator (syncrometer) can be configured to display on the RPM gauge. As with a traditional mechanical syncrometer gauge, the propeller sync gauge spins in the direction of the faster-turning engine when propeller RPM is not synchronized. The Propeller Sync Configuration page allows the propeller sync indicator to be enabled or disabled, and the maximum RPM difference to be configured. Smaller values for the Maximum Difference field make the propeller sync indicator more sensitive.



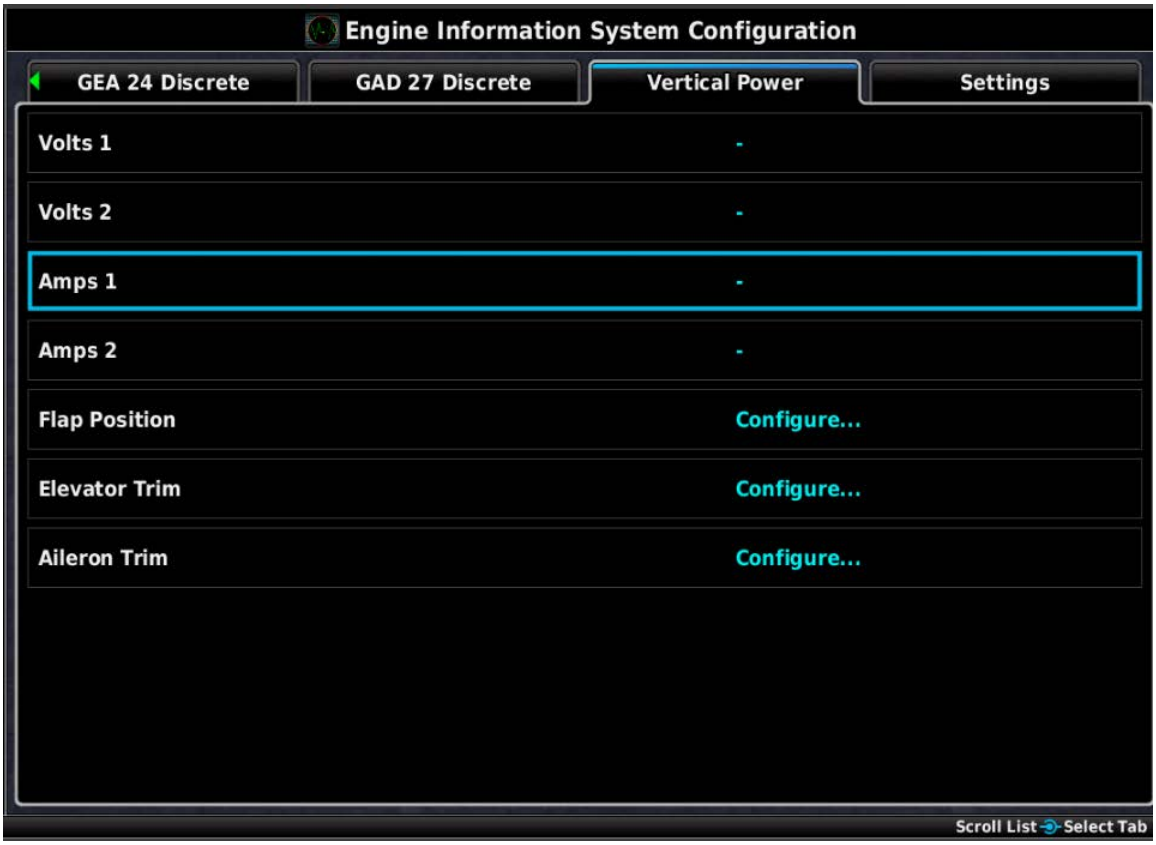


31.4.32.36 Vertical Power VP-X

Vertical Power inputs are configured through the vertical power tab within the Engine & Airframe Menu.

NOTE

Only one Vertical Power unit may be installed per aircraft.



31.4.33 External Lights Configuration Page

The external lights configuration page is used to set up the landing and/or taxi lights for alternating flashing. The lights are labeled Flash Light 1 and Flash Light 2, and the user may define their purpose.

NOTE

Electrical Control System must be enabled on the LRU Configuration Page in order to display the External Lights Configuration Page.

Flash Selection - Can be set to Light 1 to only flash lighting output 1, Light 2 to only flash the lighting output 2, or Flash Both Lights to flash both lighting outputs. If both lighting outputs are flashed, they will alternate (i.e. while light 1 is on, light 2 is off and vice versa).

Automatic Flashing - The lighting outputs may be flashed by the use of an external switch (not controlled through software), by use of an automatic switch on airspeed, or both. The automatic (airspeed controlled) flashing must be enabled to allow an airspeed value to be entered. The airspeed value should be greater than the final approach speed of an airplane so the lights will not flash during landing.

Light Priority - Controls the interaction between light flashing behavior and external light switches.

- When set to "Flash", if other settings on the External Light page determine that an external light should flash, it will flash regardless of the state of its associated switch.
- When set to "Switch (On)", an external light will be steady on any time its switch is on, and can be either off or flashing when its switch is off.
- When set to "Switch (Off)", an external light will be steady off any time its switch is off, and can be either on or flashing when its switch is on.

Warmup Time - For lighting systems requiring a warmup time (such as HID lights), select a value closest to the recommended warmup time without being smaller (than the lighting sytem's recommended warm-up time). For example, if the recommended warmup time for a lighting system is 22 seconds, then the 25 second option should be selected.



31.4.34 Cockpit Lighting Configuration Page

NOTE

Electrical Control System must be enabled on the LRU Configuration Page in order to display the Cockpit Lighting Configuration Page.

The cockpit lighting bus is split into three sections described as follows:

Input Selection Tab

Lighting Bus - Has a pull down menu to select one of six lighting buses (three DC analog outputs and three AC (PWM, pulse width modulation) outputs).

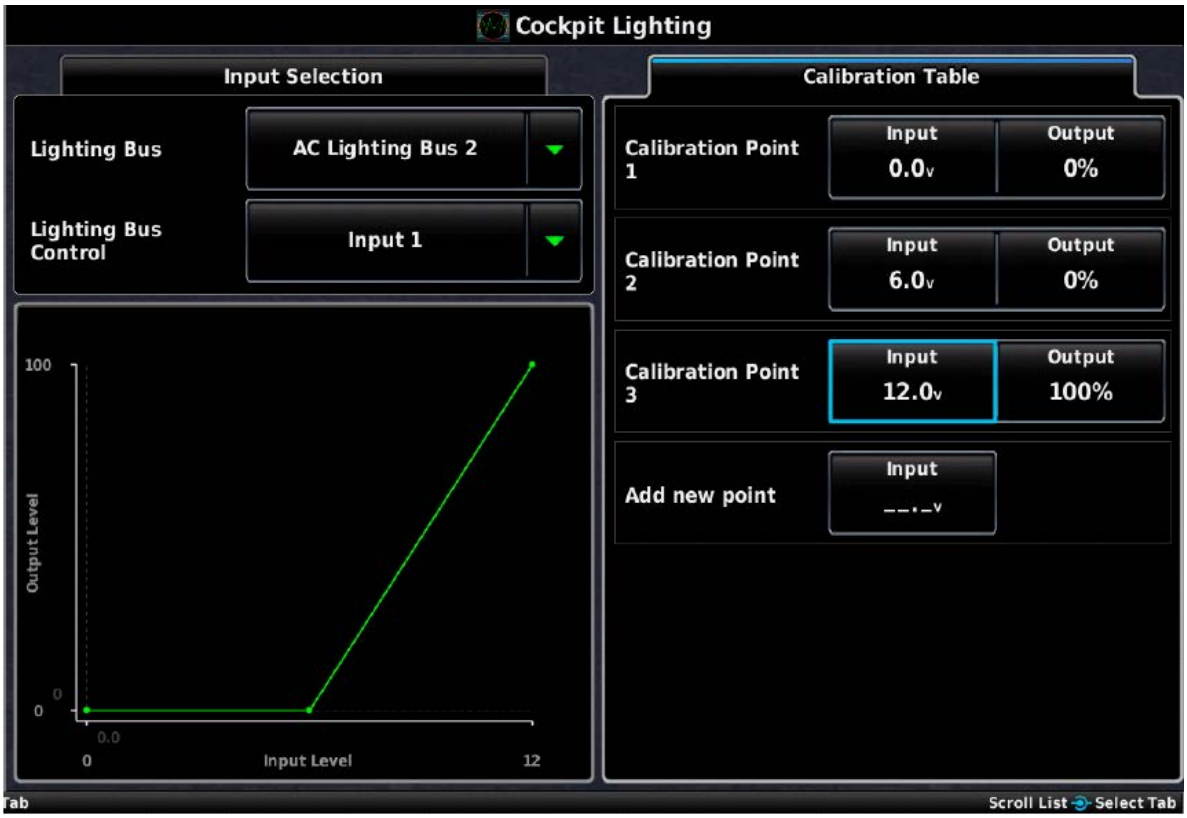
Lighting Bus Control - Can be used to select None to turn a bus off, or it can be used to select one of three controlling inputs.

Calibration Table Tab

Contains all function points (up to four) used to translate a given analog input voltage value to a given analog or PWM value on the lighting buses. The system automatically places the points in order of increasing input voltage. The output value is in terms of 100% of the maximum output for a given bus. Use the "Add new point" input to add a new voltage value. To delete a point, press the "Input" value for the point to be deleted, then press "Clear".

Graph

Lighting Bus Output (brightness) is displayed as the vertical (Y) axis, and Lighting Bus Input level is displayed as the horizontal (X) axis. For the points entered, as the input voltage increases, the output percentage must also increase (the plotted line can only go up and to the right). Points that are acceptable by the system are displayed in green. Points that have potential issues are displayed in yellow.



31.4.35 Radar Altimeter or Radio AGL

NOTE

If "Radio AGL" is enabled on the LRU Configuration Page, a "Radio AGL" option will be available from the main configuration menu. If an ARINC 429 Radar Altimeter is assigned to an ARINC 429 input, a Radar Altimeter option will be available from the main configuration menu.

Antenna Height (Garmin GHA 15 only) - Measure the physical distance between the GHA 15 and ground. Input this value into the Antenna Height input box and select the appropriate measurement units. The measured distance for antenna height can be offset if the zero foot point is desired to be at a different height than mounted unit height on ground (for example, while flaring). Unit may show negative height while on ground if measured unit distance is offset.

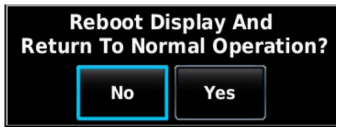
Maximum Displayed Altitude - Sets the maximum radar altitude or radio AGL value for which a data field will be displayed on the PFD. When above this value, the PFD data field will be removed from the display.

31.4.36 Save & Reboot Button

After all configuration changes have been made, use the Save & Reboot button to save all changes and return to normal mode.

The System 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 GDU 4XX. This page has no user-selectable options. Faults are indicated by a Red X next to the affected LRU.

1. In configuration mode (Section 31.2), use the Touch Panel or a Move Selector Knob to select and view the System Information Page. The user may scroll the Device List box and the selected device's info by using the Touch Panel or a Move Selector Knob.
2. Press the Back key to return to the Configuration Mode page when finished (if desired).



31.5 Garmin Database Updates

The GDU 4XX MFD database updates can be obtained by visiting the flyGarmin® website (flyGarmin.com). The flyGarmin website requires entering the System ID to update databases. This allows the databases to be encrypted with the G3X system's unique System ID when copied to the SD Card. The System ID is displayed on the Database Information Page in normal mode, and on the System Information Page in configuration mode. The Unit ID is different for each LRU in the G3X system, and cannot be used for this purpose.

Since these databases are stored internally in each GDU, 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 the appropriate databases are initialized and displayed on the start-up screen during start.

NOTE

Perform database updates on the ground only, and remain on the ground while a database update is in progress.

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.

31.5.1 Updating Garmin Databases

Equipment required to perform the update is as follows:

- Windows-compatible PC computer (Windows 2000 or XP recommended)
- SanDisk SD Card Reader, P/Ns SDDR-93 or SDDR-99 or equivalent card reader
- Updated database obtained from the flyGarmin website
- SD or SDHC card up to 32 GB can be used, 8 GB recommended for GDU 4XX units (Garmin recommends SanDisk® brand).
- SDXC and SDUC cards are not supported.

NOTE

In the event there is a file corruption problem with the SD card, it may be necessary to reformat the card. This can cause an issue when formatting the SD card using Mac OS, where the newly formatted card will not be recognized by the avionics system. When using a Macintosh computer to format the SD card, Garmin recommends using the SD Memory Card Formatter application available as a download from SDcard.org. When running the application, use the Quick Format option.

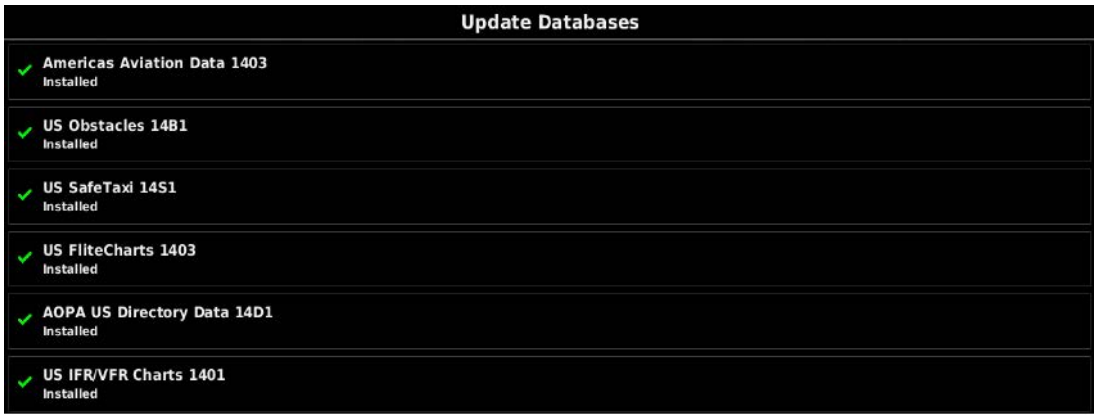
After the data has been copied to the SD card, perform the following steps:

1. Insert the SD card in the card slot of the GDU 4XX to be updated.
2. Turn on the GDU 4XX to be updated.

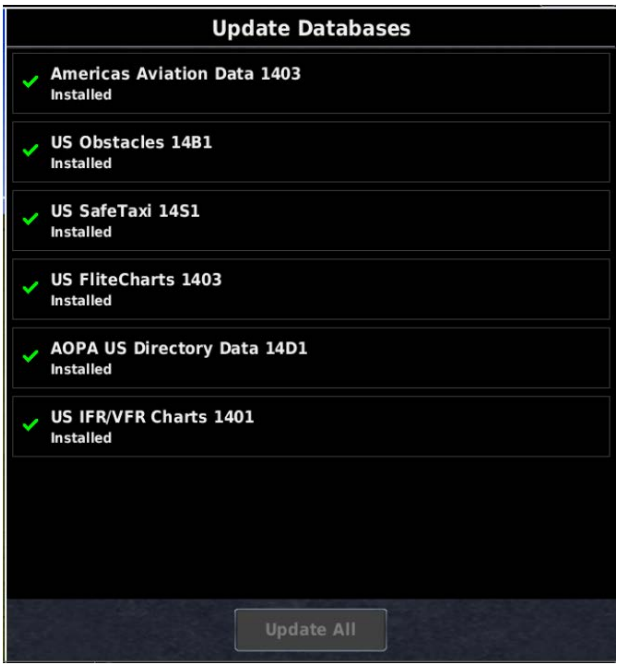
NOTE

Steps 1 and 2 can be performed in reverse order.

3. Upon turn-on, a screen appears which lists the databases on the SD card. A green checkbox indicates the database already installed on the GDU 4XX is up to date, an empty checkbox indicates the database on the SD card is more current and should be installed (alternatively, the Database Update page can be accessed using Main Menu > Tools > Database > Menu > Update Databases).



4. The database(s) can be updated by either highlighting UPDATE ALL and pressing the ENT key; or by using the Touch Panel or a Move Selector Knob 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 Back key.



8. Repeat steps 1-7 for each installed GDU 4XX.

31.5.2 Available Databases

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.

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.

FliteCharts® Approach Charts

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.

IFR/VFR Charts

The IFR/VFR Chart database contains Sectionals, Hi-Altitude, Low-Altitude, World Aeronautical Charts (WAC), and Terminal Area Charts (TAC). This database is updated on a 28-day cycle.

Aviation Navigation Data (NavData™)

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

Chartview™ Approach Charts Navigation Database

ChartView is an optional feature that must be activated by an enablement card that can be obtained by visiting the flyGarmin website (flygarmin.com). ChartView resembles the paper version of 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 can be updated by purchasing database subscription updates from Jeppesen Sanderson.

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® Database

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.

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.

31.6 SiriusXM® Activation Instructions (GDU 455/465 only)

Follow the below instructions to activate the SiriusXM receiver in the GDU 455/465.

Before SiriusXM Satellite Weather can be used, the service must be activated by calling SiriusXM at 1.866.528.7474. Service is activated by providing SiriusXM Satellite Radio with a Radio ID. SiriusXM Satellite Radio uses the Radio ID to send an activation signal that allows the G3X MFD to display weather data and/or entertainment programming. SiriusXM 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 SiriusXM Activation.
2. Make sure the aircraft's XM antenna has an unobstructed view of the southern sky. It is highly recommended 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 SiriusXM activation system.
4. Power on the avionics and allow the G3X to start. 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 455/465 to store the activation before removing power.

NOTE

During the activation process do not change channels or pages.

If the SiriusXM receiver will not receive, an Activation Refresh may resolve the issue. An Activation Refresh may be performed by visiting the link https://care.siriusxm.com/retailrefresh_view.action and following the instructions listed there. Visit http://www.siriusxm.com/sxmaviation for SiriusXM weather info.

31.7 External Interface Configuration (Garmin units only)

Refer to Section 25.2 and Appendix G.2 for wiring the interface connections between GDU 4XX 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 Section 25.2 and Appendix G.2 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).

31.7.1 GNS 4XX/5XX Series Units (including 'A', 'TAWS', & 'WAAS' models)

Entering Configuration Mode:

1. With power applied to the aviation rack and the 4XX/5XX 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 making sure the cursor is off and rotating the small right knob, select the desired Config Page.

NOTE

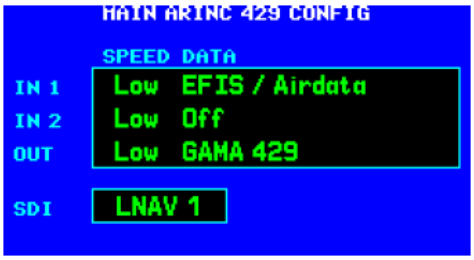
Make configuration changes only as described in this section, changing other configuration settings is not recommended and may significantly alter the unit's operation. Garmin recommends recording all configuration settings (before making any changes) for reference.

Changing data on the displayed configuration pages:

1. Press the small right knob to display 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

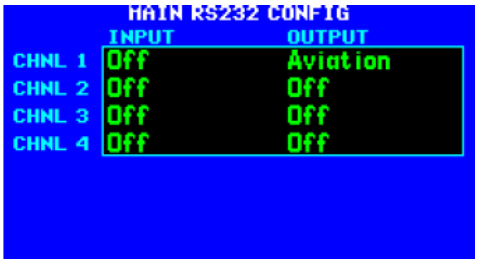
The configuration pages are in the order found when rotating the right small knob clockwise starting at the MAIN ARINC 429 CONFIG page. Follow the preceding procedures to enter configuration mode and to select the desired configuration settings (the following figures are for reference only and may vary from actual screens/settings, refer to instructions on the drawings in Section 25.2 and Appendix G.2).



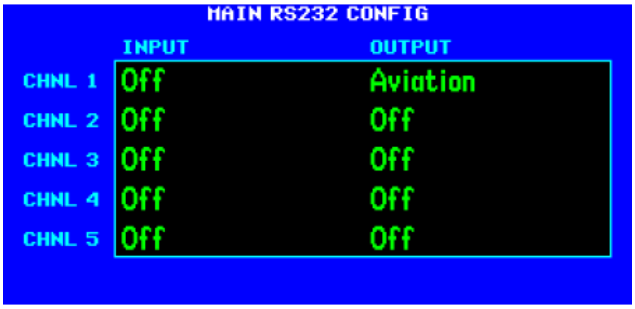
4XX Main ARINC 429 Config Page



5XX Main ARINC 429 Config Page



4XX Main RS232 Config Page



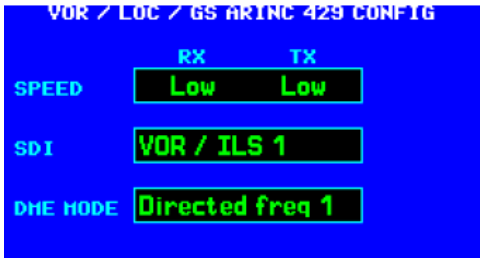
5XX Main RS232 Config Page



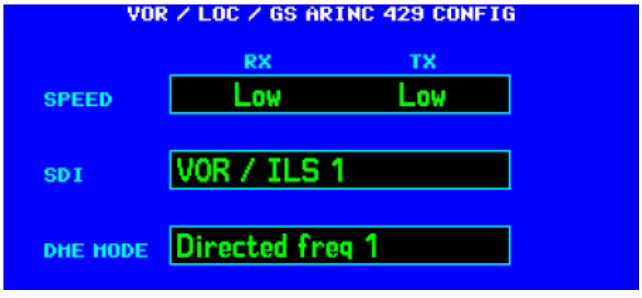
4XX Main CDI/OBS Config Page



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.

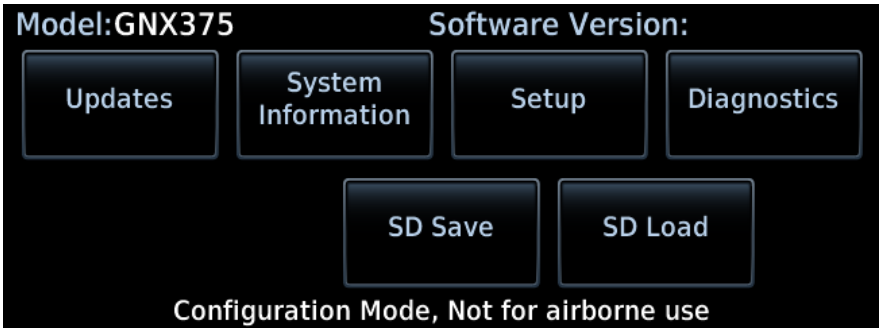
31.7.2 GNX™ 375 IFR Navigator

Perform all configurations, calibrations, and test procedures in configuration mode.

Dots display above the page name when more than one page is in a group. A cyan dot indicates the active page. Swipe left or right to change pages.

To Enter Configuration Mode:

1. Push and hold the inner knob.
2. Push the power key.
3. When the configuration mode home page displays, release the knob.



GNX 375 Configuration Mode Home Page

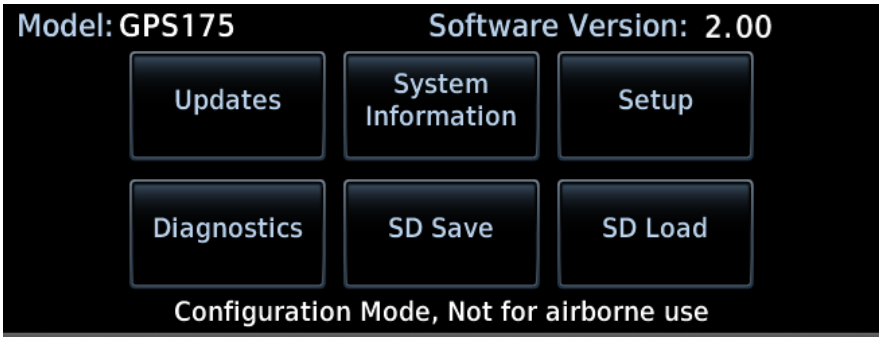
31.7.3 GPS 175

Perform all configurations, calibrations, and test procedures in configuration mode.

Dots display above the page name when more than one page is in a group. A cyan dot indicates the active page. Swipe left or right to change pages.

To Enter Configuration Mode:

1. Push and hold the inner knob.
2. Push the power key.
3. When the configuration mode home page displays, release the knob.



GPS 175 Configuration Mode Home Page

31.7.4 GTX Transponder

Refer to the applicable transponder installation manual for configuration mode instructions. The configuration settings are detailed in Section 25.2 and Appendix G.2 of this document.

NOTE

Make configuration changes only as described in Section 25.2 and Appendix G.2, 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.

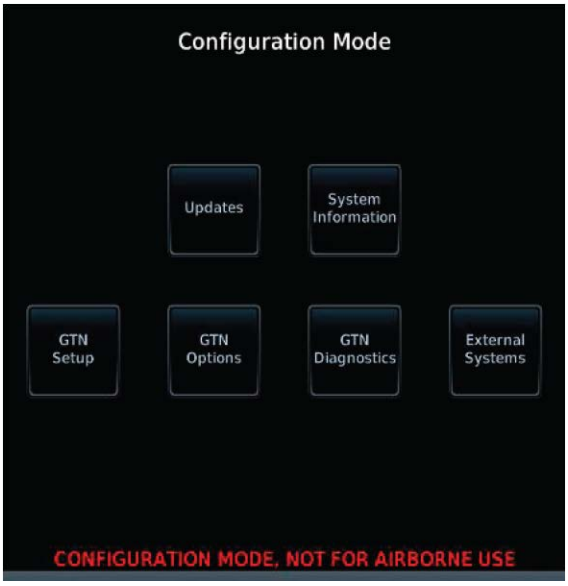
31.7.5 GTN 625/635/650/725/750 Unit

Configuration Mode Operations

Before configuring the GTN, make sure that no Configuration Module service messages are displayed in the message queue. This would indicate 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 pressing 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 pressing the screen and dragging the page in the desired direction, or by pressing the Up or Down keys.

Entering Configuration Mode:

1. With the GTN turned off (circuit breaker pulled), press 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 illuminated 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 Section 25.2 and Appendix G.2).
4. Press the GTN Setup key.



GTN 7XX Configuration Mode Home Page

5. Follow configuration instructions per applicable drawings in Section 25.2 and Appendix G.2.



GTN 6XX GTN Setup Page



GTN 7XX GTN Setup Page

31.8 Sharing G3X Touch Flight Plans (Crossfill) with External IFR Navigators

The G3X Touch system is able to share (crossfill) flight plans that are created/edited on the G3X Touch (using internal flight planning) with some external IFR navigators (currently GPS 175, GNX 375, and GTN 6XX/7XX). The IFR navigator must be correctly configured (Section 31.8.1) and wired (see Figure 25-2.19 for GTN 6XX/7XX, Figure 25-2.17 for GNX 375, Figure 25-2.18 for GPS 175) to perform this function.

If configured/wired correctly, when an internal flight plan is created on any GDU 4XX display in the G3X Touch system, that flight plan will be automatically crossfilled to the external IFR Navigator.

If the G3X Touch is using internal flight planning during a VFR flight, the IFR navigator will stay synchronized with any changes in the G3X Touch flight plan (this is useful if there is a need to switch to the IFR navigator during flight).

SIDs, STARs, and approaches cannot be loaded/activated from the G3X Touch display. Alternatively, a multi-point flight plan can be created using the G3X Touch display, then, by touching the External Flight Planning button on the G3X Touch display, that multi-point flight plan is crossfilled to the external IFR navigator which does allow loading/activating an approach if needed, to fly a procedure at the destination.

NOTE

The G3X Touch system only crossfills multi-point flight plans with the external IFR navigator when using internal flight planning on the G3X Touch. Direct-To operations and single point flight plans are not crossfilled between the systems.

NOTE

Any Direct-To operation must be commanded on the external IFR navigator (G3X Touch or IFR Navigator) being used.

NOTE

Switch the G3X Touch system to external flight planning to use the IFR navigator for normal flight planning (including enroute, SIDs, STARs, and approaches).

31.8.1 External IFR Navigator Crossfill Configuration

31.8.1.1 GPS 175, GNX 375, and GTN 6XX/7XX (v6.62 and newer only)

Two configuration changes are required to enable the crossfill function. In normal mode, External FPL Crossfill must be enabled on the System Setup page. In configuration mode, External FPL must be enabled on the Main System configuration page.

See Section 31.7.2 (GNX 375), Section 31.7.3, (GPS 175), or Section 31.7.5 (GTN 6XX/7XX) for instructions on entering configuration mode.



External FPL Crossfill Enabled (Normal Mode)



External FPL Enabled (Configuration Mode)

31.9 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.

32 TROUBLESHOOTING

In this manual, 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™ Avionics Pilot's Guide (190-01115-00) or the G3X Touch™ Avionics Pilot's Guide (190-01754-00) 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 1-866-854-8433, 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.

32.1 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™ display 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 ADAHRS. Inspect the physical installation of the affected LRU.
2. Check the connectors are fully seated, and 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. Make sure 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 vibration in the ADAHRS.
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 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.

32.1.1 Status LED

The GAD 29, GEA™ 24 engine interface module, GPS 20A, GSA 28, GSU 25, and GTR 20/200 units have an LED on their outer cases that indicates the LRUs current status. The status indications are:

Table 32-1 Status LED Indications

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

32.2 CAN Network Troubleshooting

If communication problems between LRUs are suspected, the CAN bus wiring and arrangement of devices on the network should be examined. See Section 2.3.1.3.6 for information.

32.3 GDU 37X/4XX

32.3.1 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 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).

32.3.2 Unit Communication Error Messages (Two or Three GDU Systems)

Error messages occur if there is a mismatch in GDU 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). Make sure 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 Appendix G.2 for information on GDU mode pin connections.
- Network Address Changed - Indicates the state of a GDU's mode pins was detected. Check for loose connections and see Appendix E.4.3 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.

32.4 Air Data Troubleshooting

Under normal operating conditions, the ADAHRS 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).

The displayed OAT (Figure 32-1) will either be a number (when valid), or display an X. Valid OAT is required to calculate TAS, so if TAS is invalid because OAT is unavailable, both OAT and TAS will display an X, which indicates the problem is OAT (not air data) related.

A dashed-out value for TAS may simply mean the true airspeed being measured is too low to be of value (e.g. when the aircraft is on the ground). If the TAS indication still display dashes at speeds greater than 20 knots and/or the OAT indication is Red -X'd (as shown in Figure 32-1):

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



Figure 32-1 Invalid OAT & TAS Indications

If the Airspeed and/or Altitude is failed and shows a Red-X condition as shown in Figure 32-2:

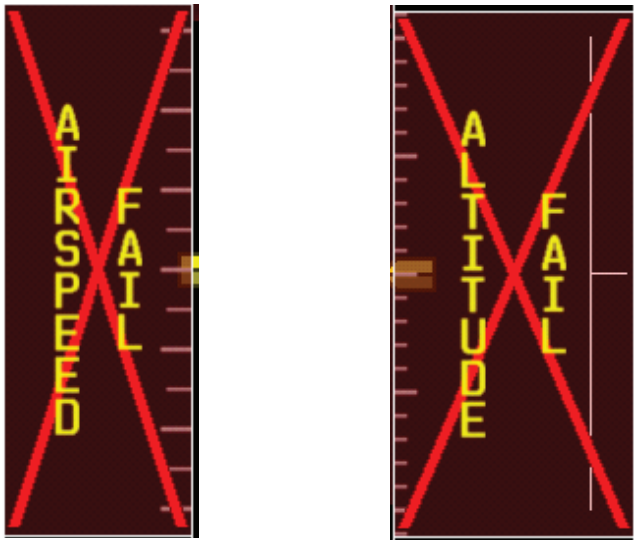


Figure 32-2 Airspeed and Altitude Failure Indications

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

If a periodic altimeter test, performed with properly calibrated static system test set, indicates the ADAHRS static pressure sensor needs to be re-calibrated, follow the procedures described in Appendix H.4.3.4 for GDU 37X or Section 31.4.7.4 for GDU 4XX units.

32.5 Engine Indication Troubleshooting

To troubleshoot an Engine Indication failure (Figure 32-3), 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.

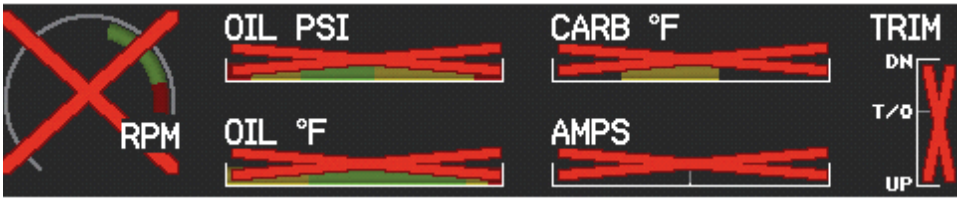


Figure 32-3 Engine/Airframe Failure Indications (Reversionary or Split-Screen PFD)

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 ADAHRS +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, make sure 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.

32.6 ADAHRS Troubleshooting

32.6.1 Heading Red-X



Figure 32-4 Heading Failure Indication (Full-Screen PFD)

If a Red-X (steady or intermittent) is displayed on the heading (Figure 32-4), 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 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 ADAHRS 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 15-4 for minimum distances for installed equipment from the GMU to prevent interference.

If magnetic heading is not present on the GDU, there may be a problem with communication between the ADAHRS and GMU magnetometer. Troubleshoot any possible wiring/connector issues before replacing either unit.

32.6.2 Attitude/Heading Failure Troubleshooting



Figure 32-5 Attitude and Heading Failure Indications (Reversionary or Split-Screen PFD)

Before 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 "ADAHRS Align: Keep Wings Level" message (which is indicative of an ADAHRS reset), or the "Attitude Fail" message (which is indicative of either ADAHRS 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?

- ADAHRS not receiving airspeed
- ADAHRS not receiving any GPS information
- ADAHRS magnetic-field model out of date
- ADAHRS 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 ADAHRS may not be able to provide valid heading/pitch/roll data for the following reasons:

1. If an "ADAHRS not Calibrated" message is displayed, the GSU 73 configuration module in the harness (that stores the installation configuration parameters) is either not present or not wired properly. In this case, either:
   - The GSU 73 configuration module is inoperative.

   OR

   - The external installation configuration parameters are not calibrated and the ADAHRS and/or Magnetometer calibration needs to be performed. If either of these is not calibrated, the ADAHRS 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 ADAHRS for it to compute valid attitude information.

Garmin product support frequently makes use of information from .csv data log files to assist in troubleshooting ADAHRS issues. Refer to Section 32.8 for information on collecting data log files.

32.7 Post Installation Calibration Procedures

The calibration procedures in Appendix H.4.3.2 and Appendix H.4.4.3 (for GDU 37X systems) or Section 31.4.7.2 and Section 31.4.8.3 (for GDU 4XX systems) may be performed during troubleshooting. Table H-2 and Table H-3 (for GDU 37X systems) or Table 31-2 and Table 31-3 (for GDU 4XX systems) list the status box requirements for each calibration procedure. The Magnetometer Interference Test may be used to find if the location of the GMU 22 is susceptible to magnetic interference. The Engine Run-Up Vibration Test can be used to find if the mounting of the ADAHRS 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 ADAHRS 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 ADAHRS and GMU, and does not account for all possible vibration profiles that may be encountered during normal aircraft operation

32.8 Sending Troubleshooting Data to Garmin

To assist with troubleshooting an issue, it may be helpful to send screenshots and/or .csv log files stored on the SD card to Garmin. This data can be especially useful to troubleshoot autopilot or AHRS related issues. This data can be sent to g3xpert@garmin.com for troubleshooting assistance.

- See Appendix H.4.12.2 (GDU 37X) or Section 31.4.13 (GDU 4XX) for instructions on enabling/using the screenshot function.
- See Appendix H.4.18 (GDU 37X) or Section 31.4.31 (GDU 4XX) for instructions on enabling/using the data logging function.

33 MAINTENANCE

33.1 Inspections/Continued Airworthiness/Maintenance

Periodic maintenance of most G3X™ avionics LRUs is not required and is "on condition" only. Instructions for Continued Airworthiness (ICA) are not required per 14 CFR Part 21 for these products as they have received no FAA approval or endorsement. Garmin recommends the G3X LRUs be inspected for proper operation, secure attachment, integrity of connectors and wiring, cleanliness, leakage of hoses and tubes, and any evidence of damage as part of the required annual or periodic aircraft inspection. For more general inspection guidance, please refer to the applicable sections of CFR Part 43 Appendix D and Chapter 12 of AC 43.13-1B. For ADAHRS Static Pressure Calibration, refer to Appendix H.4.3 for GDU™ 37X display or Section 31.4.7 for GDU 4XX.

LRUs that require periodic maintenance are listed in the following subsections.

33.1.1 GAP 26

Garmin recommends that a leak test (Section 5.5.5) be performed following any maintenance action in which the pitot or AOA pneumatic lines are opened up (i.e. whenever the GAP 26 is removed or replaced).

33.1.2 GCO™ 14

Maintenance of the GCO 14 is "on condition" only. The GCO 14 operational life limit is ten years from the time of purchase. A system message displays on the host LRU when the GCO 14 is thirty days from expiration. The message continues until the GCO 14 is replaced.

33.1.3 GSU 25

Per Part 43 Appendix E, paragraph (b)(2), Garmin recommends 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. This procedure is recommended when the static system is opened up (i.e. whenever the GSU 25 is removed or replaced). Garmin also recommends that a leak test be performed following any maintenance action in which the pitot or AOA pneumatic lines are opened up (i.e. whenever the GSU 25 is removed or replaced).

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 in July of 2020 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 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 (Appendix H for GDU 37X systems and Section 31 for GDU 4XX systems) must be repeated.

33.1.4 GSU 73

Per Part 43 Appendix E, paragraph (b)(2), Garmin recommends 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. This procedure is recommended when the static system is opened up (i.e. whenever the GSU 73 is removed or replaced). Garmin also recommends that a leak test be performed following any maintenance action in which the pitot pneumatic line is opened up (i.e. whenever the GSU 73 is removed or replaced).

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 in July of 2020 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 software update. Alternatively, the IGRF model can be updated by the end user using 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.

33.1.5 Transponder

All GTX™ 35R/45R/335/345 transponders, and GTX 23ES/33/33ES/330/330ES transponders with software version 8.00 or later are compliant with RTCA/DO-181D, which specifies the selection of transponder ALT and GND modes may not be controlled by the pilot. To allow the transponder to be operated in ALT mode while on the ground, for the purposes of performing periodic testing in accordance with the requirements of 14 CFR Part 91.413, a special transponder ground maintenance test mode is provided.

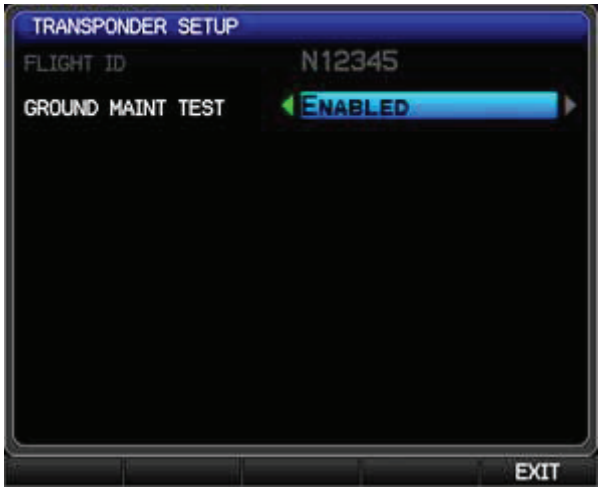
To access ground maintenance mode in a G3X Touch™ avionics system with GDU 4XX displays:

1. Access the Transponder page, press the Menu key.
2. Select Enable Maintenance Test to force the transponder into ALT mode.



To access ground maintenance mode in a G3X system with GDU 37X displays:

1. Access the Transponder Setup page using the Main Menu.
2. Change the setting for Ground Maintenance Test to Enabled to force the transponder into ALT mode.



Transponder ground maintenance mode will be cancelled following a power cycle, or if the aircraft is determined to be airborne.

33.2 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.

33.2.1 GDU 37X/GDU 4XX

33.2.1.1 Original GDU is Reinstalled

No software or configuration loading is required if the original GDU is reinstalled. Continue to Section 33.2.2.

33.2.1.2 Original GDU(s) Installed in a Different Position

No software or configuration loading is required if the GDU is installed in a different location. Continue to Section 33.2.2.

33.2.1.3 New GDU(s) Installed

If a new GDU is installed (new serial number), verify the correct software version on the MAIN page (GDU 37X) or on the System Information page (GDU 4XX) 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 33.2.2.

33.2.1.4 New GDU (PFD) Configuration Module Installed

Make sure 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 (Appendix H for GDU 37X and Section 31 for GDU 4XX).

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.

33.2.1.5 GDU 37X Replaced with New GDU 4XX

NOTE

A G3X system installation can use either GDU 37X or GDU 4XX displays, but a G3X system installation cannot use both GDU 37X and GDU 4XX displays simultaneously.

Data written to the config module by a GDU 37X display cannot be read by a GDU 4XX. Before upgrading an existing G3X system to GDU 4XX displays, take careful written note of all configuration settings, and back up fuel quantity calibration data to an SD card as described in Appendix H.4.19.4.

The main display connector is pin-compatible between the GDU 37X and GDU 4XX. The GDU 4XX supports additional RS-232 ports, which may be used when replacing two 7" GDU 37X displays with a single 10.6" GDU 46X. For redundancy of ADAHRS data, a GDU 4XX may also optionally be connected to the GSU 25 using the dedicated RS-232 port provided for this purpose (see Section 24.4.1).

After removing GDU 37X displays and installing GDU 4XX displays, including making any necessary interface wiring changes, erase the config module using the following steps:

1. Power on the system in config mode (see Section 31.2).
2. Access the System Information config page (see Section 31.4.3).
3. In the list of devices, select the PFD.
4. Press the MENU key and select "Format Config Module".
5. When prompted, confirm erasing the config module.
6. The PFD will reboot when finished. Re-enter config mode to complete GDU 4XX setup.

Re-enter configuration settings as described in Section 31.4, including restoring fuel quantity calibration data from the SD card by using the instructions in Section .

33.2.2 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.

33.2.2.1 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 33.2.4.

33.2.2.2 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 33.2.4.

33.2.3 GSU 25

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.

CAUTION

During a pitot/static test, if the AOA port is unused, connect it to the static port to avoid overpressuring (and causing damage to) the internal AOA sensor.

33.2.3.1 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 33.2.4.

33.2.3.2 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 (Appendix H.4.3.1 for GDU 37X systems and Section 31.4.7.1 for GDU 4XX systems), pitch/roll offset (Appendix H.4.3.2 for GDU 37X systems and Section 31.4.7.2 for GDU 4XX systems), and magnetometer calibration procedures (Appendix H.4.4.3 for GDU 37X systems and Section 31.4.8.3 for GDU 4XX systems) must be performed. The correct GSU 25 software version will automatically be loaded from the GDU.

33.2.4 GMU 11/22

NOTE

If the GMU 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.

33.2.4.1 GMU is Reinstalled

Any time a GMU is reinstalled, a new magnetometer calibration is required (Appendix H.4.4.3 for GDU 37X systems and Section 31.4.8.3 for GDU 4XX systems). Continue to Section 33.2.4.2

33.2.4.2 New GMU Installed

If a new GMU is installed (new serial number), a new magnetometer calibration (Appendix H.4.4.3 for GDU 37X systems and Section 31.4.8.3 for GDU 4XX systems) is required. Following a successful magnetometer calibration, the Return to Service Procedure is complete.

33.2.5 GEA™ 24 Engine Interface Module

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.

GEA 24 (010-01042-00) and GEA 24B (010-02770-00) are fit/form/function the same, with the exception of Fuel Quantity inputs. If a GEA 24 in an existing installation is replaced with a GEA 24B or vice versa, all Fuel Quantity inputs set as Resistive inputs must be re-calibrated (refer to Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems). Fuel Quantity inputs using the Digital or Voltage input do not need to be re-calibrated.

33.2.6 GSA 28

33.2.6.1 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.

NOTE

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.

33.2.7 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.

33.2.8 GMC 30X/507

No additional action is required when a GMC 30X/507 is reinstalled or replaced.

APPENDIX A FLIGHT TEST PLAN FOR AUTOPILOT TUNING

A.1 Introduction

This flight test plan provides a general outline for testing and tuning the G3X™ avionics autopilot installation.

This flight test plan assumes the aircraft and pilot have already completed the associated autopilot configuration and test steps in the G3X Installation Manual including the Servo Wiring Checkout (Appendix H.4.5.3 for G3X or Section 31.4.10.5 for G3X Touch™ avionics) and Autopilot Setup (Appendix H.4.5.4 for G3X or Section 31.4.10.6 for G3X Touch) sections.

WARNING

This stage of the flight test involves allowing the GSA 28 autopilot servos to manipulate the flight control surfaces of the aircraft. Extreme caution should be used during the engagement and tuning of the autopilot system. The pilot should always have easy access to the autopilot disconnect button to disconnect the autopilot and take control of the aircraft at any time.

A.2 Flight Test Outline

Perform and complete each of the tasks 1-15 in Table A-1 in order.

Table A-1 Flight Test Outline

Task	Description
1) Verify GSA 28 Servo Arm to Aircraft Control Linkage	The GSA 28 autopilot servos will have the finest control, most torque, and least amount of slop when connected to the control linkage using the inner most hole on the GSA 28 servo arm. This will provide the best autopilot control and experience for the user. For most of the RV series of aircraft, the optimum servo arm mounting hole has been determined and documented in the installation manual, and is not always the inner hole. Use this guidance when available, and follow the WARNING below for any installation. Verify GSA 28 is Connected to the Inner Most Hole Possible: 1. Connect the GSA 28 control servo arm to the inner most hole possible while still allowing for proper aircraft control linkage movement. **WARNING** *It is vital to make sure the autopilot servo and aircraft control linkage is free to move throughout its entire range of travel without binding or interference. Failure to provide adequate clearance between the moving parts of the control system linkage and nearby structure could result in serious injury or death.*
2) Disable Trim Motor Control	Initial autopilot tuning is done with the trim control disabled to avoid the auto-trim function from interfering with the initial autopilot tuning. Disable Trim Motor Control: 1. In configuration mode go to the Trim Configuration page 2. Disable “Trim Motor Control” for all servos

Table A-1 Flight Test Outline

Task	Description
3) Set Initial Servo Torque Limits	Autopilot tuning should be done with the maximum acceptable amount of servo torque. The servo torque should be set to the maximum value that can still be overpowered by the pilot in an emergency situation. Set Initial Servo Torque Limits: 1. In configuration mode go to the Autopilot page 2. Set the "Max Torque" value for each servo to the maximum percentage value that can still be overpowered by the pilot. Slowly apply force to the stick in order to overpower the srrvo.
4) Set Default Autopilot Gains	The initial autopilot tuning should be done using the default gains settings. Set All Initial Autopilot Gains to Default Value: 1. In configuration mode go to the Autopilot page 2. On The "Roll" tab, press the MENU button and hit the "Restore Default" button to set Roll Servo gains to the default values 3. On The "Pitch" tab, press the MENU button and hit the "Restore Default" button to set Pitch Servo gains to the default values 4. On The "Yaw Damper" tab, press the MENU button and hit the "Restore Default" button to set Yaw Damper gains to the default values
5) Enable Data Logging on the PFD Display	Data logging should be enabled so flight data and autopilot commands are logged during flight. This data can later be analyzed to assist in autopilot tuning. Enable Data Logging: 1. In configuration mode go to the Data Log page 2. Enable "SD Card Data Logging" 3. Place an SD card in the PFD card slot
6) On Ground Autopilot Test	Conduct an initial autopilot engagement and checkout with the aircraft on the ground to verify proper control movement. Engage AP and Verify Proper Control Movement: 1. Engage AP in HDG/PIT mode 2. Move heading bug and verify proper aileron response 3. Move pitch reference and verify proper elevator response 4. Move aircraft nose back and forth and verify proper rudder response 5. Verify autopilot servos can be overpowered by the pilot by slowly overpowering the servo torque 6. Verify autopilot disconnect functionality by pressing the AP Disconnect button to disengage the autopilot. 7. If any of the above tests fail, refer to the "Servo Wiring Checkout" and "Autopilot Setup" sections of the Installation Manual to correct these issues

Table A-1 Flight Test Outline

Task	Description
7) In Air Autopilot Tuning	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 GSA 28 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 to disconnect the autopilot and take control of the aircraft at any time.* **WARNING** *All initial autopilot engagement and tuning should be done well below the maneuvering speed of the aircraft (V_A) at a sufficient altitude to allow for aircraft recovery in an emergency situation.*
8) Initial Autopilot Engagement	The autopilot needs to be engaged and the pitch and roll gains coarsely adjusted so the Autopilot can roughly maintain straight and level flight. Engage AP in PIT/ROL Mode and Set Initial Pitch/Roll Gains: 1. Fly the aircraft to a sufficient altitude of 3000 feet AGL or higher 2. Set the aircraft power to maintain straight and level flight with an airspeed below the maximum maneuvering speed V_A 3. Manually trim the aircraft so it can fly straight and level at this altitude and airspeed relatively hands off 4. Engage the Autopilot in PIT/ROL mode 5. If there are any pitch or roll oscillations or aggressive responses, disengage the autopilot 6. Reduce the associated “Pitch Servo Gain” or “Roll Servo Gain” and reengage the Autopilot in PIT/ROL mode until the aggressiveness is removed

Table A-1 Flight Test Outline

Task	Description
9) Roll Servo Gain Tuning	The autopilot should now be engaged and roughly holding the aircraft straight and level. The autopilot should be in PIT/ROL mode commanding a roll attitude of zero degrees and a pitch attitude that roughly holds altitude for the given power setting. First we will tune the Roll servo. The Roll servo has a single gain it uses to fly all lateral modes of the aircraft including ROL, HDG, GPS, LOC, VOR, and LVL. The goal when tuning the roll servo gain is to have the gain large enough so the AP can quickly and accurately control the aircraft, but have the gain small enough so the AP doesn't become overly aggressive to control deflections or turbulence. To tune the roll servo gain, allow the aircraft to settle in its steady state, then use the control stick to quickly over-power the servo and displace the aircraft from the desired roll angle. The pilot should push the stick to the right or the left for roughly one second and then release the stick. After releasing the control stick see the AP response by watching the control stick. The desired response is called a "dead beat response". As the stick returns to neutral, it will just move into position and stop "dead" without cycling back and forth. As you increase the gain above the dead stick response, you will see the stick "bounce" or "cycle" once, twice, or even three times. The recommended roll gain setting is one half the gain value that causes a "three cycle response" to a quick control stick input. So if a gain setting of 2.0 caused a three cycle response, the roll gain would be set to 1.0. Use the following table to find the dead beat, one, two, and three cycle response points if possible. Then set the roll gain to one half the value it was set to that created the three cycle response. **WARNING** *Increase the roll servo gain slowly to make sure the AP does not become overly aggressive and be prepared to disconnect the AP.*

Roll Servo Gain	Response Cycles

Table A-1 Flight Test Outline

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>10)
Pitch Servo Gain Tuning</td><td>
Pitch gain tuning is done the same way the Roll gain tuning was done.
The autopilot should now be engaged and roughly holding the aircraft straight and level. The autopilot should be in PIT/ROL mode commanding a roll attitude of zero degrees and a pitch attitude that roughly holds altitude for the given power setting.
Now we will tune the Pitch servo. The Pitch servo has multiple gains for the various vertical modes, but all vertical modes are based on the basic PIT mode. PIT mode is completely controlled by the single pitch servo gain.
The goal when tuning the pitch servo gain is to have the gain large enough so the AP can quickly and accurately control the aircraft, but have the gain small enough so the AP doesn’t become overly aggressive to control deflections or turbulence.
To tune the pitch servo gain, allow the aircraft to settle in its steady state, then use the control stick to quickly over-power the servo and displace the aircraft from the desired pitch angle. The pilot should pull or push the stick to up or down for roughly one second and then release the stick.
After releasing the control stick see the AP response by watching the control stick. The desired response is called a “dead beat response”. As the stick returns to neutral, it will just move into position and stop “dead” without cycling back and forth.
As you increase the gain above the dead stick response, you will see the stick “bounce” or “cycle” once, twice, or even three times.
The recommended pitch gain setting is one half the gain value that causes a “three cycle response” to a quick control stick input. So if a gain setting of 2.0 caused a three cycle response, the pitch gain would be set to 1.0.
Use the table below to find the dead beat, one, two, and three cycle response points if possible. Then set the roll gain to one half the value it was set to that created the three cycle response.
WARNING
Increase the pitch servo gain slowly to make sure the AP does not become overly aggressive and be prepared to disconnect the AP.
<table>
<tr><th>Pitch Servo Gain</th><th>Response Cycles</th></tr>
<tr><td></td><td></td></tr>
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</td></tr>
</table>

Table A-1 Flight Test Outline

Task	Description
11) Vertical Speed Gain Tuning	The autopilot should now be performing very well in PIT mode and in all the lateral modes. If you are not satisfied with the PIT mode performance, or with any of the lateral mode performances, do not continue. If this is the case, go back to the previous two steps and continue to turn the Pitch Servo Gain and Roll Servo Gain until you are satisfied with the performance. If you cannot successfully set your Pitch Servo Gain and Roll Servo Gain to your satisfaction, contact Garmin at g3xpert@garmin.com for assistance and send us the flight data logs you should have logged on your SD card. Now we will tune the Vertical Speed Gain. The vertical speed gain depends on the pitch servo gain for controlling the pitch servo. The vertical speed gain is the gain that is adjusted to get reliable performance in VS mode which ALT mode depends on. Place the autopilot in VS/ROL mode commanding a bank angle of zero and a vertical speed setting of zero fpm. To tune the vertical speed gain, allow the aircraft to settle in its steady state, then use the control stick to over-power the servo and displace the aircraft from the desired vertical speed of zero. The pilot should pull or push the stick to up or down for roughly one-two seconds to establish a new rate of climb or decent, and then release the stick. After releasing the control stick see the AP response by watching the control stick and vertical speed indicator. The aircraft should return to the desired vertical speed of zero without being too aggressive or lazy. To increase the aggressiveness of the vertical speed response, increase the vertical speed gain. To decrease the aggressiveness of the vertical speed response, decrease the vertical speed gain.
12) Verify Altitude Hold	Altitude hold performance depends on the Vertical Speed gain. Once the vertical speed gain has been set, place the autopilot in ALT/ROL mode and verify it can acceptable hold altitude. If the autopilot struggles to hold altitude acceptably, return the previous step and continue to tune the vertical speed gain. If you cannot successfully set your Vertical Speed Gain to your satisfaction, contact Garmin at g3xpert@garmin.com for assistance and send us the flight data logs you should have logged on your SD card.
13) Verify Altitude Capture	Once altitude hold tuning is complete, it is possible to check that altitude capture is working correctly and make any needed adjustments using the Vertical Accel gain. The vertical accel gain is most often left set at 1.00, but can be adjusted when necessary to improve altitude captures when climbing or descending in VS or VNAV mode. 1. Climb to a selected altitude target in VS mode and note the altitude capture. 2. Set the vertical accel gain higher if the aircraft objectionably overshoots the altitude target before leveling off at the correct altitude. 3. Set the vertical accel gain lower if the aircraft objectionably undershoots the altitude target before leveling off at the correct altitude.

Table A-1 Flight Test Outline

Task	Description
14) Airspeed Gain Tuning	The autopilot should now be performing very well in all lateral modes and vertical modes with the exception of IAS mode. Now we will tune the Airspeed Gain. The sirspeed gain depends on the pitch servo gain for controlling the pitch servo. The airspeed gain is the gain that is adjusted to get reliable performance in IAS mode. Place the autopilot in IAS/ROL mode commanding a bank angle of zero and an IAS speed that roughly allows the aircraft to hold altitude for the given power setting. Remember to stay below the maneuvering speed of the aircraft (V_A). To tune the airspeed gain, allow the aircraft to settle in its steady state, then use the control stick to over-power the servo and displace the aircraft from the desired airspeed. The pilot should pull or push the stick to up or down for roughly one-two seconds to establish a new airspeed, and then release the stick. After releasing the control stick see the AP response by watching the control stick and airspeed indicator. The aircraft should return to the desired airspeed without being too aggressive or lazy. To increase the aggressiveness of the airspeed response, increase the airspeed gain. To decrease the aggressiveness of the airspeed response, decrease the airspeed gain.
15) Full Autopilot Checkout	The autopilot should be fully tuned at this point. The pilot should exercise all autopilot modes and transitions and verify acceptable performance. If performance is found not to be acceptable return the previous tuning steps. Remember, turn PIT/ROL first, then proceed to tuning the secondary VS and IAS modes. If you cannot get your autopilot performing acceptably, first gather data by flying the aircraft for 1-2 minutes in the autopilot mode where you are experiencing unacceptable performance while logging data. Then email your log file to g3xpert@garmin.com and we will assist you in turning your aircraft for optimal performance.

APPENDIX B AIRFRAME SPECIFIC INSTALLATION GUIDANCE

B.1 Introduction

This appendix include installation guidelines to aid the builder in the placement of various units which make up the G3X™ avionics. It is at the discretion of the builder whether 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

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 before embarking on his/her own design, and determine what additional components may be required to suit their particular installation.

B.1.1 Magnetometer

The integrity and reliability of G3X heading and attitude information is affected by the quality of the GMU magnetometer installation. Although the potential magnetometer 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. Each installation must be evaluated in order to comply with the magnetometer installation guidance given in Section 14.4 and Section 15.4. Failure to follow magnetometer installation guidance may result in error messages and degradation of system performance

In general, wing mounting of the GMU magnetometer is preferred, unless as noted in this appendix. In many aircraft, fuselage mounting is less desirable because of numerous potential disturbances that interfere with accurate operation. For installations with dual magnetometers, co-locating the two magnetometers close to each other in the tail or in one wing is recommended as this reduces the likelihood of heading differences or “miscompares” when operating on the ground in the vicinity of local magnetic anomalies.

Mechanical mounting fixtures for the GMU magnetometer 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 provide a stiffened mounting structure. Use nonmagnetic materials to mount the magnetometer, 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).

NOTE

Garmin strongly recommends the installer conduct a thorough review of Section 14.4 and Section 15.4 when choosing an appropriate mounting location for the GMU magnetometer. In addition to reviewing the guidance provided in Section 14.4 and Section 15.4, 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.

B.1.1.1 GMU 11 Magnetometer

The GMU 11 magnetometer should be securely mounted to rigid aircraft structure using appropriate hardware, following the installation guidance in Section 14.4.

B.1.1.2 GMU 22 Magnetometer

The GMU 22 magnetometer and its mounting rack should be securely mounted to rigid aircraft structure using appropriate hardware, following the installation guidance in Section 15.4. Garmin recommends the use of the prefabricated GMU 22 mounting brackets indicated in Table B-1.

Table B-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

B.2 Van's Aircraft

B.2.1 RV-7/9

The typical GMU magnetometer mounting location in RV-7/9 aircraft is in the aft fuselage, on the aft deck (F-714), just ahead of the horizontal stabilizer and just aft of the F-709 bulkhead. This location provides a level pitch and roll reference, and acceptable separation from excessive magnetic disturbances in typical RV-7/9 aircraft.

The wingtip can be used as an alternate GMU magnetometer mounting location for RV aircraft. Provide adequate separation from steel aileron counterweights, transmitting antennas, and lighting fixtures, and follow the wingtip light wiring guidance for in Section 14.4 or Section 15.4.

B.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 mounting bracket is pre-drilled to provide proper alignment with the longitudinal (yaw) axis.

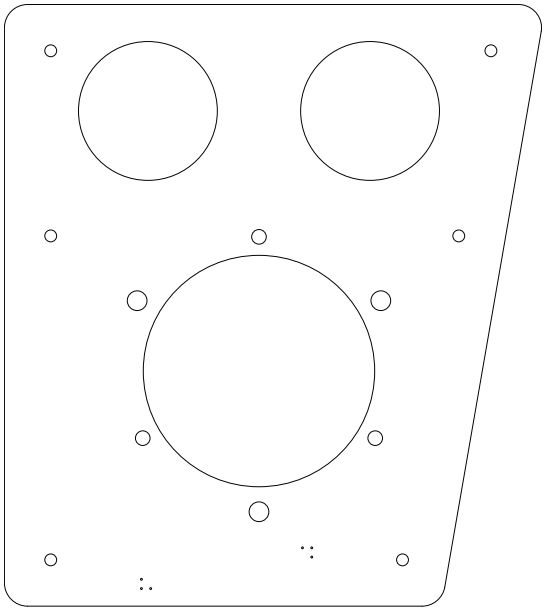


Figure B-1 RV-7/9 GMU 22 Mounting Bracket (115-01027-00)

B.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. Before installing the mounting bracket on the aft deck, the GMU 22 mounting plate (115-00481-X0) should be riveted to the mounting bracket. When riveting the mounting plate to the bracket, make sure the "Forward" arrow is pointing towards the front of the airplane and is parallel to the longitudinal axis of the aircraft. As shown in Figure B-4, 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 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 B-2).
3. Slide the GMU 22 mounting bracket forward, make sure the front edge is against the vertical portion of the F-714 aft deck (see Figure B-2).

NOTE

It is vital 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).

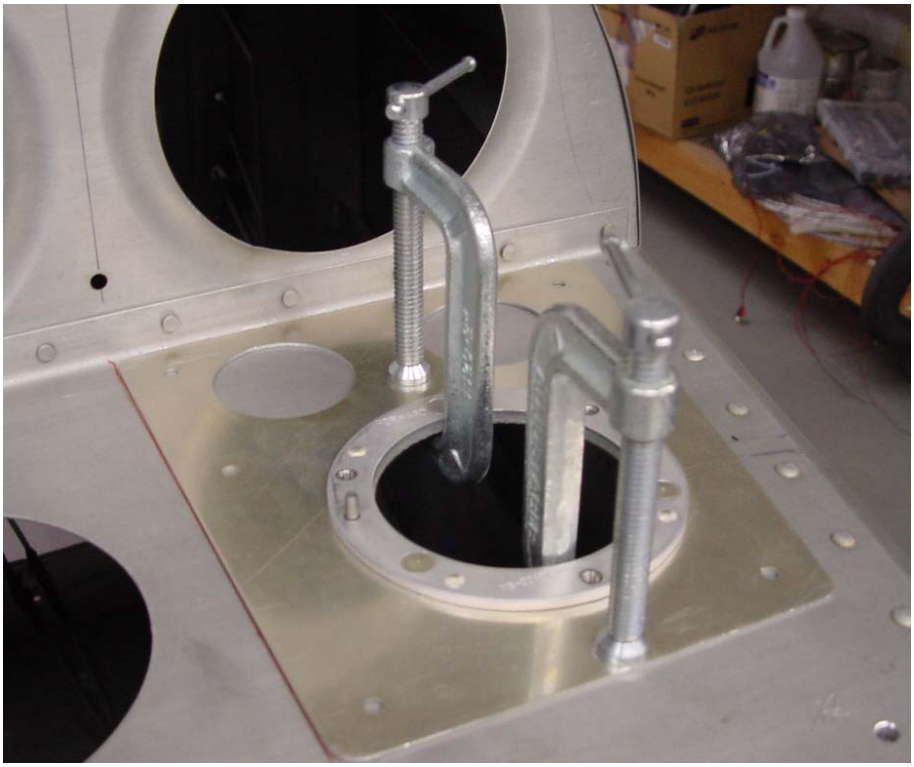


Figure B-2 RV-7/9 GMU 22 Mounting Bracket on the F714 Aft Deck

B.2.2 RV-6/8/10

In RV-6/8/10 aircraft, the GMU magnetometer is frequently mounted on a rigid aluminum shelf suspended between the aft fuselage longerons, midway between the baggage bulkhead and empennage. If this location is used, make sure the seat belt cables and attachment hardware are not magnetized. The wingtip can be used as an alternate GMU magnetometer mounting location for RV aircraft. Provide adequate separation from steel aileron counterweights, transmitting antennas, and lighting fixtures, and follow the wingtip light wiring guidance for in Section 14.4 or Section 15.4.

B.2.3 RV-12/14

Consult Van's Aircraft for information regarding GMU magnetometer mounting brackets for RV-12/14 aircraft.

B.3 Lancair Aircraft

This section provides guidance for GMU magnetometer installation in specific Lancair aircraft. GMU 11 installations should use the GMU 22 guidance given in this section as a reference for magnetometer placement.

B.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 magnetometer.

B.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.

B.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 B-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 make sure 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.

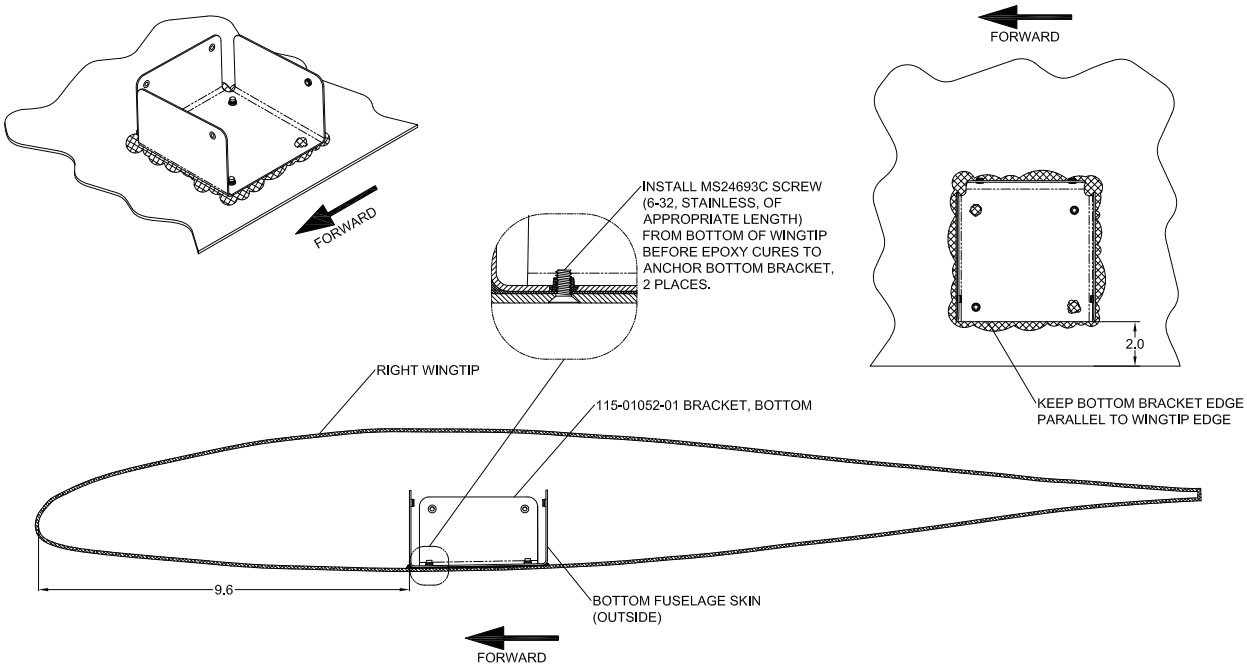


Figure B-3 Lancair IV/IV-P Right Wingtip GMU 22 Installation

1. Rivet the GMU 22 Installation Rack (115-00481-X0) to the Top Bracket Assembly (115-01052-00) as shown in Figure B-4.

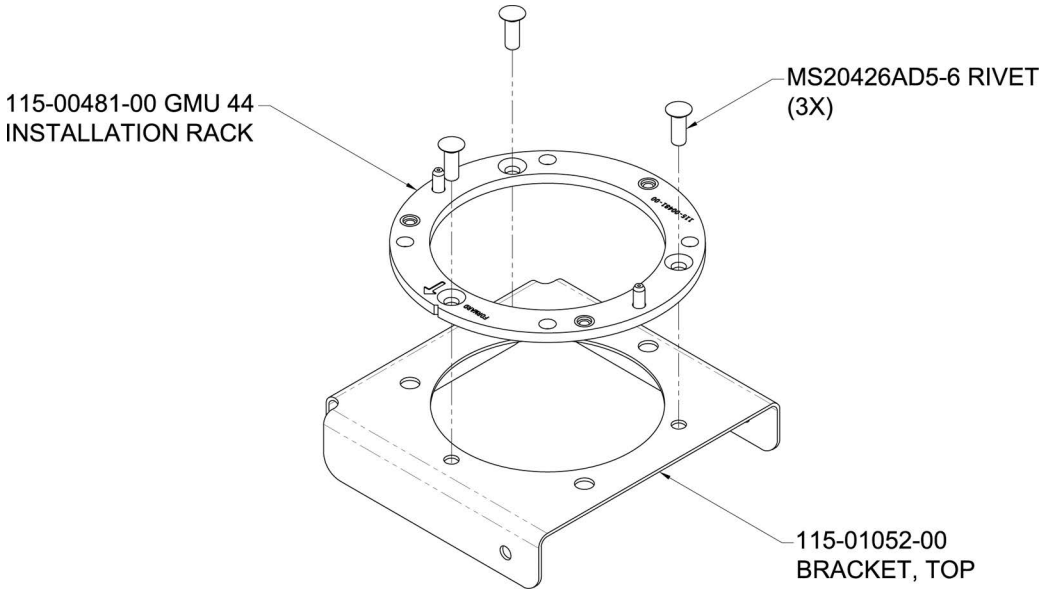


Figure B-4 Lancair IV/IV-P GMU 22 Mounting Bracket

2. Attach the GMU 22 to the Top Bracket Assembly (115-01052-00) using screws (211-60037-08) as shown in Figure B-5.

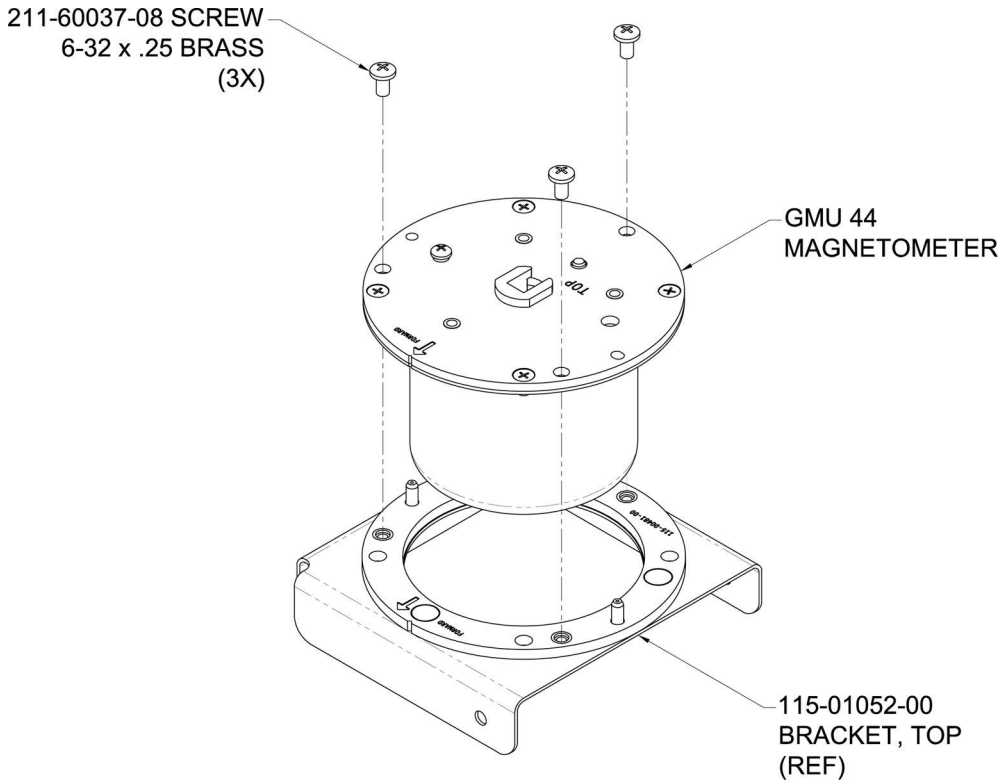


Figure B-5 Lancair IV/IV-P GMU 22 Mounting Bracket

3. Attach the Top Bracket Assembly (115-01052-00) to the Bottom Bracket Assembly (115-01052-01) as shown in Figure B-6.

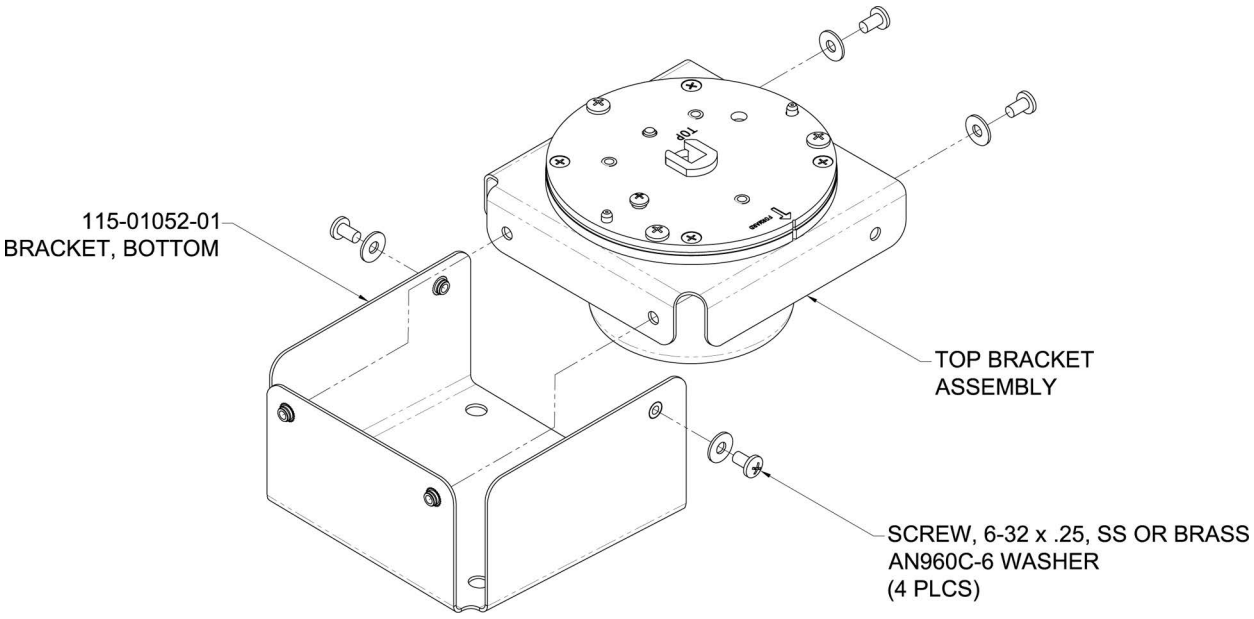


Figure B-6 Lancair IV/IV-P GMU 22 Mounting Bracket

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, make sure 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.

B.3.2 Lancair ES/ES-P

B.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.

B.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 B-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 provide access to the GMU 22.

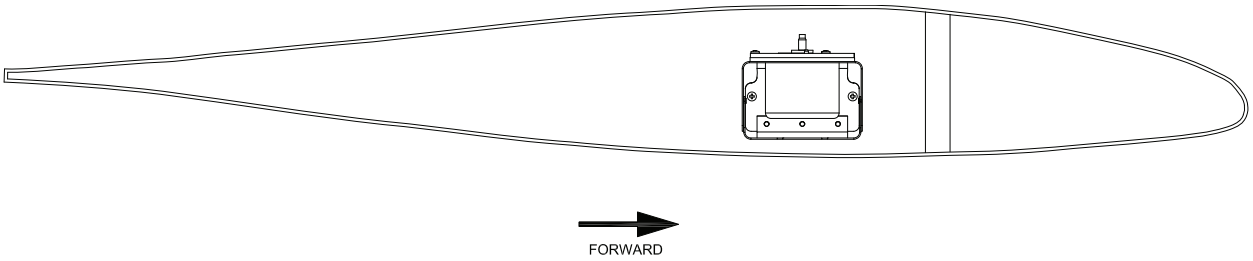


Figure B-7 Right Wingtip GMU 22 Installation

- The GMU 22 Installation Rack (115-00481-X0) should be installed parallel to the mounting surface of the Magnetometer Bracket (115-01017-00) to make sure the finished GMU 22 installation will be in alignment with the Lancair ES/ES-P aircraft heading.
- The GMU 22 Installation Rack (115-00481-X0) 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 B-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.

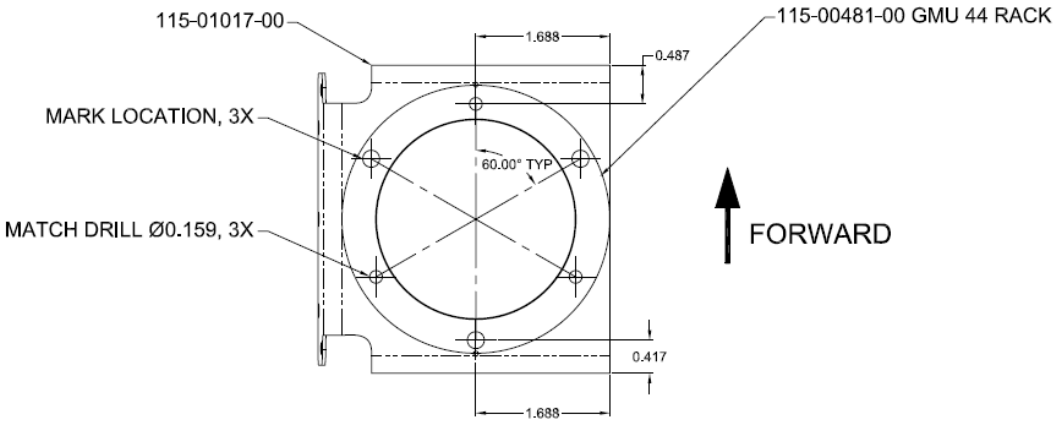


Figure B-8 GMU 22 Installation Rack (ES / ES-P)

5. Rivet the GMU 22 Installation Rack (115-00481-X0) to the Top Bracket Assembly (115-01017-00) as shown in Figure B-9.

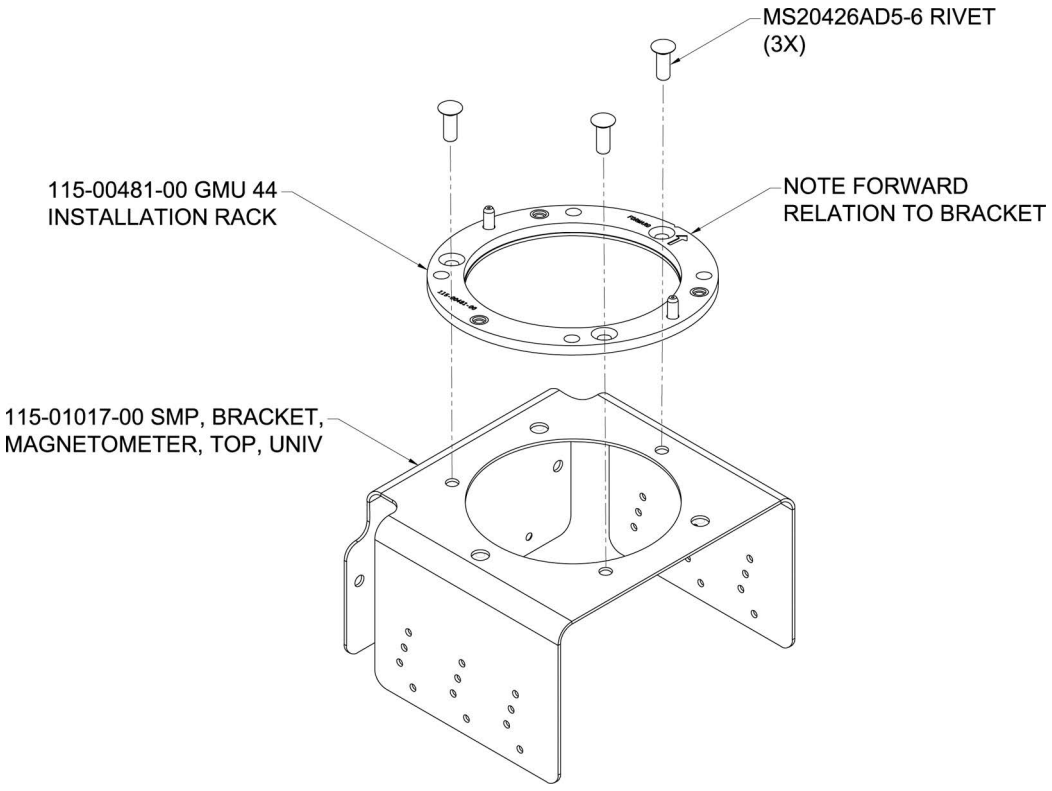


Figure B-9 GMU 22 Installation Rack (ES/ES-P)

6. Rivet the Top Bracket Assembly (115-01017-00) to the Universal Bracket Assembly (115-00939-00) as shown in Figure B-10 and Figure B-11.

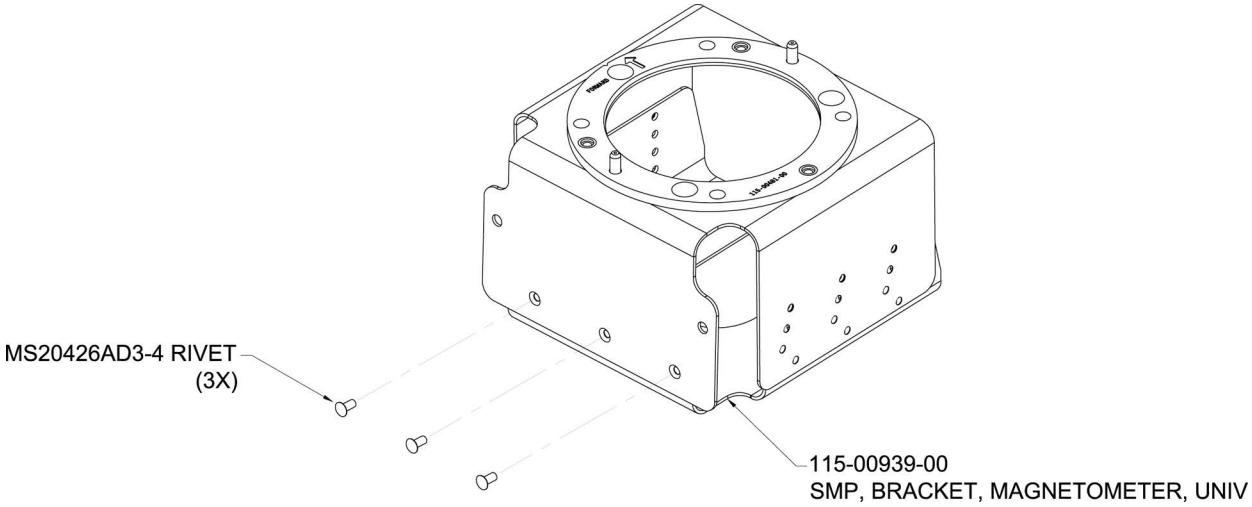


Figure B-10 Lancair IV/IV-P GMU 22 Mounting Bracket Assembly

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.

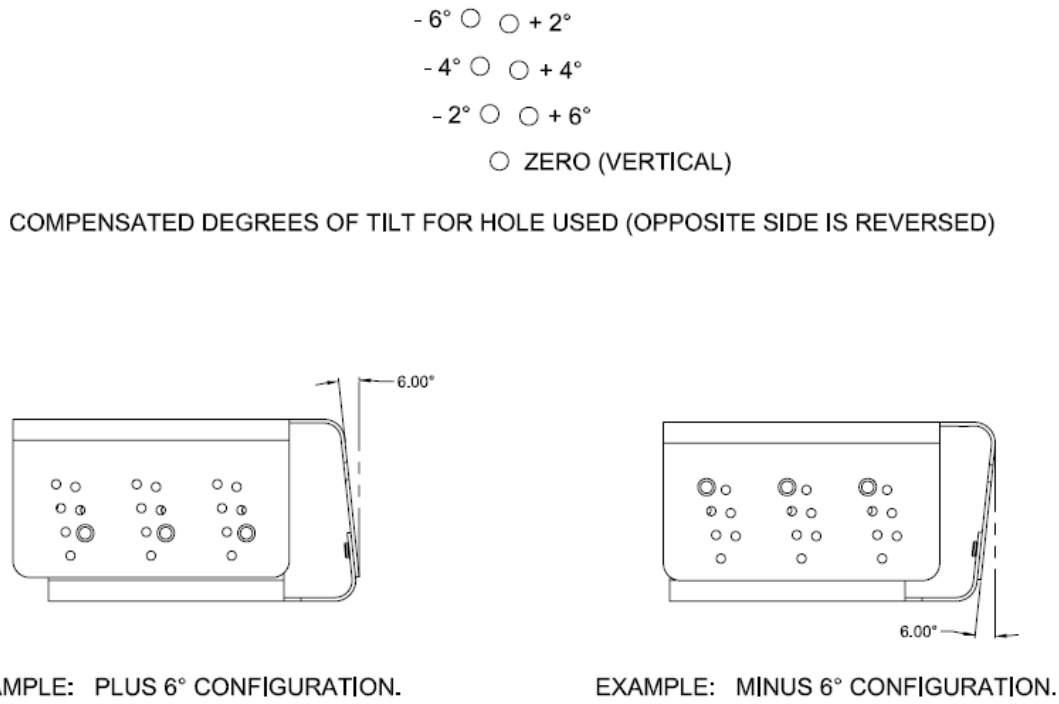


Figure B-11 Adjusting for Wing Dihedral

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 B-12.

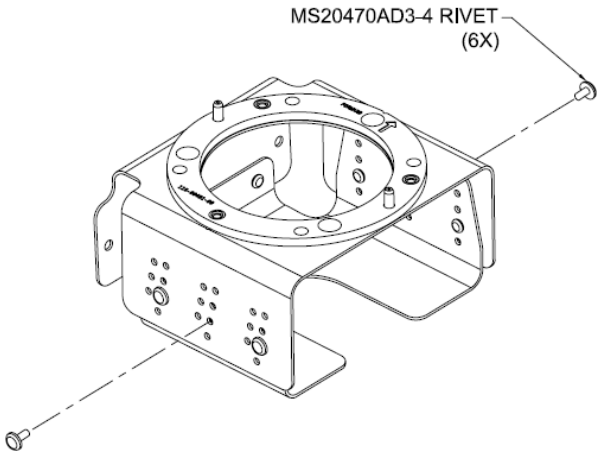


Figure B-12 Rivet shifted Magnetometer Mount

8. Attach the GMU 22 to the GMU 22 Mounting Bracket as illustrated in Figure B-13 using brass screws.

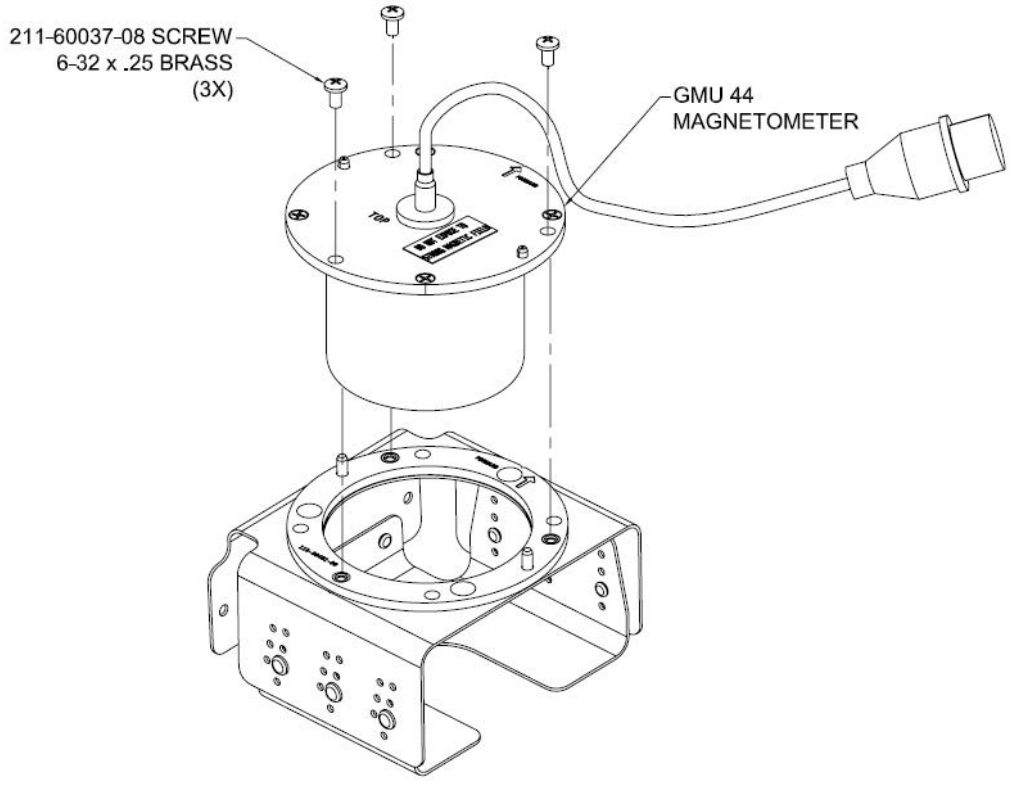


Figure B-13 Secure GMU 22 to the Mounting Bracket Assembly

9. Fabricate two disks from 2 BID sheet to the dimensions shown in Figure B-14.

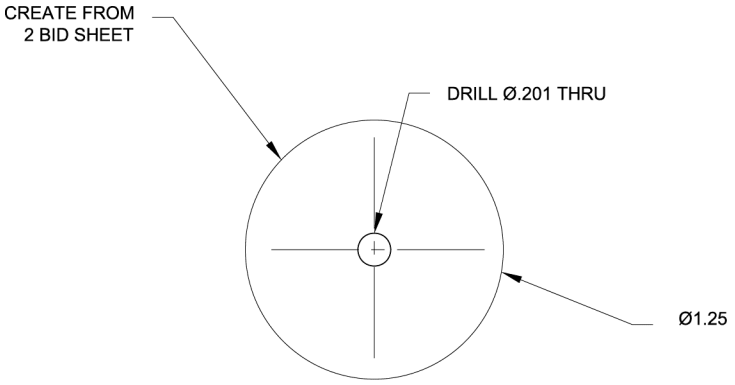


Figure B-14 2 BID Sheet Disk

10. Align one *stainless steel* nut plate MS21048-3 (or K1001-3) to each disk using the center hole as a guide. Match drill 0.098 holes to nut plate and countersink 100° on one side. Refer to Figure B-15.

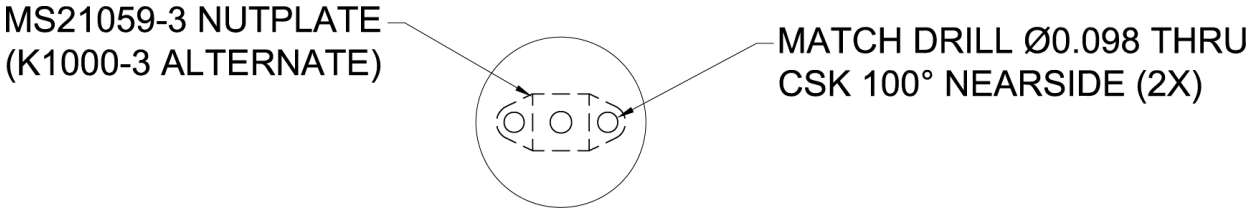


Figure B-15 Aligned Nut Plate And Disk

11. Rivet nut plate to disk with MS20426AD3-4 rivets as shown in Figure B-16.

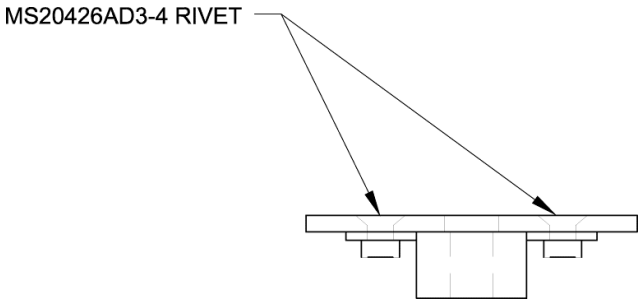


Figure B-16 Riveted Nut Plate And Disk

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 nut plate washers, see Figure B-17.

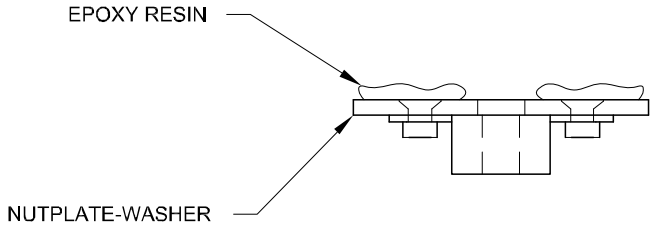


Figure B-17 Nut Plate Washers

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 B-18.

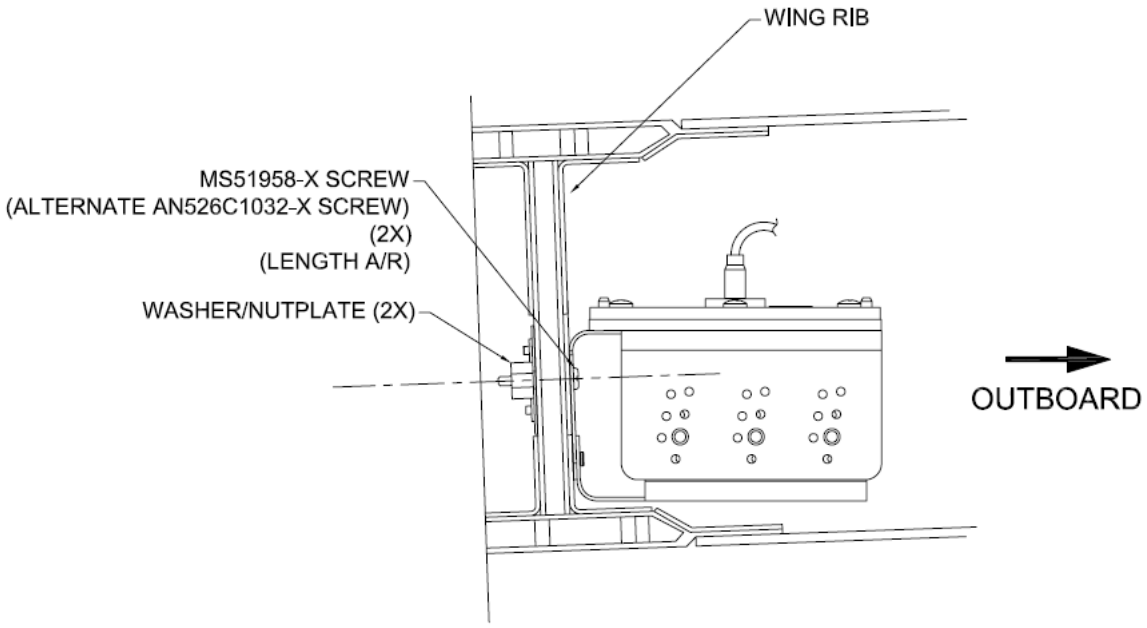


Figure B-18 Magnetometer Assembly attached to Wing Rib

NOTE

Stainless steel hardware (nut plates 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 (nut plates and screws).

NOTE

Never use a magnetic screwdriver to remove or install wingtip hardware.

B.3.3 Lancair Legacy

B.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 B-19.

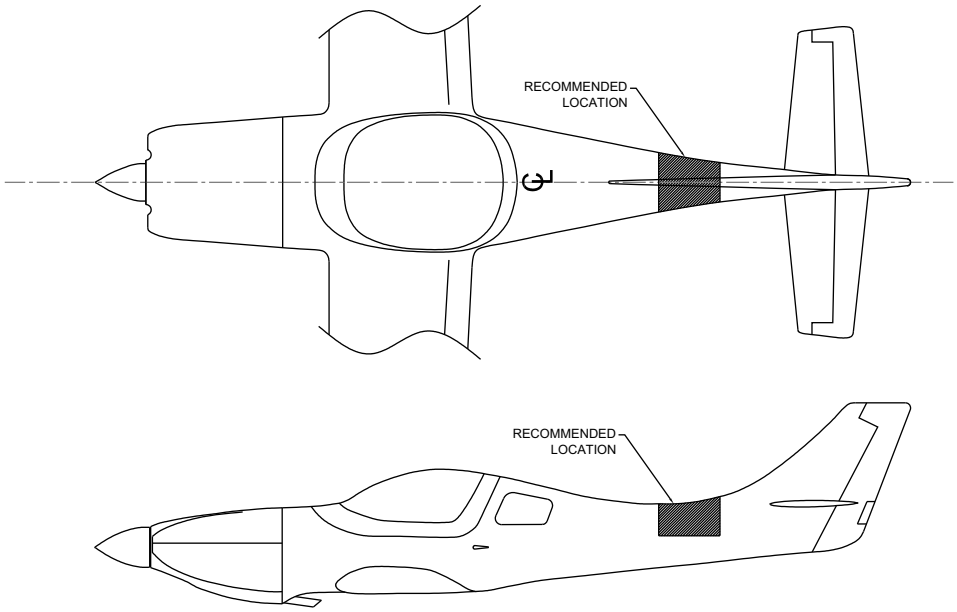


Figure B-19 Lancair Legacy Magnetometer Location

2. In determining a shelf location, make sure 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 B-20.

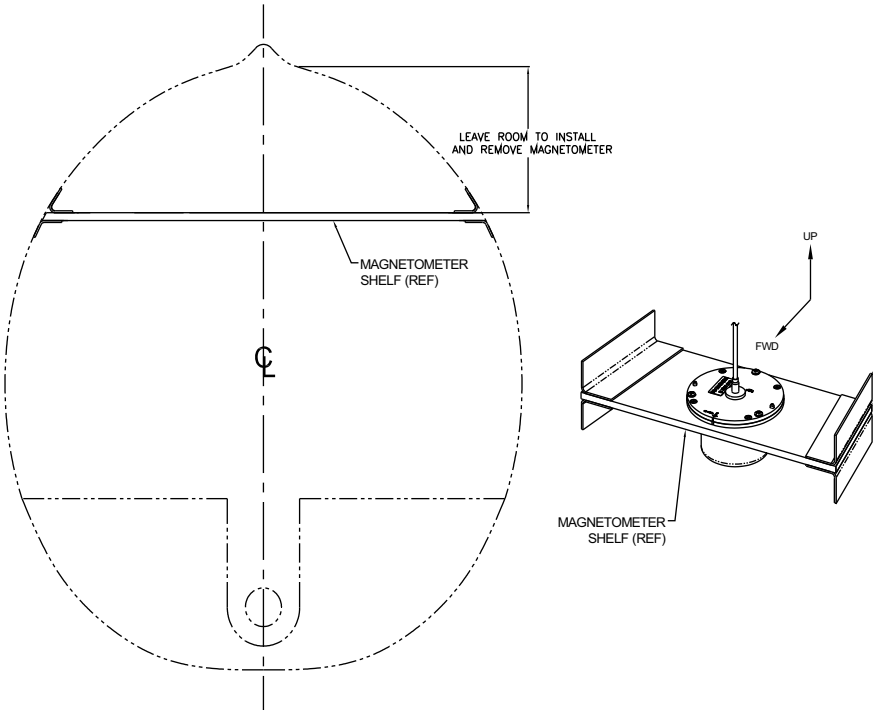


Figure B-20 View Looking AFT At Recommended Magnetometer Location

3. Measure the fuselage in multiple locations to find 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 B-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.

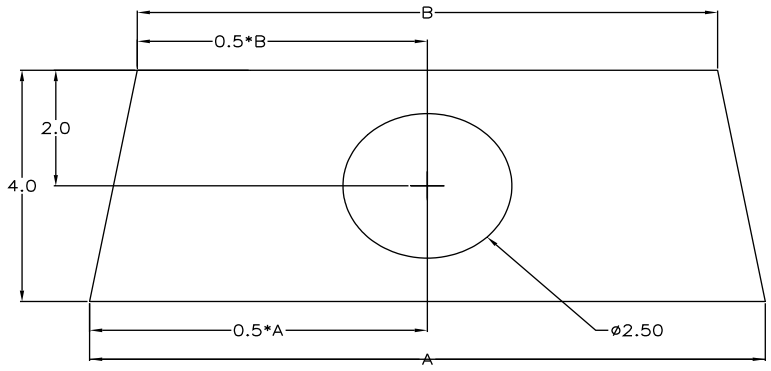


Figure B-21 Example Magnetometer Shelf

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 B-22 to smooth the corners for laying glass in the following steps. When aligning the shelf, make sure the shelf remains level to within 3° of the pitch and roll axes.

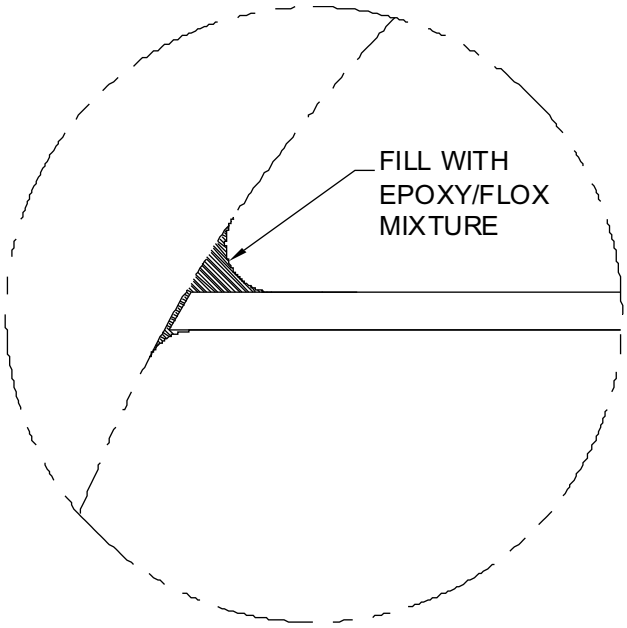


Figure B-22 Fill Detail For Corner Radii And Magnetometer Shelf

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 B-23.

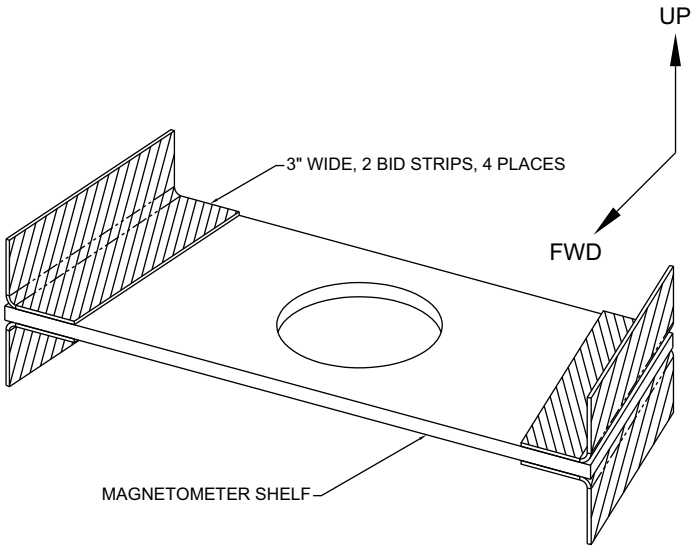


Figure B-23 Magnetometer Shelf With Lay up

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 B-24. The alignment of the magnetometer is critical and needs to be within 0.5° of the aircraft's forward direction.

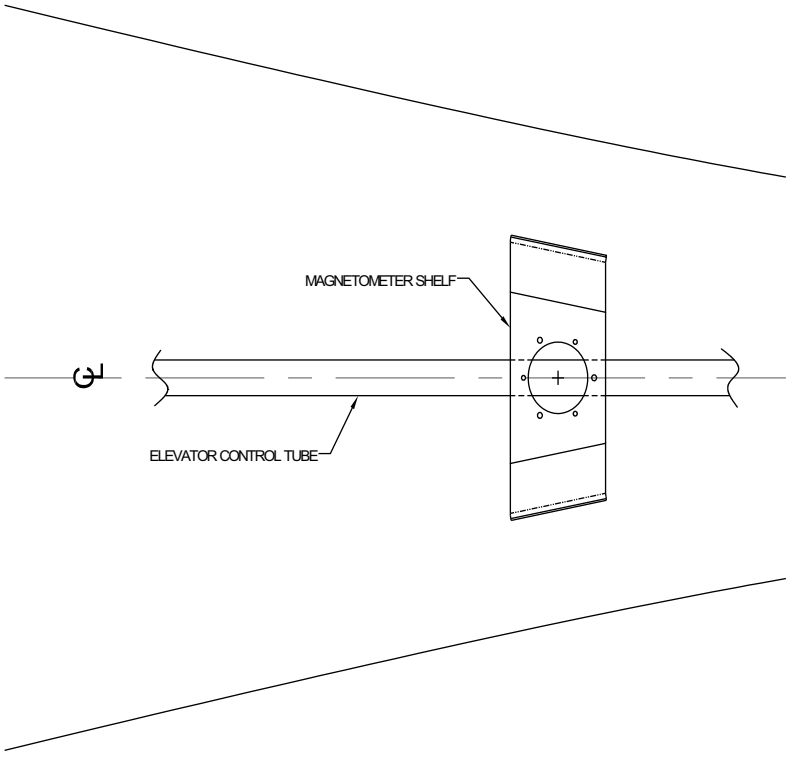


Figure B-24 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction

Alternately, if the 2.50 in. diameter hole is drilled off of centerline as shown in Figure B-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.

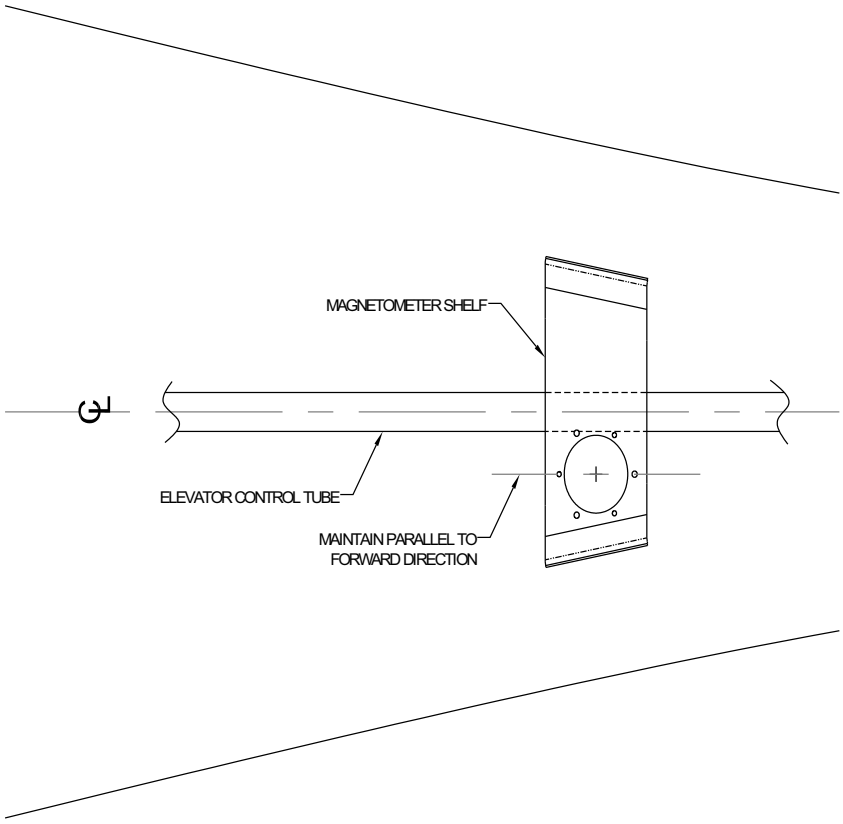


Figure B-25 Alignment Of Magnetometer Cutout With Aircraft's Forward Direction With Offset Magnetometer Cutout

Clamp the GMU 22 Installation Rack (115-00481-X0) 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 B-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.

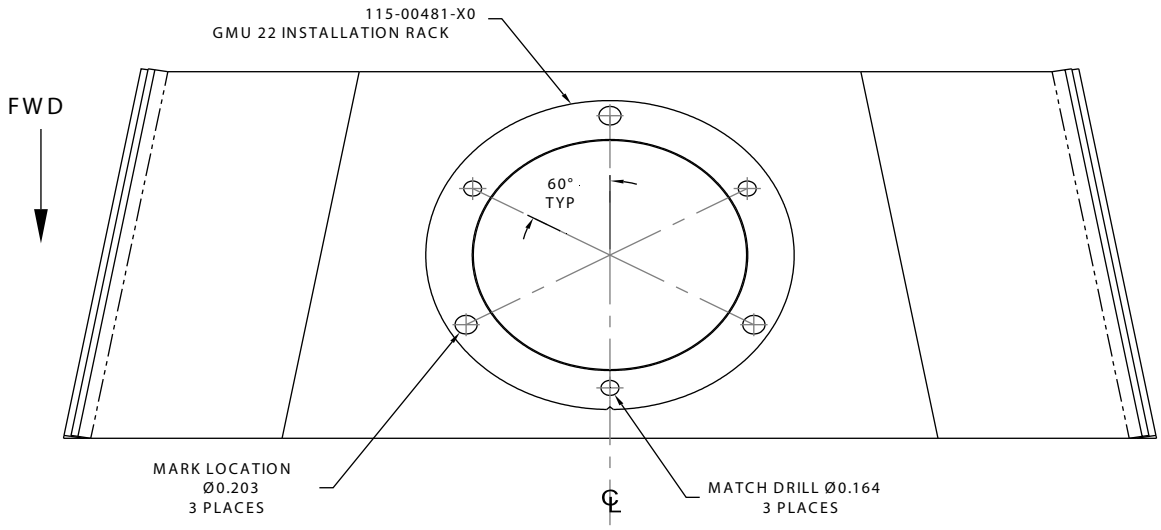


Figure B-26 Magnetometer Shelf With Hole Pattern For GMU 22 Installation Rack

7. Assemble the GMU 22 Installation Rack to the magnetometer shelf as shown in Figure B-27.

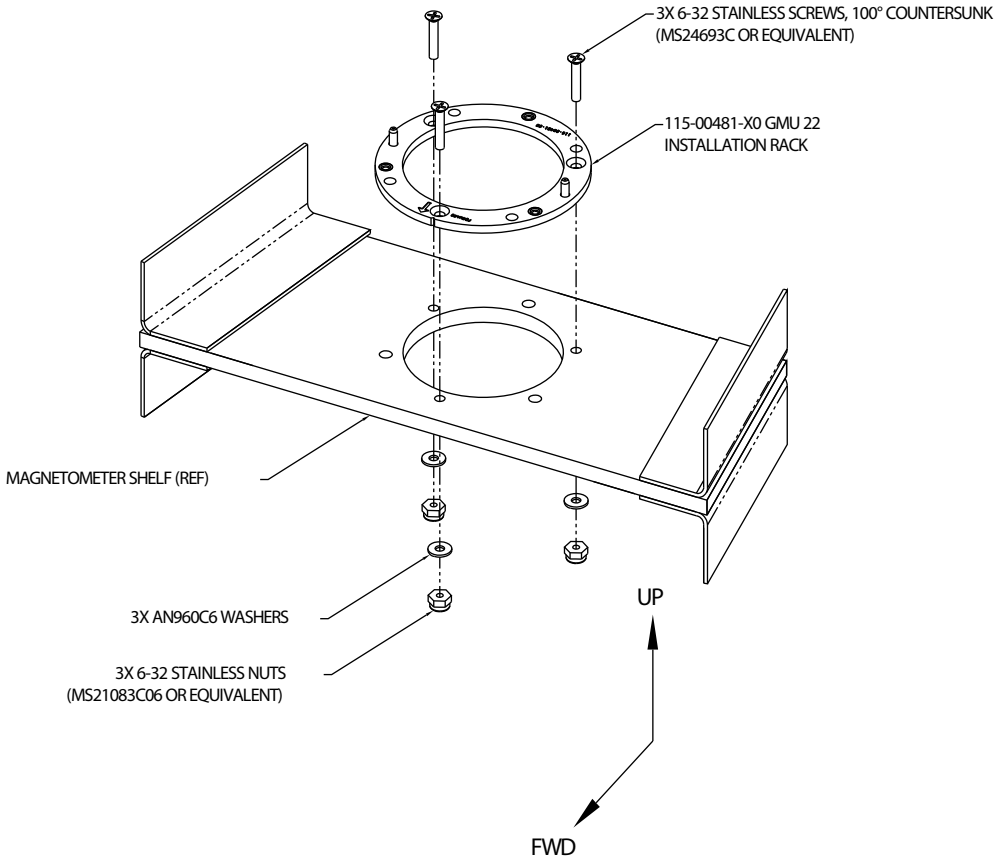


Figure B-27 Assembly Of GMU 22 Installation Rack To Magnetometer Shelf

8. Install the GMU 22 Magnetometer in the installation rack with the hardware provided as shown in Figure B-28.

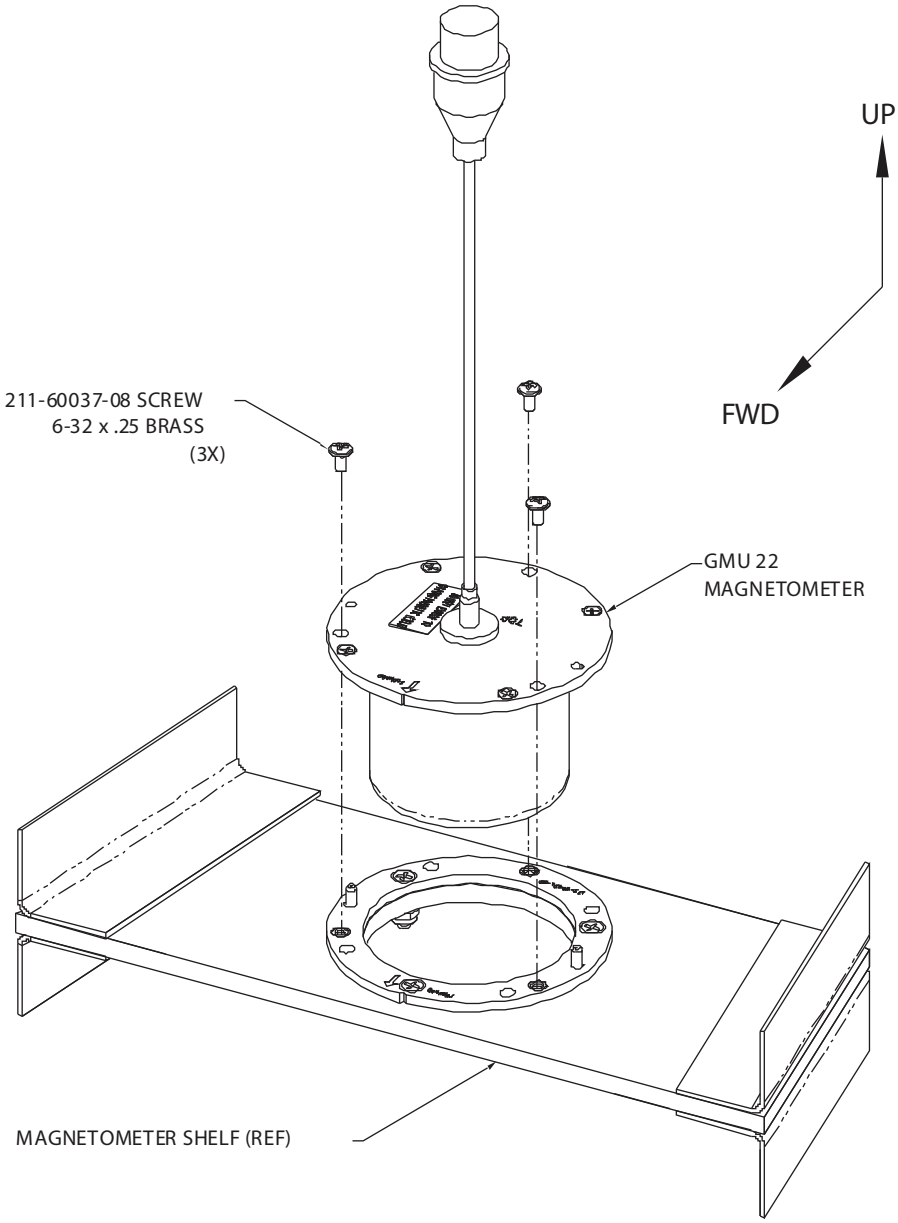


Figure B-28 Installation Of GMU 22 Magnetometer

APPENDIX C RS-232 TEXT OUTPUT FORMAT

This data is output from a GDU™ 37X/4XX display RX-232 port that has been configured to the "Text Out" format.

C.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.

C.2 Message Output Selection

Text messages are grouped into categories. Categories may be enabled or disabled in configuration mode. Enabling or disabling one category has no effect on the other categories. Enabling a category will result in all messages of that category being sent out the RS-232 port. This may be one or more messages depending on which category is enabled.

C.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).

C.4 Attitude/Air Data Message Format

The Attitude/Air Data category contains two message formats. The Attitude/Air Data message format is transmitted approximately 10 times per second. The Attitude/Air Data Set 2 message format is transmitted approximately 2 times per second. Table C-1 and Table C-2 explain the message formats.

Table C-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					

Table C-2 Attitude/Air Data Set 2 Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'='		
Sentence ID	1	1		'2'		
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
True Airspeed	11	4	0.1 knots		0000	9999
Density Altitude	15	6	1 foot		-01000	+99999
Heading Bug	21	3	1 degree	magnetic	000	359
Altitude Bug	24	6	1 foot		-01000	+99999
Airspeed Bug	30	4	0.1 knots		0000	9999
Vertical Speed Bug	34	4	10 fpm	positive = up	-999	+999
Checksum	38	2	ASCII hex	sum of all previous bytes		
CR/LF	40	2		0x0D / 0x0A		
Total length	42					

C.5 Engine Data Message Format

The Engine category contains one message format. The Engine Data message format is transmitted approximately 5 times per second. Table C-3 explains the Engine Data message format.

Table C-3 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

Table C-3 Engine Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
EGT1	111	4	1 degree C		-999	+999
TIT1	115	4	1 degree C		-999	+999
TIT2	119	4	1 degree C		-999	+999
Elevator trim position	123	5	1% of travel	0 = up, 50 = neutral, 100 = down	+0000	+0100
Units indicator	128	1		'T'		
Flap position	129	5	1 degree		-0090	+0090
Units indicator	134	1		'T'		
Carb temp	135	5	0.1 degree C		-9999	+9999
Units indicator	140	1		'C'		
Coolant pressure	141	5	0.01 PSI		+0000	+9999
Units indicator	146	1		'P'		
Coolant temperature	147	5	0.1 degree C		-9999	+9999
Units indicator	152	1		'C'		
Amps 2	153	5	0.1 A		-9999	+9999
Units indicator	158	1		'A'		
Aileron trim position	159	5	1% of travel	0 = left, 50 = neutral, 100=right	+0000	+0100
Units indicator	164	1		'T'		
Rudder trim position	165	5	1% of travel	0 = left, 50 = neutral, 100=right	+0000	+0100
Units indicator	170	1		'T'		
Fuel quantity 3	171	5	0.1 gallon		+0000	+9999
Units indicator	176	1		'G'		
Fuel quantity 4	177	5	0.1 gallon		+0000	+9999
Units indicator	182	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					

C.6 GPS Data Message Formats

The GPS category contains two message formats. The GPS Position, Velocity, and Time (PVT) message format and the GPS Data message format are transmitted approximately once per second. Table C-4 and Table C-5 explain the message formats.

Table C-4 GPS PVT 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 C-4 GPS PVT 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.

Table C-5 GPS Data Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'='		
Sentence ID	1	1		'7'		
Sentence version	2	1		'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
Height AGL	11	3	100 ft		000	999
Ground Speed	14	4	0.1 knots		000	9999
Checksum	18	2	ASCII hex	Sum of all previous bytes		
CR/LF	20	2		0x0D / 0x0A		
Total length	22					

C.7 EIS Complete Data Message Format

The EIS Complete Data Message outputs all Engine/Airframe Information System (EIS) data available to the G3X™ avionics system. Because the amount of EIS data available to the G3X system depends on the aircraft's specific configuration, EIS messages use a flexible format that is expandable and self-describing. EIS messages are identified by sub-type and contain a variable number of fixed-width fields, each of which contains data for a specific EIS parameter. These messages support up to 256 EIS parameters, each of which is identified by a numeric parameter ID. Each item of EIS data is transmitted at a periodic rate, or when its value changes. The maximum length of any EIS message, including checksum and leading/ trailing characters, will not exceed 256 bytes.

C.7.1 EIS Parameter Information

The Parameter Information message sub-type is transmitted periodically to allow receiving devices to decode the other EIS message sub-types. It contains a variable number of fixed-width parameter description records, each of which identifies the name and units of measurement associated with a single parameter ID. Transmitting details for all configured parameters may involve multiple Parameter Information messages.

Table C-6 EIS Parameter Information Message

Field Name	Offset	Width	Units	Notes
Escape character	0	1		'='
Sentence ID	1	1		'5'
Sentence version	2	1		Currently '1'
Sentence sub-ID	3	1		'i' (ASCII 0x69)
Parameter ID	12	2	ASCII hex	
Parameter Units	14	1		See Table C-5
Parameter Name	15	16		ASCII string
…variable number of records…				
Parameter ID		2	ASCII hex	
Parameter Units		1		See Table C-5
Parameter Name		16		ASCII string
Checksum	End-4	2	ASCII hex	8-bit sum of all previous bytes
CR/LF	End-2	2		0x0D / 0x0A

C.7.2 EIS Discrete Parameter Data

The Discrete Parameter Data message sub-type contains a variable number fixed-width records, each of which indicates the current state of a single EIS discrete input parameter.

Table C-7 EIS Discrete Parameter Data Message

Field Name	Offset	Width	Units	Notes
Escape character	0	1		'='
Sentence ID	1	1		'5'
Sentence version	2	1		Currently '1'
Sentence sub-ID	3	1		'D' (ASCII 0x44)
UTC hour	4	2	Hours	
UTC minute	6	2	Minutes	
UTC second	8	2	Seconds	
UTC second fraction	10	2	10 ms	
Parameter ID	12	2	ASCII hex	
Parameter Value	14	1		1 = active, 0 = inactive
…variable number of records…				
Parameter ID		2	ASCII hex	
Parameter Value		1		1 = active, 0 = inactive
Checksum	End-4	2	ASCII hex	8-bit sum of all previous bytes
CR/LF	End-2	2		0x0D / 0x0A

C.7.3 EIS Numeric Parameter Data

The Numeric Parameter Data message sub-type contains a variable number fixed-width records, each of which indicates the current numeric value of a single EIS analog/digital parameter. For multi-engine aircraft, the message sub-ID field also identifies which engine's data the message contains.

Table C-8 EIS Numeric Parameter Data Message

Field Name	Offset	Width	Units	Notes
Escape character	0	1		'='
Sentence ID	1	1		'5'
Sentence version	2	1		Currently '1'
Sentence sub-ID	3	1		'1' = Engine 1 (ASCII 0x31) '2' = Engine 2 (ASCII 0x32)
UTC hour	4	2	Hours	
UTC minute	6	2	Minutes	
UTC second	8	2	Seconds	
UTC second fraction	10	2	10 ms	
Parameter ID	12	2	ASCII hex	
Parameter Value	14	11		Numeric value in scientific notation (±X.XXXXE±XX)
…variable number of records…				
Parameter ID		2	ASCII hex	
Parameter Value		11		Numeric value in scientific notation (±X.XXXXE±XX)
Checksum	End-4	2	ASCII hex	8-bit sum of all previous bytes
CR/LF	End-2	2		0x0D / 0x0A

NOTE

If the value for a parameter is invalid, the associated numeric value field will be replaced with underscore characters ('_').

C.8 CNI Message Format

The CNI category contains one message format. The CNI message format is transmitted approximately once per second. Table C-9 explains the message CNI format.

Table C-9 CNI Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Escape character	0	1		'='		
Sentence ID	1	1		'C'		
Sentence version	2	1		'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
COM1 active frequency	11	6	KHz		118000	136990
COM1 standby frequency	17	6	KHz		118000	136990
COM1 transceiver status	23	1		'T' = Transmit 'M' = Monitor 'R' = Receive '_' = no activity		
COM1 monitor enabled	24	1		0 = disabled 1 = enabled	0	1
COM1 fail	25	1		0 = no status failure 1 = status failure	0	1
COM1 squelch bypass	26	1		0 = not bypassed 1 = bypassed	0	1
COM1 volume	27	3			000	100
COM2 active frequency	30	6	KHz		118000	136990
COM2 standby frequency	36	6	KHz		118000	136990
COM2 transceiver status	42	1		'T' = Transmit 'M' = Monitor 'R' = Receive '_' = no activity		
COM2 monitor enabled	43	1		0 = disabled 1 = enabled	0	1
COM2 fail	44	1		0 = no status failure 1 = status failure	0	1
COM2 squelch bypass	45	1		0 = not bypassed 1 = bypassed	0	1
COM2 volume	46	3			000	100

Table C-9 CNI Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Navigation source	49	1		'I' = internal GPS 'G' = GPS1 'g' = GPS2 'V' = VLOC1 'v' = VLOC2		
NAV1 active frequency	50	6	KHz		108000	117975
NAV1 standby frequency	56	6	KHz		108000	117975
NAV1 ident	62	10	ASCII			
NAV1 fail	72	1		'0' = no status failure '1' = status failure	0	1
NAV1 volume	73	3			000	100
NAV2 active frequency	76	6	KHz		108000	117975
NAV2 standby frequency	82	6	KHz		108000	117975
NAV2 ident	88	10	ASCII			
NAV2 fail	98	1		'0' = no status failure '1' = status failure		
NAV2 volume	99	3			000	100
Audio Panel COM1 RX selected	102	1		1 = selected, 0 = not	0	1
Audio Panel COM2 RX selected	103	1		1 = selected, 0 = not	0	1
Audio Panel COM1 TX selected	104	1		1 = selected, 0 = not	0	1
Audio Panel COM2 TX selected	105	1		1 = selected, 0 = not	0	1
Audio Panel NAV1 RX selected	106	1		1 = selected, 0 = not	0	1
Audio Panel NAV2 RX selected	107	1		1 = selected, 0 = not	0	1
Audio Panel intercom isolate	108	1		'0' = None 'P' = Pilot 'C' = Crew		
Audio Panel marker beacon	109	1		'n' = None 'o' = outer 'm' = middle 'i' = inner		

Table C-9 CNI Message Format

Field Name	Offset	Width	Units	Notes	Min	Max
Audio Panel failure	110	1		‘0’ = no status failure ‘1’ = status failure		
Transponder mode	111	1		‘N’ = On ‘A’ = Alt ‘S’ = Standby ‘G’ = Gnd		
Transponder code	112	4			0000	9999
Transponder ident flag	116	1		1 = set, 0 = clear	0	1
Transponder reply flag	117	1		1 = set, 0 = clear	0	1
Transponder flight ID	118	8				
Transponder failure	126	1		‘0’ = no status failure ‘1’ = status failure	0	1
Checksum	127	2	ASCII hex	sum of all previous bytes		
CR/LF	129	2		0x0D / 0x0A		
Total length	131					

APPENDIX D LRU PERFORMANCE SPECIFICATIONS/LICENSING/ COMPLIANCE

This section contains various performance specification, licensing, and compliance info for the G3X™ avionics LRUs.

D.1 GAD 29

D.1.1 Environmental Specifications

The GAD 29 has an Operating Temperature Range of -45° C to +70° C

D.2 GAP 26

D.2.1 Environmental Specifications

The GAP 26 has an Operating Temperature Range of -55° C to 240° C

D.3 GDU™ 37X Display

D.3.1 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 Appendix H.4.15 (for GDU 37X systems) and Section 31.4.24 for (GDU 4XX systems) for further information.

Table D-1 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® global positioning indicator (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)

D.3.2 Environmental Specifications

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

D.4 GDU 4XX

D.4.1 GPS Specifications

The GDU 4XX 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 4XX 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 31.4.24 for further information.

Table D-2 GDU 4XX 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)

D.4.2 Environmental Specifications

The GDU 4XX has an Operating Temperature Range of -20°C to +60°C.

D.5 GEA™ 24 Engine Interface Module

D.5.1 Environmental Specifications

The GEA 24 has an Operating Temperature Range of -45°C to +70°C.

D.6 GHA 15

D.6.1 Certification

The Garmin GHA 15 Height Advisor (011-05259-50) is not a TSO-certified product and has received no FAA approval or endorsement. See the GHA 15 Important Safety and Product Information (190-02680-10) for further compliance information.

D.6.2 Transmitter Grant of Equipment Authorization

Table D-3 Equipment Authorization

Country (Telecommunications Authority)	Authorization
United States (FCC)	FCC ID: IPH-04099
Canada (ISED)	IC: 1792A-04099 IC M/N: GMN-01410-01

RF Exposure Compliance Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

D.6.3 General Specifications

Table D-4 General Specifications

Characteristics	Specifications
Operational Temperature Range	-45° C to +70° C
Altitude Range	25,000 ft maximum
Maximum Days of Continuous Operation	49

D.6.4 Performance Specifications

Table D-5 Performance Specifications

Characteristics	Specifications
Altitude Accuracy	± 1.5 ft (3 - 100 ft AGL) ± 2 % (> 100 - 500 ft AGL)
Altitude Range	0 - 500 ft AGL
Transmitter Output	Frequency: 24.05-24.25 GHz Power: 12.7 dBm nominal
Horizontal Velocity	0 - 100 knots maximum
Vertical Velocity	20 ft/sec maximum (up to 100 ft AGL) 25 ft/sec maximum (above 100 ft AGL)
Pitch Angle	± 20° maximum
Roll Angle	± 20° maximum

D.7 GMA™ 245/245R Audio Panel

D.7.1 Certification

The Garmin GMA 245/245R Audio Panel is not a TSO-certified product and has received no FAA approval or endorsement. See the GMA 245 Pilot's Guide (190-01879-10) and the GMA 245/245R Installation Manual (190-01879-11) for further compliance information.

D.7.2 Transmitter Grant of Equipment Authorization

1. FCC

011-03519-00, 011-03784-00, and 011-03784-10 contain FCC ID: QOQWT32I
011-03519-01, 011-03784-01, and 011-03784-11 contain FCC ID: 2ADHKBM83SM1

NOTE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interferencereceived, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20mm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2. IC

011-03519-00, 011-03784-00, and 011-03784-10 contain IC: 5123A-BGTWT32I
011-03519-01, 011-03784-01, and 011-03784-11 contain IC: 20266-BM83SM1

NOTE

This device complies with Innovation, Science and Economic Development Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux normes RSS sans licence du ministére Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes : (1) ce périphérique ne doit pas causer d'interférences et (2) doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

D.8 GMC 305/307/507

D.8.1 Environmental Specifications

Table D-6 GMC 305/307/507 Environmental Specification

Characteristics	Specifications
Operating Temperature Range (GMC 305/307)	-45°C to +70°C
Operating Temperature Range (GMC 507)	-20°C to +55°C
Humidity (GMC 305/307/507)	95% non-condensing
Altitude Range (GMC 305/307)	-1,500 ft to 55,000 ft
Altitude Range (GMC 507)	-1,500 ft to 25,000 ft

D.9 GMU 11

D.9.1 Environmental Specifications

Table D-7 lists general environmental specifications.

Table D-7 GMU 11 Environmental Specifications

Specification	Characteristic
Operating Temperature Range	-55° C to +70° C
Altitude	55,000 ft

D.10 GMU 22

D.10.1 Environmental Specifications

Table D-7 lists general environmental specifications.

Table D-8 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

D.11 GSA 28

D.11.1 Environmental Specifications

Table D-9 lists general environmental specifications.

Table D-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

D.12 GSU 25

D.12.1 Environmental Specifications

Table D-10 lists general environmental specifications for the GSU 25, .Table D-12 lists general environmental specifications for the GSU 25.

Table D-10 GSU 25/25C 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 Mach Range	<1.00 Mach
Aircraft Total Air Temperature Range	-85° C to +85° C
Unit Operating Temperature Range	-45° C to +70° C

Table D-11 GSU 25B and 25D Non-MOD 1 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	465 Knots Indicated Airspeed
Aircraft Mach Range	<1.00 Mach
Aircraft Total Air Temperature Range	-85° C to +85° C
Unit Operating Temperature Range	-45° C to +70° C

Table D-12 GSU 25D (011-02929-51 MOD Level 1 or 011-02929-56) Environmental Specifications

Characteristic	Specification
Aircraft Pressure Altitude Range	-1,400 feet to 55,000 Feet
Aircraft Vertical Speed Range	-20,000 feet per minute to +20,000 feet per minute
Aircraft Airspeed Range	465 Knots Indicated Airspeed
Aircraft Mach Range	<1.00 Mach
Aircraft Total Air Temperature Range	-85° C to +85° C
Unit Operating Temperature Range	-45° C to +70° C

D.12.2 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)

D.13 GSU 73

D.13.1 Environmental Specifications

Table D-13 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 D-13 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

D.13.2 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)

D.14 GTP 59

D.14.1 TSO/ETSO Compliance

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

Table D-14 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

D.14.2 TSO/ETSO Deviations

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

Table D-15 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.

D.15 GTR 20/200

D.15.1 Environmental Specifications

Table D-16 lists general environmental specifications.

Table D-16 GTR 20/200 Environmental Specifications

Characteristic	Specification
Operating Temperature Range	-20°C to +55°C
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 55,000 ft

D.15.2 License Requirements

The Telecommunications Act of 1996, effective February 8, 1996, provides the FCC discretion to eliminate radio station license requirements for aircraft and ships. GTR 20/200 installations must comply with current transmitter licensing requirements. In the US, to find out the specific details on whether a particular installation is exempt from licensing, please visit the FCC website www.fcc.gov/wireless/bureau-divisions/mobility-division/aviation-radio-services. If an aircraft license is required, make application for a license on FCC form 404, Application for Aircraft Radio Station License. The FCC also has a fax-on-demand service to provide forms by fax. Outside the US, contact the responsible telecommunication authority. The GTR 20/200 owner accepts all responsibility for obtaining the proper licensing before using the transceiver. The maximum transmitting power, modulation identification, and frequency band information may be required for licensing and are detailed in Section 20.3.1.

D.15.3 Aircraft Radio

An aircraft radio station license is not required when operating in U.S. airspace, but may be required when operating internationally.

D.15.4 Certification

The GTR 20/200 does not have TSO authorization.

D.15.5 FCC Grant of Equipment Authorization

Table D-17 FCC Grant of Equipment Authorization

Model	FCC ID	IC ID
GTR 20/200	IPH-0211501	1792A-0211501

D.15.6 Industry Canada Compliance

The GTR 20/200 device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

APPENDIX E GDU™ 37X DISPLAY INSTALLATION

NOTE

The GDU 37X has been discontinued and is no longer available for purchase.

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 E-1 GDU 37X Unit View

E.1 Equipment Description

NOTE

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

NOTE

GPS data is used for ADAHRS sensor drift correction, so at least one source of GPS data is required. This requirement can be met by installing a GPS 20A, or by connecting a GPS antenna to at least one GDU GPS receiver. In a system with multiple GDU displays, additional GPS antennas may be connected to the other displays for redundancy, if desired.

The GDU 37X provides a central display and user interface for the G3X™ avionics 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 SiriusXM® receiver.

E.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

E.1.2 Interface Summary

NOTE

A G3X system installation can use either GDU 37X or GDU 4XX displays, but a G3X system installation cannot use GDU 37X and GDU 4XX displays.

The GDU 37X uses CAN and RS-232 interfaces to communicate with Garmin LRUs and other devices. Refer to Section 2, Section 25, Appendix G, Section 26, and Appendix H for interconnect and configuration information.

E.1.3 System Architecture and Interface Capabilities

The functionality of the G3X system is distributed between multiple interconnected devices, some of which are located in the instrument panel and some of which are remote-mounted elsewhere. An individual device in the G3X system is often referred to as a "Line Replaceable Unit", or LRU. This term is used generically in aviation for devices that can be readily "swapped out" for troubleshooting or repair.

LRUs in the G3X system are interconnected with RS-232 interfaces and a shared CAN bus network (see Section 2.3.1.3). The G3X system can interface to a variety of other devices using RS-232 and ARINC 429 connections.

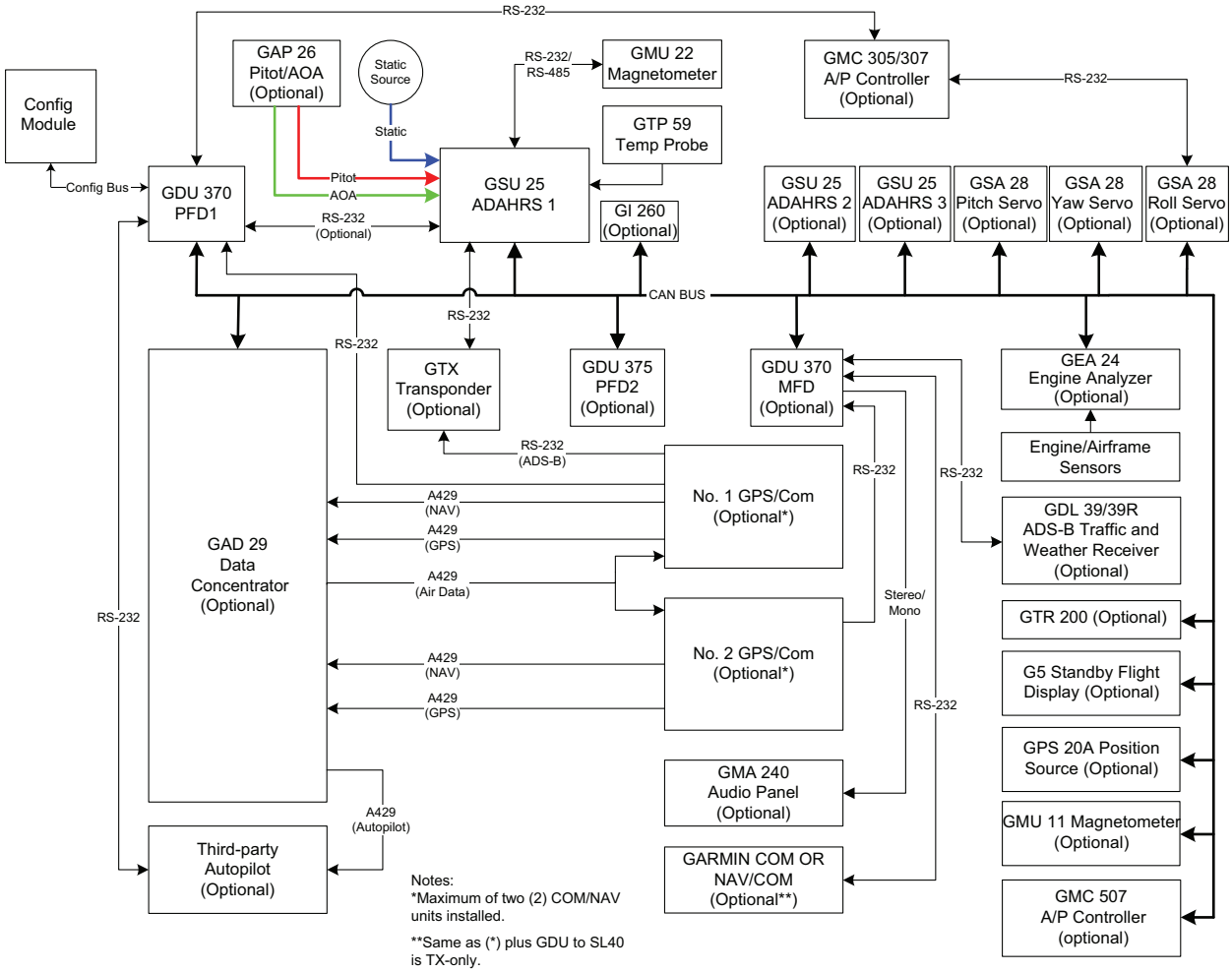


Figure E-2 G3X Interconnect Example (GDU 37X)

E.2 General Specifications

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

E.3 Installation Information

E.3.1 Required Equipment

Each of the following accessories is provided with the GDU 37X unit (010-00667-15). The connector kit is required to install the unit (Figure E-3). The GDU 37X Nut Plate (Figure E-3) is included in the installation kit for use when it is not possible to tap the instrument panel for 6-32 screw threads.

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

Table E-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

E.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.

E.3.2 Additional Equipment Required

A 3/32" hex drive tool is required to secure the GDU 37X to the panel as described in Appendix E.7.1 Unit Installation.

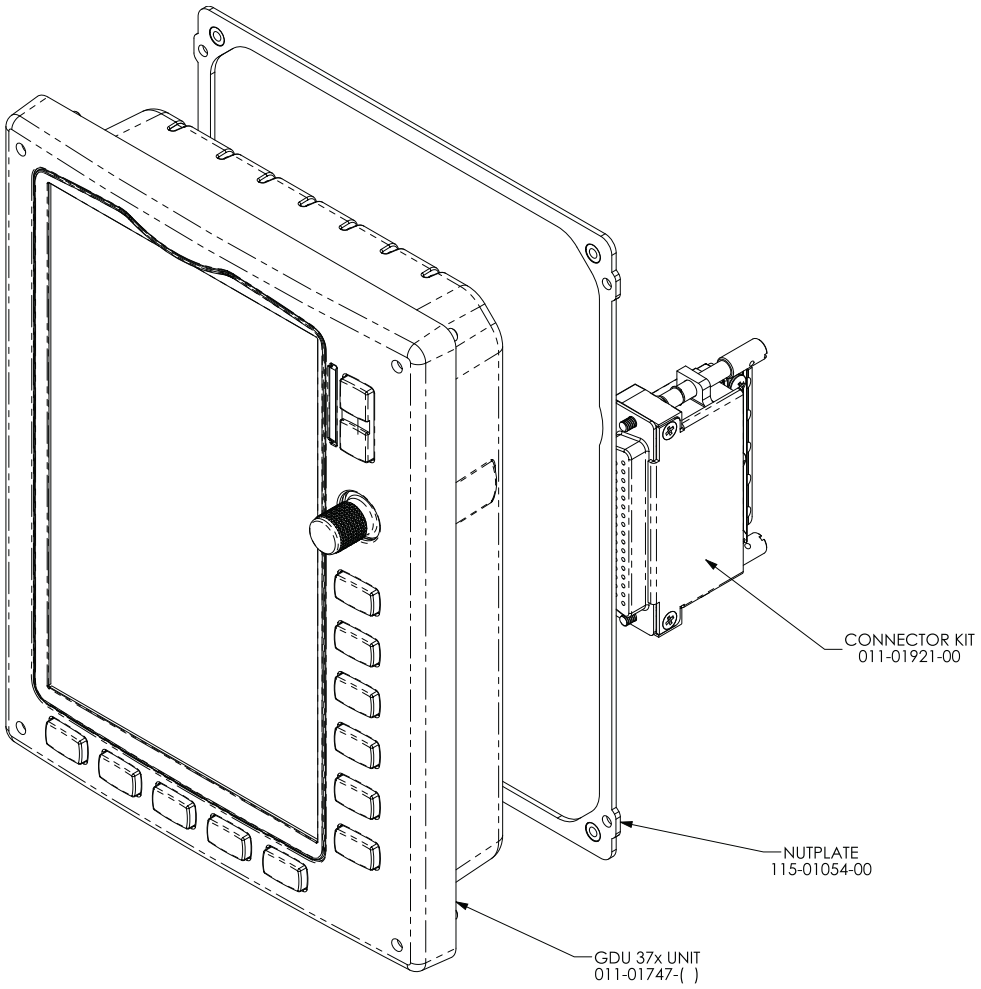


Figure E-3 GDU 37X Mounting Accessories

E.4 Pinouts

E.4.1 J3701 Connector

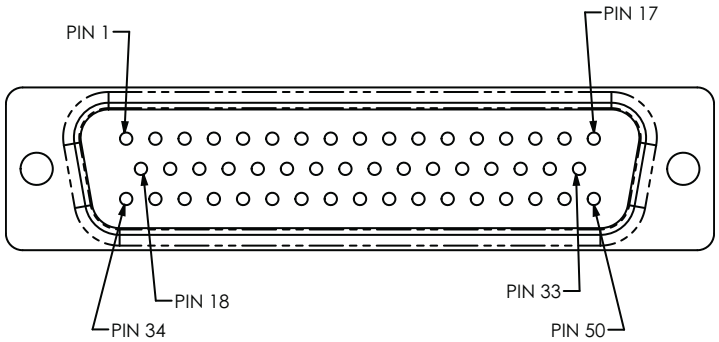


Figure E-4 J3701 on GDU 37X, as viewed looking at connector on unit

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.

E.4.2 Aircraft Power

The GDU 37X 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	--

E.4.3 Mode Selections, CDU System ID Program Pins

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

E.4.4 Serial Data

E.4.4.1 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

E.4.4.2 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 2.3.1.3.3 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	--

E.4.4.3 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	--

E.4.5 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

E.4.6 Audio

E.4.6.1 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	--

E.4.6.2 Stereo Audio

The stereo audio output provides SiriusXM® 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 Appendix H.4.13 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	--

E.5 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 24.4 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 23.

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 E-5).

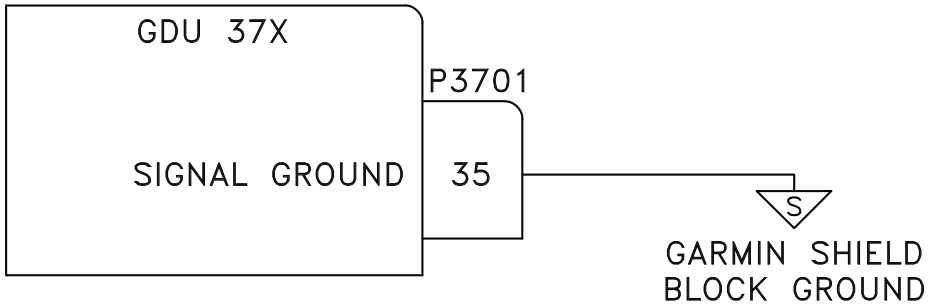


Figure E-5 Grounded Connector Shell

E.6 Antennas

Refer to Section 21 for antenna information.

NOTE

GDU 37X units cannot be used with GA 35, GA 36, or GA 37 antennas.

E.7 Mounting Requirements

Refer to Appendix E.8 for outline and installation drawings.

E.7.1 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 E-8.

E.7.2 Panel Cutout Template

Figure E-6 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 E-8 for complete cutout dimensions. A .dxf version of the drawing is also available for download at https://support.garmin.com/support/manuals.

GDU 37X PANEL CUTOUT TEMPLATE

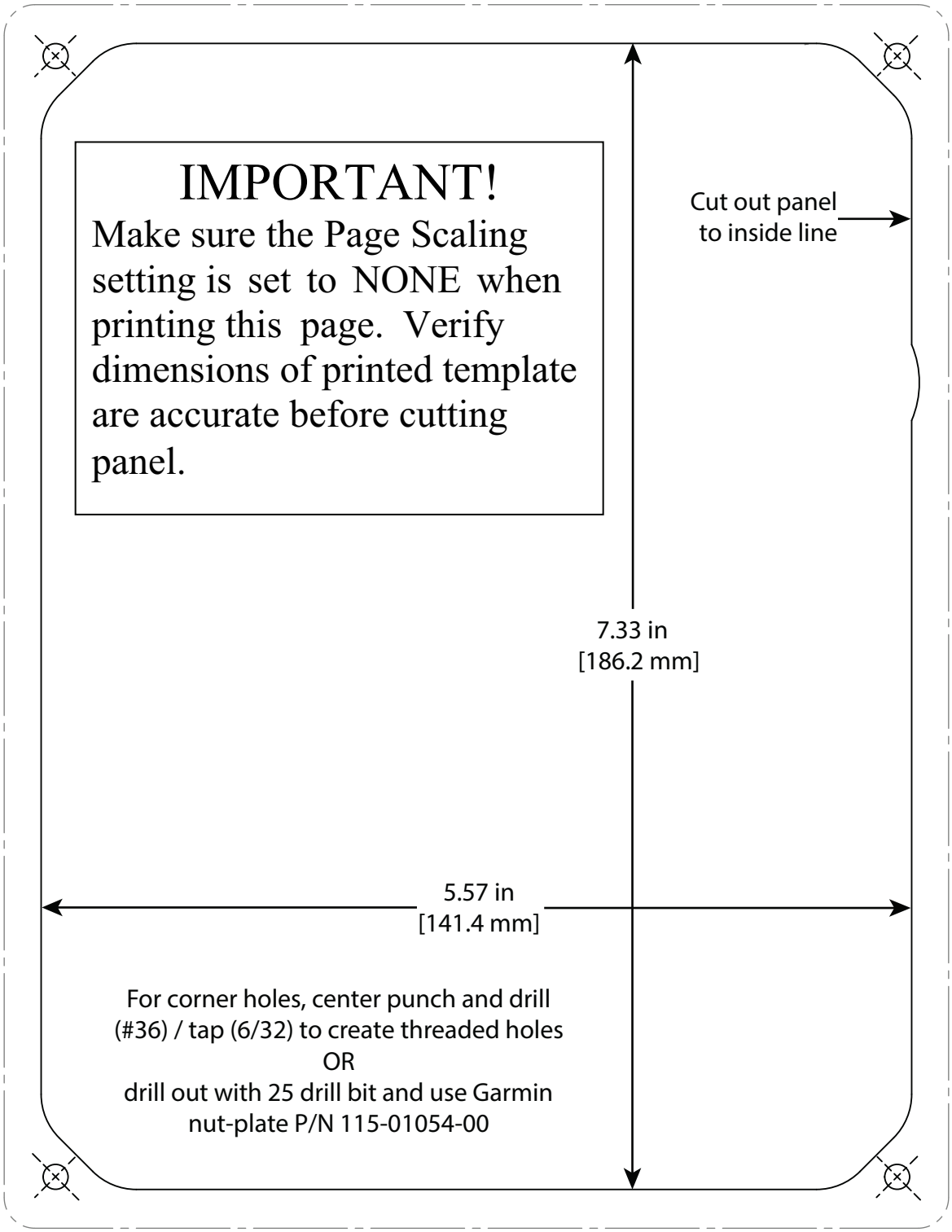


Figure E-6 GDU 37X Panel Cutout Template

E.8 Outline and Installation Drawings

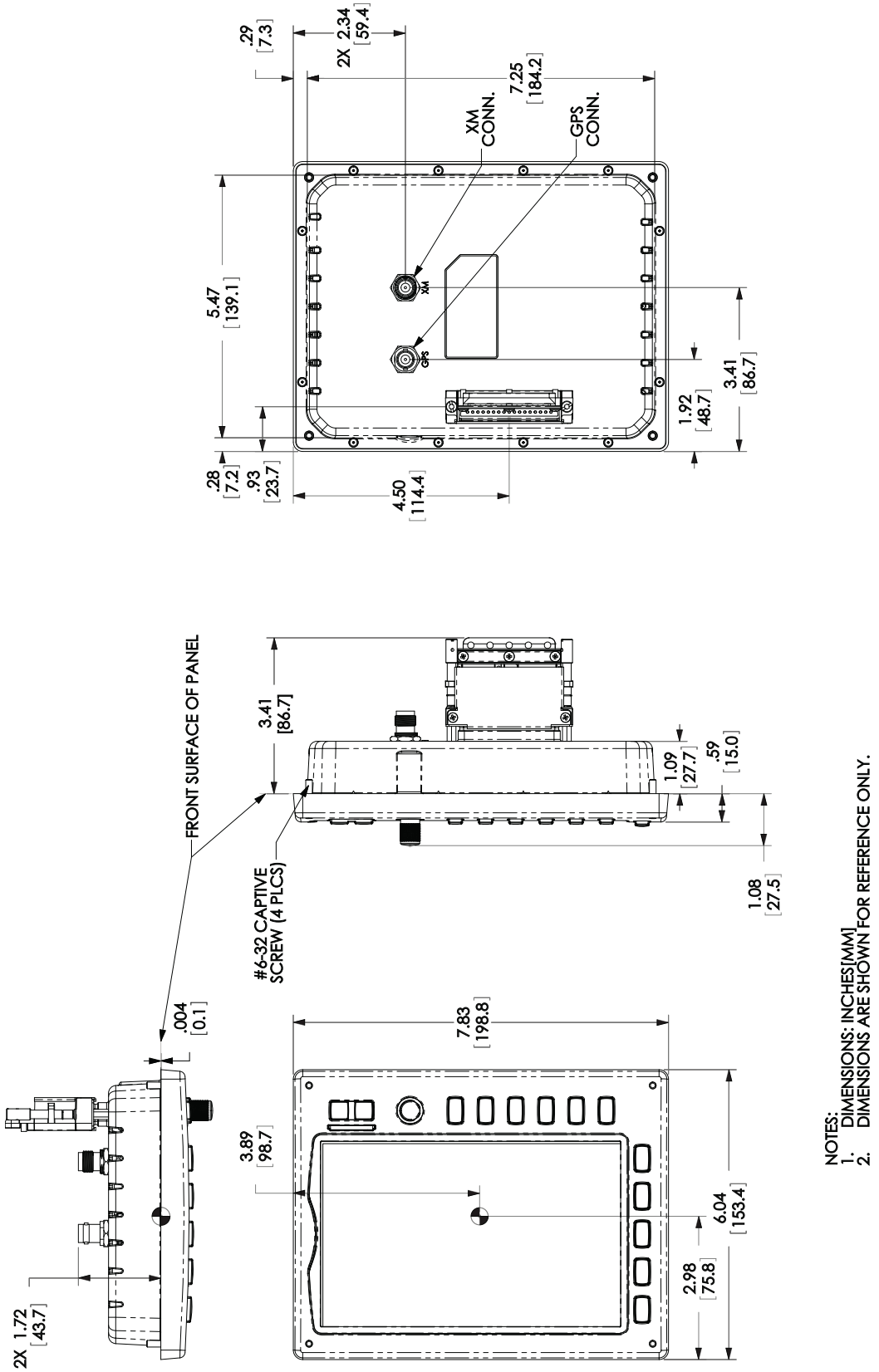


Figure E-7 GDU 37X Outline Drawing

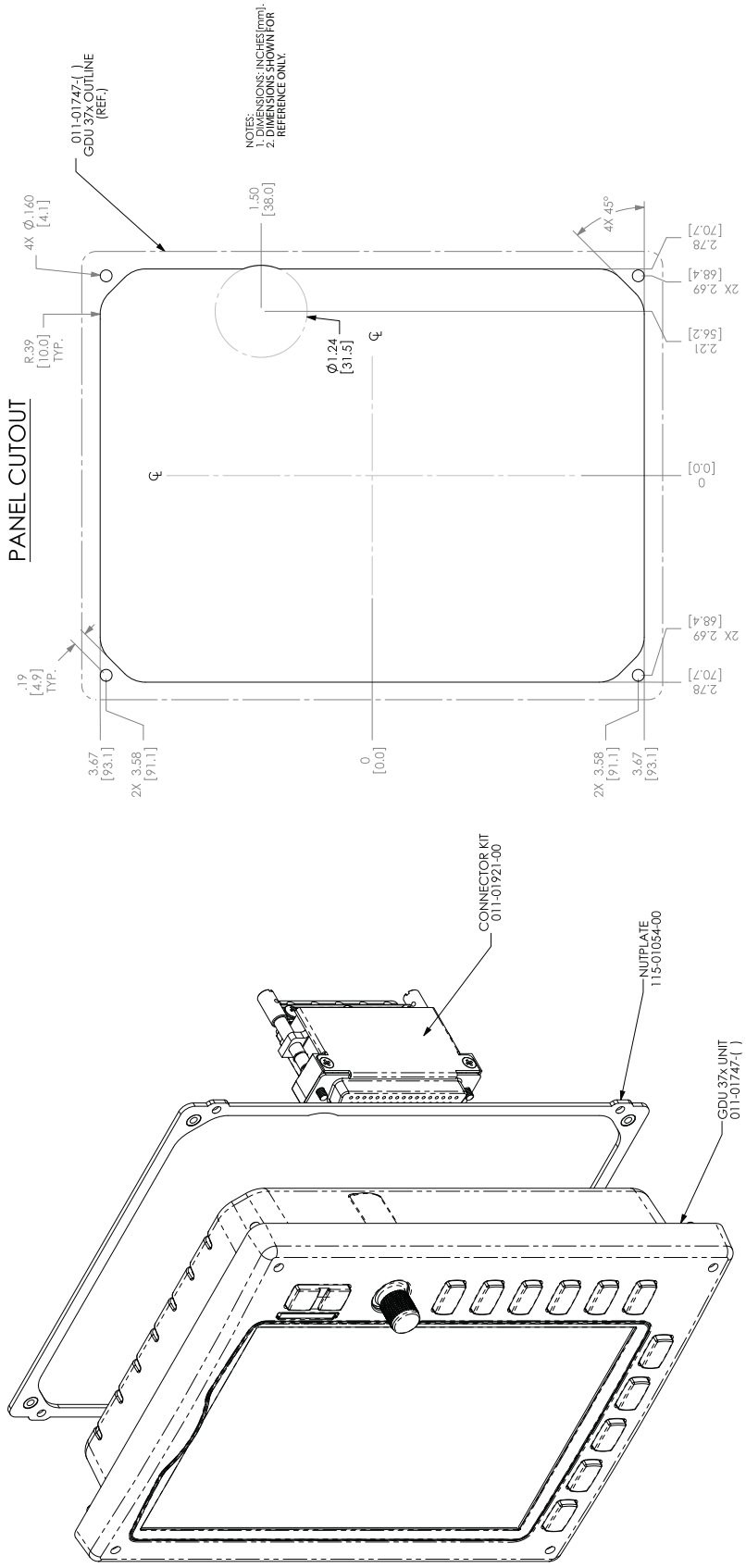


Figure E-8 GDU 37X Assembly/Panel Cutout Drawing

APPENDIX F GSU 73 SENSOR UNIT INSTALLATION

NOTE

The GSU 73 has been discontinued and is no longer available for purchase.

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

F.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

The GSU 73 is not compatible with the GMU 11 magnetometer. Installations with a GSU 73 must also include a GMU 22 connected to the GSU 73.

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.

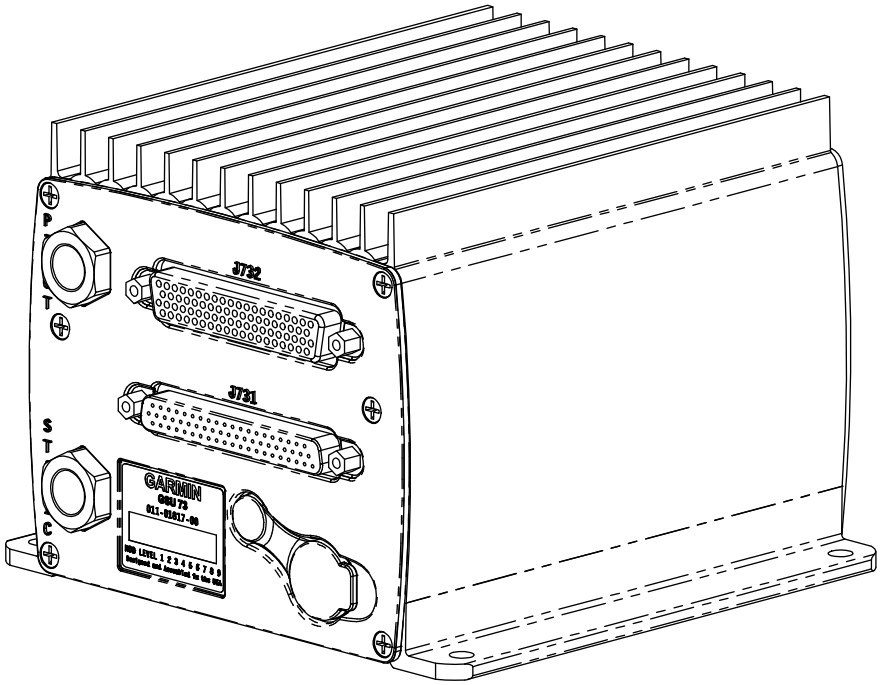


Figure F-1 GSU 73 Unit View

F.1.1 Features Summary

Air Data	Interfaces
Pressure Altitude	CAN (1)
Density Altitude	RS-232 (2 TX/2 RX)
Vertical Speed	ARINC 429 (4 RX/2 TX)
Mach Number	OAT Probe (GTP 59)
Indicated Airspeed	Magnetometer (GMU 22) (1 RS-232 TX/ 1 RS-485 RX)
True Airspeed	

AHRS	Engine/Airframe
Magnetic Heading	27 Analog Inputs
Pitch Angle	4 Digital Inputs
Roll Angle	4 Discrete Inputs
Linear Accelerations	2 Discrete Outputs
Pitch, Roll, Yaw Rotation Rates	

F.2 General Specifications

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

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

F.3 Required Equipment

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

Table F-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 F-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 F-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)

F.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 displays will be Red-x'd (Section 32) if the GSU configuration module is not present.

F.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.

F.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 Appendix F.5 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 23.

F.5 Pinouts

F.5.1 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.

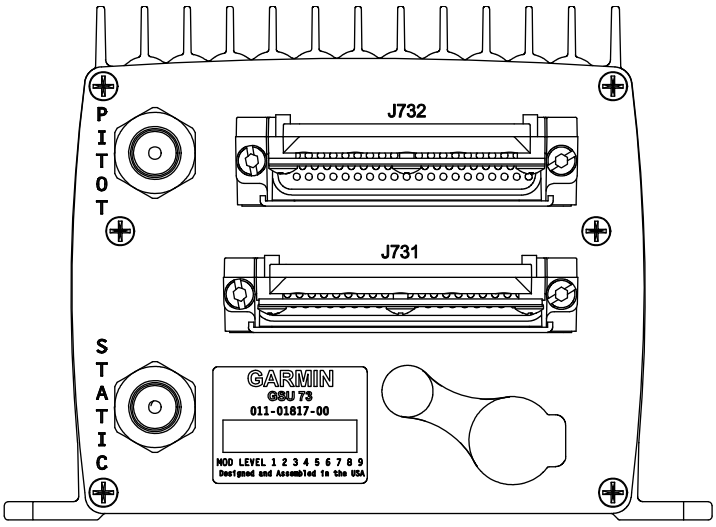


Figure F-2 Rear View of Connector End Plate

F.5.2 J731 Connector

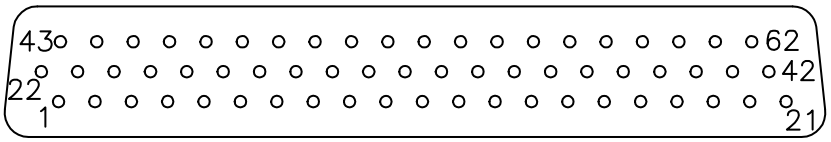


Figure F-3 J731 on GSU 73, as viewed looking at connector on unit

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
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

*Indicates Active Low

Pin	Pin Name	I/O
33	ARINC 429 IN 4 B	In
34	SIGNAL GROUND	--
35	SIGNAL GROUND	--
36	SIGNAL GROUND	--
37	SIGNAL GROUND	--
38	MAGNETOMETER POWER OUT	Out
39	MAGNETOMETER GROUND	--
40	SIGNAL GROUND	--
41	SPARE	--
42	SPARE	--
43	SIGNAL GROUND	--
44	SPARE	--
45	SPARE	--
46	SPARE	--
47	AIRCRAFT POWER 1	In
48	SPARE	--
49	AIRCRAFT POWER 2	In
50	SPARE	--
51	SPARE	--
52	SPARE	--
53	SIGNAL GROUND	--
54	SIGNAL GROUND	--
55	SPARE	--
56	SPARE	--
57	SPARE	--
58	SIGNAL GROUND	--
59	POWER GROUND	--
60	SIGNAL GROUND	--
61	POWER GROUND	--
62	SPARE	--

*Indicates Active Low

F.5.2.1 J732 Connector

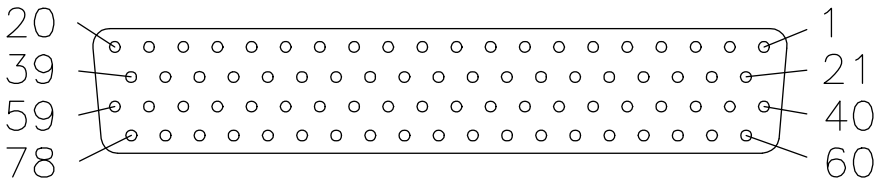


Figure F-4 J732 on GSU 73, as viewed looking at connector on unit

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
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

*Indicates Active Low

Pin	Pin Name	I/O
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)	--
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

*Indicates Active Low

Pin	Pin Name	I/O
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

F.5.3 Power I/O

F.5.3.1 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 Appendix H.4.19.3.2 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	--

F.5.3.2 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)	--

F.5.3.3 Magnetometer Power

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

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

F.5.4 Serial Data Electrical Characteristics

F.5.4.1 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

F.5.4.2 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 G-2.2 & Figure G-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

F.5.4.3 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

F.5.4.4 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™ display 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 Section 25). 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	--

F.5.4.5 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)	--

F.5.5 Discrete I/O

F.5.5.1 Discrete Inputs

The GSU 73 has 4 configurable discrete inputs.

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

ACTIVE: Vin < 3.5 VDC, or Rin < 375 Ω

INACTIVE: Vin > 8 VDC, or Rin > 100k Ω

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

ACTIVE: Vin > 8 VDC, or Rin > 100k Ω

INACTIVE: Vin < 3.5 VDC, or Rin < 375 Ω

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

F.5.5.2 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 Section 27 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 ≤ 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

F.5.6 Analog Input Configuration

Some analog inputs are multi-purpose capable and have several configuration options. These inputs are configured by the GDU (refer to Appendix H.4.19 for GDU 37X systems and to Section 31.4.32 for GDU 4XX systems) and are capable of reading any voltage up to 40 Vdc.

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 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

F.5.7 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 19-2 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

F.5.8 Frequency Counter Inputs

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

F.5.9 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 Section 27.

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

F.5.10 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 F-5). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

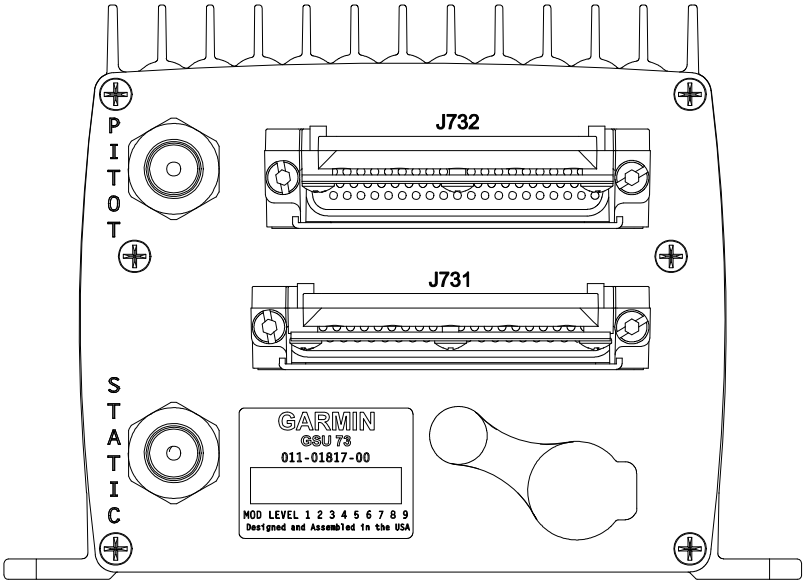


Figure F-5 GSU 73 Air Hose Fitting Locations

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. Make sure 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.

F.5.11 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. See 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 make sure 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 F-7 for reference.

F.5.12 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 F-6.

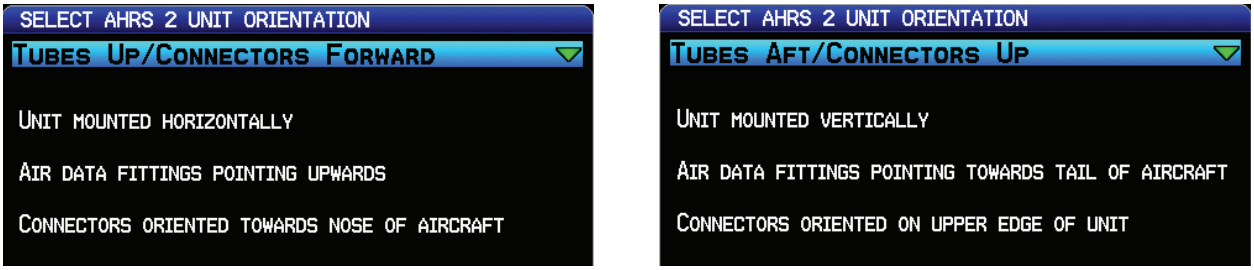


Figure F-6 AHRS Orientation Selection

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 Appendix D.13.1.

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 in-flight level cruise altitude and an aircraft leveling and offset calibration procedure carried out before flight. (This procedure is described in Appendix H.4.3.2 for GDU™ 37X display systems and Section 31.4.7.2 for GDU 4XX systems.)

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

F.5.13 Unit Mounting

For final installation and assembly, refer to the outline and installation drawing Figure F-7 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 Appendix F.5.12.
4. Connect backshell connector and hoses.

NOTE

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

F.6 Outline and Installation Drawings

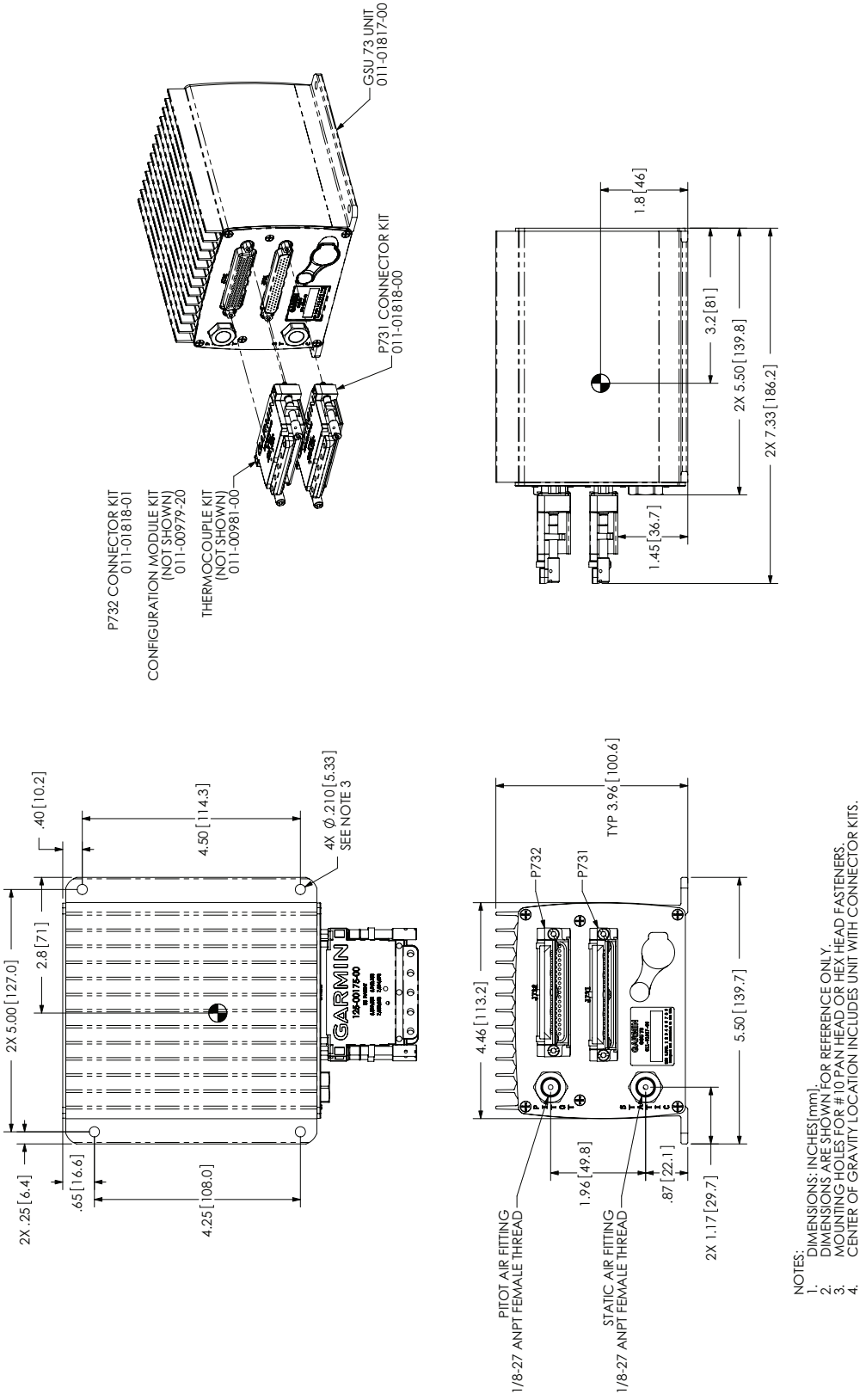


Figure F-7 GSU 73 Outline Drawing

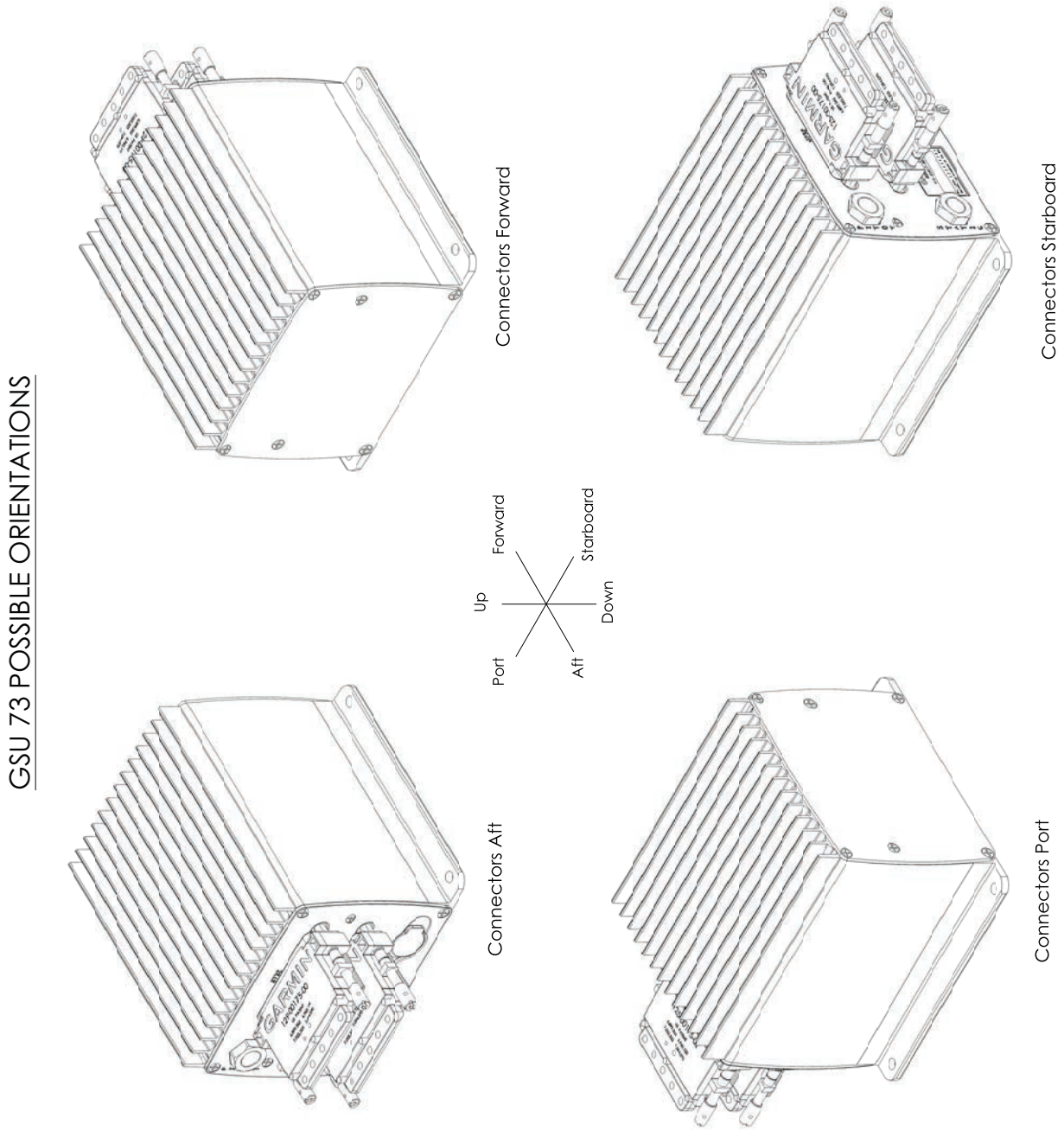


Figure F-8 GSU 73 Orientation Drawings

APPENDIX G GSU 73 INTERCONNECT DRAWINGS

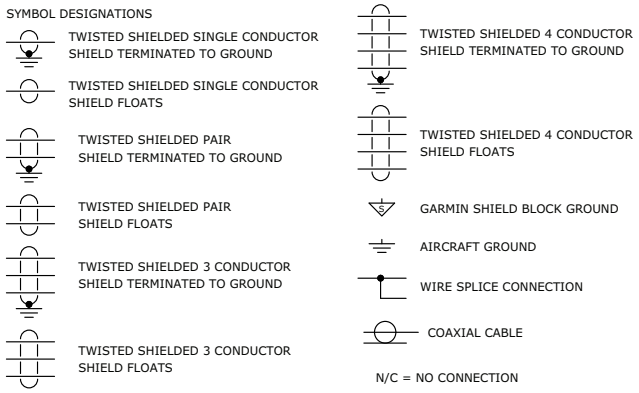
FIGURE **PAGE**

Core (w/GSU 73) Interconnect Notes for Section 28.1 and 2 Display CAN Bus Interconnect Drawing G-2
GDU/GMU 22/GSU 73 Interconnect Drawing G-3
Power, Backup Power, and Antennas Interconnect Drawing w/GSU 73 ..... G-4
GMC 30X/GSA 28 Interconnect Drawing w/GSU 73 ..... G-5
External Interconnect w/GSU 73 Drawing Notes for Section 28.2 ..... G-6
G3X w/GSU 73 - Transponders Interconnect/Configuration Example G-7
GTN 6XX/7XX - Transponder Interconnect/Configuration Example w/GSU 73 ..... G-8
Single GNS 430(W)/530(W) Interconnect/Configuration Example w/GSU 73 ..... G-9
Dual GNS 430(W)/530(W) Interconnect/Configuration Example w/GSU 73 ..... G-10
Single GTN 6XX/7XX Interconnect/Configuration Example w/GSU 73 ..... G-11
Dual GTN 6XX/7XX Interconnect/Configuration Example w/GSU 73 ..... G-12
GNS 480 Interconnect/Configuration Example w/GSU 73 ..... G-13
Non-Garmin Auto Pilot Interconnect/Configuration Example w/GSU 73 ..... G-14
G3X w/GSU 73 - GTS 8XX Interconnect/Configuration Example G-15

G.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



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. NOTE REMOVED
8. INSTALLATION INFORMATION IS PROVIDED FOR CONNECTORS, CONFIGURATION MODULES AND THERMOCOUPLES IN SECTION 21, AND IN SECTION 17 FOR THE GTP 59.
9. IN A 2 DISPLAY INSTALLATION, THE SECOND DISPLAY CAN BE CONNECTED AS SHOWN.
10. OPTIONAL INTERFACE.
11. THE GDU 46X/37X CAN BE CONFIGURED TO ACCEPT A 14V OR 28V LIGHTING BUS INPUT. SEE APPDX H FOR CONFIGURATION.
12. ONLY ONE GDU 46X/37X GPS ANTENNA CONNECTION IS REQUIRED FOR THE G3X SYSTEM. ADDITIONAL ANTENNAS CAN BE ADDED FOR REDUNDANCY IF DESIRED. SEE SECTION 17 FOR GPS CONFIGURATION INFORMATION.
13. THE CAN BUS SHOULD ONLY BE TERMINATED AT ONE GDU 46X/37X WHEN THE CAN BUS IS 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 APPDX H FOR MORE INFORMATION ON CONFIGURATION OF GSU 73 DISCRETE INPUTS.

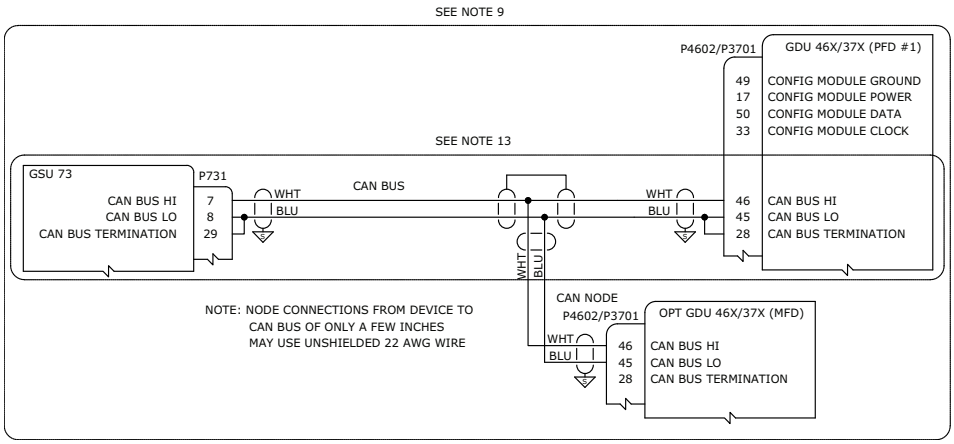


Figure G-1.1 Core (w/GSU 73) Interconnect Notes for Appendix G.1 and 2 Display CAN Bus Interconnect Drawing

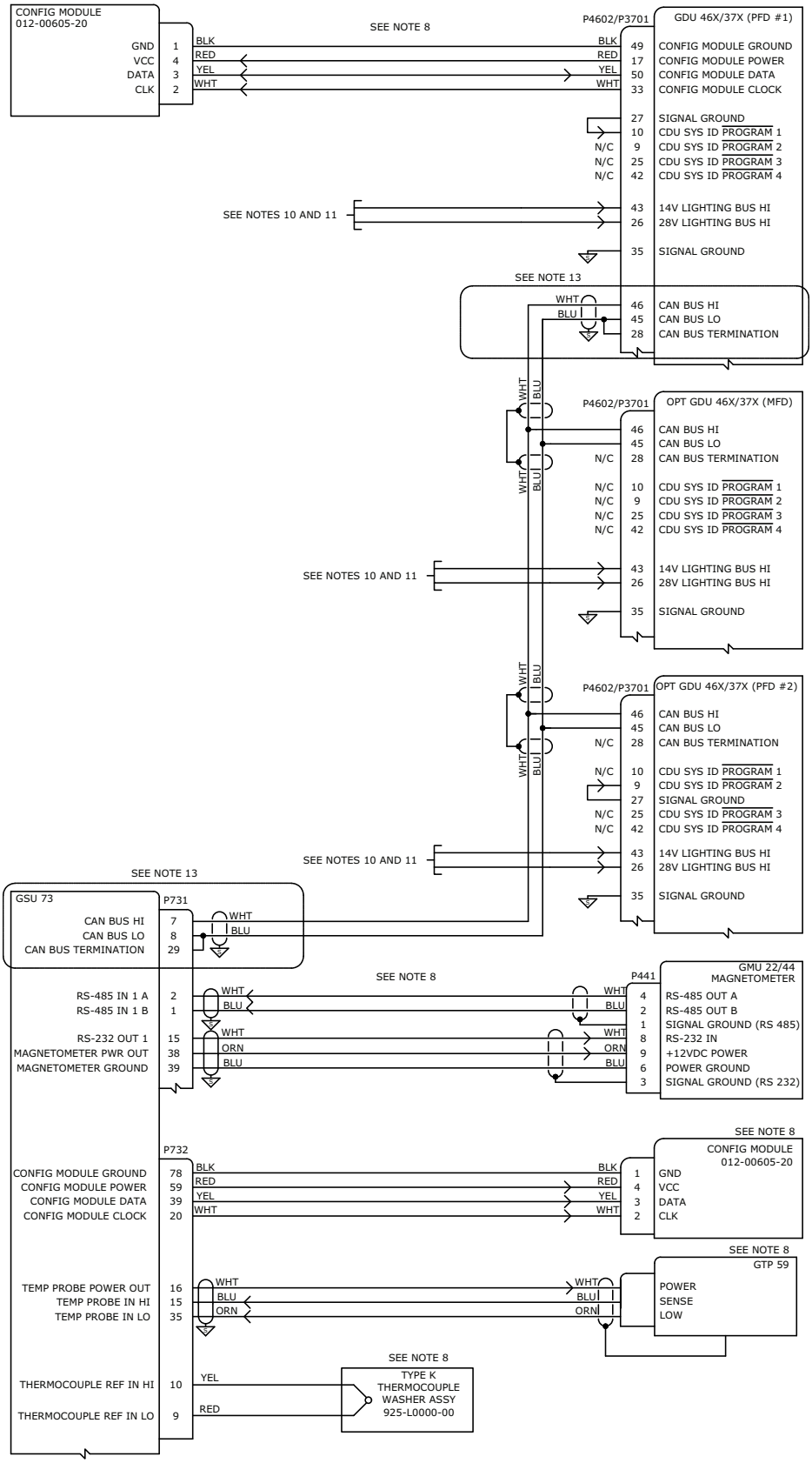


Figure G-1.2 GDU/GMU 22/GSU 73 Interconnect Drawing

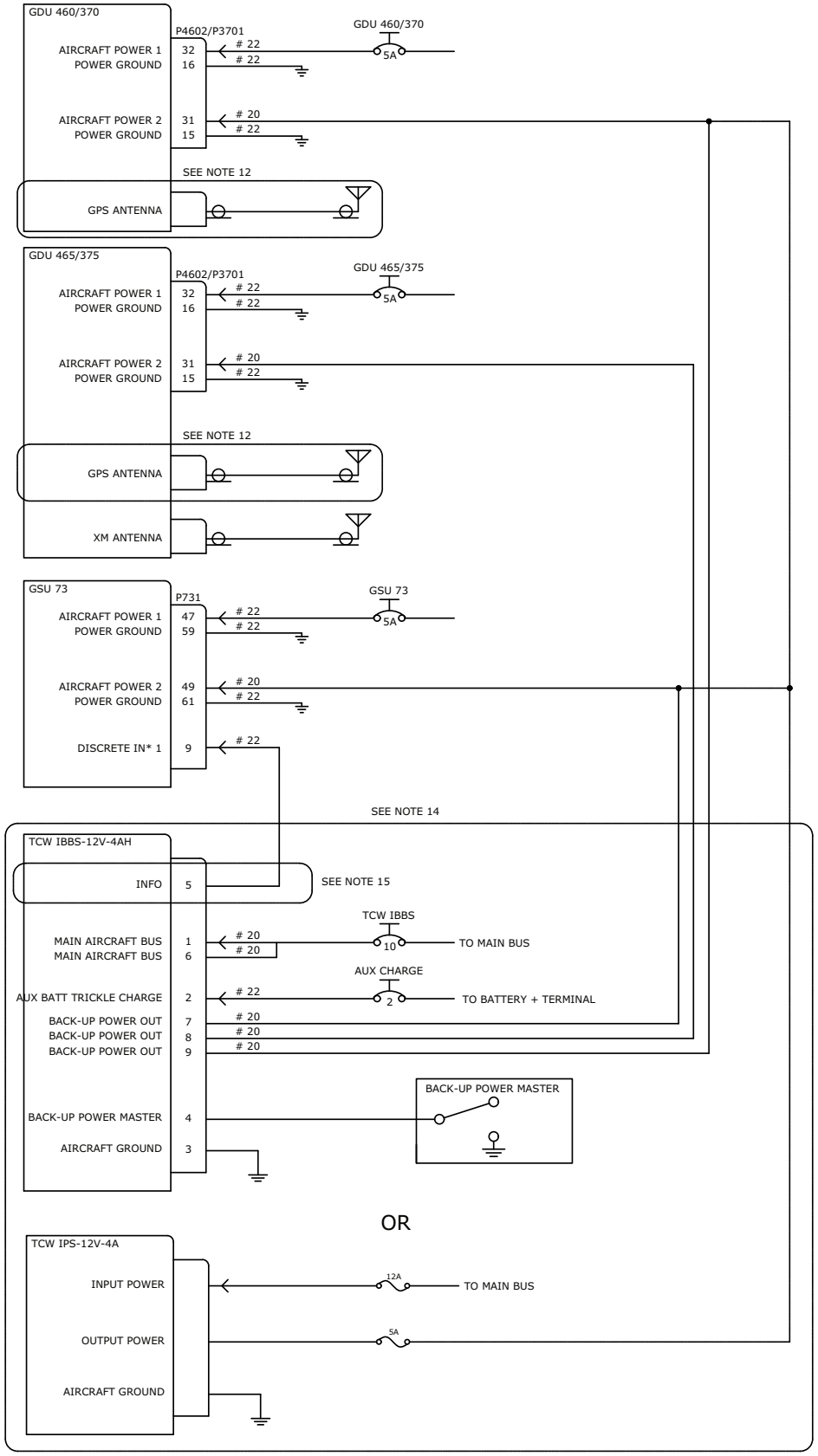
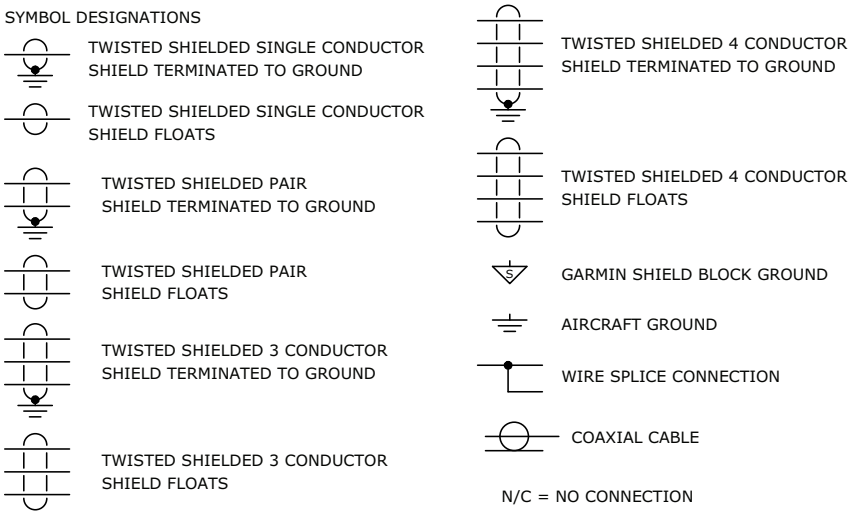


Figure G-1.3 Power, Backup Power, and Antennas Interconnect Drawing w/GSU 73

G.2 External Interconnect Drawings w/GSU 73

NOTES:

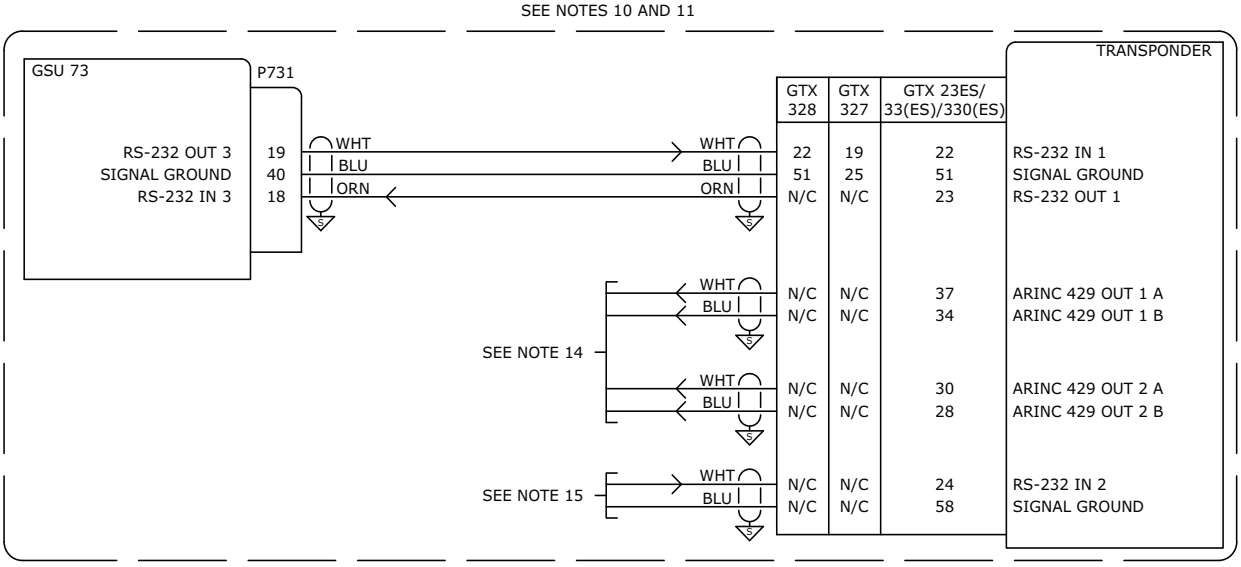
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS



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. THE VP-X MUST BE CONNECTED TO THE MFD IN A MULTIPLE DISPLAY INSTALLATION.
8. CONNECTIONS FOR AUTOPILOT SERVOS, AP DISCONNECT AND OTHER AUTOPILOT FUNCTIONALITY NOT SHOWN. CONSULT AUTOPILOT VENDOR DOCUMENTATION FOR ADDITIONAL DETAILS.
9. NOTE HAS BEEN REMOVED.
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 46X/37X. THE ALERTS GENERATED BY THE GDU 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 ALERT OUTPUTS.
13. INSTALLING THE CROSSFILL CONNECTION WILL ALLOW FLIGHT PLAN SHARING BETWEEN TWO GNS 430(W)/530(W) UNITS (VIA RS-232) OR TWO GNS 6XX/7XX UNITS (VIA ETHERNET). THE G3X SYSTEM ALWAYS DISPLAYS FLIGHT PLAN INFORMATION FROM THE ACTIVE NAV SOURCE.
14. ARINC 429 OUT 2 CAN BE OPTIONALLY CONNECTED TO A GNS 400/500 SERIES UNIT FOR DISPLAY OF TIS-A. THE G3X SYSTEM WILL CONFIGURE REMOTE MOUNT GARMIN TRANSPONDERS ARINC 429 OUT 1 FOR LOW SPEED TIS DATA AND ARINC 429 OUT 2 FOR HIGH SPEED TIS DATA BY DEFAULT. GNS 400/500 SERIES UNITS REQUIRE THE DATA TO BE HIGH SPEED. PANEL MOUNT TRANSPONDERS MUST BE CONFIGURED MANUALLY.
15. RS-232 ADS-B OUT FROM A GNS 400/500 SERIES WAAS UNIT WITH MAIN SOFTWARE VERSION 3.20 OR LATER OR A GTN 600/700 SERIES UNIT IS REQUIRED TO SUPPORT ADS-B TRANSMISSIONS. IF ADS-B TRANSMISSION FROM THE GTX 23 ES IS NOT REQUIRED, THIS CONNECTION IS NOT REQUIRED.
16. THE GTN 6XX/7XX UNITS RECEIVE ALTITUDE ENCODER DATA FROM THE GSU 73 VIA ARINC 429 AND RELAY THAT DATA TO THE TRANSPONDER. IF TWO GTN 6XX/7XX UNITS ARE INSTALLED, RS-232 CHANNEL 2 TRANSMIT AND RECEIVE ON THE TRANSPONDER COULD BE CONNECTED TO THE SECOND GTN INSTEAD OF THE GDU 46X/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 G-2.1 External Interconnect w/GSU 73 Drawing Notes for Appendix G.2

NOTE: THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTX 23, 33(ES), 327, OR 330(ES) UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTX 23, 33(ES), 327, OR 330(ES) UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION INFORMATION.



CONFIGURATION GUIDANCE

1. GTX 327/328/330(ES)/33(ES)

A. ON THE GTX 327/328/330(ES)/33(ES) RS-232 CONFIG MODE PAGE
- SET CONNECTED GTX 327/328/330(ES) RS-232 INPUT FORMAT TO "REMOTE"
- SET CONNECTED GTX 330(ES) RS-232 OUTPUT FORMAT TO "REMOTE+TIS"

B. ON THE GTX 327/328/330(ES) SQUAT SWITCH CONFIG MODE PAGE
- SET THE SQUAT SWITCH FIELD TO "NO"

C. IF REMOTE CONTROL OF THE TRANSPONDER FROM THE GDU 46X/37X IS DESIRED
- ON THE GDU 46X/37X XPDR CONFIG MODE PAGE SET TRANSPONDER TYPE TO "GTX 327" OR "GTX 328" OR "GTX 330" OR "GTX 330ES" OR "GTX 33" OR "GTX 33ES" AS APPROPRIATE

D. NO GSU 73 CONFIGURATION REQUIRED

2. GTX 33(ES)

A. ON THE GDU 46X/37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 33" OR "GTX 33ES" AS APPROPRIATE

B. NO GSU 73 CONFIGURATION REQUIRED

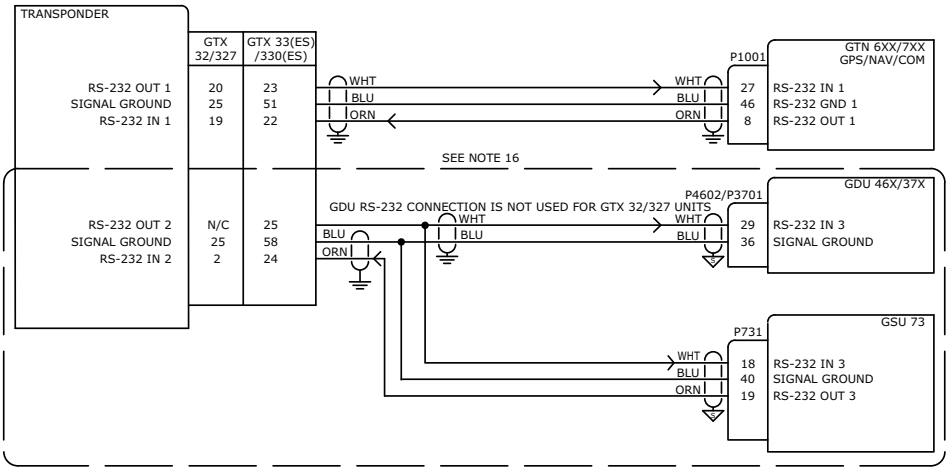
3. GTX 23ES

A. ON THE GDU 46X/37X XPDR CONFIG MODE PAGE
- SET TRANSPONDER TYPE TO "GTX 23ES"

B. NO GSU 73 CONFIGURATION REQUIRED

Figure G-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 33(ES) UNIT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTX 23, 32, 327, 33(ES), OR 330(ES) UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 46X/37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

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 46X/37X XPDR CONFIG PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

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 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"

D. ON THE GDU 46X/37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

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 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED RS-232 CHANNEL FORMAT TO "TIS IN"

D. ON THE GDU 46X/37X XPDR CONFIG MODE PAGE
- SET THE TRANSPONDER TYPE TO "NONE"

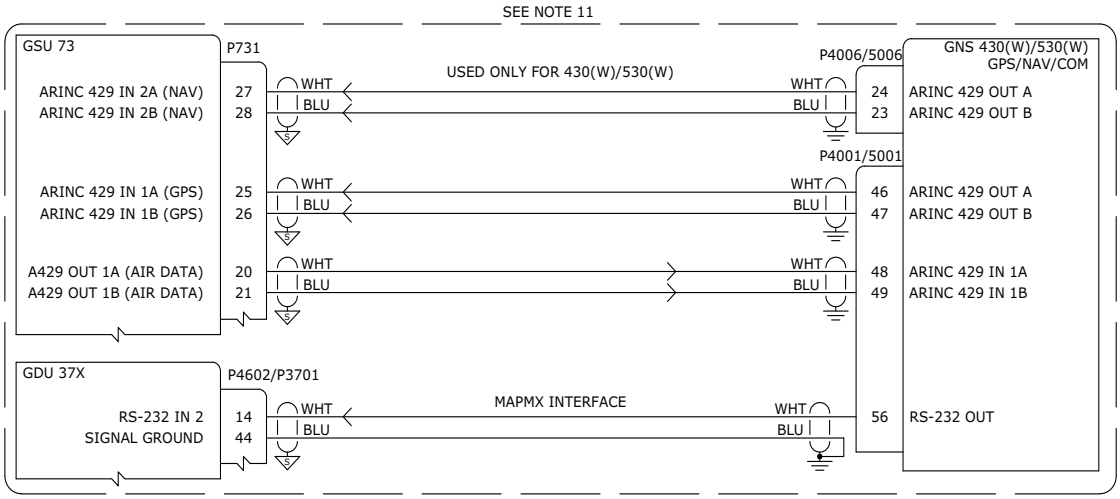
5. GTX 23ES

A. THE GTX 23ES MUST BE CONNECTED AS SHOWN ON SHEET 3

B. CONTROL OF GTX 23ES FROM THE GTN 6XX/7XX IS NOT SUPPORTED

Figure G-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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 4XX(W)/5XX(W) UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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

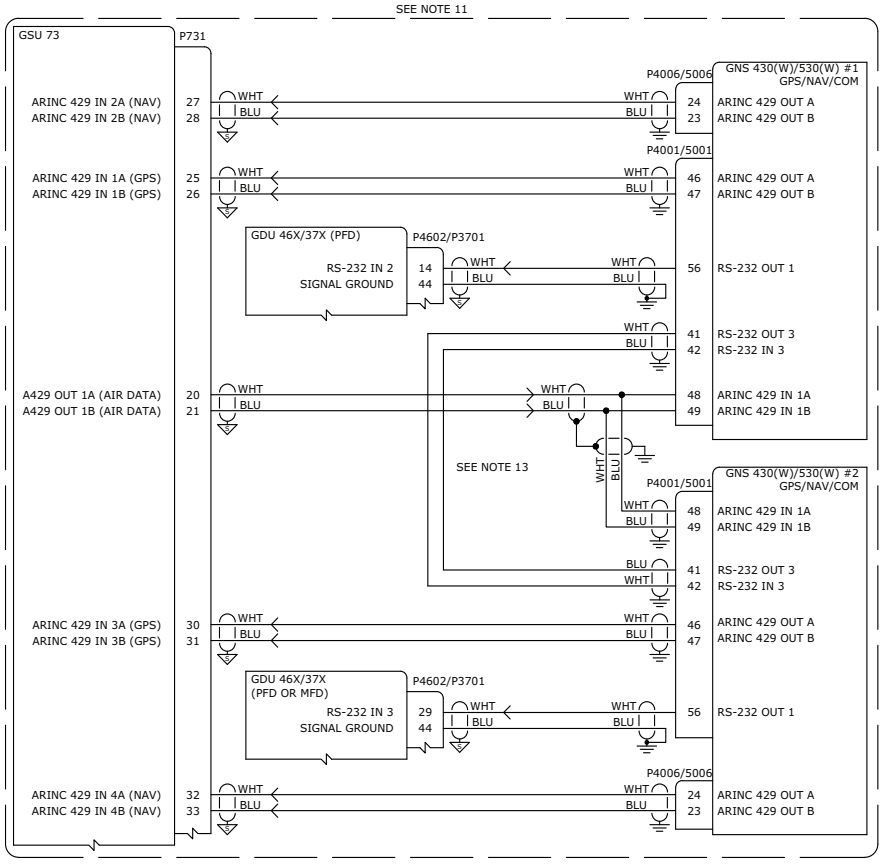
D. ON THE VOR/LOC/GS ARINC 429 CONFIG PAGE (430(W)/530(W) ONLY)
- SET RX AND TX SPEED TO "LOW"
- SET SDI TO "VOR/ILS 1"

2. G3X

A. ON THE GDU 46X/37X RS-232 AND ARINC 429 CONFIG MODE PAGES
- SET THE CONNECTED GDU 46X/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" (430(W)/530(W) ONLY)

Figure G-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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 4XX(W)/5XX(W) UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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

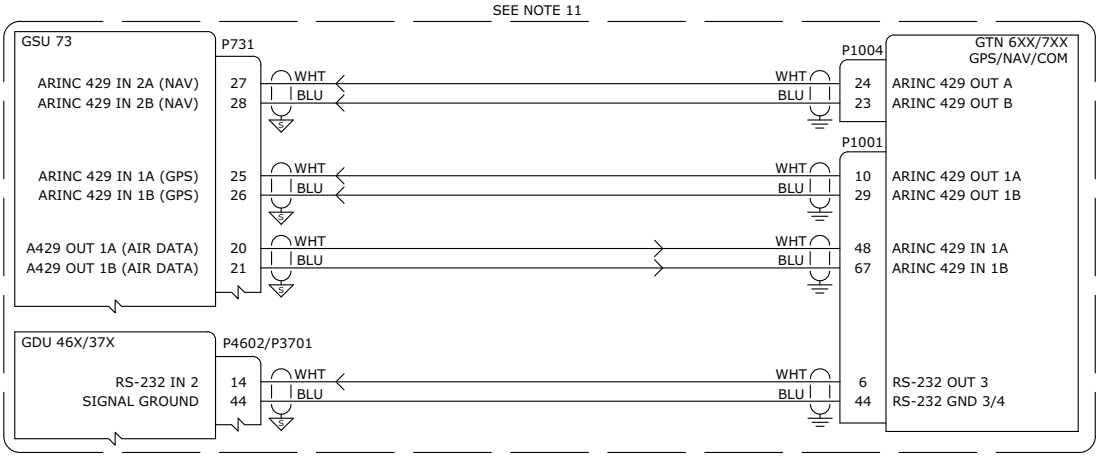
2. G3X

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED GDU 46X/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 46X/37X (PFD OR MFD) RS-232 CHANNEL TO "MAPMX" (IF CONNECTED TO A WAAS UNIT) OR "AVIATION IN" (IF CONNECTED TO A NON-WAAS UNIT) FOR GNS #2
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET GSU ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET GSU ARINC 429 RX 4 FORMAT TO "GARMIN VOR/ILS" AND "NAV 2" FOR GNS #2

IMPORTANT: GNS #1 AND #2 ARE DIFFERENTIATED IN THE G3X SYSTEM BY THE GDU 46X/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 G-2.5 Dual GNS 430(W)/530(W) Interconnect/Configuration Example w/GSU 73

THIS INTERFACE EXAMPLE DRAWING IS NOT SUFFICIENT FOR INSTALLATION OF A GTN 6XX/7XX SERIES PRODUCT. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTN 6XX/7XX UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 "GDU FORMAT 2" (GTN V6.71 AND LATER)
- SET IN 1 DATA TO "EFIS FORMAT 2" WHEN “GDU FORMAT 2” IS NOT AVAILABLE
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 DATA TO "GARMIN 429" (GTN V6.50 AND LATER)
- SET OUT 1 DATA TO "GAMA FORMAT 1" WHEN "GARMIN 429" NOT AVAILABLE
- 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

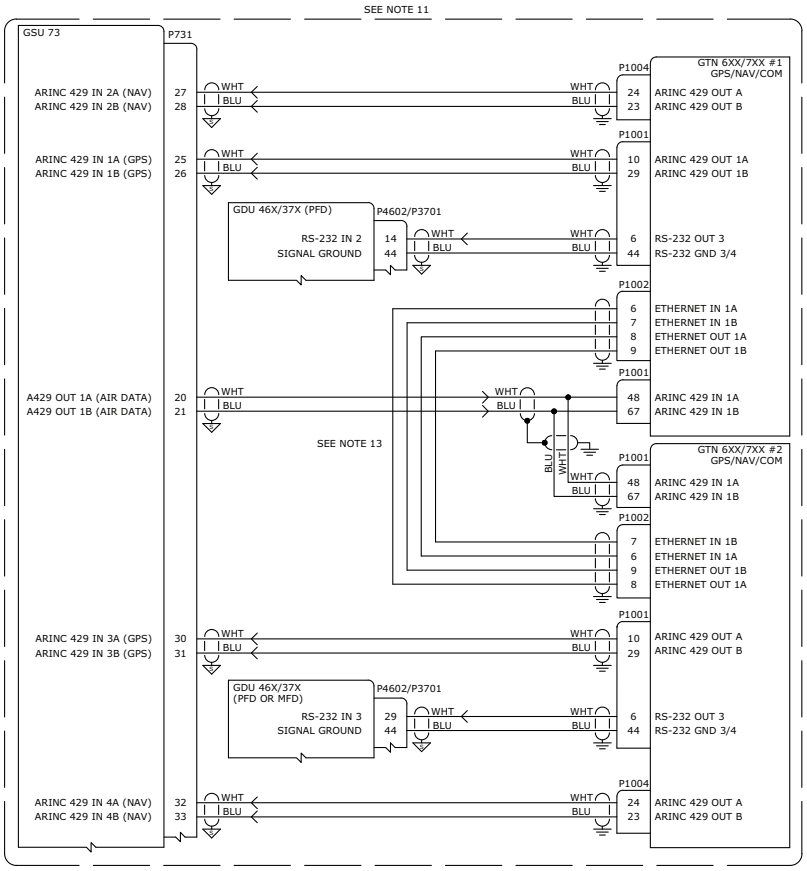
A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED GDU 46X/37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

NOTE 1: BEGINNING WITH GTN SOFTWARE V6.71 (GTN Xi SOFTWARE V20.12), AND G3X SOFTWARE 12.20, THE GTN ARINC 429 INPUT SETTING CAN BE CONFIGURED AS GDU FORMAT 2 IN PLACE OF EFIS FORMAT 2 TO ALLOW FUEL FLOW INFORMATION TO BE SENT FROM THE G3X TO THE GTN. NO CONFIGURATION CHANGE REQUIRED FOR G3X.

NOTE 2: BEGINNING WITH GDU 4XX SOFTWARE V8.91, TRANSITION TO APPROACH MAY BE ENABLED ON THE GTN 6XX/7XX NAVIGATOR.

Figure G-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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTN 6XX/7XX UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 "GDU FORMAT 2" (GTN V6.71 AND LATER)
- SET IN 1 DATA TO "EFIS FORMAT 2" WHEN “GDU FORMAT 2” IS NOT AVAILABLE
- SET OUT 1 SPEED TO "LOW"
- SET OUT 1 DATA TO "GARMIN 429" (GTN V6.50 AND LATER)
- SET OUT 1 DATA TO "GAMA FORMAT 1" WHEN "GARMIN 429" NOT AVAILABLE
- 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

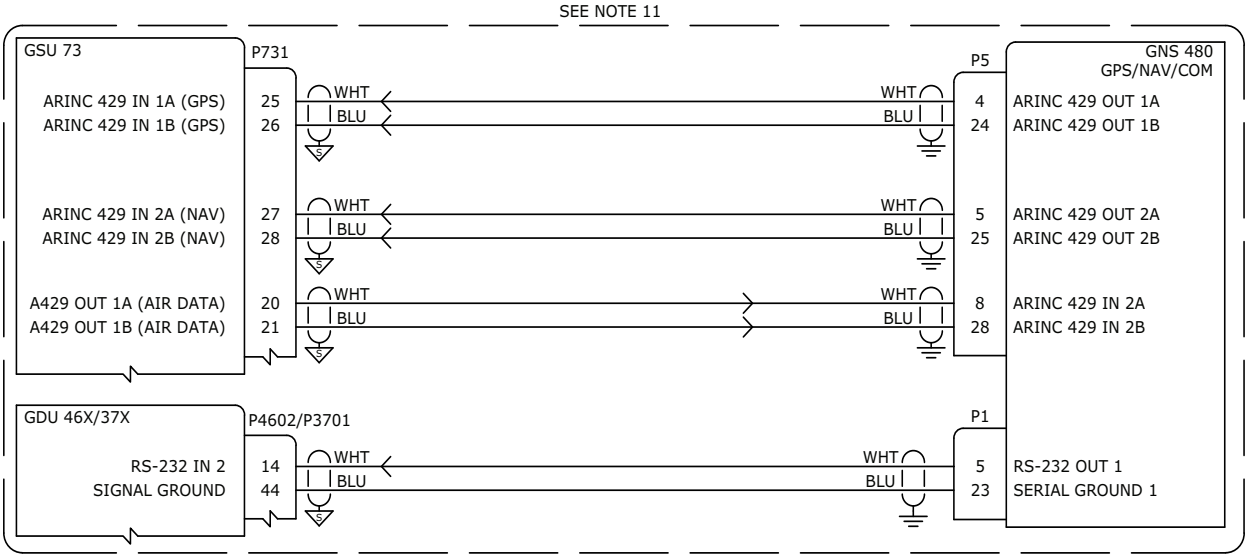
A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED GDU 46X/37X (PFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #1
- SET THE CONNECTED GDU 46X/37X (PFD OR MFD) RS-232 CHANNEL TO "MAPMX" FOR GTN #2
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1 + 2"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1" FOR GNS #1
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1" FOR GNS #1
- SET GSU ARINC 429 RX 3 FORMAT TO "GARMIN GPS" AND "NAV 2" FOR GNS #2 (IF APPLICABLE)
- SET GSU ARINC 429 RX 4 FORMAT TO "GARMIN VOR/ILS" AND "NAV 2" FOR GNS #2

IMPORTANT: GTN #1 AND #2 ARE DIFFERENTIATED IN THE G3X SYSTEM BY THE GDU 46X/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.

NOTE 1: BEGINNING WITH GDU 4XX SOFTWARE V8.91, TRANSITION TO APPROACH MAY BE ENABLED ON THE GTN 6XX/7XX NAVIGATOR.

Figure G-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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GNS 480 UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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"

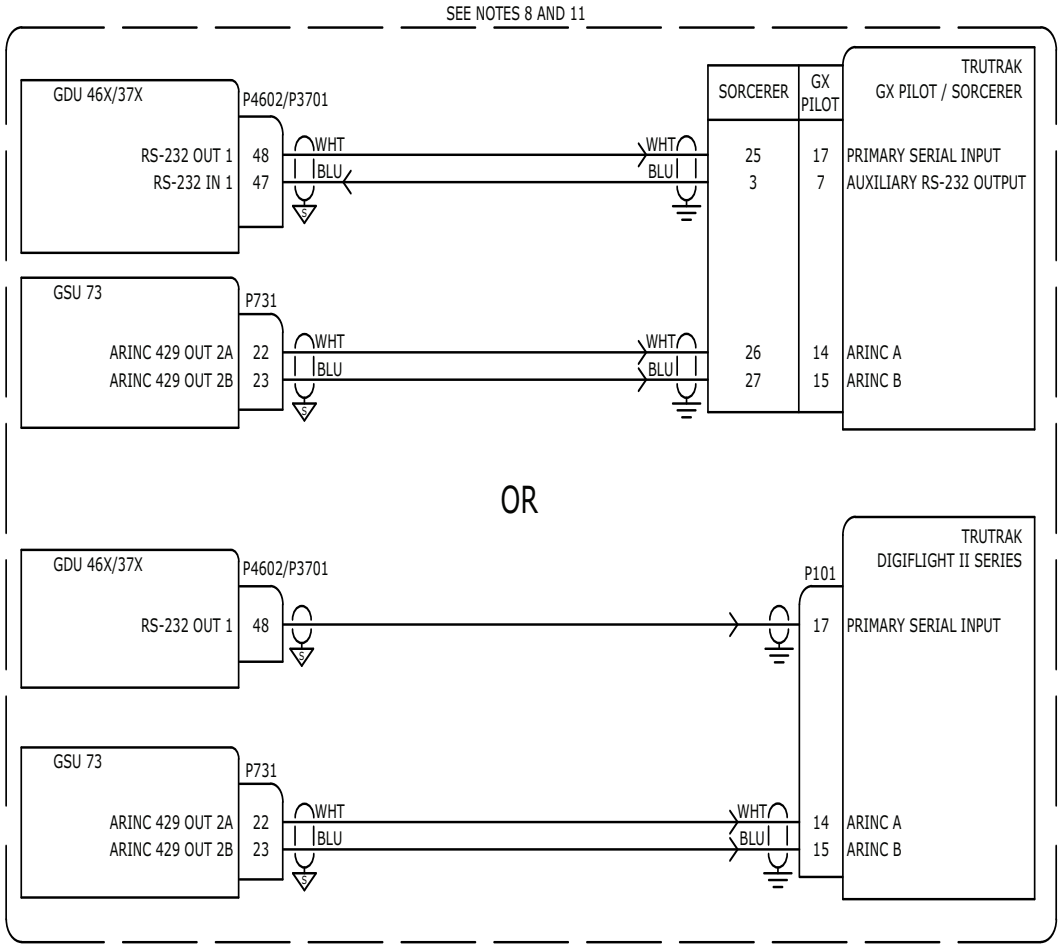
D. ON THE MISCELLANEOUS SETUP PAGE SET CDI SELECT TO "USE"

2. G3X

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET THE CONNECTED GDU 46X/37X (PFD) RS-232 CHANNEL TO "MAPMX"
- SET GSU ARINC 429 TX 1 FORMAT TO "EFIS/AIRDATA" AND "NAV 1"
- SET GSU ARINC 429 RX 1 FORMAT TO "GARMIN GPS" AND "NAV 1"
- SET GSU ARINC 429 RX 2 FORMAT TO "GARMIN VOR/ILS" AND "NAV 1"

Figure G-2.8 GNS 480 Interconnect/Configuration Example w/GSU 73

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 46X/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"
- SET GSU ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

2. TRUTRAK DIGIFLIGHT II SERIES

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "NMEA OUT"
- SET GSU ARINC 429 TX 2 FORMAT TO "AUTOPILOT"

3. TRUTRAK DIGITRAK / PICTORIAL PILOT / ADI OR TRIO AVIONICS EZ PILOT

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "NMEA OUT"

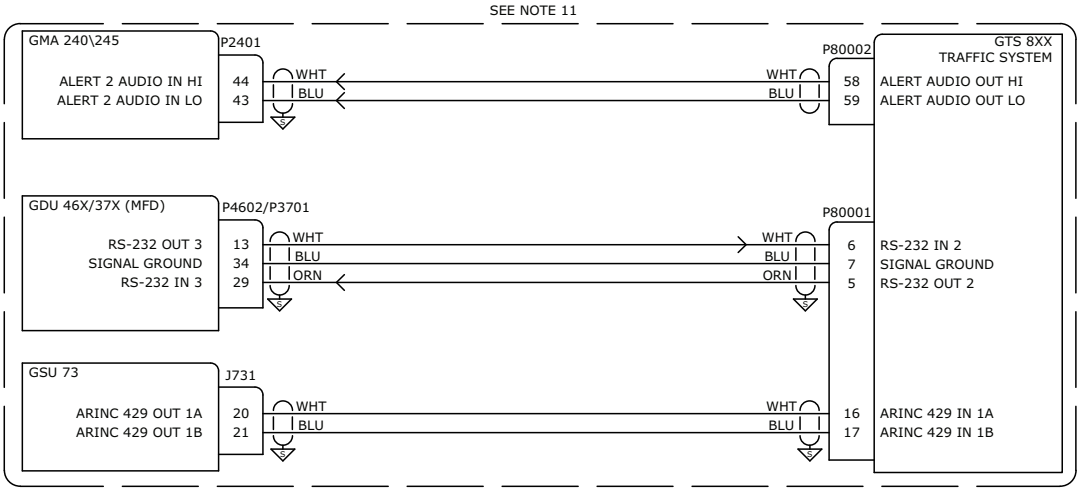
4. TRIO GX PRO / PROPILOT

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE

- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "INTEGRATED AUTOPILOT"

Figure G-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. PLEASE REFERENCE THE APPROPRIATE INSTALLATION DOCUMENTATION FOR THE GTS 8XX UNIT FOR COMPREHENSIVE INSTALLATION AND CONFIGURATION 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 V2.02 TO V3.10 (G3X NOT COMPATIBLE AT THIS TIME PAST V3.10)
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 46X/37X

A. ON THE GDU 46X/37X RS-232 CONFIG MODE PAGE
- SET CONNECTED GDU 46X/37X RS-232 CHANNEL FORMAT TO "GARMIN HSDB"
- SET THE APPROPRIATE GSU 73 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 46X/37X XPDR CONFIG MODE PAGE
- IF A REMOTE TRANSPONDER IS CONFIGURED, SET "TIS TRAFFIC DATA" TO "DISABLED"

C. ON THE GDU 46X/37X SOUND CONFIG MODE PAGE
- SET "TRAFFIC AUDIO" AND "TRAFFIC N/A ALERT" TO "OFF"

Figure G-2.10 G3X w/GSU 73 - GTS 8XX Interconnect/Configuration Example

APPENDIX H GDU™ 37X DISPLAY CONFIGURATION AND POST INSTALLATION CHECKOUT

NOTE

The GDU 37X has been discontinued and is no longer available for purchase.

The checkout procedures in this section are recommended to be performed after installing the G3X™ display. The calibration procedures are required to be performed after installing the G3X. It is assumed 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.

NOTE

Some procedures in this section require the GPS receiver is receiving sufficient satellite signal to compute a present position (Table H-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 the installer read this entire section before beginning the checkout procedure.

NOTE

Make sure that all GDU 37X displays have been updated to the current software version before performing any post-installation configuration, checkout, or calibration steps, and before attempting to troubleshoot any issues. Use up-to-date software to make sure that all previous software improvements are available, and is the most effective first step after powering on the system. See Appendix H.3.1 for information about updating GDU 37X software.

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 make sure the wiring harness does not touch any moving part.

H.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

H.2 Configuration Mode

Some of the software loading, and all of the configuration and calibration procedures in this section 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 or three-display system hold down the left-hand softkey on PFD 1 while powering on the unit.



Figure H-1 GDU 37X Softkeys

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.

H.3 Software Loading Procedure

GDU software loading can be performed in either normal or configuration mode. Appendix H.3.1 describes the GDU software load procedures. Appendix H.3.3 describes the GDL® 39/39R data transceiver software load procedure.

NOTE

Perform software updates on the ground only, and remain on the ground while a software update is in progress (included in LRU software updates - see Appendix H.3.2).

H.3.1 GDU Software Loading Procedure

See the Garmin (G3X SW Page) website for instructions on downloading and installing current software.

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

NOTE

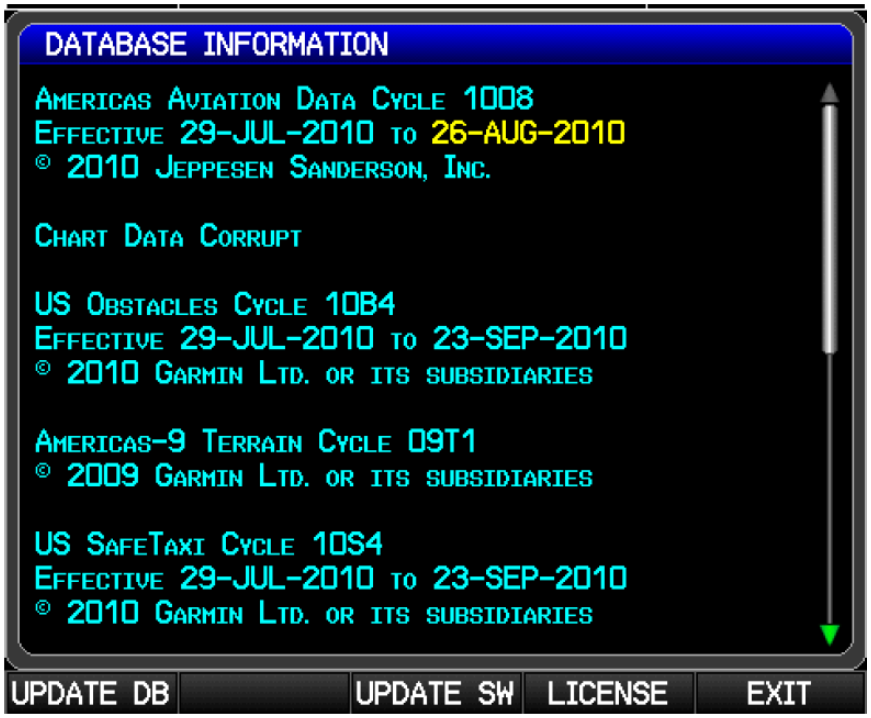
It is also acceptable to insert the SD card before powering on the unit.

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. Make sure 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 engine interface module, 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.

H.3.2 LRU Software Loading Procedure

G3X LRUs (except for GDU displays) connected through the CAN network will automatically receive software updates from the PFD1 display following a GDU software update. Progress of LRU software updates can be monitored using the MAIN configuration page. Functionality provided by an LRU will be unavailable during a software update, therefore all LRU software updates should be allowed to complete before flight after a GDU software update. The current LRU software versions included with a GDU software update can be found in the change notes on the software download page.

Problems loading LRU software updates are typically related to CAN network issues. See Section 2.3.1.3.6 for CAN bus troubleshooting guidance.

H.3.3 GDL 39/GDL 39R Software Update

GDL 39/39R software updates are loaded through the GDU. After the steps in Appendix H.3.1 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 39/39R. 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.



H.4 Configuration Pages

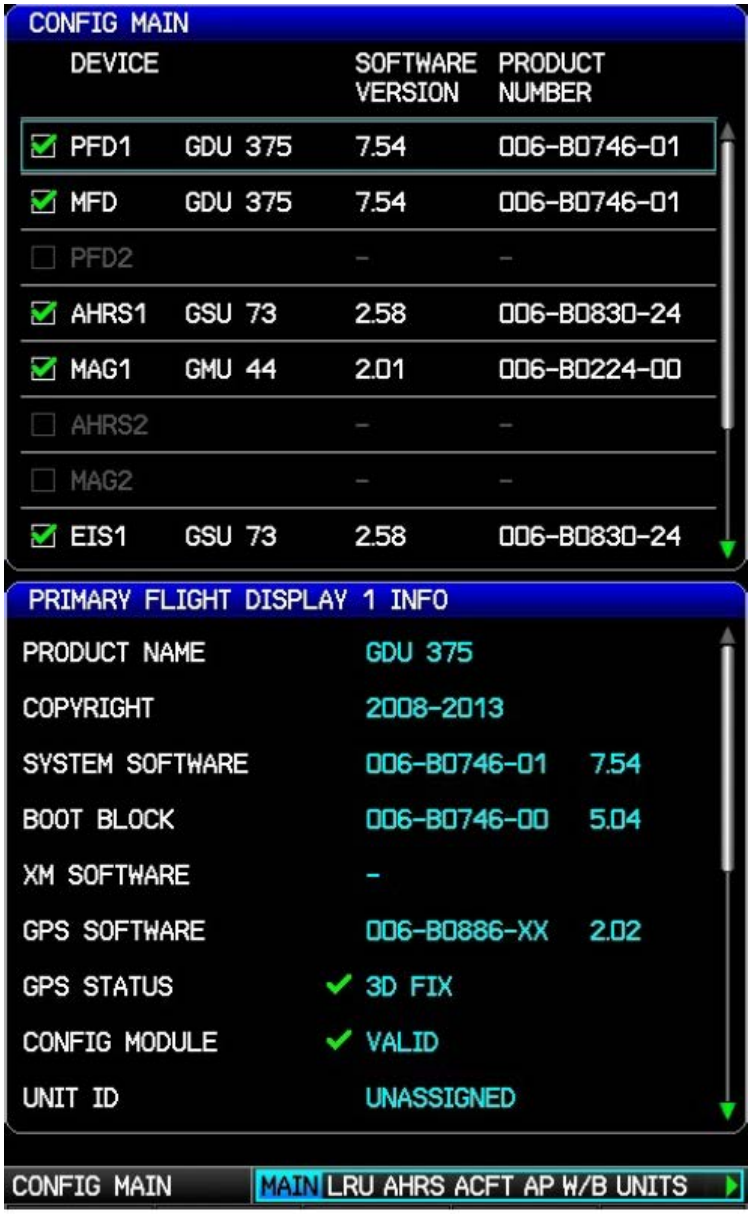
H.4.1 Main Configuration Page

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 (Appendix H.2), 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 Mode Controller LRUs by pressing the ANNUN TEST softkey.



H.4.2 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 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.

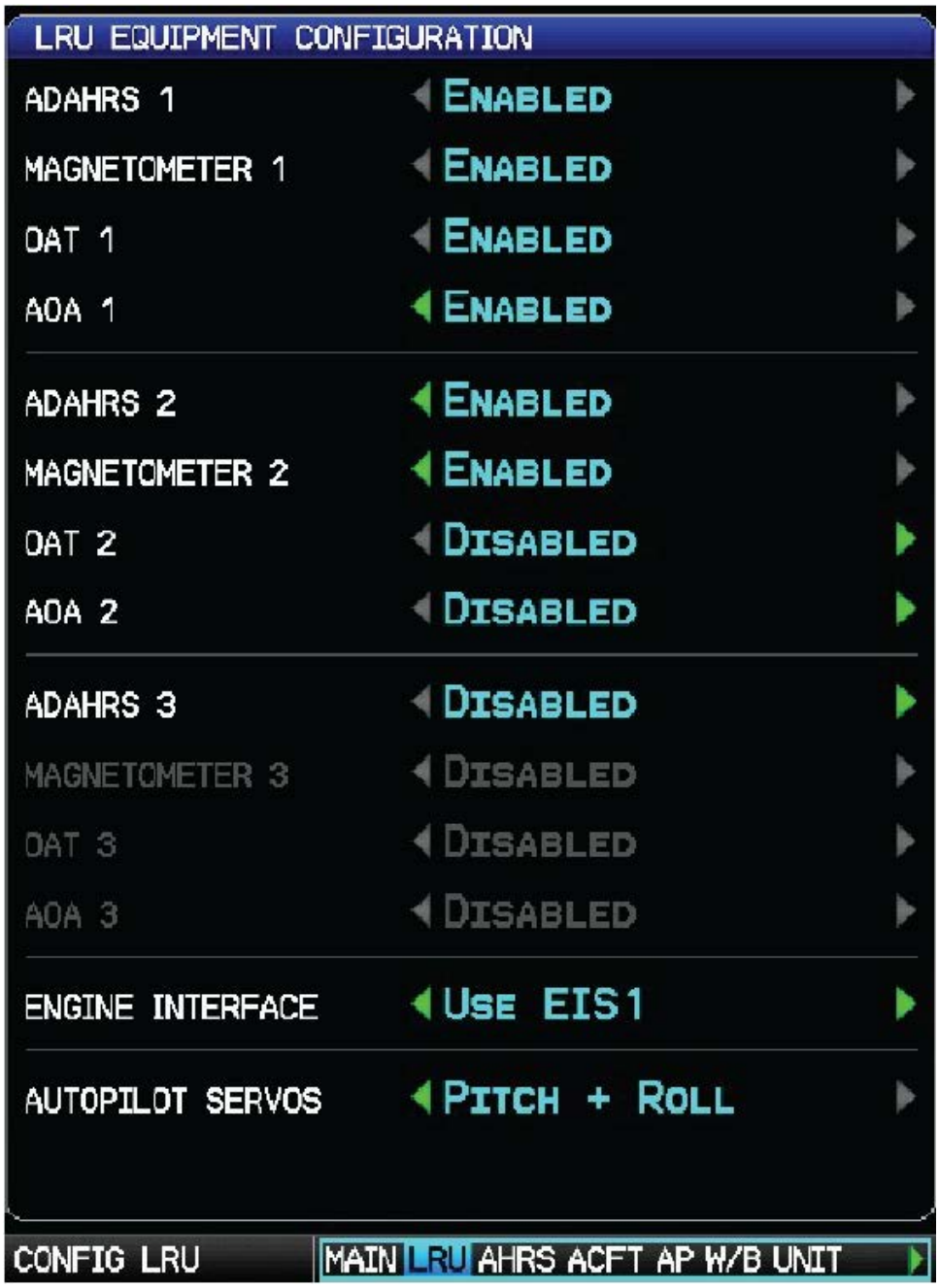
The Engine Interface item is used to configure which numbered EIS LRU should be used. This should be left configured for EIS1 except in the case of a system that includes a GSU 73 and a GEA 24, the latter of which would be wired as EIS2.

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 (Appendix H.2), use the FMS Joystick to select and view the LRU Page.



2. Use the FMS Joystick to enable or disable the listed LRUs.



H.4.3 ADAHRS (Air Data, Attitude, and Heading Reference System) Configuration Page

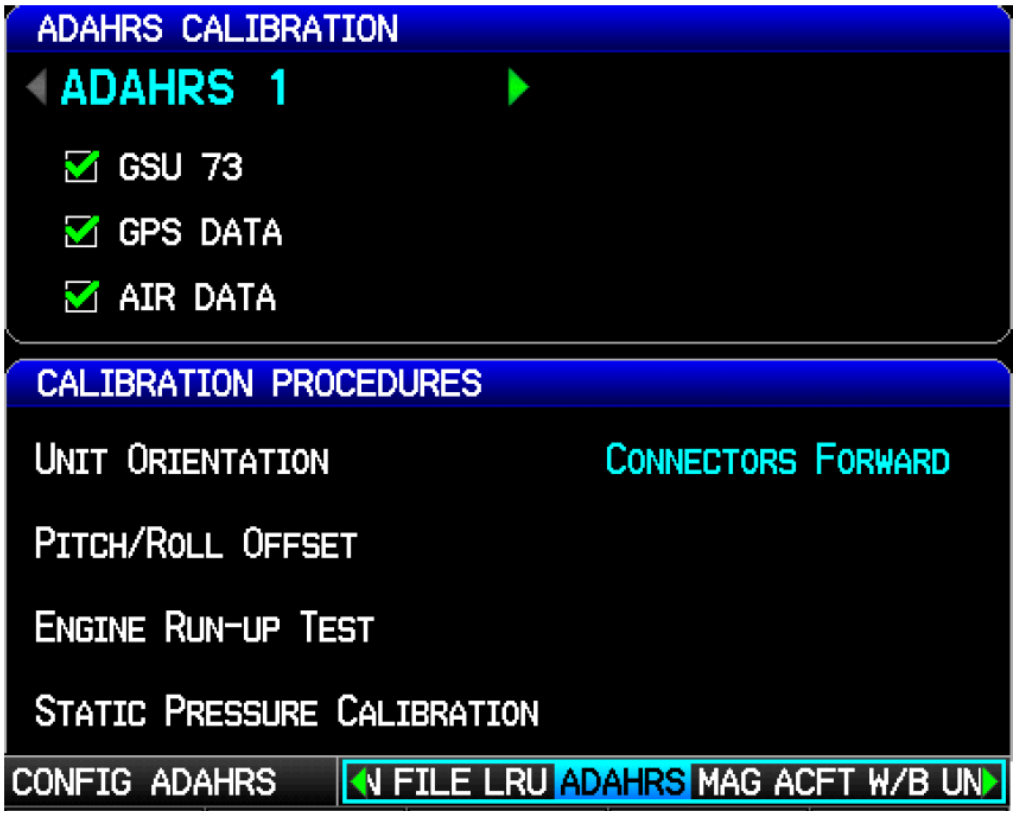
The ADAHRS Configuration Page is used to perform post-installation calibration for both the GSU 25 and/or GSU 73 (as applicable).

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

Air Data, Attitude, and Heading Reference System–The ADAHRS Status, GPS Data, and Air Data 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 ADAHRS (1, 2 or 3) is being configured.

Calibration Procedures–See Appendix H.3 (SW loading procedure) and the following sections (Post Installation Calibration Procedures) for further information regarding the ADAHRS Configuration Page.



After mechanical and electrical installation of the GSU 25/GSU 73 ADAHRS has been completed, before operation, a set of post-installation calibration procedures must be carried out on the ADAHRS Calibration page.

The calibration procedures (Appendix H.4.3.1 – Appendix H.4.3.4) require that certain status boxes on the ADAHRS page (configuration mode) indicate a positive state (green check marks) before starting the procedure. Table H-2 and Table H-3 list the status box requirements for each calibration procedure.

Table H-1 describes the calibration procedures accessed from the ADAHRS Calibration Page.

Table H-1 Post Install Calibration Procedure Summary for ADAHRS Calibration Page

Procedure Name	Procedure Description	Installations Requiring Procedure
Unit Orientation	Configure ADAHRS installation orientation	Required for all installations
Pitch/Roll Offset Compensation	Level aircraft	Required for all installations
Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Required for all installations
ADAHRS Static Pressure Calibration	Altitude re-calibration	Only used when an ADAHRS has failed a periodic altimeter test

For each Calibration Procedure, Table H-2 lists the LRUs that require valid calibration data.

Table H-2 Data Validity Requirements for ADAHRS Calibration Procedures

ADAHRS Calibration Procedure	Valid Status Required for GSU 25 Calibrations	Valid Status Required for GSU 73 Calibrations
ADAHRS Mounting Orientation Identification	None	None
Pitch/Roll Offset	None	GPS and Air Data
Engine Run-Up	None	GPS or Air Data
ADAHRS Static Pressure Calibration	None	None

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

Table H-3 Configuration Mode ADAHRS Page Status Boxes

Status Box	Valid Status
ADAHRS	ADAHRS LRU status valid
GPS Data	3D or 3D Differential GPS solution available
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid.

The ADAHRS Configuration Page status boxes referred to in Table H-2 and Table H-3 are shown in the following figure.



H.4.3.1 ADAHRS UNIT ORIENTATION

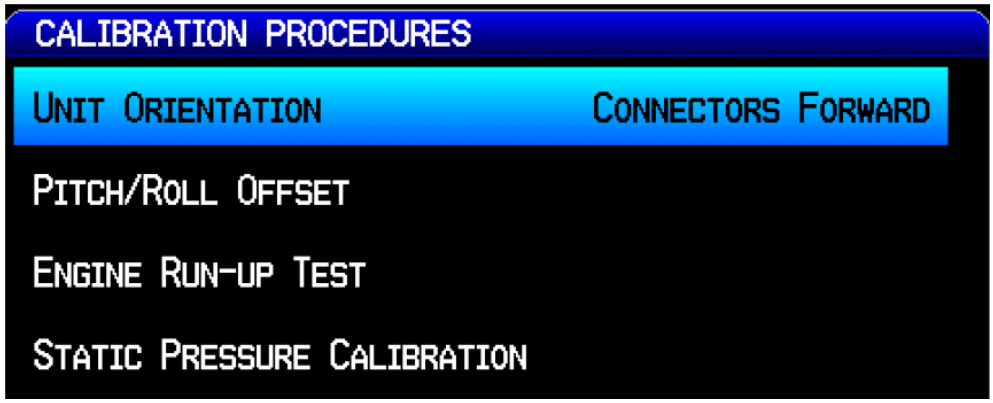
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display.
2. Use the FMS Joystick to select the ADAHRS Page.



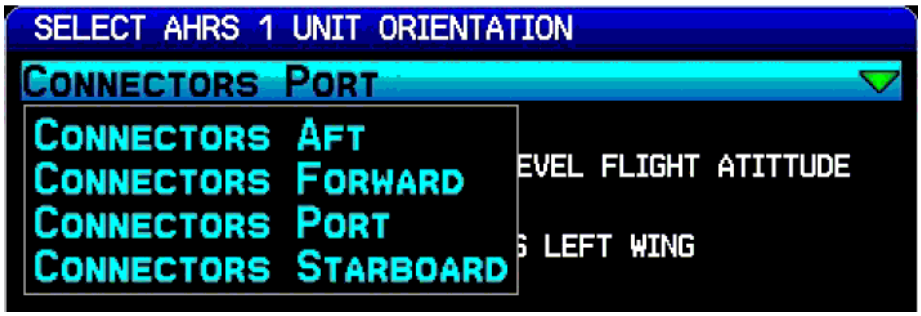
3. Use the FMS Joystick to select which ADAHRS (1, 2, or 3) is being configured.



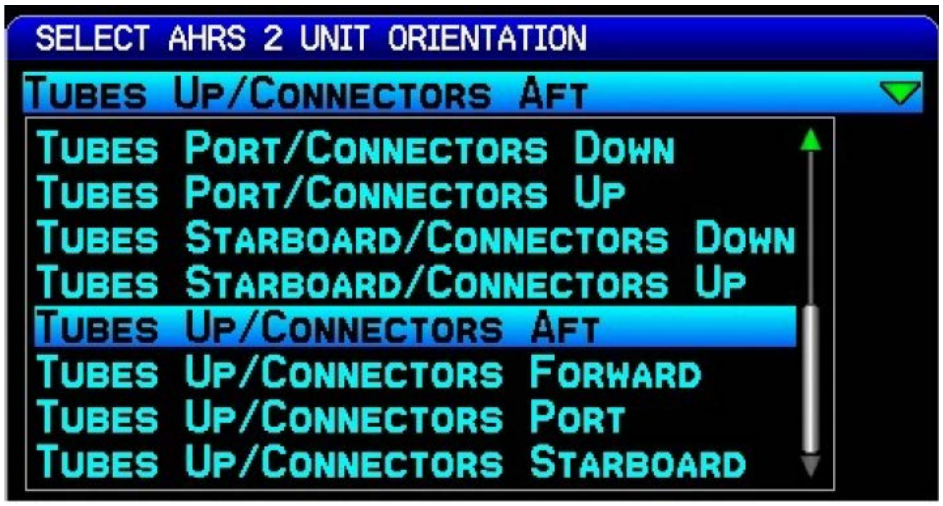
4. Use the FMS Joystick to select Unit Orientation and press the ENT key.



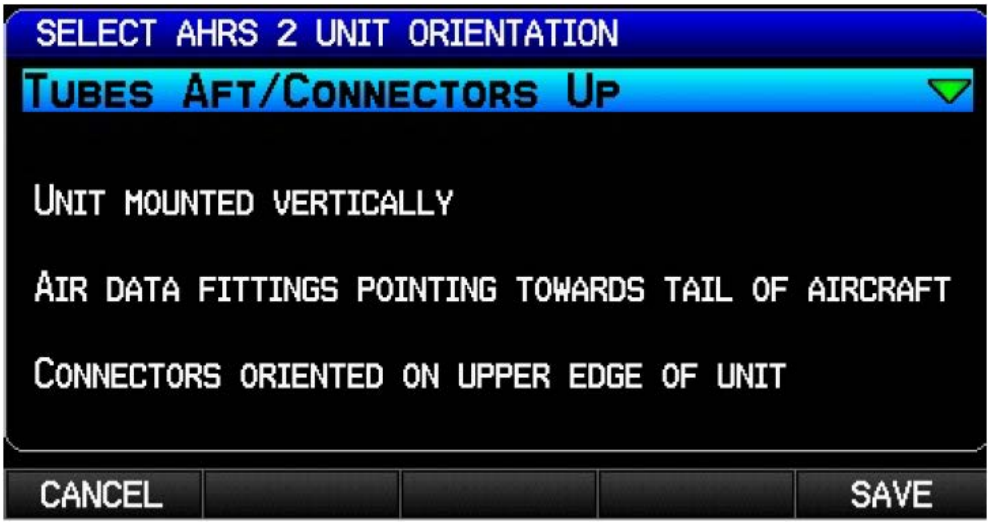
5. For a GSU 73, refer to Figure F-8 to find the correct LRU orientation. Select the correct orientation from the pull-down list, then press the ENT key. For a GSU 25, proceed to the next step (6).



6. For a GSU 25, refer to Figure 18-6 pages 1-3 to find the correct LRU orientation, then select that orientation from the pull-down list.



7. Read the description of the selected orientation to make sure the proper orientation has been selected, then press the Save softkey to store the orientation.



H.4.3.2 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 before calibration.

NOTE

The GSU 73 must be installed to be level 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 installed to be level 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).

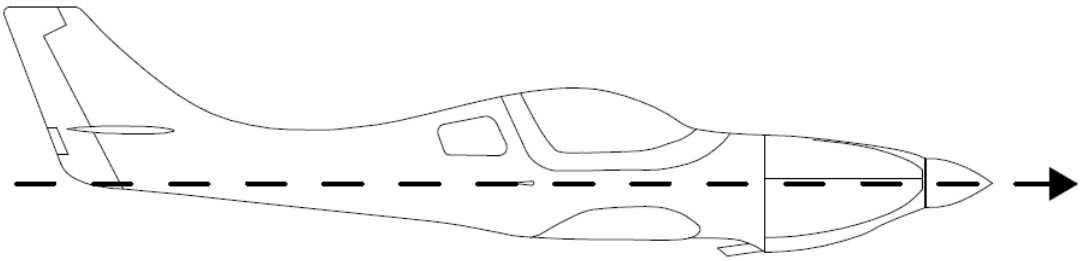
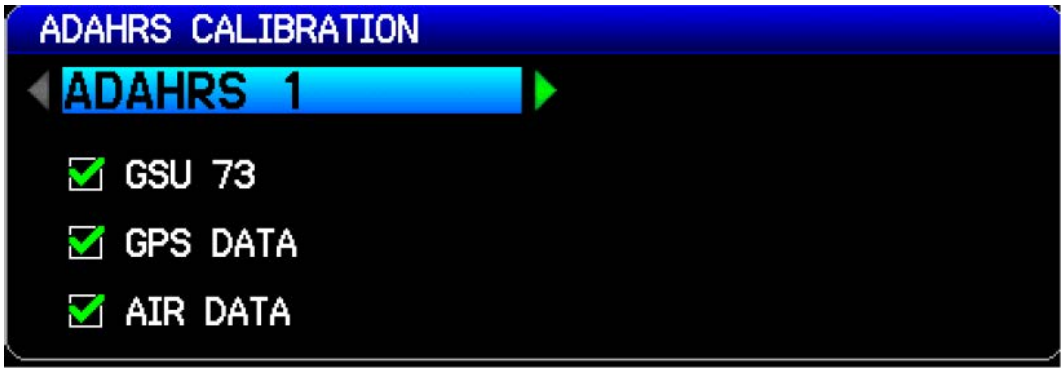


Figure H-2 In-Flight Level Cruise Attitude

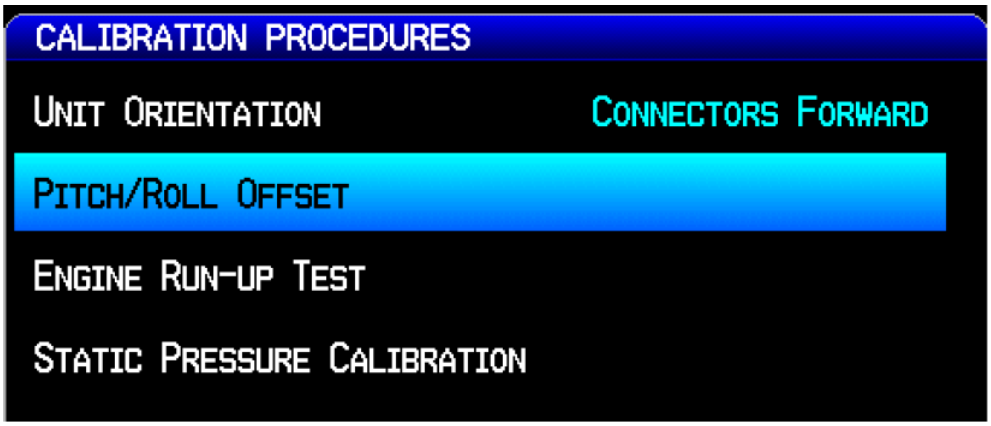
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the ADAHRS Page (if needed).



3. Make sure that all the required status boxes are checked (Table H-2 and Table H-3). Use the FMS Joystick to select which ADAHRS (1, 2 or 3) is being configured.



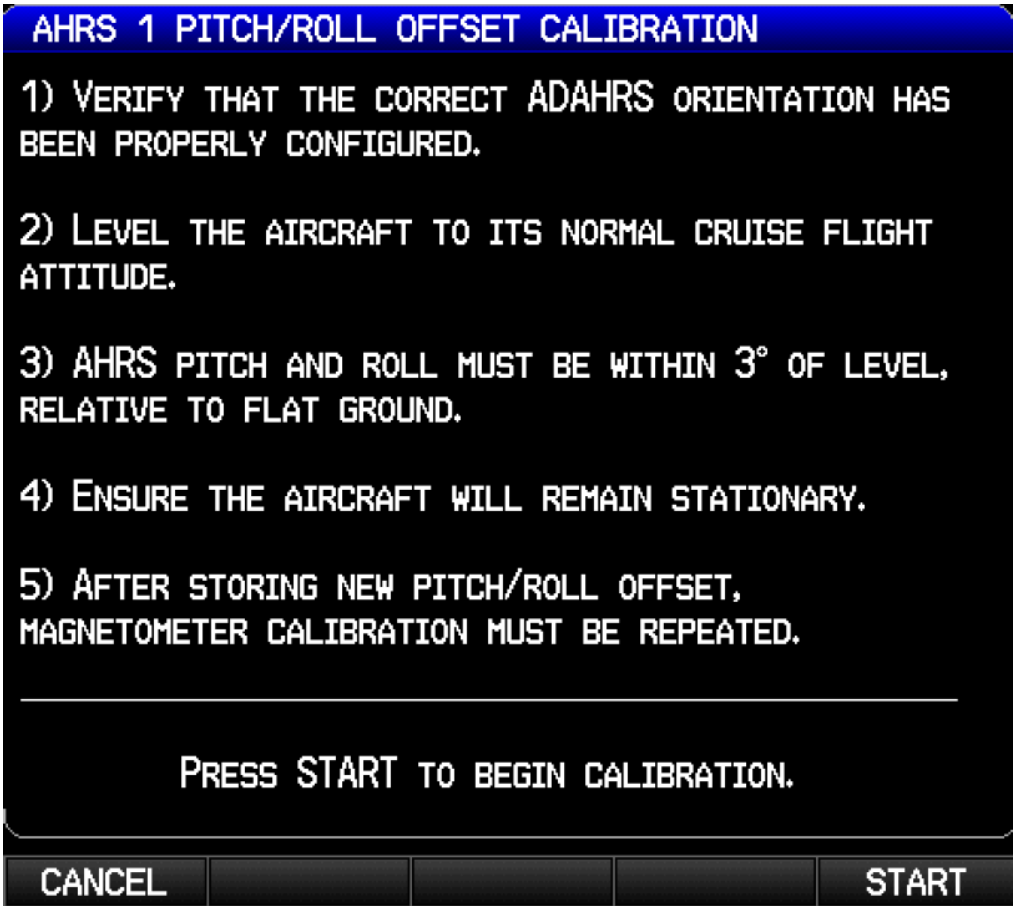
4. Use the FMS Joystick to select PITCH/ROLL OFFSET, press the ENT key.



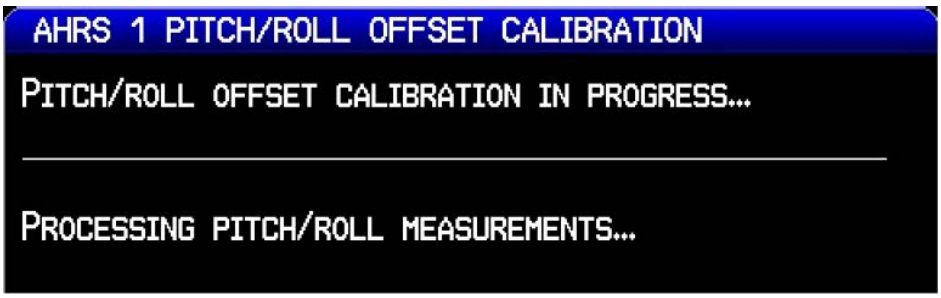
5. Make sure that aircraft and ADAHRS comply with all on-screen instructions, press the START softkey.

NOTE

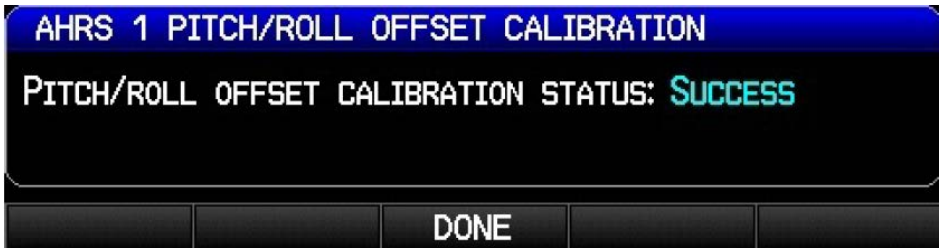
Per the following figure, GSU 73 units must have the ADAHRS pitch and roll within 3 degrees of level, GSU 25 units must have the ADAHRS pitch and roll within 30 degrees of level.



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 ADAHRS Configuration screen.



The Magnetometer Calibration (Appendix H.4.4.3) 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 an additional ADAHRS is installed in the aircraft, or the mounting location of an existing ADAHRS is changed, the pitch/roll offset compensation procedure must be performed again for all installed ADAHRS units before moving the aircraft. This applies equally to all ADAHRS units, including the GSU 25, GSU 73, and G5 backup display.

H.4.3.3 Engine Run-Up Vibration Test

NOTE

The Engine Run-Up Vibration test is required for all installations to validate the vibration characteristics of the installation. ADAHRS Unit Orientation (Appendix H.4.3.1) and Pitch/Roll Offset Compensation (Appendix H.4.3.2) are required before this procedure.

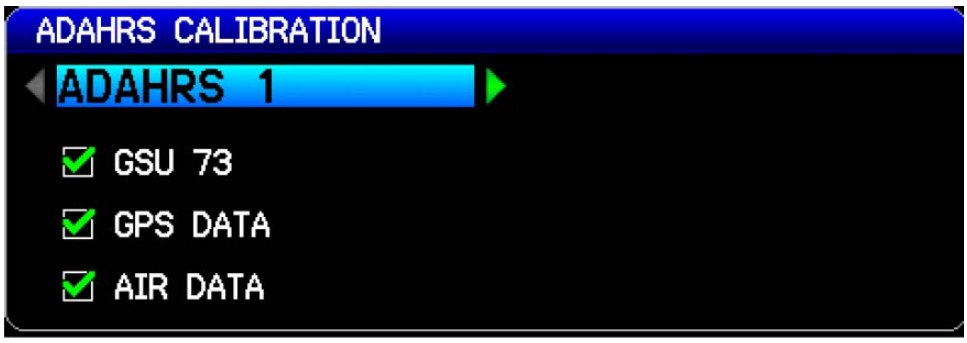
NOTE

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.

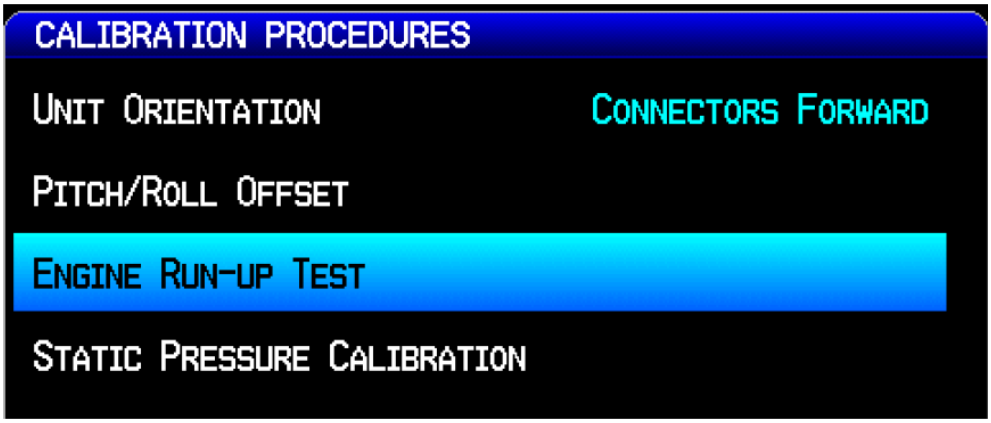
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the ADAHRS Page (if needed).



3. Make sure that all the required status boxes are checked (Table H-2 and Table H-3). Use the FMS Joystick to select which ADAHRS (1, 2 or 3) is being configured.



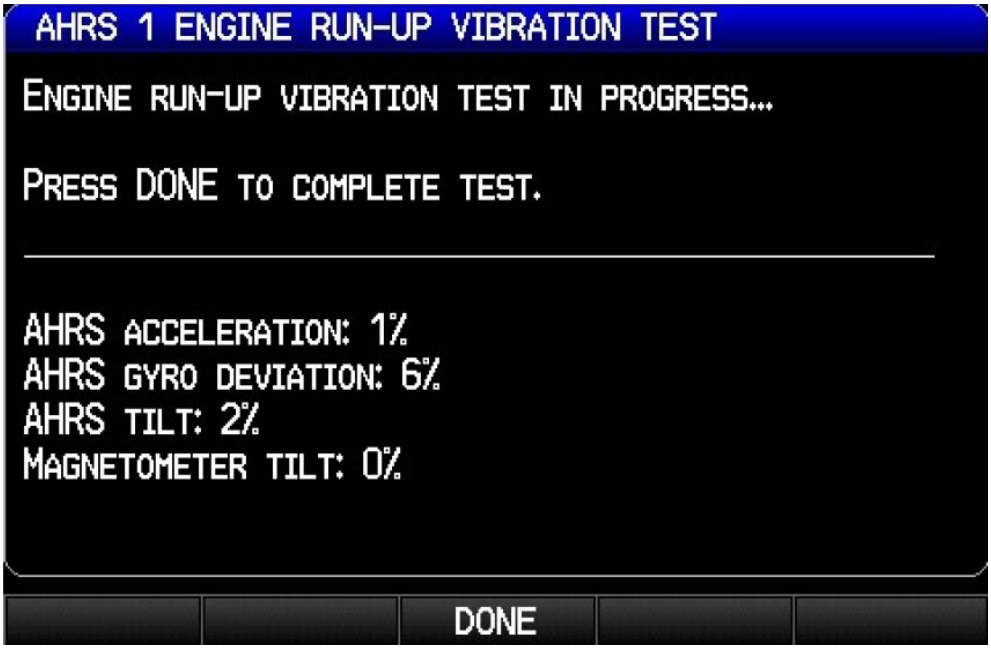
4. Use the FMS Joystick to select ENGINE RUN-UP TEST and press the ENT key.



5. Make sure the aircraft has been properly positioned per the on-screen instructions, then press the Start softkey to begin the test.



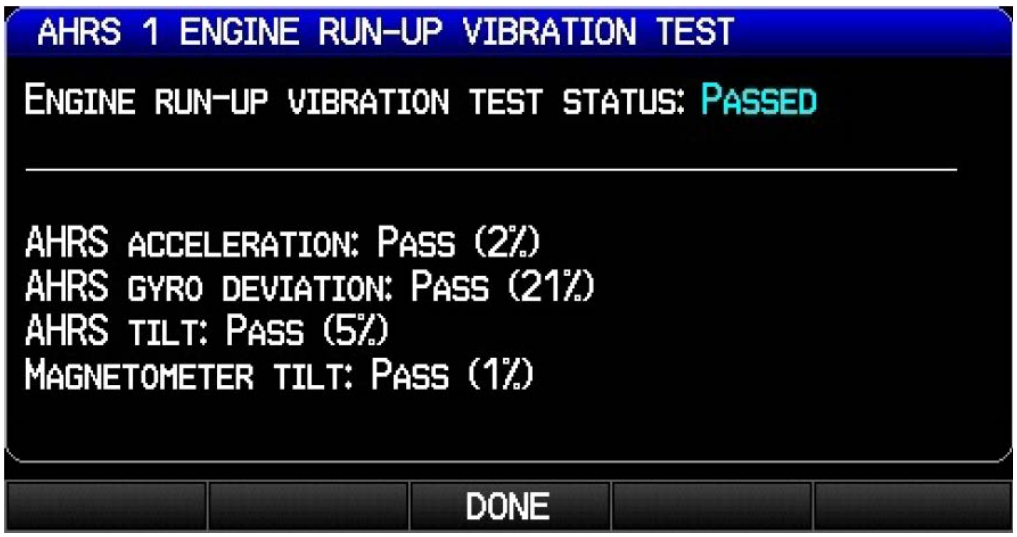
6. Gradually increase power from idle to full throttle and back to idle over the course of 1-2 minutes, the test data is displayed as the test progresses.



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. Make sure that test results indicate Passed, then press the Done softkey to return to the ADAHRS 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 magnetometer mechanical mounting with respect to airframe (see Section 15, Section 18, and Appendix F, and for applicable mounting requirements and instructions).

b) Vibration or motion of GSU 25/GSU 73 and/or GMU magnetometer caused by neighboring equipment and/or supports.

c) Mounting of GSU 25/GSU 73 at a location that is subject to severe vibrations (for example, close to an engine mount).

d) Mounting screws and other hardware for GSU 25/GSU 73 and/or GMU magnetometer 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 magnetometer not firmly secured to supporting structure.

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

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 the test would pass in calm conditions; an actual pass is required before the installation can be considered adequate.

H.4.3.4 ADAHRS Static Pressure Calibration

The ADAHRS Calibration page (configuration mode) has a selection for ADAHRS Static Pressure Calibration. This procedure is used to perform an altimeter re-calibration. The altitude pressure sensor used in any G3X ADAHRS unit is very low drift and does not typically require re-calibration.

NOTE

This calibration is only used when an ADAHRS fails a periodic altimeter test and should only rarely, if ever, be used.

The static pressure calibration requires the use of a pressure control system (test set) with an altitude accuracy of at least +/- 5 ft at sea level and +/- 20 ft at 30,000 ft. It is necessary to re-calibrate to sea level (0 ft), 10,000 ft, 20,000 ft, and optionally to 30,000 ft. The operator is allowed to finish the calibration at the end of the 20,000 ft calibration if the 30,000 ft calibration is not desired.

CAUTION

To avoid damaging the ADAHRS pressure sensors, the pitot, AOA (for GSU 25), and static ports must be connected to the test set.

It is acceptable to connect multiple pneumatic ports together. The AOA port should typically be connected to the static port so it is always exposed to the same pressure as the static port during the test.

CAUTION

Leaving the AOA port disconnected and exposed to ambient pressure during the static pressure re-calibration will damage the AOA sensor.

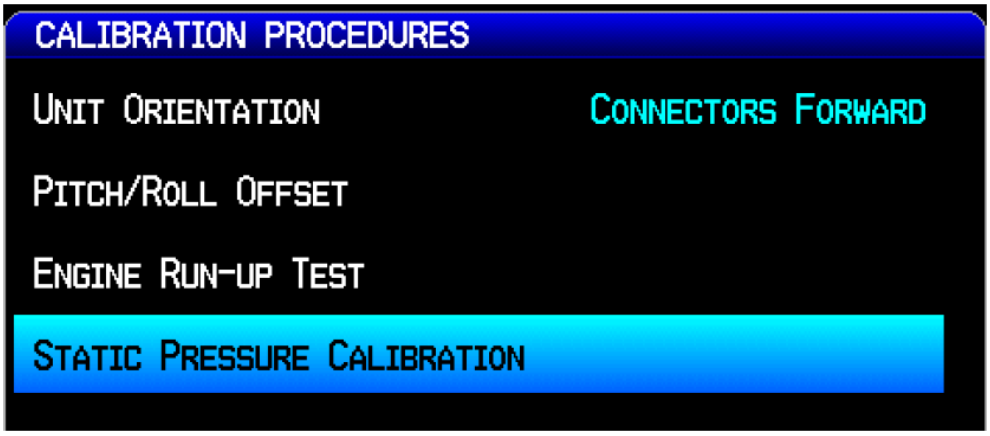
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the ADAHRS Page (if needed).



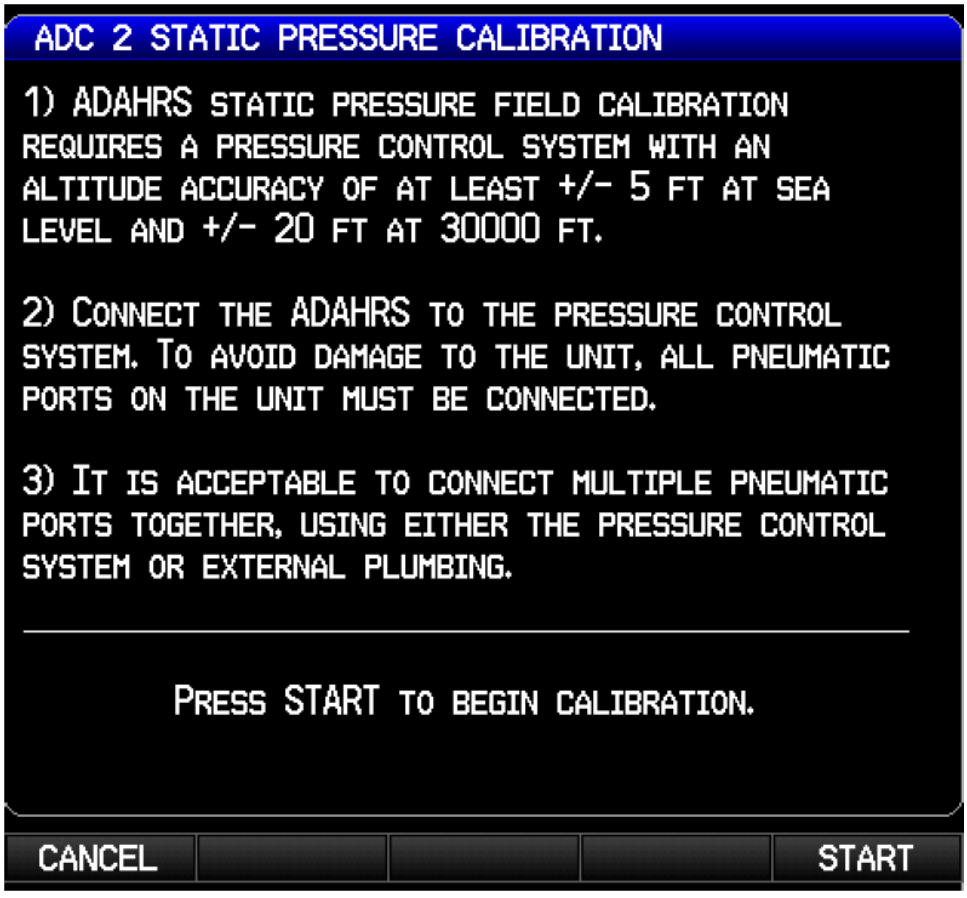
3. Use the FMS Joystick to select which ADAHRS (1, 2, or 3) is being configured.



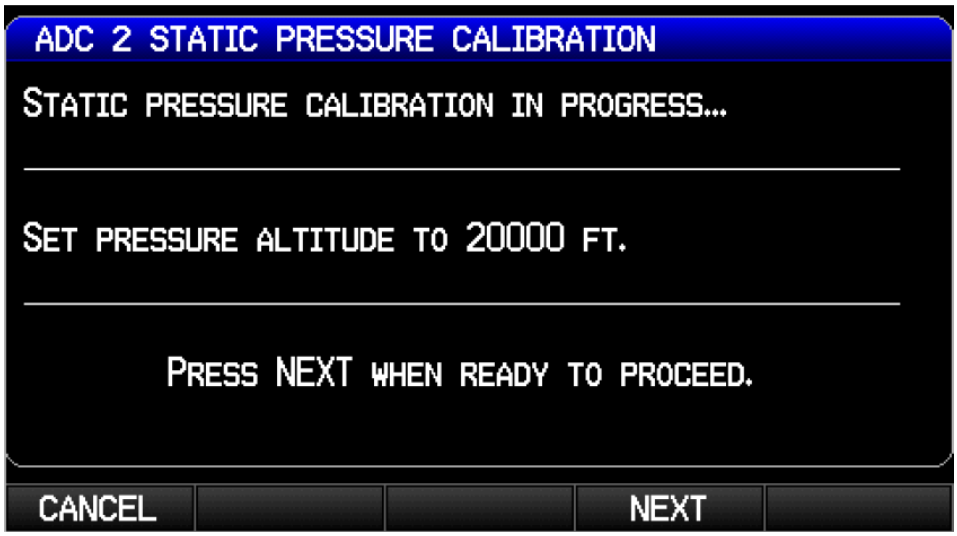
4. Use the FMS Joystick to select Static Pressure Calibration and press the ENT key.



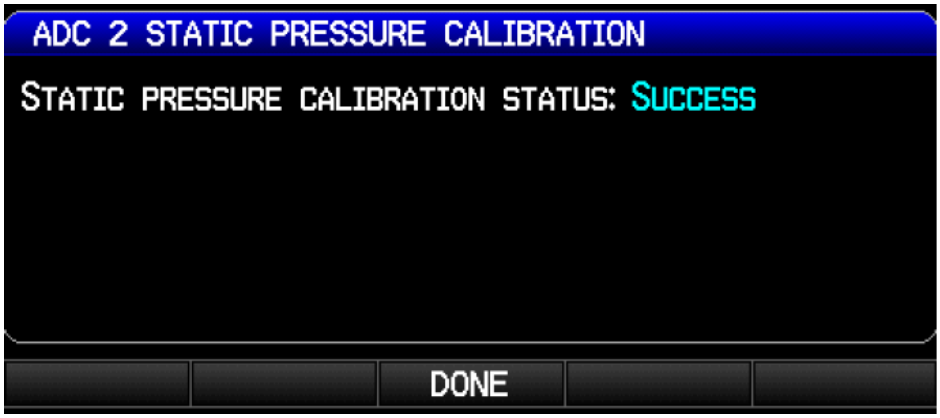
5. Make sure that all on-screen instructions have been complied with, then press the Start button to begin the calibration. Actual displayed image will be similar to following figure.



6. At each calibration point (0, 10K, 20K, and optionally 30K ft), the display will present a screen that allows time to establish the calibration pressure before continuing. For example, the following screen is presented when it is time to establish the static pressure equal to 20K ft. Press NEXT to continue and calibrate this pressure.



7. During the calibration at each pressure, the pressure must be held constant for 30 seconds for the calibration step to be successful. The calibration may be cancelled at any point should the test setup require adjustment before repeating.
8. When the static pressure calibration is complete, a status screen will show the procedure was successful.



H.4.4 MAG (Magnetometer) Configuration Page

After mechanical and electrical installation of the GMU magnetometer have been completed, before operation, a set of post-installation calibration procedures must be carried out on the MAG Calibration page.

The calibration procedures (Appendix H.4.4.1 – Appendix H.4.4.3) require that certain status boxes on the MAG page (configuration mode) indicate a positive state (green check marks) before starting the procedure. Table H-5 and Table H-6 list the status box requirements for each calibration procedure.

Table H-4 describes the calibration procedures accessed from the Magnetometer Calibration Page.

Table H-4 Post Install Cal Procedure Summary for Magnetometer Calibration Page

Procedure Name	Procedure Description	Installations Requiring Procedure
Unit Orientation	Configure magnetometer installation orientation	Required for all GMU 11 installations
Magnetic Interference Test	Validate no magnetic interference with GMU magnetometer	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 magnetometer. Such changes include, but are not limited to, wiring, shielding or grounding changes to any light, strobe, beacon or other electrical device located near or in the same wing as the GMU magnetometer. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU magnetometer. Such changes include, but are not limited to, addition, removal or modification of ferrous or electrically conductive materials located near or in the same wing as the GMU magnetometer unit. Garmin recommends this test be performed at least once every 12 months.
Magnetometer Calibration	Compass Rose Taxi Maneuver	Required for all installations. This calibration must be performed after every Pitch/Roll Offset Compensation and following a removal or replacement of the GMU unit, or degaussing of the area near the GMU location.

For each Calibration Procedure, Table H-5 lists the LRUs that require valid calibration data.

Table H-5 Data Validity Requirements for MAG Calibration Procedures

MAG Calibration Procedure	Valid Status Required for GSU 25 and GMU Calibration	Valid Status Required for GSU 73 and GMU Calibration
GMU 11 Mounting Orientation Identification (if applicable)	None	None (GMU 11 is not supported by GSU 73)
Magnetometer Interference Test	None	GPS or Air Data
Magnetometer Calibration	GPS	Air Data and GPS

Table H-6 lists the type of valid calibration data required to be output by each LRU for the Calibration Procedures listed in Table H-5.

Table H-6 Configuration Mode MAG Page Status Boxes

Status Box	Valid Status
Magnetometer	Magnetometer LRU status valid
GPS Data	3D or 3D Differential GPS solution available
Air Data	True Airspeed (TAS) available. NOTE: A valid outside air temperature (OAT) measurement is required for TAS to be valid.
Attitude (if applicable)	Magnetometer is receiving valid attitude data from ADAHRS

The Magnetometer Configuration Page status boxes referred to in Table H-5 and Table H-6 are shown in the following figure.



If removal and replacement of a GMU magnetometer is required after post-installation calibration has been completed, the GMU mounting rack must not be moved. If the mounting screws that secure the GMU 11 or GMU 22 mounting rack are loosened for any reason, post-installation calibration procedures GMU 11 Unit Orientation (Appendix H.4.3.1, if applicable), Magnetometer Interference Test (Appendix H.4.4.2), and Magnetometer Calibration (Appendix H.4.4.3) must be repeated before the aircraft can be returned to service.

Any GMU magnetometer removal or replacement requires repeating the Magnetometer Calibration (Appendix H.4.4.3).

A repeat of the Pitch/Roll Offset Compensation (Appendix H.4.3.2) requires a repeat of the Magnetometer Calibration (Appendix H.4.4.3).

The addition, removal, or modification of components that are ferrous, or otherwise magnetic, within 10.0 feet of the GMU magnetometer location after the Magnetometer Interference Test (Appendix H.4.4.2) or Magnetometer Calibration Procedure (Appendix H.4.4.3) were completed requires a repeat of both procedures.

Furthermore, electrical changes to the installation that affect components within 10.0 feet of the GMU magnetometer after the Magnetometer Calibration (Appendix H.4.4.3) and Magnetometer Interference Test (Appendix H.4.4.2) were completed will require a repeat of the Magnetometer Interference Test (Appendix H.4.4.2). If new magnetic interference is detected, it must be resolved, then the Magnetometer Calibration (Appendix H.4.4.3) must be repeated. Wiring or grounding changes associated with a device located in the vicinity of the GMU magnetometer is a good example of such a change.

H.4.4.1 Unit Orientation (GMU 11 Only)

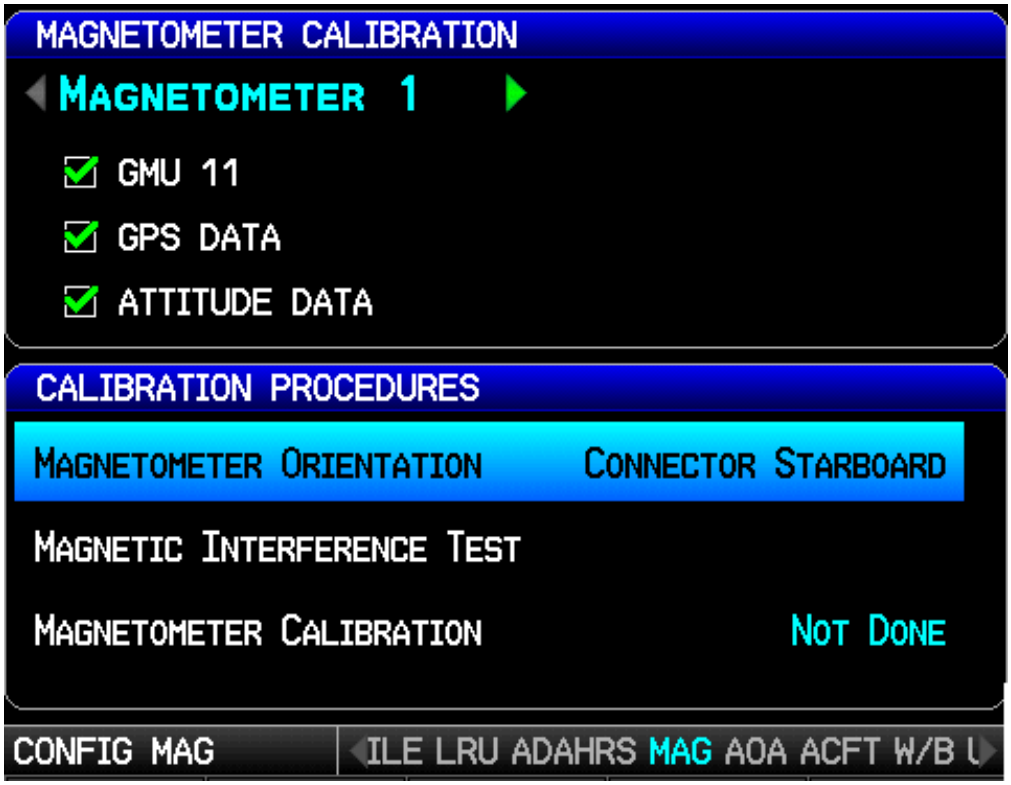
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the MAG Page (if needed).



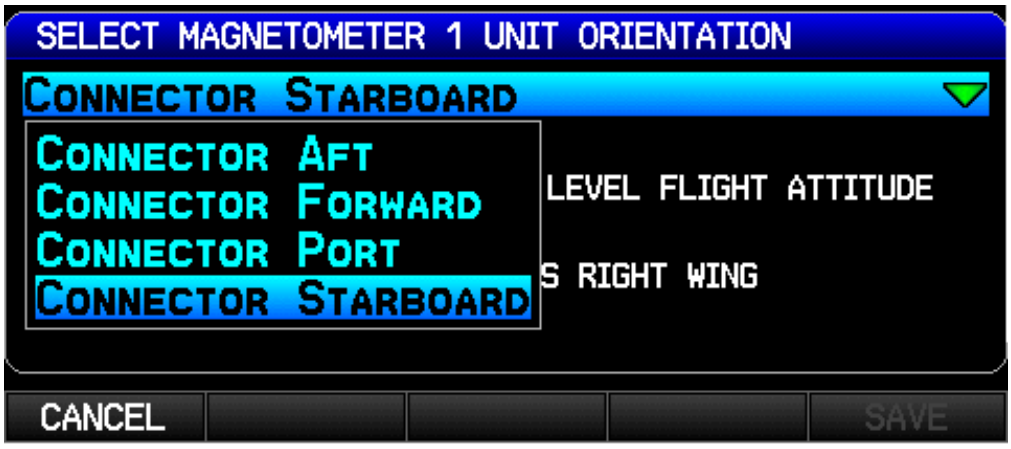
3. Use the FMS Joystick to select the Magnetometer designated for the GMU 11 and press the ENT key.



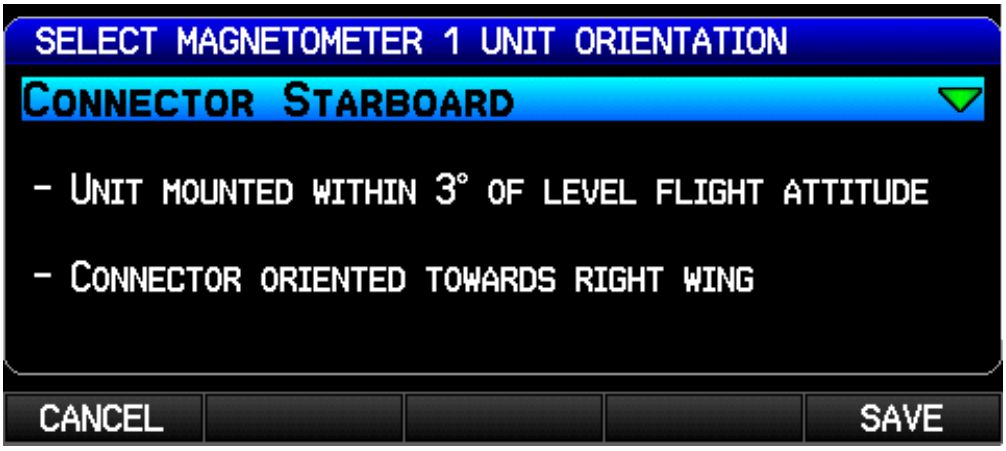
4. Use the FMS Joystick to select Magnetometer Orientation and press the ENT key.



5. Use the FMS Joystick to select the correct orientation of the mounted GMU 11 and press the ENT key.



6. Make sure the orientation of the GMU 11 complies with the displayed conditions, then press SAVE to store and complete the Magnetometer Orientation procedure.



H.4.4.2 Magnetometer Interference Test

NOTE

The Magnetometer Inteference Test 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 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 unit. Likewise, this test should also be repeated to verify all subsequent changes to materials within 10.0 feet of the GMU. 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 unit. This procedure validates that no electronic device is interfering with the operation of the GMU magnetometer which directly impacts the determination of attitude and heading by the GSU 25/GSU 73 ADAHRS.

CAUTION

The real time display 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.

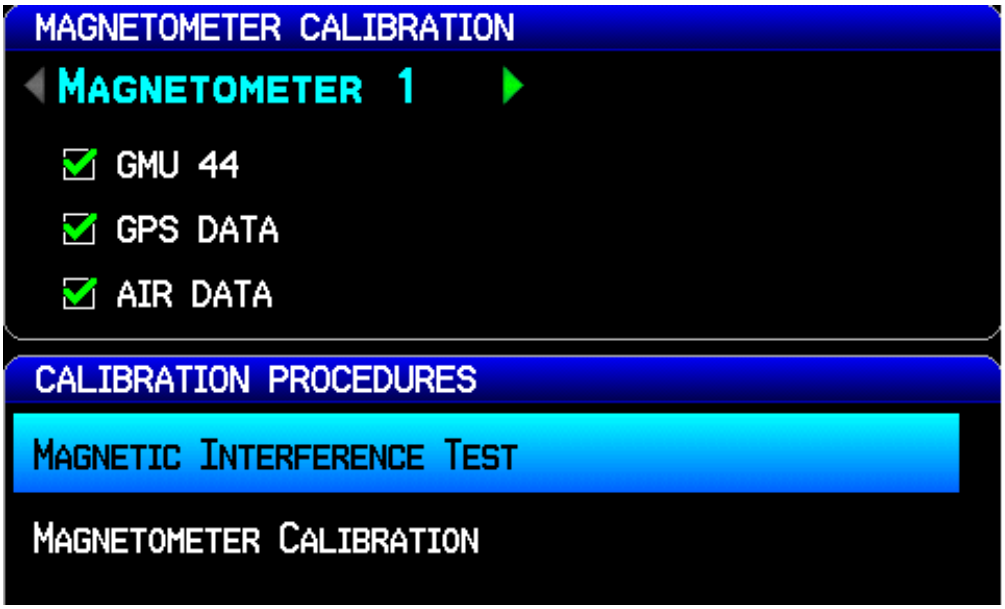
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the MAG Page (if needed).



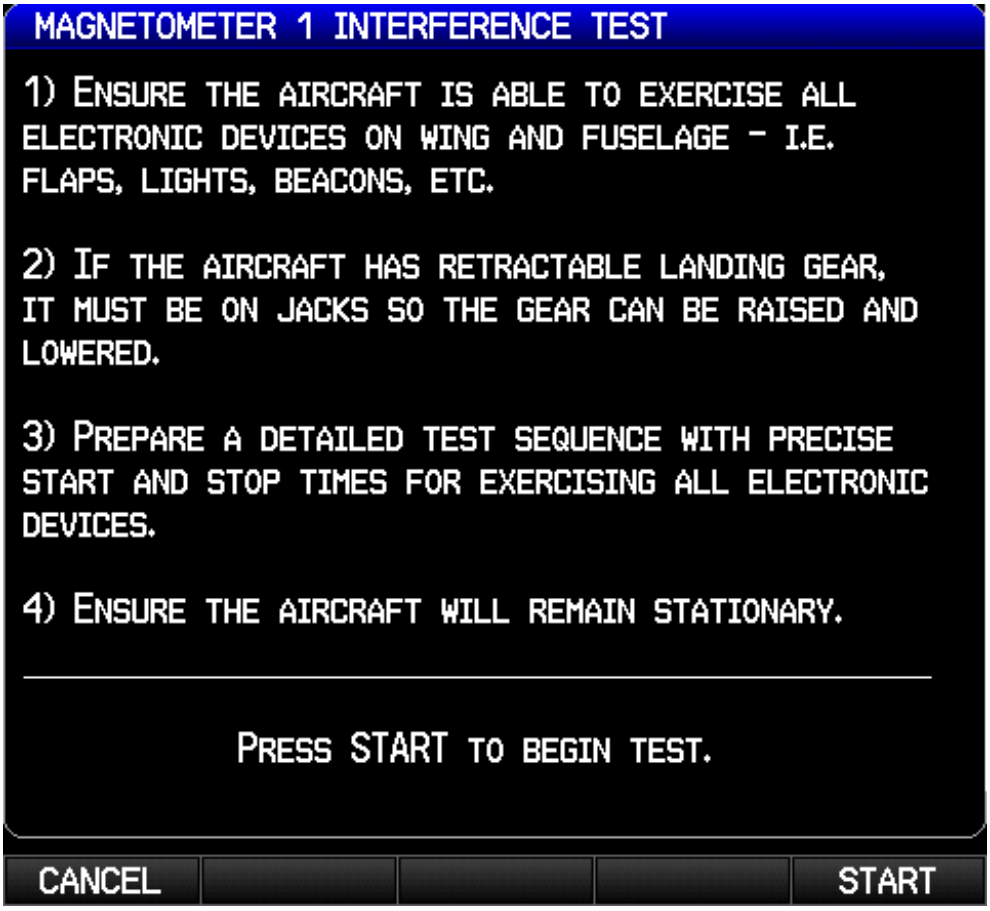
3. Make sure that all the required status boxes are checked (Table H-5 and Table H-6). Use the FMS Joystick to select which Magnetometer (1, 2 or 3) is being configured.



4. Use the FMS Joystick to select Magnetic Interference Test and press the ENT key.



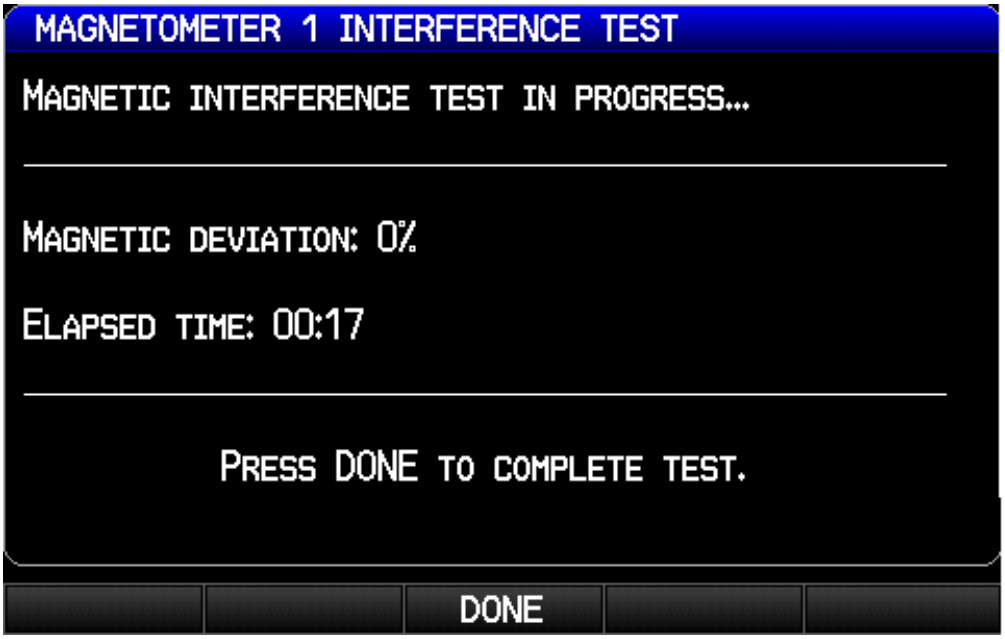
5. Make sure the aircraft has been properly prepared per the on-screen instructions. See Table H-7 for a sample test sequence. Press the Start softkey to begin the test.



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. Make sure 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 MAG Page.

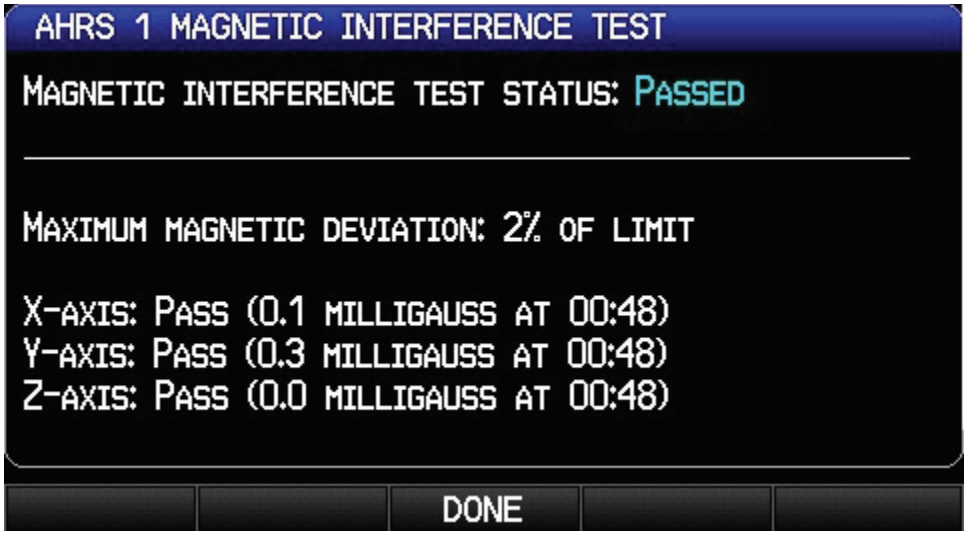


Table H-7 Magnetometer Interference Test Sequence Example

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

H.4.4.3 Magnetometer Calibration

NOTE

The ADAHRS Unit Orientation (Appendix H.4.3.1), the Pitch/Roll Offset Compensation (Appendix H.4.3.2), and the GMU 11 Unit Orientation (Appendix H.4.4.1, if applicable) must be successfully completed before performing the Magnetometer Calibration.

NOTE

The Magnetometer Calibration 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 ADAHRS cannot be guaranteed if this calibration is not performed at a magnetically clean location.

Taxi the aircraft to a site that has been determined to be free of magnetic disturbances. Make sure 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 make sure 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 H-3.

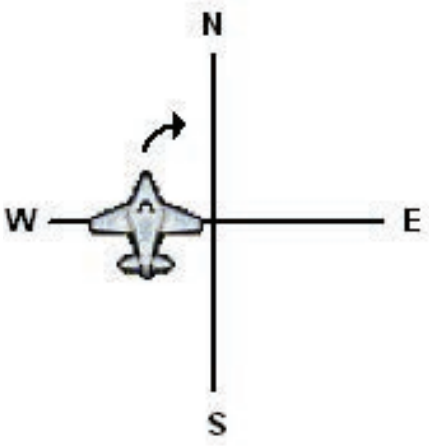


Figure H-3 Aircraft Alignment

With the aircraft stationary, initiate the GMU magnetometer calibration procedure as follows:

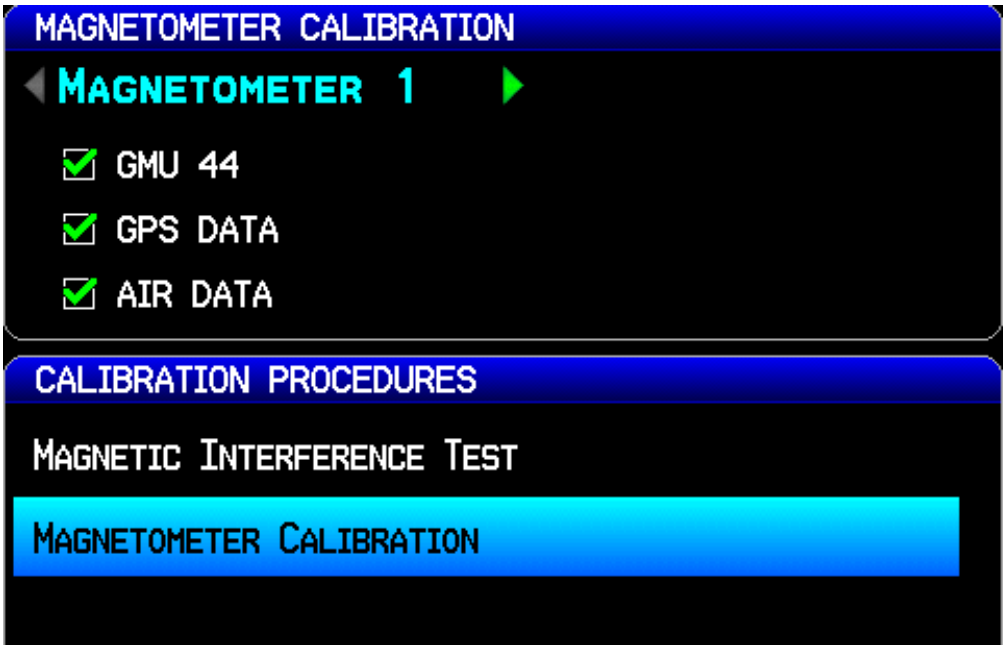
1. Enter configuration mode by holding down the left-hand softkey while powering on the PFD 1 display (if needed).
2. Use the FMS Joystick to select the MAG Page (if needed).



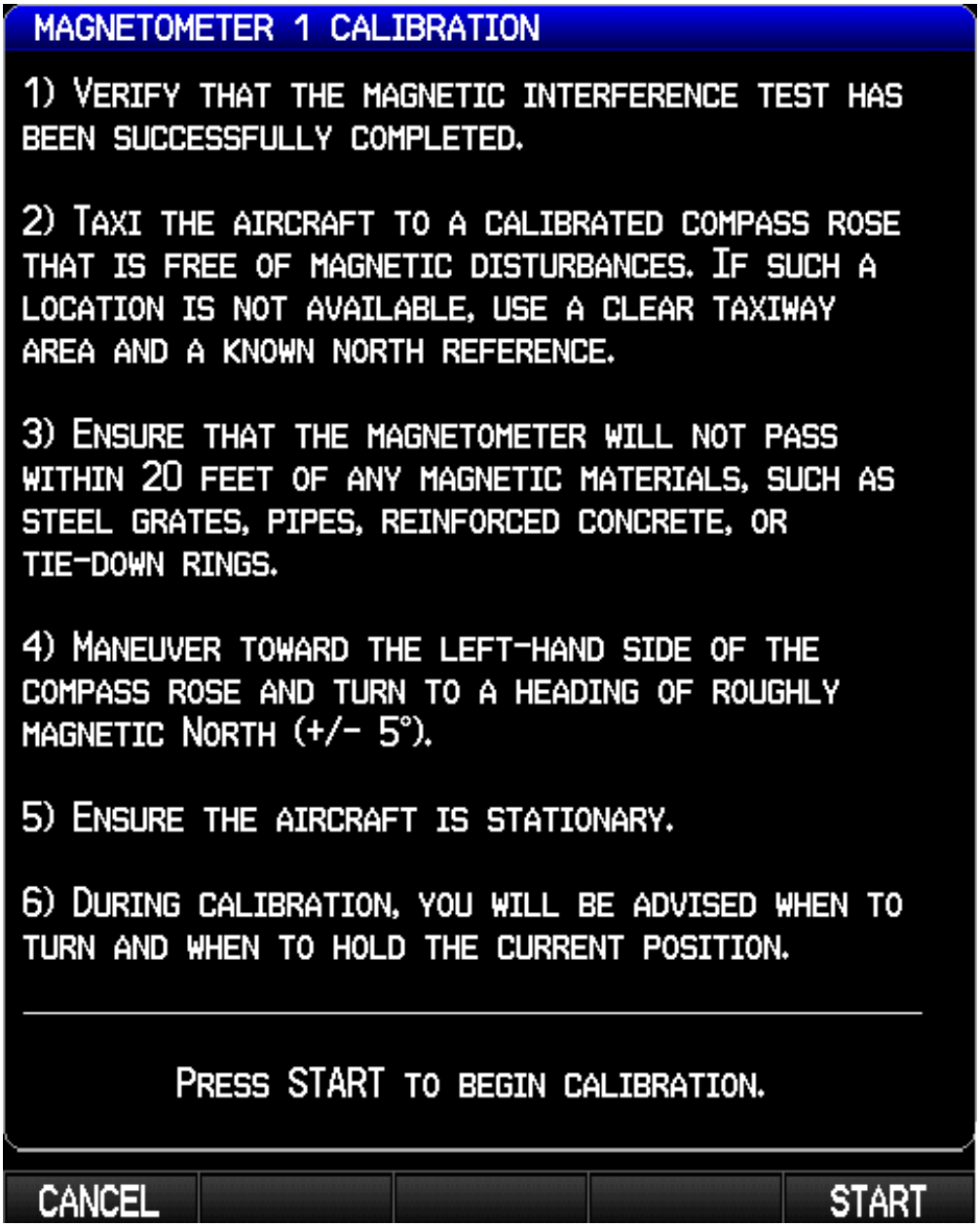
3. Make sure that all the required status boxes are checked (Table H-5 and Table H-6). Use the FMS Joystick to select which magnetometer (1, 2 or 3) is being configured.



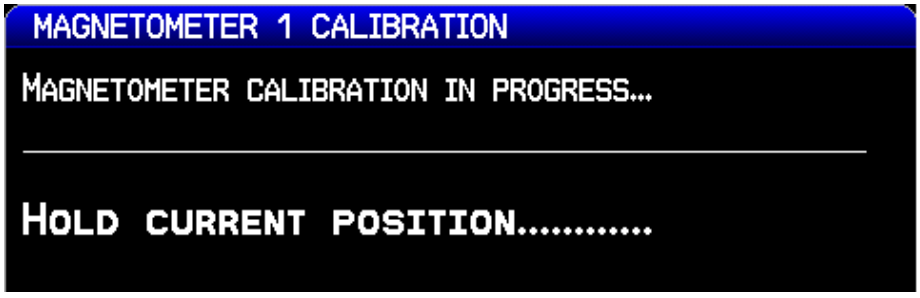
4. On the MAG page, use the FMS Joystick to select Magnetometer Calibration and press the ENT key.



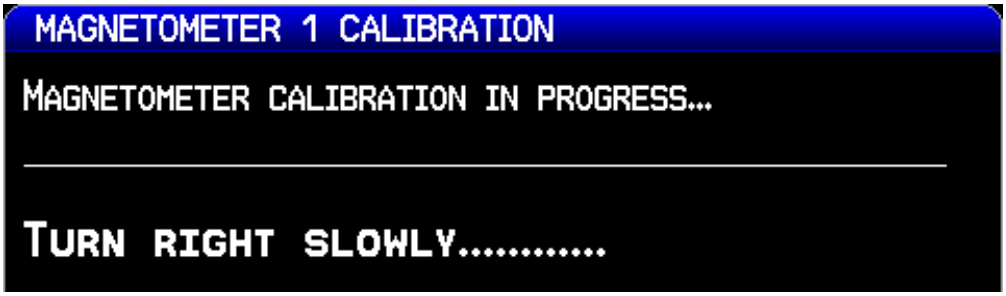
5. Make sure that all on-screen instructions have been complied with, then press the Start softkey to begin the calibration.



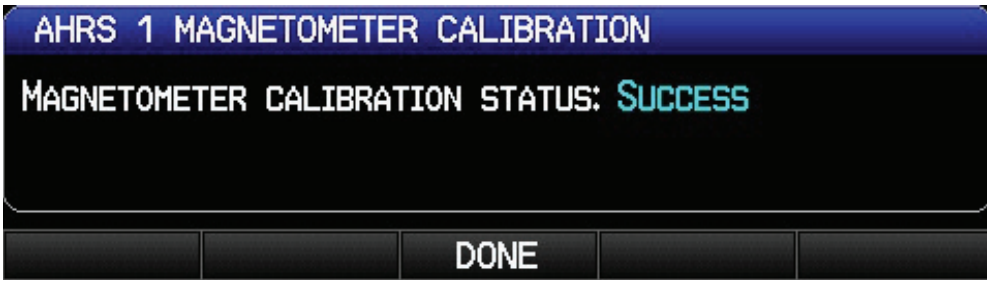
6. Follow the on-screen instructions, the dots at the end of the text will be removed as the test progresses.



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, make sure that a Calibration Status of "Success" is displayed, press the Done softkey to return to the MAG 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.

H.4.5 AP (Autopilot) Configuration Page

H.4.5.1 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 before completing the first flight with the GSA 28.

1. Verify the flight controls can move from stop to stop without binding or interference. Check the GSA 28 output mechanism and added linkage do not come in contact with any part of the airframe while traveling through its full range of motion.
   - If using a pushrod linkage, verify the servo crank arm and pushrod cannot experience an over-center condition when the flight controls are moved through their full range of travel. Consult Section 17.5 to verify complete servo pushrod installation requirements.
   - Per Figure H-4 if using a bridle cable and capstan, verify the cable is wrapped around the capstan the required number of turns, the ball is in the center of travel when the flight controls are in the neutral position, and the ball cannot exit the capstan groove when the flight controls are moved through their full range of travel. Consult Section 17.5 to verify complete servo capstan installation requirements.



Figure H-4 360º and 540º Cable Wrap Examples

2. Verify 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. Make sure 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 CWS/DISCONNECT wire is correctly wired and tested.
6. If powering the servo through a "pullable" circuit breaker (recommended), make sure 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.

H.4.5.2 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.

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.

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 the basic pitch mode performance must be properly adjusted before changing settings that adjust the vertical speed and airspeed based modes.

NOTE

Make sure 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.

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

When using GDU 37X displays, yaw damper functionality requires a GMC Mode Controller unit.

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

Make sure 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.

Trim Control

The GSA 28 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 in the air, the servos can adjust the trim control to minimize the force on the primary controls. This helps make sure 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

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

H.4.5.3 Step by Step On-Ground Setup

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”.



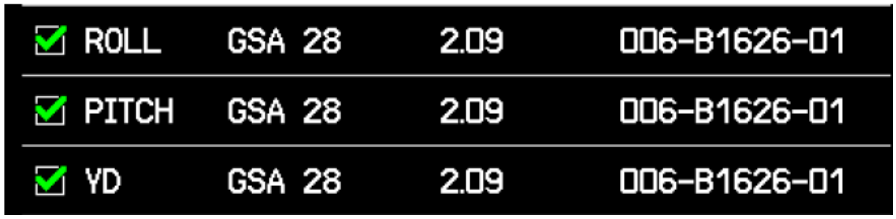
2. If you have installed a 2-axis (pitch and roll) autopilot, use the LRU page in configuration mode on the PFD to configure the “Autopilot Servos” for “Pitch + Roll”.



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.



   e) Finally, verify the electric trim motor responds in the proper directions using the TRIM L and TRIM R softkeys on the AP CONFIG page.



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.



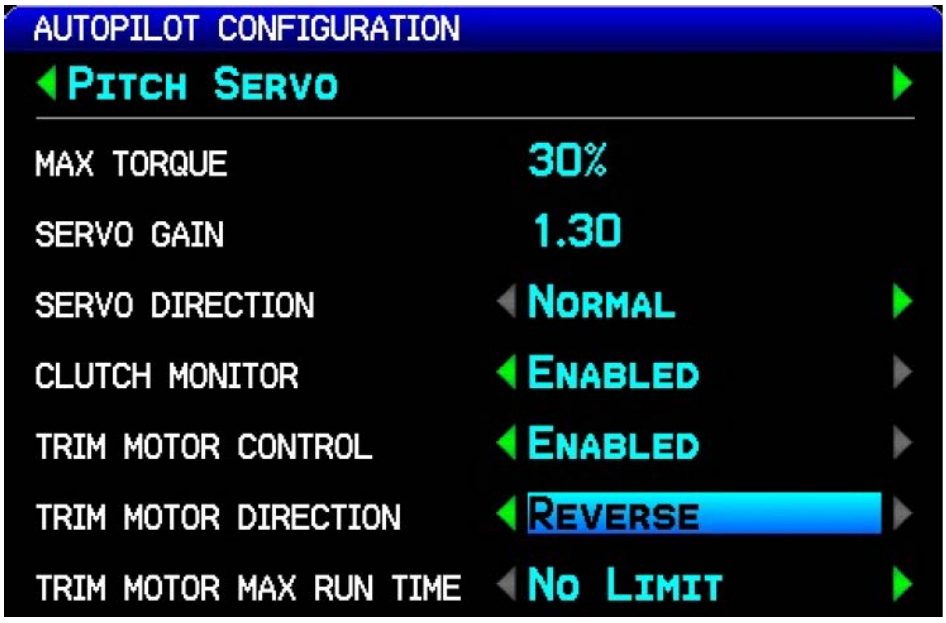
   b) Use the elevator trim switch to input a nose up TRIM command. Verify the elevator trim switch properly moves for nose up trim. Verify the Pitch servo is properly indicating NOSE UP trim activity.



   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.



   e) Finally, verify the electric trim motor responds in the proper directions using the TRIM UP and TRIM DN softkeys on the AP CONFIG page.



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.



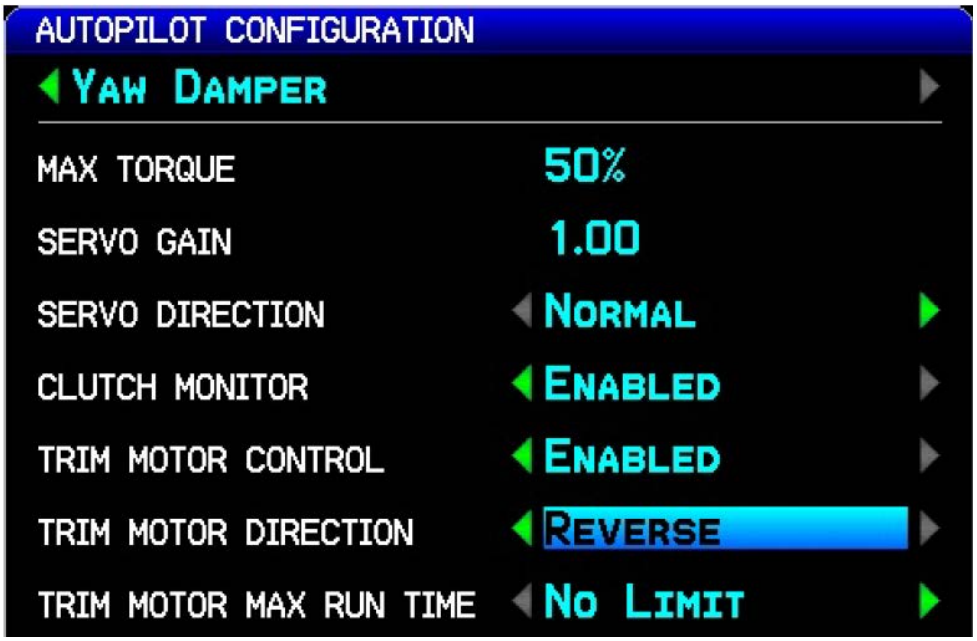
   b) Use the rudder trim switch to input a yaw right TRIM command. Verify the rudder trim switch properly moves for yaw left trim. Verify the Yaw servo is properly indicating YAW RIGHT trim activity.



   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.



   e) Finally, verify the electric trim motor responds in the proper directions using the TRIM L and TRIM R softkeys on the AP CONFIG page.



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.

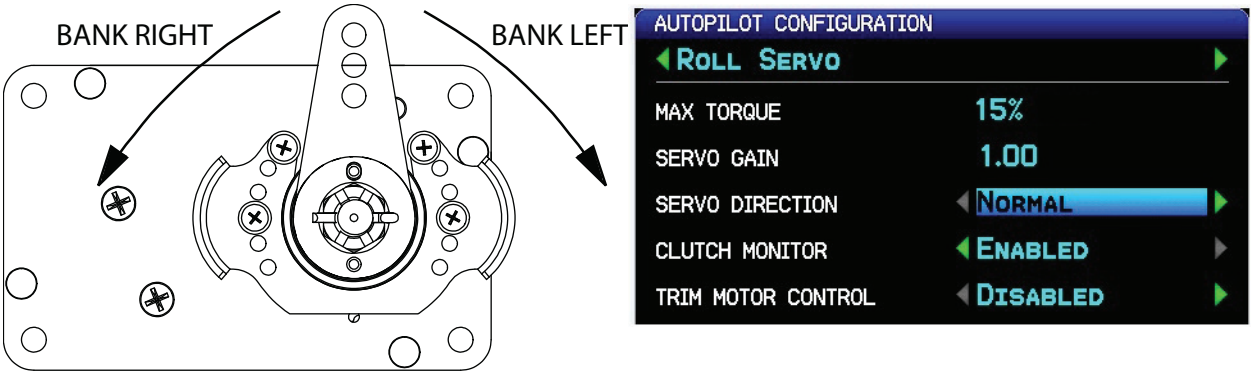


Figure H-5 Normal Roll Servo Direction

    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.

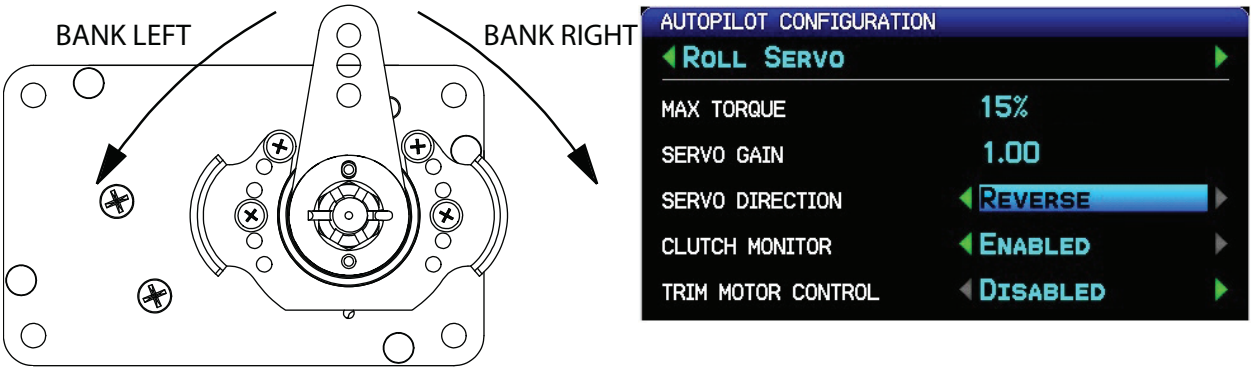


Figure H-6 Reversed Roll Servo Direction

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.

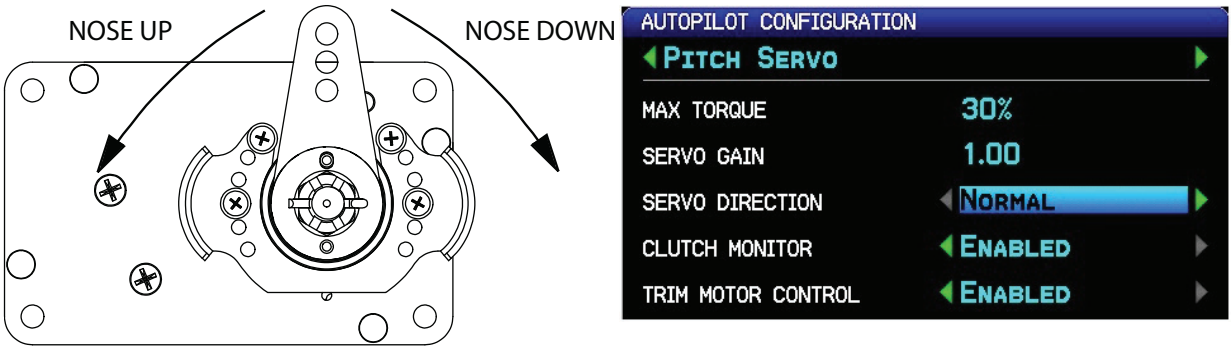


Figure H-7 Normal Pitch Servo Direction

    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.

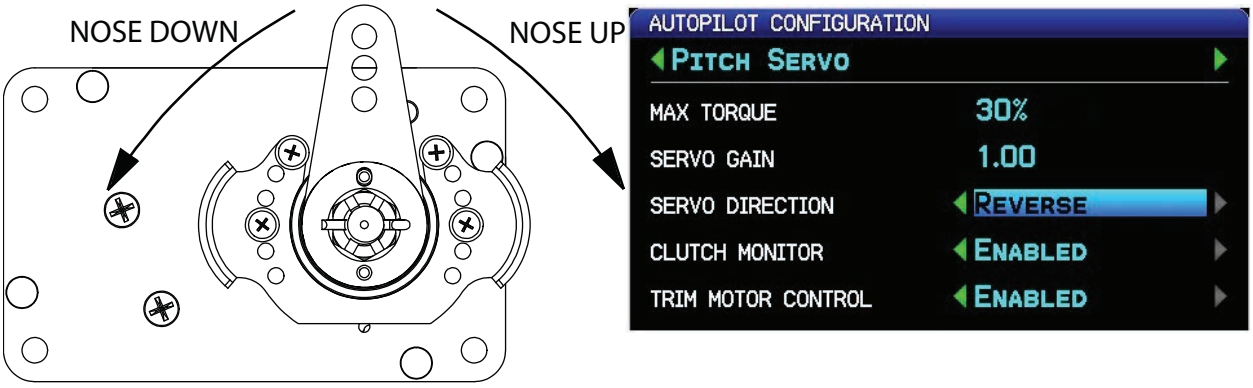


Figure H-8 Reversed Pitch Servo Direction

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.

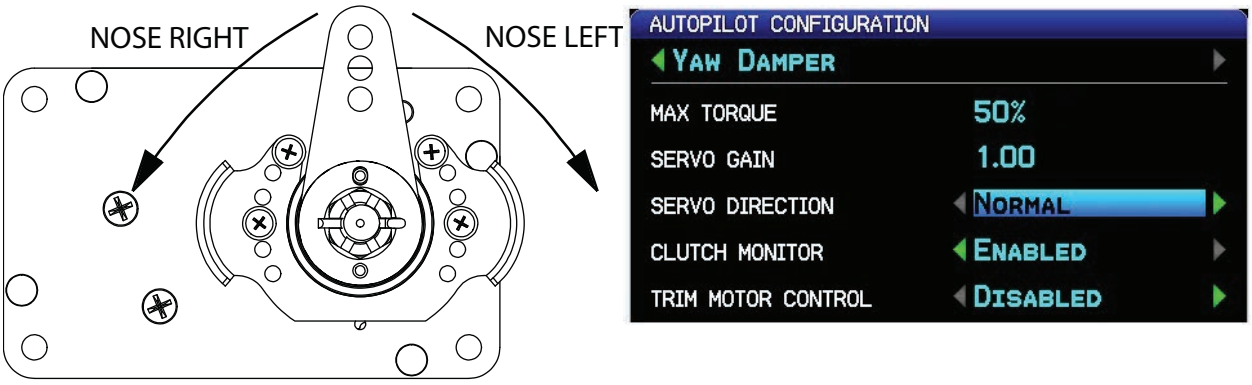


Figure H-9 Normal Yaw Damper Direction

    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.

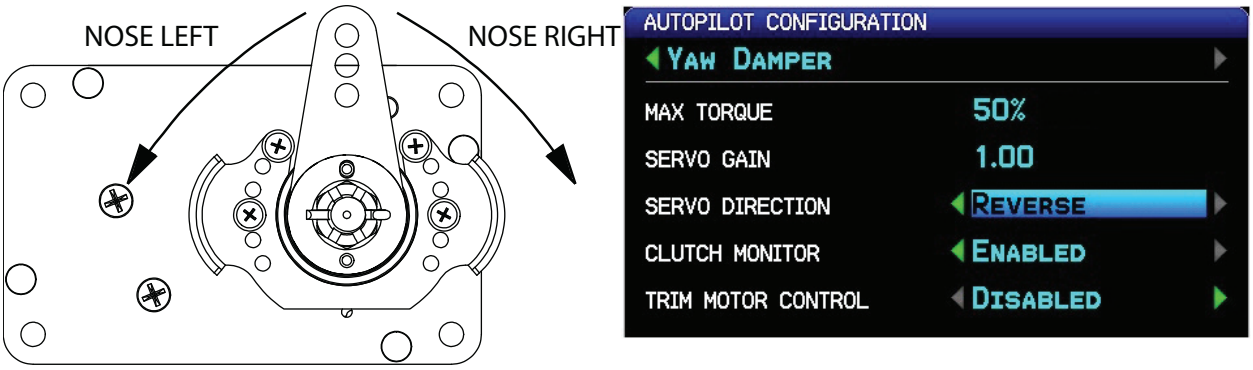


Figure H-10 Reversed Yaw Damper Direction

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.

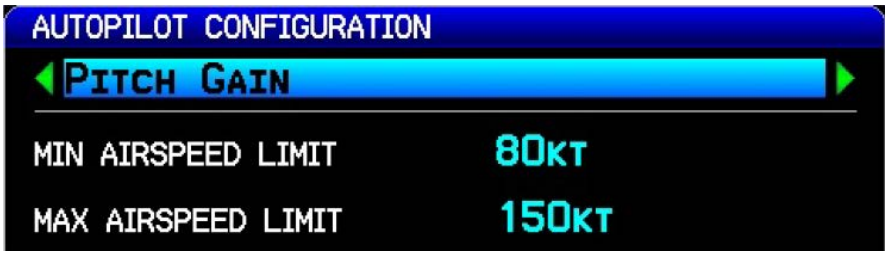


a) By disabling the TRIM MOTOR CONTROL, this will disable auto-trim and airspeed scheduled trim, but the pilot can still control trim in the aircraft using the normal manual electric trim inputs. Auto-trim and airspeed scheduled trim will be setup later in the autopilot setup procedure.

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.



H.4.5.4 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 Mode 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. Turn the joystick counter-clockwise to command a left turn
        v. Bump the joystick down to command a pitch down
    b) With a GMC Mode Controller:
        i. Press the AP button on the GMC Mode Controller
        ii. Press the HDG button on the GMC Mode Controller
        iii. Push the HDG softkey on the PFD
        iv. Push and hold the joystick on the PFD to center the HDG bug
        v. Turn the joystick on the PFD counter-clockwise to command a left turn
        vi. Turn the wheel on the GMC Mode Controller 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.

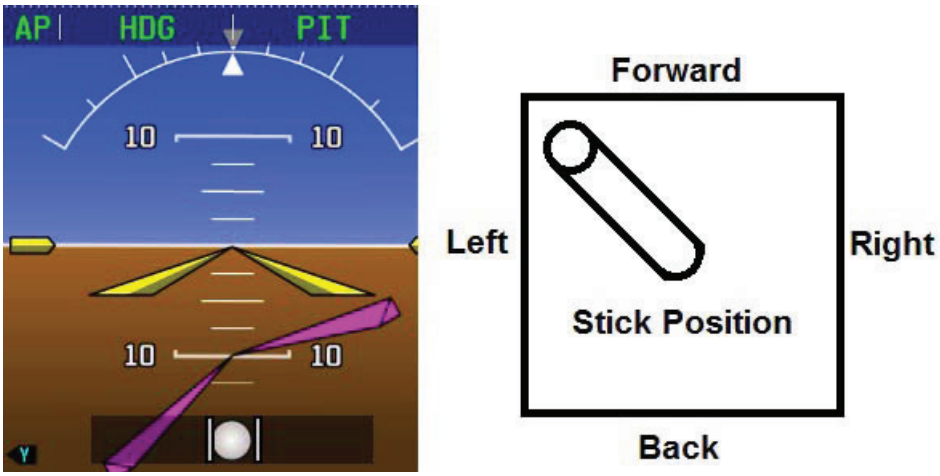


Figure H-11 Stick Position Nose Down, Bank Left

4. Engage the autopilot in HDG/PIT mode and command a nose down, right bank.
   a) With no GMC Mode 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. Turn the joystick clockwise to command a right turn
      v. Bump the joystick down to command a pitch down
   b) With a GMC Mode Controller:
      i. Press the AP button on the GMC Mode Controller
      ii. Press the HDG button on the GMC Mode Controller
      iii. Push the HDG softkey on the PFD
      iv. Push the joystick on the PFD to center the HDG bug
      v. Turn the joystick on the PFD clockwise to command a right turn
      vi. Turn the wheel on the GMC Mode Controller 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.

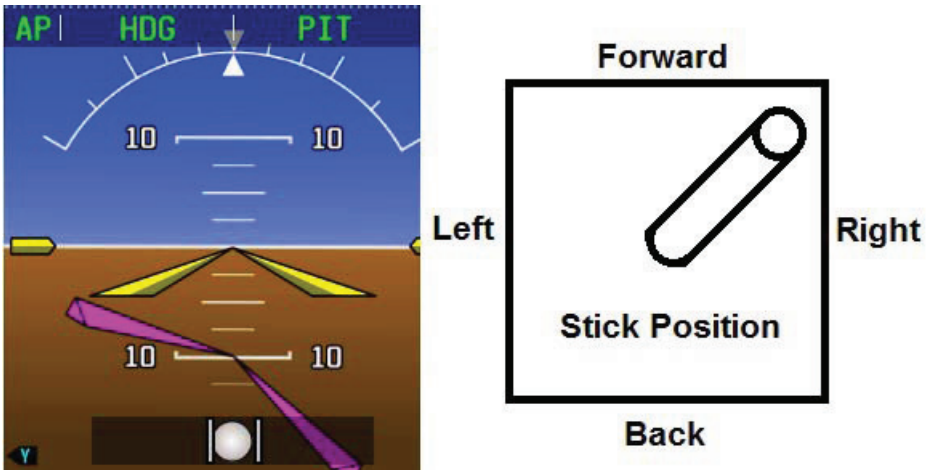


Figure H-12 Stick Position Nose Down, Bank Right

6. Engage the autopilot in HDG/PIT mode and command a nose up, right bank.
   a) With no GMC Mode 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. Turn the joystick clockwise to command a right turn
      v. Bump the joystick up to command a pitch up
   b) With a GMC Mode Controller:
      i. Press the AP button on the GMC Mode Controller
      ii. Press the HDG button on the GMC Mode Controller
      iii. Push the HDG softkey on the PFD
      iv. Push the joystick on the PFD to center the HDG bug
      v. Turn the joystick on the PFD clockwise to command a right turn
      vi. Turn the wheel on the GMC Mode Controller 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.

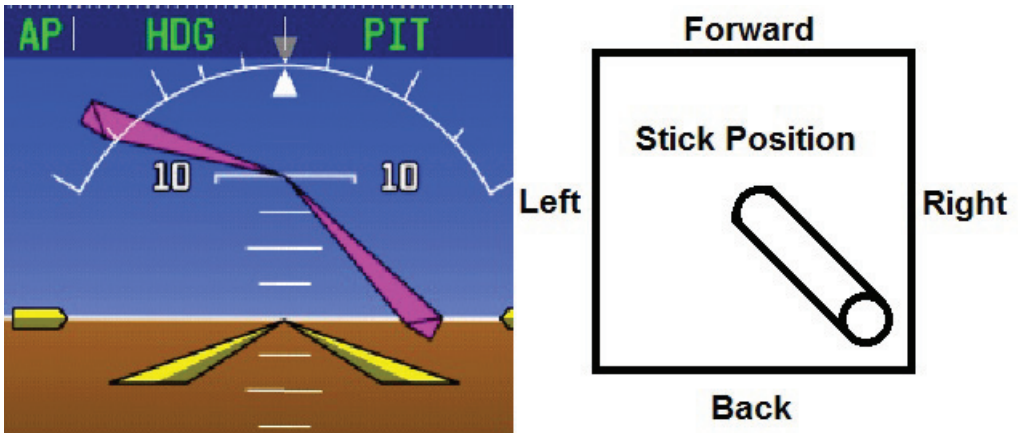


Figure H-13 Stick Position Nose Up, Bank Right

8. Engage the autopilot in HDG/PIT mode and command a nose up, left bank.
   a) With no GMC Mode 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. Turn the joystick counter-clockwise to command a left turn
      v. Bump the joystick up to command a pitch up
   b) With a GMC Mode Controller:
      i. Press the AP button on the GMC Mode Controller
      ii. Press the HDG button on the GMC Mode Controller
      iii. Push the HDG softkey on the PFD
      iv. Push the joystick on the PFD to center the HDG bug
      v. Turn the joystick on the PFD counter-clockwise to command a left turn
      vi. Turn the wheel on the GMC Mode Controller 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.

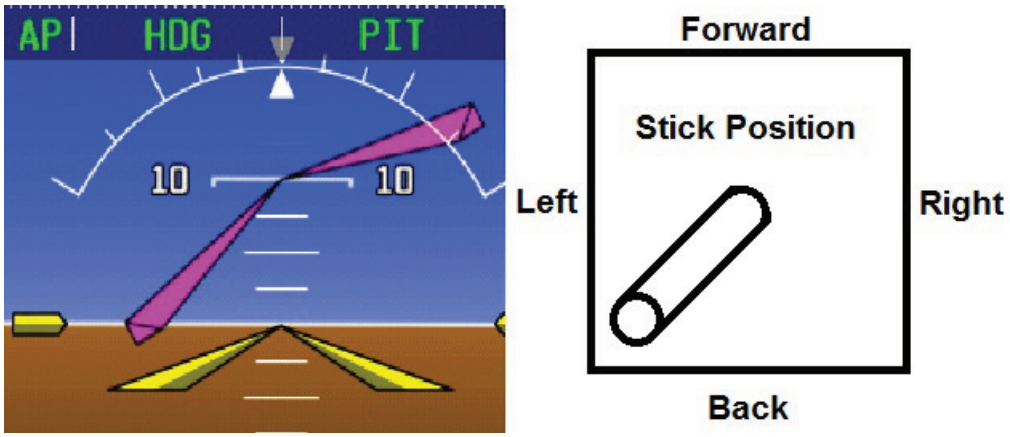


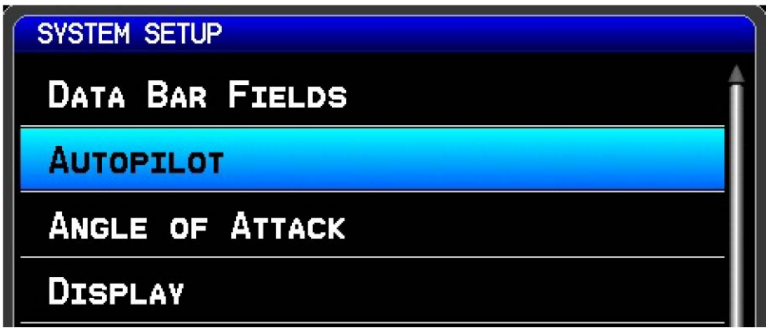
Figure H-14 Stick Position Nose Up, Bank Left

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

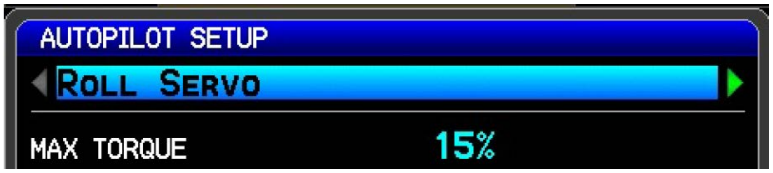
11. Engage the autopilot and verify it can be overpowered in both the pitch and roll axis. If the autopilot cannot be overpowered, use the Autopilot Setup screen to reduce the MAX TORQUE setting for the associated servo.
    a) Press MENU two times on the GDU to enter the MAIN MENU page.
    b) Select the SYSTEM SETUP page.



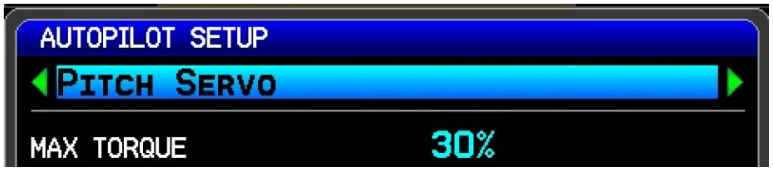
    c) Select the AUTOPILOT page.



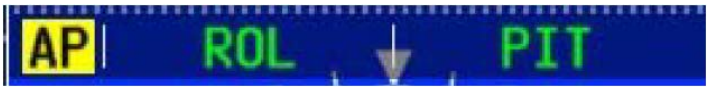
    d) Select ROLL SERVO and set the MAX TORQUE.



    e) Select PITCH SERVO and set the MAX TORQUE.



12. Engage the autopilot and verify it 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.

H.4.5.5 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 Mode Controller:
        i. YD not supported
    b) With a GMC Mode Controller:
        i. Press the YD button on the GMC Mode Controller



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 the rear fuselage is moving):

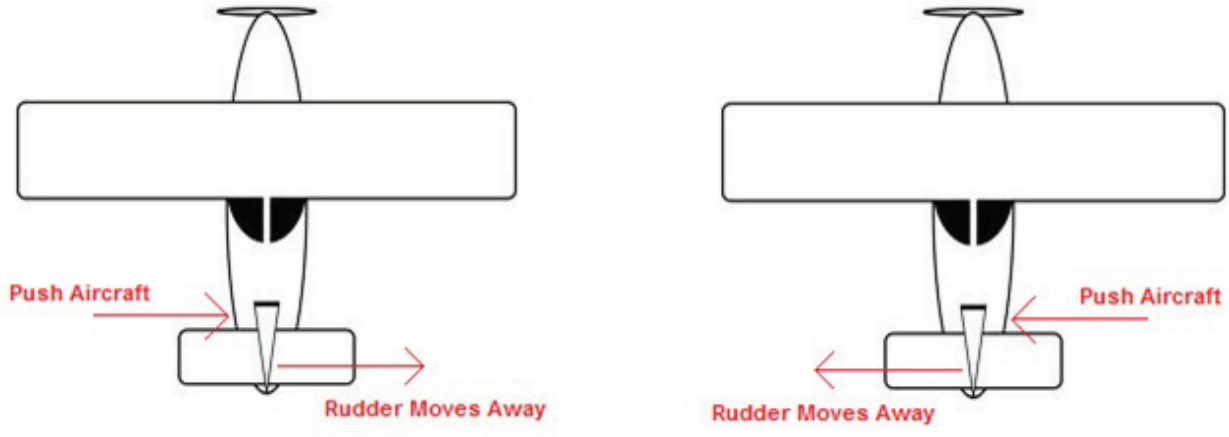


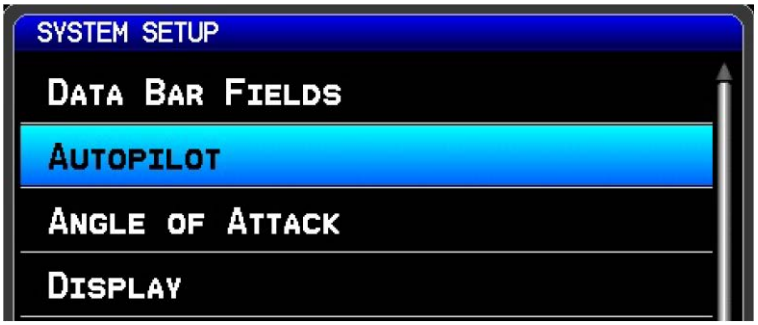
Figure H-15 Verify Correct Rudder Direction

    a) If the rudder does not move the correct direction, correct the yaw servo direction documented in Servo Wiring Checkout Step 11.

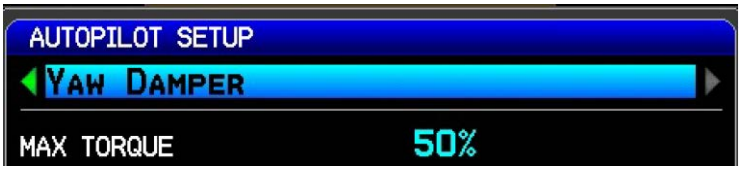
4. Engage the yaw damper and verify it can be overpowered in yaw axis using rudder pedal inputs. If the autopilot cannot be overpowered, use the Autopilot Setup screen to reduce the MAX TORQUE setting for the yaw damper servo:
   a) Press MENU two times on the GDU to enter the MAIN MENU page.
   b) Select 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.

H.4.5.6 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 while airborne.

WARNING

This stage of the flight test involves allowing the GSA 28 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 to 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)

NOTE

If desired, in the following procedures, the advanced/expert settings can be accessed from the Autopilot Setup page by pressing Menu, then selecting SHOW ADVANCED SETTINGS, then pressing ENTER. Then press MENU again, select SHOW EXPERT SETTINGS and press ENTER.

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 Mode Controller:
         1.Press, hold, and release the CWS/DISCONNECT button to engage the AP
      ii. With a GMC Mode Controller
         1.Press the AP button on the GMC Mode Controller to engage the AP
         2.Press the YD button on the GMC Mode Controller to DISENGAGE the YD

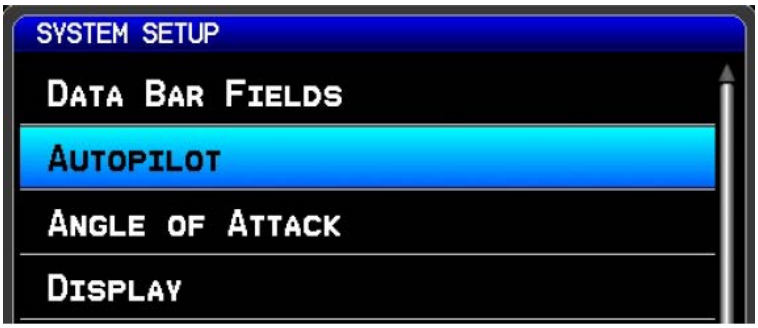


   b) Press MENU two times on the GDU to enter the MAIN MENU page.

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 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

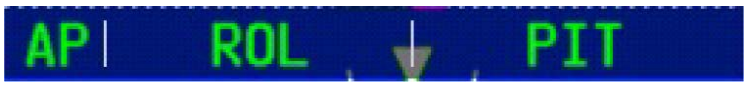
iii. Set the SERVO GAIN higher to make the autopilot more aggressive

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

2. The roll servo has additional expert settings that can be adjusted to achieve the desired lateral mode performance. These settings are detailed in Appendix H.4.5.9 and should only be adjusted after studying the description to properly understand their effect on the roll servo. See preceding note to access the expert settings.

Pitch Servo

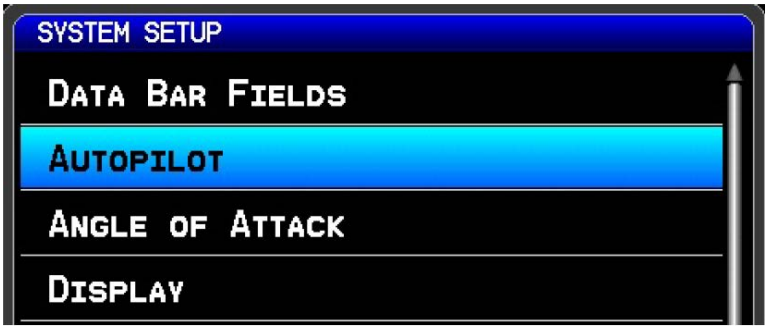
1. Use the AUTOPILOT SETUP page to adjust the PITCH SERVO gain setting
   a) Engage the autopilot in ROL/PIT mode with the aircraft approximately level
      i. With no GMC Mode Controller:
         1.Press, hold, and release the CWS/DISCONNECT button to engage the AP
      ii. With a GMC Mode Controller: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

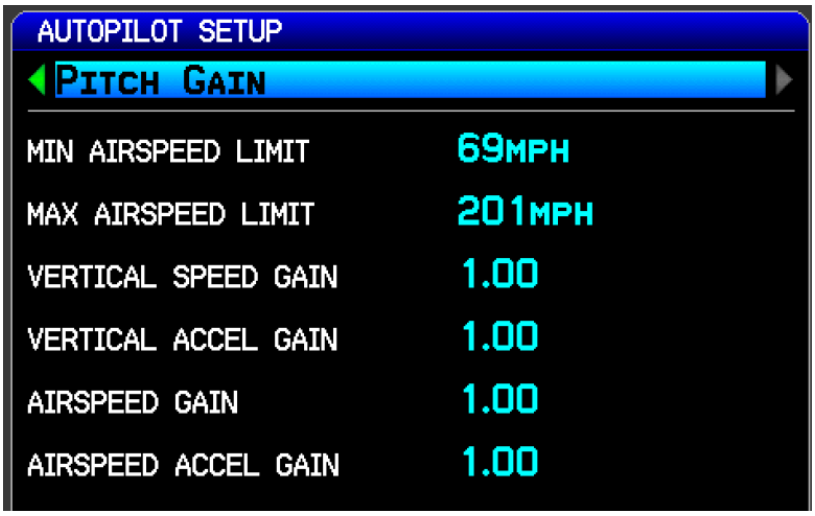
iii. Set the SERVO GAIN higher to make the autopilot more aggressive

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

2. The pitch servo has additional expert settings that can be adjusted to achieve the desired vertical mode performance. These settings are detailed in Appendix H.4.5.9 and should only be adjusted after studying the description to properly understand their effect on the pitch servo. See preceding note to access the expert settings.

Pitch Gain

The Pitch Gain settings should be configured only after the pitch/roll servo max torque and servo gains have been set per the preceding pages.



NOTE

It is important to verify proper autopilot response in PIT mode before proceeding to adjust other autopilot pitch axis gains and modes (including ALT and VS modes).

The **min/max airspeed** fields set the min/max limits of autopilot vertical authority. The autopilot will limit the pitch control to stay within the min/max airspeed limits.

The **vertical speed gain** is one of the most important gains in the system since it controls the behavior of the VNAV, ALT, and VS modes and also largely determines how well the plane flies LPV and ILS approaches.

The **vertical speed gain** is adjusted in a very similar manner to the pitch servo gain. Engage the autopilot in ROL/VS modes in level flight (vertical speed approximately zero).

Adjust the **vertical speed gain** so the aircraft properly responds to the VS guidance from the flight director.

1. Overpower the autopilot to fly away from the current flight director commanded vertical speed.
2. Release controls and monitor autopilot response and closure back to the commanded vertical speed.
3. Set the **vertical speed gain** higher to make the autopilot more aggressive if it feels “lazy” or not as responsive as desired.
4. Set the **vertical speed gain** lower to make the autopilot less aggressive if the control is too “harsh” or more responsive than desired.

The **vertical accel gain** can often be left set at 1.00, but can be used to improve altitude captures when climbing or descending in VS or VNAV mode.

1. Climb to an altitude target in VS mode and note the altitude capture.
2. Set the **vertical accel gain** higher if the aircraft objectionably overshoots the altitude target before leveling off at the correct altitude.
3. Set the **vertical accel gain** lower if the aircraft objectionably undershoots the altitude target before leveling off at the correct altitude.

Similar to the vertical speed gain and vertical accel gain, the airspeed gain and airspeed accel gain can be used to improve airspeed hold performance when needed.

Pitch Gain has advanced and expert settings that can be adjusted to achieve the desired performance. These settings are detailed in Appendix H.4.5.9 and should only be adjusted after studying the description to properly understand their effect on pitch gain. See preceding note to access the advanced/expert settings.

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 GSA 28 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.

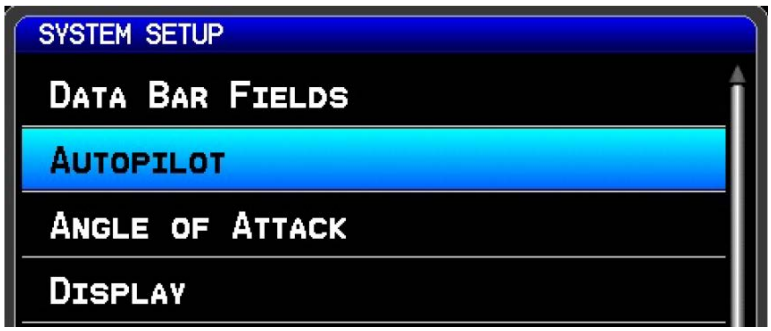
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- 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 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 Mode Controller

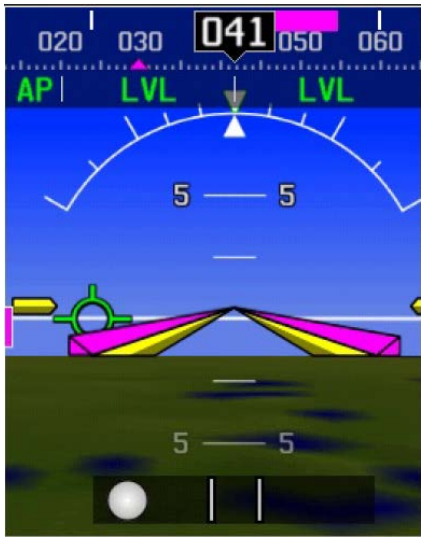
1. Press the LVL button on the GMC Mode Controller to engage the AP in LVL mode

2. Press the YD button on the GMC Mode Controller to disengage the YD

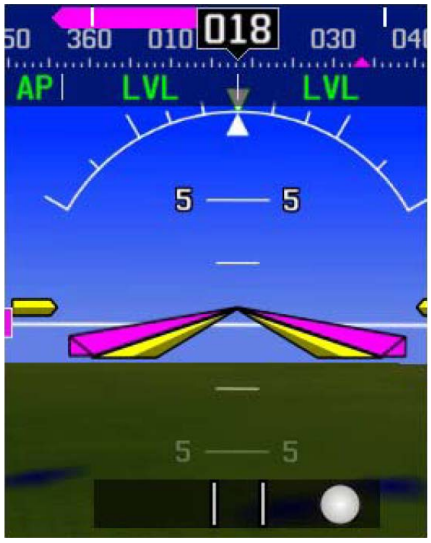


iii. Fly a yaw doublet and engage the YD as the ball swings through the center

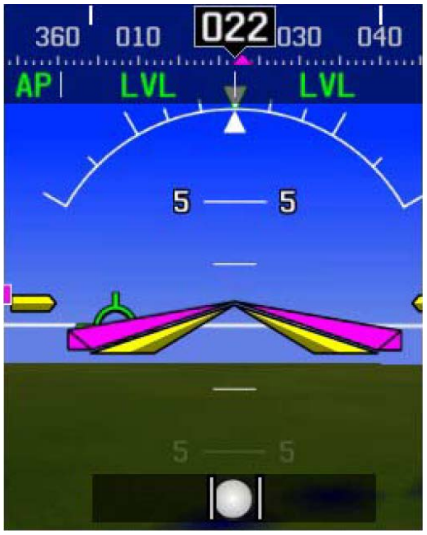
1. Right foot rudder to swing ball left



2.Left foot rudder to swing ball back right



3.Engage YD by pressing the YD button on the GMC Mode Controller 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 settings that can be adjusted to achieve the desired yaw damping performance. These settings are detailed in Appendix H.4.5.9 and should only be adjusted after studying the description to properly understand their effect on the yaw servo. See preceding note to access the advanced/expert settings.

H.4.5.7 Step by Step Trim System Setup

On-ground Setup

After setting up and testing the GSA 28 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.

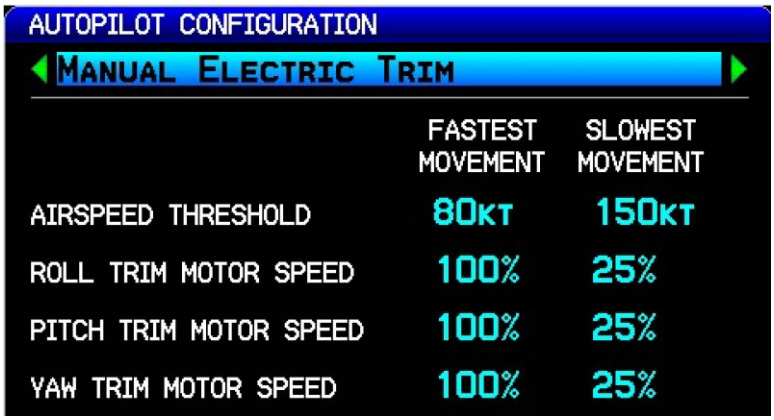
NOTE

The Trim Motor Max Run Time item allows optional configuration of a time limit for use with manual electric trim. When the manual trim input switch is pressed, the electric trim motor will stop running after the time limit expires, and will not run again until the trim input switch is released and pressed again. This can help prevent "trim runway" caused by a stuck trim input switch. If the maximum trim motor run time is set to "No Limit", the electric trim motor will run indefinitely as long as the manual trim input switch is held. This item has no effect on auto trim.



Figure H-16 Roll, Pitch, and Yaw Configuration Pages

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 Appendix H.4.5.3 Steps 6, 7, & 8.

H.4.5.8 In Air Setup

The next phase of setting up the Garmin GSA 28 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 GSA 28 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.

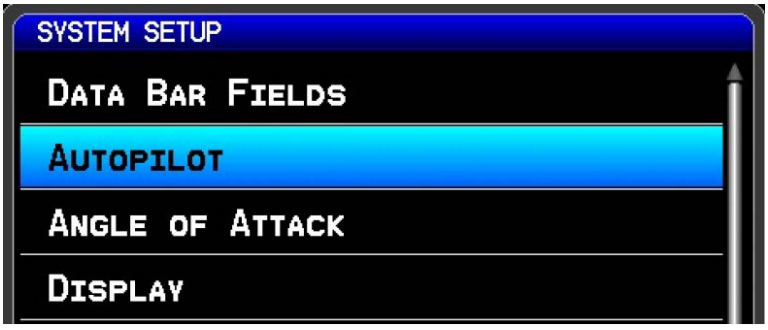
At a minimum, please follow the following safety guidelines before the initial autopilot engagement:

- 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)

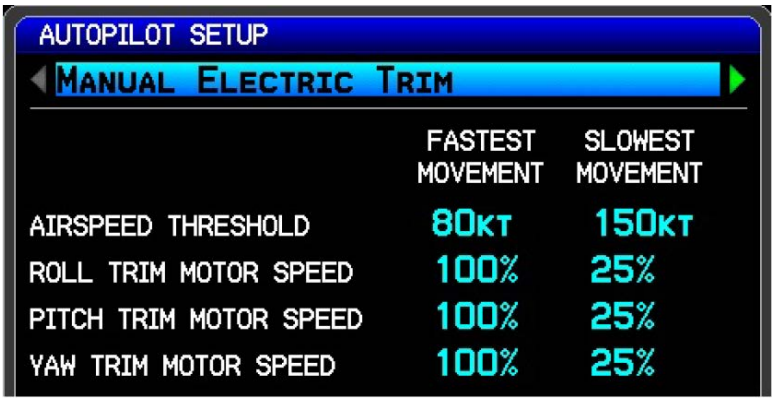
1. Use the AUTOPILOT SETUP page to adjust the TRIM MOTOR SPEED to get the desired manual electric trim response.
   a) Press MENU two times on the GDU to enter the MAIN MENU page.
   b) Select the SYSTEM SETUP page.



   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

H.4.5.9 Detailed Autopilot Configuration Options

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

General Configuration Page

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

Table H-8 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 Mode Controller AP button or the softkeys on the PFD display.

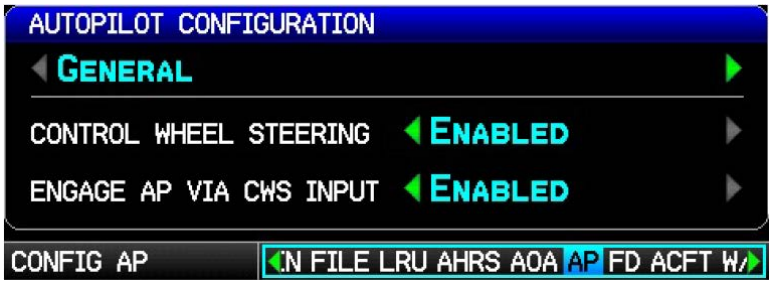


Figure H-17 General Autopilot Configuration Page

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 H-9 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 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 H-9 Roll Servo Autopilot Configuration Settings

Configuration Setting	Description
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 willmake sure 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.

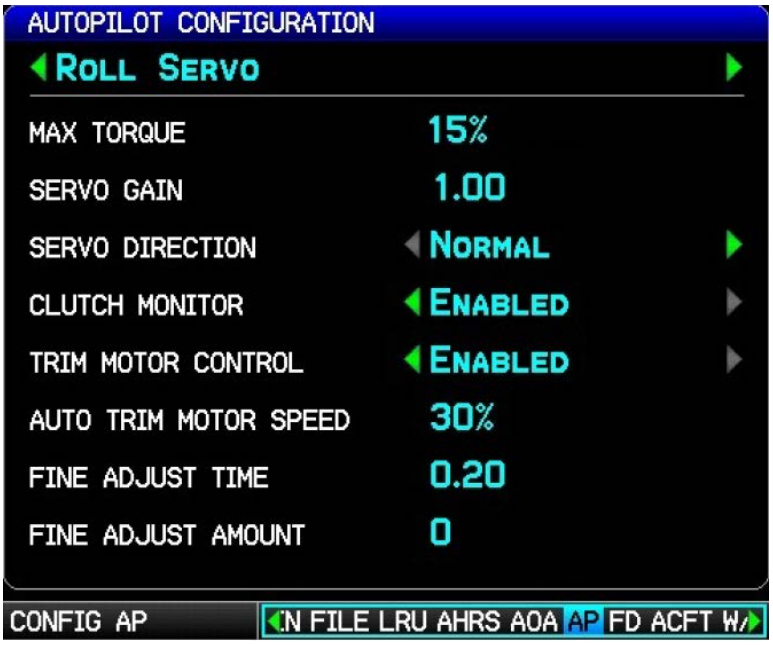


Figure H-18 Roll Servo Autopilot Configuration Page

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 H-10 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 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 H-10 Pitch Servo Autopilot Configuration Settings

Configuration Setting	Description
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 make sure 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 elevator 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 elevator 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.

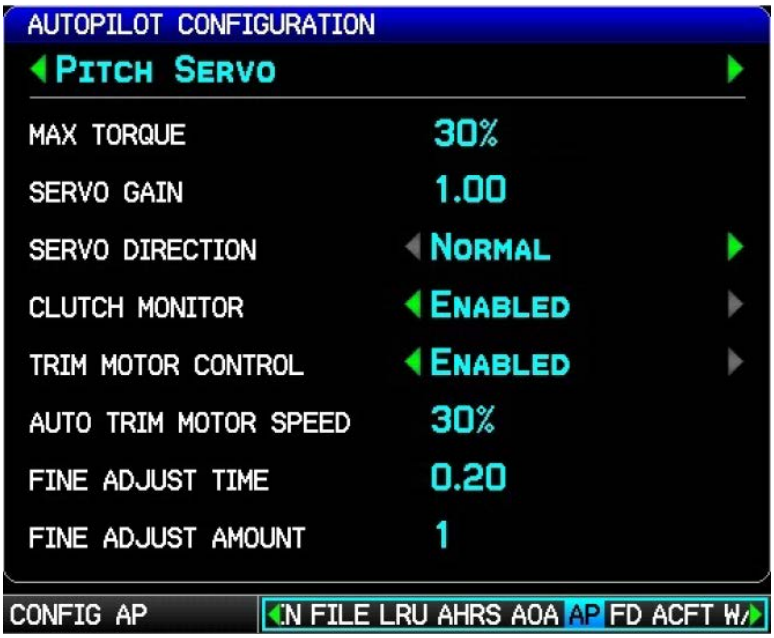


Figure H-19 Pitch Servo Autopilot Configuration Page

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 H-11 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 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 GSA 28 yaw damper servo was not connected to an auxiliary trim motor.

Table H-11 Yaw Damper Autopilot Configuration Settings

Configuration Setting	Description
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 make sure 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.

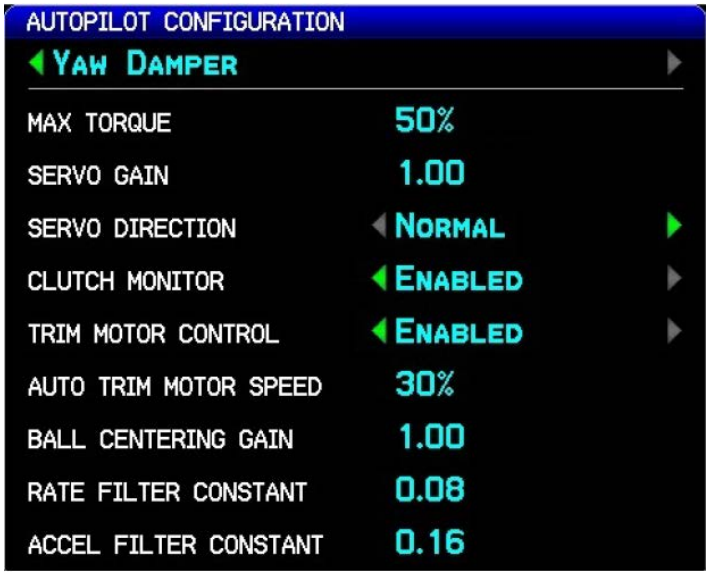


Figure H-20 Yaw Damper Autopilot Configuration Page

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 H-12 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 decreased 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 decreased if the aircraft is appears to back off from the desired airspeed target when closing on the bug.

Table H-12 Pitch Gain Autopilot Configuration Settings

Configuration Setting	Description
Airspeed Track Gain	The GSA 28 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.

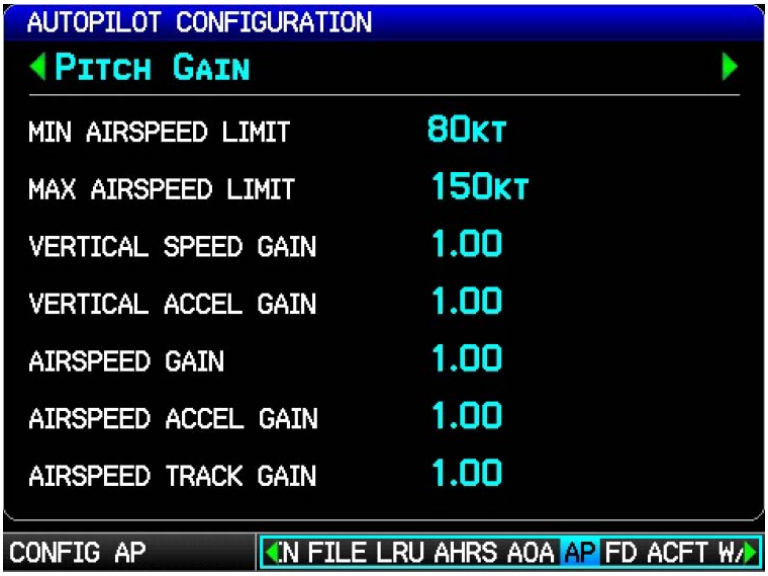


Figure H-21 Pitch Gain Autopilot Configuration Page

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 H-13 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.

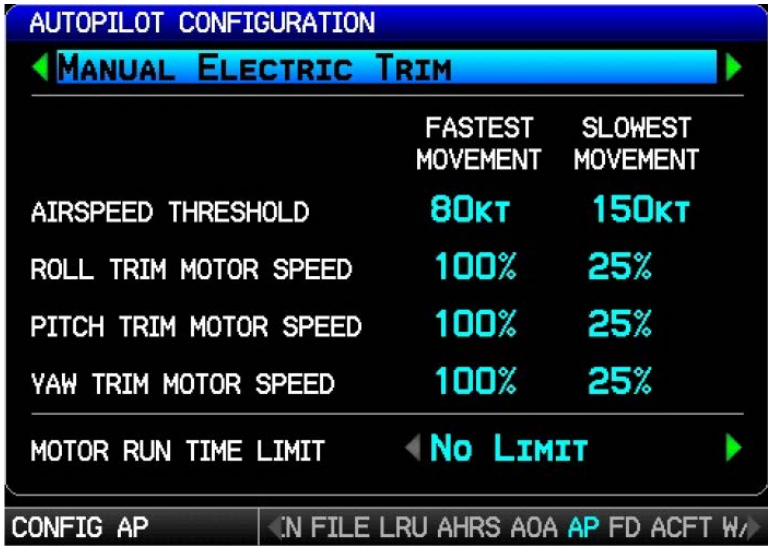
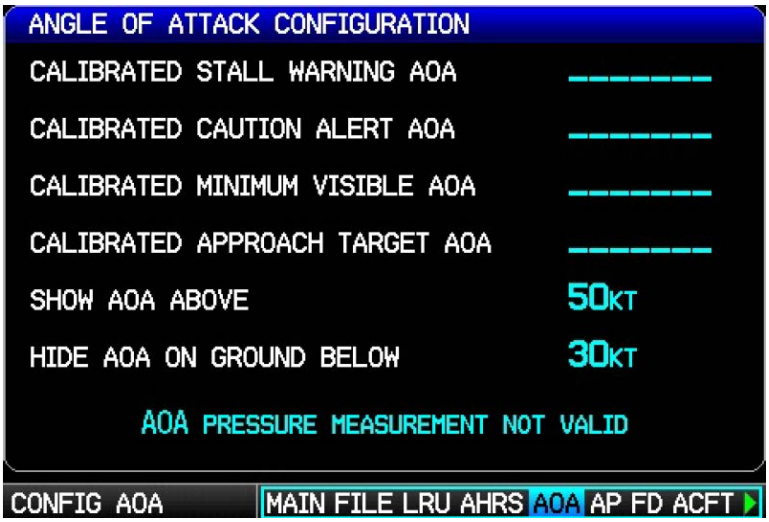


Figure H-22 Manual Electric Trim Autopilot Configuration Page

H.4.6 Angle of Attack (AOA) Configuration Page

The Angle of Attack (AOA) Configuration page is accessible only when an AOA input is enabled on the LRU Configuration page (Appendix H.4.2). The configuration mode page only allows viewing and deleting the AOA calibration values, the AOA calibration cannot be performed in configuration mode. The In-Flight AOA Calibration procedure follows.



H.4.6.1 AOA Calibration (Performed In-flight)

Installations that include a GAP 26 and which have AOA enabled require that an AOA calibration be performed to enable AOA functionality. The AOA calibration is used to find the four AOA settings shown in Figure H-23. These calibrations must be done while in flight. The AOA Setup page (Figure H-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 Appendix H.4.2).

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, make sure the aircraft is clear of all traffic and at a safe altitude for stall recovery.

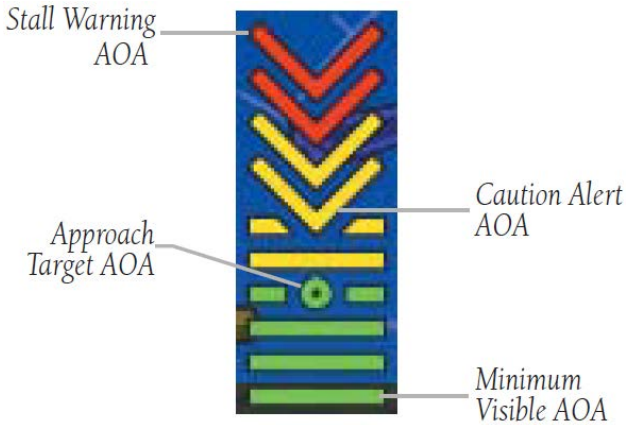


Figure H-23 Angle of Attack (AOA) Display

AOA is the angle between the aircraft's wing and the oncoming airflow (see Figure H-24). 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.

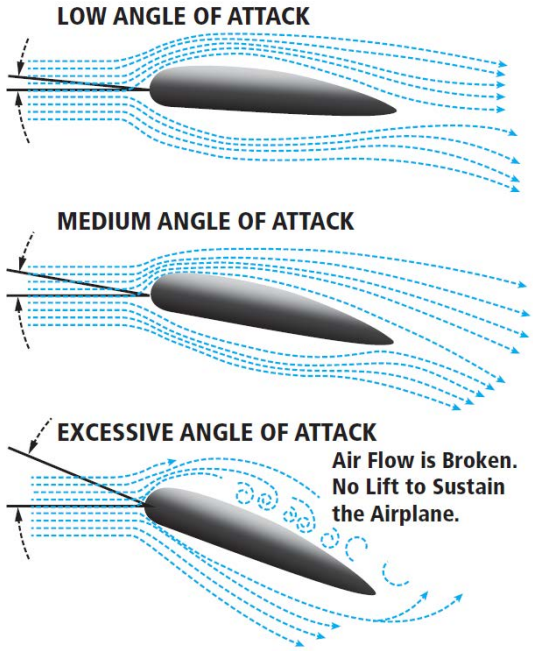


Figure H-24 Angle of Attack (AOA) Illustration

H.4.6.2 AOA Calibration Procedure

Perform the procedure steps in this section including, Minimum Visible AOA Calibration, Caution Alert AOA Calibration, Stall Warning AOA Calibration, and Approach Target AOA Calibration (Optional). 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.

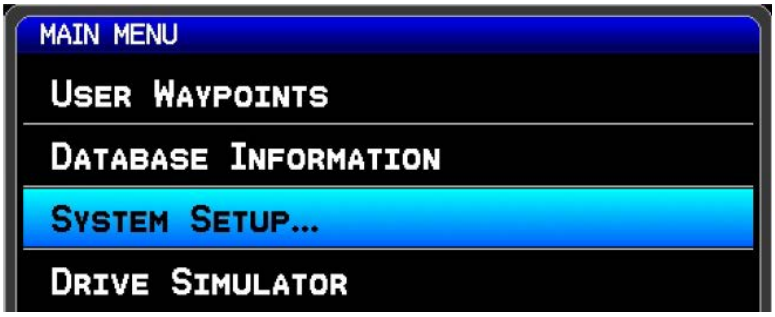
For the calibration to be valid:

- The stall warning AOA calibration value (resultant from the calibration procedure) must be greater than the minimum visible AOA calibration value (see Figure H-25).
- 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 H-25).

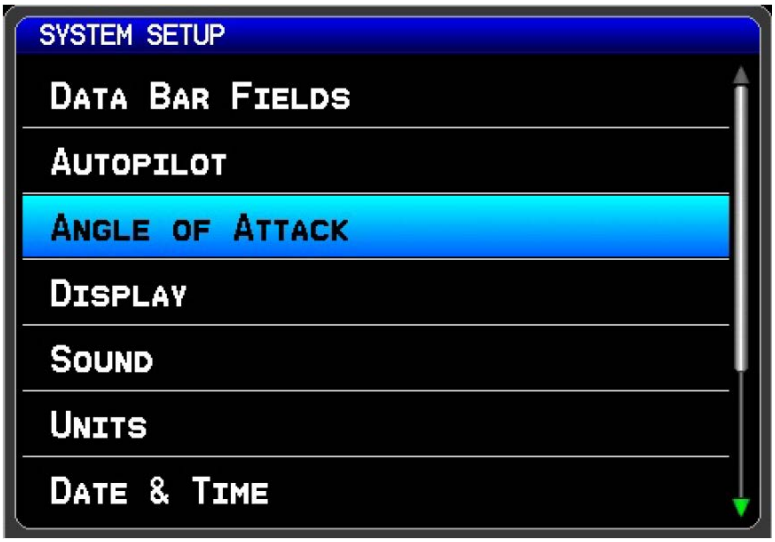


Figure H-25 Angle of Attack Setup Page

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.



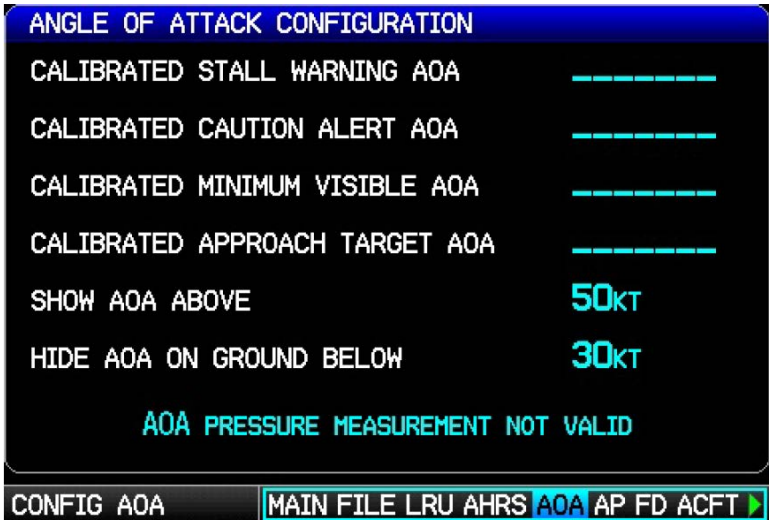
3. Press the ENT Key to display the System Setup page, use the FMS Joystick to select Angle of Attack.



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 (Calibrated Minimum Visible AOA, Calibrated Caution Alert AOA, and Calibrated Stall Warning AOA), plus 1 optional calibration point (Callibrated Approach Target AOA, if desired) in the following recommended order.

Minimum Visible AOA Calibration

This procedure sets the AOA value for the bottom of the AOA gauge green arc (Figure H-26), 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.

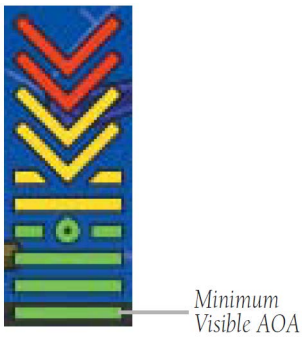
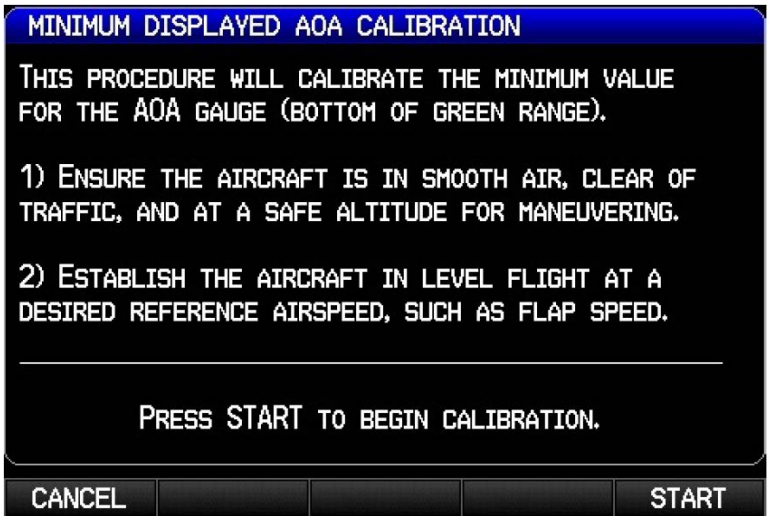
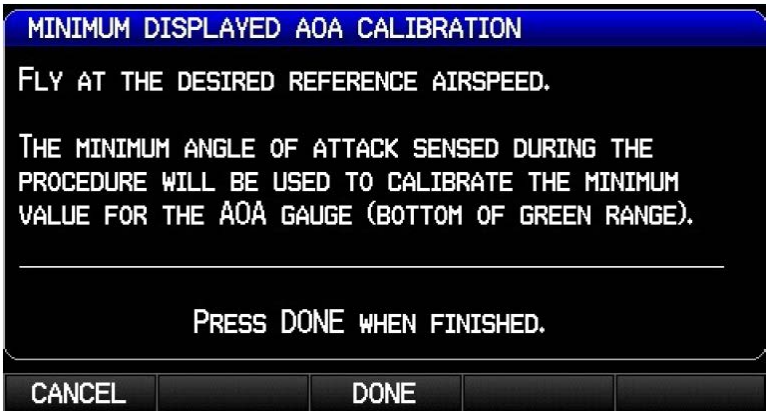


Figure H-26 Minimum Visible AOA

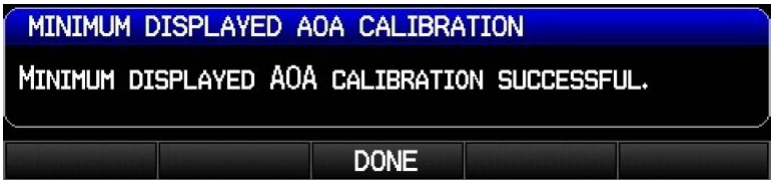
1. Use the FMS Joystick to select the Calibrated Minimum Visible AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Follow the onscreen instructions, then press the Done softkey when finished.



4. Verify the calibration is successful, then press the Done softkey when finished.



5. Proceed to Caution Alert AOA Calibration.

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.

Caution Alert AOA Calibration

This procedure sets the AOA value for the bottom of the yellow "chevron" section of the AOA gauge (Figure H-27), 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).

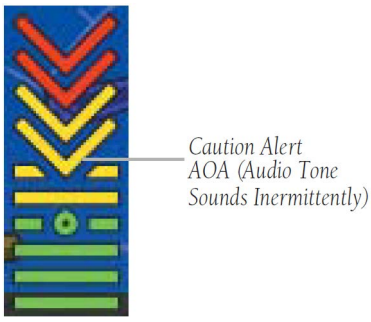
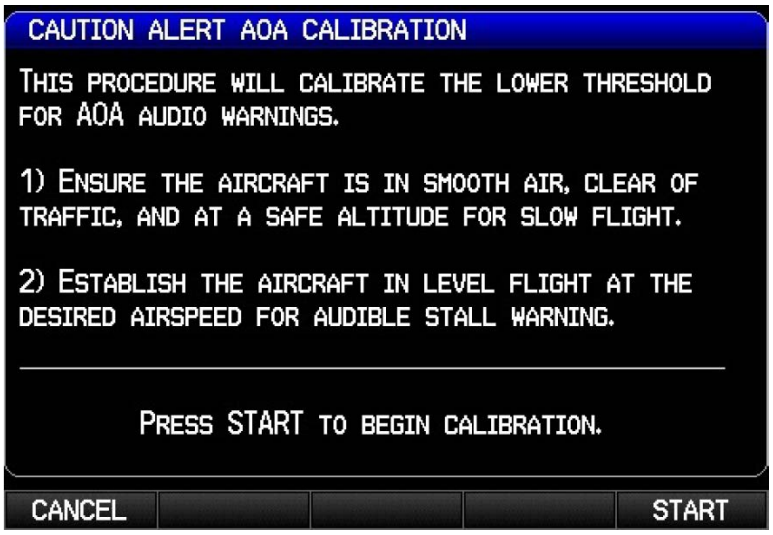
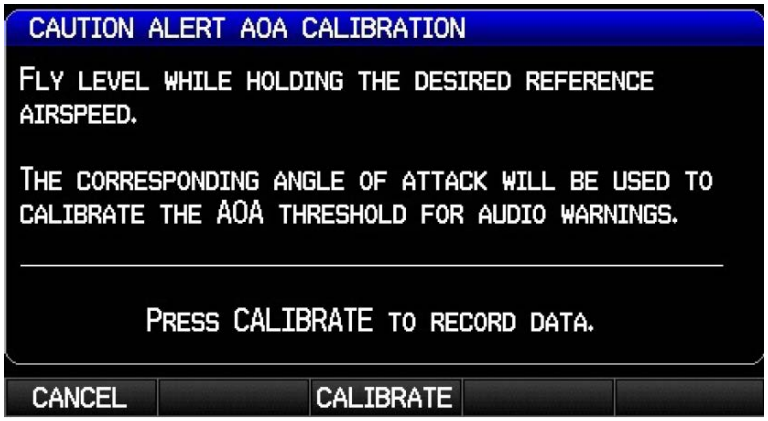


Figure H-27 Caution Alert AOA

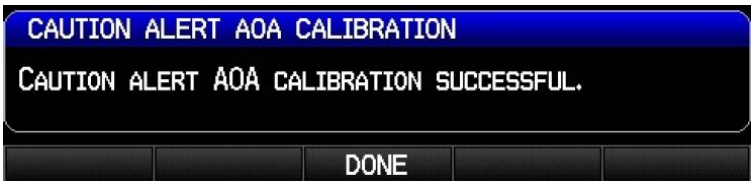
1. Use the FMS Joystick to select the Calibrated Caution Alert AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done softkey when finished.



5. Proceed to Stall Warning AOA Calibration.

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.

Stall Warning AOA Calibration

This procedure sets the AOA value for the top of the red "chevron" section of the AOA gauge (Figure H-28), which is also the AOA value at which the audible stall warning sound will play continuously (just before stall break is suggested).

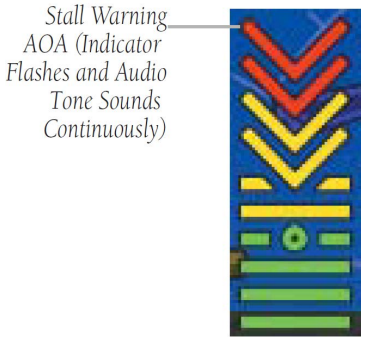
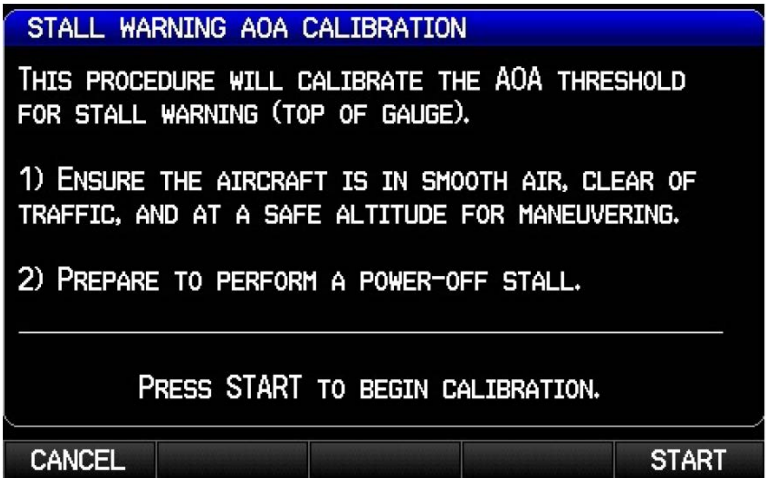
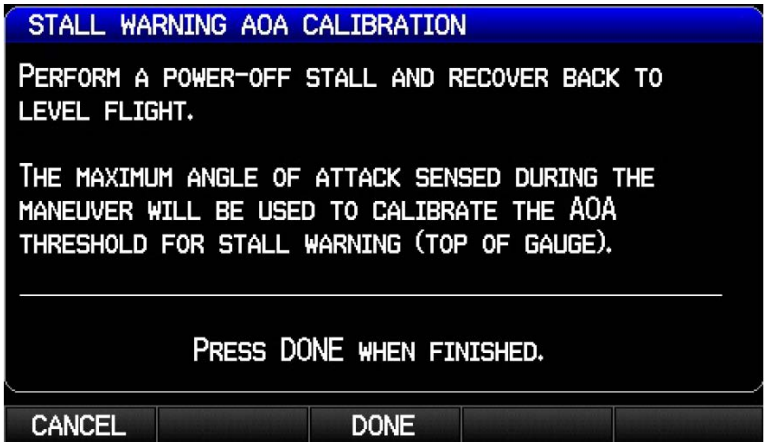


Figure H-28 Stall Warning AOA

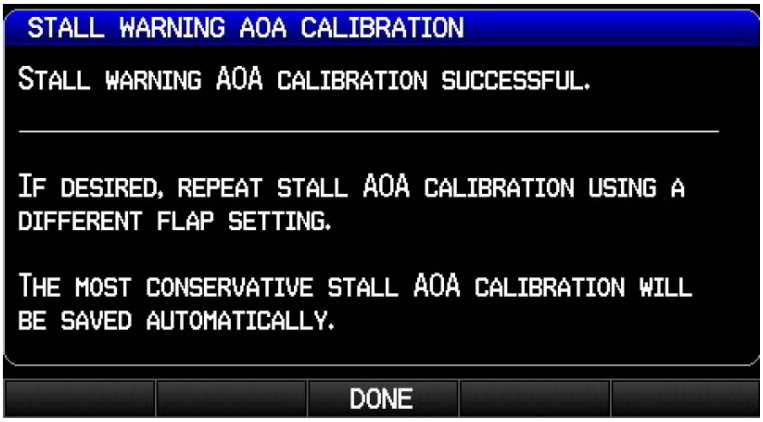
1. Use the FMS Joystick to select the Calibrated Stall Warning AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify 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 Approach Target AOA Calibration (Optional). If the Approach Target AOA Calibration procedure is not desired, the AOA Calibration Procedure is complete.

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 H-29). To be valid, the approach target AOA must be between the minimum visible (green) and caution alert (yellow chevron) AOA points.

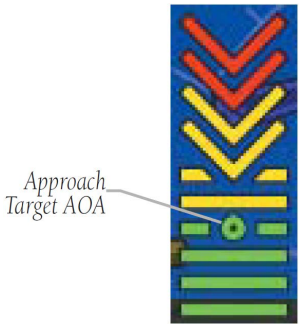
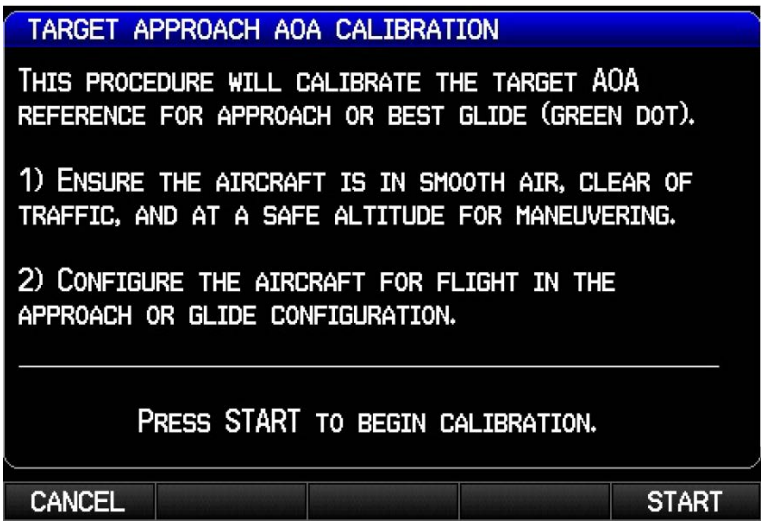
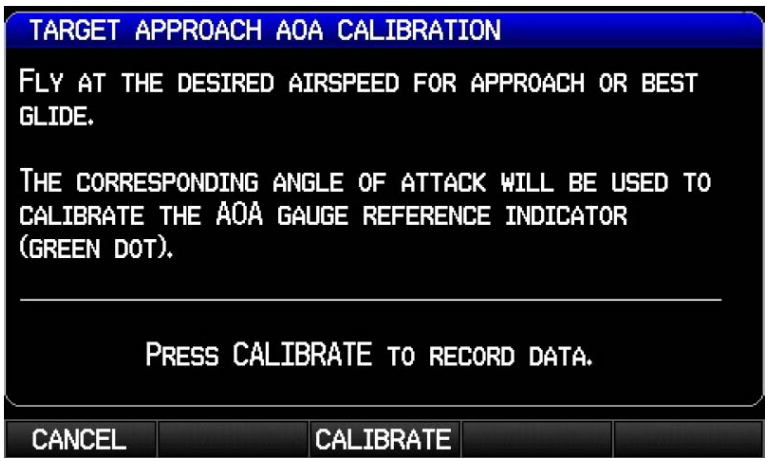


Figure H-29 Approach Target AOA

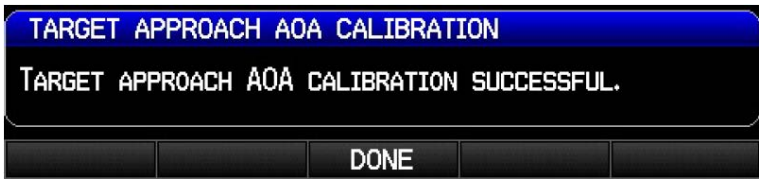
1. Use the FMS Joystick to select the Calibrated Approach Target AOA calibration field, then press the Calibrate softkey.
2. Follow the onscreen instructions, then press the Start softkey to begin the calibration.



3. Press the Calibrate softkey when in compliance with the onscreen instructions.



4. Verify the calibration is successful, then press the Done softkey when finished.



5. This completes the AOA calibration procedure.

H.4.7 FD (Flight Director) Configuration Page

This page (Figure H-30) allows configuration of certain options for the flight director, it will only appear in installations that include an autopilot.

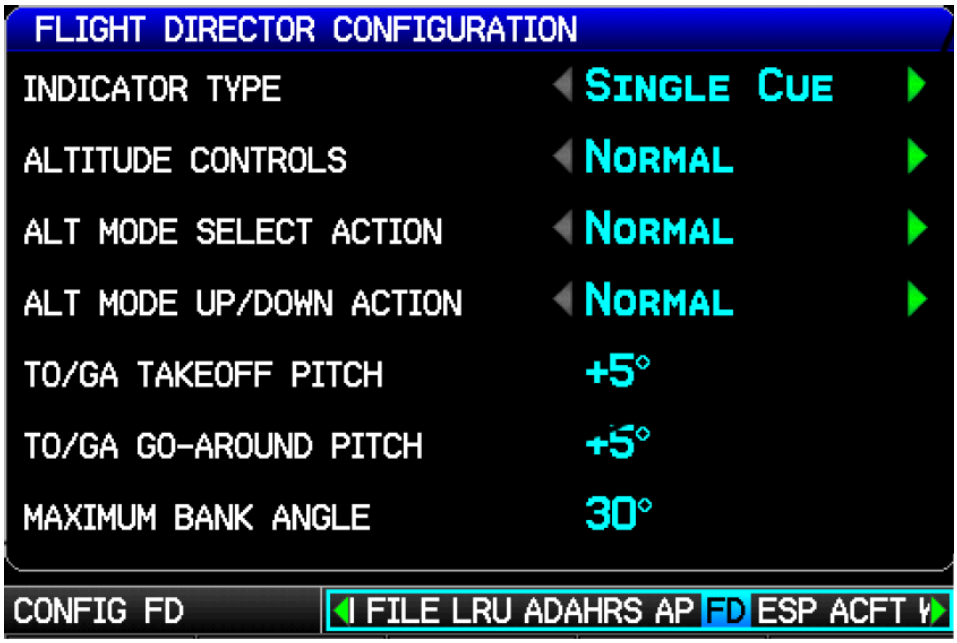


Figure H-30 Altitude Controls, Normal

Indicator Type–Controls whether the flight director command indicator on the PFD uses a single-cue or dual-cue presentation.

TO/GA Takeoff Pitch and **TO/GA Go-Around Pitch**–These fields allow customization of the pitch attitude targets 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. These fields will appear only if a discrete input is configured for the AFCS TO/GA function.

Maximum Bank Angle–Used to limit the maximum roll attitude commanded by the flight director for aircraft that have unusual attitude limitations. This setting should not be adjusted from the default of 30° except for very high performance aircraft that have bank angle limitations at high speeds.

Altitude Controls–Select Normal (default) or Simplified. Selecting Simplified results in a simpler set of behaviors for altitude hold mode. See the G3X Pilot's Guide for additional details.

When Altitude Controls is set to Normal, the following two selections (ALT Mode User Select Action and ALT Mode User Up/Down Action) appear, see Figure H-31:

ALT Mode User Select Action–Select Normal or Sync Alt Bug. This setting controls the actions that occur when the user selects altitude hold mode by pressing the ALT key on the GMC Mode Controller, or the ALT softkey on the GDU. When set to Sync Alt Bug, the selected altitude (altitude bug) will be automatically set to the current aircraft altitude when the user selects altitude hold mode manually by pressing the ALT key on the GMC Mode Controller or the ALT softkey on the display. See the G3X Pilot's Guide for additional details.

ALT Mode User Up/Down Action–Select Normal or Select VS (vertical speed) Mode. This setting controls the actions that occur when the flight director is in altitude hold (ALT) mode and the user moves the pitch wheel on the GMC Mode Controller, or the FMS Joystick up/down. When set to Select VS Mode, moving the pitch wheel on the GMC Mode Controller or the FMS Joystick results in a

change to VS mode for a climb or descent to a new altitude. See the G3X Pilot's Guide for further details.

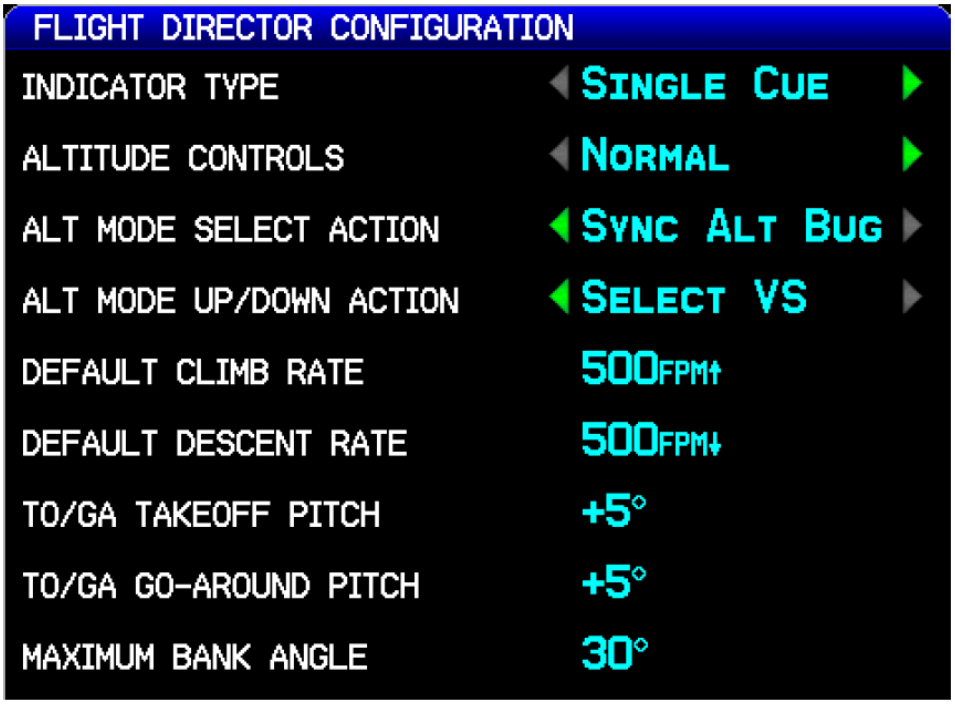


Figure H-31 Default Vertical Speed

When Altitude Controls is set to Simplified , the ALT Mode User Select Action and ALT Mode User Up/Down Action fields do not appear, but the Default Climb Rate/Descent Rate fields do appear as shown in Figure H-32.

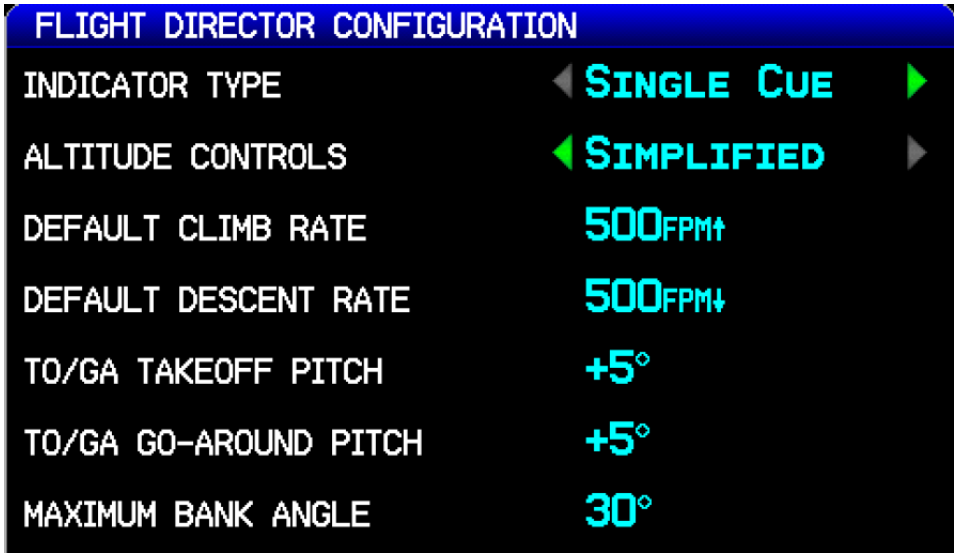


Figure H-32 Altitude Controls, Simplified

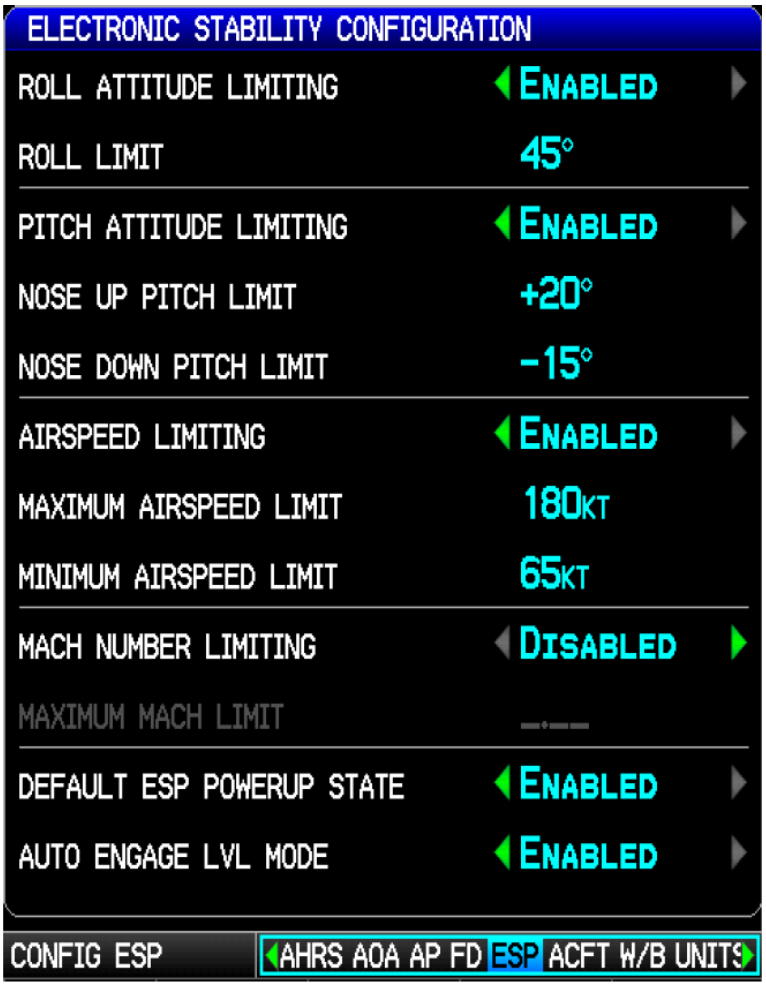
H.4.8 Electronic Stability Configuration Page

This page allows configuration of certain options for the ESP™ corrective technology (Electronic Stability and Protection) function. It will only appear in installations that include an autopilot with Garmin servos. ESP is an optionally enabled feature that is intended to assist the pilot in maintaining the aircraft in a stable flight condition. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

ESP engages when the aircraft exceeds one or more conditions (pitch, roll, airspeed) beyond the normal flight parameters. Enhanced stability for each condition provides a force to the appropriate control surface to return the aircraft to the normal flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude or high airspeed. As the aircraft deviates further from the normal attitude and/or airspeed, the force increases (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range.

See the G3X Pilot's Guide (190-01115-00) for details of ESP operation. ESP is configured on the Electronic Stability Configuration page in Configuration Mode per the following procedure.

1. In configuration mode (Appendix H.2), use the FMS Joystick to select the ESP configuration 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.



Roll Attitude Limiting–Select Enabled or Disabled (all other fields remain blank when Disabled).

Roll Limit–Enter desired Bank Limit of aircraft (range 45°to 60°, this limit will appear as Guardrails on the PFD.

Pitch Attitude Limiting–Select Enabled or Disabled.

Nose Up/Down Pitch Limit–Enter desired Pitch Limit of aircraft. Allowable range of +10° to +25° for Nose Up Limit, and -10°to -25° for Nose Down Limit (default settings are +20° and -15° respectively).

Airspeed Limiting–Select Enabled or Disabled.

Maximum/Minimum Airspeed Limit–Allowable range of settings are 50 kt minimum airspeed to 999 kt maximum airspeed.

NOTE

The minimum airspeed setting should be set to a value lower than the minimum airspeed that is anticipated during approach while above 200 ft AGL.

Mach Number Limiting–Select Enabled or Disabled.

Maximum Mach Limit–Enter desired Mach Limit of aircraft. This field does not appear unless an MMO (maximum operating mach) value is entered on the Aircraft Configuration page. Allowable range of settings are from 0.10 mach minimum to 1.0 mach maximum (default setting is 0.5).

Default ESP Powerup State–Select Enabled or Disabled. Setting determines whether the ESP is functioning upon powerup. If disabled, ESP can still be enabled in normal operating mode.

NOTE

ESP can also be inhibited with an optional external toggle switch connected to a discrete input. See ESP Inhibit information in Section 28.4.18.3.2 and interconnect example in Figure 27-2.2 page 2.

Auto Engage LVL Mode–Select Enabled or Disabled. When enabled, the autopilot will engage with the flight director in Level Mode to bring the aircraft into level flight if ESP has been engaged for more than 10 seconds of a 20 second time period.

H.4.9 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.

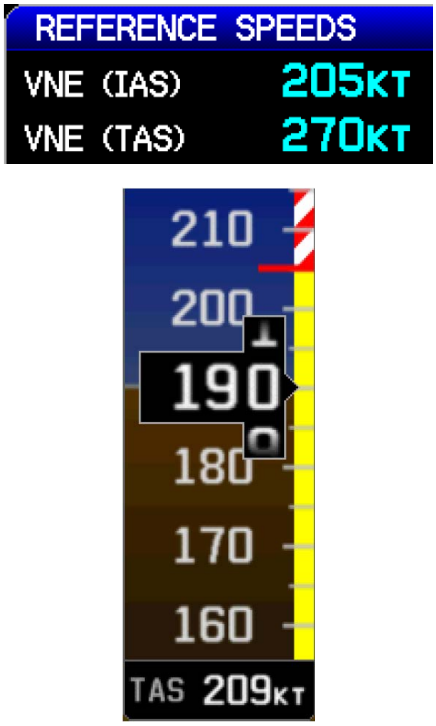
To clear a reference field:

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

To clear a label field:

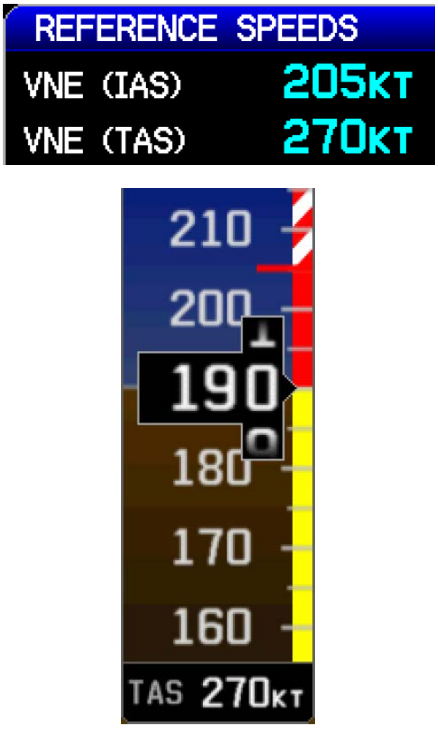
1. Highlight the desired label field.
2. Press the CLR key.

The aircraft's maximum speed limit can be configured in three different ways. All aircraft have a maximum indicated airspeed limit (VNE) which is configured using the VNE (IAS) field. This airspeed is marked on the PFD airspeed tape with a red line, and does not change with altitude. In this example, the value for VNE has been entered as 205 knots indicated airspeed. The aircraft is below the never-exceed speed any time its indicated airspeed is below 205 knots.



For certain aircraft types, maximum airspeed is additionally limited by true airspeed (TAS). A secondary airspeed limit expressed as true airspeed may optionally be configured using the VNE (TAS) field. This airspeed is marked on the PFD airspeed tape with a second red color band, which shows the equivalent indicated airspeed at which the aircraft's true airspeed will exceed the configured true airspeed limit value. At low altitudes where true and indicated airspeed are similar, the PFD airspeed tape will show only the indicated VNE limit. At higher altitudes where true airspeed increases, a second red color band will begin to appear on the PFD airspeed tape to indicate the point where the aircraft will exceed the true airspeed limit at the current pressure altitude.

In this example, the aircraft's VNE values have been configured as 205 knots indicated airspeed, and 270 knots true airspeed. At high altitudes, the aircraft can reach the true airspeed limit even if its indicated airspeed is below the normal indicated VNE "red line". The second red band on the PFD airspeed tape alerts the pilot to this condition.



A third way to configure the aircraft's maximum airspeed limit is to enter a value for Maximum Operating Mach Number (MMO, see Appendix H.4.8). As with TAS-based VNE, the value for MMO will be displayed on the PFD airspeed tape using a second red band that shows the equivalent indicated airspeed at which the aircraft's Mach number will exceed the configured maximum Mach number. At high altitudes, the aircraft can reach the maximum Mach limit even if its indicated airspeed is below the normal indicated VNE "red line". The second red band on the PFD airspeed tape alerts the pilot to this condition

Flight Planning–The flight planning fields 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 on 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.

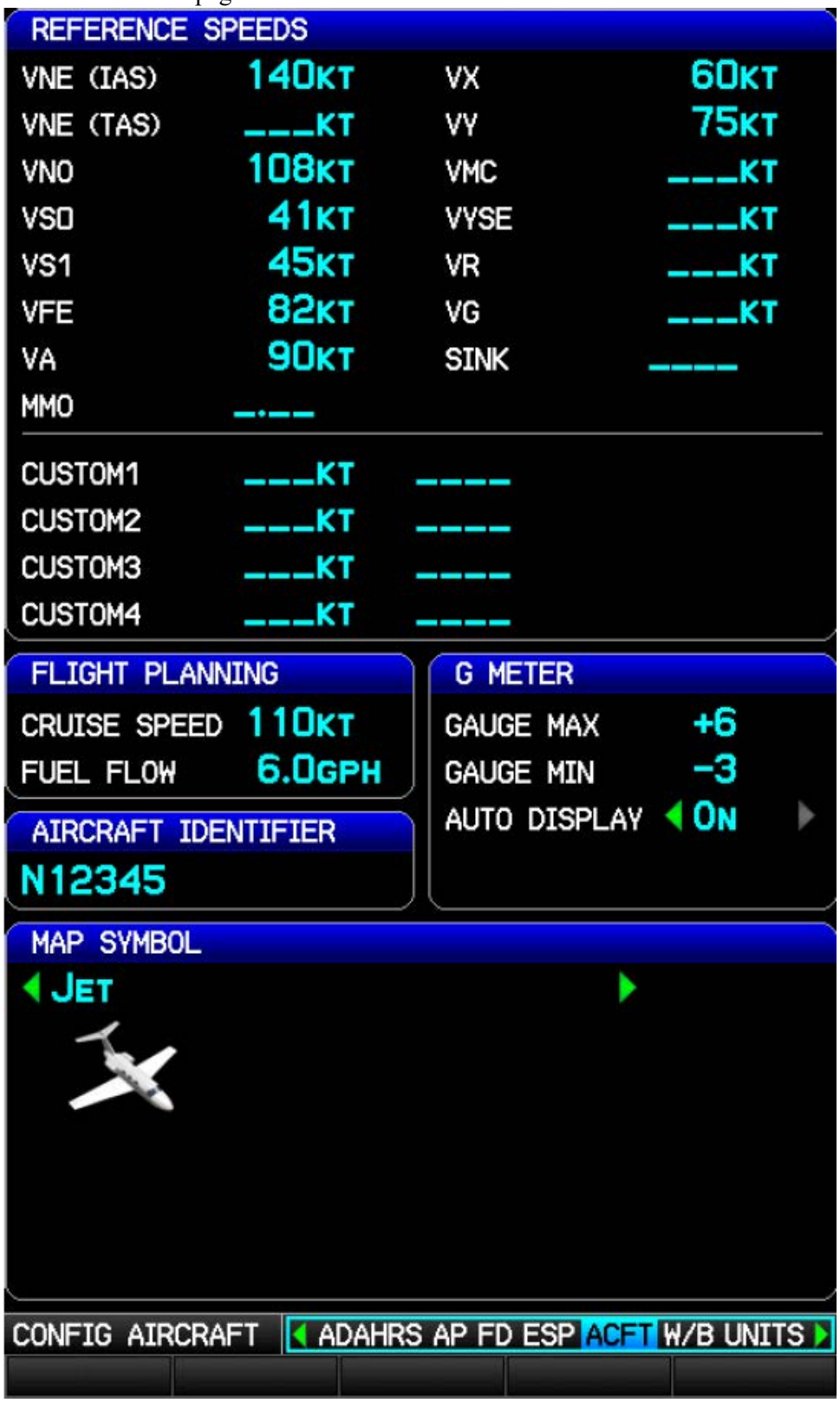
NOTE

To use a downloaded .srf aircraft symbol, create a 'Vehicle' directory on the SD card(s), then copy the .srf file to the new 'vehicle' directory. 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.



H.4.10 W/B (Weight/Balance) Configuration Page

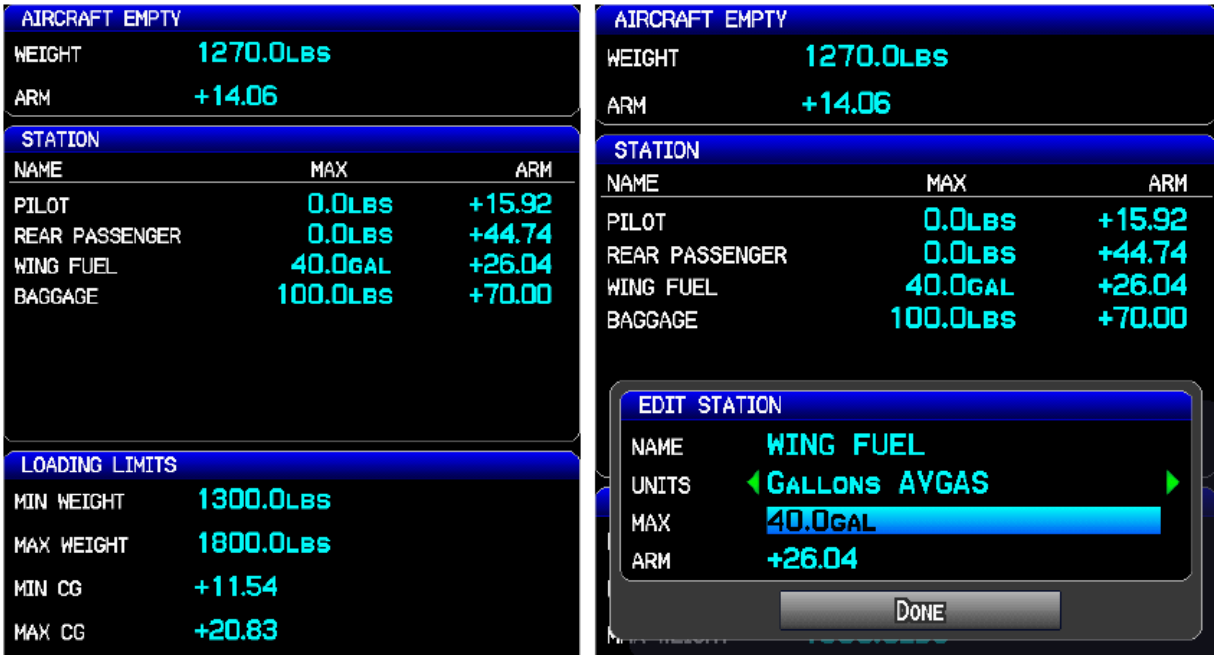
The W/B Configuration Page allows setting the weight and balance parameters for the airplane. These parameters are then used on the Main Menu W/B Page in normal mode. Weight/Balance may be used during pre-flight preparations to verify the weight and balance conditions of the aircraft. By entering the 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.

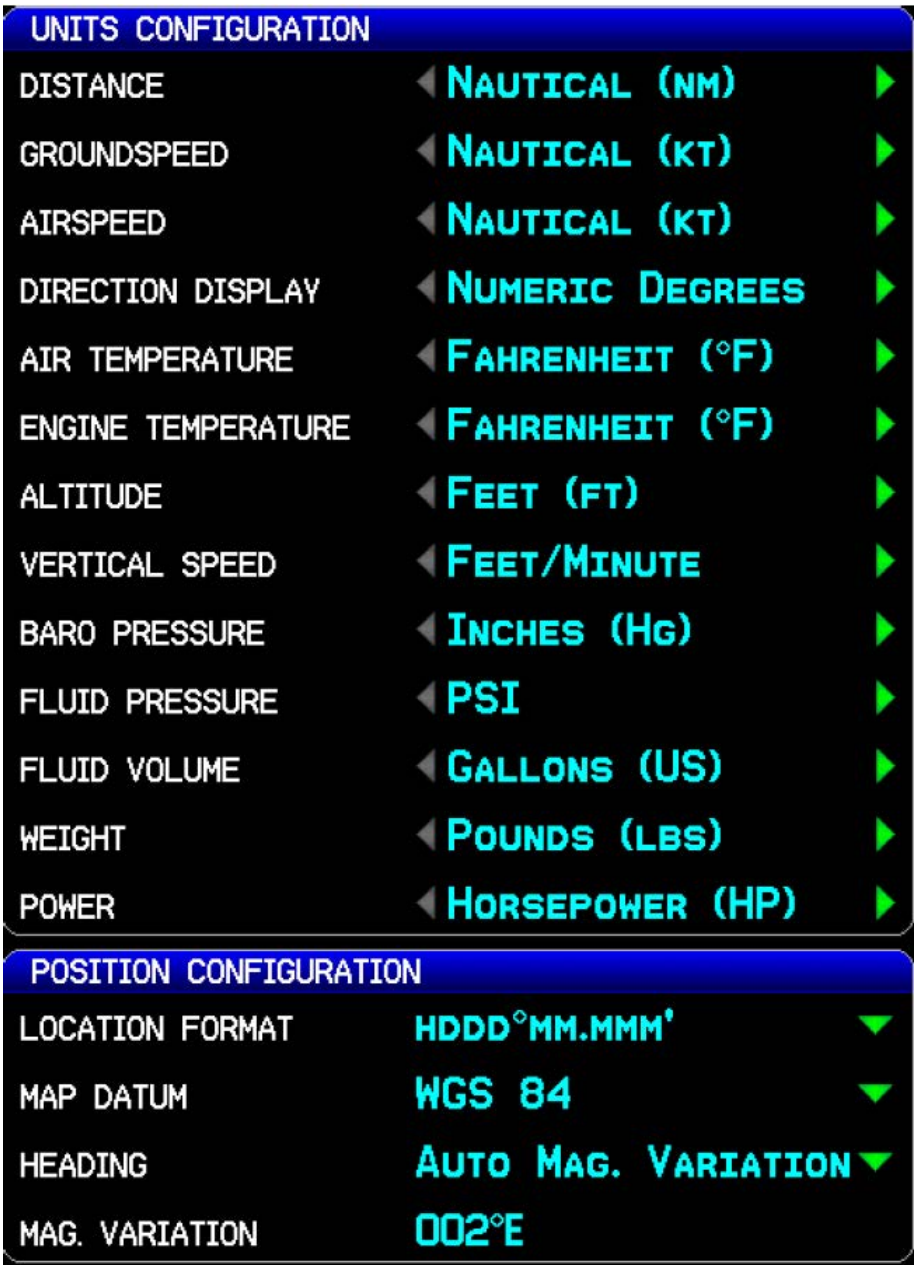
H.4.11 UNITS Configuration Page

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.



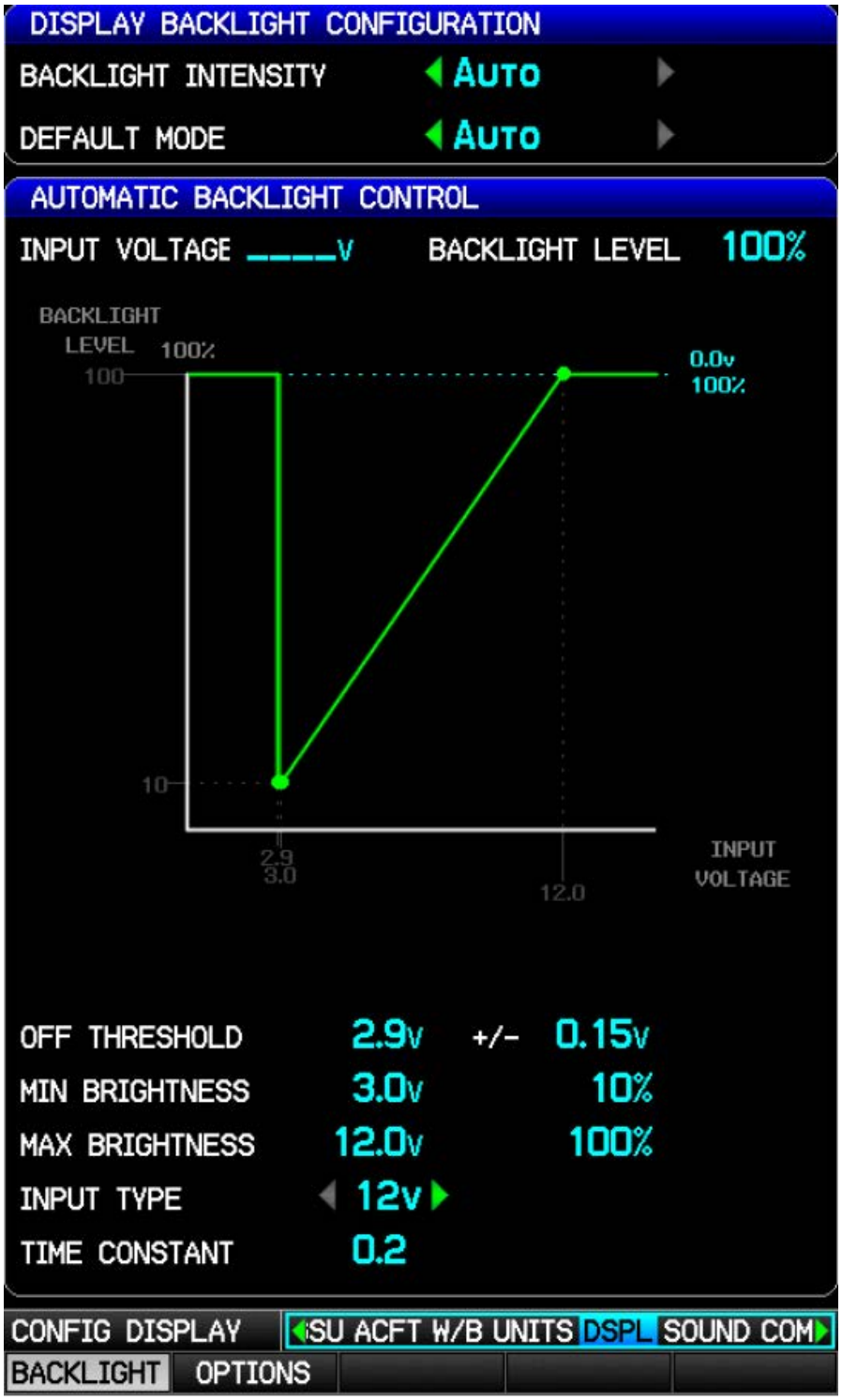
2. Use the FMS Joystick to select the desired configurable item and make the desired change. Then press the ENT Key or use the FMS Joystick to select the next item. Press the FMS Joystick to move the cursor to the page selection menu when finished.



H.4.12 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.

H.4.12.1 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 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 ignored, and the display brightness will remain at the Min Brightness level for any voltage between zero volts and the Min Brightness voltage setting.

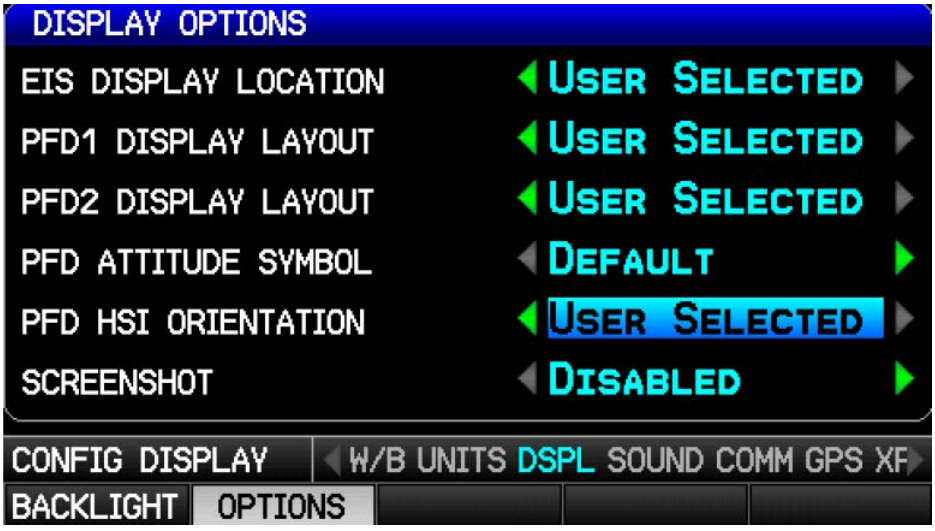
Min Brightness (Voltage and Percentage)–Sets the lower bus voltage required to turn the backlighting on to the percentage of brightness set by the Min % setting. Default values are 3.0 V and 10%.

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), the brightness level responds to changes in the input voltage level.

H.4.12.2 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 Auto Declutter - Determines whether non-essential information will be removed from the PFD display when the aircraft is in an unusual attitude. Set to “Disable” to retain all information on the PFD during aerobatic maneuvers.

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.

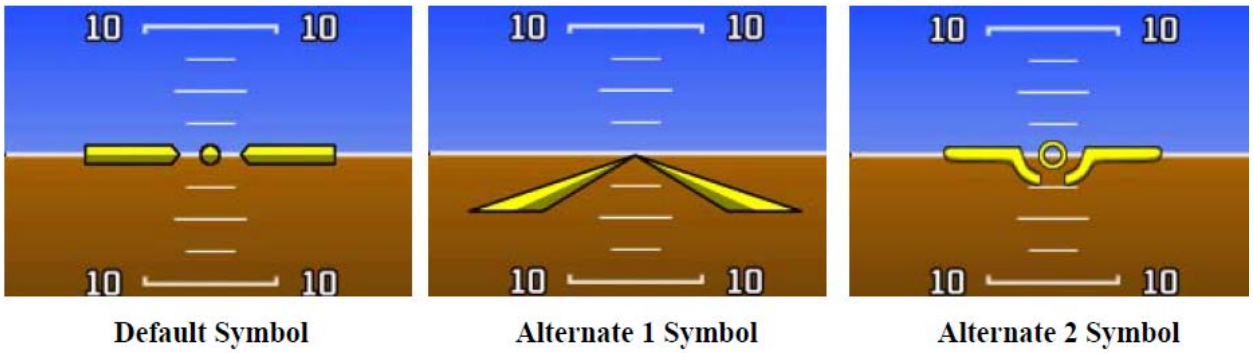


Figure H-33 PFD Attitude Symbols

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. 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.

H.4.13 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

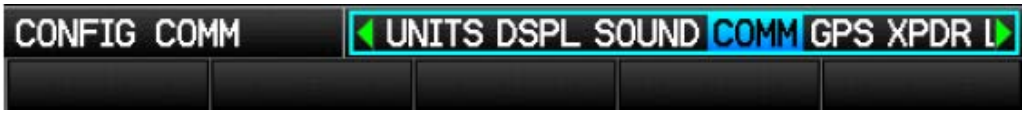
Alert Source – If more than one GDU 37X is installed, an Alert Source field will appear on the SOUND Configuration page. The Alert Source field allows the user to select which GDU will generate the alert sounds. The Alert Source options are: PFD1, PFD2, MFD, or Auto (which will use whichever unit is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

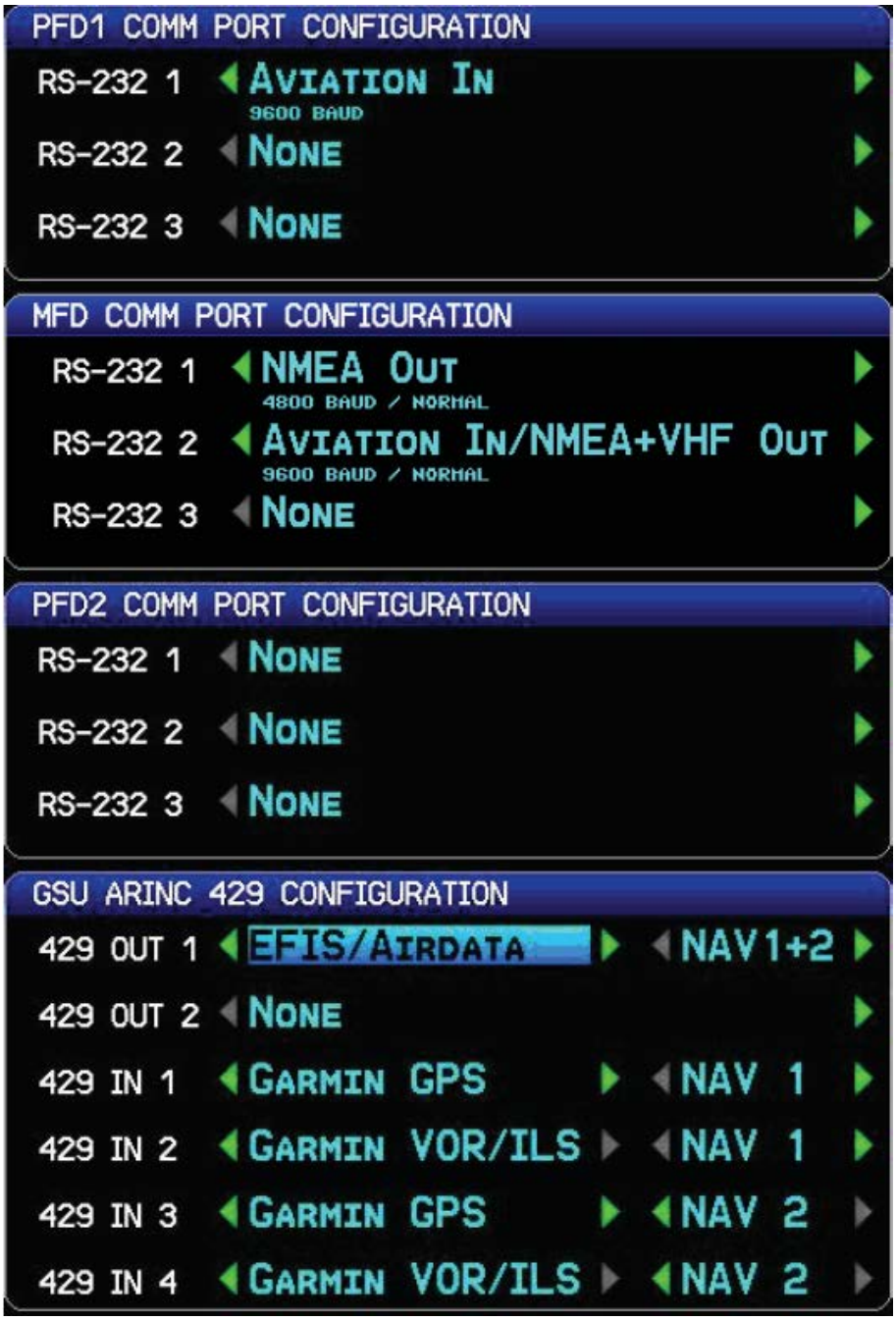
H.4.14 COMM Configuration Page

The COMM Configuration Page allows configuration of the RS-232 ports on the GDU 37X displays, and ARINC 429 ports on the GAD 29 or GSU 73.

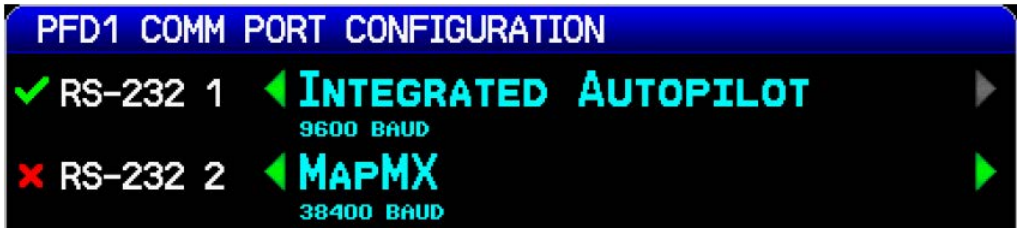
1. In configuration mode, use the FMS Joystick to select the COMM Page.



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.

NOTE

Some panel-mount GPS navigators and NAV/COM radios do not transmit RS-232 or ARINC 429 data when they are in configuration mode. To verify RS-232 and ARINC 429 connections, make sure these units are operating in normal mode.

H.4.14.1 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 30X)

Garmin HSDB - Used for connecting to compatible Garmin LRUs (e.g. GTS™ 8XX traffic system, see Section 25.2 and Appendix G.2)

NMEA Out - Supports the output of standard NMEA 0183 version 3.01 data at a user selectable baud rate of either 4800 or 9600. The GDU outputs data from the selected GPS source (internal GPS or external GPS1/GPS2) using NMEA sentences.

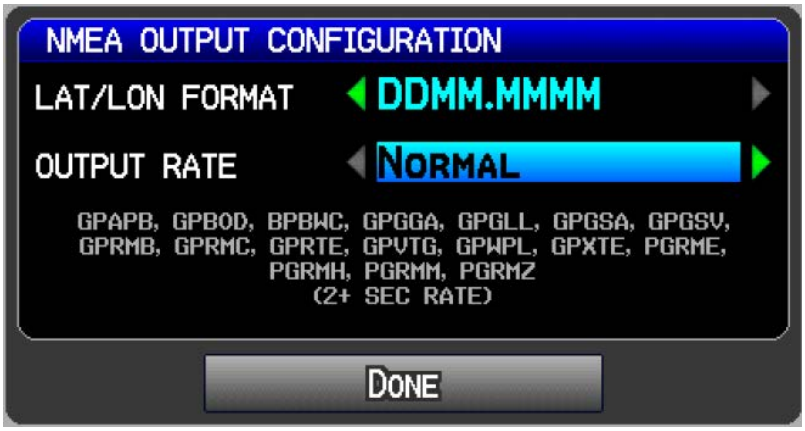
A setting that allows switching the NMEA output between "Normal" and "Fast" speeds is accessed by pressing the MENU Key on the Comm Page (at least one output must be set to NMEA Out) followed by the ENT Key.



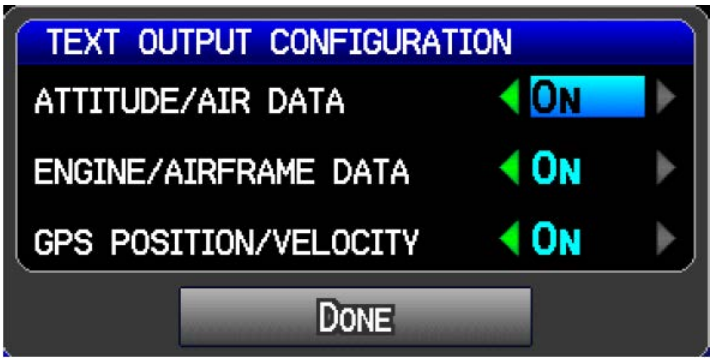
A pop-up window appears which allows the selection of the Lat/Lon format and the output rate. These settings affect all RS-232 ports that are configured to output NMEA data. The selected speed is displayed following the baud rate now for all ports configured for NMEA output. This feature is useful for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



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.

Aviation Out - Primarily used to provide GPS data to ELT units. Can also be used to send data to a portable GPS unit.

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).

GTX™ transponder 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 Section 25.2), 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 Section 25.2), it is not necessary to select TIS-A In, as the transponder data is received using the ADAHRS 1 LRU.

Garmin VHF Nav/Comm - Outputs frequency tuning and VOR radial selection data to an SL30 or GNC® 255 VHF Nav/Comm radio. Receives lateral/vertical NAV deviation signals and radio status data for on-screen radio display.

Garmin VHF Comm - Outputs frequency tuning data to an SL40, GTR 200, or GTR 225 Comm radio, and receives radio status data for on-screen radio display.

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 Section 25.2 and Appendix G.2.

Note the following when configuring the communication settings:

- Each GNS™ 4XX/5XX receivers, GNS 480, or GTN™ 6XX/7XX touchscreen avionics series unit must be connected to a 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 4XX/5XX, GNS 480, or GTN 6XX/7XX series unit will be ignored unless a corresponding MapMX/Aviation RS-232 input is also configured.
- When connecting two GNS 4XX/5XX, GNS 480, or GTN 6XX/7XX 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 using the GDU.

CO Detector - Receives data from a third-party carbon monoxide detector. Refer to the G3X Pilot’s Guide or the G3X Touch™ Avionics Pilot’s Guide for further information.

H.4.14.2 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 GNS 4XX/5XX series unit. A second selection is used to find 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
205	Mach Number	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/GTN or GNS 480 unit. A second selection is used to find if the GPS input is from NAV 1 or NAV 2.

Garmin VOR/ILS – Receives VOR/ILS labels from a GNS/GTN or GNS 480 unit. A second selection is used to find if the GPS input is from NAV 1 or NAV 2.

H.4.15 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.

'No GPS Antenna Connected' may also be selected if a GPS 20A is used for GPS position. A GPS 20A provides GPS data to the GDU(s), so the GDU(s) do not require being connected to a GPS antenna.

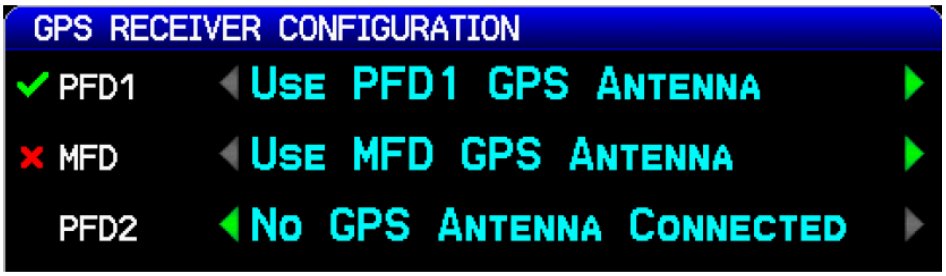
NOTE

For installations w/out a GPS 20A, 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 4XX/5XX, GNS 480, or GTN 6XX/7XX series unit, see Section 25.2 or Appendix G.2). 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 (see Section 2.5.1) 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).



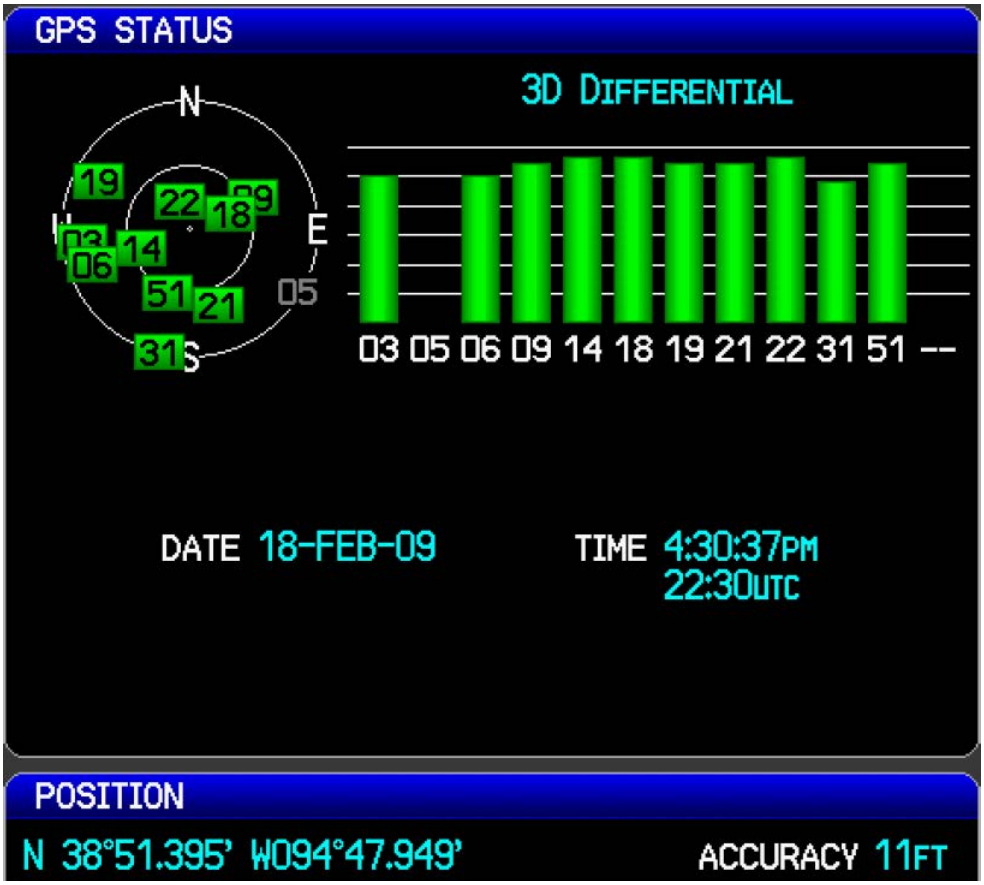
H.4.15.1 GDU 37X Test Procedure

GPS Receiver Signal Acquisition Test:

1. Power on unit (normal mode) and use the FMS Joystick to select the Info Page.



2. Verify 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. After the preceding signal acquisition test 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.

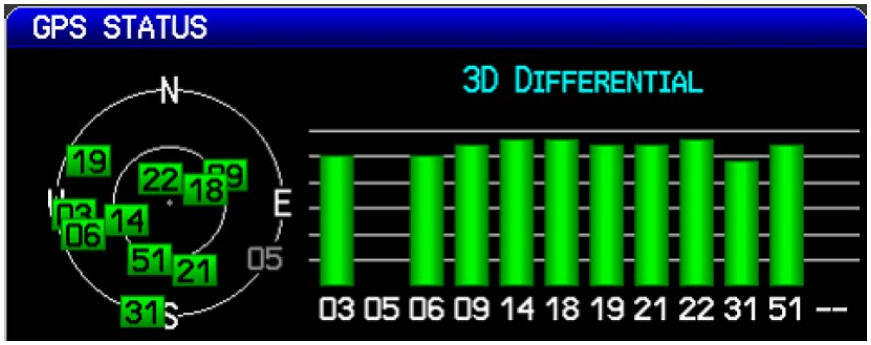


2. Monitor GPS status on the Main Page. Possible GPS status indications include:
   - NO ANTENNA
   - AutoLocate® global positioning indicator
   - LOST GPS FIX
   - 2D GPS FIX
   - 3D GPS FIX*
   - SEARCHING THE SKY
   - ACQUIRING
   - NO GPS FIX
   - 2D DIFFERENTIAL FIX
   - 3D DIFFERENTIAL FIX*

   *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.



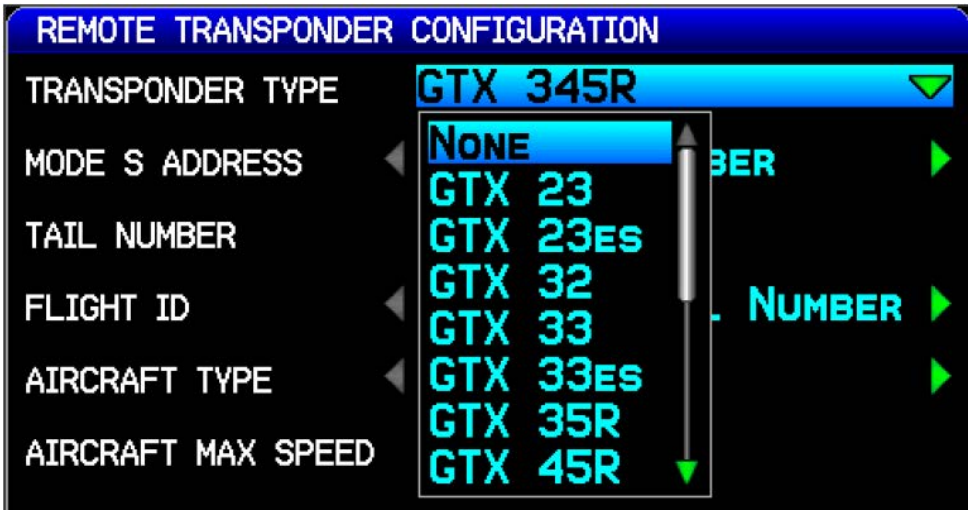
H.4.16 XPDR Configuration Page

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.



Tail Number: Enter the applicable aircraft tail number.

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 Mode S Address.

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.

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: GTX 23/23ES/33/33ES only. 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).

Position Integrity: This selection is only available for GTX 23 ES and GTX 33ES units. Refers to the integrity level of the separate TSO WAAS GPS input that can be connected to the transponder. Set to 1E-7 when a certified GNS/GTN/GPS unit or GPS 20A is providing ADS-B Out+ to the transponder. Set to "VFR GPS" if none of these devices (certified GNS/GTN/GPS unit or GPS 20A) are connected to the transponder.

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.

HSDB GTN/GTS Device: These fields are only available when Transponder Type is configured for a GTX 345, 345R, or 45R. Used to select which device(s) the GTX will communicate with (GTN and/or GTS) using HSDB.

RS-232 Ports 2-4: GTX 35R/45R/335R/345R units only.

The available selections are:

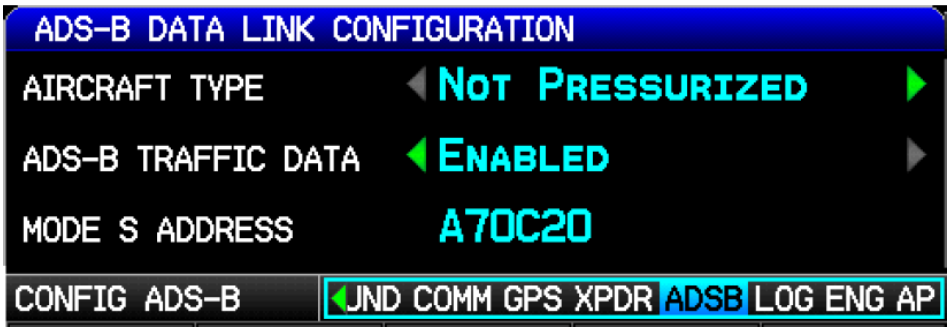
Selection	Description
None	GTX RS-232 port not used
ADS-B+ GPS	GPS position input from a TSO GPS source (9600 baud)
Connext® computer application Format 3 (GTX X45 only)	Connext weather and traffic data for a Flight Stream 110/210
GNS (GTX X45 only)	Weather data to / GPS position input from a GNS

NOTE

A "Configuration Error" indication is most commonly the result of one or more items on the transponder configuration page which have been left un-configured. For proper transponder operation, all items on this page must be properly configured.

H.4.17 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 Section 25.2 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.



H.4.18 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. Use Max Log Files to set the maximum number of log files to be stored, or press CLR for no limitation on the maximum number of files stored.



H.4.19 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. The following sections describe configuring items listed in the Engine/Airframe Input Configuration section of the Engine Configuration page.



H.4.19.1 Engine/Airframe Sensors

Each of the sensors must be correctly installed (Section 22) and configured before use. The Engine inputs being monitored are displayed as gauges on the EIS display (Figure H-34) and also on the MFD's Engine Page.

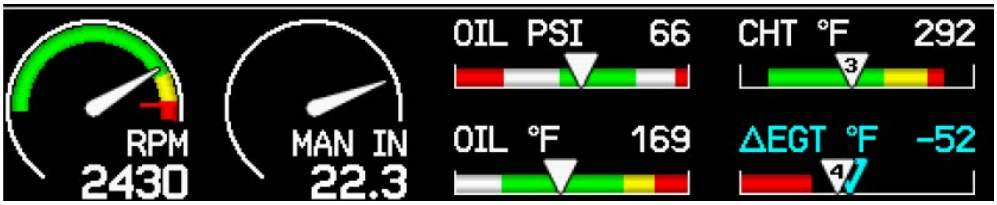


Figure H-34 EIS Display (Engine Bar)

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

H.4.19.2 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.

Section 27 through Section 30 contain interface drawings for sensor installations using the Garmin sensor kits, and for other sensor installations.

H.4.19.3 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 H-35 or GSU 73, Figure H-36) will be displayed.

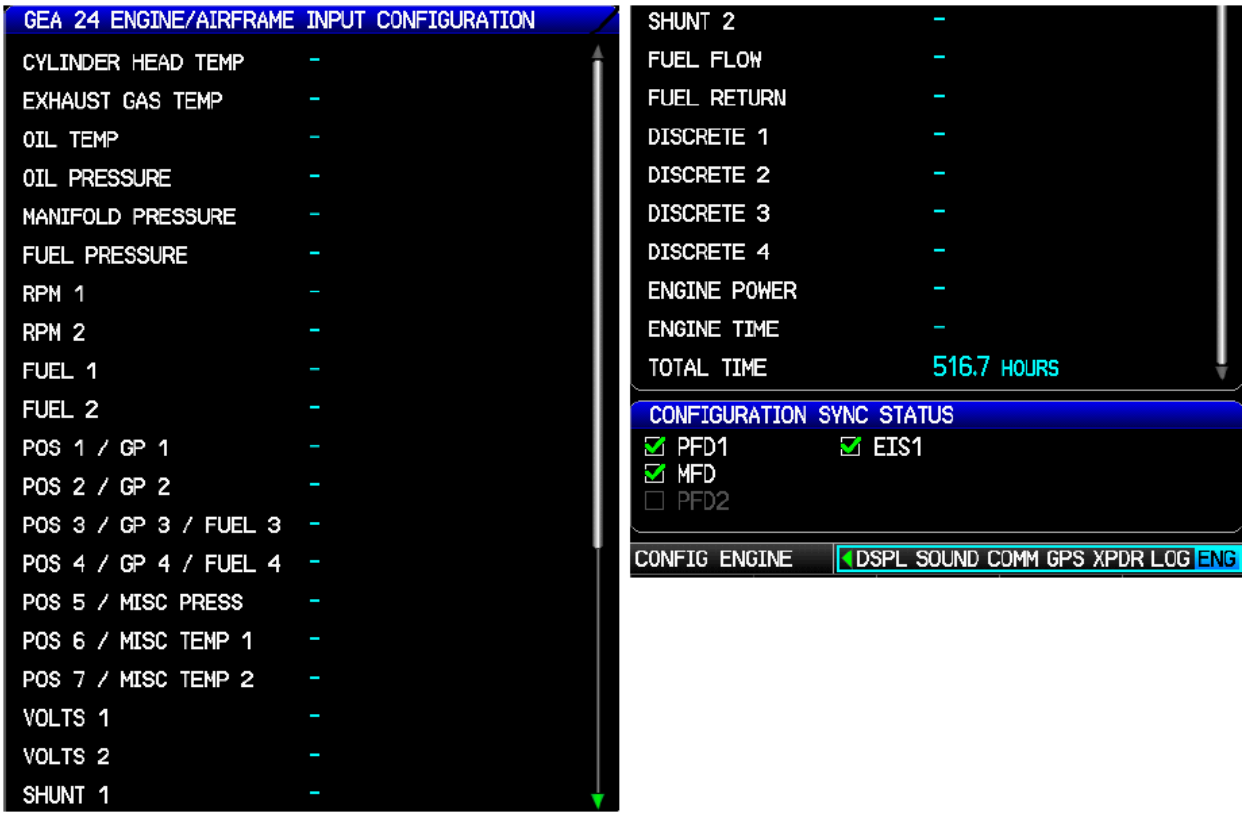


Figure H-35 GEA 24 Engine/Airframe Input Configuration Page

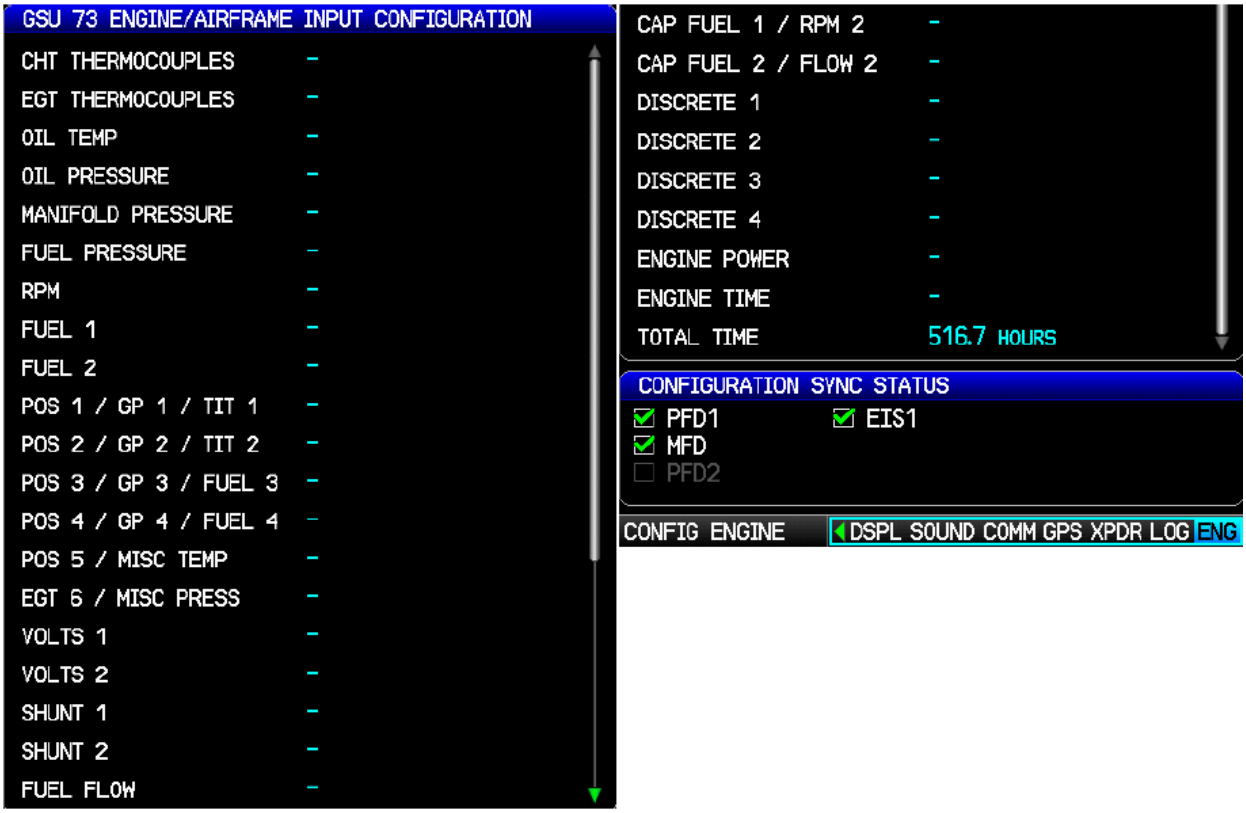


Figure H-36 GSU 73 Engine/Airframe Input Configuration Page

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 Appendix H.4.19.4 for calibration information.See also Engine Time Configuration and Total Time information.

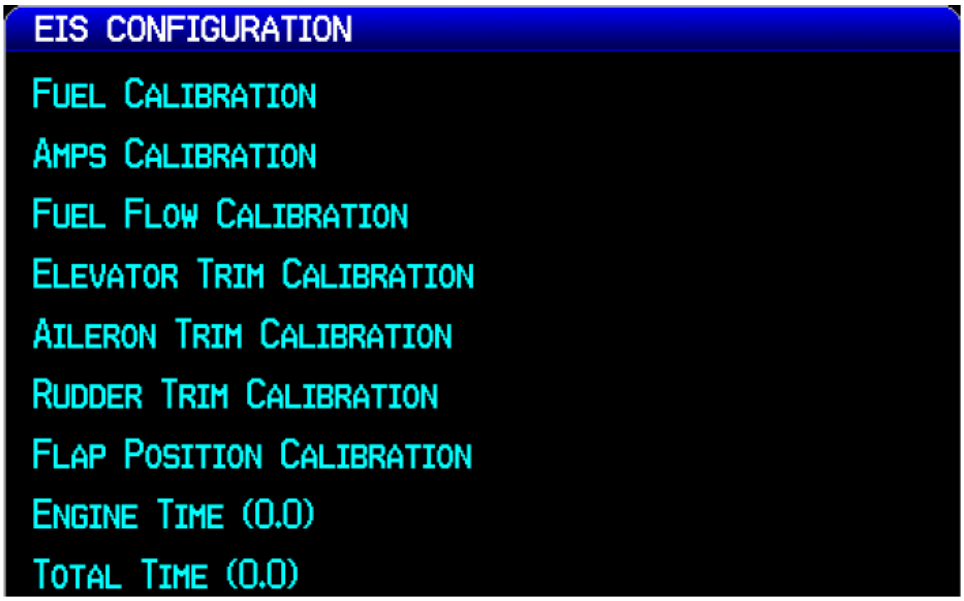


Figure H-37 EIS Configuration Page

Refer to Appendix H.2 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) (Appendix H.4.19, including Appendix H.4.19.3.1 - Appendix H.4.19.4.).
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.

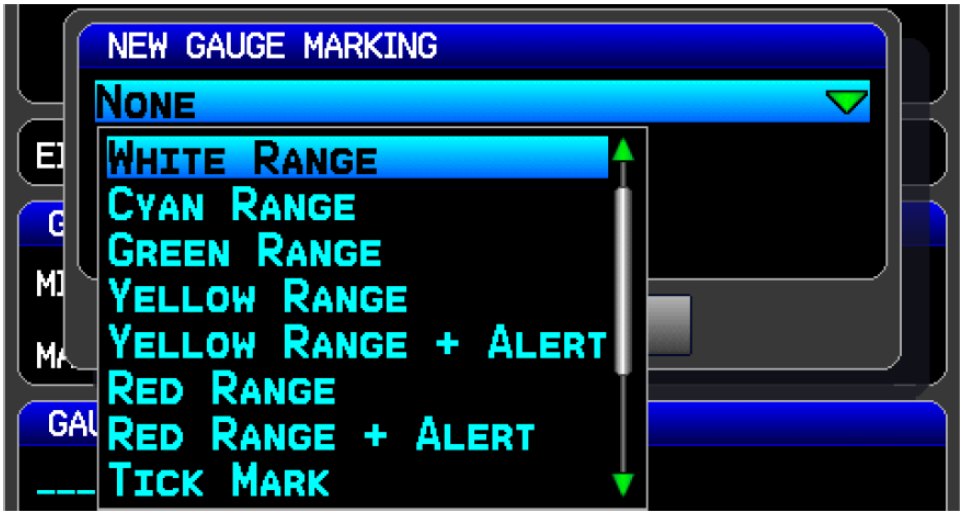
H.4.19.3.1 Common Configuration Options

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:

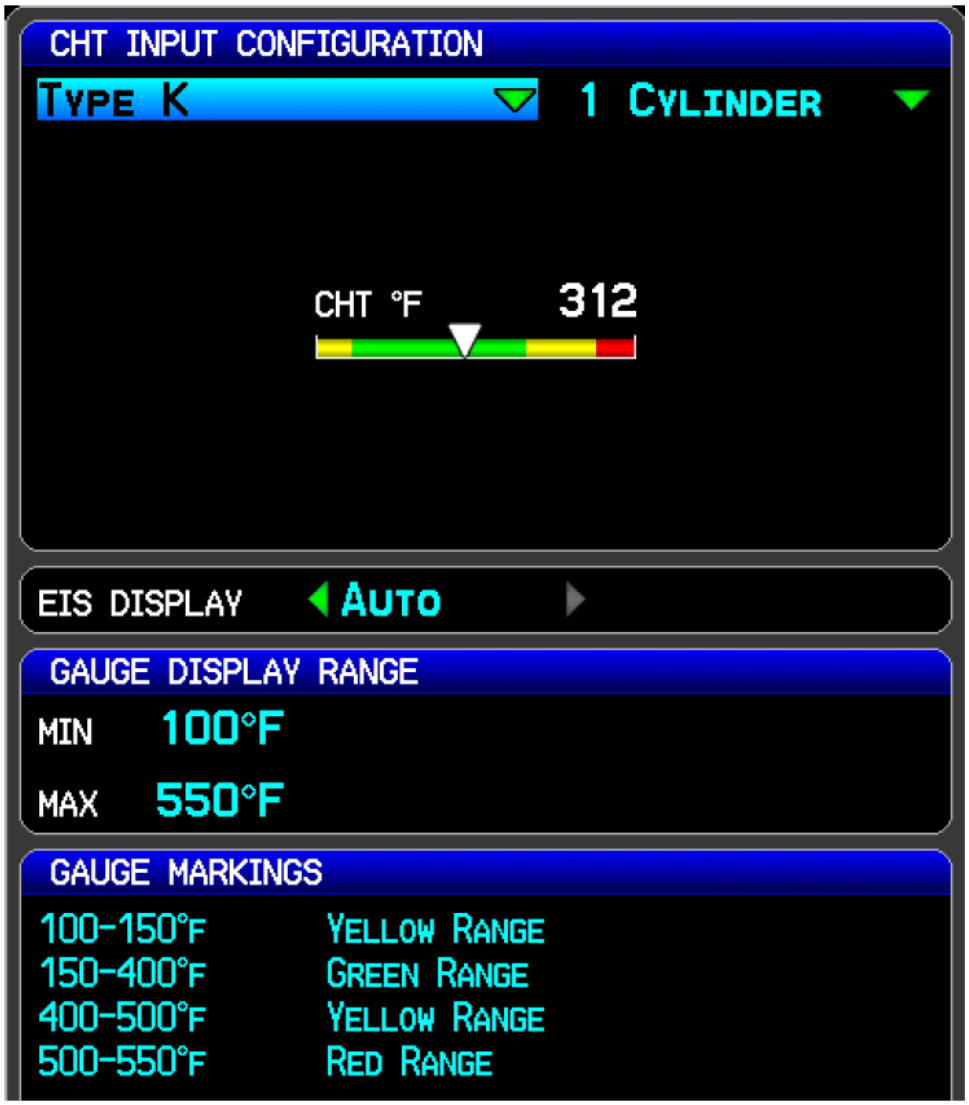
White Range	Cyan Range	Green Range
Yellow Range	Yellow Range +Alert	Red Range
Red Range + Alert	Tick Mark	Cyan Line
Green Line	Yellow Line	Red Line



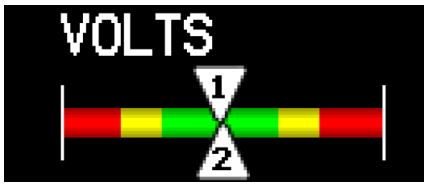
Gauge Display Range – The Gauge Display Range allows for setting the minimum and maximum values of each gauge.



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

H.4.19.3.2 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 Section 25 through Section 30 for wiring guidance.

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 (Section 29.2). For the GSU 73, Rotax CHT sensors are connected and configured using the GSU 73 general purpose (GP) inputs (Section 29.3).

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 Lean Assist for more information).

Rotax 912iS/915iS: For the GEA 24, select "Rotax FADEC" as the EGT configuration to use EGT data from the Rotax 912iS/915iS 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.

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 Lean Assist for more information).

RPM

The following sensors can be configured for the RPM 1 input on the GEA 24, or the RPM input on the GSU 73:

- 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)
- Jabiru Alternator RPM (6 pulses per revolution)
- JPI 4208XX - Magneto Port RPM Sender (4- or 6- cylinder)
- Rotax Trigger Coil RPM
- UMA 1A3C Mechanical RPM Sender
- UMA T1A9 Magneto Port RPM Sender (4- or 6-cylinder)

Rotax 912iS/915iS: For the GEA 24, select "Rotax FADEC" as the RPM configuration to use engine speed data from the Rotax 912iS/915iS FADEC interface.

NOTE

External components are required when using the Rotax Trigger Coil configuration with the GSU 73 (see Figure 29.3).

Custom: These options allows the installer to enter up to 8 points of frequency-to-RPM calibration, using any RPM sensor that has a known frequency output. The custom RPM configurations accept frequency values up to either 500 Hz or 1 kHz; the lower-frequency configuration is better suited to noisy RPM signals. Custom RPM configurations also support engine speed displayed in percent instead of RPM.

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.

Misc (miscellaneous) Pressure

These inputs (GEA 24, J244, Pin 31; GSU 73, J732, Pin 31) allow the monitoring of inputs such as hydraulic pressure, and allow the installer to create/enter the name of the gauge. Options of several different Kavlico pressure sensors are provided, or if "Misc Press (Custom)" is selected, the installer can enter up to 8 points of voltage-to-pressure calibration.

Manifold Pressure

The following sensors can be configured for the Manifold Pressure input on the GEA 24 or GSU 73:

- Garmin GPT 30A
- Kavlico P4055-30A
- Kavlico P500-30A
- UMA 1EU50A
- UMA 1EU70A

Rotax 912iS/915iS: For the GEA 24, select "Rotax FADEC" for the manifold pressure configuration to use manifold pressure data from the Rotax 912iS/915iS FADEC interface.

Oil Pressure

The following sensors can be configured for the Oil Pressure input on the GEA 24 or GSU 73:

- Garmin GPT 150G
- Kavlico P4055-150G
- UMA 1EU150G

Rotax/Jabiru oil pressure sensors: Rotax oil pressure sensor part numbers 456180, 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/915iS: For the GEA 24, select "Rotax FADEC" to use oil pressure data from the Rotax 912iS/915iS FADEC interface.

NOTE

The Rotax 456180 and 956413 oil pressure sensors require an external resistor for proper functioning (see Figure 29.2 for GEA 24 and Figure 29.3 for GSU 73).

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
- Type K Thermocouple
- Jabiru / VDO 320-021 (or similar VDO 50-150°C thermistor sensor)

Rotax 912iS/915iS: For the GEA 24, select "Rotax FADEC" to use oil temperature data from the Rotax 912iS/915iS FADEC interface.

Fuel Pressure

The following sensors can be configured for the Fuel Pressure input on the GEA 24 or GSU 73:

- Garmin GPT 15G (0-15 PSI for carbureted engines)
- Kavlico P4055-5020-2 (0-15 PSI, for most carbureted engines)
- Garmin GPT 75G (0-75 PSI for fuel-injected engines)
- Kavlico P4055-5020-3 (0-75 PSI, for most fuel-injected engines)
- Kavlico P4055-75G (0-75 PSI)
- Kavlico P500-75A (0-75 PSI absolute, for Rotax engines requiring absolute fuel pressure measurements)
- UMA NAEU07D (0-7 PSI differential, for some turbocharged carbureted engines such as the Rotax 914)
- UMA 1EU35G (0-35 PSI, for most carbureted engines)
- UMA 1EU70G (0-70 PSI, for most fuel-injected engines)
- UMA 1EU70D (0-70 PSI differential)

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
- Type K Thermocouple
- MS28034/MIL-T-7990 RTD
- Rotax 965531
- Rotax 966385

Coolant Pressure

The Garmin GPT 75G or Kavlico P4055-5020-3 sensor can be configured to monitor engine coolant pressure on the GEA 24 or GSU 73 MISC PRESS input.

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 1 & 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/915iS: For the GEA 24, select "Rotax Coolant Temp (FADEC)" for the MISC TEMP 1 input to use coolant temperature data from the Rotax 912iS/915iS FADEC interface.

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, 966385, or the VDO 320-XXX series)
- UMA 1B10R, UMA 1BXR-C (or any Pt100-type RTD sensor)
- Type J or Type K thermocouple

Rotax 912iS/915iS: For the GEA 24, select "Manifold Air Temp (Rotax FADEC)" for the MISC TEMP 1 or 2 input to use manifold air temperature data from the Rotax 912iS/915iS FADEC interface.

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 27.3).

The analog and digital fuel quantity inputs require calibration (see Appendix H.4.19.4).

NOTE

Note: After performing fuel quantity calibration, it is advised to back up the calibration data to an SD card (see Appendix H.4.19.4). Changing the configuration for a fuel quantity input may reset calibration data.

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 Appendix H.4.19.4).

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.

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/915iS: 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/915iS ECU. Configure the VOLTS 2 input to "Rotax FADEC ECU Bus B Volts" to power supply voltage data from ECU Lane B.

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 27-2.2 and Figure 27-3.1). 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 27-2.2 and Figure 27-3.1). Hall effect sensors can optionally be calibrated to adjust for installation differences (see Appendix H.4.19.4). 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.

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
- Floscan 231

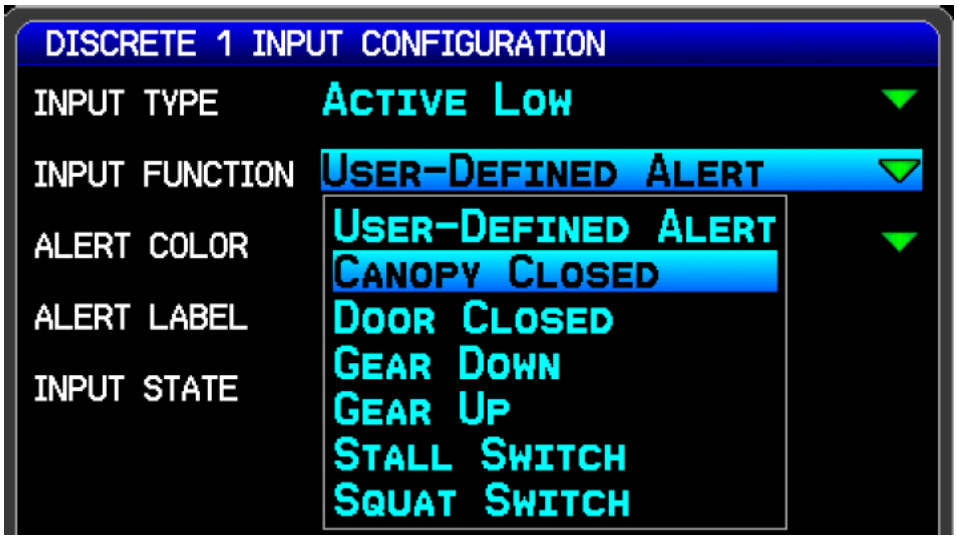
The fuel flow input requires calibration (see Appendix H.4.19.4).

Rotax 912iS/915iS: 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).

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 24.5.9 and Appendix F.5.5.1 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:

- 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 red alert will generate an audible warning tone.
- 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. When the aircraft's indicated airspeed is greater than VFE, VLE, or VLO (whichever is lowest) the CHECK GEAR alert message will not appear.
- 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).

- Gear Up (Amphib) - Same as the preceding Gear Up configuration, except it also displays a blue GEAR UP message on the PFD when the gear is confirmed up. This is intended for use in amphibious aircraft that desire a positive indication of both gear-up and gear-down states.
- Stall Switch - When the input is active, a red flashing STALL message appears on the PFD and a warning tone sounds continuously. (Audible stall warning tones are inhibited when the aircraft is on the ground.)
- 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.
- Speed Brake - Used with a switch that activates the input when the aircraft's speed brake is fully retracted (closed). A white SPEED BRAKE message will appear on the PFD if the Speed Brake discrete input is not active. If engine power is increased, such as if the speed brake is deployed during takeoff or climb, the SPEED BRAKE message will flash red and a tone will sound. If the aircraft has a maximum airspeed limit for speed brake deployment, it can be configured as a custom reference speed with the label "VSB" (see Appendix H.4.9). Regardless of engine power setting, if the Speed Brake input is not active and the aircraft's indicated airspeed exceeds VSB, the SPEED BRAKE message will flash red and a tone will sound.
- AFCS Level - Used in conjunction with the autopilot to activate LVL mode. This input should be connected to a momentary pushbutton.
- 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.
- ESP Inhibit - Used with a switch that activates the input. When in the active state (select active high or active low), the ESP (Electronic Stability and Protection) function is disabled. See Appendix H.4.8 for ESP configuration details.
- Pitot Temp - Will display a PITOT TEMP caution message on the PFD if the outside air temperature is below approximately 5°C (41°F) and the input is not active. Configure for Active Low when used with the regulated GAP 26 (-20 version). See also GAP 26 Alert Configuration.

GAP 26 Alert Configuration (-20 version only)

If the discrete output (bare blue wire) from the control box is connected to one of the EIS discrete input pins on the GEA 24 or GSU 73, the status of the GAP 26 heater can be displayed in one of three ways (following), depending on user preference:

1. The discrete input configuration shown in Figure H-38 will result in a green "PITOT HEAT" indication that will appear on the PFD any time the GAP 26 heater is powered and the probe temperature is above approximately 25° C (77° F). If pitot heat is powered off or inoperative, the green "PITOT HEAT" indication will not appear.

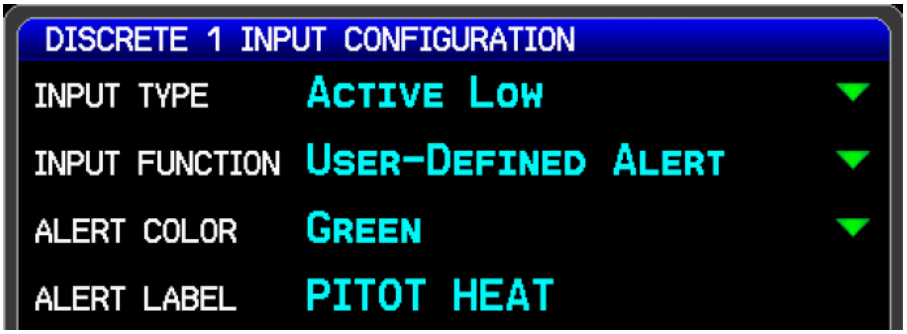


Figure H-38 Configuration #1

2. The discrete input configuration shown in Figure H-39 will result in a yellow "PITOT TEMP" alert that will appear on the PFD any time the GAP 26 heater is powered off, or if it is powered on but the probe temperature is below approximately 25° C (77° F). If pitot heat is powered and the probe temperature is sufficiently high, the yellow "PITOT TEMP" alert will not appear.

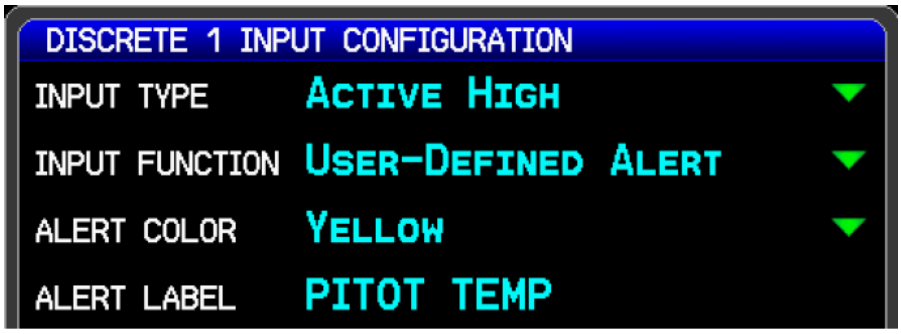


Figure H-39 Configuration #2

3. The discrete input configuration shown in Figure H-40 will result in a yellow "PITOT TEMP" alert that will appear on the PFD similar to Configuration #2, with additional logic that automatically prevents the yellow "PITOT TEMP" alert from appearing if the outside air temperature is above approximately 5° C (41° F). This configuration provides the same indication as Configuration #2, but hides the pitot temperature alert when flying in warmer weather conditions.

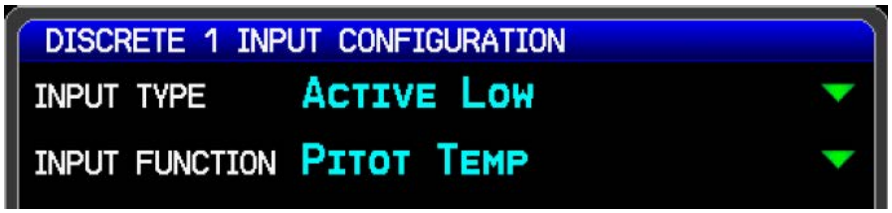


Figure H-40 Configuration #3

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.

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.

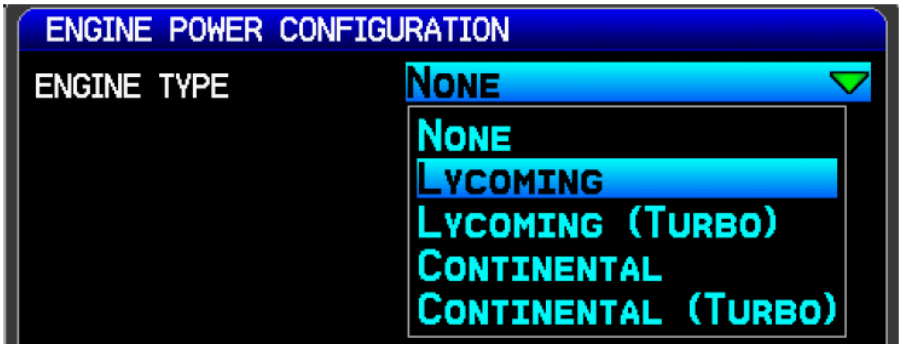
DISCRETE OUT 2 acts as a Master Caution annunciator, and is active (pulled low) any time a caution-level (yellow) alert is displayed on the PFD.

See Figure 27-2.2 and Figure 27-3.2 for guidance on wiring indicator lamps to the annunciator output pins.

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.



Figure H-41 Engine Power Display

NOTE

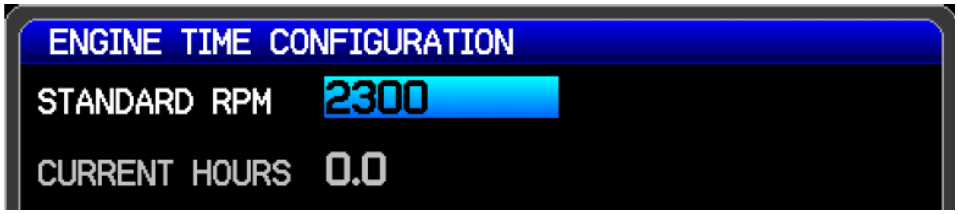
The Engine Power item is disabled when a FADEC engine is configured. For FADEC configurations, engine power or other related status information from the FADEC data interface (for example, an Economy mode indication) will be displayed if available.

Engine Time Configuration

Engine Time – Engine Time records the total operating time of the engine, in hours. Engine time will be recorded whenever engine RPM exceeds 100 RPM. To disable engine time recording, select the Standard RPM field and press the CLR key to delete the Standard RPM value.

The Standard RPM field determines the engine speed at which engine time increments at 1 hour per hour. Engine RPMs greater than the Standard RPM value will cause engine time to increase faster, and slower RPMs will cause engine time to increase more slowly. For example, if Standard RPM is set to 2300, engine time will increase by 1 hour if the engine is run for 1 hour at 2300 RPM, and the recorded engine time will increment by approximately 0.9 hours if the engine is run for 1 hour at 2100 RPM.

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.



NOTE

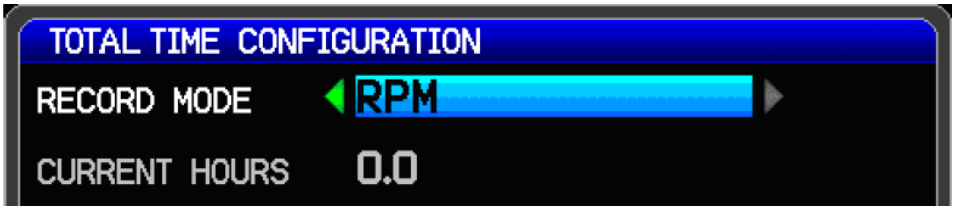
The Engine Time item is disabled when certain FADEC engines are configured. For installations where engine time data is provided by the FADEC interface, engine hours provided by the FADEC will be displayed.

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 Appendix H.2), then using the FMS Joystick to highlight the Current Hours field. The Record Mode selections are listed in Table H-14.

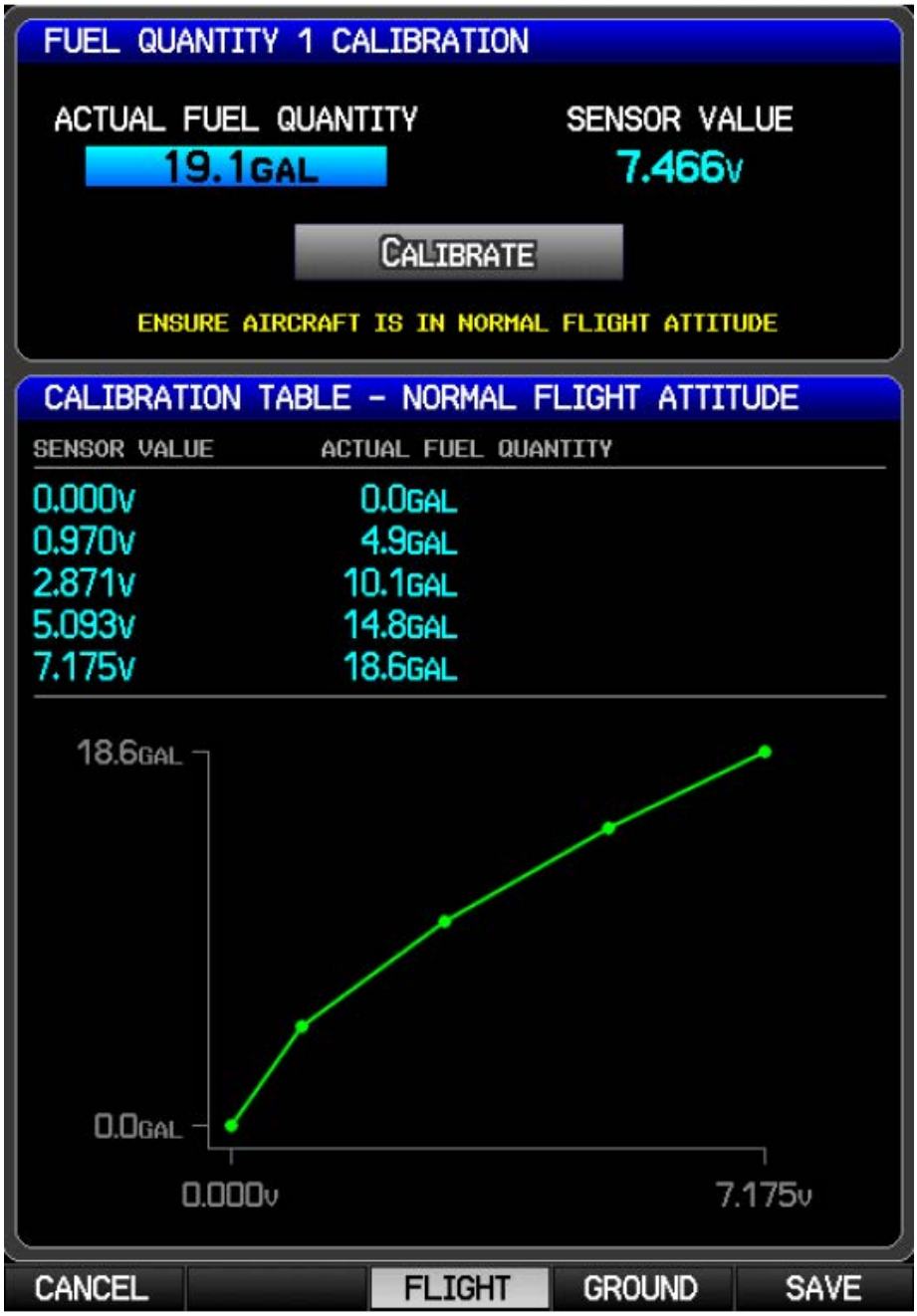
Table H-14 Record Mode Selections

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



H.4.19.4 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 the resulting frequency (in kHz) from the sensor is displayed instead of the voltage. Frequencies up to 50 kHz are supported.



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.



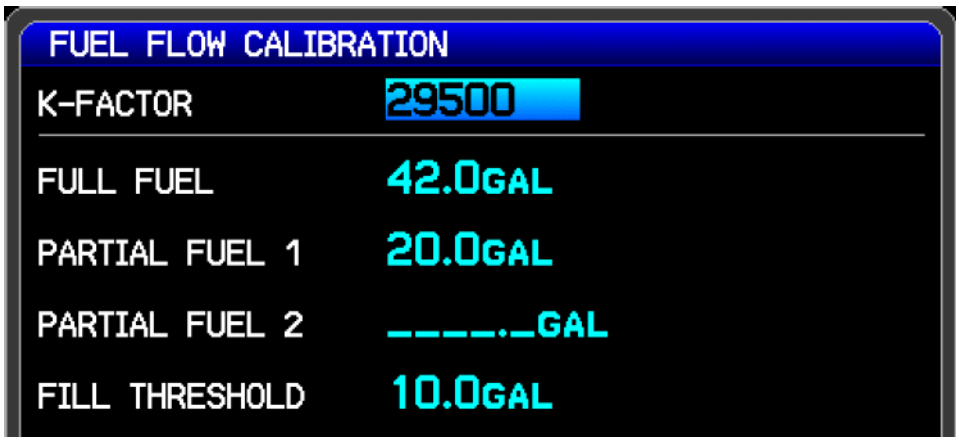
Fuel Quantity Calibration Data Backup – This option allows the user to back up fuel calibration data to an SD card placed in the SD card slot of the PFD. Access the Read/Write Calibration File menu by pressing the Menu key when displaying the Fuel Quantity Calibration Page



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 22.3.10.1).

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.

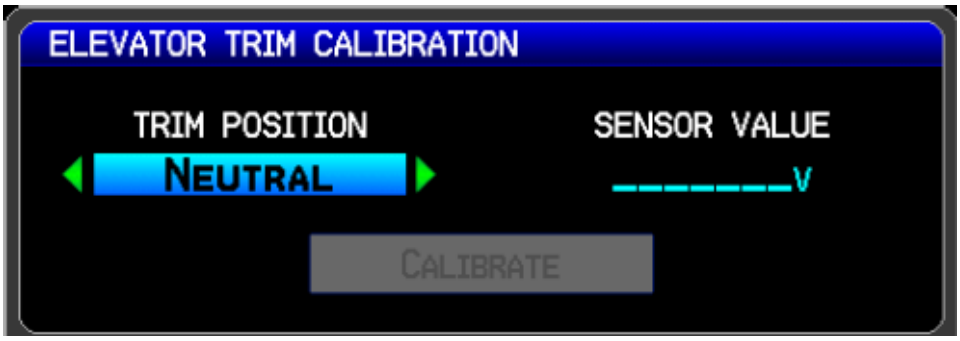
Corrected K-Factor = ([G3X reported fuel used] x [previous K-factor]) / [actual fuel used].

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 find if the fuel quantity should be confirmed upon system start. When power is applied, the system 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 Calibration – The Bus 1 and Bus 2 inputs can be calibrated (if desired) as detailed below.

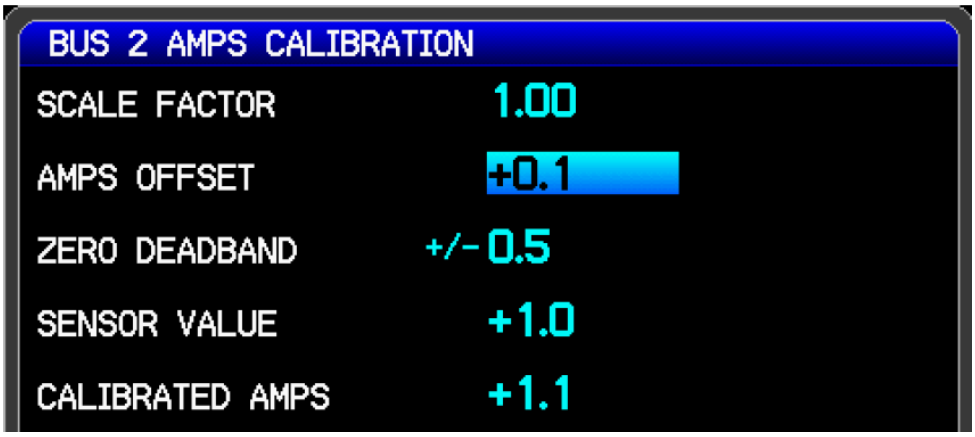
Scale Factor – For most installations, the scale factor will remain set to the default (1.00) value. A typical use for the scale factor is for a Hall Effect current sensor that has the current-carrying conductor looped through the sensor twice; in that case the scale factor should be set to 0.50 to give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



H.4.20 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.



H.5 Garmin Database Updates

The G3X database updates can be obtained by visiting the flyGarmin® website (flyGarmin.com®). The ‘flyGarmin’ website requires entering the System ID to update databases, this allows the databases to be encrypted with the G3X system’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. The Unit ID is different for each LRU in the G3X system, and cannot be used for this purpose.

NOTE

Perform database updates on the ground only, and remain on the ground while a database update is in progress.

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™ charts 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 the appropriate databases are initialized and displayed on the startup screen when power is applied.

H.5.1 Updating Garmin Databases

Equipment required to perform the update is as follows:

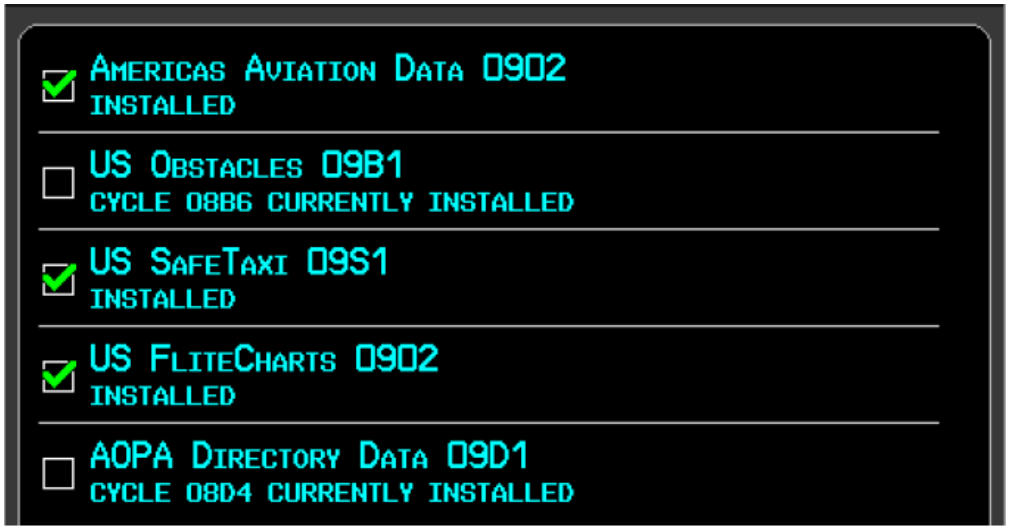
- Windows-compatible PC computer (Windows 2000 or XP recommended)
- Verbatim 96504 SD Card Reader or equivalent card reader
- Updated database obtained from the flyGarmin website
- SD Card, 2 GB recommended (Garmin recommends SanDisk® brand)
- SDXC cards are not supported.

NOTE

In the event there is a file corruption problem with the SD card, it may be necessary to reformat the card. This can cause an issue when formatting the SD card using Mac OS, where the newly formatted card will not be recognized by the avionics system. When using a Macintosh computer to format the SD card, Garmin recommends using the SD Memory Card Formatter application available as a download from SDcard.org. When running the application, use the Quick Format option.

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

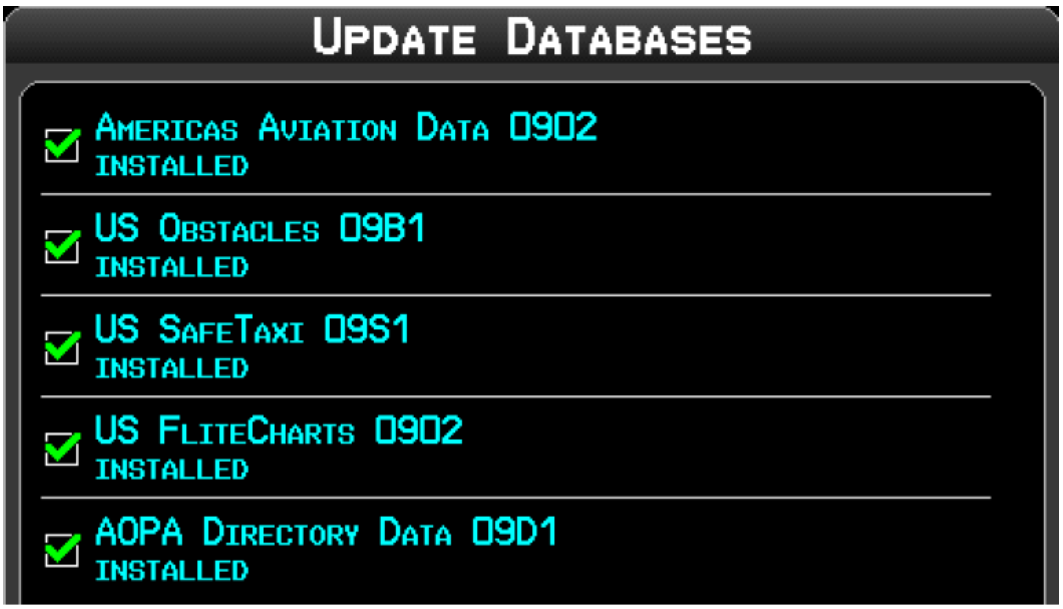
1. Insert the SD card in the card slot of the GDU 37X to be updated.
2. Turn on the GDU 37X to be updated (in normal mode).
3. Upon turn-on, a screen appears which lists the databases on the SD card. A green checkbox indicates the database already installed on the G3X is up to date, an empty checkbox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

H.5.2 Available Databases

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.

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.

FliteCharts® Database

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.

IFR/VFR Charts

The IFR/VFR Chart database contains Sectionals, Hi-Altitude, Low-Altitude, World Aeronautical Charts (WAC), and Terminal Area Charts (TAC). This database is updated on a 28-day cycle.

Aviation Navigation Data (NavData™)

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

Chartview™ Service Navigation Database

ChartView is an optional feature that must be activated by an enablement card that can be obtained by visiting the flyGarmin website (flygarmin.com). ChartView resembles the paper version of 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 can be updated by purchasing database subscription updates from Jeppesen Sanderson.

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® Database

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.

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.

H.6 SiriusXM® Activation Instructions (GDU 375 only)

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

Before SiriusXM Satellite Weather can be used, the service must be activated by calling SiriusXM at 1.866.528.7474. Service is activated by providing SiriusXM Satellite Radio with a Radio ID. SiriusXM Satellite Radio uses the Radio ID to send an activation signal that allows the G3X MFD to display weather data and/or entertainment programming. SiriusXM 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 SiriusXM Activation.
2. Make sure the aircraft's XM antenna has an unobstructed view of the southern sky. It is highly recommended 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 SiriusXM activation system.
4. Power on the avionics and allow the G3X to start. 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.

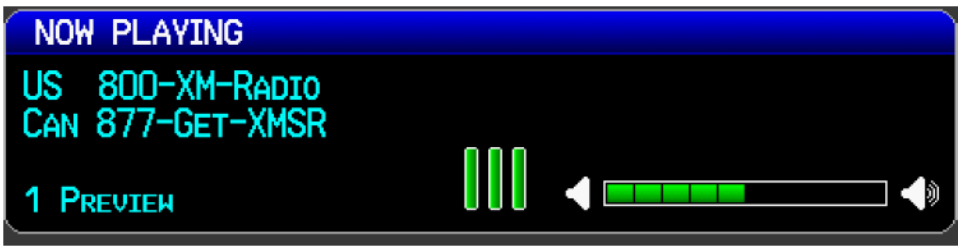
If the SiriusXM receiver will not receive, an Activation Refresh may resolve the issue. An Activation Refresh may be performed by visiting the link https://care.siriusxm.com/retailrefresh_view.action and following the instructions listed there. Visit http://www.siriusxm.com/sxmaviation for SiriusXM weather info.

Test the SiriusXM® Receiver (if applicable):

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



2. Verify the XM receiver is functioning correctly as indicated by the green signal strength bars.



H.7 External Interface Configuration (Garmin units only)

Refer to Section 25.2 and Appendix G.2 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 Section 25.2 and Appendix G.2 for specific unit configuration settings. This section lists specific instructions for changing the configuration settings of the external Garmin units.

H.7.1 GNS 4XX/5XX Series Units (including 'A', 'TAWS', & 'WAAS' models)

Entering Configuration Mode:

1. With power applied to the aviation rack and the 4XX/5XX 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 making sure the cursor is off and rotating the small right knob, select the desired Config Page.

NOTE

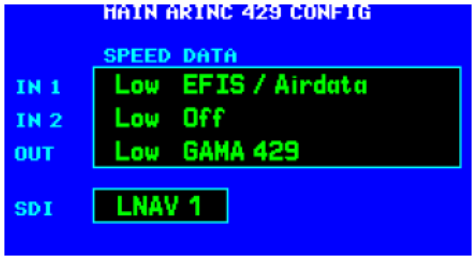
Make configuration changes only as described in this section, changing other configuration settings is not recommended and may significantly alter the unit's operation. Garmin recommends recording all configuration settings (before making any changes) for reference.

Changing data on the displayed configuration pages:

1. Press the small right knob to display 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

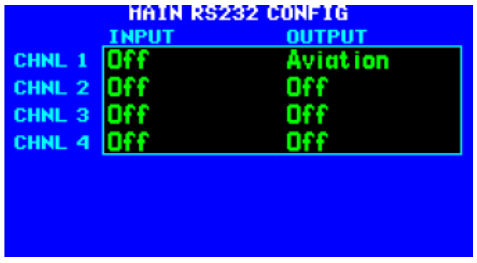
The configuration pages are in the order found when rotating the right small knob clockwise starting at the MAIN ARINC 429 CONFIG page. Follow the preceding procedures to enter configuration mode and to select the desired configuration settings (the following figures are for reference only and may vary from actual screens/settings, refer to instructions on the drawings in Section 25.2 and Appendix G.2).



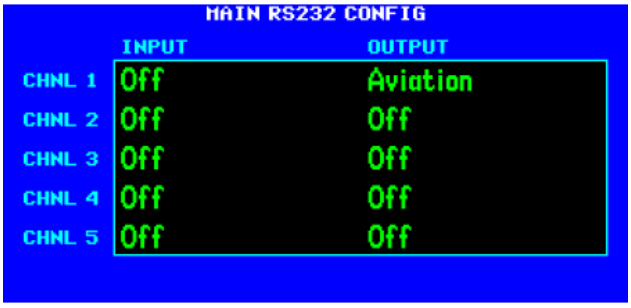
4XX Main ARINC 429 Config Page



5XX Main ARINC 429 Config Page



4XX Main RS232 Config Page



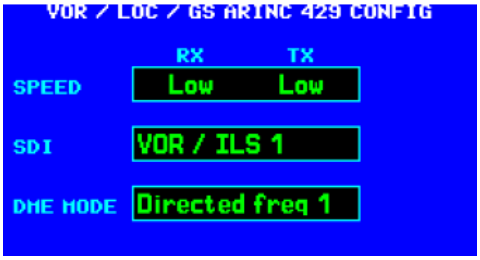
5XX Main RS232 Config Page



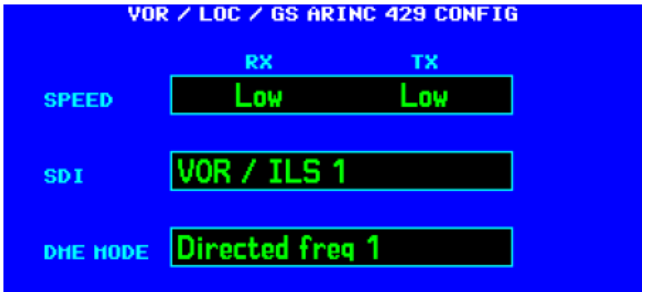
4XX Main CDI/OBS Config Page



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.

H.7.2 GTX Transponder

Refer to the applicable transponder installation manual for configuration mode instructions. The configuration settings are detailed in Section 25.2 and Appendix G.2 of this document.

NOTE

Make configuration changes only as described in Section 25.2 and Appendix G.2, 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.

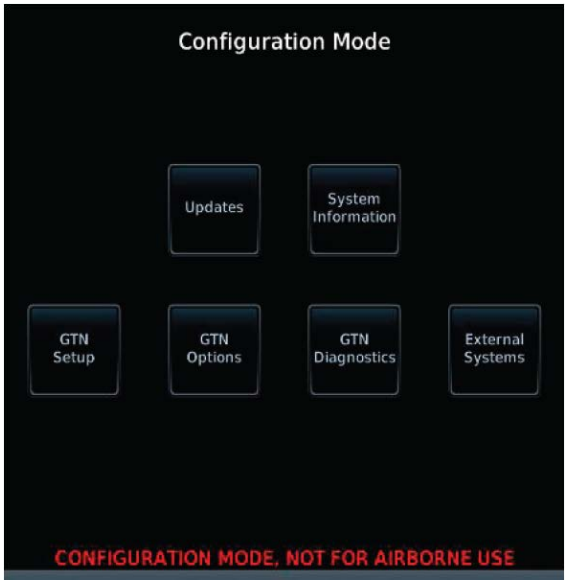
H.7.3 GTN 625/635/650/725/750 Unit

Configuration Mode Operations

Before configuring the GTN, make sure that no Configuration Module service messages are displayed in the message queue. This would indicate 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 pressing 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 pressing the screen and dragging the page in the desired direction, or by pressing the Up or Down keys.

Entering Configuration Mode:

1. With the GTN turned off (circuit breaker pulled), press 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 illuminated 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 Section 25.2 and Appendix G.2).
4. Press the GTN Setup key.



GTN 7XX Configuration Mode Home Page

5. Follow configuration instructions per applicable drawing in Section 25.2 and Appendix G.2.



GTN 6XX GTN Setup Page



GTN 7XX GTN Setup Page

H.8 GDU Start-up Screen

Users can create a custom start-up screen (displayed during start) 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, 8 bpp or 24 bpp with no alpha mask
- Max size 480 x 480 pixels
- Store file on root directory of an SD card, inserted in the MFD before power on

H.9 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

APPENDIX I GDU 4XX ADVANCED GAUGE CONFIGURATION

I.1 Example 1 - Vfe Exceedance Alert

Four Gauge Markings are applied to the General Purpose Input being used to sense Flap position in this example, as shown in Figure I-1.



Figure I-1 Gauge Display Range

1. The Invisible Range (Figure I-2) extends from 2-30 degrees and is active anytime flap position is within 2-30 degrees. The result of activation of this Invisible Range is the set/clear state of Logic Signal 9 changing to “Set”.



Figure I-2 Invisible Range

2. The Red Range + Alert Gauge Marking (Figure I-3) extends from 2-30 degrees, and carries an associated CAS message. This visible gauge marking and CAS message are only displayed when its associated Logic Signal is “Set” (in this example, Logic Signal 9 is used)



Figure I-3 Red Range + Alert

3. The White Line Gauge Markings serve to provide a visual reference for the 10 and 20 degree Flap positions.
4. An airspeed constraint can be added to Logic Signal 9 (Figure I-4) from the Settings Tab of the Engine and Airframe configuration menu. The result of this configuration is that Logic Signal 9 is “Clear” when below 90 Knots. A 5 second delay is added in this example, although this is not required.

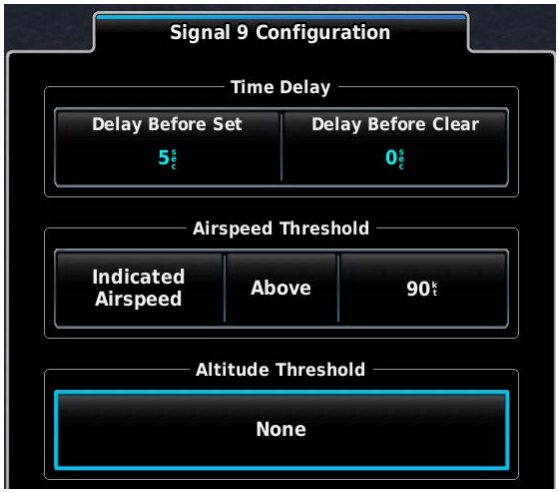


Figure I-4 Signal 9 Configuration

5. The preceding configuration settings result in the Red Range + Alert Gauge Marking and CAS message displaying when both Flaps are within the 2-30 degree position, and airspeed is above 90 Knots. If either of these thresholds are not met, the Gauge Marking and CAS message are not displayed.

I.2 Example 2 - Dynamic RPM Gauge Markings Based on Oil Temperature

In this example (Figure I-5), the Red band for the upper end of the existing RPM gauge extends from 5800-6000 RPM. The following steps add a second Red Range Gauge Marking so that the Red range will be drawn differently, as a function of oil temperature.

- If Oil Temperature > 120F, the Red Gauge extends from 5800 - 6000 RPM
- If Oil Temperature < 120F, high RPM operations are prohibited, so the Red Gauge extends from 2500 - 6000 RPM

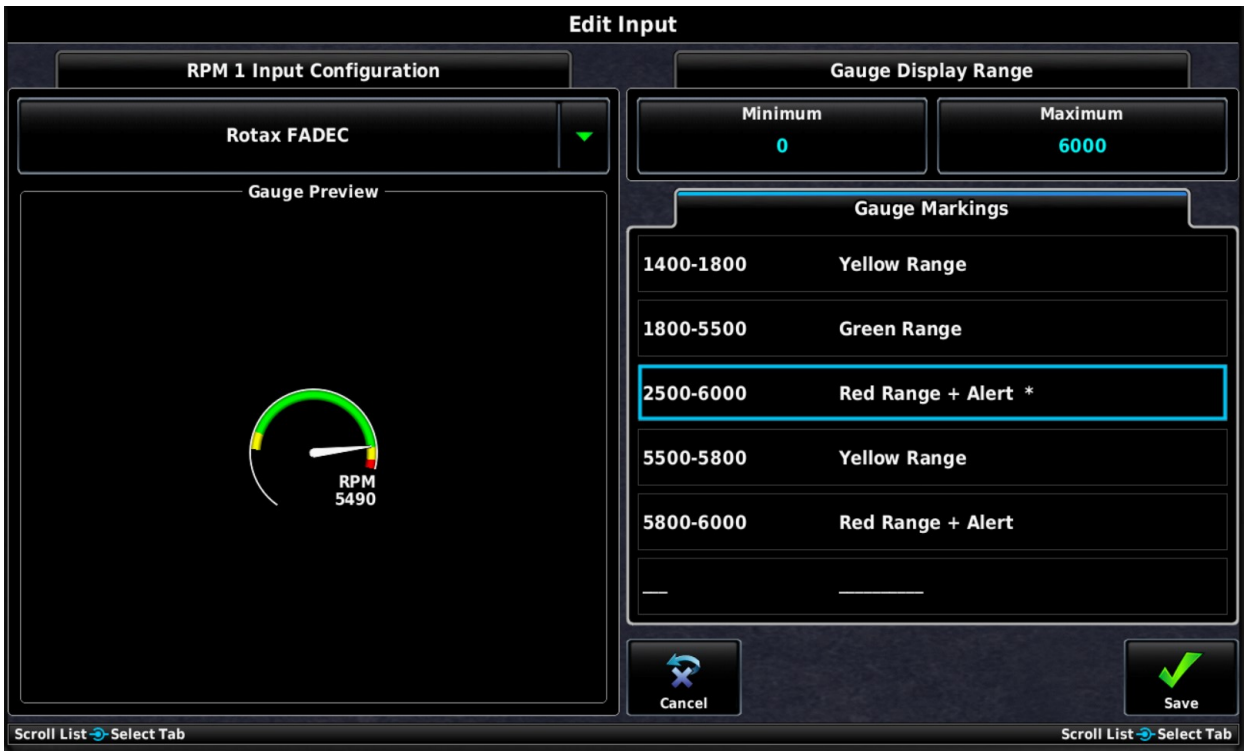


Figure I-5 Dynamic RPM

1. Add a new gauge marking to the Oil Temperature Gauge
   a) From the Oil Temperature configuration page, add a new gauge marking, and set the gauge marking type to Invisible Range (Figure I-6).
   b) Change the Mode from Normal to Set Logic Signal
   c) Choose an unused Signal identifier, (Signal 1 is used in this example).
   d) The invisible range will extend from 100 degrees to 120 degrees. Any time Oil temperature falls within that range, Signal 1 will be "Set". If oil temperature is outside of that range, Signal 1 is "Cleared". The Set/Clear state of that signal will be referenced for the gauge markings of the RPM gauge.



Figure I-6 Invisible Range

2. Edit RPM Gauge Markings (Figure I-7)

   a) In the RPM configuration menu, create the 2nd Red Gauge Arc. The existing red gauge marking (5800-6000 RPM) will remain unchanged.

NOTE

As determined in Step 1, Signal 1 is Set when Oil Temperature is below 120F, and Clear when Oil temperature is above 120F.

   b) Create a new Red Range Gauge marking for RPM, with a Max/Min RPM value of 2500-6000 RPM and set the Mode to "Require Logic Signal Set", “Signal 1”.

NOTE

When Signal 1 is Set (Oil Temp < 120F), this new range will be displayed on the RPM gauge. When Signal 1 is Clear, the new range will not be applied to the RPM gauge.



Figure I-7 Red Range + Alert

I.3 Example 3 - Takeoff Trim Position Alert

In this example, two invisible gauge markings are applied to sense when elevator trim is outside of the expected takeoff position range, while on the ground with the engine running.

1. Add a new gauge marking to the RPM gauge.
   a) From the RPM configuration page, add a new gauge marking, and set the gauge marking type to Invisible Range.



Figure I-8 Invisible Range

   b) Change the Mode from Normal to Set Logic Signal
   c) Choose an unused Signal identifier (Signal 4 used in this example).
   d) Select an RPM range that is representative of the full operating range of the engine. For this example, the invisible range was set up to extend from 100-3000 RPM. As a result of the configuration set up in this example, Logic Signal 1 will be 'set' anytime the RPM value falls within this range, which for this engine is the full operating range. Logic signal 1 is used as a reference to whether the engine is running, no RPM gauge markings visible to the pilot are modified as a result of this configuration.
   e) Touch Save.
   f) Touch Save again to return to the Engine and Airframe Menu.

2. Add 2 new gauge markings to the General-Purpose Input assigned to “Elevator Trim”

   a) Elevator Trim Position Sensor is connected to one of the General Purpose inputs on the GEA 24 EIS LRU. From the Engine and Airframe menu, select the GP input that is assigned to “Elevator Trim”.

   b) For this example, the desired elevator trim position prior to takeoff is -10. This configuration set up in this example will alert the pilot when trim position is +/- 5 outside of that value. Each aircraft will be unique, and it is up to the installer to determine what thresholds are appropriate.

   c) Add a new Gauge marking, and set the gauge marking type to “Invisible Range + Alert”.



Figure I-9 New Gauge Marking

   i. Set the Minimum to -100

   ii. Set the Maximum to -15

   iii. Change the Mode from Normal to Require Logic Signal Set

   iv. Select the same Logic Signal selected in Step 1c of this procedure (Logic Signal 4 for this example)

   v. Touch Save

d) Add an additional new Gauge marking, and set the gauge marking type to “Invisible Range + Alert”.

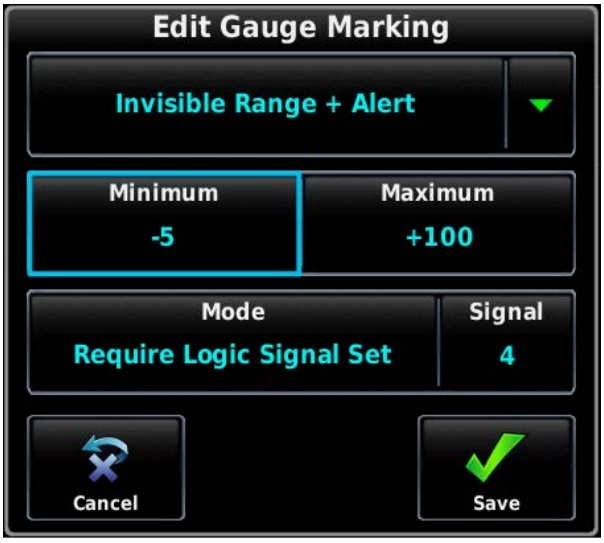


Figure I-10 Edit Gauge Marking

i. Set the Minimum to -5

ii. Set the Maximum to +100

iii. Change the Mode from Normal to Require Logic Signal Set

iv. Select the same Logic Signal selected in Step 1c of this procedure (Logic Signal 4 for this example)

v. Touch Save

e) Touch Save again to return to the Engine and Airframe Menu.

3. From the Engine and Airframe Menu, select the “Settings” tab at the top of the menu.
4. Select “Logic Signals”
5. Highlight the Logic Signal that was selected in Step 1c of this procedure. (Logic Signal 4 in this example)

6. Set an airspeed threshold that is below that which can be assumed the aircraft is on the ground.
   a) In this example we set the threshold to below 35 KIAS.

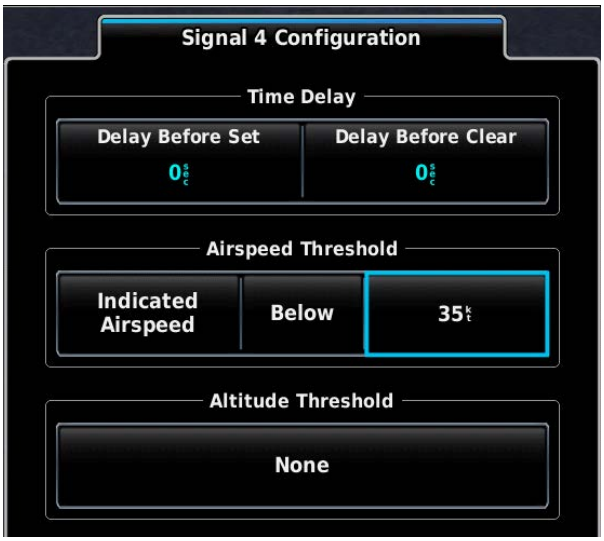


Figure I-11 Signal 4 Configuration

As a result of this set of configurations, the pilot will be alerted anytime trim position is outside of the configured range, while the engine is running, and the aircraft is moving less than 35 KIAS.

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