

GDL 69/69A Installation Manual



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GDL 69/69A HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GDL 69/69A. 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. Authorized Garmin Sales and Service Centers are encouraged to access the most up-to-date bulletin and advisory information on the Garmin Dealer Resource web site at www.garmin.com using their Garmin-provided user name and password.

Mod Level	Service Bulletin No.	Service Bulletin Date	Purpose Of Modification
1	----	----	Mod 1 unit identical to no mod unit

1 GENERAL DESCRIPTION

1.1 Scope

The information in this manual is STC approved. Only the equipment interfaces covered in this manual are within the scope of this STC. Other equipment may be suitable for use with the GDL 69/69A, but use of such equipment is beyond the scope of this STC – additional FAA approval may be required if equipment not covered in this manual is used to interface to the GDL 69/69A.

This document describes the GDL 69/69A operating with software Version 2.11, 2.13, 2.14, 3.00, 3.01, 3.02 and later.

Refer to Section 6, Limitations for additional information.

It is possible for installers to seek evaluation and approval of an alternate installation by means of the field approval process. This manual and all the data contained within may be used by the installer in pursuit of a field approval.

1.2 Introduction

This manual presents mechanical and electrical installation requirements for installing the GDL 69/69A and XM antenna (GA 55, GA 55A and GA 57) as part of the G1000 Integrated Cockpit System (GDU 104x), connected to the MX20 Multi-Function Display (MFD), or the 400/500 series displays. (See Table 1-1 for a list of 400/500 series units). The GDL 69/69A can be integrated into a variety of airframes under an appropriate TC or STC. Each airframe installation may vary. Interconnect drawings and procedures that are approved by the aircraft-manufacturer should be used during actual installation.

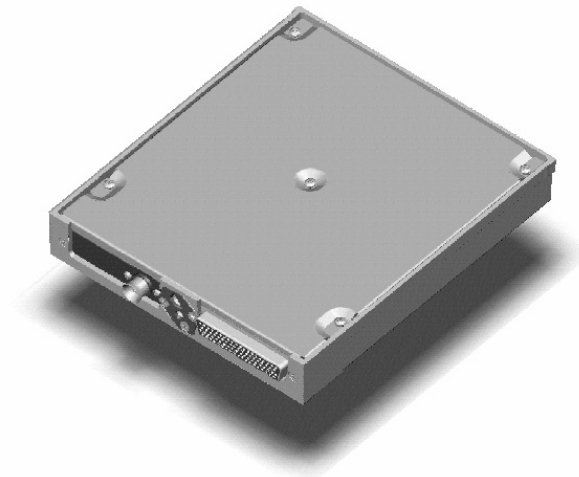


Figure 1-1. GDL 69/69A Unit View

1.3 Equipment Description

The GDL 69/69A is an XM Satellite Radio data link receiver. Two models are available; the GDL 69 is a weather data receiver. The GDL 69A is the same as the GDL 69 with the addition of XM Satellite Radio audio entertainment. For display of weather information and control of audio channel and volume, the GDL 69/69A may be interfaced to the MX20 MFD or 400/500 series units via an RS-232 bus or the GDU104x via an Ethernet link. Audio volume and channel changes may also be controlled with remotely mounted optional switches located in the cabin. The GDL 69A is also interfaced to a Garmin audio panel for amplification and distribution of the audio signal. The XM Satellite Radio antenna receives the XM Satellite Radio data signal and passes it to the GDL 69/69A.

1.4 Interfaced Equipment

Accomplishment of installation of the GDL 69/69A under this STC requires previous or concurrent installation of the following equipment. If installing the model GDL 69, a control display unit is required. If installing a GDL 69A, a control display unit and audio panel is required.

Table 1-1. Interfaced Equipment List

	Description	Manufacturer	Software Version (Or later FAA approved version)
OR	MX20 MFD Control Display Unit	Garmin AT	Ver. 5.5
	GDU 1040 MFD Control Display Unit	Garmin	4.01
	GDU 1042 MFD Control Display Unit	Garmin	5.00
	GDU 1043 MFD Control Display Unit	Garmin	5.00
	GPS 400*	Garmin	4.04
	GNC 420*	Garmin	4.04
	GNC 420A*	Garmin	4.04
	GNS 430*	Garmin	4.04
	GNS 430A*	Garmin	4.04
	GPS 500*	Garmin	5.04
	GNS 530*	Garmin	5.04
GNS 530A*	Garmin	5.04	
OR	SL15 Audio Panel Unit	Garmin AT	N/A
	SL15M Audio Panel Unit	Garmin AT	N/A
	SL10 Audio Panel Unit	Garmin AT	N/A
	SL10S Audio Panel Unit	Garmin AT	N/A
	SL10MS Audio Panel Unit	Garmin AT	N/A
	GMA 340 Audio Panel Unit	Garmin	N/A
	GMA 1347 Audio Panel Unit	Garmin	N/A

* 400/500 series units must use Pilot Guide Addendum 190-00140-13 Revision D, or later.

400/500 series units may be connected to a GDL 69A. The 400/500 series units do not have audio control capabilities, but the aircraft may be provisioned with a GDL 69A and wiring for future 400/500 series upgrade that will provide audio control and display.

1.5 Audio Entertainment Installation Limitations

The GDL 69A XM Satellite Radio audio entertainment may be installed to all passenger locations for all aircraft on the STC Approved Model List (AML). XM audio entertainment to crew locations depends on aircraft installation, which must meet requirements of 14 CFR §23.1431(e).

For purpose of this STC, 14 CFR §23.1431(e) requires that each pilot station must be able to hear the aircraft's stall warning horn with the entertainment system audio set to the maximum pilot controllable setting. This also applies to aircraft with a gear extension warning horn. Aircraft which have electric stall/gear warning may utilize the GDL 69A audio suppression input to turn off the music during an event. For these installations, the XM audio may be provided to the crew locations.

For aircraft installations with non-electric stall/gear warning horns, this STC does not provide data for installation of audio entertainment to crew locations. The GDL 69A audio entertainment may not be wired to crew locations without a separate evaluation that is beyond the scope of this STC. It is possible for installers to seek evaluation and approval of an alternate installation by means of the field approval process. Each installation or aircraft type must be evaluated for compliance with 14 CFR §23.1431(e). This evaluation may determine that the required horns can be heard satisfactorily without disabling the GDL 69A audio entertainment to the crew.

1.6 XM Satellite Radio

Welcome to the Next Generation of Radio. America's most popular satellite radio service gives you the power to choose what you want to hear - wherever and whenever you want it around the Continental United States.

XM Satellite Radio provides commercial-free music channels, channels of news, sports, talk and entertainment, dedicated channels of instant traffic and weather, the deepest play list in the industry with access to over 2 million titles, and coast-to-coast coverage. XM features digital quality audio.

Subscriptions to XM Satellite Radio weather and audio entertainment services are required before the GDL 69/69A can be activated for the first use. Refer to Section 4.5 for instructions for activating your unit.

NOTE

It is prohibited to copy, decompile, disassemble, reverse engineer, or manipulate any technology incorporated in receivers compatible with the XM Satellite Radio system. Furthermore, the AMBE(R) voice compression software included in this product is protected by intellectual property rights including patent rights, copyrights, and trade secrets of Digital Voice Systems, Inc. The user of this or any other software contained in an XM Satellite Radio is explicitly prohibited from attempting to copy, decompile, reverse engineer, or disassemble the object code, or in any other way convert the object code into human-readable form. The software is licensed solely for use within this product.

1.7 Interface Summary

The following list is an interface summary for the GDL 69/69A units. Note that the GDL 69 does not have the audio interface.

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

1.8 Technical Specifications

The GDL 69/69A and GA 55/GA55A XM antenna are PMA approved and there is no applicable TSO. The GA 57 GPS/WAAS – XM antenna is TSO authorized under TSO-c144. It is the responsibility of those desiring to install this equipment either on or within a specific type of class of aircraft to determine that the aircraft installation standards are within the prescribed standards. The following table presents general environmental specifications. For detailed specifications, see the Environmental Qualification form in Appendix B.

Table 1-2. GDL 69/69A Specifications

GDL 69/69A Characteristics	Specification
Operating Temperature Range	-55° C to +70° C
Input Voltage Range	9.0 to 33.0 VDC
Software Compliance	RTCA DO-178B Level D
Environmental Compliance	RTCA DO-160D

Table 1-3. GA 55, GA 55A, GA 57 Specifications

GA 55, GA 55A, GA 57 Characteristics	Specification
Operating Temperature Range	-55° C to +85° C
Input Voltage Range	Power provided by GDL 69/69A.
Software Compliance	None
Environmental Compliance	RTCA DO-160D

Table 1-4. GDL 69/69A Unit Dimensions

Characteristic	Specification
Width	1.05 inches (2.66 cm)
Height	6.15 inches (15.62 cm)
Depth (Rack w/ Connectors)	7.20 inches (18.26 cm)
Unit Weight (GDL 69A)	1.86 lbs (0.84 kg)
Unit (GDL 69A) and Remote Rack Weight	2.83 lbs (1.27 kg)

NOTE

See Table 2-8 outlining weights for the GDL 69, GDL 69A, remote rack, and modular rack.

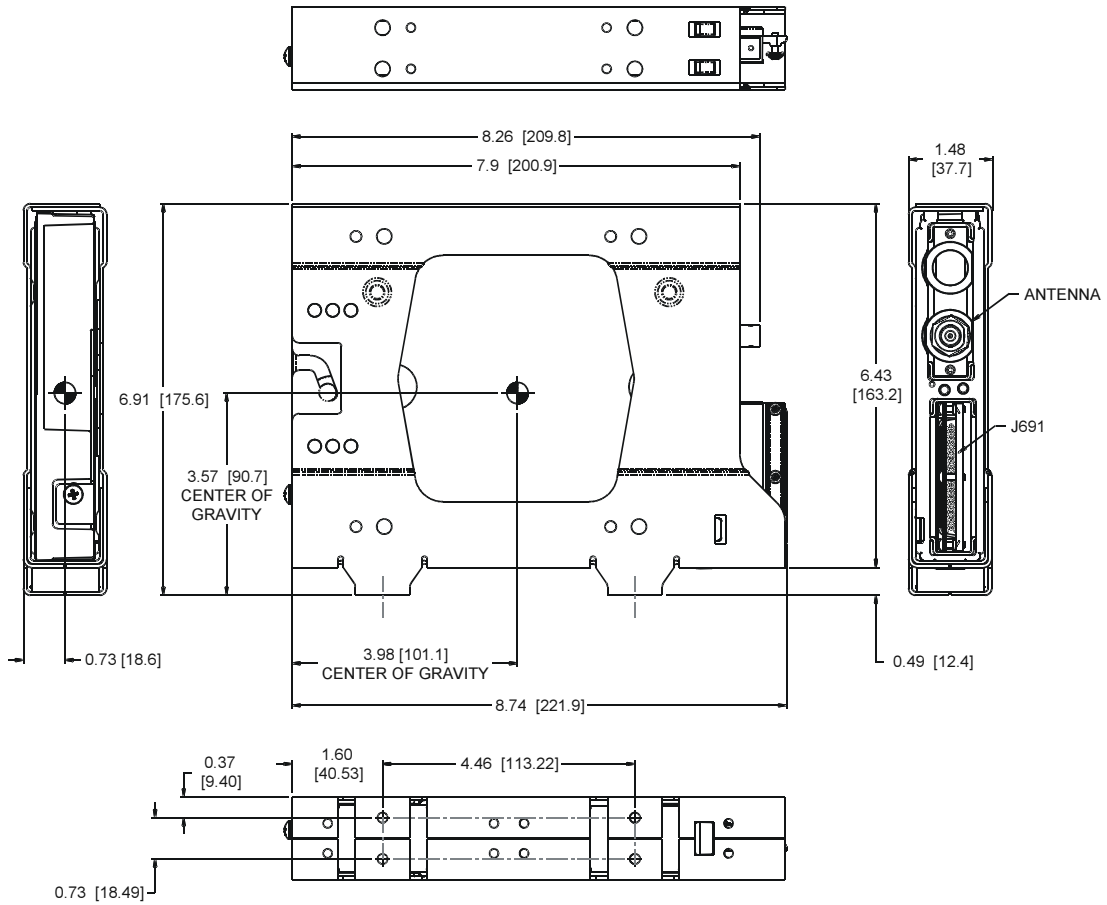


Figure 1-2. GDL 69/69A Remote Rack Unit Dimensions

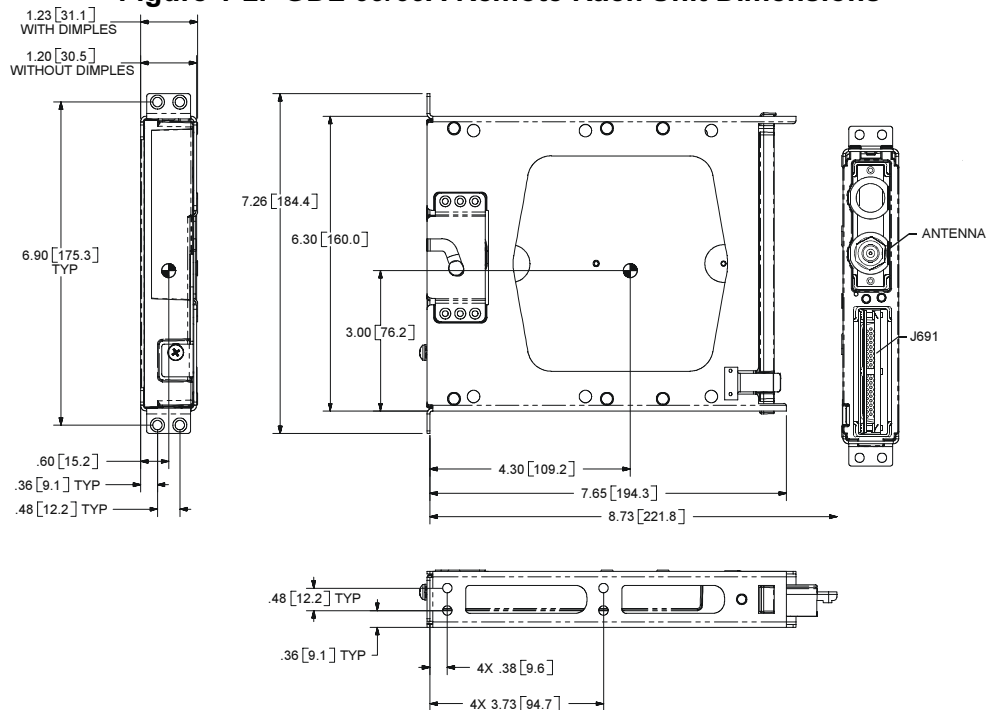


Figure 1-3. GDL 69/69A Modular Rack Unit Dimensions

1.8.1 General Antenna Requirements

Garmin recommends the Garmin XM antenna shown in the Table 1-5 below. These antennas are approved with the certification of the GDL 69/69A. However, any equivalent XM antenna with specifications listed in Table 1-6 should work with the GDL 69/69A. Antennas must provide protection from direct lightning strikes. This STC does not support installations of equivalent antennas.

Table 1-5. XM Antennas

Model	Part Number	Description	Mounting Configuration
GA 55	011-01033-00	XM Antenna	Stud mount Tear-drop form factor
GA 55A	011-01153-00	XM Antenna	Thru-mount (ARINC 743 style mount)
GA 57	011-01032-00	GPS/WAAS + XM Antenna	Thru-mount (ARINC 743 style mount)

Table 1-6. XM Satellite Radio Antenna Minimum Requirements

Frequency Range	2332.5 to 2345 MHz
Gain (Typical)	24 dB ± 1 dB**
Noise Figure	<1.2 dB
Nominal Output Impedance	50 ohms
Supply Voltage	3.6 to 5.5 VDC
Supply Current (maximum)	55 mA
Operating Temperature Gain	-50 to +85°C

** For each 1 dB gain over 24 dB, add 1 dB of attenuation into the antenna cable path between the antenna and the GDL 69/69A.

Table 1-7. GA 55, GA 55A, GA 57 XM Antenna Specifications

Frequency Range	2332.5 to 2345 MHz
Gain	25 ± 2 dB
Noise Figure	<1.2 dB
Nominal Output Impedance	50 ohms
Supply Voltage	3.6 to 5.5 VDC
Supply Current	40 to 55 mA
Operating Temperature Range	-50 to +85 ° C
Output Connector	TNC

1.9 Reference Documents

The following publications are sources of additional information for installing the GDL 69/69A. Before installing the GDL 69/69A, the technician should read all referenced materials applicable to the installation along with this manual.

Table 1-8. Referenced Publications

Manufacturer	Part Number	Document
Garmin	190-00149-01	GMA 340 Audio Panel Installation Manual
Garmin	190-00303-20	GMA 1347 Audio Panel Installation Manual
Garmin	190-00181-02	500 Series Installation Manual
Garmin	190-00140-02	400 Series Installation Manual
Garmin	190-00140-13	400/500 Series Garmin Optional Displays
Garmin	190-00303-01	GDU 1040 Installation Manual
Garmin	190-00522-01	GA 55A, GA 56A and GA 57 Antenna Installation Manual
Garmin	190-00355-04	XM™ Satellite Radio Activation Instructions
Garmin AT	560-1025-()	MX20 Installation Manual
Garmin AT	560-0979-()	SL15 Audio Panel Installation Manual
Garmin AT	560-0978-()	SL10 Audio Panel Installation Manual

1.10 Certification

The GDL 69 and GDL 69A XM Satellite Radios and the XM Satellite Radio Antenna have Parts Manufacturing Approval (PMA) for the aircraft listed on the STC Approved Mode List (AML).

1.10.1 TSO/JTSO Compliance

The GA 57 is TSO-C144 authorized. There are no other applicable TSO standards.

1.10.2 Other Regulatory Criteria

The GDL 69/69A and GA 55 and GA 55A are PMA authorized.

1.11 Unpacking Unit

Carefully unpack the equipment and make a visual inspection of the unit for evidence of damage incurred during shipment. If the unit 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 the unit to Garmin until the carrier has authorized the claim.

Retain the original shipping containers for return shipments. 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.

1.12 Warranty Statement

Limited Warranty

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

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

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

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

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2 INSTALLATION

2.1 Introduction

This section provides hardware equipment information for installing the GDL 69/69A, cabling for the XM antenna (GA 55, GA 55A, or GA 57), and related hardware. Installation of the GDL 69/69A should follow the aircraft TC or STC requirements. For interconnects with the GDU 104x, MX20 MFD or 400/500 series refer to Appendix D of this manual. For installation information on the GDU 104x, MX20 MFD or 400/500 series, refer to their installation manuals.

Installation of the XM antennas is covered under separate Garmin GA Antenna AML STC.

2.2 Pre-Installation Information

Always follow acceptable avionics installation practices per FAA Advisory Circulars (AC) 43.13-1B, 43.13-2A, or later FAA approved revisions of these documents.

Follow the installation procedure in this manual as it is presented for a successful installation. Read the entire manual before beginning the procedure. Prior to installation, consider the structural integrity of the GDL 69/69A installation as defined in AC 43.13-2A, Chapter 1 and evaluate the necessity for audio suppression inputs in accordance with the GDL 69A Audio Limitations in Section 6. Perform the post installation checkout before closing the work area in case problems occur.

Complete an electrical load analysis in accordance with AC 43.13-1B, Chapter 11, on the aircraft prior to starting modification to ensure aircraft has the ability to carry the GDL 69/69A load. Refer to Section 2.8 for the power consumption of each GDL 69/69A mode of operation. Document the results of the electrical load analysis on FAA Form 337.

2.3 Installation Materials

2.3.1 Configurations Available

Each of the GDL 69 and 69A can be ordered in different kits, each of which may contain components listed in the following table.

Table 2-1. Kit Contents

	Description	Part Number
	GDL 69 XM Weather Data Receiver	011-00986-00
	GDL 69A XM Weather/Audio Data Receiver	011-00987-00
	Back Plate Assembly	011-00796-35
	Remote Mount Rack GDL 69	115-00658-00
	Connector Kit Assembly	011-00997-00
	Configuration Module Assembly	011-00979-00
OR	GA 55 XM Antenna	011-01033-00
	GA 55A XM Antenna	011-01153-00
	GA 57 XM Antenna	011-01032-00
	Rack Nut Plate, 2 POS	011-00915-00
	Modular Rack	115-00411-00

2.3.2 Equipment Required But Not Supplied

- Wire: MIL-W-22759/16 or equivalent
- Shielded Wire: MIL-C-27500 or equivalent
- Hardware for Remote Mount Rack:
Vertical Mount: Four #8-32 Pan Head Screws (MS35206, AN526 or equivalent)
Horizontal Mount: Four #6-32 x 100° Counter-Sunk Flat Head Screw (MS24693, AN507R or equivalent)
- Circuit Breaker: Appropriate for selected wire size

2.4 Equipment Mounting

2.4.1 Rack Location and Installation

The GDL 69/69A may be mounted in a pressurized or unpressurized location. The GDL 69/69A does not require forced-air cooling; when mounting, avoid locating the GDL 69/69A near sources that produce high levels of heat. The GDL 69/69A has two mounting rack options available, the remote rack and the modular rack for use with the G1000 system.

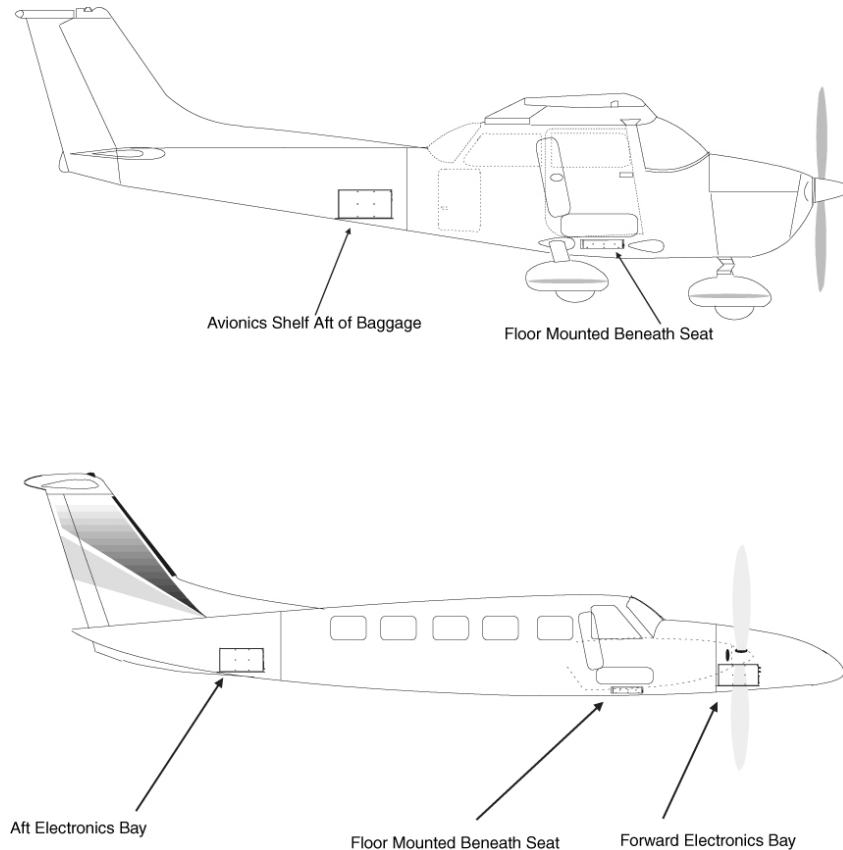


Figure 2-1. Suggested Mounting Locations for Remote Rack

2.4.2 Remote Mount Rack

The remote mount rack can be installed in a variety of locations, such as the electronics bay, behind the instrument panel, under the seat or behind the rear baggage area. Leave sufficient clearance between the GDL 69/69A and any obstruction. Install the rack in accordance with AC43.13-2A Chapter 2 Radio Installations. The remote mount rack should be mounted to a surface known to have sufficient structural integrity to withstand additional inertial forces imposed by a 1.86 pound unit (1.72 lbs. for GDL 69). If it is necessary to build a shelf or bracket to mount the GDL 69/69A rack or if is not certain that the chosen location is of sufficient structural integrity, refer to Appendix C. Refer to Figure 1-2 for the GDL 69/69A remote mount rack dimensions. The rack can be mounted vertically using four 8-32 pan head screws (MS35206, AN526 or equivalent.) It can also be mounted horizontally using four 6-32 100° counter-sunk flathead screws (MS24693, AN507R or equivalent.) Ensure that the rack has a ground path to the airframe by having at least one mounting screw in contact with the airframe to minimize radiated electromagnetic interference (EMI).

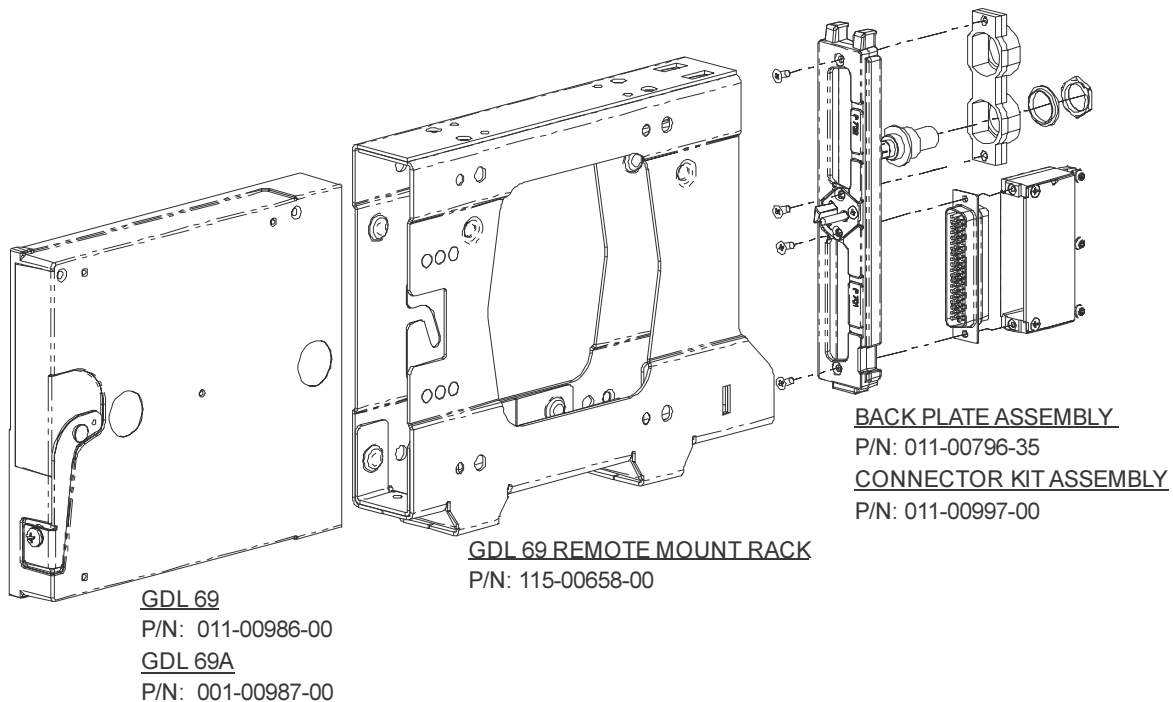


Figure 2-2. GDL 69/69A Remote Mount Rack

2.4.3 G1000 Modular Rack

The G1000 modular rack is used to install the GDL 69/69A in the standard G1000 integrated avionics system rack. This modular rack may be mounted behind the instrument panel or in the avionics bay. Refer to Figure 1-3 for the GDL 69/69A G1000 modular rack dimensions. This STC covers the installation of the GDL 69/69A modular rack into the installed G1000 integrated avionics system rack, but does not cover the installation of the G1000 integrated avionics system rack.

2.4.4 Remote Switches

Installation of rocker switches should be made on a flat surface and located at a convenient location within the cabin. Each rocker switch installed must be properly marked of its function. Use of rocker switches vs. toggle switches will prevent the possibility of raising and lowering the volume at the same time or raising and lowering the channels at the same time. Wire used for discrete switches should be 24 AWG (MIL Spec M22759) and should be routed as appropriate, avoiding kinking or sharp bends. Figure 2-3 shows typical rocker switches.

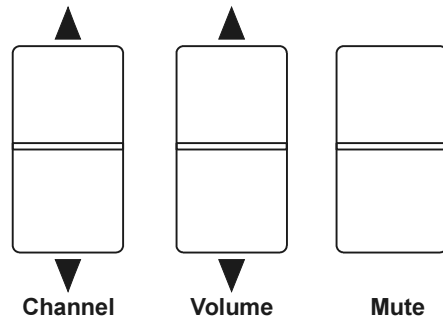


Figure 2-3. Typical Rocker Switches

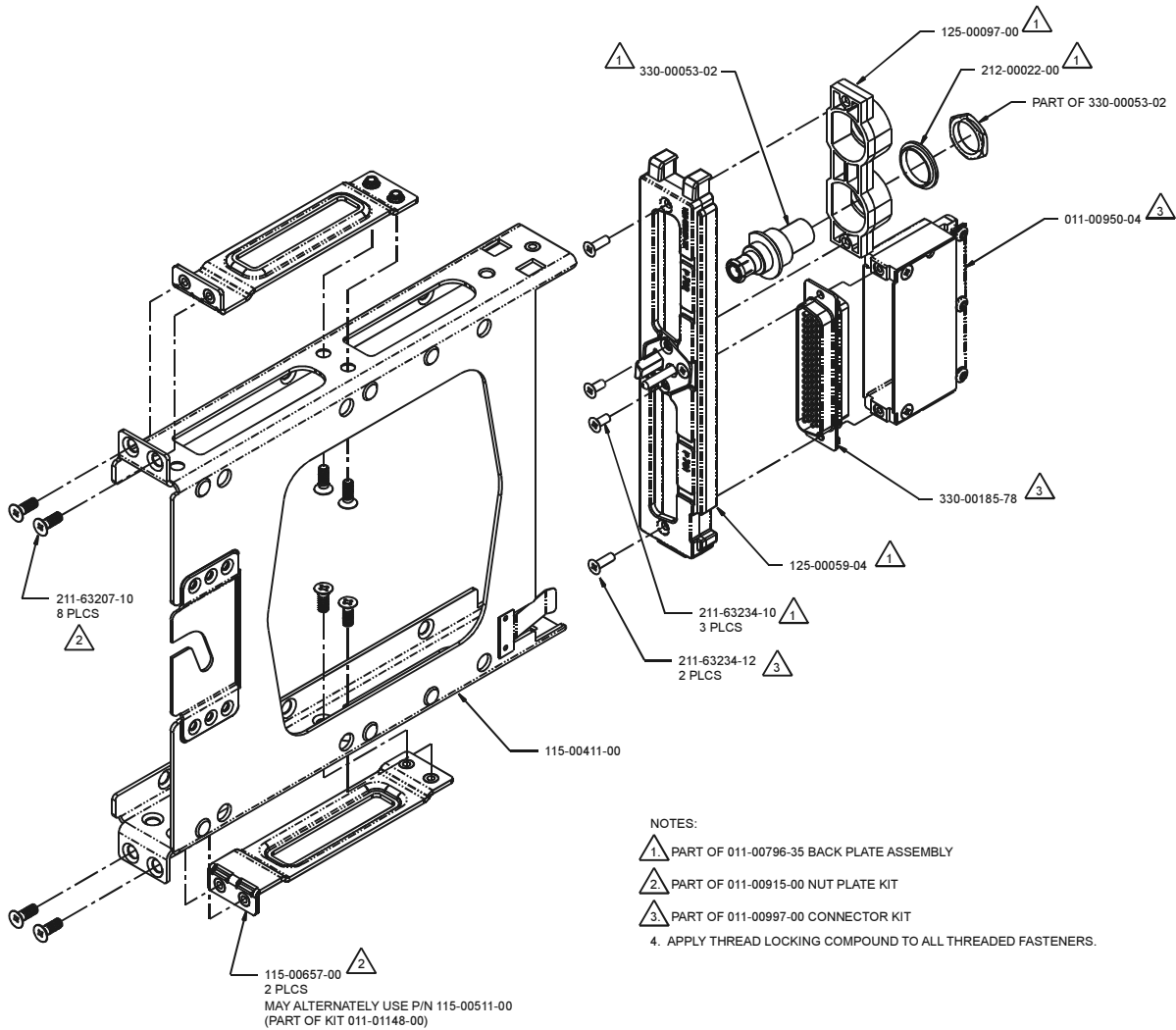


Figure 2-4. Modular Rack for the G1000

2.5 Cabling and Wiring

Wiring should be installed in accordance with AC 43.13-1B Chapter 11. When wire separation cannot be achieved, the following issues should be addressed:

- The cable harness should not be located near flight control cables and control, high electrical capacity lines or fuel lines
- The cable harness should be located in a protected area of the aircraft
- Do not route cable near high-energy sources

Refer to the interconnection diagrams in Appendix D for the appropriate wiring. Once the cable assemblies have been made, attach the cable connector to the rear of the rack. Route the wiring bundle as appropriate. Use 22 or 24 AWG wire for all connections except for power. Use 22 AWG for power/ground. Avoid sharp bends.

After the cable assemblies are made assemble the backshell as shown in Figure 2-6. Then install the backshell connector to the rear plate using the screws provided in the connector kit. After the rack is installed, assemble the rear plate into the rack.

2.5.1 Wiring Harness

Allow adequate space for installation of cables and connectors. The installer supplies and fabricates all of the cables. Except for the antenna connection, all electrical connections are made through a 78-pin D-Subminiature connector provided by Garmin. Construct the wiring harness according to the information contained in this and the following sections. Cable lengths will vary depending upon installation. Strip all wires going to the 78-pin D-Sub connector 1/8". Insert the wire into the pin and crimp with one of the recommended (or equivalent) crimping tools. Insert the pin into the 78-pin D-Sub connector housing location as specified by the interconnect drawing in Appendix D. Verify the pin is properly engaged into the connector by gently tugging on the wire. Route and secure the cable run from the GDL 69/69A to the other units away from sources of electrical noise.

Section 3 defines the electrical characteristics of all input and output signals. Required connectors and associated hardware are supplied with the connector kit. See Appendix D for interconnect wiring diagrams.

CAUTION

Check wiring connections for errors before inserting the GDL 69/69A into the rack or mounting bracket. Incorrect wiring could cause component damage.

Table 2-2. Pin Contact Part Numbers

Wire Gauge	78 pin connectors (P691) 22-28 AWG
Garmin P/N	336-00021-00
Military P/N	M39029/58-360
AMP	204370-2
Positronic	MC8522D
ITT Cannon	030-2042-000

Table 2-3. Recommended Crimp Tools

Wire Gauge	Hand Crimping Tool	20-24 AWG	
		Positioner	Insertion/ Extraction Tool
Military P/N	M22520/2-01	M22520/2-09	M81969/1-04
Positronic	9507	9502-3	M81969/1-04
ITT Cannon	995-0001-584	995-0001-739	n/a
AMP	601966-1	601966-6	91067-1
Daniels	AFM8	K42	M81969/1-04
Astro	615717	615725	M81969/1-04

NOTE

1. Insertion/extraction tools from ITT Cannon are all plastic; others are plastic with metal tip.
2. Non-Garmin part numbers shown are not maintained by Garmin and are subject to change without notice.

2.5.2 Connector Assembly

1. Backshell Cast Housing: Provides a mounting point for all other connector accessories.
2. Configuration Module: Installation details provided in Section 2.5.3.
3. D-Sub-Miniature Connector: Installation details provided in Section 2.5.3.
4. Spider Ground System: Allows shield grounds to be made to the backshell housing. Installation details provided in Section 2.5.5.
5. Strain Relief Tab: Provides strength and support to wiring bundles.
6. Backshell Lid: Provides easy access when servicing connector.

Table 2-4. Garmin Connector Assembly

Item Number (Reference Figure 2-5)	Description	Qty	Garmin Part Number
1	Backshell, with Config 50/78 Pin	1	125-00085-00
2	PCB Assembly, Configuration Module	1	012-00605-00
3	Connector, High Density, 78 Pin	1	330-00185-78
4	Wire Harness, Backshell Ground	1	320-00212-00
5	Clamp, Backshell, 62/78 Pin	1	115-00499-03
6	Cover, Backshell, 50/78 Pin	1	115-00500-04
7	Screw, 4-40 x .187 FLHP100, Stainless Steel	2	211-63234-06
8	Screw, 4-40 x .375, Phillips, Stainless Steel	3	211-60234-10
9	Screw, 4-40 x .250, FLHP, Stainless Steel	2	211-63234-08

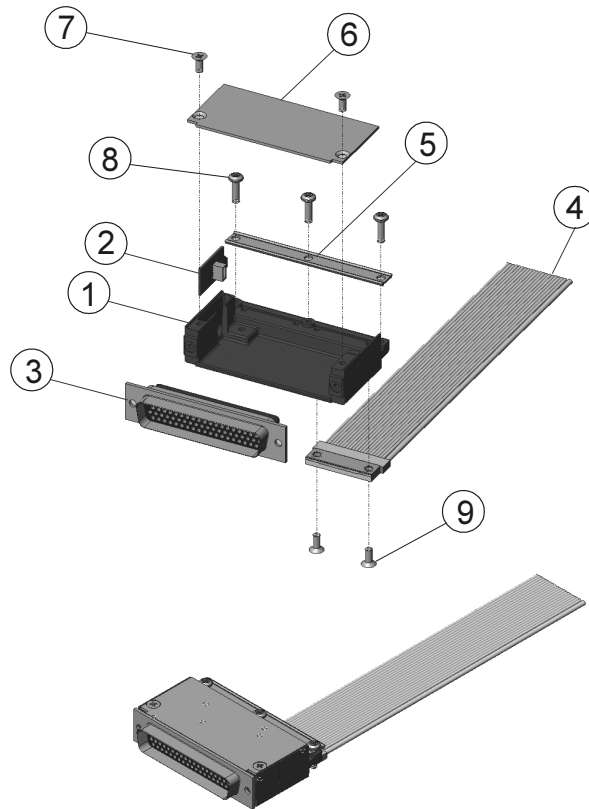


Figure 2-5. Garmin Connector Assembly

2.5.3 Configuration Module Installation

The GDL 69/69A connector kit includes one Garmin backshell assembly. The backshell assembly houses the configuration module. Garmin's backshell also gives the installer the ability to easily terminate shield grounds at the backshell housing using the Spider grounding kit. Refer to Figure 2-6 for details and item numbers referenced below.

1. Crimp pins (4) onto each wire of the four-conductor wire harness (3). Strip 1/8" of insulation from each wire prior to crimping.
2. Insert newly crimped pins and wires (3, 4) into the appropriate connector housing (5) location as specified by the interconnect drawings in Appendix D.
3. Apply the spacer (2) by wrapping it around the PCB Board (1) making sure to insert the plastic connector mounted on the board into the provided hole of the spacer.
4. Plug the four-conductor wire harness (3) into the connector on the PCB Board (1).
5. Insert into the backshell (6) recess, PCB Board (1) with pad (2) in position.
6. Attach cover (7) to backshell (6) using screws (8).

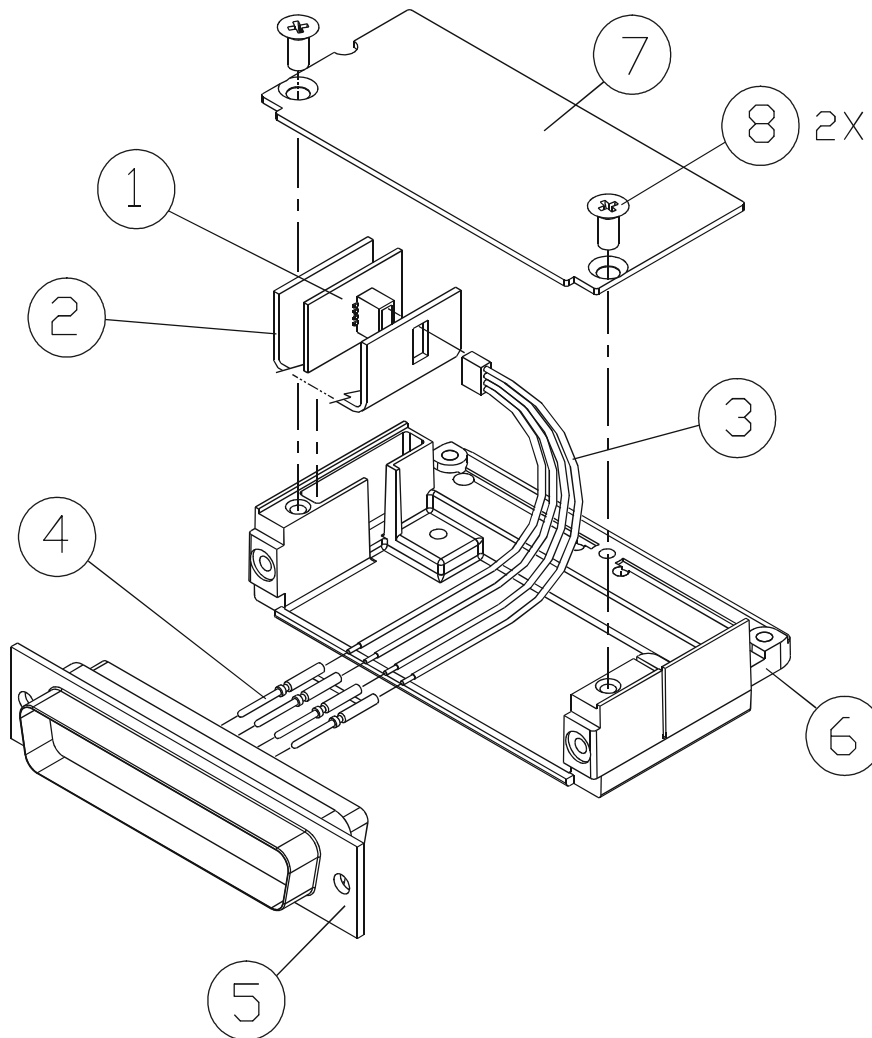


Figure 2-6. Backshell Assembly

2.5.4 Spider Grounding Installation

The Spider Grounding Kit, part of the connector kit, allows shielded cables that go to a backshell to be terminated to the backshell. Twenty AWG #24 wires are available to splice with the cable shields. The wires all terminate to a terminal that is fastened to the backshell. A single AWG #16 wire provides ground reference to the terminal, thereby grounding all Spider leads to the aircraft.

Spider Kit terminals are screwed to the backshell using the tapped holes provided.

Table 2-5. Spider Kits

Reference Figure 2-7	Description	Qty. Included	Garmin Part Number
Spider Kit w/ 21 Conductors: 011-00980-00 (Included in 011-00997-00)			
2	Wire Harness, Backshell Ground, 21 Conductor	1	320-00212-00
3	1 Conductor, 24", AWG #16		
4	20 Conductor, 6", AWG #24		
5	Screw, 4-40 x .250, FLHP 100°, SS/P, Nylon	2	211-63234-08

2.5.4.1 Spider Parts List

The following table provides a list of parts needed to install a Spider kit. Most parts for this installation are included in the Spider installation kits shown in Table 2-5. Some are to be provided by the installer. The following tables show the list of required parts as well as callouts for the drawings shown in Figure 2-7.

Table 2-6. Spider Installation Required Parts

Reference Figure 2-7	Description	Qty. Included	Garmin Part Number/MIL Spec
1	Cast Housing from Garmin Backshell Kit	0	011-00950-()
2, 3, 4, 5	Spider Kit	1	011-00980-00 or 011-00980-01
6	Shield Termination (method optional, see Step 3 below)	0	Parts used depend on method chosen
7	Multiple-Conductor Shielded Cable (2 –conductor demonstrated here)	0	Reference Interconnect Diagrams
8	Pins	0	336-00021-00
9	Ring Terminal	0	MS25036-152
10	Strain Relief from Garmin Backshell Kit	0	011-00950-()
11	Screw, 4-40x.375, PHP, SS/P, w/NYL	0	211-60234-10

2.5.5 Spider and Connector Assembly Procedure

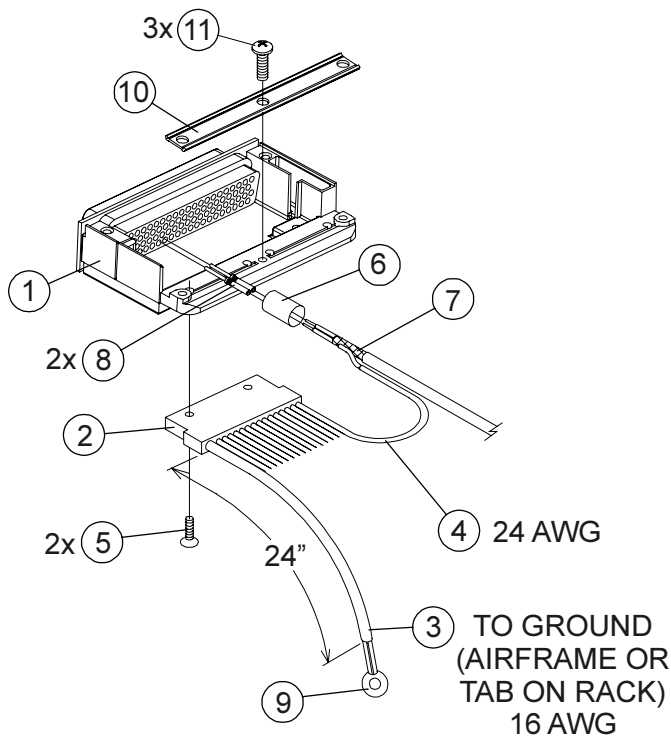


Figure 2-7. Spider Installation Drawing

1. At one end of the shielded cable (7), strip back 2.0" to 3.5" of jacket while retaining the shield. Trim away enough to leave 0.5" of shield exposed.
2. Strip 1/8" of insulation from one of the AWG #24 wires (4) on the Spider.
3. Connect the prepared AWG #24 Spider wire (4) to the shield (7) using an approved shield termination technique.

Installation Options:

- a) Slide a solder sleeve (6) onto the prepared wire assembly (4, 7) and shrink with a heat gun. The size of solder sleeve must accommodate the number of conductors present in the cable. Reference the following MIL-Specs for solder sleeves (M83519/1-1, M83519/1-2, M83519/1-3, M83519/1-4, M83519/1-5).
 - b) Solder the prepared wire assembly (4, 7). Slide a piece of shrink tube (6) onto the prepared wire assembly and shrink using a heat gun. The size of shrink tube must accommodate the number of conductors present in the cable.
4. Strip 1/8" of insulation from the shielded cable end and crimp a pin (8) to each of the conductors (7).
 5. Insert crimped pins and wires (7, 8) into the appropriate housing location as specified by the installation wiring diagrams.
 6. Repeat steps 1 through 3 as needed for the remaining shielded cables (7). Use only one Spider wire (4) per shield. Remaining AWG #24 wires should be tied back and dressed with shrink tubing.
 7. Wrap the cable bundle with Silicone Fusion Tape (Garmin P/N: 249-00114-00 or a similar version) at the point where the backshell strain relief (10) and cast housing (1) contacts the cable

bundle. Separation of the bundle into two smaller bundles, wrapped individually, may make installation of the strain relief easier.

8. Place the smooth side of the backshell strain relief (10) across the cable bundle and secure using the three screws (11).

WARNING

Placing the strain relief grooved side across the cable bundle may cause damage to wires.

9. Attach the Spider terminal (2) to the backshell (1) by inserting the two screws (5) into the tapped holes on the backshell (1).
10. Attach a ring terminal (9) to the AWG #16 wire (3) length 24” and terminate to ground. The ground connection can be made using either the closest aircraft ground or with tabs on racks. Trimming of this wire to the shortest practical length before attaching the ring terminal is recommended to reduce the effects of noise and interference. Do not extend this wire’s length.

2.5.6 Audio Suppression

XM Audio Entertainment to crew locations may require audio suppression to comply with the STC Limitations. Determine the activation state for each horn installed in the aircraft (aircraft power signifying active high or ground signifying active low) by using one of the following methods:

- Find the horn and compare the installation with Figure D-5.
- Activate the horn per the method described in the aircraft’s maintenance manual. (For the gear horn, this may require having the aircraft raised on jacks).
- With a multimeter, determine which horn contact changes state with the activation signal and if the active state is high or low.

Wire the appropriate audio suppression input (high or low) in accordance with Figure D-5.

2.5.7 Remote Discrete Switches (Optional)

If XM audio entertainment is installed in the aircraft, optional functional switches may be installed as desired. The functions of the switches must include the ability to mute the audio, adjust the volume and channels. It may be incorporated as desired depending on the installation. Figure D-1 and Figure D-2 detail the wiring for the optional discrete switches. A common aircraft ground signal may be used for each switch. It is recommended to use a rocker type switch for channel and volume control. Using a rocker type switch will prevent inadvertently raising and lowering the channel at the same time as well as the volume. An acceptable switch for this installation of the remote discrete switches is Carlingswitch P/N 62111281-0-0-N (62111231-0-0-N for the switch used for muting). Since the input signals are active-lo it is permissible to use multiple switches for each function. This would allow volume and channel control to be available at each passenger station.

2.6 XM Antenna

For use with the GDL 69/69A, the GA 55, GA 55A, and GA 57 antennas are an XM Satellite Radio antenna operating within a frequency range of 2332-2345 MHz for general aviation.

NOTE

Depending on specific installations, the installer may want to use a different make/model of XM Satellite Radio antenna. (An alternate antenna may be used providing it meets the minimum requirements shown in Table 1-6).

It is the installer's responsibility to ensure that their choice of antenna meets FAA certification standards according to the specific installation. This installation manual discusses only the antennas listed in Table 1-5, which is used during STC certification by Garmin. Other antennas may be acceptable but their installation is not covered by this manual and is outside the scope of the data approved in the GDL 69/69A STC.

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.

2.6.1 Antenna Mounting

For installation mounting of the XM antenna listed in Table 1-5, use Garmin GA Antenna AML STC. Verify aircraft model is listed on the AML and follow limitations defined in that STC data.

2.6.2 Antenna Grounding

NOTE

Improper grounding of the antenna is typically the primary cause of reduced signal reception quality.

It is very important to have good conductivity between the coaxial shield and the ground plane. This is ensured when all the fasteners properly ground the antenna base to the skin of the aircraft. The resistance between the antenna and the skin of the aircraft should be less than 10 milliohms.

2.6.3 XM Antenna Location

As with any antenna installation, keep the following points in mind:

1. The XM Satellite signal is a line-of-sight signal. Locating antennas too close to obstructions such as the vertical stabilizer will limit the reception of the satellite signal.
2. Maintain about three feet from heater, ignition, autopilot, and other control surface actuators and motors. Maintain about five feet from fluorescent lamps, related ballast, air conditioners, blowers, strobe lights and power supplies.
3. The minimum distances to be observed when selecting an antenna location are as follows:
 - 1.25 inches from any passive (receive only) antenna such as a GPS or another XM.
 - 5 inches from a VHF active antenna such as COM or ACARS.
 - 5 inches from an active radar altimeter (4 GHz).
 - 12 inches from a UHF / Microwave transmitting antenna such as a transponder, DME, active TCAS, UAT, SATCOM, or Flitephone.
4. The XM antenna must be mounted on top of the aircraft for greatest satellite visibility. For best performance, select a location with an unobstructed view of the sky above the aircraft when in level flight. Location of communication antennas too close to the XM antenna may not only degrade the transmission through reflection, but can also absorb and re-radiate the transmission causing a condition similar to having two COM antennas located in close proximity to each other.

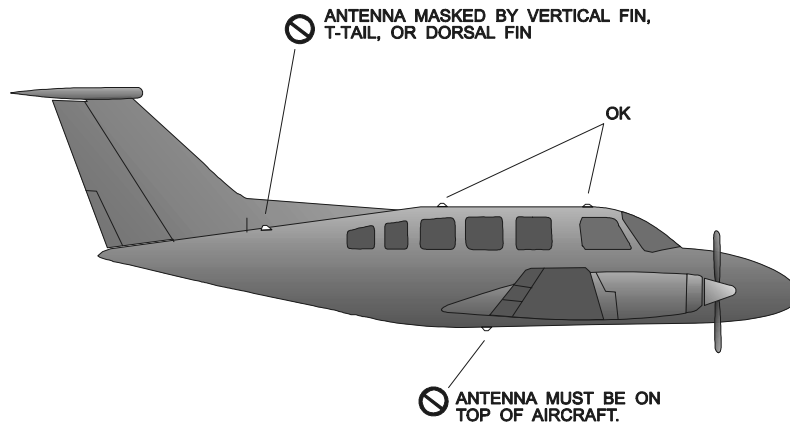
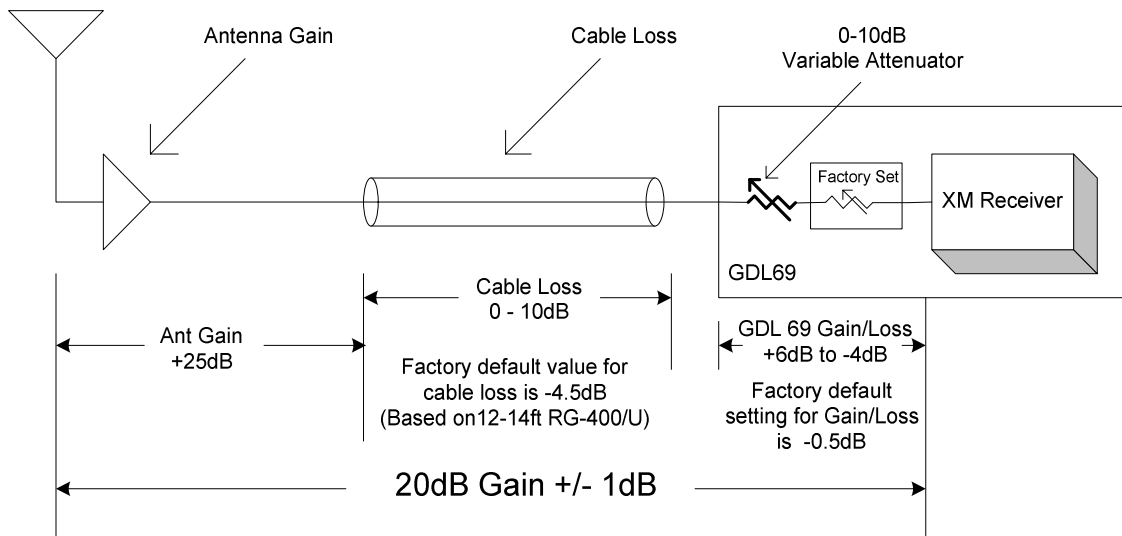


Figure 2-8. Antenna Installation Location

2.6.4 XM Radio Antenna to Receiver Signal Requirements

The XM Radio Receiver used in the GDL 69/69A has a system signal requirement of 20dB +/- 1dB gain from the input of the antenna to the input of the XM receiver internal to the GDL 69/69A. To insure the proper operation and optimum performance of the GDL 69/69A, the installation must meet the requirements specified in Table 1-6, and the installer must account for the signal gain and loss factors that exist between the antenna and the XM receiver. The gain/loss factors that need to be accounted for are shown in Figure 2-9. The GDL 69/69A has the capability to internally adjust for variances in the gain/loss factors by providing additional gain or loss within the range of +6dB to -4dB. If the GDL 69/69A gain/loss factor is outside this range, additional gain or loss must be added between the antenna and the GDL 69/69A RF input. Record the gain/loss components in Table 2-7. The variable attenuation value required to attain the GDL 69/69A gain/loss component will be programmed into the configuration module during post installation checkout.

GDL69 XM Antenna to Receiver Signal Gain Requirements



Signal Gain Equation

$$20\text{dB } \pm 1\text{dB} = \text{Antenna Gain} - \text{Cable Loss } (\pm) \text{ GDL 69 Internal Gain/Loss}$$

Equation Values	Limit-----Range-----
Antenna Gain =	23dB to 40dB (GA 55, GA 55A, GA 57 typically 25 dB)
Cable Loss =	0.5dB to 26dB
GDL 69 Internal Gain/Loss =	+6dB to -4dB (Based on Variable Attenuator setting 0dB to 10dB)

Equation using GA 55, GA 55A, GA57 Antenna with 12-16ft RG-400/U cable (Factory Default setting)
 $25\text{dB} - 4.5\text{dB} - 0.5\text{dB} = 20\text{dB}$

Figure 2-9. XM Signal Gain Requirements

Table 2-7. XM Gain/Loss Component Calculation

Antenna Gain (1)	+
Cable Loss (2) (3)	-
GDL 69/69A Gain/Loss (4) +6dB ≥ x ≥ -4dB	+/-
Total Gain Antenna/Receiver	= 20 dB

Note:

- (1) Garmin GA 55, GA 55A, GA 57 XM antenna typical gain 25 dB. For antenna gain for other antennas, see manufacturer's specifications.
- (2) If 12-16ft of RG-400/U cable is used, a value of 4.5dB can be used. See Section 2.6.4.1 for explanation of calculation.
- (3) If an antenna with increased gain is installed (antenna other than the Garmin antennas listed in Table 1-5), additional cable length may be required to be coiled to compensate for the required cable loss. Alternately, an external attenuator may be used to obtain the desired antenna cable loss. However, installation of the external attenuator is beyond the scope of this STC. Additional manufacturer's data may be necessary and FAA approval may be required to cover the installation of an external attenuator.
- (4) The GDL 69/69A Gain/Loss component must be between +6dB and -4dB. If the GDL 69/69A gain/loss component is outside this range, additional gain or loss must be added between the antenna and the GLD 69/69A RF input. The factory default setting for the internal GDL 69/69A component is -0.5dB. The variable attenuation value required to attain the GDL 69/69A gain/loss component will be programmed into the configuration module during post installation checkout. See Section 2.6.4.2 for explanation of calculation.

2.6.4.1 Determining Antenna Cable Loss Value

The GDL 69/69A is factory preset with a default cable loss value of 4.5 dB, which is equivalent to 12 to 16 feet of RG-400/U cable with two properly terminated TNC connectors. If the installed antenna cable is within this length, use this value in Table 2-7. If the cable is different from the default cable, use the following formula to determine the cable loss value to use in Table 2-7.

$$\text{Loss in dB} = \frac{(\text{Length} \times \text{Loss})}{100} + (0.5 \times \#\text{Connectors})$$

Where:

Length – Cable length in feet

Loss – Specified cable loss per 100 feet at 2332-2345 MHz

Connectors – Number of connectors on cable

For example:

If an RG-400 coax cable is 10 feet long with 2 TNC connectors, the cable loss component is

$$\text{Loss} = \frac{(10 \times 26.1)}{100} + (0.5 \times 2) = 3.61 \text{ dB}$$

2.6.4.2 Determining GDL 69/69A Gain/Loss Component Value

The GDL 69/69A has a zero to 10dB variable attenuator that is used to balance the gain/loss component between its RF input and internal XM Receiver. The gain/loss components can be adjusted between +6dB and -4dB to balance the Antenna input to XM receiver 20dB gain requirement as specified for the XM system. The Gain/Loss component is factory preset with a default value of -0.5 dB. Using the Signal Gain Equation shown in Figure 2-9 and solving for the GDL 69/69A component the equation becomes

$$\mathbf{GLcomp\ in\ dB = XMgain - Antenna + Cable}$$

Where:

GLcomp – GDL 69/69A Gain/Loss Component

XMgain – XM specified gain from antenna input to XM receiver input (20dB)

Antenna – Antenna Gain

Cable – Cable Loss

Example:

If the cable loss calculated in the previous example is used, the GDL 69/69A loss component is:

$$\begin{aligned} \text{GLcomp} &= 20\text{dB} - 25\text{dB} + 3.61\text{dB} \\ &= -5\text{dB} + 3.61\text{dB} \\ &= -1.39\text{dB} \end{aligned}$$

The GDL 69/69A gain/loss component will be programmed into the configuration module during post installation checkout.

2.6.5 Coaxial Cable Installation

1. Choose the correct coax: RG-400/U has good characteristics for loss, size, and flexibility.

NOTE

The cable loss of the antenna cable is critical to the performance of the GDL 69/69A operation. To accommodate this, the GDL 69/69A has the ability to be configured for the amount of antenna cable loss. To reduce the need to configure the GDL 69/69A for cable loss, the GDL 69/69A is factory-preset with a cable loss of 4.5 dB, which is equivalent to 12 to 16 feet of RG-400/U with two properly terminated TNC connectors. If the cable loss is different than the default value, the cable loss must be calculated or measured and the loss value programmed into the GDL 69's configuration module. Refer to Section 4.2 for additional information on determining antenna cable loss value and how to program the configuration module.

NOTE

To avoid programming the configuration module, use a coax cable length that is within the factory default cable loss value (refer to Section 2.6.4.1). When using the default cable loss value, additional cable after routing through the aircraft may be coiled and secured as needed. Do not coil the cable tighter than a one foot diameter.

2. Trim the coaxial cable to the desired length and install TNC connectors at each end per the cabling instructions listed in Figure 2-10. For routing convenience, one end of the coaxial run can be terminated prior to installation.
3. With the GDL 69/69A receiver and antenna installed, route and clamp the coaxial cable in position. Secure cable in accordance with AC 43.13-1B, Chapter 11.

2.7 Weight and Balance

Weight and balance computation is required after the installation of the GDL 69/69A. Follow the guidelines as established in AC 43.13-1B, Chapter 10, Section 2. Make appropriate entries in the equipment list indicating items added, removed, or relocated along with the date accomplished. Include your name and certificate number in the aircraft records. Table 2-8 identifies the weight of the new GDL 69/69A equipment and Figure 1-2 and Figure 1-3 shows the center of gravity.

Table 2-8. Unit Weights

Item	Weight
GDL 69 Weight	1.72 lbs (0.78 kg)
GDL 69 and Remote Rack Weight	2.69 lbs (1.22 kg)
GDL 69 and Modular Rack Weight	2.67 lbs (1.21 kg)
GDL 69A Weight	1.86 lbs (0.84 kg)
GDL 69A and Remote Rack Weight	2.83 lbs (1.29 kg)
GDL 69A and Modular Rack Weight	2.81 lbs (1.27 kg)
GA 55 Antenna	0.25 lbs (0.11 kg)
GA 55A Antenna	0.43 lbs (0.20 kg)
GA 57 Antenna	0.47 lbs (0.21 kg)

2.8 Electrical Load Analysis

An electrical load analysis should be completed on each aircraft prior to installation in accordance with AC 43.13-1B, Chapter 11 and recorded on FAA Form 337. Use the following values for computation:

GDL 69

Unit Status	Max Current @ 28 VDC	Max Current @ 14 VDC
Off	0.01 A	0.01 A
On	0.28 A	0.425 A

GDL 69A

Unit Status	Max Current @ 28 VDC	Max Current @ 14 VDC
Off	0.01 A	0.01 A
On	0.35 A	0.65 A

Note: Unit OFF is defined as the unit has power but is turned off with the remote power control signal.

NOTE

Circuits should be protected in accordance with guidelines in AC 43.13-1B, chapter 11, Section 2, Paragraph 429.

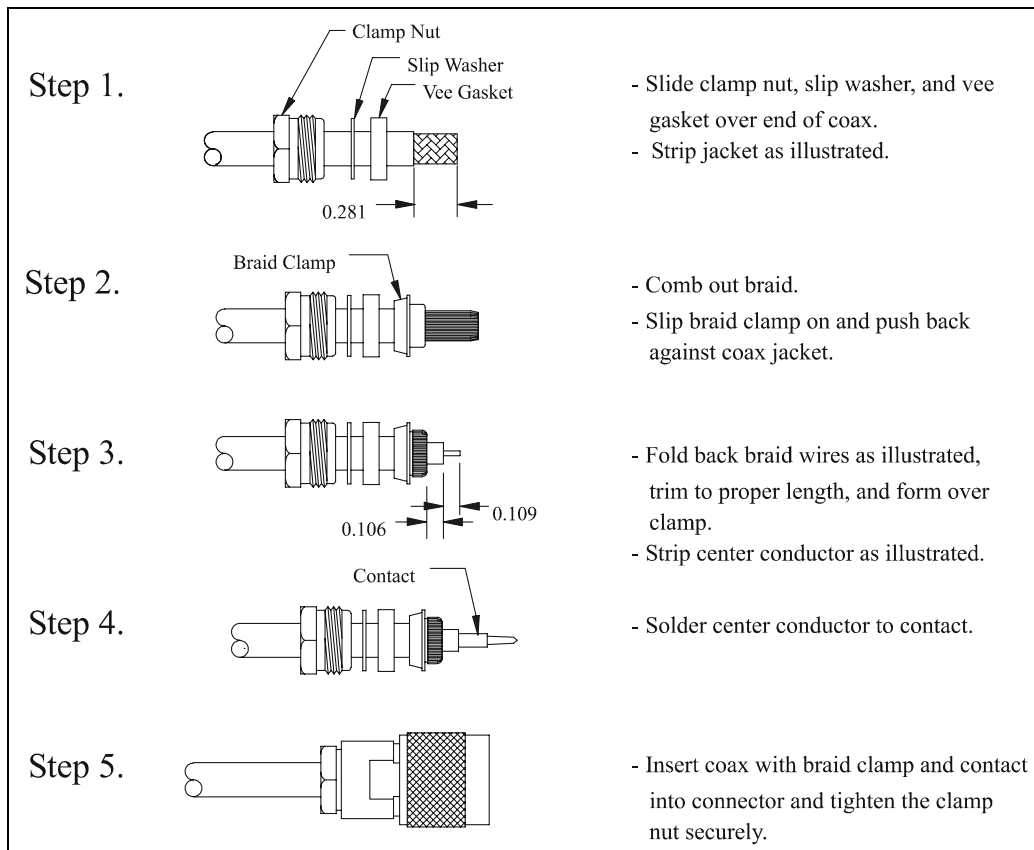


Figure 2-10. TNC Connector Installation

2.9 Cooling Air

The GDL 69/69A units do not require cooling air and do not generate an excessive amount of heat during typical operations; however the thermal characteristics of the installation should always be assessed. An undesirable thermal condition could be created due to the unit's own internal power dissipation combined with restricted ventilation, or due to heat generated by adjacent equipment. Limiting thermal build up, by means of fan or natural convection is always a good practice and recommended to increase the product life.

2.10 Installing/Inserting Unit

For final installation and assembly, refer to the outline and installation drawings shown in Figure 2-2 or Figure 2-4 of this manual. The two installation configurations available are the G1000 modular rack or remote mount. For both configurations, insert the GDL 69/69A into the rack, noting proper orientation as shown on the installation drawing in Figure 2-2 or Figure 2-4.

NOTE

The following steps are for the remote mounting rack which is illustrated in Figure 2-11. The steps are identical for the modular rack.

1. Loosen and remove the Locking Lever Handle Securing Screw (4). Then, lift up on the end of the Locking Lever Handle (1).
2. Slide the GDL 69/69A unit into the Mount Rack carefully fitting the Locking Lever Handle Cam Head (2) into the slot of the Locking Plate (3) of the Mount Rack.
3. After fully inserting the unit into the mount rack, visually note that the Cam Head (2) remains seated in the slot of the Locking Plate (3).

NOTE

When inserting the GDL 69/69A into the Remote Mount Rack, it may be possible for the Pivot Pin (2) to fit between the unit and the mount rack without going into the slot of the Locking Plate (3). If the Cam Head (2) does not seat in the slot of the Locking Plate (3), the unit will not firmly engage with the mount rack and the unit could come loose from the rack.

4. With the unit firmly engaged with the mount rack, lower the Locking Lever Handle (1). Then, insert and tighten the Locking Lever Handle Securing Screw (4) to mechanically secure the unit to the Mount Rack.

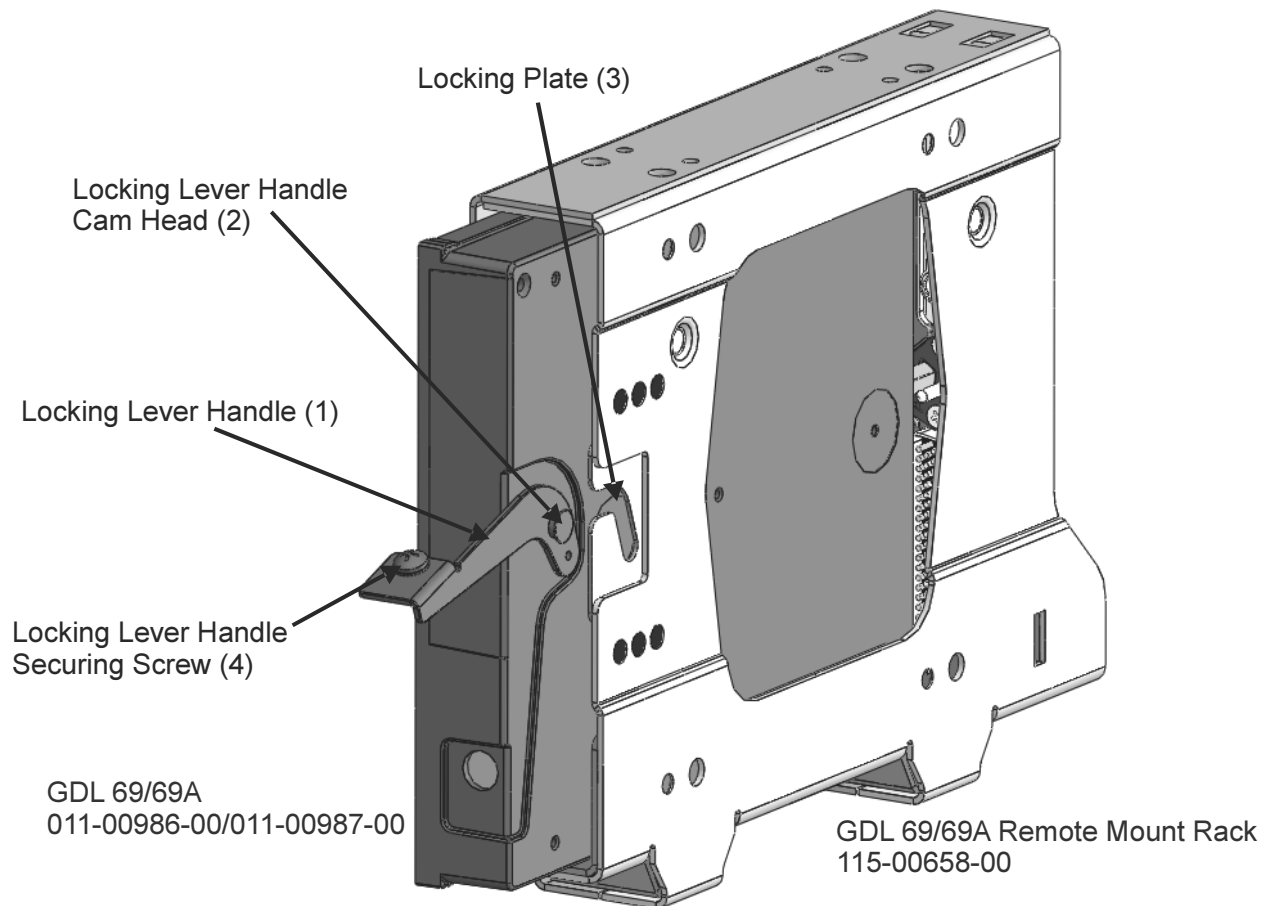


Figure 2-11. GDL 69/69A Installation

CAUTION

Do not use excessive force when inserting the GDL 69/69A into the rack. This may cause damage to occur to the connectors, unit, and/or unit rack. If heavy resistance is felt during installation, **STOP!** Remove the GDL 69/69A and identify the source of resistance. The unit is designed with a key and the back plate is designed to float in the unit rack. Check to ensure the rear plate is not bound by the connector harness.

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3 SYSTEM INTERCONNECTS

3.1 Pin Out List

View of P691 connector looking at rear of unit.

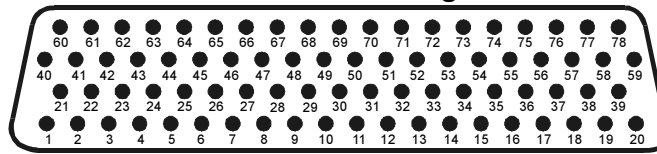


Figure 3-1. Pin Out

Table 3-1. Pin Out List

Pin #	Name	I/O	Notes
1	Config Module Ground	Out	
2	RS-232 Out 2	Out	
3	RS-232 Out 3	Out	
4	Signal Ground	--	
5	RS-232 In 2	In	
6	RS-232 In 3	In	
7	RS-232 In 1	In	For Factory Use Only
8	RS-232 Out 1	Out	For Factory Use Only
9	Data Link System ID Program 1	In	
10	Data Link System ID Program 2	In	
11	Signal Ground	--	
12	Spare	--	
13	Signal Ground	--	
14	Spare	--	
15	Spare	--	
16	Spare	--	
17	Audio Out Lo	Out	GDL 69A Only
18	Audio Out Right	Out	GDL 69A Only
19	Audio Out Left	Out	GDL 69A Only
20	Power Ground	--	
21	Config Module Power Out	Out	
22	Ethernet In 1 B	In	
23	Ethernet In 1 A	In	
24	Ethernet Out 1 B	Out	
25	Ethernet Out 1 A	Out	
26	Ethernet In 2 B	In	
27	Ethernet In 2 A	In	
28	Ethernet Out 2 B	Out	
29	Ethernet Out 2 A	Out	
30	Ethernet In 3 B	In	
31	Ethernet In 3 A	In	
32	Ethernet Out 3 B	Out	
33	Ethernet Out 3 A	Out	
34	Spare	--	
35	Aircraft Power 1	In	

Pin #	Name	I/O	Notes
36	Spare	--	
37	Aircraft Power 2	In	
38	Spare	--	
39	Signal Ground	--	
40	Config Module Data	I/O	
41	Spare	--	
42	Spare	--	
43	Spare	--	
44	Spare	--	
45	Spare	--	
46	Spare	--	
47	Spare	--	
48	Spare	--	
49	Spare	--	
50	Spare	--	
51	Spare	--	
52	Line Out Lo	Out	GDL 69A Only (Note 1)
53	Line Out Right	Out	GDL 69A Only (Note 1)
54	Line Out Left	Out	GDL 69A Only (Note 1)
55	Spare	--	
56	Ethernet In 4 B	In	
57	Ethernet In 4 A	In	
58	Ethernet Out 4 B	Out	
59	Ethernet Out 4 A	Out	
60	Config Module Clock	Out	
61	Audio Suppression Hi 1	--	GDL 69A Only
62	Audio Suppression Hi 2	--	GDL 69A Only
63	Audio Suppression Hi 3	--	GDL 69A Only
64	Audio Suppression Lo 1	--	GDL 69A Only
65	Audio Suppression Lo 2	--	GDL 69A Only
66	Audio Suppression Lo 3	--	GDL 69A Only
67	Discrete In 2	In	
68	Discrete In 1	In	
69	Test Enable	In	For factory use only
70	Audio Mute	In	
71	Channel Up (+)	In	
72	Channel Down (-)	In	
73	Volume Up (+)	In	
74	Volume Down (-)	In	
75	Signal Ground	--	
76	Spare	--	
77	Data Link Remote Power Off	In	
78	Power Ground	In	

Note 1: Line Out Audio is not supported in GDL 69A with software version prior to 3.00.

3.2 Functional Descriptions

All connections to the GDL 69/69A are provided on the sub-miniature DB-78 connector labeled P691. The antenna cable connection is provided on a TNC coaxial connector.

3.2.1 Power

The GDL 69/69A will accept input power from 9 to 33 VDC. The two aircraft power inputs (Aircraft Power 1, Aircraft Power 2) are intended to allow power to be provided by two different power busses. Typically, both power input pins are connected on a single bus through a single circuit breaker. If power is obtained from two different power busses, each leg should have its own circuit breaker.

P691-35 Aircraft Power 1 +
 P691-37 Aircraft Power 2 +
 P691-20 Power Ground
 P691-78 Power Ground

Refer to Appendix D for recommended power connections.

3.2.2 Configuration Module

The GDL 69/69A stores installation-specific configuration information in an aircraft configuration module located in the DB-78's backshell. This eliminates the need to set up aircraft specific configuration items again if a new GDL 69/69A is installed. Since configuration module input pins contain no lightning protection, the configuration module must be mounted within the connector backshell as described in Section 2.5.3.

P691-1 Configuration Module Ground
 P691-21 Configuration Module Power (from GDL 69/69A)
 P691-40 Configuration Module Data (bi-directional)
 P691-60 Configuration Module Clock (from GDL 69/69A)

Refer to Appendix D for interconnect information.

The configuration module is not used when installed with GDU 104x series units. The configuration module does not store XM Satellite Radio subscription information. When a new GDL 69/69A is installed in the aircraft, contact XM Satellite Radio to update the radio IDs on the current subscription or start a new subscription.

3.2.3 RS-232 Ports (Qty 3)

Three RS-232 ports are available. Ports 2 and 3 can be used to connect the GDL 69/69A to control/display devices (e.g., the MX20). Port 1 is reserved for factory use only.

P691-2 Port 2 TX (out)
 P691-3 Port 3 TX (out)
 P691-4 Signal Ground
 P691-5 Port 2 RX (in)
 P691-6 Port 3 RX (in)
 P691-7 Port 1 RX (in) (RESERVED FOR FACTORY USE)
 P691-8 Port 1 TX (out) (RESERVED FOR FACTORY USE)
 P691-11 Signal Ground

NOTE

In order for a serial port to function correctly, the baud rate of the RX and TX channels on a given RS232 port must be the same. This must be considered when assigning serial ports to interfacing equipment.

3.2.4 Ethernet Ports (Qty 4)

Four Ethernet ports are provided. All four ports are set up to a connection speed of 10 Mb/s. PORT 1 is used to transmit weather data to the display. The other three ports are not supported.

PORT 1

P691-22 Ethernet Receiver input Ch1-B
P691-23 Ethernet Receiver input Ch1-A
P691-24 Ethernet Receiver output Ch1-B
P691-25 Ethernet Receiver output Ch1-A

PORT 2

P691-26 Ethernet Receiver input Ch2-B
P691-27 Ethernet Receiver input Ch2-A
P691-28 Ethernet Receiver output Ch2-B
P691-29 Ethernet Receiver output Ch2-A

PORT 3

P691-30 Ethernet Receiver input Ch3-B
P691-31 Ethernet Receiver input Ch3-A
P691-32 Ethernet Receiver output Ch3-B
P691-33 Ethernet Receiver output Ch3-A

PORT 4

P691-56 Ethernet Receiver input Ch4-B
P691-57 Ethernet Receiver input Ch4-A
P691-58 Ethernet Receiver output Ch4-B
P691-59 Ethernet Receiver output Ch4-A

3.2.5 Discrete Inputs (GDL 69A Only)

The discrete inputs are used to control the XM radio channels and volume. All of these inputs are active low (i.e. grounded when active, and open otherwise). Each input presents a load of greater than 10 k Ω .

3.2.5.1 Audio Volume Inputs (Up, Down, Mute)

The Up, Down, and Mute discrete provides audio volume control of the audio output. (Note: The volume and mute controls have no affect on the Line Out output volume.)

- P691-73 Volume increment
- P691-74 Volume decrement
- P691-70 Audio Mute

3.2.5.2 Audio Channel Control Inputs (Up, Down)

- P691-71 Channel Increment
- P691-72 Channel Decrement

3.2.5.3 Audio Suppression Inputs

There are six discrete inputs for audio suppression. There are three active low and three active high inputs. The Audio Suppression inputs suppress the Audio Out output by activating any one of multiple inputs. The threshold voltages are as follows:

Active HIGH discrete inputs: Input will go active with input voltages above 8.5V

Active LOW discrete inputs: Input will go active with input voltages below 5.0V

- P691-61 Active HIGH discrete input.
- P691-62 Active HIGH discrete input.
- P691-63 Active HIGH discrete input.
- P691-64 Active LOW discrete input.
- P691-65 Active LOW discrete input.
- P691-66 Active LOW discrete input.

3.2.5.4 Other Discrete Inputs (Not used)

The following discrete input pins are reserved for factory use.

- P691-67 Discrete 2
- P691-68 Discrete 1
- P691-69 Test Enable

3.2.6 Remote Power ON/OFF Input

The unit will turn off if this input is pulled above 3 volts. The unit will turn ON if the input is left floating or grounded. The input presents a load of greater than 100 k Ω .

- P691-77 Data Link Remote power off.

3.2.7 Audio Out (GDL 69A Only)

The Audio Out provides stereo output for XM radio to be interconnected to an audio panel. The Audio Out is affected by the volume controls, mute function, and suppression inputs. See Limitations Section 6.2 for requirements on use of suppression inputs.

- P691-17 Audio Out Lo. This is the common ground for the audio output
- P691-18 Audio Out Right. This is the right channel audio
- P691-19 Audio Out Left. This is the left channel audio

3.2.8 Line Out (GDL 69A Only)

The Line Out output is always at a fixed output. The Line Out is not affected by the volume controls, mute function, and suppression inputs. Support for Line Out was enabled with software version 3.00.

P691-52 Line Out Lo. This is the common ground for the Line Out audio output

P691-53 Line Out Right. This is the right channel audio

P691-54 Line Out Left. This is the left channel audio

3.2.9 Reserved Pins

These pins are reserved and should not be connected.

P691-9

P691-10

3.2.10 Spare Pins

The following pins are spare pins and not connected inside the GDL 69/69A. Wires should not be routed to these pins as they may be used in future configurations of the GDL 69/69A. Use of these pins may result in unintended behavior.

P691-12 P691-44

P691-14 P691-45

P691-15 P691-46

P691-16 P691-47

P691-34 P691-48

P691-36 P691-49

P691-38 P691-50

P691-41 P691-51

P691-42 P691-55

P691-43 P691-76

4 SYSTEM CONFIGURATION/CHECKOUT

4.1 Post-Installation Power Check

Move the aircraft outside and ensure that there is an unobstructed view of the Southern sky. Attach a ground power cart to the external power connector on the aircraft and apply power.

NOTE

Use of an external power cart is optional in order to prevent the aircraft battery from discharging to a critically low level.

Power on all systems and allow two to four minutes for initialization. Verify that the control/display unit and the audio panel are connected, and operating properly. Ensure the circuit breaker for the GDL 69/69A is closed.

4.2 Initialization of Configuration Module

The GDL 69/69A requires aircraft installation information to be stored in the configuration module.

For MX20 and 400/500 series units the configuration module is installed in the back panel connector backshell assembly and the only parameter stored in the configuration module is the variable attenuator value needed to obtain the required GDL 69/69A gain/loss component.

For installations with the GDU 104x, the configuration information is stored with the G1000 avionics system. Therefore the configuration module is not installed in the GDL 69/69A connector backshell. For installations with the G1000 avionics system, the configuration information contains the variable attenuator value and may contain several other parameters.

NOTE

The GDL 69/69A does not provide proper operation until the configuration initialization procedure is completed.

4.2.1 Configuration Module Procedure for Installation with MX20

Refer to the latest revision of the MX20 Installation Manual (Garmin AT Part Number 560-1025-()) for instructions.

4.2.2 Configuration Module Procedure for Installation with 400/500 Series

Perform the following steps to program the configuration module of the GDL 69/69A when using the 400/500 Series as the control and display unit:

1. Power up the 400/500 in Configuration Mode (refer to the 400/500 Install Manual for instructions)
2. Go to GDL CONFIG Page (the last page)
3. Enter in the Attenuation value, which is computed as in the following formula:

$$\text{Attenuation} = (6 - \text{GLcomp}) * 10$$

GLcomp = GDL 69/69A gain/loss component value from Table 2-7.

Example: If GLcomp from Table 2-7 is -1.39dB (calculated from example in Section 2.6.4.2) than;

$$\begin{aligned} \text{Attenuation} &= (6 - (-1.39)) * 10 \\ &= (6 + 1.39) * 10 \end{aligned}$$

Attenuation = 7.39 * 10 = 73.9 rounded up 74 to enter in the 400/500 Series.

NOTE

If Attenuation from the above calculation is < zero or > 100 then the gain/loss compensation is outside the range required for proper operation. Review Section 2.6.4 for appropriate corrective action.

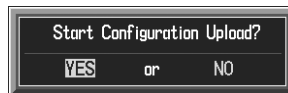
4.2.3 Configuration Module Procedure for GDU 104x

1. Insert the correct Loader Card into the top slot of the PFD.
2. Start the G1000 system in Configuration mode.
3. On the PFD, go to the Configuration Upload page using the FMS knob:
4. Activate the cursor and use the small FMS knob to highlight the airframe type in the FILE field.

NOTE

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

5. Press the ENT key to select the appropriate airframe type. Once an airframe type is selected the configuration files in the SECTION field will be displayed.
6. Using the FMS knob, highlight 'GDL69' in the FILE LIST field.
7. Press the LOAD softkey.
8. Select YES and press the ENT key to acknowledge the following prompt:



9. Monitor the status of the upload. When the upload is finished, press the ENT key to acknowledge the following confirmation:



10. View the SUMMARY field and ensure that all items are 'complete', then de-activate the cursor.
11. Go to the System Status page.
12. Activate the cursor and highlight 'GDL69' in the LRU window.
13. Verify that the reported part number and version of the software matches the data in the Required Equipment List.
14. Continue to the GDL 69A Test procedure.

4.3 Configure RS-232 Port

For installations with the MX20, refer to the MX20 Installation Manual for configuring the correct RS-232 port of the MX20 that the GDL 69/69A is connected. For installations with the 400/500 series units, refer to the 400/500 Series Pilot's Guide Addendum for configuring the correct RS-232 port of the 400/500 series unit that the GDL 69/69A is connected.

4.4 System Operational Checkout

Before performing system checkout, ensure that the configuration module (if applicable) is properly programmed and the GDL 69/69A connected to the correct communication port.

Display/Control device refers to either the MX20 or the 400/500 series units.

4.4.1 Data Link Status and Connection

Power up the GDL 69/69A. View the data link status on the display/control device to verify XM signals are being received. Refer to the MX20 installation manual or the 400/500 Series Pilot's Guide Addendum for instructions on how to access the data link status page on those units. For GDU 104x units, refer to the G1000 Configuration Manual, 190-00303-04 or the aircraft specific configuration manual.

The antenna gain setting should be 25 for the GA 55, GA 55A and GA 57, and may be different for equivalent antennas. The cable loss setting should be set to 4.5 dB at the factory. Set this setting to the value computed in Section 2.6.4.1 if it is different from the default value.



Figure 4-1. Data Link Configuration Page on the MX20



Figure 4-2. Data Link Configuration Page on the 400/500 Series (500 Series shown, 400 Series screen is similar)

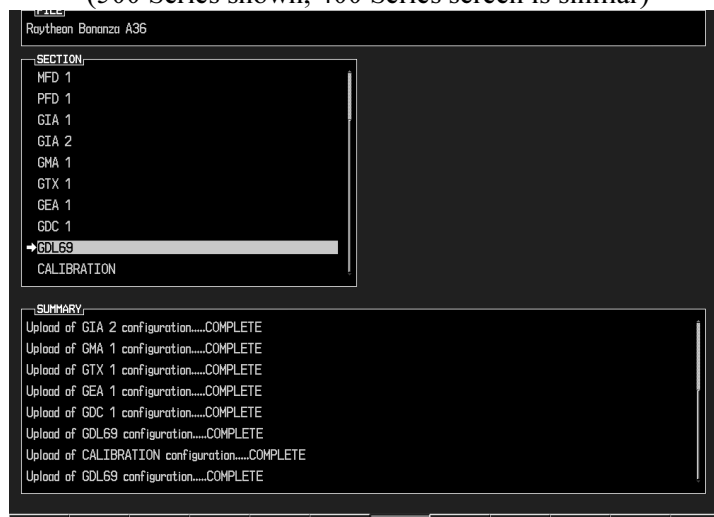


Figure 4-3. Configuration Upload Page - GDU 104x



Figure 4-4. Configuration Page – GDU 104x

4.4.2 Audio Output (for GDL 69A connected to MX20 or GDU 104x)

CAUTION

If GDL 69A is connected to an audio panel, the music input should be used. A test must be conducted to ensure COMM radio signals will mute audio output from the GDL 69A.

NOTE

If a GDL 69A is installed with the 400/500 series, the GDL 69A audio feature is not operational.

Verify Channel 0 or other channel is displayed. The GDL 69A powers up with the audio muted. Press mute or volume keys (switch or on display/control device). Verify sound output from speakers. The GDL 69A may come with a trial activation to XM audio entertainment. With this trial activation, all audio channels for the given subscription should be available.

4.4.3 Discrete Switches (for GDL 69A only, if installed)

Channel Up/Down— Press the Channel Up or Down switches and observe that channel display on the display/control device increments or decrements, respectively.

Volume Up/Down— Press the Volume Up or Down switches and observe that speaker volume increases or decreases, respectively.

Mute—Pressing the Mute switch should terminate sound from speakers. Pressing it again should resume audio.

More optional checkout procedures are available after the GDL 69/69A is activated with XM Satellite Radio Corporation. Refer to the XM Activation Procedure document, P/N 190-00355-04.

4.4.4 Audio Suppression Input (GDL 69A only)

The GDL 69A has audio suppression inputs to disable the audio output when an electronic aural warning, such as a stall warning or gear warning, is activated.

With installations where the Audio Suppression is used, activate the Stall Warning, Gear Warning, or other interfaced inputs to the Audio Suppression inputs, one at a time. Verify the GDL 69A audio to the crew headphones is muted when each warning alarm is activated. The stall warning horn may be activated by simply raising the stall vane on the leading edge of the wing. The gear warning horn may be simulated by providing power or ground, as appropriate, directly to the horn. This can only be done provided the horn has been tested for proper operation when a gear retraction test was performed.

4.5 Activation with XM Satellite Radio

Before the GDL 69/69A can be used, the unit has to be activated by XM Satellite Radio and services have to be subscribed to XM Satellite Radio Corporation. Reference latest revision of 190-00355-04.

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5 TROUBLESHOOTING

Table 5-1. Troubleshooting Guide

Problem	Action
No communication with GDL 69/69A.	<ul style="list-style-type: none"> • Check power wiring and pin out. • Verify correct communication port setting on display/control device.
No or low-quality XM signal	<ul style="list-style-type: none"> • Ensure the XM antenna has an unobstructed view of satellite constellation. • Check the antenna cable and connectors. • Verify correct antenna loss value in the configuration module. • Verify antenna ground plane is adequate.
No audio output (for GDL 69A)	<ul style="list-style-type: none"> • Verify installed unit is GDL 69A, and not GDL 69 (with no audio feature). • Verify wiring of audio suppression input. Verify wiring is going to correct active high or active low input sense. • Check wiring from GDL 69A to audio panel. • Verify 'Mute' is not on. • Increase volume by pressing Volume Up. • If there is audio output only on Channel 1, verify that audio XM service has been activated. Reference 190-00355-04.
Incorrect or no XM subscribed services displayed	<ul style="list-style-type: none"> • Verify subscription with XM Satellite Radio. • GDL 69/69A might not have been properly activated. Reference 190-00355-04.
XM audio entertainment does not mute when audio suppression interfaced inputs (stall, gear) are activated. (GDL 69A only)	<ul style="list-style-type: none"> • Verify wiring of audio suppression inputs. • Verify alarm activation state of warning active high and active low.

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6 LIMITATIONS

6.1 Operation

The installation of a GDL 69/69A into an aircraft does not alter the operation approvals previously granted to the aircraft. Additional operation approvals may required FAA evaluation of all systems installed in a particular aircraft and is outside the scope of the GDL 69/69A STC.

Any higher priority audio cautions or alerts, such as the stall warning or gear warning, must disable XM audio to crew locations by muting the GDL 69A XM audio with the use of the audio suppression discrete inputs on the GDL 69A.

6.2 Installation

The GDL 69A XM Satellite Radio audio entertainment may be installed to all passenger locations for all aircraft on the STC Approved Model List (AML). XM audio entertainment to crew locations depends on aircraft installation, which must meet requirements of 14 CFR §23.1431(e).

For purpose of this STC, 14 CFR §23.1431(e) requires that each pilot station must be able to hear the aircraft's stall warning horn with the entertainment system audio set to the maximum pilot controllable setting. This also applies to aircraft with a gear extension warning horn. Aircraft which have electric stall/gear warning may utilize the GDL 69A audio suppression input to turn off the music during an event. For these installations, the XM audio may be provided to the crew locations.

For aircraft installations with non-electric stall/gear warning horns, this STC does not provide data for installation of audio entertainment to crew locations. The GDL 69A audio entertainment may not be wired to crew locations without a separate evaluation that is beyond the scope of this STC. It is possible for installers to seek evaluation and approval of an alternate installation by means of the field approval process. In both cases, each installation or aircraft type must be evaluated for compliance with 14 CFR §23.1431(e). This evaluation may determine that the required horns can be heard satisfactorily without disabling the GDL 69A audio entertainment to the crew.

NOTE

For installations with non-electric stall warnings, the installer may attenuate the GDL 69A audio provided to crew locations to assist meeting the requirements of 14 CFR §23.1431(e). The GDL 69A audio output may be attenuated by installing series resistors per Figure D-6.

For preservation of essential equipment in aircraft with multiple power busses, the GDL 69/69A should be powered from a non-essential bus.

6.2.1 Antenna

The GDL 69/69A is compatible with the Garmin antennas listed in Table 1-5 or those with equivalent specifications. Refer to Table 1-7 for specifications.

6.2.2 Equipment Interfaced to the GDL 69/69A

Any aircraft systems, other than those shown in this installation manual, that interface to the GDL 69/69A are outside the scope of this manual and may require further evaluation and/or certification approval.

All equipment interfaced to the GDL 69/69A must be previously or concurrently approved.

6.2.3 Preservation of Previous Systems

It is the installer's responsibility to preserve the essential characteristic of the aircraft being modified by this manual to be in accordance with the aircraft manufacturer's original design. This includes the preservation of multiple power buses, which reduce the probability of interrupting power to essential instruments and avionics. The GDL 69/69A is non-essential equipment and as such, if an option to power the unit from a non-essential bus is available, it must be used.

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7 PERIODIC MAINTENANCE

The GDL 69/69A does not require maintenance except as included in this section.

7.1 Audio Suppression

If installation requires use of audio suppression inputs, each installed input must be verified for proper operation on an annual basis.

7.2 Equipment Calibration

No scheduled servicing tasks or internal manual adjustments are required on the GDL 69/69A.

7.3 Cleaning

The GDL 69/69A does not require regular cleaning.

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Appendix A - STC Data

A.1 STC/PMA Information

The STC SA01487SE with Approved Model List (AML), Master Data List (Garmin P/N 005-C0217-00) information is available on the Garmin web site at www.garmin.com. Download from the Dealers Only page.

A.2 Permission to use STC

Consistent with Order 8110.4C and AC 21-40, Garmin AT grants permission to Garmin dealers, installers and owners of the GDL 69 and GDL 69A to use STC SA01487SE and the data associated with it, for the sole and express purpose of installation and approval of installation of the GDL 69 and GDL 69A XM Radios and associated interfaces to other previously approved equipment.

A.3 Continued Airworthiness Instructions

Refer to the GDL 69/69A XM Satellite Radio Instructions for Continued Airworthiness (Garmin P/N 190-00355-00).

A.4 STC Approved Model List

This STC SA01487SE includes an Approved model List (AML) attached to the STC. The GDL 69 and GDL 69A XM Satellite Radio is approved for installation on all aircraft listed on the AML following installation instructions and limitations described in this GDL 69/69A Installation Manual. The AML is attached to the STC and may be downloaded from the Garmin web site at www.garmin.com.

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Appendix B - Environment Qualification Form

Go to the Dealers Only site at <http://www.garmin.com> for the latest Environmental Qualification Forms. Refer to the table below for the specific Qualification Form number.

Model	Qualification Form Number
GDL 69/69A	005-00217-33
GA 55	005-00233-00
GA 55A	005-00240-00
GA 57	005-00240-00

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Appendix C - Construction and Validation of Structures

This appendix includes information necessary for testing load-carrying capabilities of equipment mounting structures, such as shelves, mounting plates and mounting brackets, used to mount the GDL 69/69A remote rack.

Baggage compartments and cabins or cockpit floors are good mounting platforms providing the floor attachments meet the strength requirements. If support racks, brackets or shelves need to be fabricated, they should be fabricated and attached to the aircraft structure in accordance with the methods outlined in AC 43.13-2A Chapter 2. After the structure is installed, it should be tested as outlined in AC43.13-2A Chapter 1 to verify that it is capable of supporting the required loads.

The GDL69/69A installation must be capable of withstanding the Ultimate Load Factors listed in Table C-1 for at least 3 seconds in each direction specified without damage or permanent deformation. Note that these required loads differ somewhat from those normally required for equipment installations. The following tables, C-1 and C-2, show the static test loads for the GDL 69/69A with both types of racks.

The combined weight of the **GDL 69 and the remote rack** is 2.69 lbs, the static loads which must be applied (Load Factor x 2.69 lbs.) will be the following:

Table C-1. Static Test Load (GDL 69 with Remote Rack)

Direction of Force	Load Factor	Static Test Load (Load Factor x (GDL 69 + Rack Weight))
Downward	6.6 g	$(6.6 \times 2.69) = 17.75$ lbs
Upward	6.0 g	$(6.0 \times 2.69) = 16.14$ lbs
Sideward	4.5 g	$(4.5 \times 2.69) = 12.11$ lbs
Forward	18.0 g	$(18.0 \times 2.69) = 48.42$ lbs

The combined weight of the **GDL 69A and the remote rack** is 2.83 lbs, the static loads which must be applied (Load Factor x 2.83 lbs.) will be the following:

Table C-2. Static Test Load (GDL 69A with Remote Rack)

Direction of Force	Load Factor	Static Test Load (Load Factor x (GDL 69A + Rack Weight))
Downward	6.6 g	$(6.6 \times 2.83) = 18.68$ lbs
Upward	6.0 g	$(6.0 \times 2.83) = 16.98$ lbs
Sideward	4.5 g	$(4.5 \times 2.83) = 12.74$ lbs
Forward	18.0 g	$(18.0 \times 2.83) = 50.94$ lbs

One method of determining the static load capability is as follows:

1. Mark and drill the holes where the GDL 69/69A equipment rack will be mounted.
2. Install four 8-32 machine screws (MS35206, AN526 or equivalent) in the four holes which will be used to mount the GDL 69/69A remote rack.

NOTE

Some means of a locking fastener must be used, such as lock nuts and lock washers.

3. For testing downward loading, place shot bags or other suitable weights totaling the weight of your equipment plus the rack (See Tables C-1 and C-2) within the footprint outlined by the four screw holes (assuming the mounting surface is horizontal) or use a calibrated force gauge at the location of the center of gravity when the unit is mounted.
4. Verify there is no damage or permanent deformation of the structure after 3 seconds.

5. Fasten a 36 inch loop of suitable material such as fishing line, braided wire, or other similar material having a breaking strength of at least 150 lbs, diagonally between two of the screws. Then fasten another loop diagonally between the other two screws, adjusting the length of the loop so it exactly matches the first.
6. Hook a calibrated force gauge through both loops and apply a sustained pull for at least 3 seconds in each of the other three directions (upward, sideward and forward) at the above calculated forces shown for your particular unit and rack. The values are found in Tables C-1 and C-2.
7. Examine the support structure carefully. If there has been damage or permanent deformation, the structure is not suitable and must be replaced with one which is strong enough to withstand the test loads. Examine all aircraft stringers, bulkheads and skin surfaces, which may have direct or indirect contact with the fabricated shelf. If it is determined that no damage or permanent deformation has occurred, the structure is of sufficient strength and the GDL 69/69A equipment rack may be permanently mounted on it.

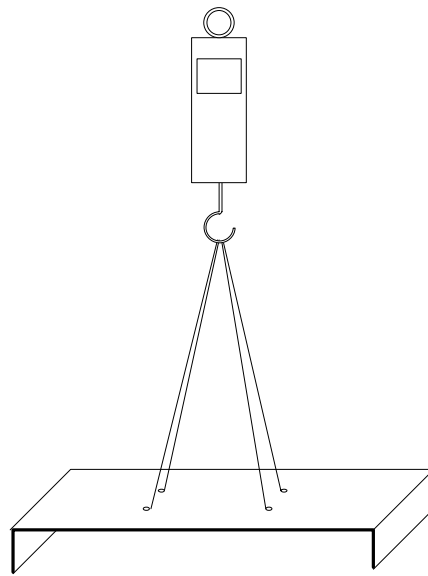


Figure C-1. Upward Static Load Test

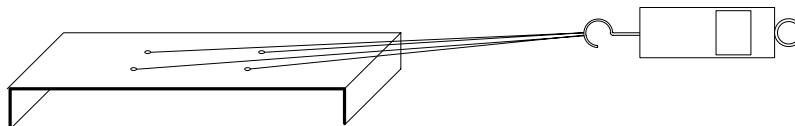


Figure C-2. Forward Static Load Test

Appendix D – Installation Drawings

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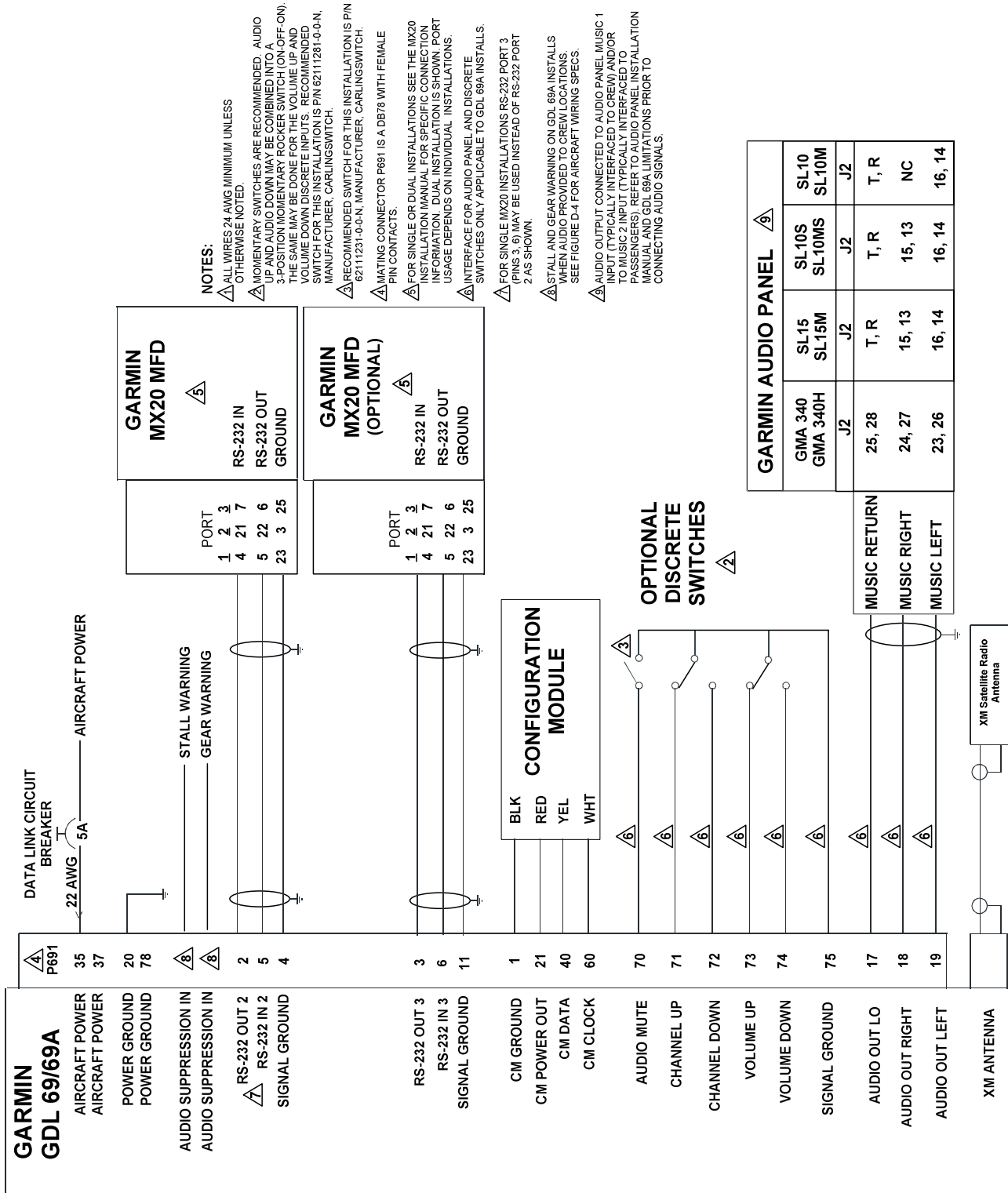


Figure D-1. GDL 69 Interconnect to MFD and Audio Panel

NOTES:

- ⚠ ALL WIRES 24 AWG UNLESS OTHERWISE NOTED.
- ⚠ MOMENTARY SWITCHES ARE RECOMMENDED. AUDIO UP AND AUDIO DOWN MAY BE COMBINED INTO A 3-POSITION MOMENTARY ROCKER SWITCH (ON-OFF-ON). THE SAME SHOULD BE DONE FOR THE VOLUME UP AND VOLUME DOWN DISCRETE INPUTS. RECOMMENDED SWITCH FOR THIS INSTALLATION IS P/N 62111281-0-0-N, MANUFACTURER, CARLINGSWITCH.
- ⚠ RECOMMENDED SWITCH FOR THIS INSTALLATION IS P/N 62111231-0-0-N, MANUFACTURER, CARLINGSWITCH.
- ⚠ MATING CONNECTOR P691 IS A DB78 WITH MALE PIN CONTACTS.
- ⚠ PINOUT FOR ALL ETHERNET PORTS SHOWN. USE ANY ETHERNET PORT AVAILABLE.
- ⚠ INTERFACE FOR AUDIO PANEL AND DISCRETE SWITCHES ONLY APPLICABLE TO GDL 69A INSTALLATIONS.
- ⚠ STALL AND GEAR WARNING ON GDL 69A INSTALLATIONS WHEN AUDIO PROVIDED TO CREW LOCATIONS. SEE FIGURE D-4 FOR AIRCRAFT WIRING SPECIFICATION.
- ⚠ AUDIO OUTPUT CONNECTED TO AUDIO PANEL MUSIC 1 INPUT (TYPICALLY INTERFACED TO CREW) AND/OR TO MUSIC 2 INPUT (TYPICALLY INTERFACED TO PASSENGERS). REFER TO AUDIO PANEL INSTALLATION MANUAL AND GDL 69A LIMITATIONS PRIOR TO CONNECTING AUDIO SIGNALS.
- ⚠ USE AIRCRAFT GRADE CATEGORY 5 ETHERNET CABLE. THESE INCLUDE THE FOLLOWING:

MANUFACTURER	P/N
PIC WIRE AND CABLE	E10422 (22 GAUGE)
PIC WIRE AND CABLE	E10424 (24 GAUGE)
ELECTRONIC CABLE SPECIALIST	392404 (24 GAUGE)

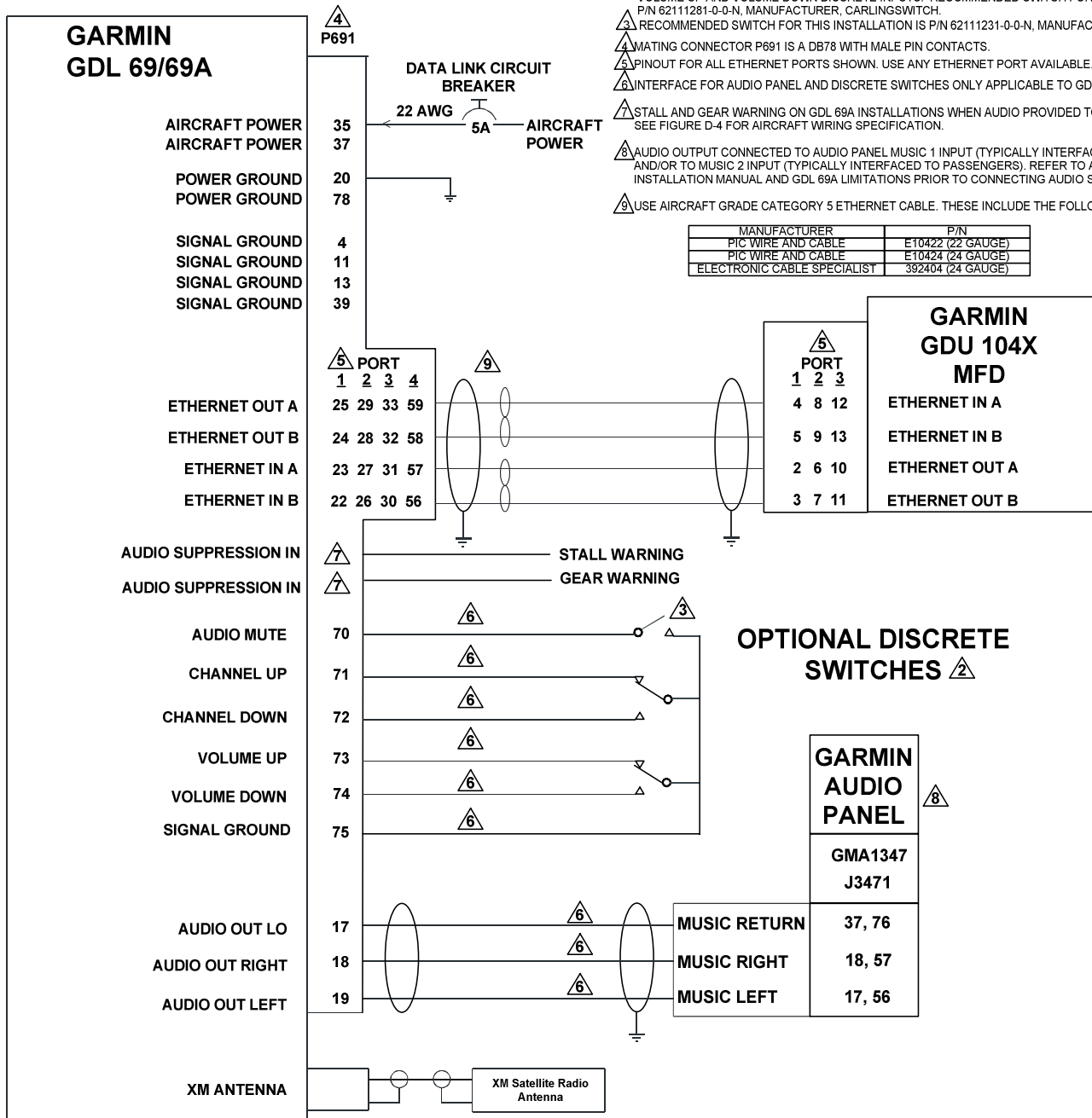


Figure D-2. GDL 69 Interconnect to GDU 104x

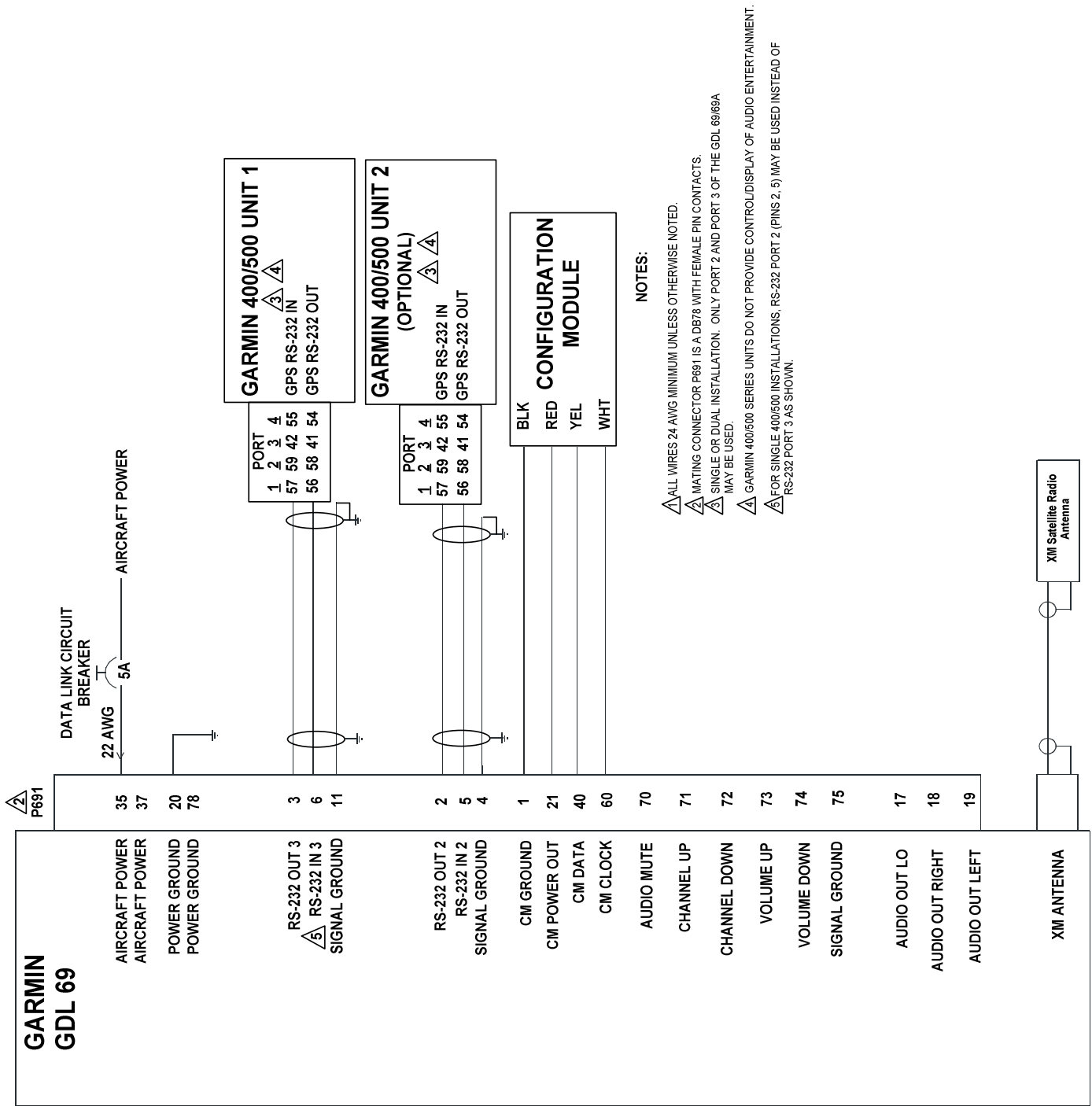


Figure D-3. GDL 69 Interconnect to 400/500 Series

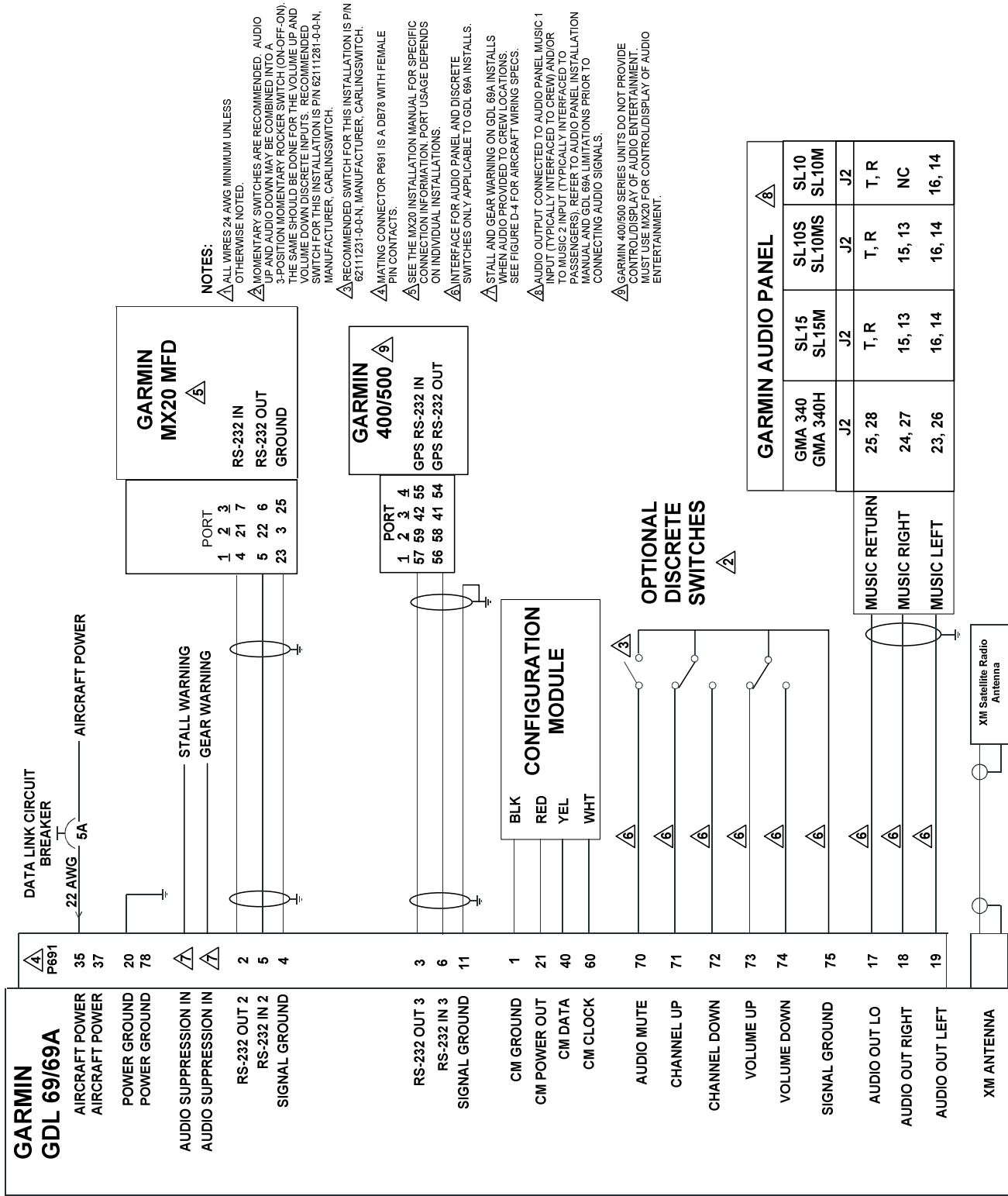


Figure D-4. GDL 69 Interconnect to MFD and 400/500 Series

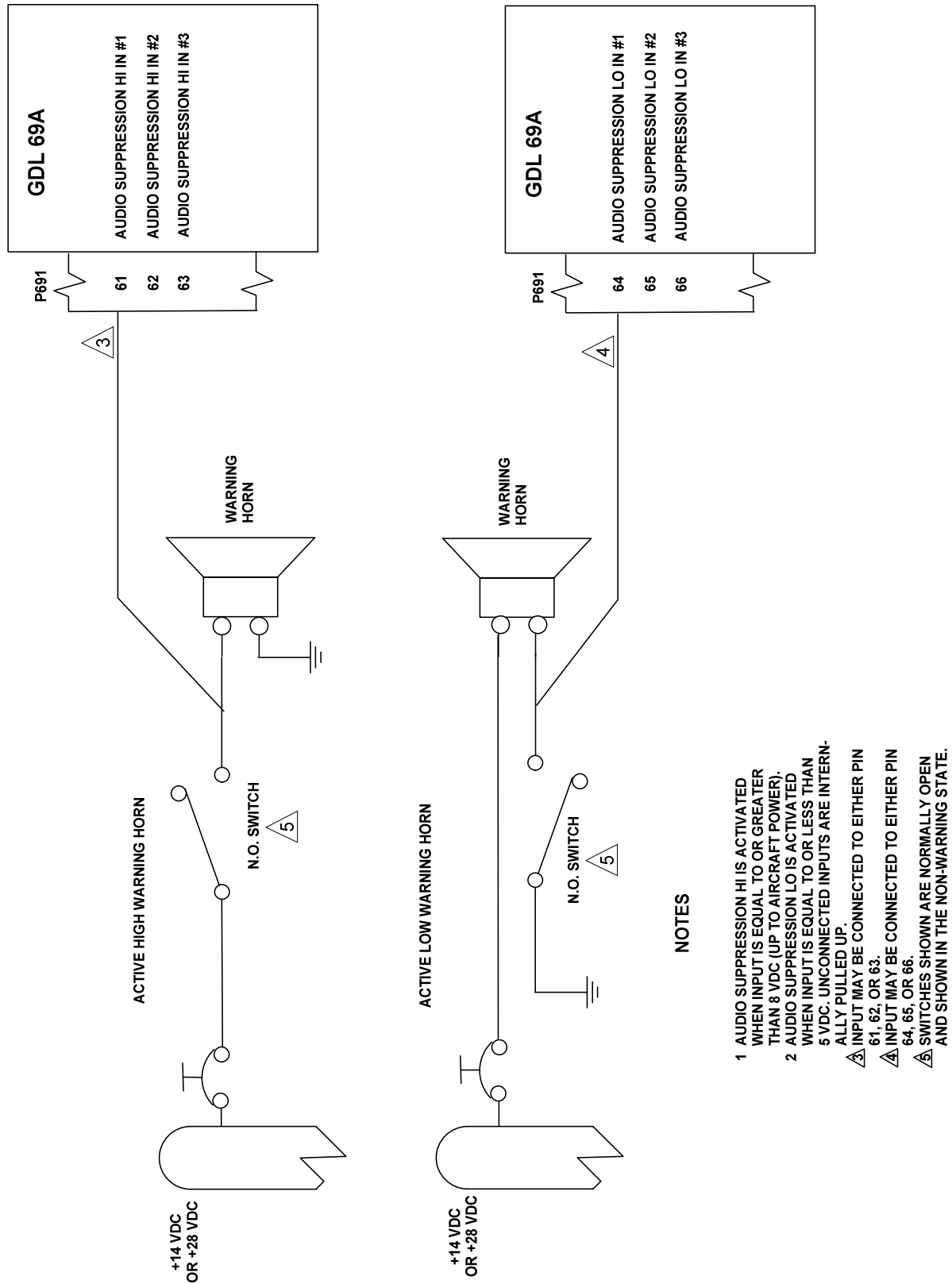


Figure D-5. Interconnect to Warning Horns

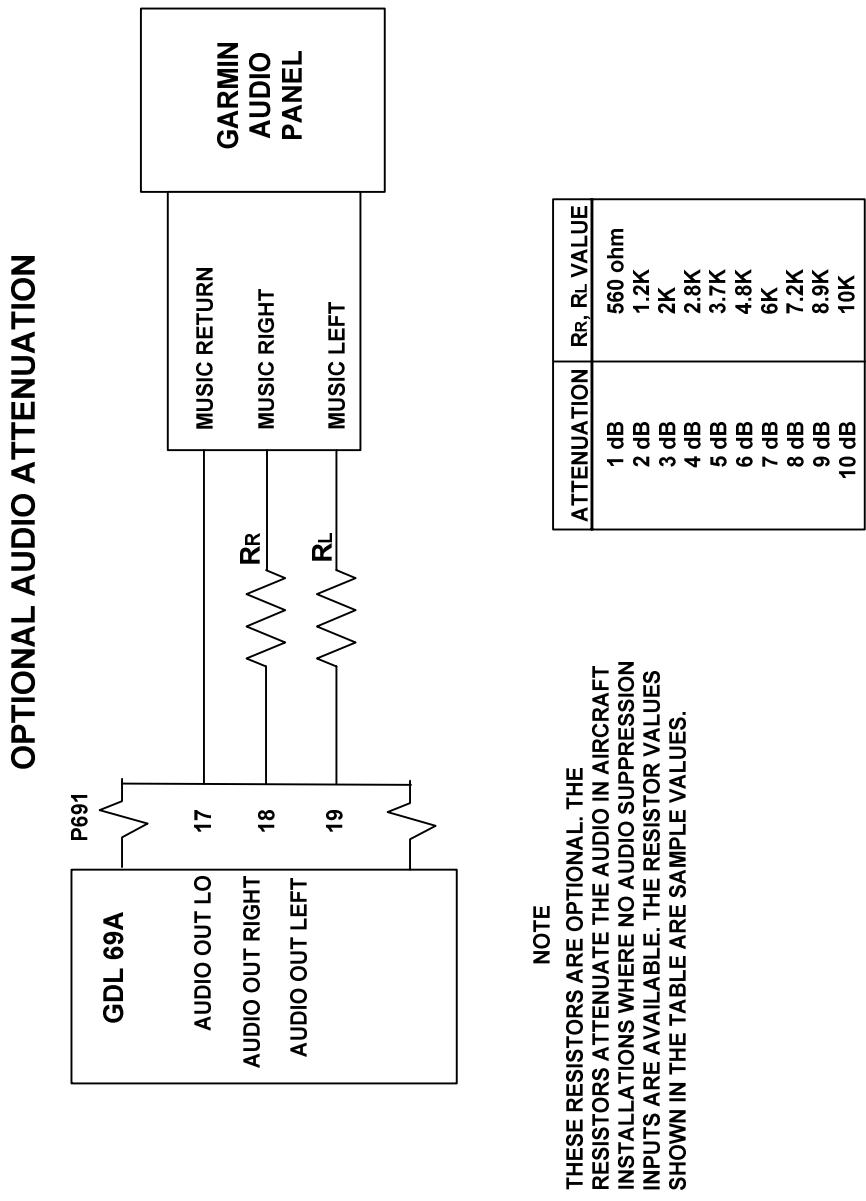


Figure D-6. Optional Audio Attenuation

