GIA 6300 Installation Information and Description

DRAFT

Contents

1 Overview

The GIA 6300 is an integrated avionics unit meeting robust environmental requirements. The major functions of the GIA6300 are:

- Communications Hub and Data Concentrator,
- VHF digital COM (118 – 152 MHz; extended frequency range),
- VOR/VLOC and GBAS receiver,
- Glideslope receiver,
- GPS SBAS receiver,
- Audio Selection, and
- Marker Beacon Receiver.
- Other functions such as AFCS (Flight Director) have significant portions of their processing executed by the GIA 6300.

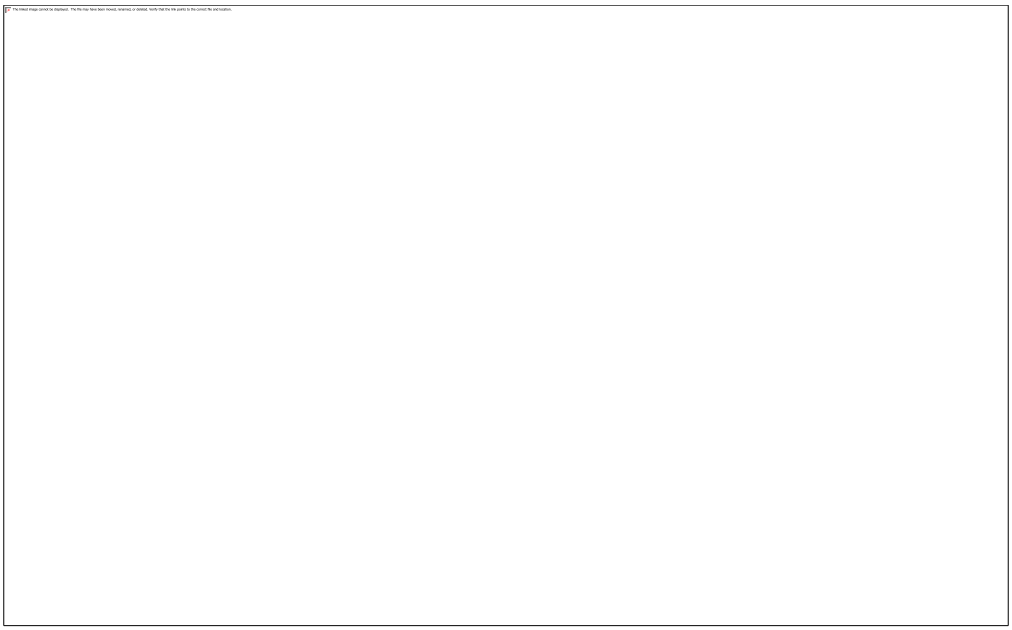
The GIA 6300 is designed as though the functions are spread out across a federated system. This provides independence and redundancy between the functions.

2 Physical Characteristics

The GIA 6300 is 7.4” wide x 5.86” high (with the mounting rack). It has a depth of 14.48” to the end of the strain relief. And additional 0.5“ of clearance is desired behind the cooling accessory to allow for adequate ventilation, and this clearance should be no less than 0.25” .

The weights for the unit and its accessories are listed below.

- Unit (Standalone) 11.94 lbs
- Mounting Rack 0.57 lbs
- Cooling Accessory 0.65 lbs (approximate TBD)



3 Installation Overview

3.1 Cabling and Wiring

Coaxial cable with 50 Ω nominal impedance and meeting applicable aviation regulations should be used for the installation. A typical maximum cable length for the GPS antenna is 40 feet. The installer shall insure that the attenuation of the GPS cable run falls between 3 dB and 7 dB inclusive at 1.5 GHz.

3.2 VHF COM Cable Routing

Avoid routing the COM antenna cable near aircraft control cables or near GPS antenna cables. Avoid sharp bends in the antenna cable.

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. 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.

4 Cooling Accessory

The GIA 6300 requires cooling accessory, 011-03516-00, for normal operation. This cooling accessory contains 4 fans, powered by the GIA Main Boards. Main A powers 2 of the fans, and Main B powers the other 2. The GIA 6300 can operate at full functionality with up to 2 fan failures.

A ported version of the cooling accessory could be considered/designed if desired by an OEM.

5 GIA6300 Interfaces

5.1 I/O Data Concentration and Computation (provided by Main Boards)

Table XXX lists the interfaces provided by Main A and Main B in the GIA 6300. Main A and Main B in the GIA6300 function as two independent units, and interfaces to specific units should not be split across the boards if practical. Additionally, where practical, primary and secondary sensors should be split between the two boards so that one board does not directly connect to both the primary and secondary sensor for given data.

Interface Description	Quantity	Comment
Active Low Discrete Input	4	
Active Low/High Discrete Input	30	
Active Low/High Discrete Output	20	
ARINC-429 Receiver	26	
ARINC-429 Transmitter	8	
ARINC-717/429 Transmitter	2	
ARINC-717/708 Receiver	2	
ARINC-743 GPS Time-Mark Output	1	
Ethernet	4	
RS-485	14	
RS-232	10	
CAN	2	
Analog Audio Output	1	

5.1.1 Active Low/High Discrete Inputs and Outputs

The GIA 6300 has configurable discrete I/O in order to use the pins on the external connector more efficiently. Each discrete interface, input and output, is configurable between either active high or low.

Each discrete output is capable of sourcing 20 mA in the active state when configured as active high. Six discrete outputs (3 per main board) can be used as super flag outputs capable of providing up to 0.5 Amps of current. Active low states are capable of sinking up to 0.5 Amps.

All of the discrete outputs have a default state of inactive implemented during and after a reset. This is specifically targeted at those outputs supporting auto pilot functionality, ensuring that those outputs reset when the microprocessor resets.

Each discrete input provides 1mA of wetting current when connected to ground.

Both the Audio and Main board are capable of reading the state of 10 of the discrete inputs, and these pins should be reserved as practical. This provides a low latency input path to the audio panel to allow for current and future functionality where delay is undesirable. These functions include 3D Audio, oxygen mask selection, key'ed ICS, and additional ASR Push-to-Command inputs.

5.1.2 Configurable ARINC-717/708 Interface

The GIA 6300 can support any combination of 2 ARINC-717 transceivers and 2 ARINC-708 receivers. The GIA 6300 has an ARINC-708 receiver to support interfacing to a 3rd party radar. The GIA 6300 also supports an ARINC-717 transceiver to add support for connecting to a 3rd party Flight Data Recorder. These interfaces are combined such that they can be configured between ARINC-717 and ARINC-708.

5.1.3 Ethernet

The GIA 6300 has a total of 4 Ethernet interfaces. The 4 Ethernet interfaces are divided equally between the two processors on the main boards, each interface can be used to support redundant connections to the rest of the system from each processor. Each processor can have two high speed communication paths independent of the 2nd processor.

These Ethernet interfaces are all capable of up to 100 Mbps of bandwidth, but it is not available in flight.

5.1.4 RS-485/422

The GIA 6300 has a total of 14 RS-485 transceivers. Any two of these transceivers can be paired together to make one RS-422 interface allowing up to 7 RS-422 interfaces. The RS-485/422 interfaces are capable of a maximum baud rate of 921.6 kbps.

5.2 VHF COM Interfaces

Interface Description	Quantity	Comment
Analog Audio Output	1	
Analog Audio Input	1	
Active Low Discrete Inputs	2	
Active Low Discrete Outputs	1	
Active Low Discrete Input/Output	1	

5.2.1 Key Event Out

The Key Event Out active low discrete output signals that the GIA COM is transmitting. In installations with more than 2 VHF COM radios, this input can be used to connect to the Transmit Interlock input on the other radios.

5.2.2 RX Squelch Break

The RX Squelch Break active low discrete output/input signals that the RF squelch has broken on the COM receiver. This output may be used in the future to hold off digital transmissions or to coordinate two digital transmitters in a CSMA environment. This pin functions as both the input and output signal for a single signal between all of the digital radios in the system: the two GIA 6300s and the GDR 66.

5.2.3 Emergency COM Operation

The Emergency COM Operation active low discrete input tunes the transceiver to the emergency frequency, 121.500 MHz, when active.

5.3 NAV

Interface Description	Quantity	Comment
Analog Audio Output	1	

5.4 Audio Panel

Interface Description	Quantity	Comment
Transceiver (I/O) Interface	3	
Transceiver (I/O) / Microphone Interface	4	
Receiver Inputs	7	
Alert Inputs	4	
Crew Headset Outputs	2	
Passenger Headset Outputs	2	
Microphone Inputs	6	
Music Inputs	2	
AES3 Interfaces	2	
Active Low Discrete Inputs	6	
Active Low Discrete Outputs	7	
Summed Audio Output	1	

Speaker Outputs	2	

5.4.1 Transceiver Interfaces

The GIA 6300 supports a total of 8 radio transceivers including the internal VHF COM radio. One of these interfaces is used to connect to the cross-side GIA 6300 VHF COM.

Four transceiver inputs can be configured as microphone inputs. This allows a total of 8 passenger or support staff positions per GIA 6300. In cases where both 8 passenger microphones and 8 transceivers are required, some of the receiver and alert inputs can be repurposed as transceiver inputs.

5.4.2 Receiver and Alert Inputs

The GIA 6300 has a total of 11 differential audio inputs. These can be used as either un-switched, alert inputs or as inputs from radio receivers. Two of these inputs are used to interface from the cross-side GIA 6300 NAV radio and Alert Output.

With the division list in Table XXX, the GIA 6300 will be capable of supporting up to 8 receiver inputs including the integrated NAV radio.

5.4.3 Headset Outputs and Microphone Inputs

The GIA 6300 will be capable of supporting 2 crew members and 4 or 8 passenger headset locations per unit. This is facilitated with 2 headset-microphone crew locations and a two passenger headset outputs with 4 microphone locations (and the 4 configurable Transceiver/Microphone inputs).

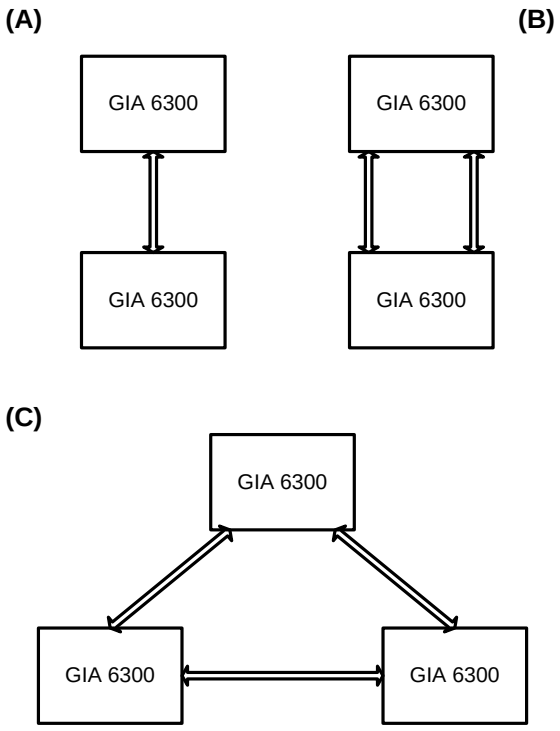
The Pilot Headset and Microphone interface has a hardware failsafe connection to the integrated VHF COM. When in hardware failsafe, the Pilot microphone input will be hardwired through relays to the COM input and the COM output will be hardwired through relays to the Pilot Left Headset output.

Each of the passenger headset output is capable of driving 4 stereo headsets in parallel. If desired, the output can be configured as two mono channels allowing 2 groups of passengers to receive separate, mono selected audio sources per output. The total number of passengers supported by the GIA 6300 is limited by microphone inputs, 8.

5.4.4 AES3 Interface

The GIA 6300 has 2, digital, AES3 interfaces (primary and secondary). The primary AES3 interface implements carries ICS, communication, and navigation related audio between GIAs.

The secondary AES3 interface can be used to carry high fidelity music audio. This secondary interface will be configurable to either carry 8 (4 stereo) high fidelity channels, or 24 low fidelity channels (just like the primary AES3 interface).



(A) Dual GIA 6300 system with single AES3 connection, (B) Dual GIA 6300 system with Dual AES3 connection, (C) Triple GIA 6300 installation.

Figure XXX illustrates the AES3 interconnect configurations provisioned by the GIA 6300 AES3 interfaces. The majority of GIA 6300 installations will require only the low fidelity connection depicted by (A) with cross-side music audio being implemented with wiring splices. Connecting the secondary AES3 interface as per (B) allows up to 4 entertainment audio sources to be connected to the audio system.

For a Triple GIA 6300 system, as depicted in (C) of Figure XXX, the secondary AES3 interfaces will be configured to run in the low fidelity mode and the GIA's will be connected in a loop. Each GIA 6300 only provides the audio sourced by its specific inputs.

5.4.5 Discrete Inputs and Outputs

The Audio board provides 6 discrete, active low inputs and 7 discrete, active low outputs. The 7 outputs are for providing Push-To-Talk keys to the externally connected transceivers.

The 7 discrete inputs are divided up as follows.

a. 3 Push-To-Command keys for signaling an Automatic Speech Recognition Request,
b. 2 Push-To-Talk keys for signaling the desire to transmit on the selected transceiver, and
c. 1 Force Failsafe Input. When the Force-Failsafe input is active, the unit is placed in Hardware Failsafe outside of software control.

Note that there is an additional 10 discrete inputs available from connections shared with the main boards.

5.4.6 Summed Audio Output

The GIA 6300 has a summed audio output suitable for driving a CVR input. When in hardware failsafe, the COM is hardwired to the Summed output.

5.4.7 Speaker Output

The GIA 6300 has two speaker outputs to support mid-sized aircraft that need one or two additional PA speakers in the cabin area but do not need the flexibility or output capabilities of a full IFE or passenger address system. Both speaker outputs will be capable of outputting 10W into a 4-ohm load and 5W into an 8-ohm load.

5.4.8 External RF Interfaces

The GIA 6300 has 5 separate RF interfaces:

- VHF COM RF In/Out,
- VLOC RF In,
- Glideslope RF In,
- GPS/SBAS RF In, and
- Marker Beacon RF In

6 Power

The Main A, Main B, COM, and Audio Boards will all have separate, independent power supplies with separate Power connections on the external connector. NAV and GPS are powered by the 2 Main Boards.

The GIA 6300 is only intended for use in 28V systems, but will be required to remain "online" down to 10 V_{DC} for 60 seconds during engine start conditions. The power supplies will be designed to allow the units to remain fully functional with minimal exceptions

The Main A, Main B, Audio, NAV, and COM boards will have 200 ms of backup power provided by independent banks of capacitors. Some loads and circuitry on the these boards may be shed during a power interrupt and the COM will not transmit in order to conserve back-up power and reduce the physical size of the capacitor banks. The backup power is only intended to ensure a short power interruption is transparent to the rest of the system.

Function	Connector	Pins	Typical Current @ 28V	Max Current @ 28 V
COM				
AM Rx			0.37 A	
AM Tx			2.5 A	3.6A (3:1 VSWR)
VLD Mode 2 Rx			0.5 A	
VDL Mode 2 Tx			3.8 A	5.0A (3:1 VSWR)
Main A [1]			1.5 A	3.25 A
Main B [1]			1.5 A	3.25 A
Audio			0.3 A	1.2 A

Note 1: Main A and Main B share the responsibility of powering the navigation and GPS receivers. Typical power consumptions numbers assumed shared loading while maximum numbers assuming a single board is powering all radios.

Note 2: See the Environmental Qualification Form for details on surge rating and minimum/maximum operating voltages.

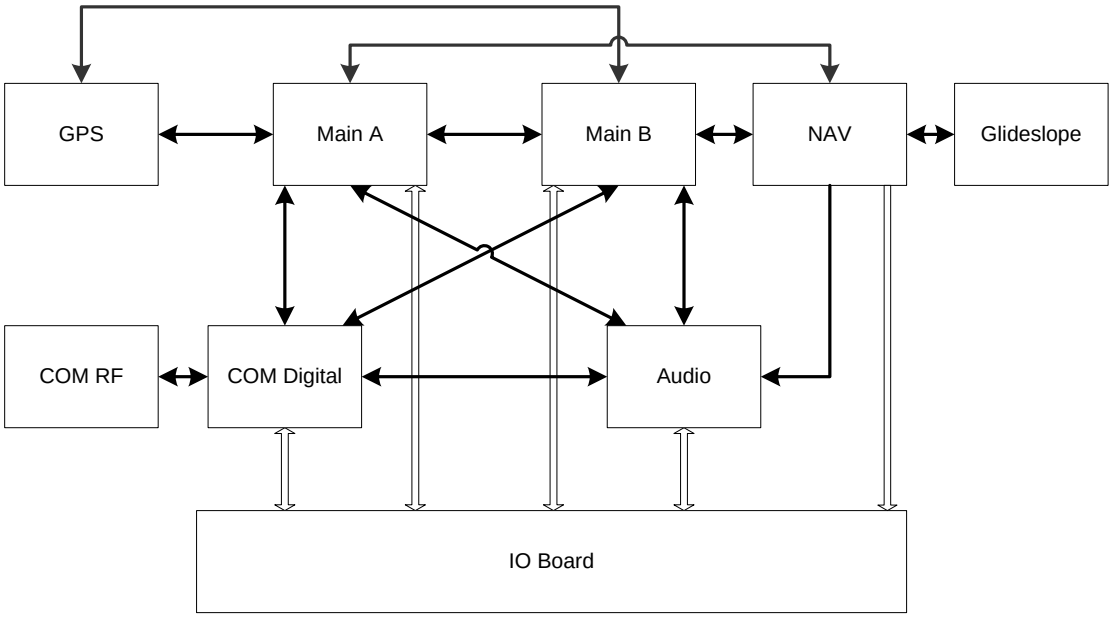
7 Environmental Qualifications

Reference the Environmental Qualification Form in Requiem GIA6300 EQF.

8 System Interconnect

8.1 Unit Level Connections

Figure XXX shows the electrical top level design of the GIA 6300. The GIA 6300 consists of 9 separate circuit boards and the GPS module. External interfaces are passed through the IO Board to the Main A, Main B, COM Digital, NAV, and Audio boards.



8.1.1 Main A and Main B Redundancy

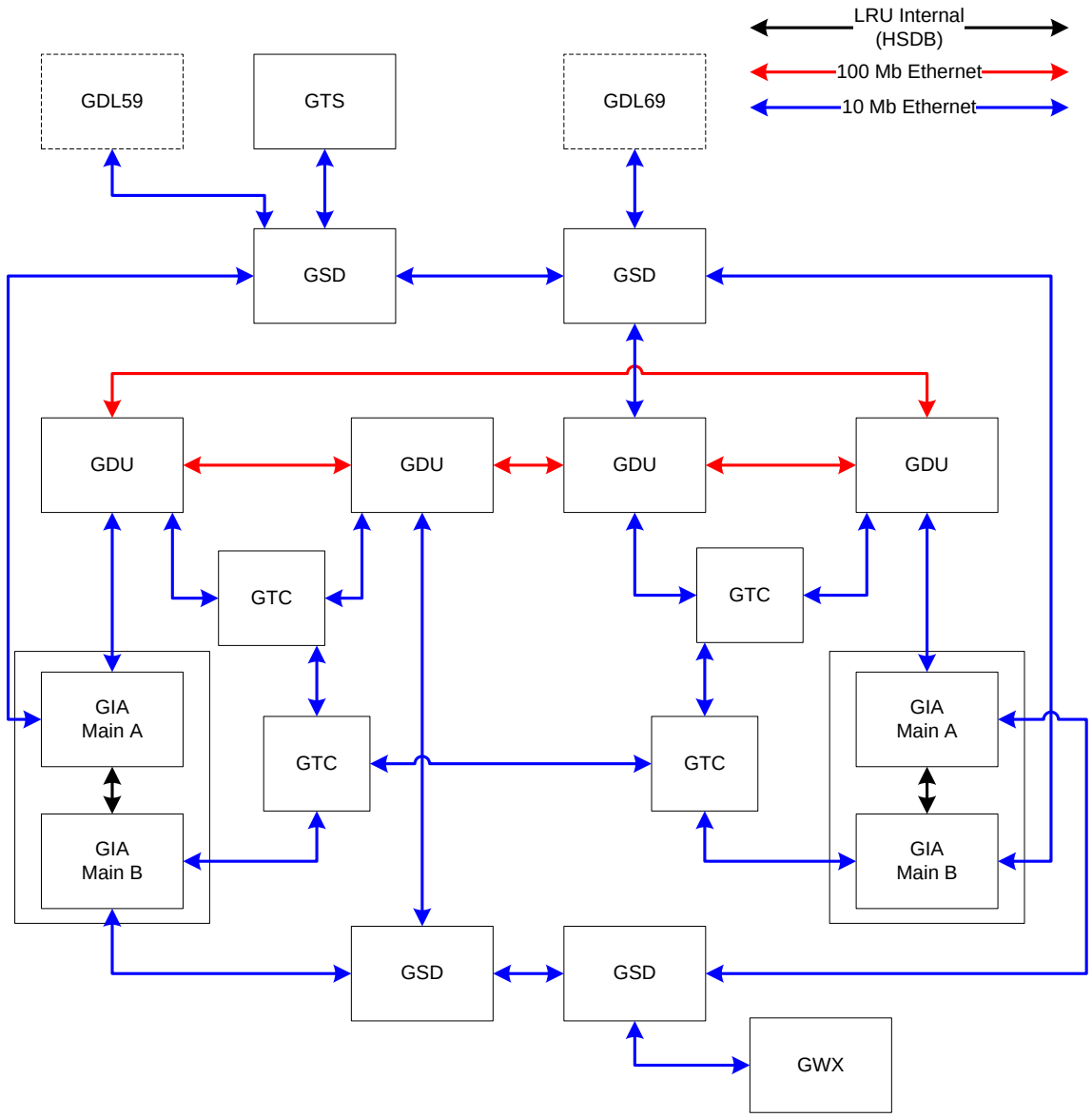
Main A and Main B in the GIA6300 function as two independent units, allowing for separation and redundancy in each GIA. Both GIA 1 and GIA 2 are connected to the sensors, but in each GIA, Main A and Main B can be connected to a different set of sensors (i.e. Main A is connected to all primary sensors and Main B is connected to all redundant sensors). Data is shared between the two main boards through the inter-processor communication.

The COM Digital, NAV, and the Audio board each connect to both Main A and B so that there is redundant communication between these components and the rest of the system. It is possible to wire the aircraft such that a total failure of either Main A or Main B cannot cause a total loss of COM, NAV, or Audio functionality. In the event of a single Main Board failure, the second main board would still be capable of tuning the COM, collecting navigation data, and processing autopilot and flight director functionality (as examples).

8.2 System Level Connection

Figure XX shows the system level, Ethernet interconnects between the GIA 6300 and the rest of the Garmin system. This shows a larger system containing 4 GSD data concentrators, GTC touch screen controllers, and GDU displays. Most foreseeable systems are expected to be a subset.

The GIA 6300 implements 4 Ethernet interfaces between the two Main boards. Main A and Main B have independent processors each with a separate HSDB address. Passing between the two processors will be considered an additional HSDB hop.



9 GIA6300 Pin Out

See the GIA 6300 pin out at the Prism location below. This document also lists the keying for each connector.

prism://hw-bin-vc.aviation.garmin.com/gia6300/trunk/Design/IO Board/GIA 6300 Pin Out.docx

10 Electrical Bonding

Electrical equipment, supporting brackets, and racks should be electrically bonded to the aircraft's main structure. Refer to SAE ARP 1870 section 5 when aluminum surface preparation is required to achieve electrical bond. An equivalent OEM bonding procedure may also be substituted. The electrical bond should achieve direct current (DC) resistance less than or equal to 2.5 milliohms to local structure to where the equipment is mounted. Compliance should be verified by inspection using a calibrated milliohm meter.

A statement like below should be in the harness fabrication section somewhere.

The wiring shall be prepared per the Garmin specifications, 190-00313-12 Circular Connector (and Configuration module) Installation Instructions.

11 Antenna Considerations

11.1 VHF COM Antenna Location

The GIA6300 VHF COM antenna should be well removed from all projections, engines and propellers. The ground plane surface directly below the antenna should be a flat plane over as large an area as possible (18 inches square, minimum). The antenna should be mounted a minimum of three feet from any DME antennas, three feet from any GPS antennas, and as far as practical from the VHF NAV and ELT antennas. Some ELTs have exhibited re-radiation problems generating harmonics which may interfere with other signals.

In addition, the COM antenna must have at least 16 dB of isolation from other COM antennas to prevent damage to the GIA6300 COM receiver. For COM antennas mounted on the same side of the fuselage, 16 dB of isolation can be achieved by a physical separation of approximately 4 feet (1.2 meters).

If simultaneous use of two or more COM transceivers is desired the COM antennas must be spaced for maximum isolation. For a two COM installation, one COM antenna should be mounted on the top of the fuselage and the other antenna should be mounted on the bottom of the fuselage. For installations with three COM transceivers, one COM antenna should be mounted on the top of the fuselage and the other two antennas should be mounted on the bottom of the fuselage and physically separated from each other as much as possible.

The recommended minimum isolation between COM antennas for simultaneous use of two or more COM units is 40 dB. Separating the COM antennas between the top and bottom of the fuselage typically provides 35 – 45 dB of isolation for metal skin aircraft. For COM antennas mounted on the same side of the fuselage, 40 dB of isolation can be achieved by a physical separation of approximately 60 feet (18.3 meters). At antenna isolations of less than 40 dB, there may be reductions in receiver sensitivity (range), squelch breaks, or bleed-through.

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 determine the expected performance of simultaneous COM.

12 License Requirements

The Telecommunications Act of 1996, effective February 8, 1996, provides the FCC discretion to eliminate radio station license requirements for aircraft and ships. The GIA 6300 installation must comply with current transmitter licensing requirements. To find out the specific details on whether a particular installation is exempt from licensing, please visit the FCC web site.

Characteristic	Specification
Transmitter Description:	Aviation-band VHF transceiver with 25 and 8.33 kHz channel spacing.
Antenna Characteristics:	Broad-band, 50 ohms, vertically polarized.
Rated Power:	20 Watts typical, 16 Watts minimum
Emission Type (Voice):	6K00A3E (25 kHz Channel Spacing Mode) 5K60A3E (8.33 kHz Channel Spacing Mode)
Emission Type (Data):	13K0A2D (VDL Mode A, ACARS) 14K0G1D (VDL Mode 2)
Frequency of Operation:	VDL Mode A and Mode 2: 118.000 – 136.975 MHz 25 KHz AM Voice Mode: 118.000 – 136.975 MHz 138.000-144.000 MHz 148.000-149.900 MHz 150.500-150.800 MHz 8.33 KHz AM Voice Mode: 118.000 – 136.99166 MHz

If an aircraft license is required, make application for a license on FCC form 404, Application for Aircraft Radio Station License. The FCC also has a fax-on-demand service to provide forms by fax. The GIA 6300 owner accepts all responsibility for obtaining the proper licensing before using the transmitter. International transmitter license procedures vary by country. Contact the local spectrum agency for license requirements.

NOTES

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

2) *This device complies with Industry Canada's license-exempt RSSs. 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."

   « Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. »

3) *Canadian installations are required to meet Industry Canada specifications for maximum radiation as documented in Radio Specification 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), RF field strength exposure to persons from an antenna connected to this device should be limited to 60V/m for controlled environments and 28V/m for uncontrolled environments.