GARMIN

GTS 8XX/GPA 65

Installation Manual

(Includes the GA 58 Antenna)

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RECORD OF REVISIONS

Revision	Revision Date	Description
1TP	08/06/08	1TP Release
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3TP	2/18/09	Updated manual with various engineering changes
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DOCUMENT PAGINATION

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This manual reflects the operation of software version X.XX. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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NOTE

Throughout this document references made to the GTS 8XX shall equally apply to the GTS 800, 820, and 850 except where specifically noted.

WARNING

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

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GTS 8XX HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GTS 8XX. 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.

APPLICABLE LRU PART NUMBER	MOD LEVEL	SERVICE BULLETIN NUMBER	SERVICE BULLETIN DATE	PURPOSE OF MODIFICATION

1 GENERAL DESCRIPTION

1.1 Introduction

This manual presents mechanical and electrical installation requirements for installing the GTS 8XX/GPA 65 Traffic Advisory System (TAS) and Traffic Collision Avoidance System (TCAS I).

1.2 Equipment Description

The GTS 8XX is a microprocessor-based Line Replaceable Unit (LRU) that uses active interrogations of Mode S (GTS 820 and GTS 850 only) and Mode C transponders to provide Traffic Advisories to the pilot. The GTS 820 and GTS 850 include a GPA 65 power amplifier/low-noise amplifier (PA/LNA) module, which allows for up to 40 nm of active surveillance range as well as Mode S interrogation capability. When installed with a 1090 MHz ADS-B transmit class of equipment the GTS 8XX also utilizes passive surveillance. Traffic is displayed on an external MFD via ARINC 429 and/or Ethernet High Speed Data Bus (HSDB). An aural alert is also provided to inform the crew a traffic advisory (TA) will be displayed.

A top-mounted directional antenna is used to derive bearing of the intruder aircraft, which is displayed with relative altitude to own aircraft. Top antenna transmitted interrogations are directional, reducing the number of transponders that receive the interrogation thus reducing potential garble on the 1090 MHz band. Optional bottom antenna transmit interrogations are omni directional, using a monopole antenna (recommended for fixed gear installations) or a directional antenna (recommended for retractable gear installations). A bottom directional antenna installation gives the benefit of intruder bearing visibility for targets that are shaded from the top directional antenna.

1.2.1 GTS 8XX Model Differences

The following table summarizes the differences between the various GTS 8XX models documented in this manual.

		Traffic Advisory System (TAS)	Traffic Collision Avoidance System (TCAS I)	1090 ES ADS-B Receiver	GPA 65 PA/LNA	Transmit Power (Watts)
GTS 800	**011-01356-00**	X		X		40
GTS 820	**011-01446-00**	X		X	X	200
GTS 850	**011-01553-00**		X	X	X	200

1.3 Interface Summary

The GTS 8XX is designed as an open architecture system that uses typical ARINC 429, RS-232, and Ethernet communications interfaces.

1.4 Technical Specifications

1.4.1 Environmental Qualification Form

It is the responsibility of the installing agency to obtain the latest revision of the GTS 8XX/GPA Environmental Qualification Form. This form is available directly from Garmin under the following part number:

GTS 8XX Environmental Qualification Form, Garmin part number 005-00323-02
GPA 65 PA/LNA Environmental Qualification Form, Garmin part number 005-00323-22
GA 58 Antenna Environmental Qualification Form, Garmin part number 005-00232-23

To obtain a copy of this form, see the dealer/OEM portion of the Garmin web site (www.garmin.com).

1.4.2 Physical Characteristics

Characteristics	Specifications
GTS 8XX Width	2.81 inches (7.14 cm)
GTS 8XX Height	6.94 inches (17.63 cm)
GTS 8XX Depth w/Connector Kit	14.78 inches (37.54 cm)
GPA 65 Width	4.25 inches (10.80 cm)
GPA 65 Height	1.00 inches (2.54 cm)
GPA 65 Depth Not Including Connector And Cable	7.96 inches (20.22 cm)
GPA 65 Depth w/Connector And Cable Fully Extended	16.83 inches (42.75 cm)
GTS 8XX Unit Weight w/out Connector Kit	~~9.0 lbs. (4.08 kg)~~
GTS 8XX Unit Weight with Connector Kit/w Vertical Rack	~~10.7 lbs. (4.85 kg)~~
GTS 8XX Unit Weight with Connector Kit/w Horizontal Rack	~~11.5 lbs. (5.22 kg)~~
GPA 65 PA/LNA Unit Weight with Pigtail Connector Kit*	1.9 lbs. (0.86 kg)
GA 58 TAS/TCAS Antenna w/screws and o-ring	0.82 lbs. (0.37 kg)
QMA straight connector kit, 4 pcs	0.10 lbs. (0.05 kg)
QMA straight connector kit, 1 pc	0.03 lbs. (0.01 kg)
QMA right angle connector kit, 4 pcs	0.18 lbs. (0.08 kg)
QMA right angle connector kit, 1 pc	0.05 lbs. (0.02 kg)
QMA termination connector kit	0.07 lbs. (0.03 kg)

*Used with the GTS 820 and 850.

1.4.3 General Specifications

The table below contains general specifications. For detailed environmental specifications, see the Environmental Qualification Form.

Characteristics	Specifications
Operating Temperature Range	-55°C to +70°C.
Humidity	95% non-condensing
Altitude Range	-1,500 ft to 55,000 ft
Software Compliance	RTCA/DO-178B levels ~~B,~~ C, ~~and D~~
Hardware Compliance	RTCA/DO-254 Level C
Environmental Compliance	RTCA/DO-160E

1.4.4 Power Requirements

Characteristics	Specifications
GTS 8XX Power Requirements	14/28 Vdc. See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages.
GTS 800 Power Consumption	1.1 +/- 0.2 A typical 1.5 A max operating @ 28 Vdc 2.2 +/- 0.2 A typical 2.6 A max operating @ 14 Vdc
GTS 820/850 Power Consumption	1.3 +/- 0.2 A typical 1.6 A max operating @ 28 Vdc 2.7 +/- 0.3 A typical 3.2 A max operating @ 14 Vdc
GTS 8XX Boot-up Current Draw	4.0 A @ 28 Vdc for 70 ms 5.6 A @ 14 Vdc for 100 ms

1.5 Certification

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR part 43 or the applicable airworthiness requirements.

The following table provides a list of applicable TSO/ETSOs for the GTS 8XX/GPA 65.

1.5.1 TSO/ETSO Compliance

Applicable LRU	Function	TSO/ETSO	Category	Applicable LRU SW Part Numbers	Applicable CLD Part Numbers
GTS 850 GPA 65	Traffic Alert and Collision Avoidance System (TCAS I) Airborne Equipment	TSO-C118 ETSO-C118		006-B0551-()	006-C0081-()** 006-C0092-()***
GTS 800 GTS 820 GPA 65	Traffic Advisory System (TAS) Airborne Equipment	TSO-C147 ETSO-C147	Class A	006-B0551-()	006-C0081-()** 006-C0092-()***
GTS 800 GTS 820 GTS 850	Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)	TSO-C166a	Class A0/Type 1 Receiving Only* Class A1/Type 1 Receiving Only*	006-B0551-()	006-C0081-()**

* Equipment is Class A0 when installed with a single antenna, Class A1 when installed with diversity antennas.

**GTS 8XX only

***GPA 65 only

1.5.2 TSO/ETSO Deviations

1.5.2.1 GTS 800

TSO/ETSO	Deviation
TSO-C147	1. Garmin was granted a deviation from TSO-C147 section 1.c to use RTCA DO-160E, instead of RTCA DO-160D as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
RTCA DO-197A	1. Garmin was granted a deviation from RTCA DO-197A section 2.2.3.2.1 to use the Interrogations Spectrum requirement of RTCA DO-185A section 2.2.3.3 instead of the requirement of RTCA DO-197A section 2.2.3.2.1
	3. Garmin was granted a deviation from RTCA DO-197A section 2.2.9.1 to realize the bearing estimation function using a direction finding antenna augmented by tracked correlated ADS-B data when such data is available and of sufficient integrity.
	4. Garmin was granted a deviation from RTCA DO-197A section 2.2.11 to use the suppression pulse on the aircraft suppression bus specified by RTCA DO-185A section 2.2.3.12 (70 +/-1 µs from top antenna and 90 +/-1 µs from bottom antenna) instead of 100 +/-5 µs.
RTCA DO-185A	1. Garmin was granted a deviation to use DO-185A as modified by Appendix 1 of TSO-C119B and 'RWG Recommended Modification 2.0 to TSO-C119B.'
	2. Garmin was granted a deviation from RTCA DO-185A section 2.2.3.8.2 Mode S signal definition.
	3. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.b to use the Enhanced Preamble Detection method of RTCA DO-260A Appendix I section I.4.1.
	4. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.c to use the Baseline Multi-sample bit and confidence declaration technique of RTCA DO-260A Appendix I section I.4.2.3.1.
	5. Garmin was granted a deviation from RTCA DO-185A section 2.4.2.1.1.4.
RTCA DO-260A	1. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.3.4.7.3.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	2. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.4.2 to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	3. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.5.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.

1.5.2.2 GTS 820

TSO/ETSO	Deviation
TSO-C147	1. Garmin was granted a deviation from TSO-C147 section 1.c to use RTCA DO-160E, instead of RTCA DO-160D as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
	2. Garmin was granted a deviation from TSO-C147 Appendix 1 section 1.6 to use selective Mode S interrogations as specified by RTCA DO-185A section 2.2.3.8.1 and 2.2.3.9 following all the applicable protocols for Mode-S surveillance interrogations in the NAS as stated in DO-185A and DO-181C.
RTCA DO-197A	1. Garmin was granted a deviation from RTCA DO-197A section 2.2.3.2.1 to use the Interrogations Spectrum requirement of RTCA DO-185A section 2.2.3.3 instead of the requirement of RTCA DO-197A section 2.2.3.2.1
	2. Garmin was granted a deviation from RTCA DO-197A section 2.2.3.5 to use the “Mode C Only All-Call” format specified by RTCA DO-185A section 2.2.3.8.1 instead of the “Mode C” format for ATCRBS interrogations.
	3. Garmin was granted a deviation from RTCA DO-197A section 2.2.9.1 to realize the bearing estimation function using a direction finding antenna augmented by tracked correlated ADS-B data when such data is available and of sufficient integrity.
	4. Garmin was granted a deviation from RTCA DO-197A section 2.2.11 to use the suppression pulse on the aircraft suppression bus specified by RTCA DO-185A section 2.2.3.12 (70 +/-1 µs from top antenna and 90 +/-1 µs from bottom antenna) instead of 100 +/-5 µs.
RTCA DO-185A	1. Garmin was granted a deviation to use DO-185A as modified by Appendix 1 of TSO-C119B and ‘RWG Recommended Modification 2.0 to TSO-C119B.’
	2. Garmin was granted a deviation from RTCA DO-185A section 2.2.3.8.2 Mode S signal definition.
	3. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.b to use the Enhanced Preamble Detection method of RTCA DO-260A Appendix I section I.4.1.
	4. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.c to use the Baseline Multi-sample bit and confidence declaration technique of RTCA DO-260A Appendix I section I.4.2.3.1.
	5. Garmin was granted a deviation from RTCA DO-185A section 2.4.2.1.1.4.
RTCA DO-260A	1. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.3.4.7.3.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	2. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.4.2 to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	3. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.5.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.

1.5.2.3 GTS 850

TSO/ETSO	Deviation
TSO-C118	1. Garmin was granted a deviation from TSO-C118 section a.(2) to use RTCA DO-160E, instead of RTCA DO-160B as the standard for Environmental Conditions and Test Procedures for Airborne Equipment.
RTCA DO-197A	1. Garmin was granted a deviation from RTCA DO-197A section 2.2.3.2.1 to use the Interrogations Spectrum requirement of RTCA DO-185A section 2.2.3.3 instead of the requirement of RTCA DO-197A section 2.2.3.2.1.
	2. Garmin was granted a deviation from RTCA DO-197A section 2.2.3.5 to use the “Mode C Only All-Call” format specified by RTCA DO-185A section 2.2.3.8.1 instead of the “Mode C” format for ATCRBS interrogations.
	3. Garmin was granted a deviation from RTCA DO-197A section 2.2.6 to use selective Mode S interrogations following all the applicable protocols for Mode-S surveillance interrogations in the NAS as stated in DO-185A and DO-181C.
	4. Garmin was granted a deviation from RTCA DO-197A section 2.2.9.1 to realize the bearing estimation function using a direction finding antenna augmented by tracked correlated ADS-B data when such data is available and of sufficient integrity.
	5. Garmin was granted a deviation from RTCA DO-197A section 2.2.11 to use the suppression pulse on the aircraft suppression bus specified by RTCA DO-185A section 2.2.3.12 (70 +/-1 µs from top antenna and 90 +/-1 µs from bottom antenna) instead of 100 +/-5 µs.
RTCA DO-185A	1. Garmin was granted a deviation to use RTCA DO-185A as modified by Appendix 1 of TSO-C119B and ‘RWG Recommended Modification 2.0 to TSO-C119B’.
	2. Garmin was granted a deviation from RTCA DO-185A section 2.2.3.8.2 Mode S signal definition.
	3. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.b to use the Enhanced Preamble Detection method of RTCA DO-260A Appendix I section I.4.1.
	4. Garmin was granted a deviation from RTCA DO-185A section 2.2.4.4.2.2.c to use the Baseline Multi-sample bit and confidence declaration technique of RTCA DO-260A Appendix I section I.4.2.3.1.
RTCA DO-260A	1. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.3.4.7.3.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	2. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.4.2 to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.
	3. Garmin was granted a deviation from RTCA DO-260A section 2.2.4.5.b to use the Conservative and Brute Force error correction techniques specified by RTCA DO-260A section 2.2.4.4.3.1 instead of section 2.2.4.4.2.2.d and Appendix A, Section 3 of RTCA DO-185A.

1.6 Reference Documents

The following publications are sources of additional information for installing the GTS 8XX. Before installing the GTS 8XX, the technician should read all referenced materials along with the manual.

Part Number	Document
190-00313-11	Jackscrew Backshell Installation Instructions
190-00303-00	G1000 System Installation Manual
190-00303-04	G1000 Line Maintenance and Configuration Manual
190-00903-00	G1000 System Maintenace Manual LJ/VLJ
190-00907-00	G1000 System Maintenance Manual Standard Piston/Turboprop Aircraft

1.7 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 OVERVIEW

2.1 Introduction

This section provides hardware equipment information for installing the GTS 8XX/GPA 65 and related hardware. Installation of the GTS 8XX/GPA 65 should follow the aircraft TC or STC requirements. Cabling is fabricated by the installing agency to fit each particular aircraft. The guidance of FAA advisory circulars AC 43.13-1B and AC 43.13-2A, where applicable, may be found useful for making retro-fit installations that comply with FAA regulations.

2.1.1 Unit Configurations

The GTS 8XX and GPA 65 are available under the following part numbers:

Item	Applicable LRU Software Part Numbers	Applicable Custom Logic Device Part Numbers	Garmin P/N
GTS 800, (011-01356-00)	006-B0551-()	006-C0081-()	010-00519-00
GTS 820, (011-01446-00)	006-B0551-()	006-C0081-()	010-00562-00
GTS 850, (011-01553-00)	006-B0551-()	006-C0081-()	010-00563-00
GPA 65, (011-01347-00)	006-B0551-()	006-C0092-()	010-10721-00

2.1.2 Required Accessories

NOTE

Refer to the Dealer's Only portion of www.garmin.com for instructions on determining what accessories are needed.

Each of the following accessories are provided separately from the GTS 8XX and GPA 65 unit and are required to install the unit.

Installation Racks*	Garmin P/N
GTS 8XX Vertical Installation Rack	115-00781-00
GTS 8XX Horizontal Installation Rack	115-00784-00

* Only one is required.

For a GTS 800 installation with a single GA 58 directional antenna, two QMA Connector Kits (4 pieces, either straight or right angle) are required.

For a GTS 800 installation with dual GA 58 directional antennas, four QMA Connector Kits (4 pieces, either straight or right angle) kits are required.

For a GTS 800 installation with a single GA 58 directional antenna and a monopole antenna, two QMA Connector Kits (4 pieces, either straight or right angle) and one QMA Connector Kit (1 piece, either straight or right angle) are required.

For GTS 820 and 850 installations, add two QMA Connector Kits (4 pieces, either straight or right angle) for the GPA 65 connections.

One QMA Termination Connector Kit (4 pieces) is required for single antenna installations.

Connector Kits	Garmin P/N
QMA Right Angle Connector Kit (4 pieces)	011-01364-00
QMA Straight Connector Kit (4 pieces)	011-01364-01
QMA Right Angle Connector Kit (1 piece)	011-01364-02
QMA Straight Connector Kit (1 piece)	011-01364-03
QMA Termination Connector Kit (4 pieces)	011-01364-04
GTS 8XX Connector Kit	011-01360-00
GPA 65 Circular Connector Kit	011-01365-00
USB-B Pigtail (non-G1000 installations only)	011-01782-00

Antennas	Garmin P/N
GA 58 Directional Antenna, (011-01346-00)	010-10720-00*
Monopole Antenna	010-10160-00 or L-Band Monopole Antenna that meets TSO-C74c

*010-10720-00 includes mounting screws and o-ring, unless specifically requested to exclude.

Configuration Module	Garmin P/N
Configuration Module (non-G1000 installations only)	011-00979-20

2.2 Installation Considerations

Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required for installation of the GTS 8XX/~~GPS~~ 65.

2.2.1 Antenna Considerations

Antenna installations on pressurized cabin aircraft require FAA approved installation design and engineering substantiation data whenever such antenna installations incorporate alteration (penetration) of the cabin pressure vessel by connector holes and/or mounting arrangements. For needed engineering support pertaining to the design and approval of such pressurized aircraft antenna installations, it is recommended that the installer proceed according to any of the following listed alternatives:

1. Obtain approved antenna installation design data from the aircraft manufacturer.
2. Obtain an FAA approved STC, pertaining to, and valid for the antenna installation.
3. Contact the FAA Aircraft Certification Office in the appropriate Region and request identification of FAA Designated Engineering Representatives (DERs) who are authorized to prepare and approve the required antenna installation engineering data.
4. Obtain FAA Advisory Circular AC-183C and identify a DER from the roster of individuals in it.
5. Contact an aviation industry organization such as the Aircraft Electronics Association for assistance.

For all composite aircraft, antenna installation requires that a ground plane be fabricated on the internal surface of the aircraft directly under the antenna. The TAS/TCAS antenna pattern is dependent upon a ground plane under the antenna. The minimum recommended antenna ground plane dimensions are 18” x 18” for composite aircraft.

A fabricated doubler plate assembly supplied by the installing agent or antenna vendor may be required inside the fuselage to complete the antenna hardware installation.

NOTE

For all GTS 8XX installations, a monopole antenna is recommended if installing an optional bottom mounted antenna on a fixed-gear aircraft, while retractable-gear aircraft may use either a monopole or a directional bottom mounted antenna. The target bearing accuracy may be degraded for bottom directional antenna installations on aircraft with fixed gear.

2.2.1.1 TAS/TCAS Antenna Location

To achieve proper interrogation and surveillance volumes the following GTS 8XX antenna installation guidelines should be followed.

The GTS 8XX requires a top-mounted directional antenna. An optional bottom mounted directional or L-band monopole antenna can be installed in conjunction with the top-mounted directional antenna.

Antenna locations are critical to maintain the surveillance coverage across all azimuth and elevation angles. Locations shall be chosen so the top mounted and bottom mounted antenna will represent same range and bearing to an intruder. The mounting location, geometry, and surroundings of the antenna can affect the system performance. The following guidance provides information to aid the installer in ensuring that the most optimum location is selected for the installation of the antenna. Because meeting all of these installations guidelines may not be possible on all aircraft, these guidelines are listed in order of importance to achieve optimum performance. The installer must use best judgment to balance the installation guidelines.

Installations must be thoroughly tested to verify that performance degradation as a result of antenna placement is not an issue for the TAS/TCAS system as well as other systems.

1. As far as physically possible, the top directional antenna shall be mounted at the most forward location.

2. The TAS/TCAS antenna(s) shall be mounted on the aircraft skin so that the horizontal base is horizontal to within +/-5° in longitudinal and lateral axes when the aircraft is in level flight.

3. The TAS/TCAS antenna(s) shall be mounted on a flat section of the fuselage to reduce the gap formed between the base plate and the fuselage when normal mounting torque is applied.

4. It is recommended that all antennas be mounted at least 20 inches away (measured from center to center) from the TAS/TCAS antenna(s).

5. Ground plane considerations shall include minimization of any discontinuities such as overlapped un-riveted airframe skins, cowlings, or hatches. It is recommended that all such discontinuities be at least 18 inches from the nearest edge of the TAS/TCAS antenna.

6. For installations using a bottom mounted antenna, it is recommended that the top and bottom antennas be located near the same vertical line through the aircraft such that they represent the same range and bearing to an intruder.

7. The top and bottom mounted TAS/TCAS Antenna shall be as close as possible to the aircraft centerline.

8. It is recommended that no antenna be mounted in front of the TAS/TCAS antenna(s).

2.3 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 surface preparation is required to achieve electrical bond. 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. An equivalent OEM procedure may also be substituted. There may be OEM-specific reasons for electrically isolating equipment or having a higher bond resistance. These reasons should be rationalized upon installation approval. In general, Garmin recommends that all GTS 8XX equipment be electrically bonded.

The antenna ground plane and doubler plate must be electrically bonded to the antenna baseplate. The electrical bond must achieve direct current (DC) resistance less than or equal to 2.5 milliohms.

For composite aircraft, the antenna baseplate must be electrically bonded to the common ground of other installed equipment for lightning purposes. This can be achieved through the antenna mounting screws.

2.4 Cabling and Wiring

Use #24 AWG or larger diameter wire for all connections unless otherwise specified. The minimum diameter wire size for all GTS 8XX installation wiring is #24 AWG, except in the case of Aircraft Power and Aircraft Ground and both shall be a minimum of #18 AWG. Refer to Table 2-1 for GPA 65 wiring specifications.

A single circuit breaker shall be dedicated to the GTS 8XX unless specifically approved by the manufacturer on a case by case basis, or allowed by the STC. Do not attempt to combine more than one unit on the same circuit breaker unless it is specified on an aircraft manufacturer approved drawing, or STC documentation, for the specific installation requiring a combined configuration.

The current rating for each standard density 37-pin D-sub connector pin is 5 Amps, and the current rating for each high density 78-pin D-sub connector pin is 2 Amps. A 14 Vdc installation requires a minimum of two Aircraft Power and two Aircraft Ground wires in the harness. A 28 Vdc installation requires a minimum of one Aircraft Power and one Aircraft Ground wires in the harness.

It is the responsibility of the installing agency to take into account wire sizing based on the length and number of wires, current draw of the unit, D-sub connector pin current rating, and the unit's internal protection requirements.

NOTE

The maximum wiring length from the GTS 8XX to the GPA 65 is 45 feet.

Table 2-1. GPA 65 Minimum Wiring Requirements

Line	Number of Pins/Wires	Length of Wire	Wire Gauge Specification
+35V	2	Up To 45'	#24 AWG
+6V	2	Up To 45'	#24 AWG
	1	Up To 30'	#22 AWG
	1	Up To 20'	#24 AWG
-5V	2	Up To 45'	#24 AWG
	1	Up To 30'	#22 AWG
	1	Up To 20'	#24 AWG
Ground	3	Up To 45'	#24 AWG

The contacts used to facilitate the use of #18 AWG wire for Aircraft Power and Aircraft Ground have expanded-diameter barrels that extend out from the back of the standard D-sub connector body to accommodate the larger diameter wire. Appropriate heat shrink tubing should be utilized to provide sufficient insulation from surrounding contacts.

Ensure that routing of the wiring does not come in contact with sources of heat, RF or EMI interference. Check that there is ample space for the cabling and mating connectors. Avoid sharp bends in cabling and routing near aircraft control cables.

NOTE

All appliance to antenna cabling shall bundle top channels as a group and bottom channels as a group to prevent incorrect wiring between top and bottom channels.

A visual inspection shall be performed to verify that all coaxial cables are connected properly, before attempting to operate the equipment.

2.4.1 Coaxial Cable

The GTS 800 requires two sets of coaxial cable assemblies and the GTS 820/850 requires three sets of coaxial cable assemblies when a directional GA 58 antenna (or other Garmin approved antenna) is used for both top and bottom. Each set consists of four coaxial cable assemblies.

Each set of four cables must be assembled using the same type of coaxial cable in order to meet phase and attenuation matching requirements. In order for the system to operate in compliance with manufacturer specifications, the coaxial cable assemblies must not exceed the attenuation specifications as stated in this document. This section explains in further detail the coaxial cable and termination requirements.

2.4.1.1 GTS 800 Installations

NOTE

A monopole antenna is ~~required~~ if installing an optional bottom mounted antenna on ~~all~~ fixed-gear ~~aircraft. Retractable gear aircraft can~~ use either a monopole or a directional bottom mounted antenna.

A GTS 800 installation with both top and bottom mounted directional antennas uses one set of coaxial cables for the four GTS 800 TOP jacks (J1 TOP, J2 TOP, J3 TOP, J4 TOP) that are connected to the corresponding top antenna jacks J1, J2, J3 and J4. A second set of coaxial cables are used for the four GTS 800 BTM jacks (J1 BTM, J2 BTM, J3 BTM, J4 BTM) that are connected to the corresponding bottom antenna jacks J1, J2, J3 and J4. Each cable assembly shall not exceed the maximum attenuation of 2.5dB at 1090MHz as shown in Figure 2-1.

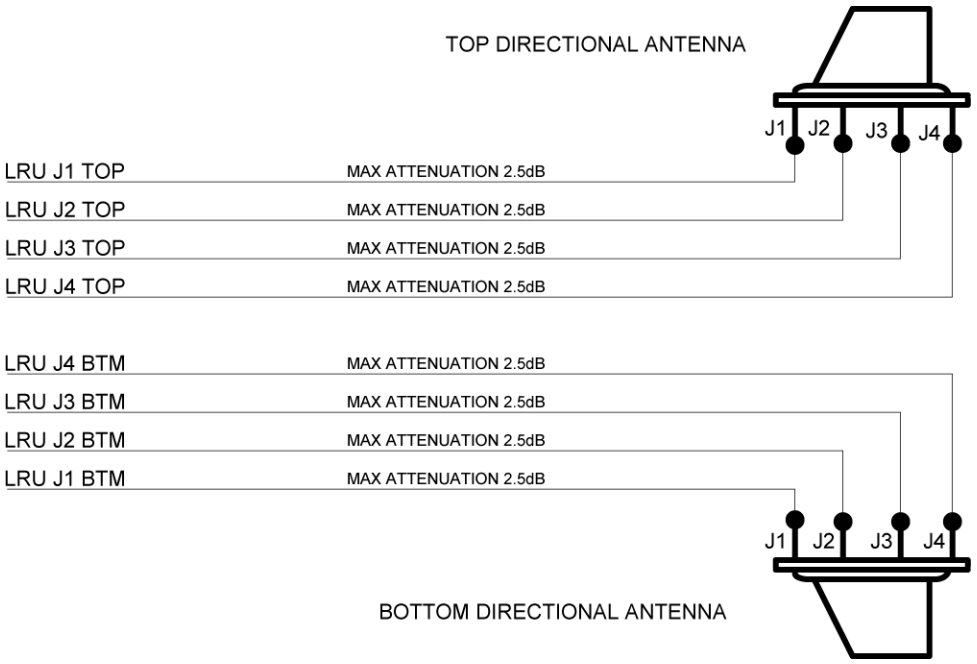


Figure 2-1. GTS 800 Installation with Top and Bottom Directional Antennas

If an optional bottom mount monopole antenna is installed, a single coaxial cable must be used to connect the GTS 800 bottom jack J1 BTM to the monopole antenna jack. The coaxial cable assembly shall not exceed the maximum attenuation of 2.5dB at 1090MHz as shown in Figure 2-2 and stated in Table 2-4. Each of the remaining GTS 800 bottom jacks (J2 BTM, J3 BTM, J4 BTM) are to be terminated using a QMA 2 watt termination as specified in Table 2-2.

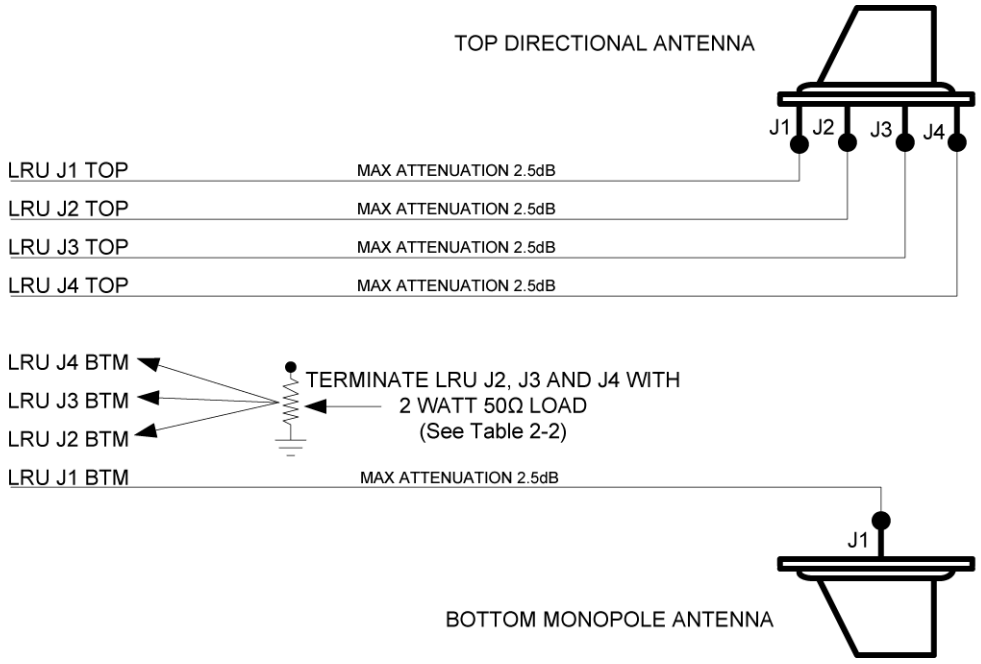


Figure 2-2. GTS 800 Installation with Top and Bottom Monopole Antennas

If no bottom mount antenna is installed, each of the GTS 800 bottom jacks (J1 BTM, J2 BTM, J3 BTM and J4 BTM) must be terminated with a QMA 2 watt termination as specified in Table 2-2 and shown in Figure 2-3.

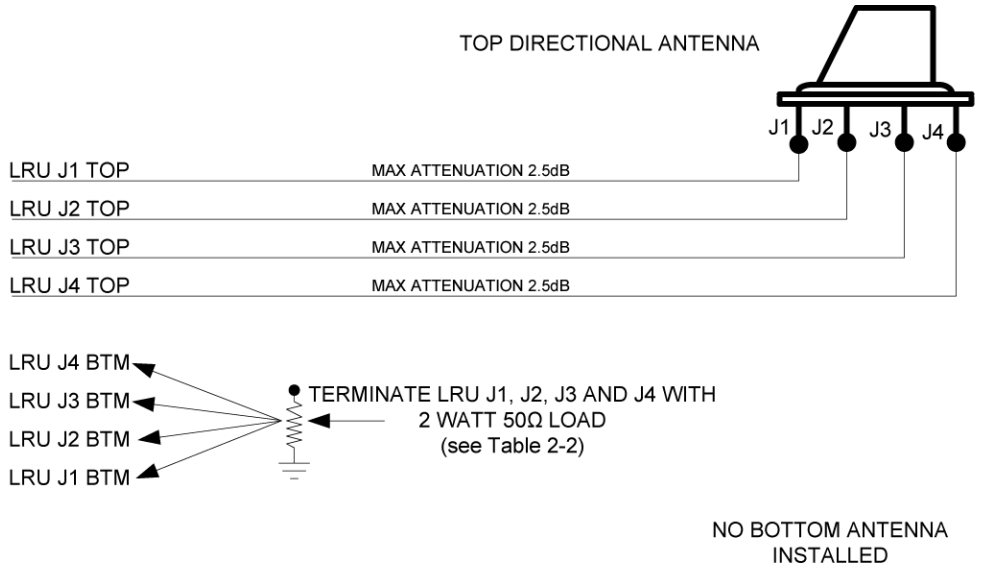


Figure 2-3. GTS 800 Installation with Top Directional Antennas and No Bottom Antenna

2.4.1.2 GTS 820 and GTS 850 Installations

GTS 820 and GTS 850 installation with both top and bottom mount directional antennas use one set of coaxial cables for the four GTS 820 or GTS 850 TOP jacks (J1 TOP, J2 TOP, J3 TOP, J4 TOP) that are connected to the corresponding GPA 65 processor unit jacks (J1U, J2U, J3U, J4U).

Each top cable assembly shall not exceed the maximum attenuation of 3.0dB at 1090MHz as shown in Figure 2-4 and stated in Table 2-3. Each bottom cable assembly shall not exceed the maximum attenuation of 2.5dB at 1090MHz as shown in Figure 2-4 and stated in Table 2-3.

A second set of coaxial cables are used to connect the four GPA 65 antenna jacks (J1A, J2A, J3A, J4A) to the corresponding top antenna jacks (J1, J2, J3, J4). Each cable assembly shall not exceed the maximum attenuation of 0.4dB at 1090MHz as shown in Figure 2-4 and stated in Table 2-3. A third set of coaxial cables are used to connect the four LRU BTM jacks (J1 BTM, J2 BTM, J3 BTM, J4 BTM) to the corresponding bottom antenna jacks (J1, J2, J3, J4). Each cable assembly shall not exceed the maximum attenuation of 2.5dB at 1090MHz as shown in Figure 2-4.

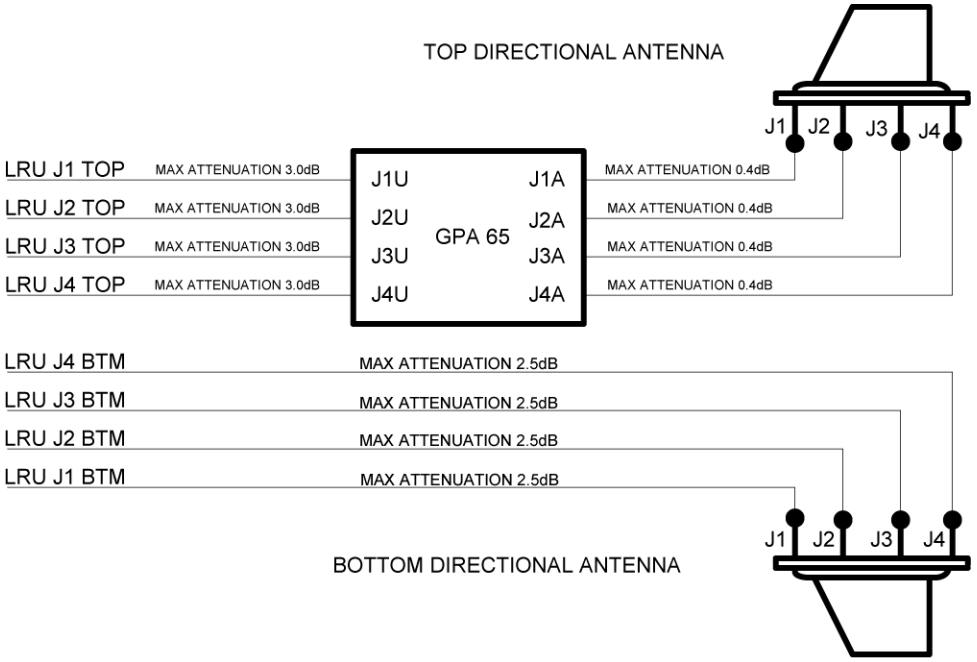


Figure 2-4. GTS 820 and GTS 850 Installation with Top and Bottom Directional Antenna

If an optional bottom mount monopole antenna is installed, a single coaxial cable must be used to connect the GTS 820 or GTS 850 J1 BTM jack to the monopole antenna jack. The cable assembly shall not exceed the maximum attenuation of 2.5dB at 1090MHz as shown in Figure 2-5 and stated in Table 2-3. Each of the remaining GTS 820 or GTS 850 bottom jacks (J2 BTM, J3 BTM, J4 BTM) are to be terminated using a QMA 2 watt termination as specified in Table 2-2.

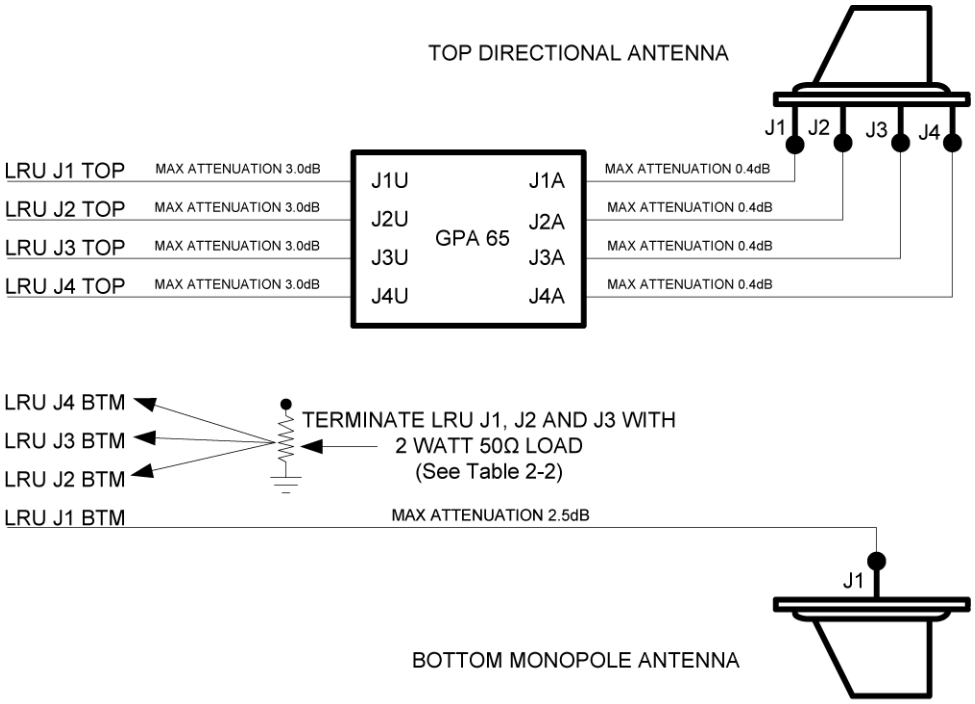


Figure 2-5. GTS 820 and GTS 850 Installation with Top Directional and Bottom Monopole Antenna

If no bottom mount antenna is installed, each of the GTS 820 or GTS 850 bottom jacks (J1 BTM, J2 BTM, J3 BTM and J4 BTM) shall be terminated with a QMA 2 watt termination as specified in Table 2-2 and shown in Figure 2-6.

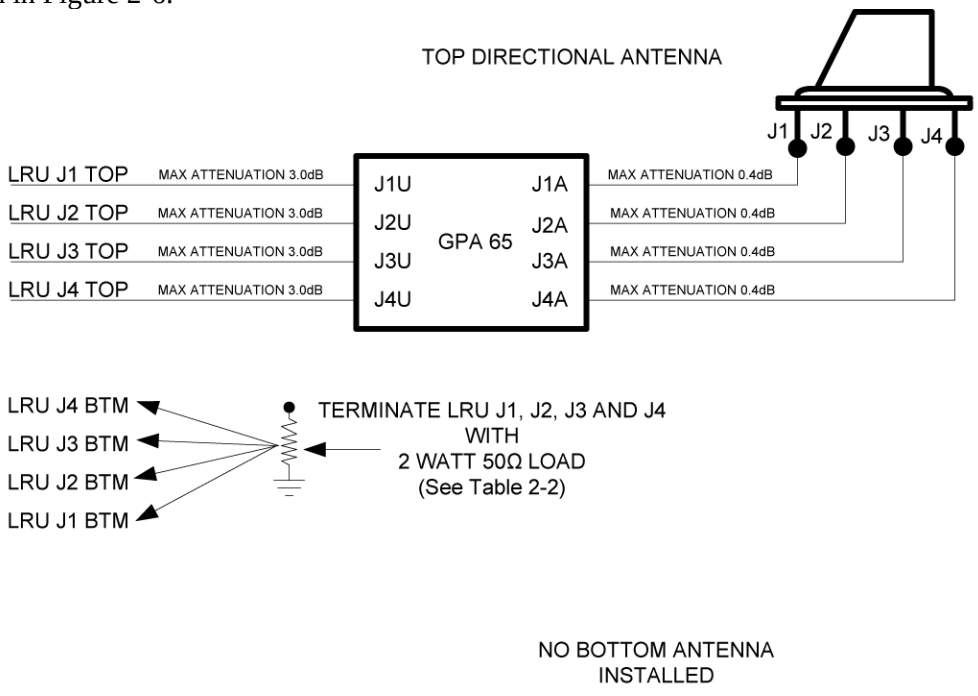


Figure 2-6. GTS 820 and GTS 850 Installation with Top Directional and No Bottom Antenna

NOTE

Any QMA terminations used other than those specified in Table 2-2 will constitute the installation as being non-compliant with the manufacturer's installation standards.

2.4.1.3 Fabrication of Coaxial Cable Assemblies

The installing agency may fabricate cable assemblies by terminating either M17/128-RG400 or M17/60-RG142 coaxial cable with available QMA connector kits. Table 2-2 lists recommend cable types to be used with specified QMA connectors for the GTS 8XX.

Table 2-2. Cable Types and QMA Connectors

Connector Type	Cable Type	Manufacturer	Connector Part Number	Garmin Order Number	
				4 Piece Kit	1 Piece Kit
QMA Right Angle	RG 400, RG 142, ECS 311901	Amphenol	930-189P-51A	011-01364-00	011-01364-02
		Garmin	330-00500-00		
	ECS 311501, ECS 311601, ECS 421601, PIC S67163	Amphenol	930-191P-51A	N/A	
		ECS	930-191P-51A		
		PIC	110477		
QMA Straight	RG 400, RG 142, ECS 311901	Amphenol	930-192P-51S	011-01364-01	011-01364-03
		Garmin	330-00500-01		
	ECS 311501, ECS 311601, ECS 421601, PIC S67163	Amphenol	930-190P-51S	N/A	
		ECS	930-190P-51S		
		PIC	110476		
QMA 50 Load Termination	N/A	Amphenol	930-187P-51T	011-01364-04	N/A
		Garmin	330-00500-02		

The recommended coaxial cable lengths in Table 2-3 are for reference only. Along with standard MIL-C-17/128-RG400 or MIL-C-17/60-RG142, Table 2-3 lists recommended antenna cable vendors along with the cable type that each specific vendor offers. The recommended coaxial cable lengths are defined as the end to end length of a non-terminated coaxial cable. The attenuation values listed in Table 2-3 include the maximum attenuation of both the maximum length of coaxial cable and two RF coaxial connectors at a frequency of 1090 MHz. It is the installing agencies responsibility to ensure that the coaxial cable assemblies built meet the manufacturer's attenuation specifications in order to comply with the manufacturer's installation standards.

NOTE

Any in-line or bulkhead penetrations must be evaluated separately. It is the installing agency's responsibility to show airworthiness of the installed fabricated or purchased coaxial cable assemblies.

Table 2-3. Recommended Coaxial Length

Attenuation						Attenuation (dB/100ft)	ECS Type	PIC Type	MIL-C-17 Type	RG Type
Loss of 0.4 dB	Loss of 0.5 dB	Loss of 1.5 dB	Loss of 2.0 dB	Loss of 2.5 dB	Loss of 3.0 dB					
1' 10" [0.55m]	2' 7" [0.79m]	9' 0" [2.74m]	12' 0" [3.66m]	15' 5" [4.70m]	18' 8" [5.68m]	15.5			M17/128 -RG400	RG-400
2' 0" [0.60m]	2' 9" [0.84m]	10' 5" [2.94m]	13' 0" [3.96m]	16' 6" [5.03m]	20' 1" [6.12m]	14.45			M17/60-RG142	RG-142
2' 5" [0.74m]	3' 4" [1.02m]	11' 6" [3.50m]	15' 5" [4.70m]	19' 6" [5.94m]	23' 10" [7.26m]	12.16	311901			
3' 3" [0.99m]	4' 6" [1.37m]	15' 8" [4.77m]	21' 0" [6.40m]	26' 8" [8.13m]	32' 7" [9.93m]	8.93	421601			
3' 5" [1.04m]	4' 6" [1.37m]	16' 1" [4.90m]	21' 5" [6.55m]	27' 6" [8.38m]	33' 6" [10.21m]	8.7	311601		M17/127 -RG393	RG-393
4' 2" [1.27m]	5' 7" [1.70m]	19' 8" [5.99m]	26' 5" [8.05m]	33' 5" [10.19m]	40' 10" [12.44m]	7.12	311501			
4' 0" [1.21m]	5' 5" [1.60m]	18' 5" [5.61m]	25' 0" [7.62m]	31' 6" [9.60m]	38' 3" [11.65m]	7.5		S67163		
Supplier Information							Vendor: Electronic Cable Specialists 5300 W. Franklin Drive Franklin, WI 53132 Tel: 800-327-9473 414-421-5300 Fax: 414-421-5301 www.ecsdirect.com	Vendor: PIC Wire and Cable N53 W24747 S Corporate Circle Sussex, WI 53089-0330 Tel: 800-742-3191 262-246-0500 Fax: 262-246-0450 www.picwire.com	See current issue of Qualified Products List QPL-17.	RG types are obsolete and are shown for reference only; replaced by M17 type numbers.

The coaxial cable lengths in each coaxial cable assembly set used to connect the GTS 800 TOP and BOTTOM jacks to the top and bottom antenna jacks, the TOP GTS 820 or GTS 850 jacks to the GPA 65 jacks, and the BOTTOM GTS 820 or GTS 850 jacks to the directional antenna jacks, shall be within 2 inches of each other.

The coaxial cable assembly lengths in each coaxial cable assembly set between the GPA 65 jacks and directional antenna jacks for the GTS 820 or GTS 850 shall be within 0.25 inches of each.

Table 2-4. Coaxial Cable Set Length Tolerance

Coaxial Cable Set	Length Tolerance*
GTS 800 TOP/BOTTOM to top and bottom antenna	2" of each other
GTS 820 and/or 850 TOP to ~~GPS~~ 65	2" of each other
GTS 820 and/or GTS 850 BOTTOM to directional antenna	2" of each other
GPA 65 to directional antenna (for the GTS 820 and/or GTS 850	0.25" of each other

* Ensure cables do not exceed the maximum lengths as stated in Table 2-3.

NOTE

It is recommended that a color band be placed on both ends of each cable to match the color marking designating the mating jack connector.

NOTE

It is recommended that the nominal end to end coaxial cable (non-terminated) length for each set be recorded for the specific installation in the event that a particular coaxial cable assembly associated with an installed set should require replacement.

2.4.1.4 Coaxial Cable Assembly Instructions

The following assembly instructions apply to coaxial cables assemblies using QMA connectors specified in Table 2-2 for use with RG-400 or RG-142 cable types:

1. Slide the heat shrink sleeve and crimp ferrule onto the cable.

2. Strip the cable to the dimensions shown in Figure 2-7.

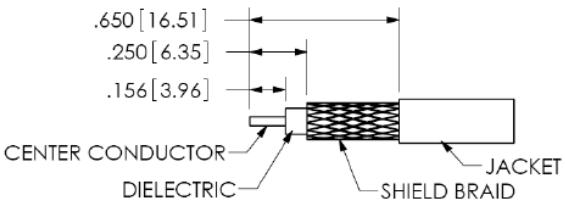


Figure 2-7. RG-400/RG-142 Coaxial Cable Stripping Dimensions

3. Slide the center contact onto the center conductor of the cable. Ensure the center conductor of the cable is visible through the inspection hole of the center contact and crimp using Tyco tool 354940-1 and die assembly 220189-3, or Tyco tool 354940-1 and die assembly 91901-1, or Tyco tool 69478-1.

4. Expand the shielding braid and insert the crimped center contact into the connector body until the cable dielectric is flush with the dielectric inside the connector body. Insure the shield braid does not enter the connector body.

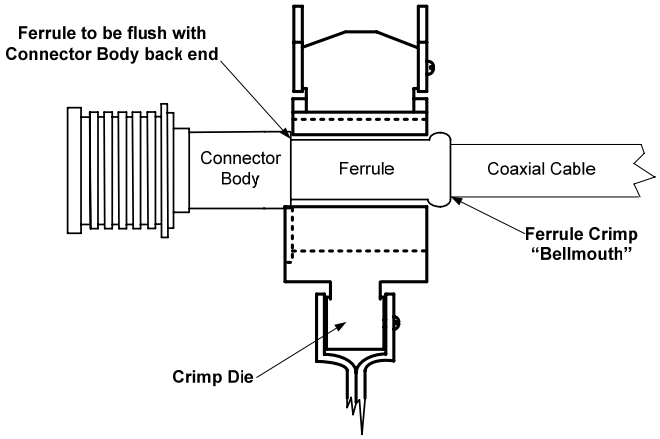


Figure 2-8. Ferrule and Crimp Die Positioning

5. Slide the crimp ferrule over the shielding braid to the back of the connector body. Position the crimp tool flush with the back of the connector body and crimp using Tyco tool 35940-1 and die assembly 220189-3, or Tyco tool 354940-1 and die assembly 91901-1, or Tyco tool 69478-1. The crimp tool should be positioned such that a "bellmouth" (see figure 2-8) is present in the crimp ferrule on the coaxial cable side of the crimp after crimping.

6. Slide heat shrink sleeve to back of connector body and shrink in place. Ensure that the heat shrink does not protrude past the connector body back end once it is shrunk into place. It is recommended that the color-coded heat shrink tubing provided in the kit be used.

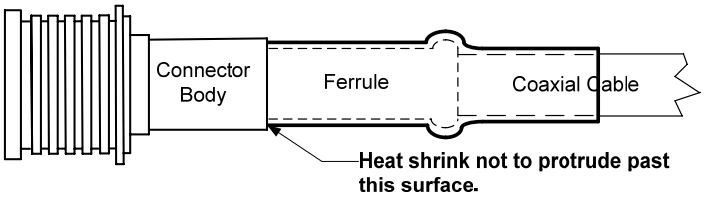


Figure 2-9. Heat Shrink Positioning

NOTE

Use of QMA connectors other than those specified in Table 2-2 for coaxial cable assemblies fabricated by the installing agency using either M17/128-RG400 or M17/60-RG142 coaxial cable will constitute the cable assemblies as being non-compliant with the manufacturer's installation standards.

2.4.1.5 Coaxial Cable Assembly Repair and Rework

In the event that an individual coaxial cable assembly requires rework, between a GTS 800 jack and antenna jack, a TOP GTS820/850 jack and GPA 65 jack or a BTM GTS 820/850 jack and antenna jack, the repairable coaxial cable may be reduced in length a maximum of two inches.

In the event that rework is required on a coaxial cable assembly between a GPA 65 jack and antenna jack on a GTS 820/850 installation, complete replacement of the cable assembly shall be required in lieu of rework.

Refer to Table 2-3 for recommended maximum cable assembly lengths for cable assemblies fabricated by the installer.

2.5 Cooling Requirements

The GTS 8XX and GPA 65 meet all TSO requirements without external cooling. A 5/8" diameter air fitting is provided on the rear of the GTS 8XX for the purpose of admitting cooling air if desired. If a form of forced air cooling is installed, make certain that rainwater cannot enter and be sprayed on the equipment.

For G1000 installations refer to the G1000 System Installation manual, Garmin part number 190-00303-00, for more information on cooling requirements.

2.6 Mounting Requirements

The GTS 8XX can be mounted vertically or horizontally using the installation racks shown below. Refer to Appendix A for outline and installation drawings.

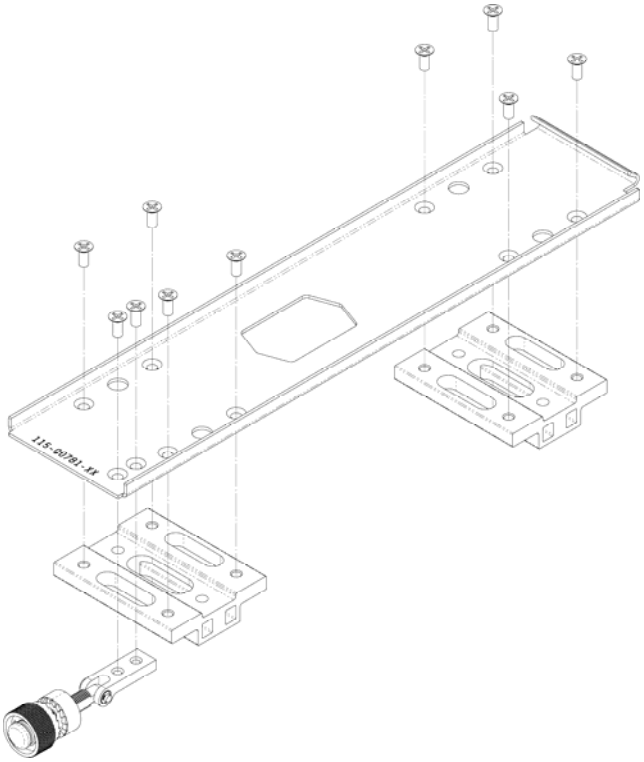


Figure 2-10. GTS 8XX Vertical Installation Rack (Garmin P/N115-00781-00)

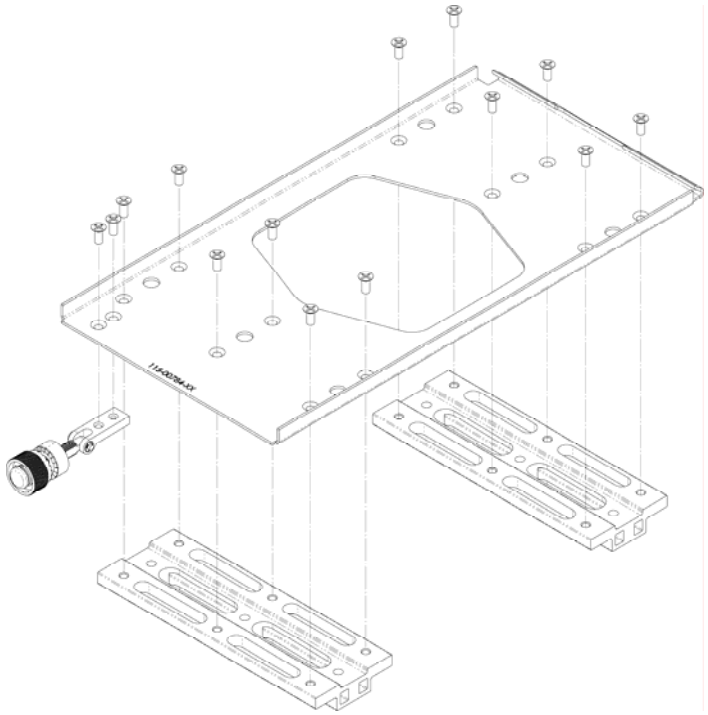


Figure 2-11. GTS 8XX Horizontal Installation Rack (Garmin P/N115-00784-00)

3 INSTALLATION PROCEDURE

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

3.2 Wiring Harness Installation

Allow adequate space for installation of cables and connectors. The installer shall supply and fabricate all of the cables. All electrical connections are made through two 78-pin high-density D subminiature connectors, one 37-pin standard density connector, and one 19-pin circular connector (GTS 820 and GTS 850 only). Section 4 defines the electrical characteristics of all input and output signals. Required connectors and associated hardware are supplied with the connector kit.

See Appendix B for examples of interconnect wiring diagrams. Construct the actual harness in accordance with aircraft manufacturer authorized interconnect standards.

Table 3-1. Socket and Pin Contact Part Numbers

Manufacturer	78 Pin High Density D-Subminiature Connectors P8001 & P8002 37 Pin Standard Density D-Subminiature Connector P8003 19 Pin Circular Connector P651			
	High Density Pin (P8001 & P8002)	Standard Socket (P8003)	Circular Connector Socket (P651)	Standard Socket (P8003)
Garmin P/N	336-00021-00	336-00022-00	N/A	336-00023-00
Military P/N	M39029/58-360	M39029/63-368	M39029/5-115	N/A
Positronic	*	*	*	FC6018D
AMP	*	205090-1	*	*
ITT Cannon	*	031-1007-042	*	031-1007-054**

*Identify manufacturer part number by MIL SPEC identification

** Use only positioner part numbers ITT Cannon 980-0005-722, Astro Tools 616245 and Daniels MFG K250

Table 3-2. Socket Contact MIL SPEC M39029/5-115 Crimp Tooling

Manufacturer	Hand Crimping Tool	Positioner	Insertion/Extraction Tool
Tools Option 1			
Military P/N	M22520/1-01	M22520/1-02	M81969/14-11*
Daniels	AF8	TH1A	M81969/14-11*
Tools Option 2			
Military P/N	M22520/2-01	M22520/2-02	M81969/14-11*
Daniels	AFM8	K1S	M81969/14-11*

***** Indicates plastic insertion/extraction tool

Table 3-3. Pin Contact GPN 336-00021-00 MIL SPEC M39029/58-360 Crimp Tooling

Manufacturer	Hand Crimping Tool	Positioner	Insertion/Extraction Tool
Military P/N	M22520/2-01	M22520/2-09	M81969/1-04
Daniels	AFM8	K42	M81969/1-04
Positronics	9507	9502-4	M81969/1-04
ITT Cannon	995-0001-584	M22520/2-09	274-7048-000* MIL SPEC M81969/14-01
Tyco-AMP	601966-1	601966-6	91067-1 MIL SPEC M81969/1-04
Astro	615717	615725	M81969/1-04
Amphenol	9507	9502-4	M81969/1-04

* Indicates plastic insertion/extraction tool

Table 3-4. Pin Socket Contacts GPN 336-00022-00 MIL SPEC M39029/63-368 and GPN 336-00023-00 Crimp Tooling

Manufacturer	Hand Crimping Tool	22 AWG Socket Contact GPN 336-00022-00 (M39029/63-368)		18 AWG Socket Contact GPN 336-00023-00	
		Positioner	Insertion/Extraction Tool	Positioner	Insertion/Extraction Tool
Military P/N	M22520/2-01	M22520/2-08	M81969/1-02	N/A	M81969/1-02
Daniels	AFM8	K13-1	M81969/1-02	K774	M81969/1-02
Positronics	9507	9502-5	M81969/1-02	9502-11	M81969/1-02
ITT Cannon	995-0001-584	995-0001-604	980-2000-426*	980-0005-722** or Daniels K250**	N/A
Tyco-AMP	601966-1	601966-5	91067-2 or M81969/1-02	N/A	N/A
ASTRO	615717	615724	M81969/1-02	616245**	N/A
Amphenol	9507	N/A	N/A	9502-11	M81969/1-02

* Indicates plastic insertion/extraction tool

** Use only positioner part numbers ITT Cannon 980-0005-722, Astro Tools 616245 and Daniels MFG K250 for contact part number ITT Cannon 031-1007-001

NOTES

1. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.
2. Extracting a contact used for #18 AWG requires that the wire barrel be cut off from the contact. It may also be necessary to push the pin out from the face of the connector when using and extractor due to the absence of the wire. A new contact must be used when reassembling the connector.
3. Contacts for #16 AWG and Contact Crimp Tooling: Contact Garmin for information regarding contacts and contact crimp tooling. Note 2 also applies.
4. Alternate Contacts for Use With #18 AWG: As an alternative to the Positronic contacts listed, and provided in the installation kit, if the need arises the installer may use contacts made by ITT Cannon under P/N 031-1007-001. The particular contact is not compatible with the Daniels MFG K774, Positronics 9502-11 or Amphenol 9502-11 positioners, though. Only use postioner part numbers Daniels MFG K250, ITT Cannon 980-0005-722 and Astro 616245.

3.3 QMA Connector Insertion and Removal

To engage the QMA connectors, use the outer sleeve of the QMA plug to align the connectors and insert the plug onto the jack until it snaps into place. There will be an audible "snap" when the connectors are fully engaged, refer to Figure 3-1. No tools are required for the insertion of a QMA plug onto a QMA jack.

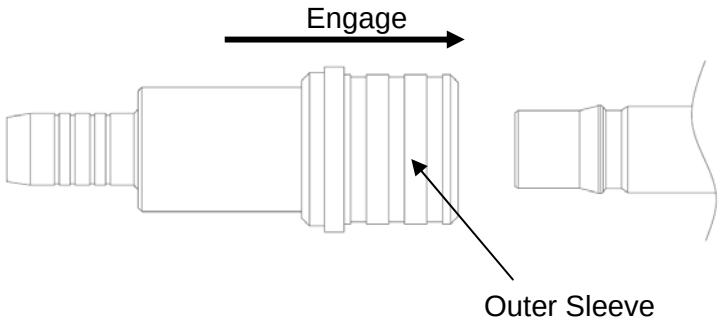


Figure 3-1. Engaging QMA Connectors

CAUTION

Do not pull on the cable when removing the QMA plug from the jack.

To disengage the QMA connectors, pull back firmly on the outer sleeve of the QMA plug away from the jack connector (refer to Figure 3-2). This will disengage the locking mechanism that secures the plug connector to the jack connector. Pulling on or disengaging the QMA connectors in any other way is not recommended and may cause damage to both the connectors and coaxial cable.

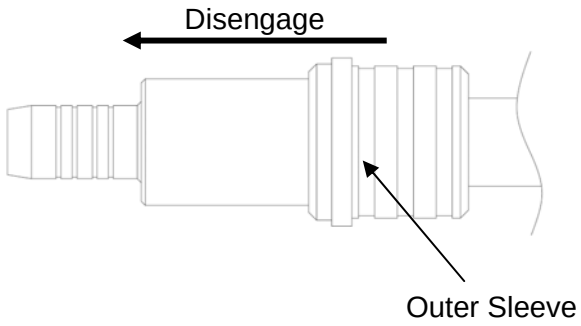


Figure 3-2. Disengaging QMA Connectors

CAUTION

Side-loading of the QMA connectors should be avoided during both the insertion and removal of the connectors. It is recommended service loops with adequate length of coaxial cable be used to insure that side-loading on the connectors is minimized once the cable is securely fastened in the aircraft. Excessive side-loading may result in damage or premature failure of the QMA connectors.

3.4 Backshell, Pigtail Circular Connector, and Configuration Module Assemblies

The GTS 8XX connector kits includes three Garmin backshell assemblies. The backshell assembly houses the configuration module, if applicable. Garmin's backshell also gives the installer the ability to easily terminate shield grounds at the backshell housing.

Refer to the Jackscrew Backshell Installation Instructions (Garmin part number 190-00313-11) for backshell assembly instructions.

Refer to the GPA 65 Pigtail Circular Connector Installation Instructions (Garmin part number 190-00313-XX) for pigtail assembly instructions.

Refer to the Jackscrew Configuration Module Installation Instructions (Garmin part number 190-00313-10) for configuration module assembly instructions.

3.5 Unit Installation

Refer to the outline and installation drawings shown in Appendix A of this manual

3.5.1 Post Installation Configuration & Checkout

Before beginning the installation calibration, the installer must perform a visual inspection to verify the coaxial cables are installed correctly based upon the system and antenna configuration.

NOTE

Tests performed with a ramp tester should be performed away from buildings that may reflect the signal. Local air traffic control should be advised if the ramp tester has an altitude programmed into it that may cause interaction with other TCAS-equipped traffic.

The following actions need to be performed after the equipment is installed:

1. GTS 8XX Configuration Options
2. CDTI (Cockpit Display of Traffic Information) Display setup and configuration
3. Calibration
4. Self test
5. Ramp test and return to service tests
6. Antenna verification

3.5.2 GTS 8XX Configuration Options

GTS 8XX Configuration is performed using a computer (installed with Microsoft Windows XP or later) and the GTS 8XX Install Tool, Garmin part number 006-A0242-00. The tool is available for download from the Dealers Only portion of the Garmin website (www.garmin.com).

G1000 Installations:
When installed as part of the G1000 integrated flight deck, the GTS 8XX must have FAA approved configuration data. Configuration data is loaded to the GTS 8XX from an aircraft-specific G1000 software loader card.

For basic configuration information refer to the G1000 Line Maintenance and Configuration Manual (190-00303-04), G1000 System Maintenance Manual LJ/VLJ (190-00903-00), or the G1000 System Maintenance Manual Standard Piston/Turboprop Aircraft (190-00907-00). For actual installation/checkout, use only aircraft manufacturer approved or STC checkout procedures.

Non-G1000 Installations:
Configuration and software uploading is accomplished by using a computer (installed with Microsoft Windows XP or later) and the GTS 8XX Install Tool. An optional USB pigtail installed in the wiring harness may be used.

The GTS 8XX Install Tool allows for configuration, diagnostics, and upload of GTS 8XX software.

The following GTS 8XX modes are accessible with the GTS 8XX Install Tool.

- Normal Mode – Allows selection of Traffic Mode to Standby, Operate, or Test. Reports System Faults, Status Flags, and Operating Status. Allows Ground Test Mode to be Enabled or Disabled.
- Configuration Mode – Allows selection of installation options
- Upload Mode – Allows upload of software to GTS 8XX unit
- Debug Mode – Runs system diagnostics

3.5.2.1 Normal System Mode Tab

The Normal tab displays various faults, flags, and operational information. When the Normal tab is selected, the unit is commanded to Normal System Mode.

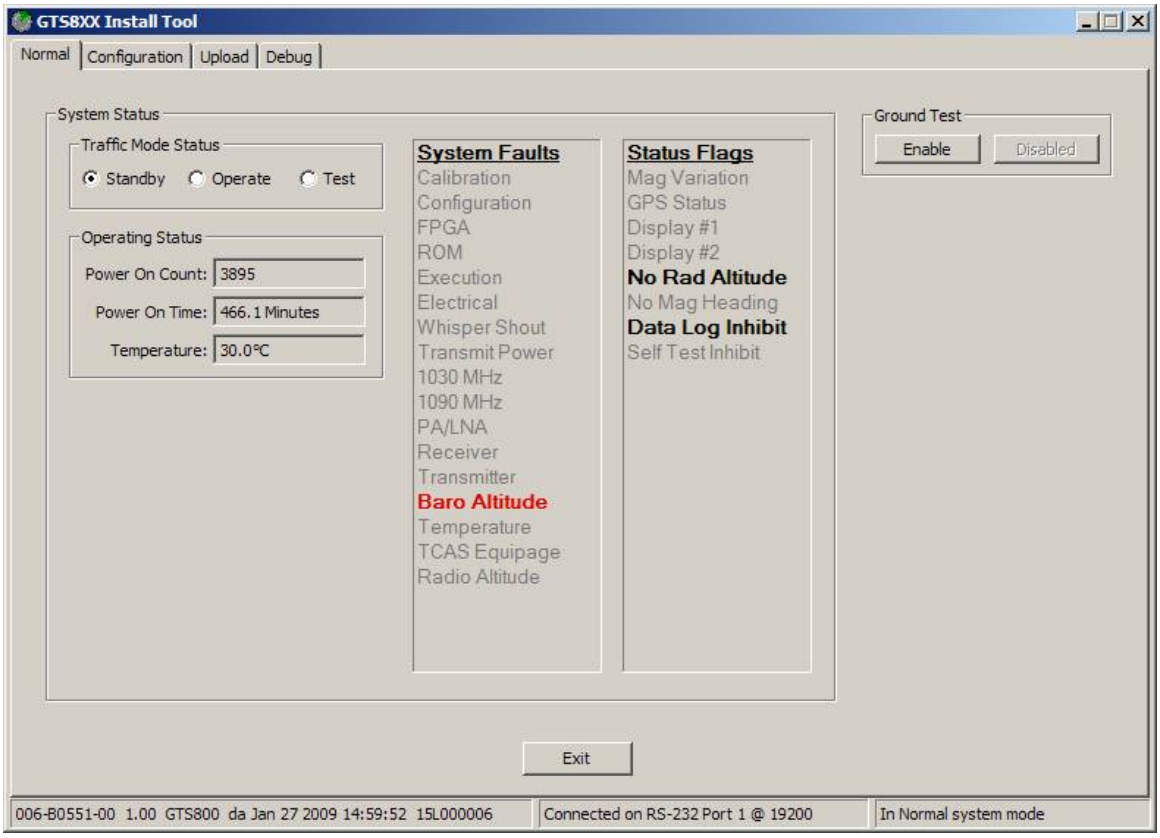


Figure 3-3. GTS 8XX Install Tool – Normal Tab

Normal Mode –

System Faults:

Red Bold text indicates that a fault is active.
Gray text indicates that there is no active fault.
(System Faults are described in the Self-Test section.)

Status Flags:

Black Bold text indicates that a flag is set.
Gray text indicates that the flag is not set.
(Status Flags are described in the Self-Test section.)

Traffic Mode Status:

Standby – Unit is not transmitting or receiving data
Operate – Unit is interrogating and processing received data
Test – Allows special transmit interrogation rates and data patterns to be initiated
(Selected mode is active.)

Ground Test:

Enabled
Disabled
(Ground Test is described in the Ramp Test and Return to Service Tests section.

3.5.2.2 Configuration System Mode Tab

The Configuration tab displays configuration data and allows the installer to change the installation configuration. When the Configuration tab is selected, the unit is commanded to Configuration System Mode.

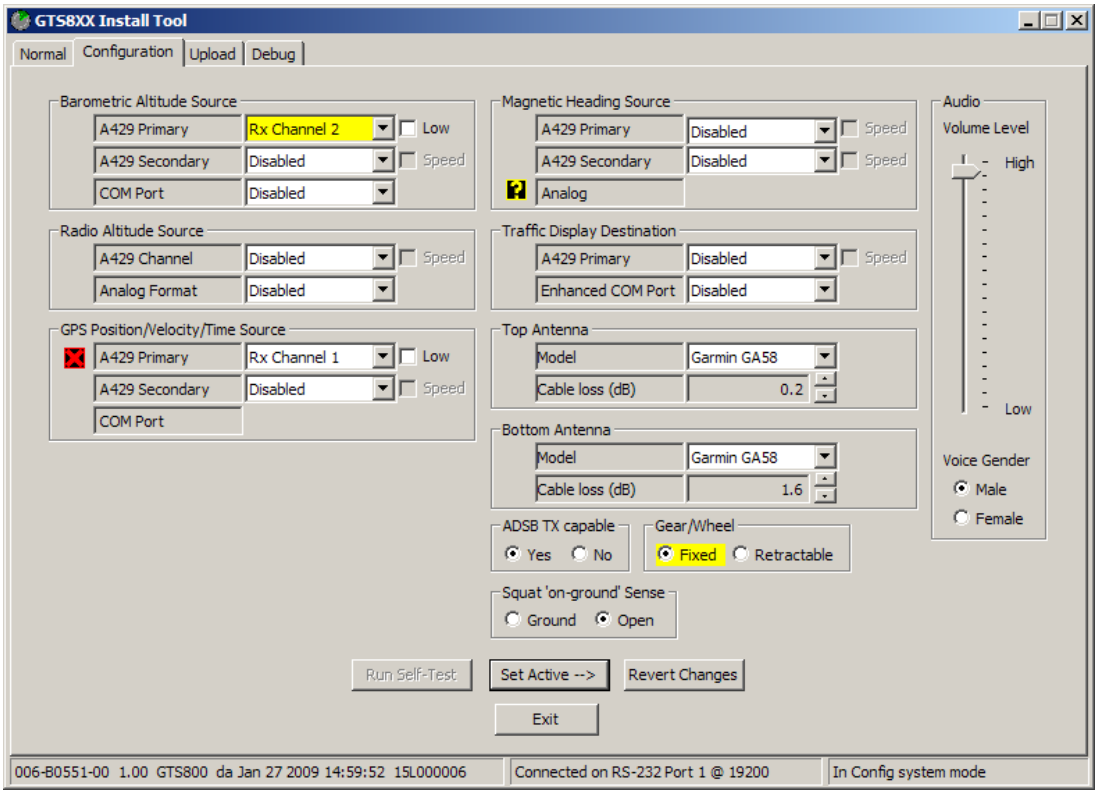


Figure 3-4. GTS 8XX Install Tool – Configuration Tab (GTS 800)

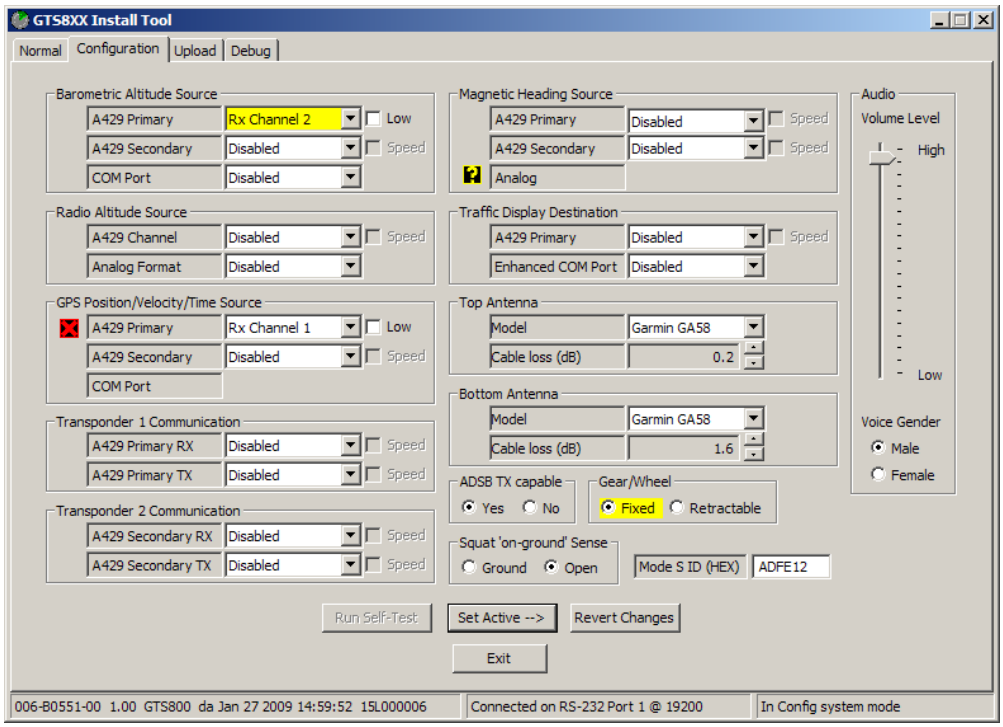


Figure 3-5. GTS 8XX Install Tool – Configuration Tab (GTS 820 and GTS 850)

The Configuration tab displays installation configuration options. Changes made in the Configuration tab are not immediately committed to the GTS. Changed options will be colored yellow until 'Set Active' is selected.

Configuration Mode –

Barometric Altitude Source:

Note: At least one source must be selected (same altitude source used for the transponder).

Primary	A429 RX Channels 1 - 6 or Disabled
Secondary	A429 RX Channels 1 - 6 or Disabled
COM	RS-232 Ports 1 - 5 or Disabled

Magnetic Heading Source (optional):

Primary	A429 RX Channels 1 - 6 or Disabled
Secondary	A429 RX Channels 1 - 6 or Disabled

Radio Altitude Source (optional):

A429	A429 RX Channels 1 - 6 or Disabled
Analog	Disabled
	ARINC 552
	ARINC 552A
	Bonzer MK10X
	Collins ALT50
	Collins ALT55
	King KRA10
	King KRA405
	Sperry AA100
	Terra TRA3000
	Terra TRA3500

GPS Position/Velocity/Time Source:

Note: At least one source required for ADS-B IN functionality.

Primary	A429 RX Channels 1 - 6 or Disabled
Secondary	A429 RX Channels 1 - 6 or Disabled

Traffic Display Destination:

Note: At least one source is required.

Primary	A429 TX Channels 1 - 6 or Disabled
COM	RS-232 Ports 1 - 5 or Disabled

Transponder 1 & 2 Communication:

Note: At least Transponder 1 RX and TX required for GTS 820 and GTS 850.
Primary should be configured for channels wired to Transponder 1.
Secondary should be configured for channels wired to Transponder 2 in a dual transponder installation.

Primary RX	A429 RX Channels 1 - 6 or Disabled
Primary TX	A429 TX Channels 1 - 6 or Disabled
Secondary RX	A429 RX Channels 1 - 6 or Disabled
Secondary TX	A429 TX Channels 1 - 6 or Disabled

Top Antenna:

Model	None Monopole Garmin GA58 Sensor Systems
Cable loss (dB)	0.2 – 4.0 *Note: Cable loss information is described in Fabrication of Coaxial Cable Assemblies section.*

Bottom Antenna:

Model	None Monopole Garmin GA58 Sensor Systems
Cable loss (dB)	0.2 – 4.0 *Note: Cable loss information is described in Fabrication of Coaxial Cable Assemblies section.*

Note: All A429 options have the ability to select High or Low speed.

Note: If an input is inactive, a ☒ *will be displayed.*
If an input is active, a ☑ *will be displayed.*
If an input is in an unknown state, a ? *will be displayed.*

Volume Level:

Allows audio volume level selection from 0 to -63 dB in 0.5 dB increments.
Maximum audio output is at least 80 mW into a 600 Ohm load. (6.93 Vrms)

Voice Gender:

Enter voice preference selection.

Gear/Wheel:

Enter type of aircraft gear design.

ADSB TX Capable:

Indicate whether aircraft is equipped with ADS-B transmitter.

Squat ‘on-ground’ Sense:

Indicate type of sense switch.

Mode S ID (HEX):

Applicable to GTS 820 and GTS 850 only. Enter Mode S transponder ID (must match the Mode S ID used by the transponder).

Set Active:

Must select Set Active to enable the settings on the GTS 8XX.

Revert Changes:

Select to show current GTS 8XX settings.
An incorrect configuration will be reverted back to previous settings.

Note: Default is “disabled” for all inputs and outputs.

3.5.2.3 Upload System Mode Tab

The Upload tab displays version information for Boot Block, Region List, System, FPGA, Audio, Magnetic Variation. Boot Block updating is not allowed. For other files, select the appropriate image files and select upload.

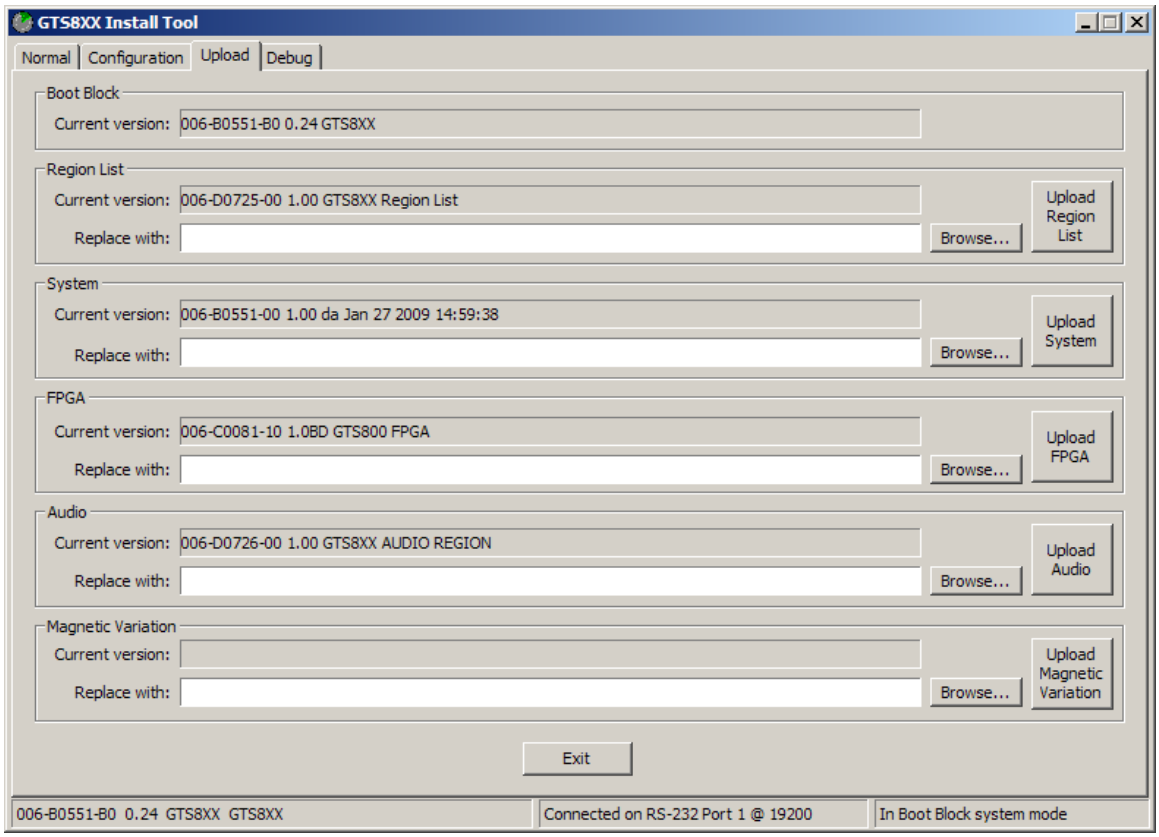


Figure 3-6. GTS 8XX Install Tool – Upload Tab

3.5.2.4 Debug Tab

The Debug tab is reserved and not available for field installation use.

3.5.3 CDTI Display Setup and Configuration

For configuration of the displays, refer to their respective installation manuals.

- 500 Series Installation Manual (190-00181-02)
- GMX 200 Installation Manual (190-00607-04)
- GDU 620 Installation Manual (190-00601-04)
- G1000 Line Maintenance and Configuration Manual (190-00303-04)
- G1000 System Maintenance Manual LJ/VLJ (190-00903-00)

3.5.4 Self Test

A self-test feature tests the (aural) alarm, attempts self calibration, and activates each display element in a pre-determined sequential pattern to allow visual verification that display outputs issued by the digital processor can be correctly interpreted by the pilot.

NOTE

Self tests may be performed indoors but signal multi-path from building walls may be a factor. If problems are experienced, self tests should be performed outside away from buildings, and where local traffic is not a factor.

With the GTS 8XX powered up and Standby indicated on the CDTI, cycle the GTS 8XX to Self Test. The self test feature of the GTS 8XX tests the following internal parameters as well as performs calibration of various components in the GTS 8XX:

a) Calibration data fault – Stored factory calibration parameters are invalid. Return unit to Garmin for service.
b) Configuration data fault – Stored system configuration parameters are invalid or Mode S address is invalid (All 0's or F's). Fault will persist until configuration is corrected. Attempt configuration per the Configuration Section.
c) FPGA fault – Check of the FPGA image failed. Fault will persist until valid FPGA image is loaded. If upload of FPGA image was recently attempted, retry the upload. Otherwise, return unit to Garmin for service.
d) ROM fault – Internal non-volatile memory failure, or invalid data image detected. If upload of audio image or IGRF magnetic field image was recently attempted, retry the upload. Otherwise return unit to Garmin for service.
e) Execution fault – CPU execution fault has occurred. Cycle power and retry self test. If fault persists, return unit to Garmin for service.
f) Electrical fault – One of the internal electrical voltages are out of range. Fault will persist until power is cycled. Check aircraft power supply. If fault persists, return unit to Garmin for service.
g) Whisper Shout fault – Transmitted power is out of tolerance. Check cable loss configuration, antenna installation and all cable connections and retry self test. If fault persists, return unit to Garmin for service.
h) Transmit Power fault - One of the internal transmitter power source voltages are out of range. Fault will persist until power is cycled. Check aircraft power supply. If fault persists, return unit to Garmin for service.
i) 1030 MHz Frequency Source fault - Transmit Frequency synthesizer is not locked. Cycle power and retry self test. If fault persists, return unit to Garmin for service.
j) 1090 MHz Frequency Source fault - Receive Frequency synthesizer is not locked. Cycle power and retry self test. If fault persists, return unit to Garmin for service.

k) Receiver Calibration fault. Check antenna installation and all cable connections and retry self test. Ensure that self test occurs in area free of buildings and large objects that can reflect signals. If fault persists, return unit to Garmin for service.

NOTE

Receiver self-calibration is performed prior to the transmitter self-calibration. In the event that a receiver calibration fault occurs, a transmitter self-calibration will not be performed.

l) Transmitter Calibration fault. Check antenna installation and all cable connections and retry self test. Ensure that self test occurs in area free of buildings and large objects that can reflect signals. If fault persists, return unit to Garmin for service.

NOTE

A transmitter self-calibration can only be performed after a successful receiver self-calibration.

m) Barometric Altitude Input fault – Own ship barometric altitude calculation is invalid or has timed out. Check wiring to source of barometric altitude and ensure that source is operating. Fault will clear as soon as valid barometric altitude data is received.
n) Main Board Temperature fault – Main board temperature or RF receiver temperature is greater than 90° Celsius or less than -60° Celsius. Fault will persist until internal temperature returns to acceptable range.
o) TCAS Equipage Timeout fault – TCAS Equipage data is not being received or has timed out for 800ms. Check wiring to TCAS Equipage data source and ensure that source is operating. Fault will clear as soon as valid TCAS Equipage data is received.

The self test feature also checks the following external parameters:

a) Mag Variation – Magnetic variation data (difference between 'True' North and Magnetic North) is available.
b) GPS Status – GPS Position, Velocity and Time data is available
c) Display #1 status - Check of Traffic display #1 discrete input is inactive for 2 or more seconds.
d) Display #2 status - Check of Traffic display #2 discrete input is inactive for 2 or more seconds.
e) Radio Altimeter Input status – Radio altimeter is installed and radio altimeter input status is inactive.
f) Magnetic Heading Input status – Invalid magnetic heading data is received.
g) Maintenance/Data logger Input status – Data logger is inhibited if active.
h) Self Test Inhibit status – Self test is inhibited if active.

When the display receives an indication that a pilot initiated Self Test is in progress, this state is clearly annunciated on the traffic display and the following test patterns will be executed.

Figure 3-7. Self Test

Table 3-5. Self Test

Intruder #1 (transmitted in intruder number field)	
	2.0 NM
	Vertical Rate = Climbing, relative altitude = –200 feet
	TA, Bearing = –90 degrees
Intruder #2 (transmitted in intruder number field)	
	3.625 NM
	Vertical Rate = Descending, relative altitude = –1,000 feet
	Prox Traffic, Bearing = +33.75 degrees
Intruder #3 (transmitted in intruder number field)	
	3.625 NM
	No vertical rate, relative altitude = +1,000 feet
	Other traffic, bearing = –33.75 degrees.

Audio annunciation shall be:

GTS 800/820 - “TAS system Passed” or “TAS system Failed”
GTS 850 - “TCAS system Passed” or “TCAS system Failed”

Any faults and flags are also displayed on the Normal tab of the GTS8XX Install Tool. Faults that occur will be colored in red and flags will be colored in black.

If self test fails, refer to the diagnostics data to determine a cause.

Insure that no Intruder appears at close range to own aircraft.

NOTE

If the intruder appears at close range to own aircraft, verify that the mutual suppression line is connected between GTS 8XX and other L-band equipment (transponder, DME, etc.).

3.5.5 Ramp Test and Return To Service Test

Using a ramp tester, such as a TIC TR220 or equivalent, make the following setup and measurements to verify GTS 8XX operational and surveillance functional.

To select a scenario that will properly converge and intercept the GTS 8XX, the GTS 8XX must be in Ground Test mode. To enable Ground Test mode, the aircraft must be on the ground and the GTS 8XX must be in Normal System mode and in Standby.

Activate ground test mode by clicking 'Enable' in the Ground Test field on the Normal tab of the GTS 8XX Install Tool.

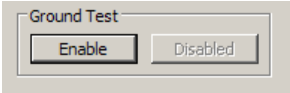


Figure 3-8. Ground Test

This simulates the GTS to be airborne at 50,000 ft with magnetic heading of 0°.

NOTE

The GTS 8XX will not accept the Ground Test command unless the unit is in Standby and the squat switch indicates the aircraft is on the ground.

Position the test set directional antenna with a clear line of sight to the GTS 8XX antenna at 90 degrees. With the GTS 8XX powered up and in Standby mode indicated on the CDTI, cycle the GTS 800 to "Operate".

Select the following scenario:
Set the intruder type as ATCRBS.

Intruder Start Distance	Intruder Start Altitude	Vertical Speed	Velocity
10 NM	50,000 ft	0 fpm.	360 Kts

Initiate the intruder scenario and observe the following:

- Traffic should be acquired at approximately 10 NM at 90 degree bearing and co-altitude. Observe intruder closes on own aircraft at a rate of .1 NM/sec.
- The intruder should transition from Other Traffic (displayed as an open diamond with 00 displayed above), to proximate traffic (displayed as a filled white diamond with 00 displayed above), to a Traffic Advisory (TA) alarm.
- The appropriate TA symbology (yellow filled circle with 00 displayed above, and an audio annunciation of "Traffic! 3 O'clock! At Altitude! 3 Miles!"), displayed when the intruder approaches within 3 NM.

3.5.6 Antenna Verification

The first step in antenna verification is to verify auto-calibration operates without indicating a fault.

1. With the GTS 8XX powered up and "Standby" indicated on the CDTI cycle the GTS 8XX to "Operate". Each time the GTS 8XX transitions between these modes a self test of the antenna circuit is initialized. If the antenna connection is not correct the CDTI will display "Failure" indicating it will be necessary to recheck the antenna coaxial connections. If the CDTI displays "Operate" without indicating a fault, proceed to the next step of antenna verification.

Using a ramp tester, such as a TIC TR220 or equivalent, make the following set up and measurements to assure the antenna is properly connected and the GTS 8XX is operational.

2. Position the test set directional antenna with a clear line of sight to the GTS8XX antenna.

3. Ensure that the transmitter or receiver (RX/TX) that you are testing is significantly closer to the ramp tester than another operating RX/TX, or erroneous and inaccurate results may occur. All four quadrants (forward, starboard, aft, and port) will be similarly tested to verify bearing of simulated intruder supplied via the ramp tester are correctly displayed on the CDTI.

4. Using the ramp tester, select the proper antenna gain and distance to aircraft.

5. Position ramp test set at 0 degrees.

6. Turn the test set on.

7. Connect the directional antenna to the ramp test set.

8. Set the multifunction test set to perform "TCAS" testing. Configure the GTS 8XX to the normal operating mode.

9. Program a static intruder per the following scenario:

NOTE

See ramp test set operators manual to set the following parameters

Intruder Start Distance	Intruder Start Altitude	Vertical Speed	Velocity
2 NM	50,000	0 fpm.	0 Kts

10. Set the intruder type as ATCRBS.

11. Verify a target is annunciated on the GTS 8XX TAS/TCAS display at the correct bearing of approximately 0 degree azimuth at 2 NM and co-altitude (read as 00 above a filled diamond indicating proximate traffic).

12. Toggle intruder traffic to standby or off.

13. Reposition ramp test set and directional antenna to a starboard position of 90 degrees.

14. Reengage the same intruder scenario as above.

15. Verify a target is annunciated on the GTS 8XX TAS/TCAS display at the correct bearing of approximately 90 degree azimuth at 2 NM and co-altitude.

16. Toggle intruder traffic to standby or off.

17. Reposition ramp test set and directional antenna to an aft position of 180 degrees.

18. Reengage the same intruder scenario as above.

19. Verify a target is annunciated on the GTS 8XX TAS/TCAS display at the correct bearing of approximately 180 degree azimuth at 2 NM and co-altitude.

20. Toggle intruder traffic to standby or off.

21. Reposition ramp test set and directional antenna to a port position of 270 degrees.

22. Reengage the same intruder scenario as above.

23. Verify a target is annunciated on the GTS 8XX TAS/TCAS display at the correct bearing of approximately 270 degree azimuth at 2 NM and co-altitude.

24. Toggle intruder traffic to standby or off.

25. If the bearing is not as anticipated, recheck the antenna coaxial connections and verify the correct antenna type is selected.

NOTE

If multiple targets are displayed during the antenna tests, recheck the antenna coaxial connections.

3.6 GA 58 Antenna Installation

Refer to the GA 58 installation drawing shown in Appendix A of this manual.

CAUTION

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

1. Refer to the GA 58 installation drawing shown in Appendix A for the mounting cutout.

2. For composite aircraft, fabricate a ground plane under the antenna base plate on the internal surface of the aircraft with recommended minimum dimensions of 18" x 18", with center of ground plane under the center of the antenna baseplate. Refer to notes in Antenna Considerations section and Electrical Bonding section of this document.

3. For metal skin aircraft, do NOT remove paint on outer skin of aircraft under the footprint of the antenna baseplate. The painted surface prevents corrosion.

4. Install a doubler plate to reinforce the aircraft skin as necessary.

5. Place the supplied O-ring, 251-00011-00, in the groove on the bottom surface of the antenna.

6. Mount the antenna to the airframe with the four supplied #8-32 stainless steel screws, 211-60209-16. Washers and locking nuts (not provided, may be part of doubler plate) are required to secure the antenna. Apply torque evenly across all mounting screws.

7. Ensure that the antenna base and aircraft skin are in continuous contact.

8. Fillet seal the antenna and gasket to the fuselage using a good quality electrical grade sealant, MIL-S-8802B or equivalent. Run a bead of the sealant along the edge of the antenna where it meets the exterior aircraft skin. Use caution to ensure that the antenna connector is not contaminated with sealant. Seal the mounting screws with sealant.

9. Connect the four antenna cables ensuring each cable is connected to the correct antenna connector. Each antenna connector and cable has a matching color band.

3.7 GPA 65 PA/LNA Installation

Refer to the GPA 65 installation drawing shown in Appendix A of this manual.

1. Assemble the wiring harness and circular connector per Section 3.4.

2. Assemble the coaxial cables per Section 2.4.1.

3. Mount the unit to a suitable mounting location using #8-32 pan head screws (4 ea) (not provided).

4. Connect the circular connector and eight coaxial cables ensuring each coaxial cable is connected to the correct jack connector. Each jack connector and cable has a matching color band.

3.8 Continued Airworthiness

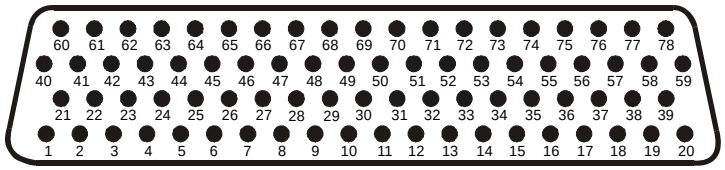
Maintenance of the GTS 8XX and GPA 65 is “on condition” only.

4 SYSTEM INTERCONNECTS

4.1 GTS 8XX Pin Function List

4.1.1 P8001 (Digital)

View of J8001 connector from back of unit

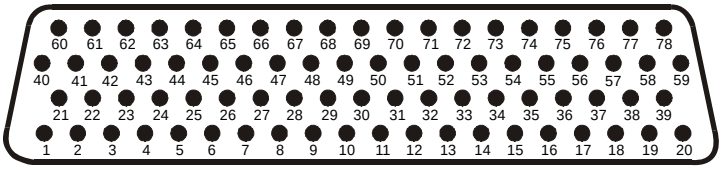


Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	RS-232 OUT 1	Out
3	RS-232 IN 1	In
4	SIGNAL GROUND	--
5	RS-232 OUT 2	Out
6	RS-232 IN 2	In
7	SIGNAL GROUND	--
8	RS-232 OUT 3	Out
9	RS-232 IN 3	In
10	SIGNAL GROUND	--
11	RS-232 OUT 4	Out
12	RS-232 IN 4	In
13	SIGNAL GROUND	--
14	ARINC 429 OUT 1 A	Out
15	ARINC 429 OUT 1 B	Out
16	ARINC 429 IN 1 A	In
17	ARINC 429 IN 1 B	In
18	SIGNAL GROUND	--
19	GPS PPS 1 IN	In
20	SIGNAL GROUND	--
21	CONFIG MODULE POWER OUT	Out
22	SIGNAL GROUND	--
23	ARINC 429 OUT 2 A	Out
24	ARINC 429 OUT 2 B	Out
25	ARINC 429 IN 2 A	In
26	ARINC 429 IN 2 B	In
27	SIGNAL GROUND	--
28	ARINC 429 OUT 3 A	Out
29	ARINC 429 OUT 3 B	Out
30	ARINC 429 IN 3 A	In
31	ARINC 429 IN 3 B	In
32	SIGNAL GROUND	--
33	ARINC 429 OUT 4 A	Out
34	ARINC 429 OUT 4 B	Out
35	ARINC 429 IN 4 A	In
36	ARINC 429 IN 4 B	In
37	RS-422 IN A	In
38	RS-422 IN B	In

Connector P8001, continued		
Pin	**Pin Name**	**I/O**
39	SIGNAL GROUND	--
40	CONFIG MODULE DATA	I/O
41	SIGNAL GROUND	--
42	ARINC 429 OUT 5 A	Out
43	ARINC 429 OUT 5 B	Out
44	ARINC 429 IN 5 A	In
45	ARINC 429 IN 5 B	In
46	SIGNAL GROUND	--
47	ARINC 429 OUT 6 A	Out
48	ARINC 429 OUT 6 B	Out
49	ARINC 429 IN 6 A	In
50	ARINC 429 IN 6 B	In
51	SIGNAL GROUND	--
52	ETHERNET OUT A	Out
53	ETHERNET OUT B	Out
54	ETHERNET IN A	Out
55	ETHERNET IN B	Out
56	SIGNAL GROUND	--
57	RS-422 OUT A	Out
58	RS-422 OUT B	Out
59	SIGNAL GROUND	--
60	CONFIG MODULE CLOCK	Out
61	TOP PA/LNA DATA RS-422 OUT A	Out
62	TOP PA/LNA DATA RS-422 OUT B	Out
63	TOP PA/LNA DATA RS-422 IN A	In
64	TOP PA/LNA DATA RS-422 IN B	In
65	RESERVED	--
66	RESERVED	--
67	RESERVED	--
68	RESERVED	--
69	SPARE	--
70	SPARE	--
71	SPARE	--
72	SPARE	--
73	GPS PPS IN 2 HI	In
74	GPS PPS IN 2 LO	In
75	USB VBUS POWER	In
76	USB DATA HI	I/O
77	USB DATA LO	I/O
78	USB GROUND	--

4.1.2 P8002 (Analog/Discrete)

View of J8002 connector from back of unit



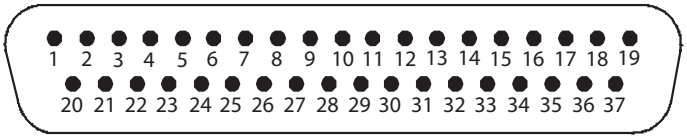
Pin	Pin Name	I/O
1	SIGNAL GROUND	--
2	RESERVED	--
3	RESERVED	--
4	RESERVED	--
5	SIGNAL GROUND	--
6	AIR/GROUND*	In
7	SPARE	--
8	TRAFFIC DISPLAY 1 STATUS VALID*	In
9	TRAFFIC DISPLAY 2 STATUS VALID*	In
10	GEAR DOWN AND LOCKED*	In
11	TA INHIBIT* 1	In
12	TA INHIBIT* 2	In
13	RESERVED	--
14	SELF TEST INHIBIT PROGRAM*	In
15	TA INTRUDER DISPLAY LIMIT 16 PROGRAM *	In
16	TA INTRUDER DISPLAY LIMIT 8 PROGRAM *	In
17	TA INTRUDER DISPLAY LIMIT 4 PROGRAM *	In
18	TA INTRUDER DISPLAY LIMIT 2 PROGRAM *	In
19	TA INTRUDER DISPLAY LIMIT 1 PROGRAM *	In
20	RESERVED	--
21	SIGNAL GROUND	--
22	RESERVED	--
23	RESERVED	--
24	RESERVED	--
25	RESERVED	--
26	RESERVED	--
27	RESERVED	--
28	RESERVED	--
29	RESERVED	--
30	RESERVED	--
31	RESERVED	--
32	RESERVED	--
33	RESERVED	--
34	RESERVED	--
35	RESERVED	--
36	RESERVED	--
37	RESERVED	--
38	RESERVED	--
39	SIGNAL GROUND	--
40	SIGNAL GROUND	--
41	HEADING X HI	In

Connector P8002, continued		
Pin	**Pin Name**	**I/O**
42	HEADING X LO (GROUND)	--
43	SIGNAL GROUND	--
44	HEADING Y HI	In
45	HEADING Y LO (GROUND)	--
46	SIGNAL GROUND	--
47	SPARE	--
48	EXTERNAL SUPPRESSION I/O	I/O
49	SIGNAL GROUND	--
50	TA DISPLAY ENABLE*	Out
51	AURAL TA ALERT*	Out
52	SPARE	--
53	VISUAL TA ALERT*	Out
54	TRAFFIC SYSTEM STATUS VALID*	Out
55	RESERVED	--
56	RESERVED	--
57	SIGNAL GROUND	--
58	ALERT AUDIO OUT HI	Out
59	ALERT AUDIO OUT LO	Out
60	HEADING Z HI (GROUND)	In
61	HEADING Z LO (GROUND)	--
62	SIGNAL GROUND	--
63	26 VAC HEADING REF HI	In
64	26 VAC HEADING REF LO	In
65	SIGNAL GROUND	--
66	SPARE	--
67	SPARE	--
68	HEADING VALID	In
69	HEADING VALID*	In
70	SIGNAL GROUND	--
71	ANALOG RADAR ALTIMETER HI	In
72	ANALOG RADAR ALTIMETER LO	In
73	SIGNAL GROUND	--
74	SELF TEST INITIALIZE SELECT*	In
75	TRAFFIC OPERATE/STANDBY*	In
76	ANALOG RADAR ALTIMETER VALID	In
77	SPARE	--
78	SIGNAL GROUND	--

An asterisk (*) following a signal name denotes that the signal is Active Low. Refer to Section 4.6.4 for signal description.

4.1.3 P8003 (Power Supply)

View of J8003 connector from back of unit



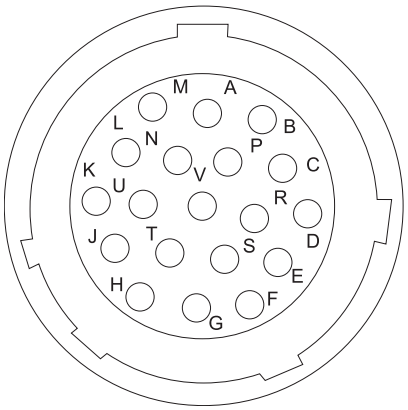
Pin	Pin Name	I/O
1	POWER GROUND	--
2	AIRCRAFT POWER 1	In
3	AIRCRAFT POWER 1	In
4	AIRCRAFT POWER 2	In
5	AIRCRAFT POWER 2	In
6	POWER GROUND	--
7	+6 VDC PA/LNA POWER OUT	Out
8	+6 VDC PA/LNA POWER OUT	Out
9	RESERVED	--
10	RESERVED	--
11	POWER GROUND	--
12	+35 VDC PA/LNA POWER OUT	Out
13	+35 VDC PA/LNA POWER OUT	Out
14	POWER GROUND	--
15	-5 VDC PA/LNA POWER OUT	Out
16	-5 VDC PA/LNA POWER OUT	Out
17	POWER GROUND	--
18	TRAFFIC SYSTEM REMOTE POWER ON*	In
19	POWER GROUND	--
20	POWER GROUND	--
21	POWER GROUND	--
22	POWER GROUND	--
23	POWER GROUND	--
24	POWER GROUND	--
25	POWER GROUND	--
26	POWER GROUND	--
27	POWER GROUND	--
28	POWER GROUND	--
29	POWER GROUND	--
30	POWER GROUND	--
31	POWER GROUND	--
32	POWER GROUND	--
33	POWER GROUND	--
34	POWER GROUND	--
35	POWER GROUND	--
36	TRAFFIC SYSTEM REMOTE POWER OFF	In
37	POWER GROUND	--

An asterisk (*) following a signal name denotes that the signal is Active Low. Refer to Section 4.6.4 for signal description.

4.2 GPA 65 Pin Function List

4.2.1 P651

View of J651 connector from back of unit



Pin	Pin Name	I/O
A	POWER GROUND	--
B	+35 VDC POWER IN	In
C	POWER GROUND	--
D	RESERVED	--
E	-5 VDC POWER IN	In
F	PA/LNA DATA RS-422 OUT B	Out
G	PA/LNA DATA RS-422 OUT A	Out
H	PA/LNA DATA RS-422 IN B	In
J	PA/LNA DATA RS-422 IN A	In
K	POWER GROUND	--
L	+6 VDC POWER IN	In
M	+35 VDC POWER IN	In
N	RESERVED	--
P	+6 VDC POWER IN	In
R	RESERVED	--
S	-5 VDC POWER IN	In
T	RESERVED	--
U	RESERVED	--
V	RESERVED	--

4.3 Power

4.3.1 Aircraft Power Functions

This section covers the power input requirements.

4.3.1.1 Aircraft Power

Pin Name	Connector	Pin	I/O
AIRCRAFT POWER 1	P8003	2	In
AIRCRAFT POWER 1	P8003	3	In
AIRCRAFT POWER 2	P8003	4	In
AIRCRAFT POWER 2	P8003	5	In
AIRCRAFT GROUND	P8003	21	--
AIRCRAFT GROUND	P8003	22	--
AIRCRAFT GROUND	P8003	23	--
AIRCRAFT GROUND	P8003	24	--

Pins 2 and 3 are internally connected to form AIRCRAFT POWER 1. Pins 4 and 5 are internally connected to form AIRCRAFT POWER 2. AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode ORed" to provide aircraft power redundancy.

4.3.1.2 Remote Power

Pin Name	Connector	Pin	I/O
TRAFFIC SYSTEM REMOTE POWER ON*	P8003	18	In
TRAFFIC SYSTEM REMOTE POWER OFF	P8003	36	In

An asterisk (*) following a signal name denotes that the signal is Active Low.

Used to remotely control power.

Remote Power ON*
ACTIVE: Vin < 3 VDC or grounded (Unit ON)
INACTIVE: Vin > 8 VDC or floating (Unit OFF)

Remote Power OFF
ACTIVE: Vin > 8 VDC (Unit OFF)
INACTIVE: Vin < 3 VDC or floating (Unit ON)

Active Low Remote Power On (J8003 Pin 18)		Active High Remote Power Off (J8003 Pin 36)		Expected Unit State
State	Level	State	Level	
Inactive	Vin > 8 VDC or Open	Inactive	Vin < 3VDC or Open	OFF
Active	Vin < 3VDC or Gnd	Inactive	Vin < 3VDC or Open	ON
Inactive	Vin > 8 VDC or Open	Active	Vin > 8 VDC	OFF
Active	Vin < 3VDC or Gnd	Active	Vin > 8 VDC	OFF

4.3.1.3 PA/LNA

Pin Name	Connector	Pin	I/O
+6 VDC PA/LNA POWER OUT	P8003	7	Out
+6 VDC PA/LNA POWER OUT	P8003	8	Out
+35 VDC PA/LNA POWER OUT	P8003	12	Out
+35 VDC PA/LNA POWER OUT	P8003	13	Out
-5 VDC PA/LNA POWER OUT	P8003	15	Out
-5 VDC PA/LNA POWER OUT	P8003	16	Out
+6 VDC POWER IN	P651	L	In
+6 VDC POWER IN	P651	P	In
+35 VDC POWER IN	P651	B	In
+35 VDC POWER IN	P651	M	In
-5 VDC POWER IN	P651	E	In
-5 VDC POWER IN	P651	S	In

Used to provide power to the GPA 65.

4.4 Serial Data

4.4.1 RS-232

Pin Name	Connector	Pin	I/O
RS-232 OUT 1	P8001	2	Out
RS-232 IN 1	P8001	3	In
RS-232 OUT 2	P8001	5	Out
RS-232 IN 2	P8001	6	In
RS-232 OUT 3	P8001	8	Out
RS-232 IN 3	P8001	9	In
RS-232 OUT 4	P8001	11	Out
RS-232 IN 4	P8001	12	In

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

4.4.2 RS-422

Pin Name	Connector	Pin	I/O
RS-422 IN A	P8001	37	Out
RS-222 IN B	P8001	38	In
RS-422 OUT A	P8001	57	Out
RS-422 OUT B	P8001	58	In
TOP PA/LNA DATA RS-422 OUT A	P8001	61	Out
TOP PA/LNA DATA RS-422 OUT B	P8001	62	Out
TOP PA/LNA DATA RS-422 IN A	P8001	63	In
TOP PA/LNA DATA RS-422 IN B	P8001	64	In
PA/LNA DATA RS-422 OUT B	P651	F	Out
PA/LNA DATA RS-422 OUT A	P651	G	Out
PA/LNA DATA RS-422 IN B	P651	H	In
PA/LNA DATA RS-422 IN A	P651	J	In

The RS-422 channels conform to EIA standard RS-422.

4.4.3 ARINC 429

Pin Name	Connector	Pin	I/O
ARINC 429 OUT 1 A	P8001	14	Out
ARINC 429 OUT 1 B	P8001	15	Out
ARINC 429 IN 1 A	P8001	16	In
ARINC 429 IN 1 B	P8001	17	In
ARINC 429 OUT 2 A	P8001	23	Out
ARINC 429 OUT 2 B	P8001	24	Out
ARINC 429 IN 2 A	P8001	25	In
ARINC 429 IN 2 B	P8001	26	In
ARINC 429 OUT 3 A	P8001	28	Out
ARINC 429 OUT 3 B	P8001	29	Out
ARINC 429 IN 3 A	P8001	30	In
ARINC 429 IN 3 B	P8001	31	In
ARINC 429 OUT 4 A	P8001	33	Out
ARINC 429 OUT 4 B	P8001	34	Out
ARINC 429 IN 4 A	P8001	35	In
ARINC 429 IN 4 B	P8001	36	In
ARINC 429 OUT 5 A	P8001	42	Out
ARINC 429 OUT 5 B	P8001	43	Out
ARINC 429 IN 5 A	P8001	44	In
ARINC 429 IN 5 B	P8001	45	In
ARINC 429 OUT 6 A	P8001	47	Out
ARINC 429 OUT 6 B	P8001	48	Out
ARINC 429 IN 6 A	P8001	49	In
ARINC 429 IN 6 B	P8001	50	In

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers.

4.4.4 Ethernet

Pin Name	Connector	Pin	I/O
ETHERNET OUT A	P8001	52	Out
ETHERNET OUT B	P8001	53	Out
EHTERNET IN A	P8001	54	In
ETHERNET IN B	P8001	55	In

This Ethernet based HSDB (High Speed Data Bus) meets the hardware aspects of IEEE standard 802.3 for 10 base T Ethernet communications.

4.4.5 USB

Pin Name	Connector	Pin	I/O
USB VBUS POWER**	P8001	75	In
USB DATA HI**	P8001	76	I/O
USB DATA LO**	P8001	77	I/O
USB GROUND	P8001	78	--

**Signals have ESD (Electrostatic Discharge) protection, but not lightning protection. USB TYPE B RECEPTACLE pigtail cable must be wired directly to P8001 to minimize lightning exposure.

This interface is used for unit configuration and software uploads. Conforms to the Universal Serial Bus Version 1.1 standard for a "full-speed" device.

4.5 Configuration

4.5.1 Configuration Module

Pin Name	Connector	Pin	I/O
CONFIG MODULE GND	P8001	1	--
CONFIG MODULE PWR OUT**	P8001	21	--
CONFIG MODULE DATA**	P8001	40	I/O
CONFIG MODULE CLK**	P8001	60	I/O

**Signals have ESD (Electrostatic Discharge) protection, but not lightning protection.

4.6 Analog/Discrete

4.6.1 Heading Input

4.6.1.1 26 Volt AC References

Pin Name	Connector	Pin	I/O
26 VAC HEADING REF HI	P8002	63	In
26 VAC HEADING REF LO	P8002	64	In

Used to sample AC inputs.

This signal must be the same phase and frequency as the indicator being driven.

Frequency: 400 Hz ± 10%
Voltage: 22.6 Vrms to 28.6 Vrms
Input Impedance: >10 kΩ

4.6.1.2 Radar Altimeter

Pin Name	Connector	Pin	I/O
ANALOG RADAR ALTIMETER HI	P8002	71	In
ANALOG RADAR ALTIMETER LO	P8002	72	In

Provides altitude information during approach.

4.6.2 Inputs From Gyros

Pin Name	Connector	Pin	I/O
HEADING X	P8002	41	In
HEADING LO (GROUND)	P8002	42	--
HEADING Y	P8002	44	In
HEADING LO (GROUND)	P8002	45	--
HEADING Z (GROUND)	P8002	60	In
HEADING LO (GROUND)	P8002	61	--

Inputs heading information from a directional gyro.
3-wire synchro magnetic heading input, with HEADING Z grounded. Index reference is 0° as specified by ARINC 407.

Frequency: 400Hz ± 10%
Voltage: 11.8 Vrms nominal, 13.0 Vrms maximum
Input Impedance: >10 kΩ
Resolution: ± 0.1° or better
Accuracy: ± 2°

4.6.3 Audio

Pin Name	Connector	Pin	I/O
ALERT AUDIO OUT HI	P8002	58	Out
ALERT AUDIO OUT LO	P8002	59	Out

4.6.4 Active Low Discrete Inputs

Pin Name	Connector	Pin	I/O
AIR/GROUND*	P8002	6	In
TRAFFIC DISPLAY 1 STATUS VALID*	P8002	8	In
TRAFFIC DISPLAY 2 STATUS VALID*	P8002	9	In
GEAR DOWN AND LOCKED*	P8002	10	In
TA INHIBIT* 1	P8002	11	In
TA INHIBIT* 2	P8002	12	In
SELF TEST INHIBIT PROGRAM*	P8002	14	In
TA INTRUDER DISPLAY LIMIT 16 PROGRAM *	P8002	15	In
TA INTRUDER DISPLAY LIMIT 8 PROGRAM *	P8002	16	In
TA INTRUDER DISPLAY LIMIT 4 PROGRAM *	P8002	17	In
TA INTRUDER DISPLAY LIMIT 2 PROGRAM *	P8002	18	In
TA INTRUDER DISPLAY LIMIT 1 PROGRAM *	P8002	19	In
DATA RECORDER ENABLE*	P8002	20	In
HEADING VALID*	P8002	69	In
SELF TEST INITIALIZE SELECT*	P8002	74	In
TRAFFIC OPERATE/STANDBY*	P8002	75	In

An asterisk (*) following a signal name denotes that the signal is Active Low.

ACTIVE: 0 V ≤ Vin ≤ 3.5 V, or Rin ≤ 375 ohms
INACTIVE: 8 V ≤ Vin ≤ 36 V, or Rin ≥ 100k ohms
Source current is internally limited to approximately 1 mA max for a grounded input

4.6.5 Active High Discrete Inputs

Pin Name	Connector	Pin	I/O
HEADING VALID	P8002	68	In
ANALOG RADAR ALTIMETER VALID	P8002	76	In

ACTIVE: 8 V ≤ Vin ≤ 36 V
INACTIVE: 0 V ≤ Vin ≤ 3.5 V, or Rin ≥ 100k ohms
Sink current is internally limited to approximately 1 mA typical for an input connected to +28VDC.

4.6.6 Annunciator Output

Pin Name	Connector	Pin	I/O
TA DISPLAY ENABLE*	P8002	50	Out
AURAL TA ALERT*	P8002	51	Out
VISUAL TA ALERT*	P8002	53	Out
TRAFFIC SYSTEM STATUS VALID*	P8002	54	Out

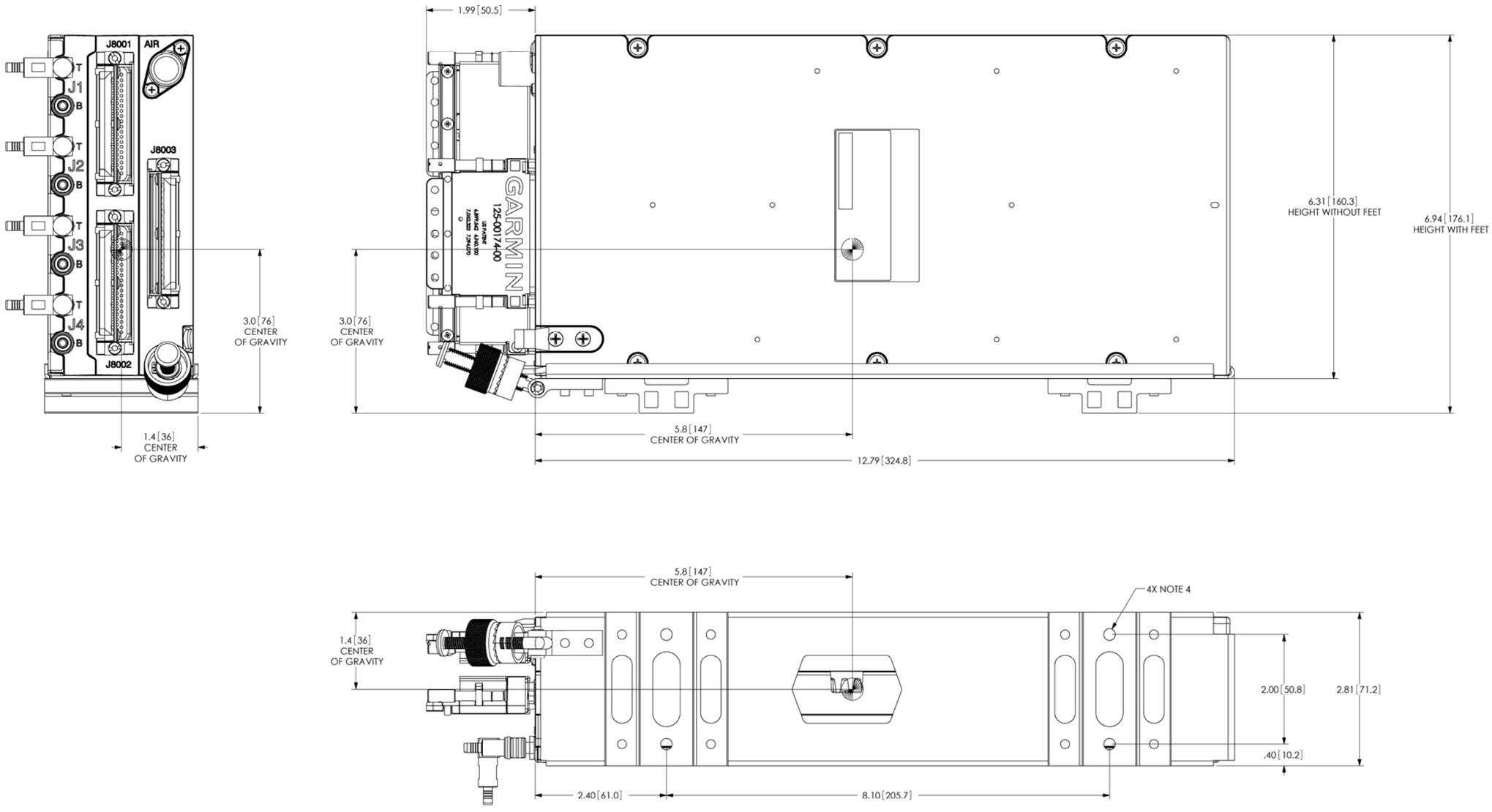
An asterisk (*) following a signal name denotes that the signal is Active Low.

ACTIVE: 0 V ≤ Vout ≤ 0.5 V or Rout ≤ 10 ohms, sinking up to 500 mA
INACTIVE: Rout ≥ 100k ohms to ground, withstanding up to +36 VDC.

4.7 Mutual Suppression Bus

Pin Name	Connector	Pin	I/O
EXTERNAL SUPPRESSION I/O	P8002	48	I/O

Mutual Suppression Input/Output bus compliant with ARINC 735A Attachment 8, with the exception that the maximum applied DC steady state voltage is +30.3V. Suppression I/O signal is pulsed under normal operation.



NOTES:
1. DIMENSIONS: INCHES [mm].
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. RACK FEET MAY BE REMOVED WHEN REQUIRED OR PREFERRED DUE TO INSTALLATION CONSTRAINTS.
4. MOUNTING HOLE FOR #8 PANHEAD OR SOCKET HEAD CAP SCREW. RECOMMENDED LENGTH .750 INCHES MINIMUM.

Figure A-1. GTS 8XX Vertical Outline Drawing

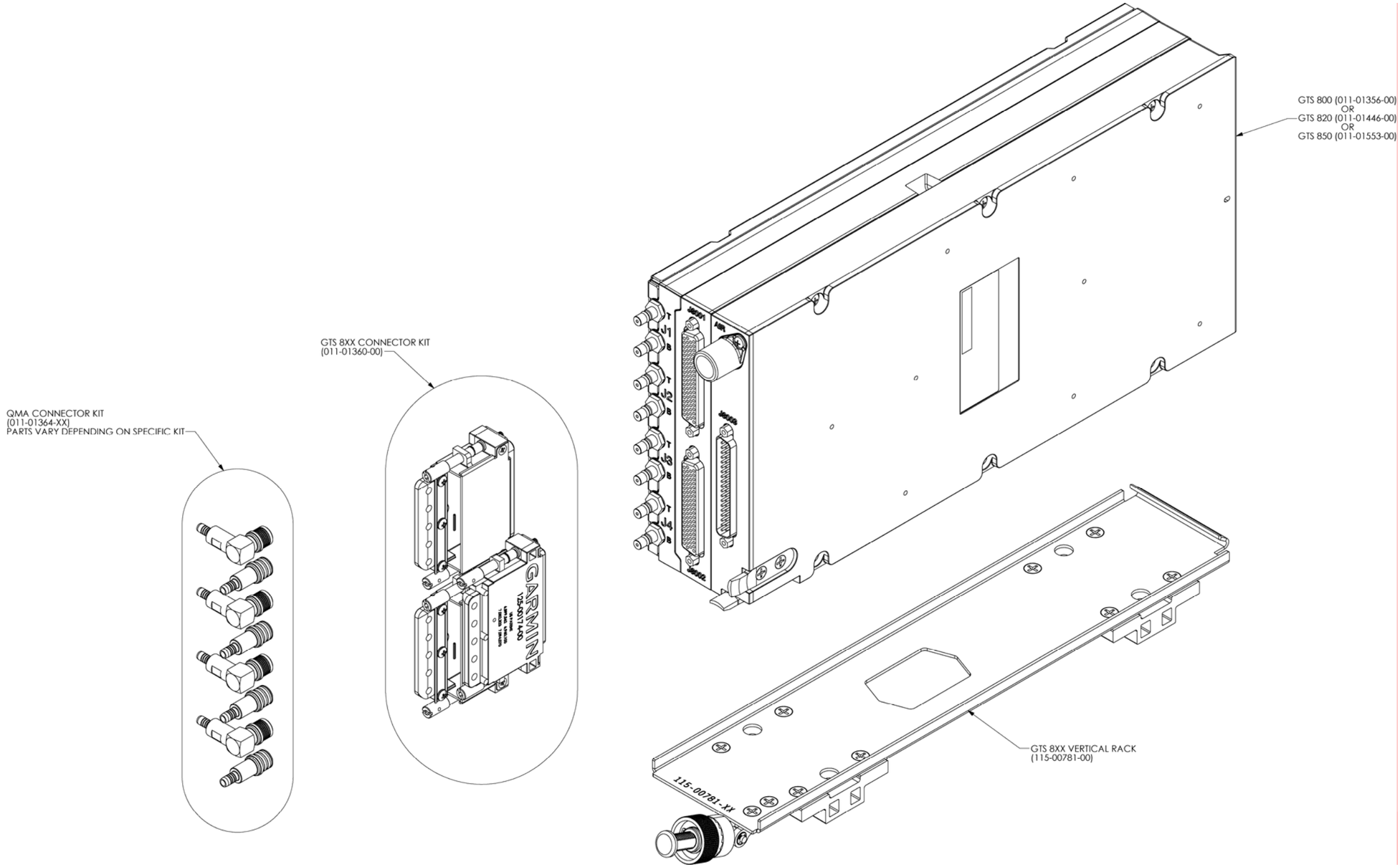
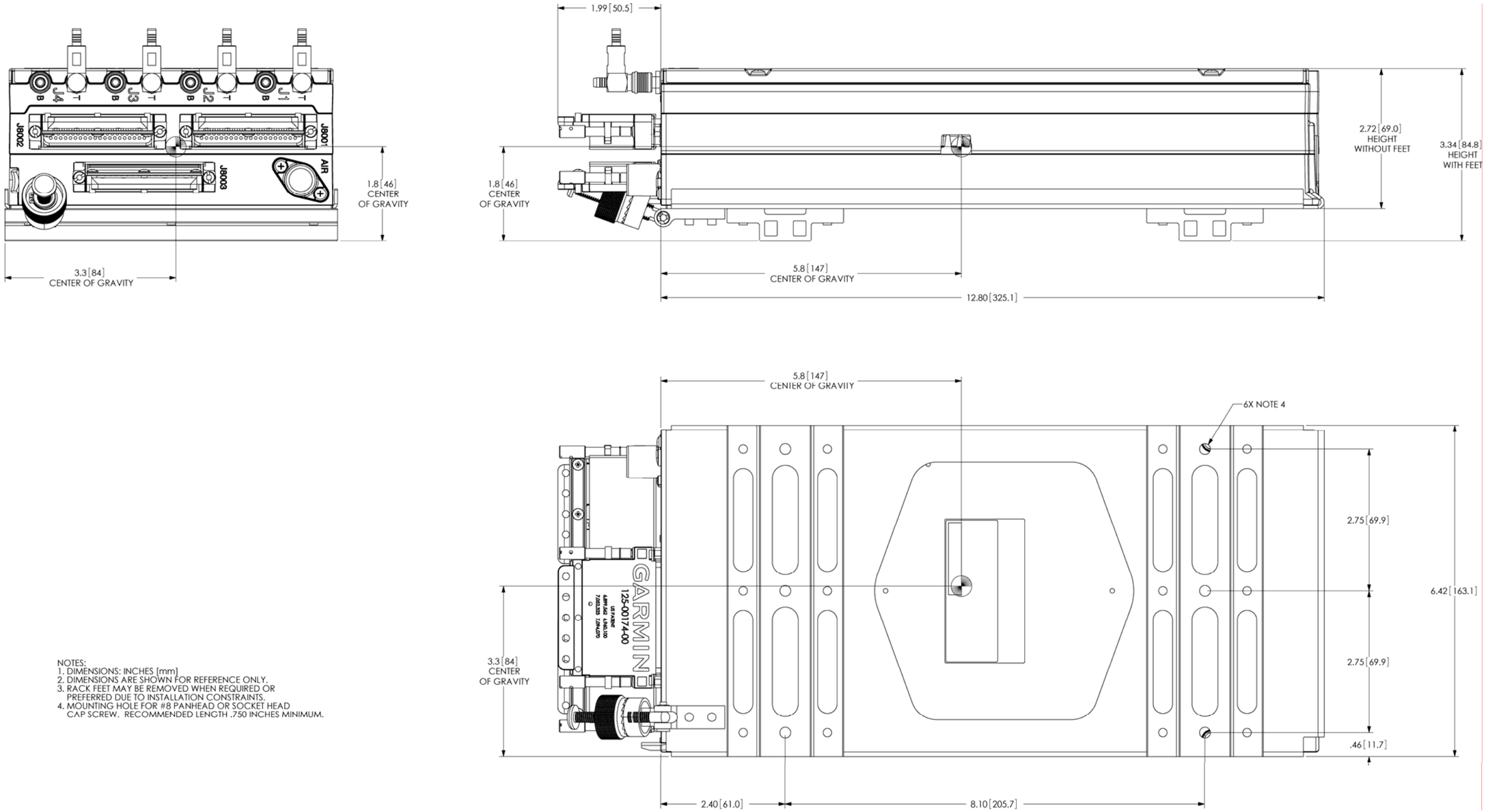


Figure A-2. GTS 8XX Vertical Installation Drawing



NOTES:
1. DIMENSIONS: INCHES [mm]
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. RACK FEET MAY BE REMOVED WHEN REQUIRED OR PREFERRED DUE TO INSTALLATION CONSTRAINTS.
4. MOUNTING HOLE FOR #8 PANHEAD OR SOCKET HEAD CAP SCREW. RECOMMENDED LENGTH .750 INCHES MINIMUM.

Figure A-3. GTS 8XX Horizontal Outline Drawing

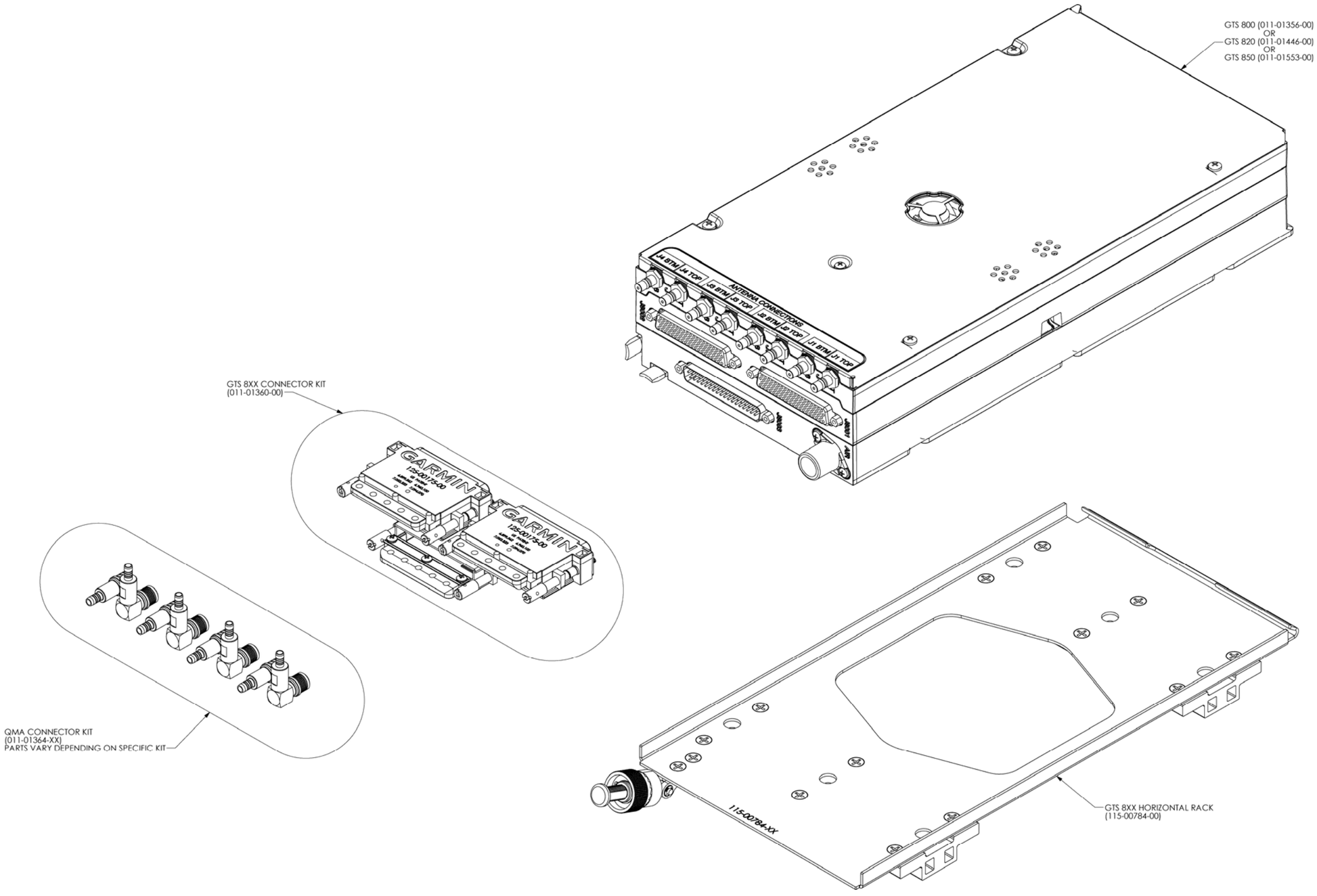
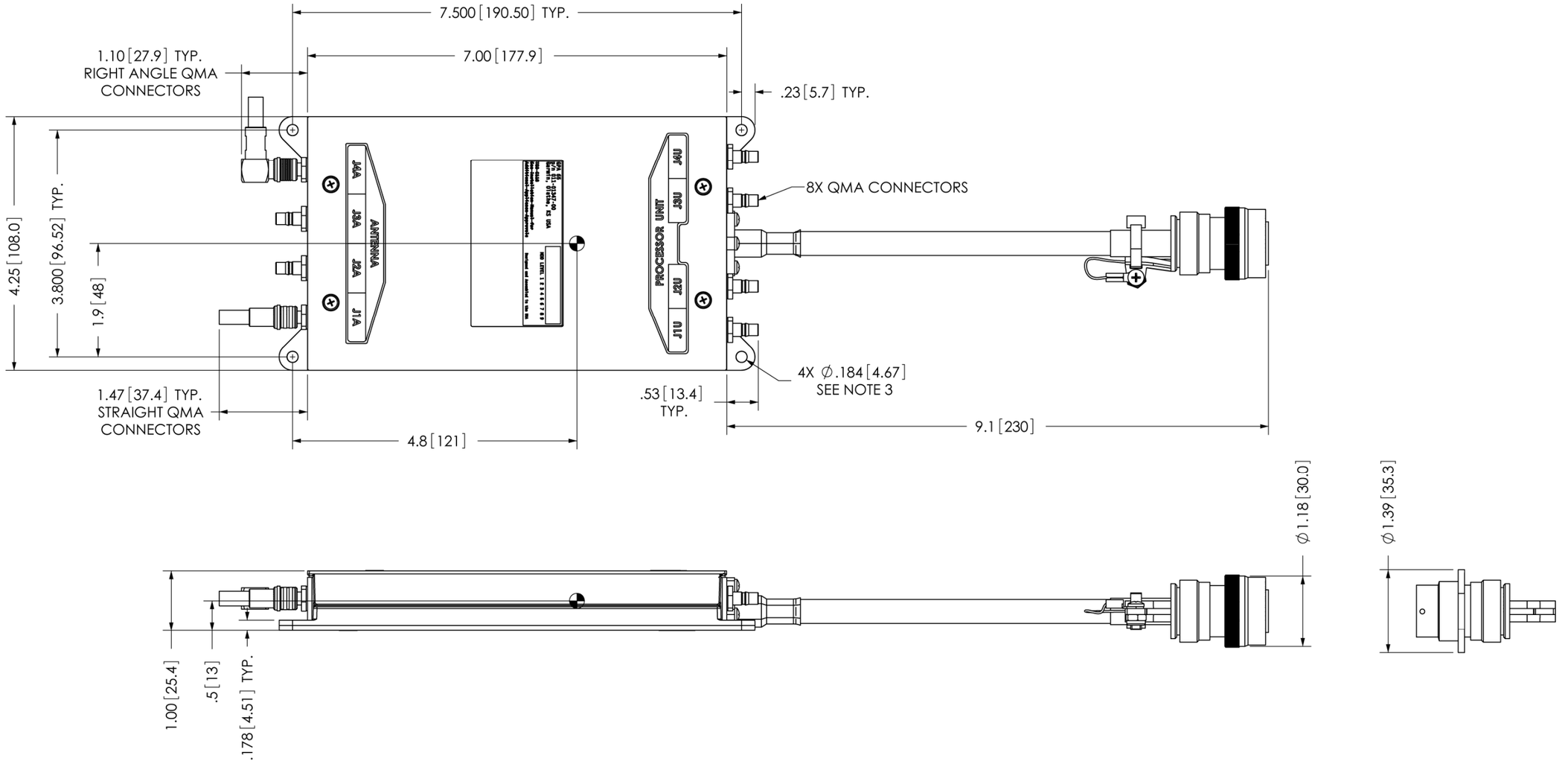


Figure A-4. GTS 8XX Horizontal Installation Drawing



NOTES:
1. DIMENSIONS: INCHES [mm].
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. MOUNTING HOLES FOR #8 PAN HEAD OR HEX HEAD FASTENERS.

Figure A-5. GPA 65 Outline Drawing

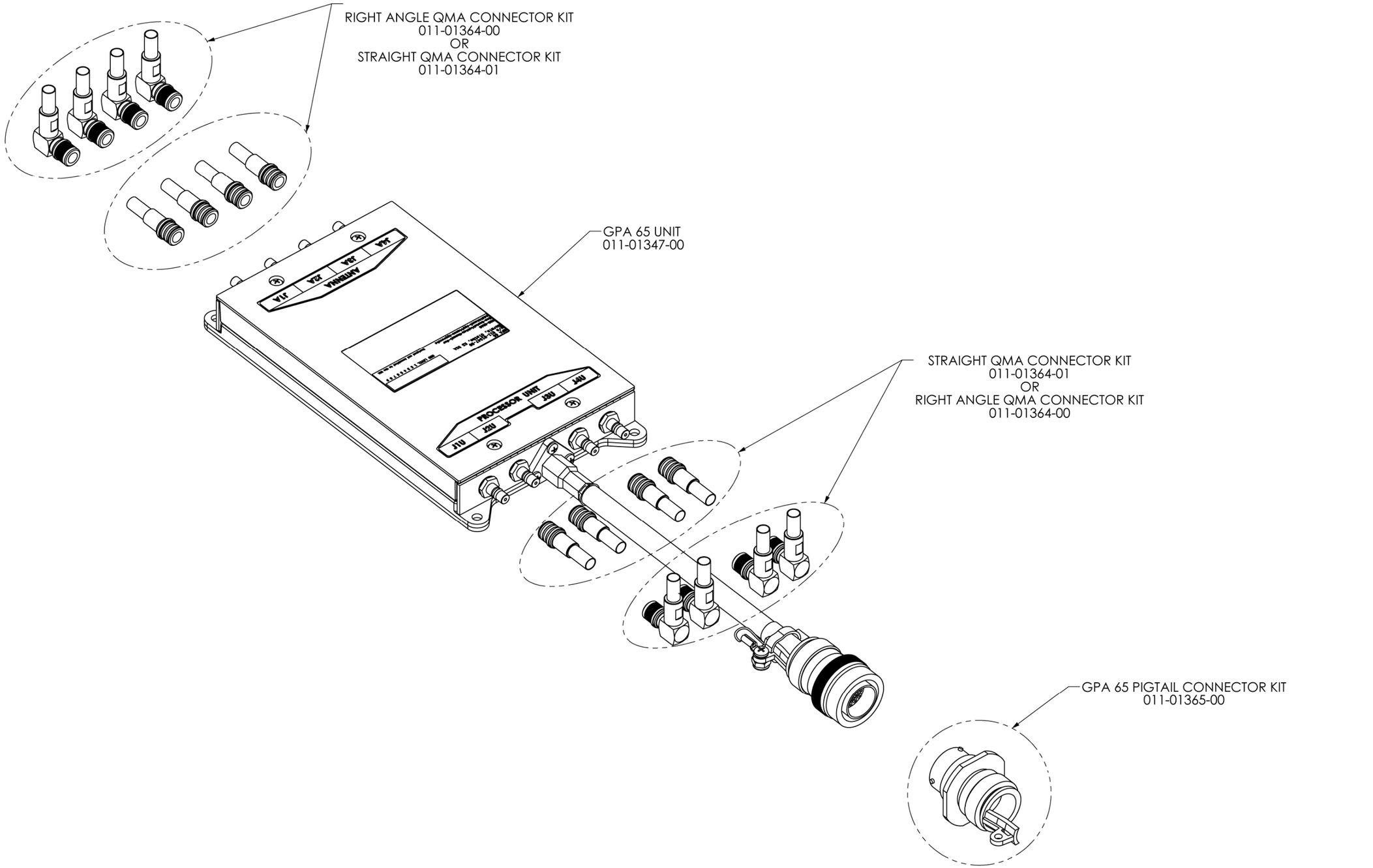
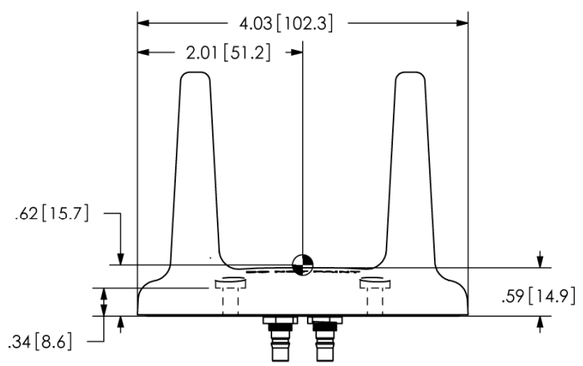
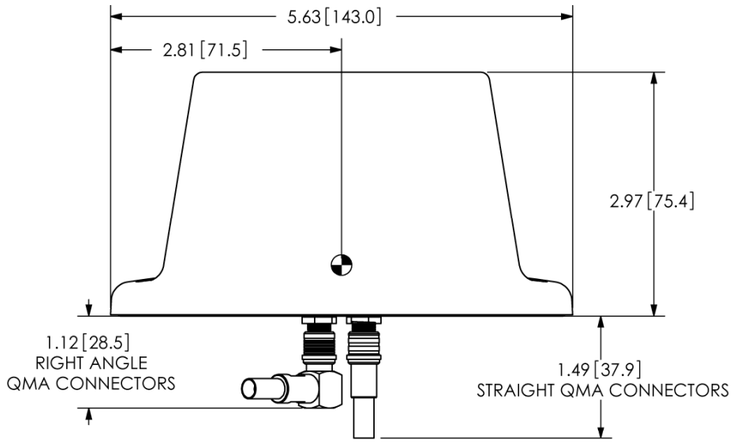
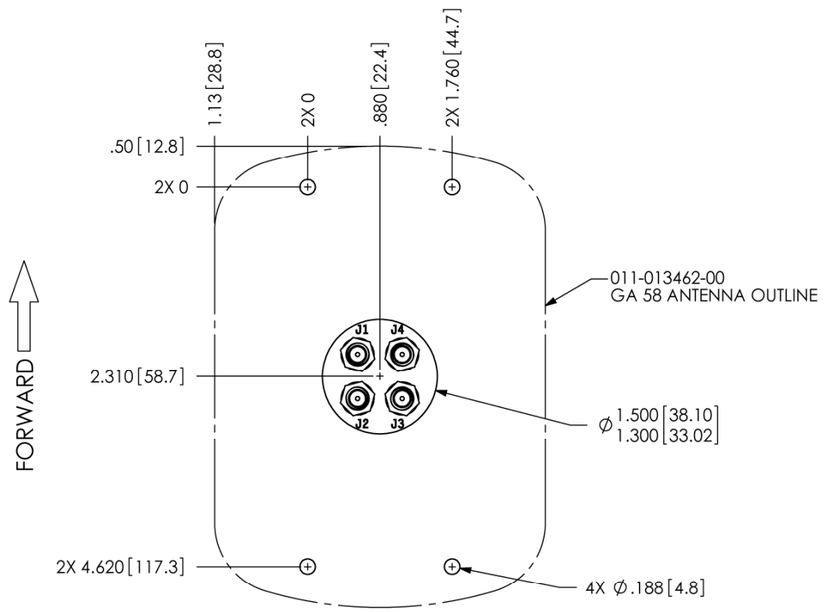


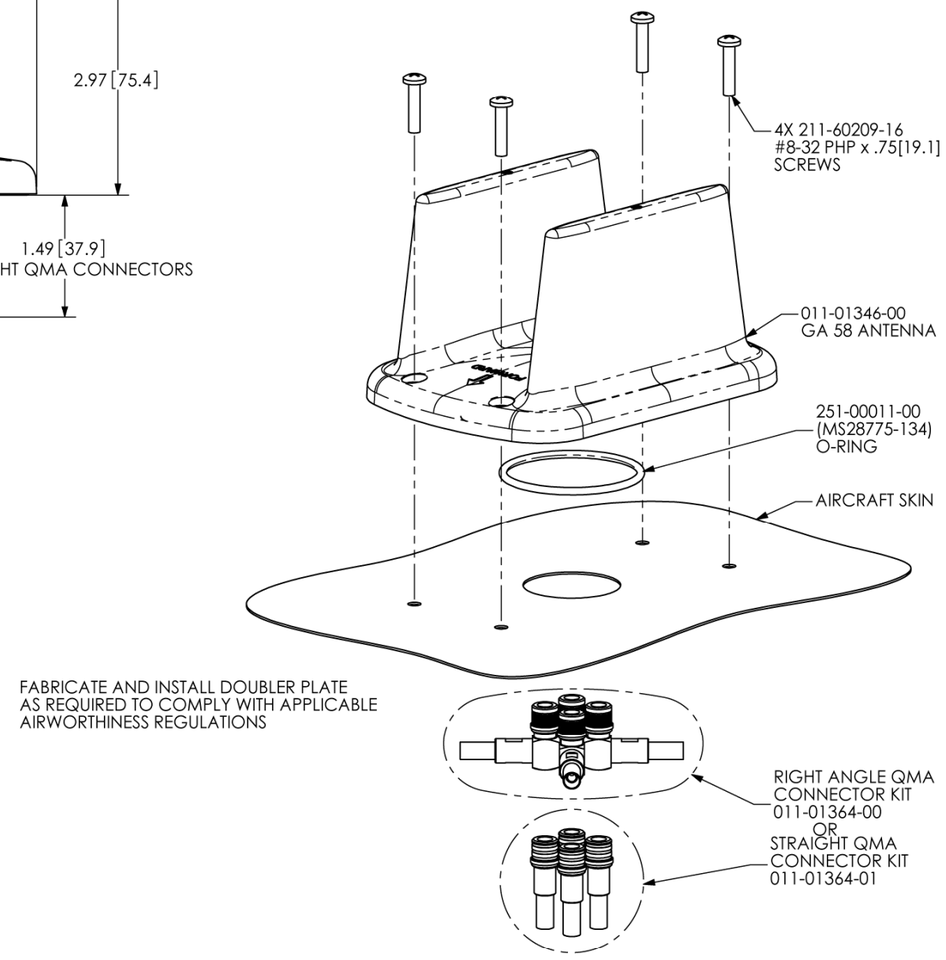
Figure A-6. GPA 65 Installation Drawing







MOUNTING CUTOUT
TOLERANCES: INCH mm
.XXX ±0.010 .XX ±0.25

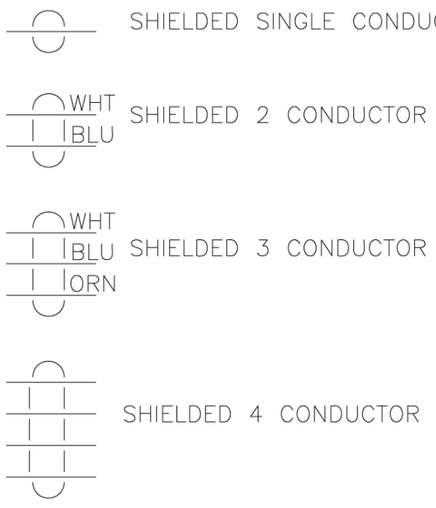


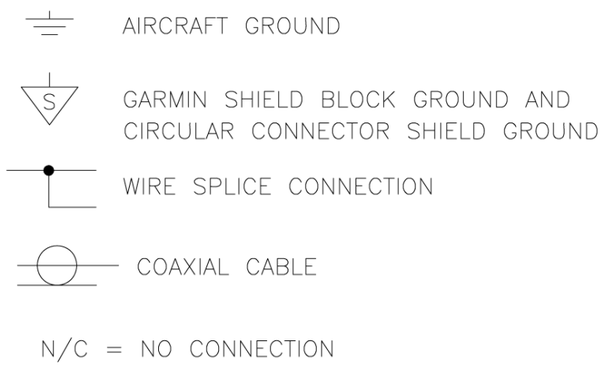
NOTES:
1. DIMENSIONS: INCHES[mm].
2. ANTENNA OUTLINE DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.

Figure A-7. GA 58 Antenna Outline Drawing

NOTES:

1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-22759/16 OR EQUIVALENT
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27500 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL WIRES ARE 24 GAUGE MINIMUM.
4. SYMBOL DESIGNATIONS





5. UNLESS OTHERWISE NOTED, ALL SHIELD GROUNDS MUST BE MADE TO THE RESPECTIVE CONNECTOR BACKSHELLS. ALL OTHER GROUNDS SHOULD BE TERMINATED TO AIRCRAFT GROUND AS CLOSE TO THE RESPECTIVE UNIT AS POSSIBLE.
6. CONFIGURE SQUAT 'ON GROUND' SENSE AS GROUND IF NO SENSE SWITCH IS INSTALLED. LEAVE AIR/GROUND* DISCRETE OPEN.
7. CONFIGURATION OF GEAR/WHEEL AS FIXED WILL CAUSE SYSTEM TO IGNORE THE GEAR DOWN AND LOCKED* DISCRETE INPUT.

Figure B-1. Notes

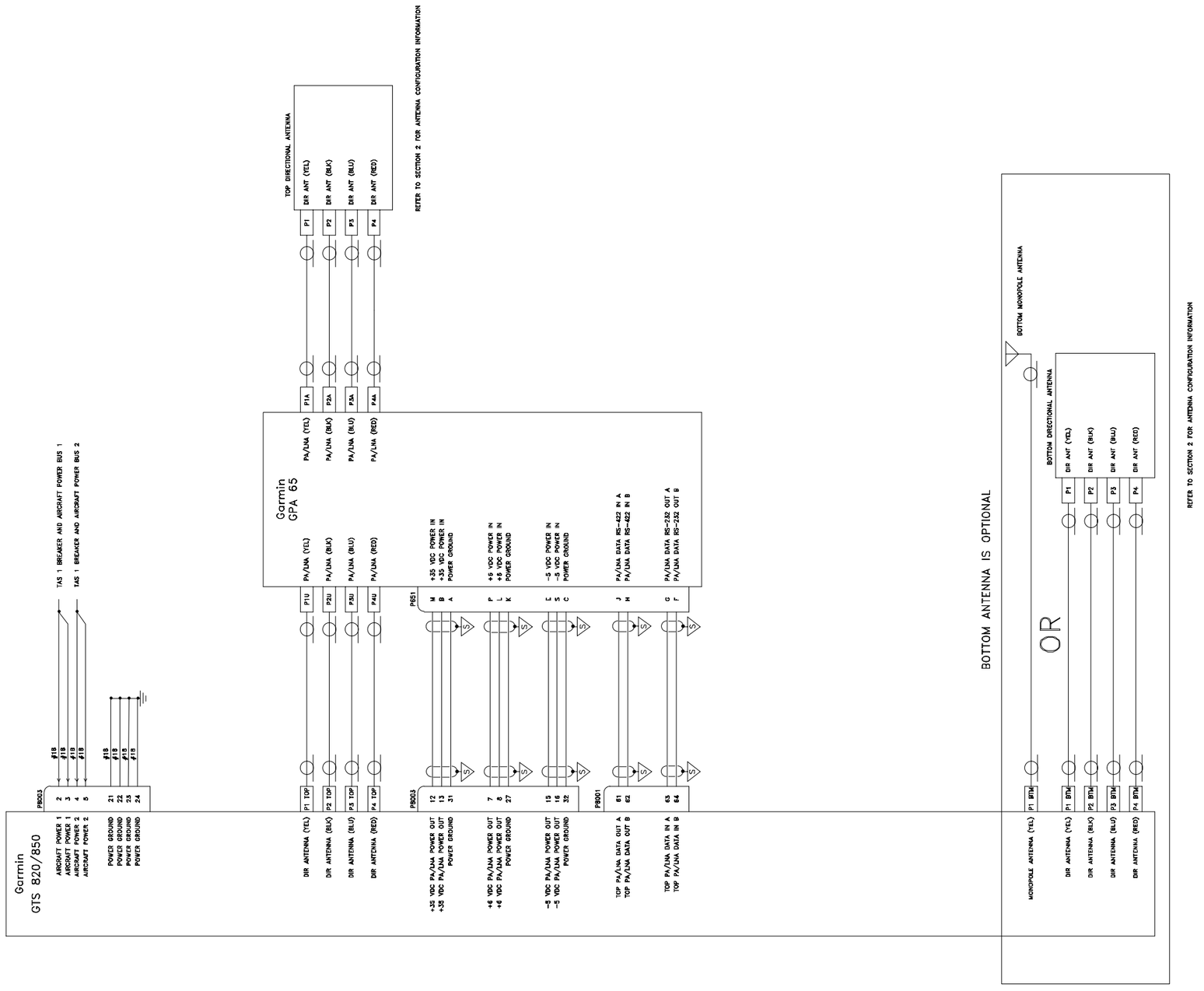


Figure B-2. GTS 820/850/GPA 65 Example Interconnect

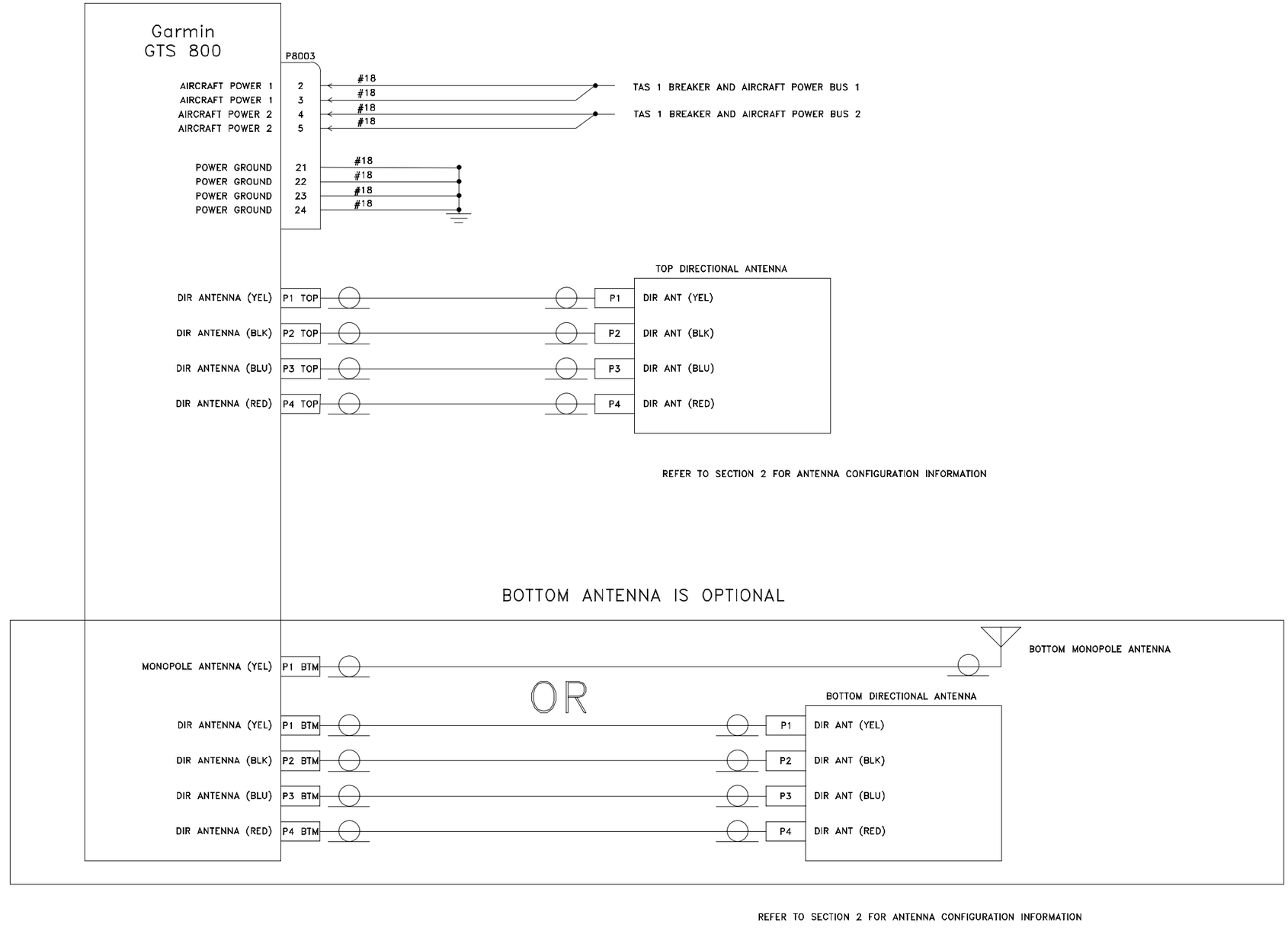


Figure B-3. GTS 800 Example Interconnect

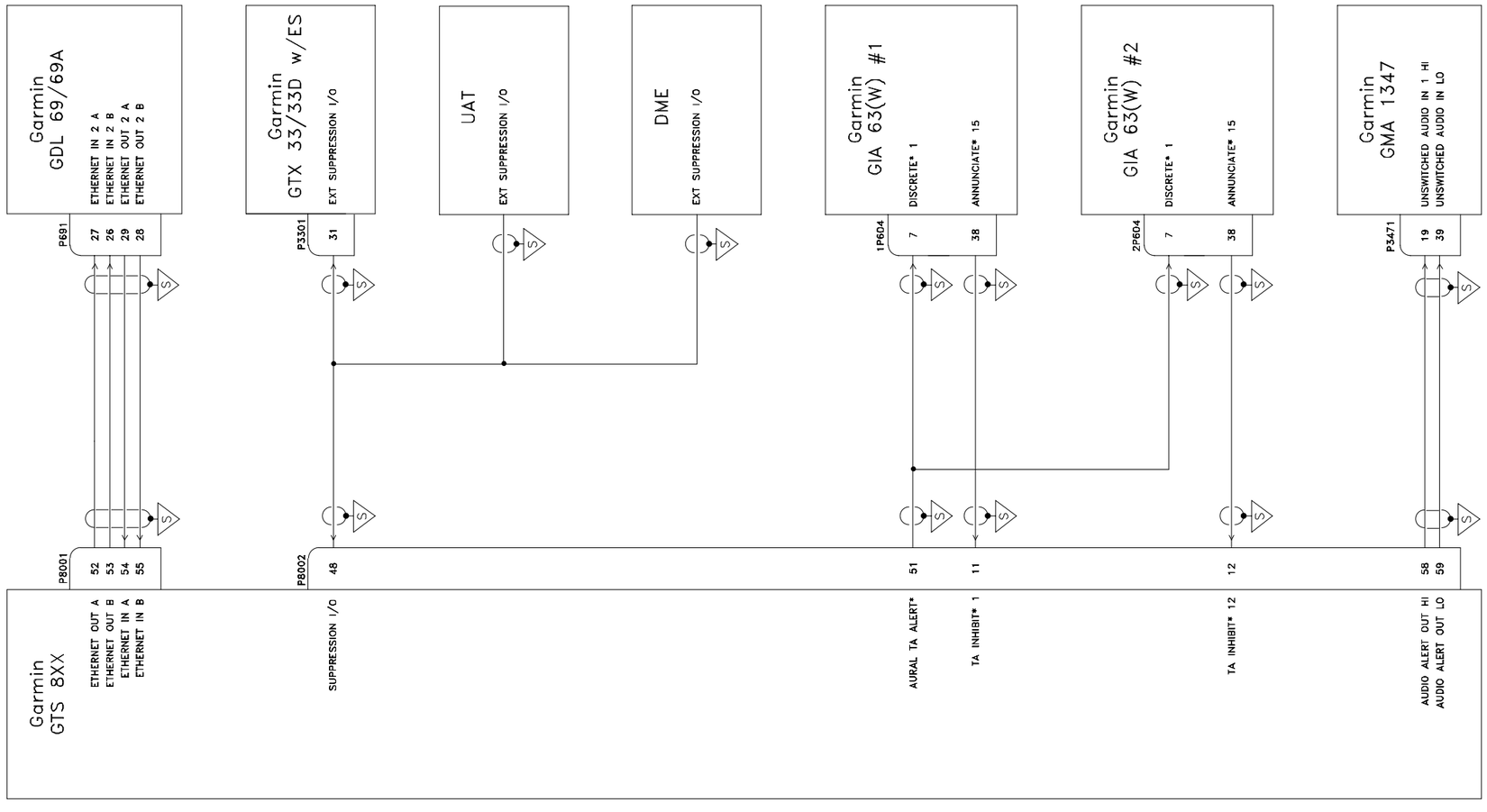
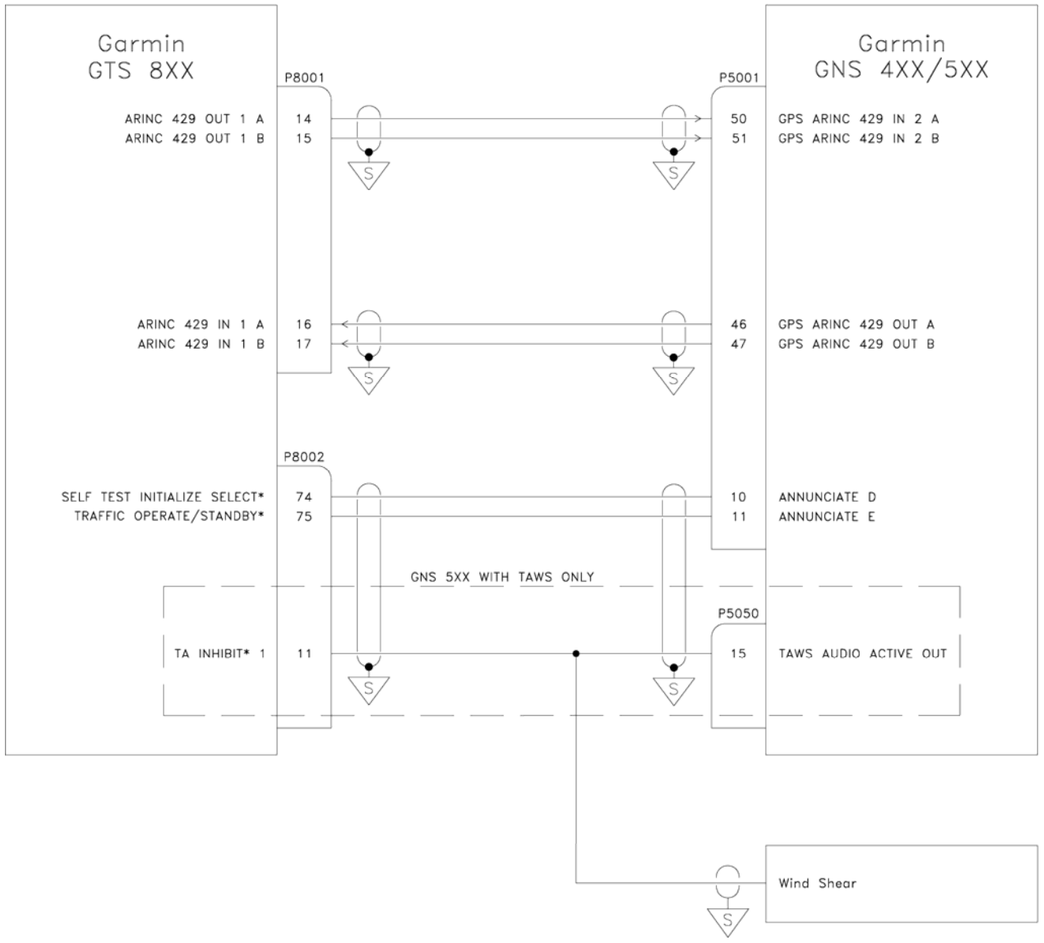


Figure B-4. GTS 8XX G1000 Example Interconnect



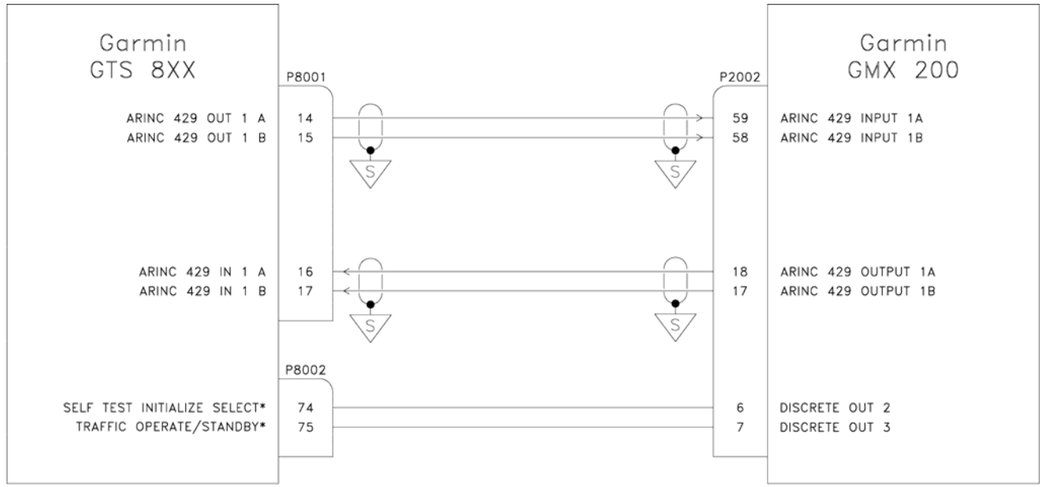


Figure B-5. GTS 8XX GNS 4XX/GNS 5XX/GMX 200 Example Interconnect

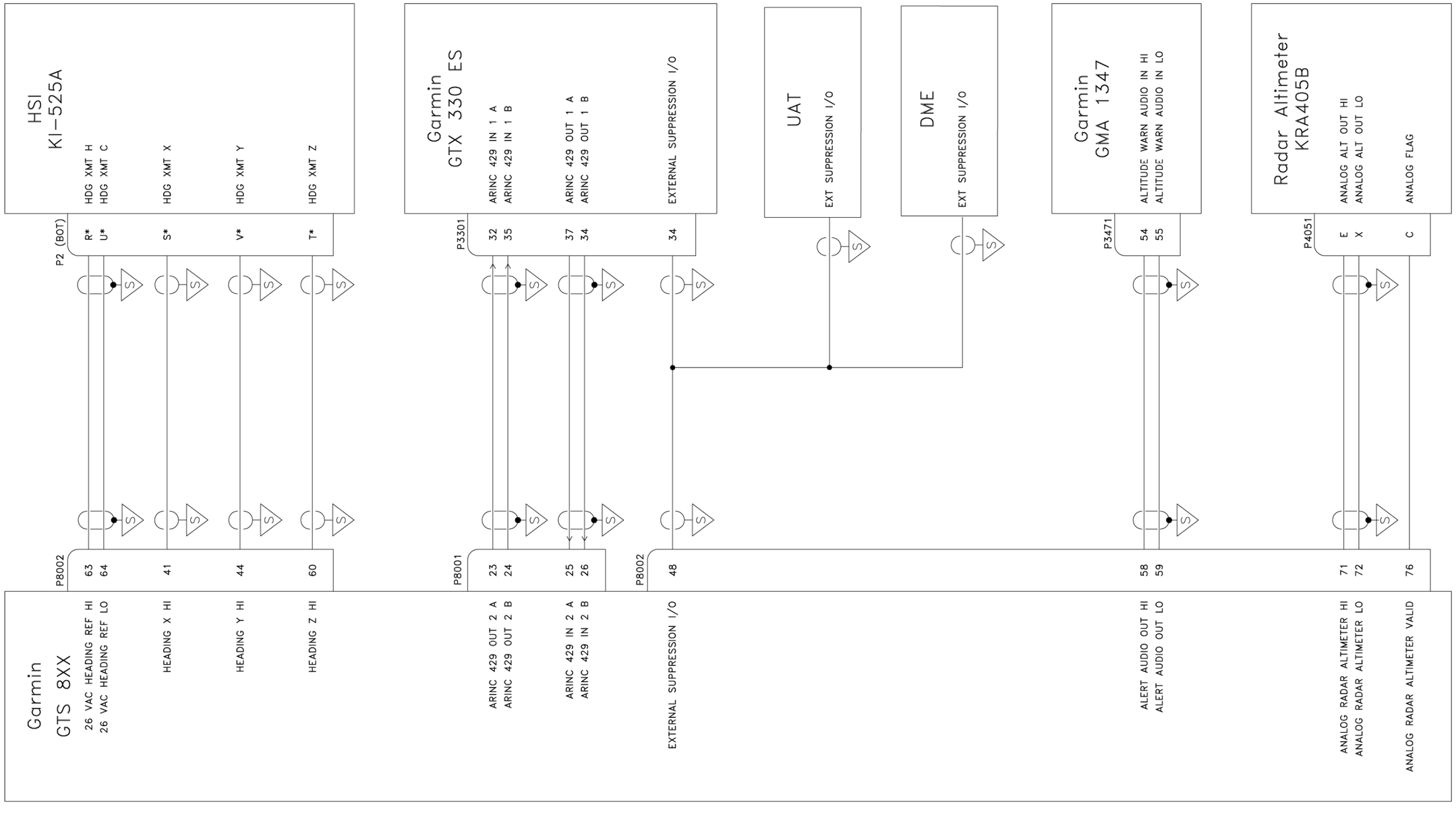


Figure B-6. GTS 8XX/GMA/HSI/Altimeter Example Interconnect

NOTE: USB TYPE B RECEPTACLE PIGTAIL MUST BE WIRED DIRECTLY TO P8001 TO MINIMIZE LIGHTNING EXPOSURE. USB EXTENSION CABLES SHOULD BE DISCONNECTED FROM THE PIGTAIL WHILE FLYING.

Figure B-7. GTS 8XX Dongle Cable (Non-G1000 Installations Only)

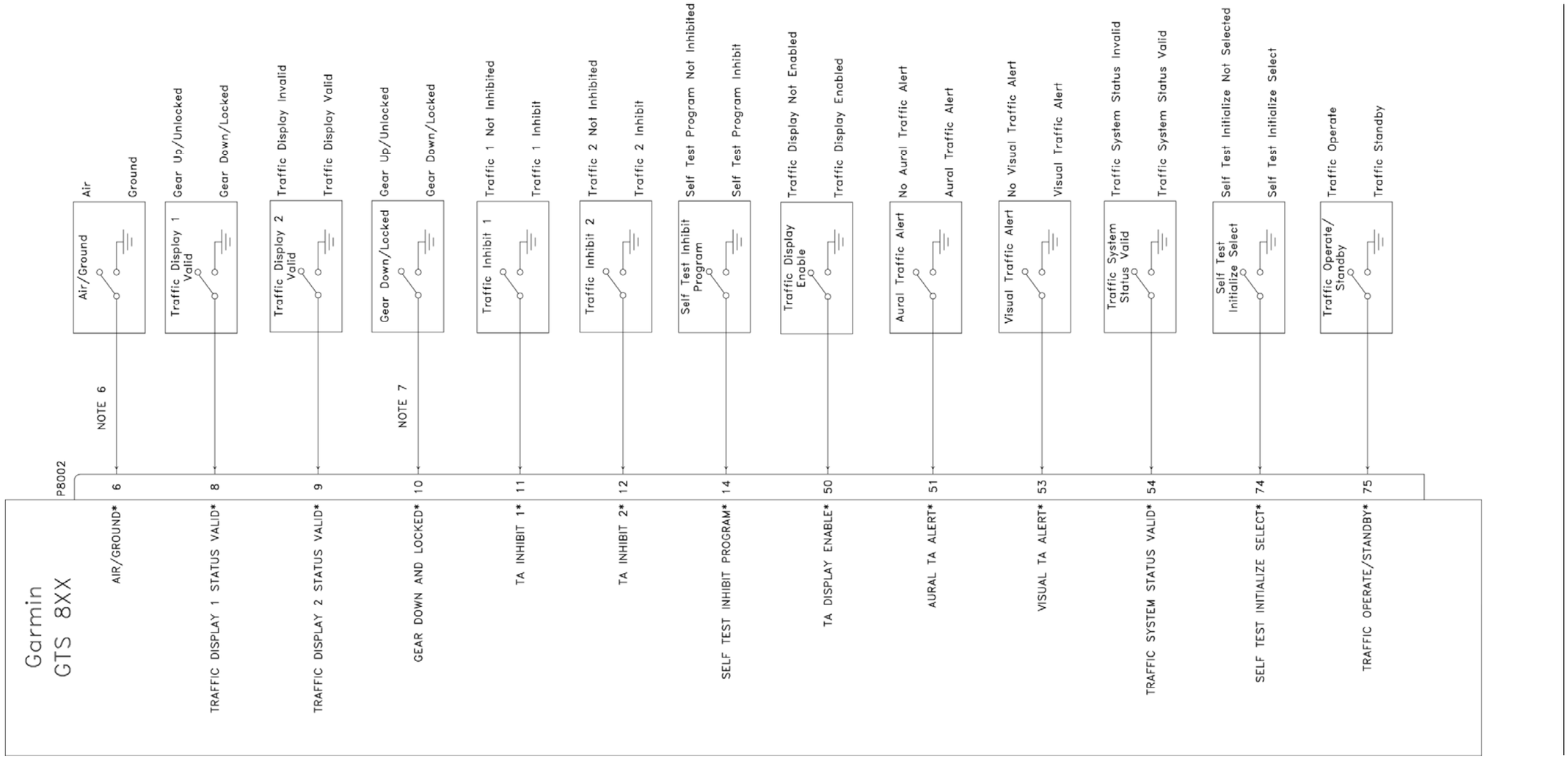


Figure B-8. GTS 8XX Discrete Interconnects

The Configuration Module is only applicable for retrofit installtions

Figure B-9. GTS 8XX Config Module Example Interconnect