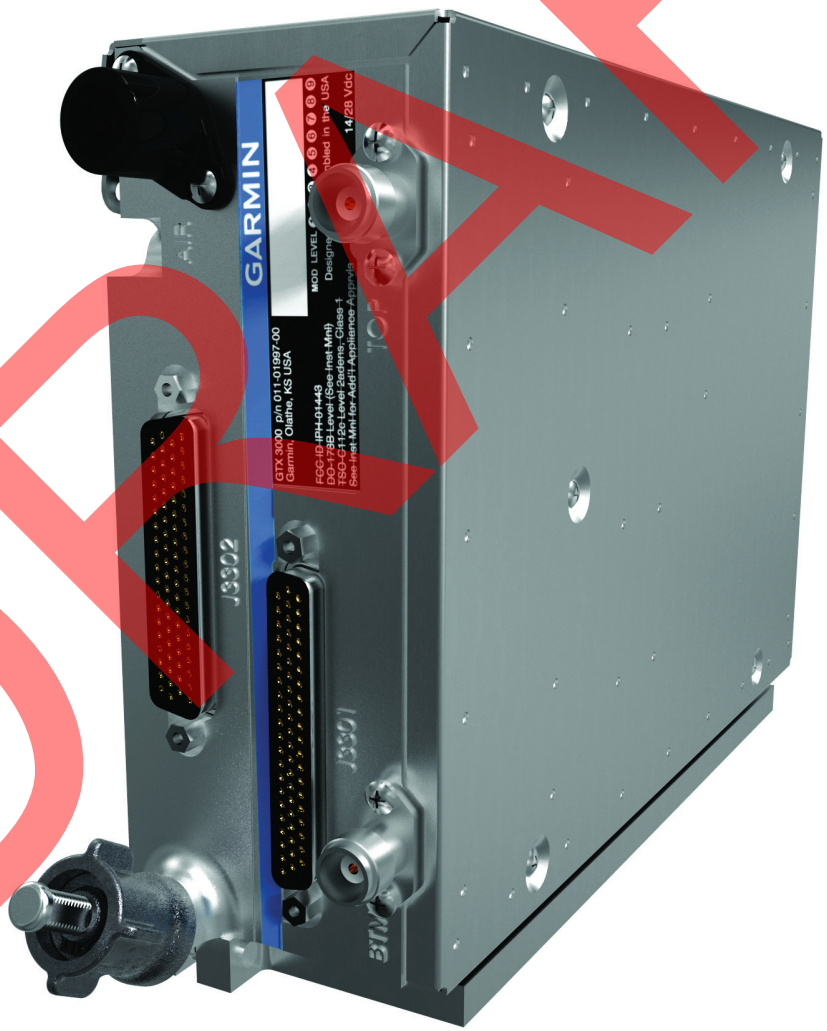
GARMIN

GTX 3000

Transponder Installation Manual



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1 GENERAL DESCRIPTION

1.1 Introduction

This manual provides mechanical and electrical information for installing a GTX3000 as part of a Garmin Integrated Flight Deck.

1.2 Equipment Description

The Garmin GTX 3000 is a remote-mount Mode S and ADS-B compliant transponder suitable for installation in part 25 jets and any class of part 23 aircraft. It implements ARINC, UF16 and DF16, and BDS(3,0) support for TCAS II operation. The unit has high transmit power sufficient to accommodate longer (lossier) antenna cable runs in larger aircraft while still meeting TSO requirements for transmit power. It is also designed and certified to meet DO-160 categories suitable for installation outside the pressure vessel and in aircraft where safety expectations high. The GTX 3000 is designed to be controlled from other Garmin avionics such as a GDU or GTC. These avionics will also typically provide (over the same connection) fundamental data the transponder needs such as pressure altitude.

The Garmin GTX 3000 is a Mode A, C, and S transponder. It is certified under TSO-C112c and ETSO-C112c. The Mode S minimum operating performance specifications for these TSOs ("MOPS," which are RTCA DO-181D and EUROCAE ED-73C respectively) define a labeling convention that identifies the primary characteristics of a transponder. The GTX 3000's label is "level 2adens, Class 2".

This label identifies that the GTX3000 supports:

- Basic data link support (level 2)
- TCAS compatibility (the "a" in "adens")
- Antenna diversity operation (the "d" in "adens")
- Extended squitter (the "e" in "adens")
- Enhanced surveillance (including elementary surveillance) (the "n" in "adens")
- Surveillance identifier codes (the "s" in "adens")
- Higher minimum transmit power and reply rate (Class 1)

Basic data link support: The "level" (e.g. level 2) of the transponder is an indication of what degree of data link support the transponder has. Level 1 indicates no support. Level 5 indicates support for sending and receiving extended length messages to multiple interrogators at the same time. The GTX3000 is a level 2 transponder in order to support elementary and enhanced surveillance as well as TCAS-II communication. It is not a level 3, 4, or 5 transponder because there are not common applications that use the extended length messaging these levels support.

TCAS compatibility: The GTX 3000's TCAS compatibility consists of an ARINC 429 interface based on the ARINC 735B specification. It is designed to be connected to a Garmin TCAS, and its primary purpose is to provide resolution advisory coordination with other TCAS-II aircraft.

Antenna diversity: The GTX 3000 implements antenna diversity because it improves air-to-air surveillance and communication, and it is required for TCAS-II operation. The Mode S MOPS also recommends diversity for aircraft "with gross mass in ecess of 5,700 kg or a maximum cruising true airspeed capability in excess of 324 km/h (175 kt)."

Extended squitter relates to ADS-B, which is discussed in the following paragraphs.

Elementary and enhanced surveillance use the Mode S data link to provide ATC information regarding aircraft identification, TCAS information, vertical intention, track and turn, and heading and speed. This information may be displayed on an air traffic controller's radar display or it may be used in ground system processing for functions such as detection of level bust or early recognition of aircraft maneuvers. Ultimately this information is made available to improve safety and capacity. Flight in Europe has mandates for elementary surveillance on most aircraft and enhanced surveillance on some aircraft.

Surveillance identifier (SI) codes are a set of 64 IDs that uniquely identify ground radars within a Mode S coverage area. SI codes were a later expansion upon the original 16 ID "interrogator codes" that allows a reduction in ground station infrastructure complexity. These 16+64 ID codes allow transponders to communicate with select ground stations when the transponder is within range of multiple ground stations. Flight in Europe mandates a transponder support SI codes.

Class 1: The Mode S MOPS defines two classes of Mode S transponders: class1 and class 2. Class 1 equipment has higher minimum transmit power and reply rates than class 2 equipment. The MOPS explains that class 2 equipment is intended to be restricted to aircraft that operate below 15,000 feet altitude and have a maximum cruising true airspeed below 175 kt. Class 1 transponders are for aircraft that operate above those speed and altitude boundaries.

ADS-B transmit is the GTX3000's other primary function. The unit is certified to TSO-C166b and ETSO-C166a. It is certified to meet the DO-260B MOPS. The unit is a class B1 device per RTCA DO-260B. This indicates the GTX3000 is transmit-only device for aircraft (vs ground vehicles or fixed objects) with a minimum of 125 watts peak pulse power and supporting the following messages:

- Airborne Position
- Surface Position
- A/C Identification & Category
- Airborne Velocity
- A/C Operational Status
- Extended Squitter A/C Status.

1.3 Interface Summary

The GTX 3000 provides the following interface connections via the rear connector. See Section 4 and Appendix C for connection details.

- Diversity Antenna Ports
- Two bidirectional RS-232 and one bidirectional RS-422 serial connections for data and control
- Eight ARINC 429 inputs and four ARINC 429 outputs supporting various ARINC protocols to maximize options for connectivity and allow redundancy
- Ten (10) encoding altimeter inputs
- External IDENT input
- External suppression pulse input/output
- Switched power output of up to 1.5 amps (for powering an encoding altimeter)
- Remote power turn on

1.4 Technical Specifications

1.4.1 General Specifications

Table 1-1 General Specifications

Characteristic	Specification
Environmental Qualification Form	0050-00503-01
FCC Authorization	Emission Designator 12M0M1D
Antenna Compatibility	Compatible with any antenna certified to one of the following TSOs: TSO-C66() [DME TSO] TSO-C74() [ATCRBS TSO] TSO-C112() [Mode S TSO]
Antenna Cable Requirements	Cable + bulkhead connector loss @1090 MHz < 3.0 dB
Transmitter Power	250 Watts minimum, 500 Watts nominal
Transmitter Frequency	1090 MHz ±1 MHz
Receiver Frequency	1030 MHz
Receiver Sensitivity	-74 dBm nominal for 90% replies
External Suppression Input	Low ≤ 1.0 V; High ≥ 9 V
External Suppression Output	Minimum is greater than +8V into 350 Ω in parallel w/ 1800 pF Maximum is less than +36V into any load

Note:

1. Each unit's external suppression is tested to the specifications above. The design based on the specifications in ARINC 718A Attachment 6 and ARINC 735A Attachment 8.

1.4.2 Transponder Capabilities

Table 1-2 Transponder Capabilities

Characteristic	Specification
Mode A Capability	4096 Identification Codes
Mode C Capability	100 Foot Increments from -1000 to 62,700 feet. 25 Foot Increments from -1000 to 50, 175 feet with suitable serial data altitude.
Mode S Uplink Capability	UF0, UF4, UF5, UF11, UF16, UF20, UF21
Mode S Downlink Capability	DF0, DF4, DF5, DF11, DF16, DF17, DF20, DF21
Data link capability	Level 2, Comm-A, Comm-B, Comm-U, Comm-V
TCAS II support	Yes
Diversity	Yes
Extended squitter	Yes, see note 1
Elementary surveillance	Yes, see note 2
Enhanced surveillance	Yes, see note 2
SI code support	Yes
(E)TSO-C112c class	Class 1

Note 1: The GTX 3000 does not source the data for extended squitter / ADS-B messages. The GTX 3000 must receive this data from other equipment in order to provide extended squitter / ADS-B functionality. Also, ADS-B must be configured on.

Note 2: Compliance with elementary and enhanced surveillance is shown at the installation-level per AMC 20-18 and AMC20-13. The GTX 3000 implements the technical requirements necessary of a transponder that AMC 20-18 and AMC 20-13 require, but installation of a GTX 3000 does not constitute compliance with elementary and enhanced surveillance. Also, in order for the GTX 3000 to meet the technical requirements of AMC 20-13 for enhanced surveillance, the GTX 3000 must have enhanced surveillance configured on and it must receive data to populate the relevant BDS registers.

BDS Register Support

The following Binary Data Selector (BDS) registers are supported.

General Mode S Registers:

- BDS (0,0) Air Initiated Comm-B (AICB)
- BDS (1,0) Data Link Capability Report
- BDS (1,7) Common Usage Ground Initiated Comm-B (GICB) Capability Report
- BDS (1,8) Mode S Specific Services GICB Capability Report
- BDS (1,9) Mode S Specific Services GICB Capability Report
- BDS (1,C) Mode S Specific Services Protocols (MSP) Capability Report

Elementary Surveillance Registers

- BDS (2,0) Aircraft Identification
- BDS (2,1) Aircraft and Airline Registration Markings
- BDS (2,5) Aircraft Type
- BDS (3,0) TCAS/ACAS Active Resolution Advisory

Enhanced Surveillance Registers

- BDS (4,0) Selected Vertical Intention
- BDS (5,0) Track and Turn Report
- BDS (6,0) Heading and Speed Report

Extended Squitter/ADS-B Registers

- BDS (0,5) Airborne Position Message
- BDS (0,6) Surface Position Message
- BDS (0,7) Extended Squitter Status
- BDS (0,8) Aircraft Identification and Category Message
- BDS (0,9) Airborne Velocity Message – Subtypes 1, 2, 3, and 4
- BDS (0,A) Event Driven Data
- BDS (6,1) Aircraft Status Message – Subtypes 1 and 2
- BDS (6,5) Aircraft Operational Status – Subtypes 1 and 2

The GTX3000 sources data for:

- Air-initiated Comm B (BDS(0,0))
- Most bits in the capability reports (BDS(1,x))
- Aircraft identification registers (BDS(2,x))

The GTX3000 does **not** source data for registers relating to:

- TCAS functionality (BDS(3,0) and capability bits in BDS(1,0))
- Enhanced surveillance (BDS(4,0), BDS(5,0), and BDS(6,0))
- Extended squitter / ADS-B (BDS(0,5) through BDS(0,A) and BDS(6,1) and BDS(6,5))

Data for these registers must be obtained through a RS-232, RS-422, or ARINC interface.

1.4.3 ADS-B Capabilities

The GTX 3000 is certified to meet the version 2 ADS-B requirements of TSO-C166b / ETSO-C166a and the RTCA DO-260B MOPS. The MOPS classifies it as a class B1 device. The GTX 3000 is capable of broadcasting the following ADS-B messages:

- BDS (0,5) Airborne Position Message
- BDS (0,6) Surface Position Message
- BDS (0,7) Extended Squitter Status
- BDS (0,8) Aircraft Identification and Category Message
- BDS (0,9) Airborne Velocity Message – Subtypes 1, 2, 3, and 4
- BDS (0,A) Event Driven Data
- BDS (6,1) Aircraft Status Message – Subtypes 1 and 2
- BDS (6,5) Aircraft Operational Status – Subtypes 1 and 2

The GTX 3000 does not source the data for ADS-B messages. It must receive this data from its RS-232, RS-422, or ARINC inputs. Units in a Garmin Integrated Flight Deck such as the G5000 will typically provide this data to the GTX 3000.

In order to transmit these messages, the GTX 3000 must have ADS-B enabled in its configuration.

1.4.4 Physical Characteristics

Table 1-3 GTX 3000 with 011-02515-00 Rack

Characteristic	Specification
Width, Unit in Rack	2.58 inches (65.4 mm)
Height, Unit in Rack	6.47 inches (164.2 mm)
Depth (rack w/connectors)	10.94 inches (278 mm)
Weight, Unit only	5.2 lbs (2.36 kg)
Connecter (including backshell) and Rack Weight	0.7 lbs (0.32 kg)
Installed Weight (unit, rack, and connectors)	5.9 lbs (2.68 kg)

1.4.5 Power Requirements

Table 1-4 Power Requirements

Characteristic	Specification
Input Voltage	14/28 Vdc See the Environmental Qualification Form for details on surge ratings and minimum/maximum operating voltages.
Power Input	22 Watts Typical, 45 Watts Maximum
Maximum Full TSO Reply Rate; 1200 PRF, Code 7777	1.6 A @ 28 Vdc, 3.6 A @14 Vdc
Maximum Quiescent	0.85 A @ 28 Vdc, 1.7A @ 14 Vdc

1.5 License Requirements

The Telecommunications Act of 1996, effective February 8, 1996, provides the FCC discretion to eliminate radio station license requirements for aircraft and ships. The GTX 3000 installation must comply with current transmitter licensing requirements. To find out the specific details on whether a particular installation is exempt from licensing, please visit the FCC web site http://wireless.fcc.gov/aviation.

If an aircraft license is required, make application for a license on FCC form 404, Application for Aircraft Radio Station License. The FCC also has a fax-on-demand service to provide forms by fax. The GTX 3000 owner accepts all responsibility for obtaining the proper licensing before using the GTX 3000.

CAUTION

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

1.6 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.

1.6.1 TSO/ETSO/RTCA/ICAO Compliance

Table 1-5 TSO/ETSO/RTCA/ICAO Compliance

Function	Performance Standard (TSO/ETSO/RTCA/ EUROCAE)	Category	Applicable LRU SW Part Numbers	CLD Part Numbers
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/MODE S) Airborne Equipment	TSO-C112c	Level 2adens Class 2	All 006-B0912-00	All 006-C0129-00
	ETSO-2C112c			
Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B) on the Radio Frequency of 1090 MHz	TSO-C166b	B1 (diversity)		
	ETSO-C166a			
RTCA DO-178B Compliance	DO-178B	Level B		
RTCA DO-254 Compliance	DO-254	Level B		

1.6.2 TSO/ETSO Deviations

Table 1-6 TSO/ETSO Deviations

TSO/ETSO	Deviation
TSO-C112c	Garmin was granted a deviation from RTCA DO-181D §2.2.22.h to not interface with FAA TSO-C119a TCAS units.
TSO-C112c	Garmin was granted a deviation from RTCA DO-181D §2.2.23.1.3a to use the newer specifications in RTCA DO-260B §2.2.3.3.2.12.
ETSO-C112c	Garmin was granted a deviation from ED-73C section 3.28.3.4 to use the newer specification in RTCA DO-260B section 2.2.3.3.2.12 instead.
ETSO-C166a	Garmin was granted a deviation from to use RTCA DO-260B as the minimum operating performance standard instead of the older RTCA DO-260A.
ETSO-C166a	Garmin was granted a deviation from ETSO-C166a section 4.2 to not mark the unit with the class information.

1.7 Reference Documents

The following publications are sources of additional information for installing the GTX 3000. Before installing the unit, the technician should read all relevant referenced materials along with this manual.

Table 1-7 Reference Documents

Part Number	Document
190-00303-00	G1000 System Installation Manual
190-00303-04	G1000 Line Maintenance and Configuration Manual

1.8 Aviation Limited Warranty

All Garmin avionics products are warranted to be free from defects in materials or workmanship for: one years from the date of purchase for new Remote-Mount and Panel-Mount products; one year from the date of purchase for new portable products and any purchased newly-overhauled products; six months for newly-overhauled products exchanged through a Garmin Authorized Service Center; and 90 days for factory repaired or newly-overhauled products exchanged at Garmin in lieu of repair. Within the applicable period, Garmin will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Garmin; or (v) damage to a product that has been modified or altered without the written permission of Garmin. In addition, Garmin reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

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2 INSTALLATION OVERVIEW

2.1 Introduction

This section provides hardware equipment information for installing the GTX 3000 Mode S transponder, related hardware, and optional accessories. Installation of the GTX 3000 should follow the data detailed in this manual. Cabling is fabricated by the installing agency to fit each particular aircraft. The guidance of FAA advisory circulars AC 43.13-1B and AC 43.13-2B, where applicable, may be found useful for making retro-fit installations that comply with FAA regulations.

Refer to the G1000 System Installation Manual, Garmin part number 190-00303-00 for further details on the mechanical aspects of the G1000 system rack. For installation in an aircraft using the remote mounted stand-alone rack refer to Appendix B for rack drawings and dimensions.

2.2 Installation Materials

The GTX 3000 is available as a single unit under the following part numbers:

Table 2-1 Installation Materials

Item	Catalog Part Number
GTX 3000 Unit Only (011-01997-00)	010-00736-00
GTX 3000 Standard (011-01997-00), includes connector kit	010-00736-01

2.2.1 Equipment Available

Each of the following accessories is provided separately for the GTX 3000 unit. Either rack and the remainder of the accessories are required for installation.

Table 2-2 Available Equipment

Item	Garmin Number
Configuration Module, w/EEPROM, Jackscrew	011-00979-20
GTX 3000 Rack	011-02515-00
Connector Kit, GTX 3000	011-02019-00
Connector Kit 90 Degree, GTX 3000	011-02019-01
Garmin Transponder Antenna kit* ???????? (two required for diversity)	010-10160-00

*Note: A transponder antenna approved to TSO C66( ) or C74( ) that has been installed to meet the requirements of this manual may be used with the GTX 3000.

Table 2-3 Connector Kit (011-02019-00)

Item	Garmin Part Number	Quantity
Backshell w/hardware, Jackscrew, 37/62 pin	011-01855-03	1
Backshell w/hardware, Jackscrew, 50/78 pin	011-01855-04	1
Teflon heat shrink tubing, .093 ID	312-00005-05	6 (cm)
High density D-Sub connector, male 62 pin	330-00776-62	1
High density D-Sub connector, male 78 pin	330-00776-78	1
Crimp Contact Pin 22D	336-00021-00	20
Crimp Contact Pin 22D, 18 & 20 AWG	336-00044-00	7

Table 2-4 Connector Kit, 90 Degree (011-02019-01)

Item	Garmin Part Number	Quantity
Backshell w/hardware, 90 Degree Jackscrew, 37/62 pin	011-01959-03	1
Backshell w/hardware, 90 Degree Jackscrew, 50/78 pin	011-01959-04	1
Teflon heat shrink tubing, .093 ID	312-00005-05	6 (cm)
High density D-Sub connector, male 62 pin	330-00776-62	1
High density D-Sub connector, male 78 pin	330-00776-78	1
Crimp Contact Pin 22D	336-00021-00	20
Crimp Contact Pin 22D, 18 & 20 AWG	336-00044-00	7

2.2.2 Additional Equipment Required

The following installation accessories are required but not provided:

- Cables – The installer will supply all system cables including circuit breakers. Cable requirements and fabrication is detailed in Section 3 of this manual.
- Hardware – #6-32 x 100° Flathead SS Screw [(MS24693, AN507R or other approved fastener) (4 ea.)] for horizontal mounting of the remote stand-alone rack.
- Hardware – #8-32 Panhead Machine Screw [(MS35206, AN526 or other approved fastener) (4 ea.)] for vertical mounting of the remote stand-alone rack.
- Encoding altitude Digitizer – For GNS 480 (CNX80) and GMX 200 (MX20) installation. Use encoding altimeter manufacturer's instructions. The Garmin GAE 43 (Garmin P/N 013-00066-00) can provide altitude data in either serial or parallel gray code format.

2.3 Installation Considerations

In a Garmin Integrated Flight Deck, the GTX 3000 interfaces with both GIA units. Optional available discrete line interfaces are shown in Section 4.5 Discrete Functions.

In other system installations, the GTX 3000 can interface with equipment including altimeters and Air Data Computers (ADC). RS-232, RS-422, and ARINC 429 provide a serial communication path between interfacing equipment. Fabrication of a wiring harness is required..

2.3.1 Preservation of Previous Systems

It is the installer's responsibility to preserve the essential characteristic of the aircraft being modified with this equipment to be in accordance with the aircraft manufacturer's original design. This includes the preservation of multiple power buses, which reduces the probability of interrupting power to essential instruments and avionics.

2.3.2 Antenna Location Considerations

Antenna mounting should utilize the aircraft manufacturer's Type Certificated antenna location and style of antenna. If a second (diversity) antenna is installed in the aircraft, considerations for its mounting should be made as outlined in Figure 2-1. The antenna installation should be installed in accordance with AC 43.12-2A Chapter 3. Note that penetration of the pressure vessel on the pressurized aircraft requires additional data not contained in this manual. (See Section 2.5)

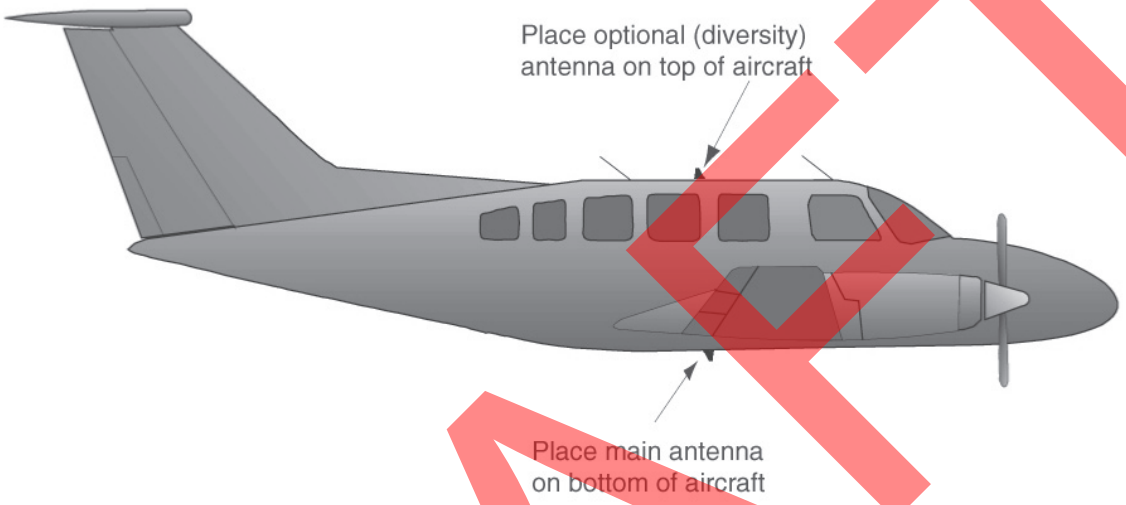


Figure 2-1 Antenna Installation Considerations

a. The antenna (Garmin P/N 010-10160-00 or equivalent) should be mounted away from major protrusions, such as engine(s), propeller(s), and antenna masts. It should also be as far as practical from landing gear doors, access doors, or other openings that could shadow (block) the signal between the transponder antenna and ATC radar on TCAS.
b. The main antenna should be mounted vertically on the bottom of the aircraft (Figure 2-1). The optional second (diversity) antenna should be mounted vertically on top of the aircraft. Horizontal separation must be no more than 7.6 merers (25 feet).
c. Antenna Separation: DME and TCAS receive signals in the same frequency range that aviation transponders transmit at, so their antennas should be separated from the transponder antenna by as much as feasible. Six feet of separation is a guideline. Radar altimeters (should one be installed on an aircraft with a GTX 3000) also have some potential to receive interference from a transponder (the transponders' fourth harmaonic), so it is good practice to separate transponder and radar altimeter antennas by as much as practical also. Avoid mounting the antenna within three feet of the ADF sense antenna or any other communication antenna and six feet from the DME antenna.
d. To prevent RF interference, the antenna must be physically mounted a minimum distance of three feet from the GTX 3000.

NOTE

If the antenna is being installed on a composite aircraft, sufficient ground plane material must be added. Conductive wire mesh, radials, or thin aluminum sheets embedded in the composite material provide the proper ground plane allowing the antenna gain pattern to be maximized for optimum transponder performance.

2.4 Cabling and Wiring

Refer to the interconnect examples in Appendix C for wire gauge guidance.

In some cases, a larger gauge wire such as AWG #18 may be needed for power connections. If using #18 barrel contacts, ensure that no two contacts are mounted directly adjacent to each other. This minimizes the risk of contacts touching and shorting to adjacent pins or to ground.

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. It is also good practice to avoid routing cables near sharp edges because aircraft vibration might wear away the insulation on the wires, which will leave them exposed to moisture and potentially create arcing or intermittent short circuits.

The maximum attenuation at 1090 MHz between the unit and the antenna must not exceed 3.0 dB. This loss specification includes connector loss; for example, through a bulkhead connector (0.2 dB is typical loss for each bulkhead connector). The GTX 3000 back-plate assembly utilizes a BNC-type (bayonet connection) coaxial connector.

Table 2-5 lists examples of recommended antenna cable. Use the table to determine the length of cable needed to connect the transponder to the antenna, and to look up a recommended cable manufacturer and part number that will meet the 3.0 dB loss spec. The table assumes a loss figure of 0.2 dB per connector. Note that any 50 Ω, double shielded coaxial cable assembly that meets airworthiness requirements and the 3.0 dB maximum loss figure (including connectors) may be used.

Differential cable loss: If the cable loss difference between top and bottom channels is less than 1 dB, the unit's default cable loss values are applicable, and the unit does not require cable loss configuration. If that cable loss difference is more than 1 dB different between antennas, then cable loss configuration is required..

Table 2-5 Cable Specifications

Max. Length (feet – [m])	Insertion loss (dB/100ft)	ECS Type	MIL-C-17 Type	RG Type
17' 5.2" [4.40m]	18.0		M17/128-RG400	RG-400
17' 11.7" [5.48m]	14.45	3C142B		
21' 7.8" [6.60m]	12.00		M17/112-RG304	RG-304
29' 6.7" [9.01m]	8.80	311601	M17/127-RG393	RG-393
36' 6.2" [11.13m]	7.12	311501		
47' 4.9" [14.25m]	5.56	311201		
71' 7.4" [21.83m]	3.63	310801		
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	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 maximum one-way propagation delay through the cables must not be more than 125 ns. The maximum difference in the one-way propagation delay between the top and bottom antenna cables must be less than or equal to 75 ns. Use Table 2-6 to determine the maximum difference in length between the top and bottom antenna cables.

Absolute cable delay: Each antenna cable must have less than 75 ns of delay. The 75 ns spec is for one-way cable delay – not delay down the cable and back up it (which one might consider given the receive and transmit functions). If you meet the 3 dB cable loss requirement, you'll almost certainly meet the 75 ns delay requirement.

Differential cable delay: If the cable delay difference between the two cables is less than 25 ns, the unit does not require cable delay to be configured. The unit's default values will suffice. Otherwise, we'll simply have to configure each channel's cable delay.

Table 2-6 Maximum Difference in Cable Lengths

Max. Difference in Length (feet – [m])	Velocity of Propagation (ns/ft)	ECS Type	MIL-C-17 Type	RG Type
14' 5.2" [4.40m]*	1.46		M17/128-RG400	RG-400
17' 11.7" [5.48m]*	1.46	3C142B		
21' 7.8" [6.60m]*	1.46		M17/112-RG304	RG-304
29' 6.7" [9.01m]*	1.25	311601	M17/127-RG393	RG-393
36' 6.2" [11.13m]*	1.25	311501		
47' 4.9" [14.25m]*	1.25	311201		
59' 11.7" [18.28m]	1.25	310801		

* Maximum difference in cable length is limited by maximum cable length.

2.4.1 Cable Routing Considerations

When routing cables, observe the following precautions:

- All cable routing should be kept as short and as direct as practical.
- Avoid sharp bends to prevent insulation from being breached.
- Avoid routing close to sharp edges to prevent insulation from being breached due to vibration or handling the cable.
- Avoid routing cables near power sources (e.g., 400 Hz generators, trim motors, etc.) or near power for fluorescent lighting.
- Avoid routing antenna cables near DME, TCAS, radar altimeter, and ADF antenna cables (allow at least a 12-inch separation).

2.5 Installation Approval Considerations for Pressurized Aircraft

Antenna and cable installations on pressurized cabin aircraft require FAA approved installation design and engineering substantiation data whenever such installations incorporate alteration (penetration) of the cabin pressure vessel by connector holes and/or mounting arrangements. Use of existing bulkhead connectors previously approved by other means is permissible without additional approval.

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 options:

1. Obtain approved antenna installation design data from the aircraft manufacturer.
2. Obtain an FAA approved Supplemental Type Certificate (STC) pertaining to and valid for the subject 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 select (and contact) a DER from the roster of individuals identified thereunder.
5. Contact an aviation industry organization such as the Aircraft Electronics Association and request their assistance.

2.6 Cooling Air

Cooling air is generally not required. However, if the unit is located in a confined space or near a source of heat, cooling air is recommended for maximizing the life of the GTX 3000. A 5/8 inch air fitting is provided on the rear of the backplate for the purpose of admitting cooling air. If a form of forced air cooling is installed, make certain that rainwater or condensation cannot enter and be sprayed on the equipment.

2.7 GTX 3000 Mounting Requirements

Refer to the G1000 System Installation manual, Garmin part number 190-00303-00, for information on cooling requirements. For remote mounted units, forced air cooling is not required. However, the application of forced air cooling is recommended to provide beneficial cooling if the unit is located in a confined space or near a source of heat.

A 5/8 inch air fitting is provided on the rear of the backplate for the purpose of admitting cooling air under such conditions. If a form of forced air cooling is installed, make certain that rainwater or condensation cannot enter and be sprayed on the equipment.

2.7.1 Remote Mounted Stand-Alone Rack Considerations

Figure 2-2 and the drawing in Appendix B show the GTX 3000 remote mounted stand-alone rack. The remote rack can be installed in a variety of locations, such as the electronics bay, under a seat or on an avionics shelf behind the rear baggage area. Refer to Figure 2-3 for suggested location. Leave sufficient clearance between the GTX 3000 and any obstruction. Install the rack in accordance with AC 43.13-2A Chapter 2 "Radio Installations". The rack should be mounted to a surface known to have sufficient structural integrity to withstand additional inertia forces imposed by a 4.3-pound (1.95 kg) unit. If it is necessary to build a shelf or bracket to mount the GTX 3000 stand-alone rack or it is not certain that the chosen location is of sufficient structural integrity, refer to Appendix A for validation of rack mounting structures and determining static load capability.

Figure B-1 gives the GTX 3000 stand-alone rack dimensions. The rack can be mounted vertically using four 8-32 pan head screws (MS35206, AN526 or other approved fastener). It can also be mounted horizontally using four 6-32 100° counter-sunk flathead screws (MS24693, AN507R or other approved fastener). Ensure that the GTX 3000 chassis has a ground path to the airframe by having at least one mounting screw in contact with the airframe. If more water-resistance is desired, the rack should be installed in the upright vertical orientation only, otherwise, the rack may be mounted in either vertical or horizontal orientation.

After the cable assemblies are made and wiring installed to the rack back plate, route wiring bundle as appropriate. Use cable ties to secure the cable assemblies and coax to provide strain relief for the cable assemblies.

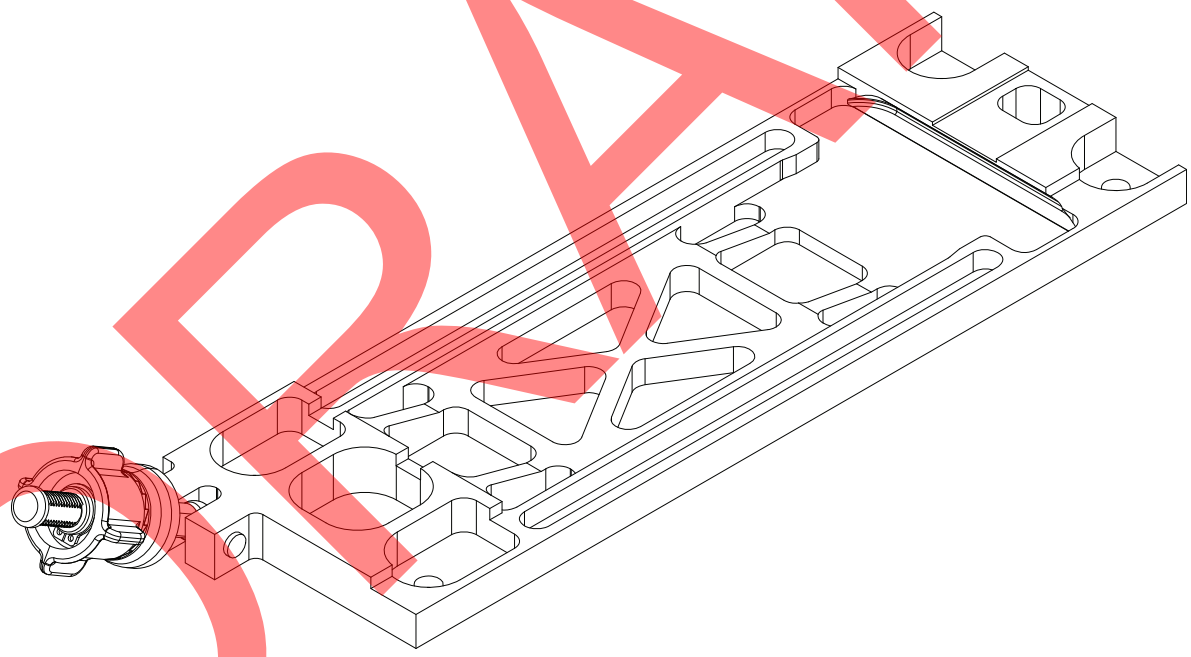


Figure 2-2 GTX 3000 Stand Rack (011-02515-00)

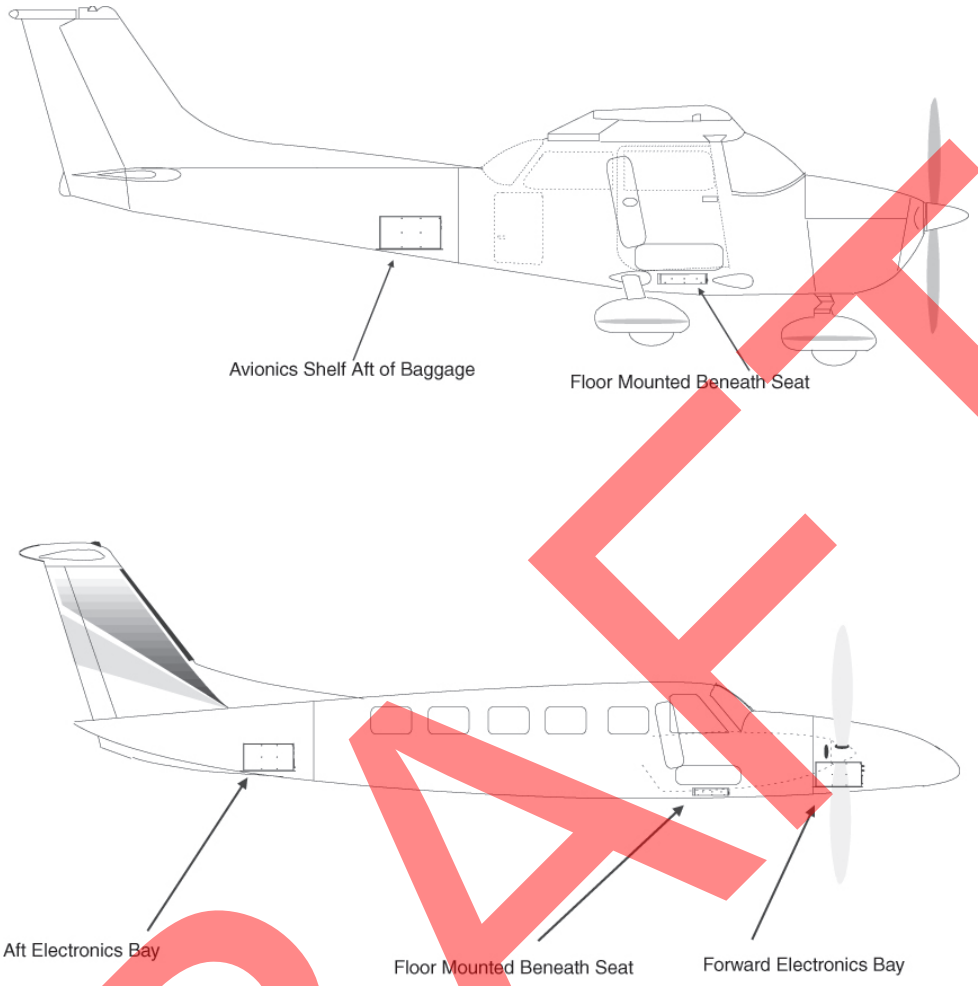


Figure 2-3 GTX 3000 Rack, Suggested Mounting Locations

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 cables. All electrical connections to the GTX 3000 are made through one 62-pin D-subminiature connector and one 78-pin D-subminiature connector. 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 C for examples of interconnect wiring diagrams. Construct the actual harnesses in accordance with the aircraft manufacturer authorized interconnect standards.

CAUTION

Check wiring connections for errors before inserting the GTX 3000 into the rack. Incorrect wiring could cause internal component damage.

Table 3-1: Pin Contact Part Numbers

Manufacturer (Note 1)	62 pin D-Subminiature connector (P3301)	
	18-20 AWG	22-28 AWG
Garmin P/N	336-00044-00	336-00021-00
Military P/N	N/A	M39029/58-360
AMP	N/A	204370-2
Positronic	N/A	MC8522D
ITT Cannon	N/A	030-2042-000

Table 3-2 Recommended Crimp Tools

Manufacturer (Note 1)	Hand Crimping Tool	18-20 AWG		22-28 AWG	
		Positioner (Note 3)	Insertion/ Extraction Tool (Note 2)	Positioner	Insertion/ Extraction Tool
Military P/N	M22520/2-01	N/A	M81969/1-04	M22520/2-09	M81969/1-04
Positronic	9507	9502-11	M81969/1-04	9502-3	M81969/1-04
ITT Cannon	995-0001-584	N/A	N/A	995-0001-739	N/A
AMP	601966-1	N/A	91067-1	601966-6	91067-1
Daniels	AFM8	K774	M81969/1-04	K42	M81969/1-04
Astro	615717	N/A	M81969/1-04	615725	M81969/1-04

NOTE

1. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.
2. Extracting the 18 AWG contacts requires that the expanded 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 an extractor due to the absence of the wire. A new contact must be used when reassembling the connector.

3.3 Backshell Assembly

The GTX 3000 connector kit includes two Garmin backshell assemblies. Garmin's backshells give the installer the ability to quickly and easily terminate shield grounds at the backshell housing using the Shield Block grounding method.

G1000 Installations:
To assemble the backshell and grounding system, refer to the instructions provided in the G1000 System Installation Manual (190-00303-00), as well as the Shield Block Installation Instructions (190-00313-09).

Non-G1000 Installations:
For GTX 3000 installations mounted as a remote transponder system, refer to the Shield Block Installation Instructions (190-00313-09) for grounding instructions.

3.4 Weight and Balance

Weight and balance computation is required after the installation of the GTX 3000. Follow the guidelines as established in AC 43.13-1B, Chapter 10, Section 2. Make appropriate entries in the equipment list indicating items added, removed, or relocated along with the date accomplished. Include your name and certificate number in the aircraft records. Section 1.5.1 identifies the weight of the new GTX 3000 equipment and the drawings in Appendix B show the center of gravity.

3.5 Electrical Load Analysis

An electrical load analysis should be completed on each aircraft prior to installation in accordance with AC43.13-1B, Chapter 11. Use the following values for computation:

Table 3-3 Unit Power Loads

GTX 3000 Input	14 Vdc		28 Vdc	
	Typical	Max.	Typical	Max.
GTX 3000 Main Power	1.6 A	3.2 A	0.85 A	1.6 A

3.5.1 Circuit Breaker Placard

Install a Circuit Breaker Placard labeled Transponder or Transponder 1, Transponder 2 as appropriate as indicated in AC 43.13-2A, paragraph 27c(4).

3.6 Final Installation

??????????????????????

3.7 Post Installation Configuration and Checkout

NOTE

The GTX 3000 Mode S Transponder will not provide valid outputs until the aircraft post installation configuration procedures are completed.

3.7.1 Configuration

When installed as part of the Garmin Integrated Flight Deck, the GTX 3000 transponder must have FAA approved configuration data. Configuration data is loaded to the GTX 3000 from an aircraft-specific Software Loader Card. Transponder settings are predetermined for a specific aircraft and are typically contained within the file named 'GTX1'. However, the aircraft registration number must be entered manually.

The PFD serves as the graphics user interface to the installer configuring the system. For basic configuration information, refer to the G1000 Line Maintenance and Configuration Manual, Garmin part number 190-00303-04. For actual aircraft installation/checkout, use only aircraft manufacturer approved checkout procedures.

Verify proper operation of the transponder by testing in accordance with Appendix F to 14 CFR Part 43 – ATC Transponder Tests and Inspections.

For transponder installations operating with a Garmin GNS 480 (CNX80), refer to GNS 480 (CNX80) Installation Manual, 560-0982-01 for configuration procedures and operation checks.

3.7.2 Interference Check

Turn on and verify operation of all avionics equipment except GTX 3000. Then power the GTX 3000 on and verify there is no interference with any other equipment in the aircraft. The operation/performance checks should be made with all other avionics turned on. Verify that there is no interference during any mode of transponder operation.

3.7.3 Operation/Performance Checkout.

CAUTION

If the unit is removed from the aircraft and operated, always connect J3303 and J3303 to an antenna or a 50 Ω, 5-Watt load. The GTX 3000 transmits Mode S acquisition squitter replies about once per second whether interrogations are received or not.

Verify proper operation of the transponder by testing as specified in Appendix F of 14 CFR, Part 43, to AC 43-6B, and/or other appropriate regulations. The test is typically done as a ramp test using a transponder ramp test set, such as the TIC TR-220, IFR ATC-601 or other suitable Mode S transponder test set.

Self Test

Verify that the unit does not display a failure indication when turned on.

Altitude Input

Verify that the displayed altitude matches the altimeter pressure altitude (at 29.92).

External Inputs

If the external ident or standby inputs are connected, verify operation by:

a) Verify that the unit goes to standby when the external standby input is pulled low.

b) Verify that the ident indication turns on when the external ident button is pressed (must be in the "ON" or "ALT" modes).

3.7.4 Performance (Ramp) Test

After installation, the transponder should be tested as specified in 14 CFR Part 43 Appendix F, AC 43-6B, and other appropriate regulations. The test is typically done as a ramp test using a transponder ramp test set, such as the IFR ATC-601A. The ramp test includes checks as follows:

Reference Part 43 Appendix F:

a) Reply Frequency

b) Suppression

c) Receiver Sensitivity

d) Reply RF Output Power

e) Mode S Diversity Channel Isolation (if applicable)

f) Mode S Address

g) Mode S Formats

h) Mode S All-Call

i) ATCRBS –Only All Call

j) Squitter

Reference AC 43-6B and 14 CFR Part 43, Appendix E (c):

a) Altitude Reporting

3.8 Continued Airworthiness

Test according to Title 14 CFR §§ 91.411 and 91.413 as well as Part 43 Appendix F. Other than for regulatory checks, maintenance of the GTX 3000 is 'on condition' only.

4 SYSTEM INTERCONNECTS

4.1 Pin Function List

4.1.1 P3301

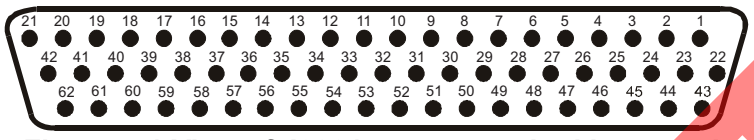


Figure 4-1 View of J3301 connector, looking at unit

Table 4-1 P3301 Pin List

Pin	Pin Name	I/O
1	RESERVED [AVIONICS MASTER ON SELECT]	--
2	ALTITUDE A1	In
3	ALTITUDE C2	In
4	ALTITUDE A2	In
5	ALTITUDE A4	In
6	ALTITUDE C4	In
7	ALTITUDE B1	In
8	ALTITUDE C1	In
9	ALTITUDE B2	In
10	ALTITUDE B4	In
11	ALTITUDE D4	In
12	EXTERNAL IDENT SELECT*	In
13	EXTERNAL STANDBY SELECT*	In
14	RESERVED [28V LIGHTING BUS HI]	--
15	AUDIO OUT HI	Out
16	AUDIO OUT LO	Out
17	SQUAT SWITCH IN	In
18	RESERVED [BOOT BLOCK SELECT]	--
19	ALTITUDE ALERT ANNUNCIATE*	Out
20	RESERVED [HIJACK MODE SELECT]	--
21	RESERVED [AIRCRAFT POWER 1]	--
22	RS-232 IN 1	In
23	RS-232 OUT 1	Out
24	RS-232 IN 2	In
25	RS-232 OUT 2	Out
26	ARINC 429 IN 3 A	In
27	RESERVED [POWER GROUND]	--
28	ARINC 429 OUT 2 B	Out
29	ARINC 429 IN 3 B	In
30	ARINC 429 OUT 2 A	Out
31	EXTERNAL SUPPRESSION I/O	I/O

* Denotes Active Low (Ground to activate).

Table 4-1 P3301, Pin List continued

Pin	Pin Name	I/O
32	ARINC 429 IN 1 A	In
33	ARINC 429 IN 2 A	In
34	ARINC 429 OUT 1 B	Out
35	ARINC 429 IN 1 B	In
36	ARINC 429 IN 2 B	In
37	ARINC 429 OUT 1 A	Out
38	RESERVED [VOLTAGE TEMPERATURE PROBE OUT]	--
39	RESERVED [VOLTAGE TEMPERATURE PROBE IN]	--
40	GPS PPS IN 1	In
41	CURRENT TEMPERATURE PROBE OUT	Out
42	RESERVED [AIRCRAFT POWER 1]	--
43	RESERVED [POWER GROUND]	--
44	CURRENT TEMPERATURE PROBE IN	In
45	RESERVED [14V/5V LIGHTING BUS HI]	--
46	TIS CONNECT SELECT*	In
47	AUDIO MUTE SELECT*	In
48	ARINC 429 IN 4 A	In
49	ARINC 429 IN 4 B	In
50	ALTITUDE COMMON (GROUND)	In
51	RESERVED [SIGNAL GROUND]	--
52	GPS PPS IN 2 HI	In
53	GPS PPS IN 2 LO	In
54	RESERVED [XPDR REMOTE POWER OFF]	--
55	SPARE	--
56	RESERVED [AIRCRAFT POWER 2]	--
57	SPARE	--
58	RESERVED [SIGNAL GROUND]	--
59	SPARE	--
60	RESERVED [AIRCRAFT POWER 2]	--
61	XPDR FAIL* OUT 1	Out
62	RESERVED [SWITCHED POWER OUT]	--

Denotes Active Low (Ground to activate).

4.1.2 P3302

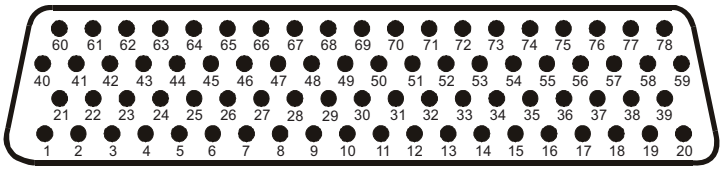


Figure 4-2 View of J3302 connector, looking at unit

Table 4-2 P3302 Pin List

Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	RESERVED [SIGNAL GROUND]	--
3	AIRCRAFT POWER 1	In
4	RESERVED [SIGNAL GROUND]	--
5	AIRCRAFT POWER 1	In
6	RESERVED [SIGNAL GROUND]	--
7	AIRCRAFT POWER 2	In
8	RESERVED [SIGNAL GROUND]	--
9	AIRCRAFT POWER 2	In
10	RESERVED [POWER GROUND]	--
11	SWITCHED POWER OUT	Out
12	ARINC 429 OUT 3 A	Out
13	ARINC 429 OUT 3 B	Out
14	ARINC 429 OUT 4 A	Out
15	ARINC 429 OUT 4 B	Out
16	RS-422 IN A	In
17	RS-422 IN B	In
18	RS-422 OUT A	Out
19	RS-422 OUT B	Out
20	XPDR FAIL* OUT 2	Out
21	CONFIG MODULE POWER OUT	Out
22	RESERVED [SIGNAL GROUND]	--
23	RESERVED [SIGNAL GROUND]	--
24	RESERVED [SIGNAL GROUND]	--
25	RESERVED [SIGNAL GROUND]	--
26	RESERVED [SIGNAL GROUND]	--
27	RESERVED [SIGNAL GROUND]	--
28	RESERVED [SIGNAL GROUND]	--
29	RESERVED [SIGNAL GROUND]	--
30	ARINC 429 IN 5 A	In
31	ARINC 429 IN 5 B	In

*Denotes Active Low (Ground to activate).

Table 4-2 P3302, Pin List continued

Pin	Pin Name	I/O
32	ARINC 429 IN 6 A	In
33	ARINC 429 IN 6 B	In
34	ARINC 429 IN 7 A	In
35	ARINC 429 IN 7 B	In
36	ARINC 429 IN 8 A	In
37	ARINC 429 IN 8 B	In
38	XPDR REMOTE POWER OFF	In
39	RESERVED [SPARE DISCRETE OUT* 1]	--
40	CONFIG MODULE DATA	I/O
41	RESERVED [SIGNAL GROUND]	--
42	SPARE	--
43	SPARE	--
44	SPARE	--
45	SPARE	--
46	SPARE	--
47	SPARE	--
48	SPARE	--
49	SPARE	--
50	SPARE	--
51	SPARE	--
52	SPARE	--
53	SPARE	--
54	RESERVED [SPARE DISCRETE IN* 1]	--
55	RESERVED [SPARE DISCRETE IN* 2]	--
56	RESERVED [SPARE DISCRETE IN* 3]	--
57	RESERVED [SPARE DISCRETE IN* 4]	--
58	XPDR REMOTE POWER ON*	In
59	RESERVED [SPARE DISCRETE OUT* 2]	--
60	CONFIG MODULE CLOCK	Out
61	RESERVED [SIGNAL GROUND]	--
62	POWER GROUND	--
63	RESERVED [POWER GROUND]	--
64	POWER GROUND	--
65	RESERVED [POWER GROUND]	--
66	RESERVED [SIGNAL GROUND]	--
67	RESERVED [SIGNAL GROUND]	--

Table 4-2 P3302, Pin List continued

*Denotes Active Low (Ground to activate).

Pin	Pin Name	I/O
68	RESERVED [SIGNAL GROUND]	--
69	RESERVED [SIGNAL GROUND]	--
70	RESERVED [SIGNAL GROUND]	--
71	RESERVED [SIGNAL GROUND]	--
72	RESERVED [SIGNAL GROUND]	--
73	RESERVED [SIGNAL GROUND]	--
74	RESERVED [SIGNAL GROUND]	--
75	RESERVED [SIGNAL GROUND]	--
76	RESERVED [SIGNAL GROUND]	--
77	RESERVED [SIGNAL GROUND]	--
78	RESERVED [SPARE DISCRETE OUT* 3]	--

*Denotes Active Low (Ground to activate).

4.2 Power Function

Power Input requirements are listed in the following tables. The power-input pins accept 14/28 Vdc. Switched Power Out is a power source available for devices such as a remote digital altitude encoder. Refer to Figure C-1 and C-2 for power interconnections.

4.2.1 Aircraft Power

Table 4-3 Aircraft Power

Pin Name	Connector	Pin	I/O
RESERVED [AIRCRAFT POWER 1]	P3301	21	In
AIRCRAFT POWER 1	P3301	42	In
AIRCRAFT POWER 2	P3301	56	In
AIRCRAFT POWER 2	P3301	60	In
SWITCHED POWER OUT	P3301	62	Out
RESERVED [POWER GROUND]	P3301	27	--
POWER GROUND	P3301	43	--
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--
AIRCRAFT POWER 1	P3302	3	In
AIRCRAFT POWER 1	P3302	5	In
AIRCRAFT POWER 2	P3302	7	In
AIRCRAFT POWER 2	P3302	9	In
SWITCHED POWER OUT	P3302	11	Out
RESERVED [POWER GROUND]	P3302	10	--
RESERVED [POWER GROUND]	P3302	63	--
RESERVED [POWER GROUND]	P3302	65	--

4.3 Altitude Functions

Altitude functions with pin assignments are shown for reference since the altitude function is available in the GTX 3000. In the Garmin Integrated Flight Deck system, altitude data is received from the GIA 63 in RS-232 format.

Parallel gray code altitude inputs are considered active if either the voltage to ground is < 1.9 V or the resistance to ground is < 375 Ω. These inputs are considered inactive if the voltage to ground is 11-33 Vdc.

NOTES

The GTX 3000 contains internal altitude code line isolation diodes to prevent the unit from pulling the encoder lines to ground when the transponder is turned off.

If two separate altitude encoders are connected to the GTX 3000, one providing parallel gray code and the other, serial data, the unit selects only one for use at a time, with serial data input receiving the highest priority.

For altitude encoders that can be connected in both serial data and parallel gray code format, such as the Garmin GAE 43 (Garmin P/N 013-00066-00), select one or the other but not both wiring connections.

When connecting two altitude encoders to the Garmin GNS 480 (CNX80), the unit can only receive serial data from one unit at a time. Use a DPDT switch to connect both serial data and External Standby Select. Refer to Figure C-3.

Among the surveillance items the Mode S transponder will transmit to the ground stations and other aircraft are altitude reporting in 25’ increments with the proper encoder. In order to report altitude in 25-foot increments the GTX 3000 must receive altitude from suitable altitude reporting devices through serial input connections. Altitude input to the GTX 33 received from parallel wire gray code encoders is supplied to the unit in 100-foot increments and thus reported in 100-foot increments.

4.3.1 Altimeter Inputs

Table 4-4 Altimeter Inputs

Pin Name	Connector	Pin	I/O
ALTITUDE A1	P3301	2	In
ALTITUDE A2	P3301	4	In
ALTITUDE A4	P3301	5	In
ALTITUDE B1	P3301	7	In
ALTITUDE B2	P3301	9	In
ALTITUDE B4	P3301	10	In
ALTITUDE C1	P3301	8	In
ALTITUDE C2	P3301	3	In
ALTITUDE C4	P3301	6	In
ALTITUDE D4	P3301	11	In
ALTITUDE COMMON (GROUND)	P3301	50	In

4.3.2 Altimeter Interconnect, Dual GTX 3000 Installation

For complete dual installation in which digital altitude encoders are connected to the GTX 3000, it is best to install two digital sources, connecting one encoder to each transponder.

4.3.3 Altimeter Selection Priority

When connecting the transponder to a GNS 480 (CNX80), the installer must be aware of the GTX 33 priority for selecting encoded altimeter interconnections. The GTX 33 searches in this sequence for altitude, and stops when it finds a valid pressure altitude input.

Altitude reporting equipment order of precedence:

1) ARINC 429 Air Data Computer (label 203, if configured W/ALT) (25')
2) ARINC 429 EFIS (label 203, if configured W/ALT) (25')
3) RS-232 data from GNS 480 (CNX80), or Garmin Integrated Flight Deck (25')
4) RS-232 Fuel/Air Data Computer (if configured W/ALT.) (25')
5) Shadin Altitude Serializer/Encoder (if configured for 25')
6) Icarus Altitude Serializer/Encoder (if configured for 25')
7) Parallel wire Gray Code input (100')
8) Shadin Altitude Serializer/Encoder (if configured for 100')
9) Icarus Altitude Serializer/Encoder (if configured for 100')

Only approved devices may provide altitude to the GTX 33 in accordance with 14 CFR 91.217. In addition, all altitude reporting devices installed in the aircraft must meet certification requirements of 14 CFR 91.413. The installer must select an altitude reporting device that is a certified altitude source for the particular aircraft.

It is the installing agency's responsibility to determine that the installed encoder is compatible with the selected altitude reporting criteria, either 100' or 25'. Refer to the GNS 480 (CNX80), installation manual 560-0982-01 for the altitude data reporting configuration.

For additional information, refer to GNS 480 (CNX80) Installation Manual 560-0982-01 for the altitude data reporting configuration when connecting a GTX 330 to a GNS 480 (CNX80).

4.4 Discrete Functions

Discrete functions with pin assignments are shown for reference since the functions are available in the GTX 3000. External suppression should be connected if another transponder or DME is installed in the aircraft avionics system. Depending on system configuration, the Garmin Integrated Flight Deck may not use these inputs, as many functions are received from the GIA 63 in RS-232 format.

4.4.1 Discrete Outputs

External suppression should be connected if a DME is installed in the aircraft avionics system. The GTX 3000 suppression I/O pulses may not be compatible with all models of DME. Known incompatible units include the Bendix/King KN 62, KN 64 and KNS 80. These models have an output-only suppression port and can be damaged by the GTX 3000 mutual suppression output. In this case, leave the suppression pin open.

Table 4-5 Discrete Outputs

Pin Name	Connector	Pin	I/O
ALTITUDE ALERT ANNUNCIATE*	P3301	19	Out
EXTERNAL SUPPRESSION I/O (TXP/DME)	P3301	31	I/O
RESERVED [SIGNAL GROUND]	P3301	51	--
RESERVED [SIGNAL GROUND]	P3301	58	--

*INACTIVE: 10 ≤ Vin ≤ 33VDC or Rin ≥100kΩ

ACTIVE: Vin ≤ 1.9VDC with ≥ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

4.4.2 Discrete Inputs

Table 4-6 Discrete Inputs

Pin Name	Connector	Pin	I/O
EXTERNAL IDENT SELECT*	P3301	12	In
EXTERNAL STANDBY SELECT*	P3301	13	In
SQUAT SWITCH IN	P3301	17	In
AUDIO MUTE SELECT*	P3301	47	In

*INACTIVE: 10 ≤ Vin ≤ 33VDC or Rin ≥100kΩ
ACTIVE: Vin ≤ 1.9VDC with ≥ 75 uA sink current, or Rin ≤ 375Ω
Sink current is internally limited to 200 uA max for a grounded input

EXTERNAL IDENT SELECT (remote IDENT) is a momentary input. Refer to the GNS 480 (CNX80), installation manual for the squat switch configuration.

EXTERNAL STANDBY SELECT (remote STANDBY) is a momentary input used when two GTX 33 systems are installed in an aircraft. Refer to Figure C-3, for the EXTERNAL STANDBY SELECT interconnect. When EXTERNAL STANDBY SELECT is grounded, ARINC 429 OUT PORT 1 remains active, while PORT 2 is inactive.

4.5 Serial Data Electrical Characteristics

The GTX 33 manages support for several equipment interfaces. The GTX 33 can be configured to include GPS, Airdata, AHRS, EFIS/Airdata, and ADLP 429 inputs, functioning as an ARINC 429 data concentrator.

The GTX 33 has four ARINC 429 input ports, making it capable of taking altitude, air data, heading, EFIS selected course and possible future features, and then concentrating it on the ARINC 429 OUT 2 ports for possible data link applications.

The GTX 33 is designed to feed all outgoing data to the external display via RS-232 data ports.

4.5.1 RS-232 Input/Output

Table 4-7 RS-232 Input/Output

Pin Name	Connector	Pin	I/O
RS-232 IN 1	P3301	22	In
RS-232 OUT 1	P3301	23	Out
RS-232 IN 2	P3301	24	In
RS-232 OUT 2	P3301	25	Out
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--

The RS-232 outputs conform to EIA Standard RS-232C with an output voltage swing of at least ±5 V when driving a standard RS-232 load. Refer to figures in Appendix C for the RS-232 serial data interconnect.

When connecting two GTX 3000 transponders to a GPS, the unit can only receive RS-232 serial data from one unit at a time. Use a DPDT switch for connecting both serial data and External Standby Select. Refer to Figure C-4, Sheets 2 and 3.

4.5.2 RS-422 Input/Output

Table 4-8 RS-422 Input/Output

Pin Name	Connector	Pin	I/O
RS-422 IN A	P3302	16	In
RS-422 IN B	P3302	17	In
RS-422 OUT A	P3302	18	Out
RS-422 OUT B	P3302	19	Out
SIGNAL GROUND	P3302		--
SIGNAL GROUND	P3302		--

These data busses conform to EIA standard RS-422.

4.5.3 Configuration Module Connections

The configuration module, mounted in the J3302 connector backshell, contains an EEPROM.

Table 4-9 Configuration Module Connections

Pin Name	Connector	Pin	I/O
CONFIG MODULE GROUND	P3302	1	--
CONFIG MODULE POWER OUT	P3302	21	Out
CONFIG MODULE DATA	P3302	40	I/O
CONFIG MODULE CLOCK	P3302	60	Out

4.5.4 ARINC 429 Input/Output

Table 4-10 ARINC 429 Input/Output

Pin Name	Connector	Pin	I/O
ARINC 429 IN 1A	P3301	32	In
ARINC 429 IN 1B	P3301	35	In
ARINC 429 OUT 1A	P3301	37	Out
ARINC 429 OUT 1B	P3301	34	Out
ARINC 429 IN 2A	P3301	33	In
ARINC 429 IN 2B	P3301	36	In
ARINC 429 OUT 2A	P3301	30	Out
ARINC 429 OUT 2B	P3301	28	Out
ARINC 429 IN 3A	P3301	26	In
ARINC 429 IN 3B	P3301	29	In
ARINC 429 IN 4A	P3301	48	In
ARINC 429 IN 4B	P3301	49	In
SIGNAL GROUND	P3301	51	--
SIGNAL GROUND	P3301	58	--
ARINC 429 OUT 3A	P3302	12	Out
ARINC 429 OUT 3B	P3302	13	Out
ARINC 429 OUT 4A	P3302	14	Out
ARINC 429 OUT 4B	P3302	15	Out
ARINC 429 IN 5A	P3302	30	In
ARINC 429 IN 5B	P3302	31	In
ARINC 429 IN 6A	P3302	32	In
ARINC 429 IN 6B	P3302	33	In
ARINC 429 IN 7A	P3302	34	In
ARINC 429 IN 7B	P3302	35	In
ARINC 429 IN 8A	P3302	36	In
ARINC 429 IN 8B	P3302	37	In

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

The following data is sent out at specified intervals using high speed ARINC 429 (100 kHz). The transmit data labels and their rates are as follows:

Table 4-11 Transmit Data Labels

LABEL	DATA	RATE
100	Selected Course (degrees)	200 ms
203	Pressure Altitude [in feet set to 29.92" Hg (1013.25 mb)]	100 ms
204	Barometric Corrected Altitude (feet)	100 ms
206	Indicated Air Speed (knots)	100 ms
210	True Air Speed (knots)	100 ms
211	Total Air Temperature (degrees)	100 ms
213	Static Air Temperature (degrees)	100 ms
306	Joystick Lat	500 ms
307	Joystick Lon	500 ms
314	True Heading	100 ms
320	Magnetic Heading (Degrees)	100 ms
371	GA Equipment Identifier	500 ms
377	Equipment Identifier	500 ms

4.6 RS-232 Input/Output, Software Update Connections

When the GTX 33 is installed in a system other than a Garmin Integrated Flight Deck an optional RS-232 serial data connector should be installed in the aircraft for future software upgrades, negating the need to remove the transponder from the aircraft. The connector can be mounted anywhere convenient for access, such as under the instrument panel, on a remote avionics shelf next to the unit or in the instrument panel itself. Be sure to label the connector for Software Update. Do not include the Test Mode Select switch in the aircraft. See Figure 4-3 for software update connections.

If the GTX 33 installation interfaces with a GNS 480 (CNX80) in the aircraft, the GNS 480 (CNX80) must be turned off during GTX 330 software upload, due to loading of RS-232 port 1.

NOTE

The installation of an optional software upgrade connector is highly recommended. If the connector is wired in the aircraft, transponder removal and reinstallation for software upgrade is not required.

CAUTION

If the unit is removed from the aircraft and operated, always connect J3302, (and J3303 for GTX 33D) to an antenna or a 50 Ω, 5-Watt load. The GTX 33 transmits Mode S acquisition squitter replies about once per second whether interrogations are received or not.

Beginning with software version 3.06, the GTX 33 software can be updated in the Configuration mode as well as in Test mode. Updating software in Configuration mode does not require the TEST MODE SELECT switch.

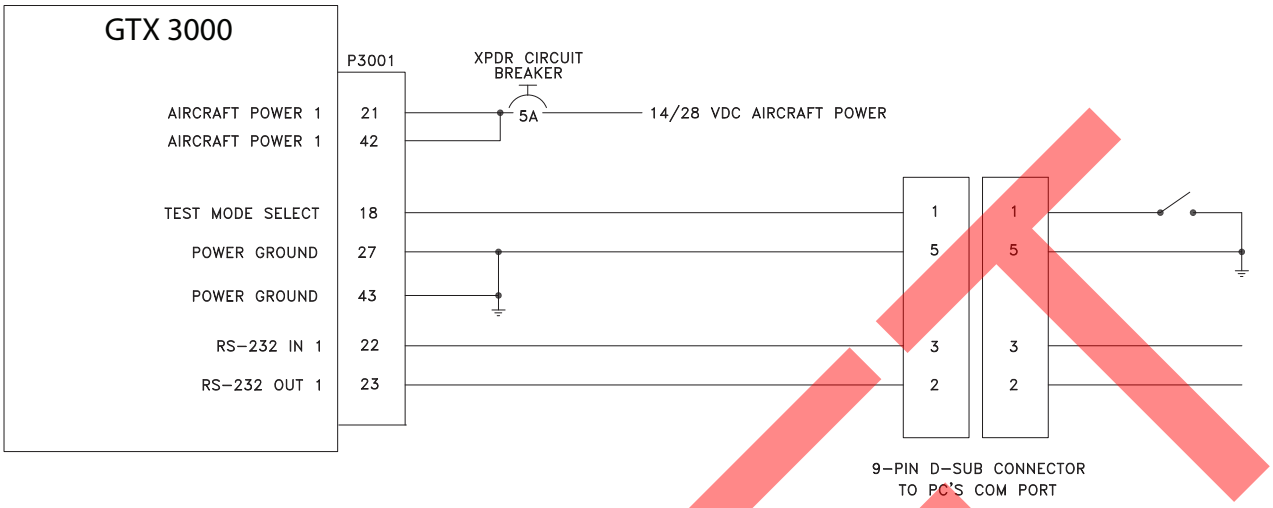


Figure 4-3 GTX 3000 Software Update Connections

APPENDIX A Construction and Validation of Structures

A.1 Static Test Loading

This appendix includes information necessary for testing load-carrying capabilities of equipment mounting structures, such as shelves, mounting plates and mounting brackets, used to mount the GTX 3000 remote mounting tray.

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

The GTX 3000 installation must be capable of withstanding the Ultimate Load Factors listed in Table A-1 for at least 3 seconds in each direction specified without damage or permanent deformation. Note that these required loads differ somewhat from those normally required for equipment installations.

Since the combined weight of the GTX 3000 and its equipment mounting rack and connector is 4.3 lbs, the static loads which must be applied (Load Factor x 4.3 lbs.) will be as follows:

Table A-1 Static Test Load

Direction of Force	Load Factor	Static Test Load (Load Factor x GTX 3000 weight)
DOWNWARD	6.6 G	(6.6 x 4.3) = 28.4 lbs
UPWARD	6.0 G	(6.0 x 4.3) = 25.8 lbs
SIDEWARD	4.5 G	(4.5 x 4.3) = 19.4 lbs
FORWARD	18.0 G	(18.0 x 4.3) = 77.4 lbs

A.2 Determining Static Load Capability

A recommended method of determining the static load capability is as follows:

1. Mark and drill the holes where the GTX 3000 equipment rack will be mounted.
2. Install four 8-32 machine screws (MS35206, AN526 or other approved fastener) in the four holes which will be used to mount the GTX 3000 equipment rack using washers, nuts and nutplates to mount the equipment rack to the mounting surface. Note that some means of locking fastener must be used, e.g. either lock nuts or steel nuts with lock washers.
3. For testing downward loading, place shot bags or other suitable weights totaling 28.4 pounds within the footprint outlined by the four screw holes (assuming the mounting surface is horizontal) or use a calibrated force gauge at the location of the center of gravity when the unit is mounted.
4. Verify there is no damage or permanent deformation of the structure after 3 seconds.
5. Fasten a 36 inch loop of suitable material such as fishing line, braided wire, or other similar material having a breaking strength of at least 100 lbs., diagonally between two of the screws. Then fasten another loop diagonally between the other two screws, adjusting the length of the loop so it exactly matches the first.
6. Hook a calibrated force gauge through both loops and apply a sustained pull for at least 3 seconds in each of the other three directions (upward, sideward and forward) at the above calculated forces (i.e. 25.8 lb. upward, 19.4 lb. sideward and 77.4 lb. forward).

7. Examine the support structure carefully. If there has been damage or permanent deformation, the structure is not suitable and must be replaced with one that is strong enough to withstand the test loads. Examine all aircraft stringers, bulkheads and skin surfaces, which may have direct or indirect contact with the fabricated shelf. If it is determined that no damage or permanent deformation has occurred, the structure is of sufficient strength and the GTX 3000 equipment rack may be permanently mounted on it.

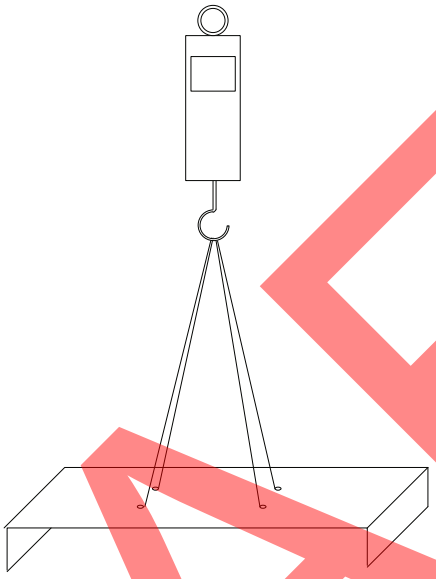


Figure A-1 Upward static Load Test

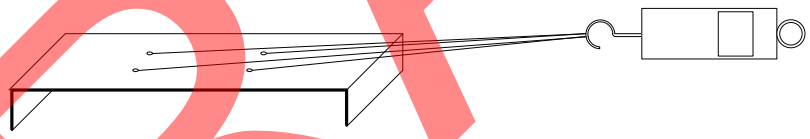
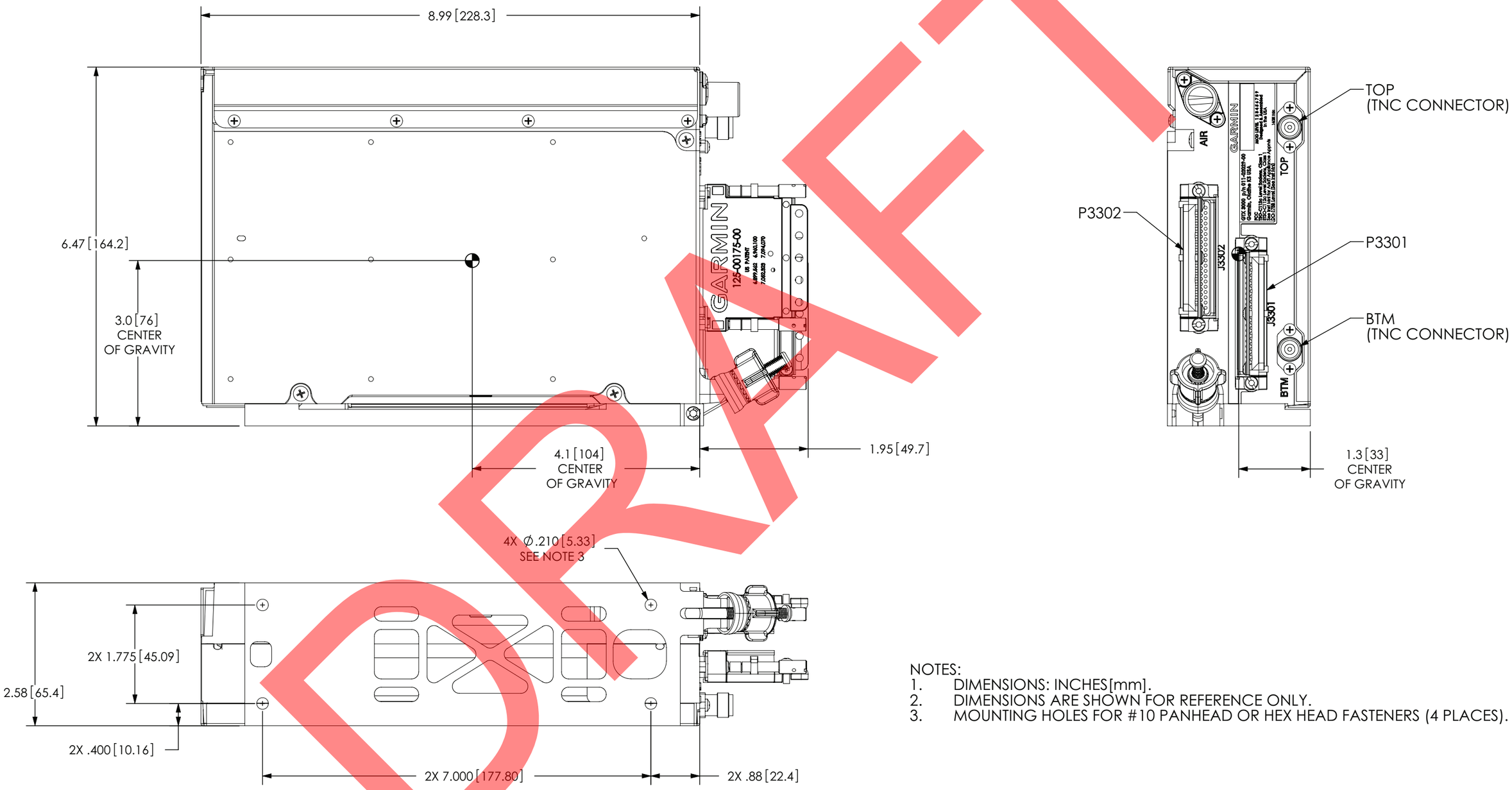
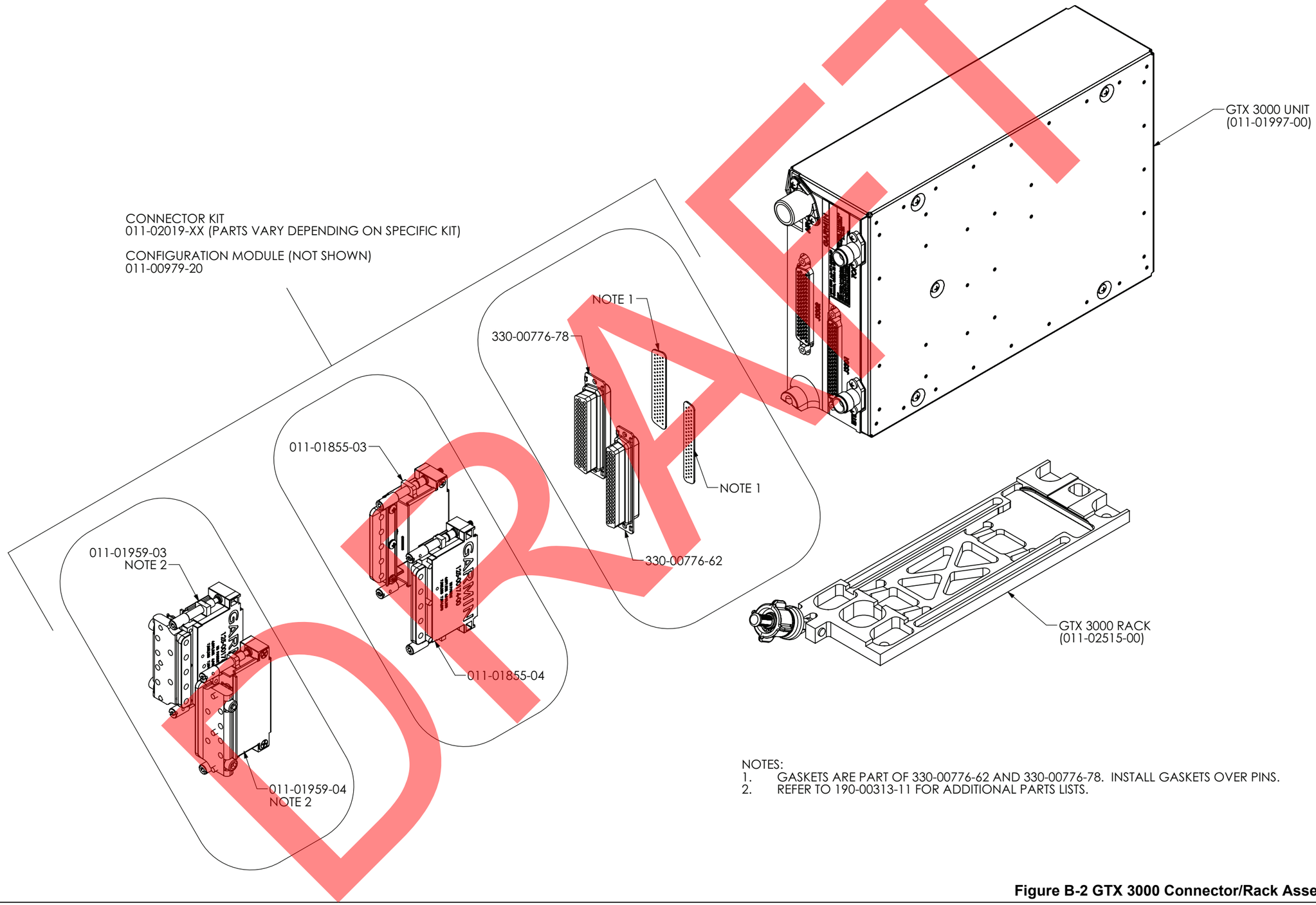


Figure A-2 Forward Static Load Test



NOTES:
1. DIMENSIONS: INCHES[mm].
2. DIMENSIONS ARE SHOWN FOR REFERENCE ONLY.
3. MOUNTING HOLES FOR #10 PANHEAD OR HEX HEAD FASTENERS (4 PLACES).

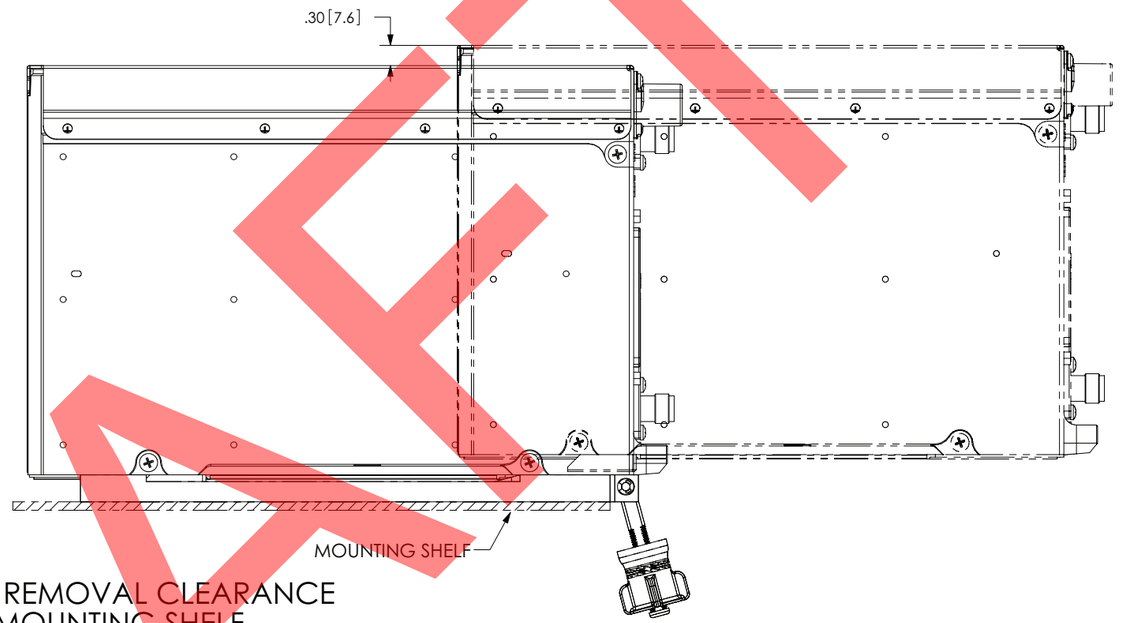
Figure B-1 GTX 3000 Outline Drawing



NOTES:
1. GASKETS ARE PART OF 330-00776-62 AND 330-00776-78. INSTALL GASKETS OVER PINS.
2. REFER TO 190-00313-11 FOR ADDITIONAL PARTS LISTS.

Figure B-2 GTX 3000 Connector/Rack Assembly Drawing

MINIMUM REQUIRED INSTALLATION AND REMOVAL CLEARANCE
WITH LOCKDOWN OVERHANGING MOUNTING SHELF



MINIMUM RECOMMENDED INSTALLATION AND REMOVAL CLEARANCE
WITH LOCKDOWN NOT OVERHANGING MOUNTING SHELF

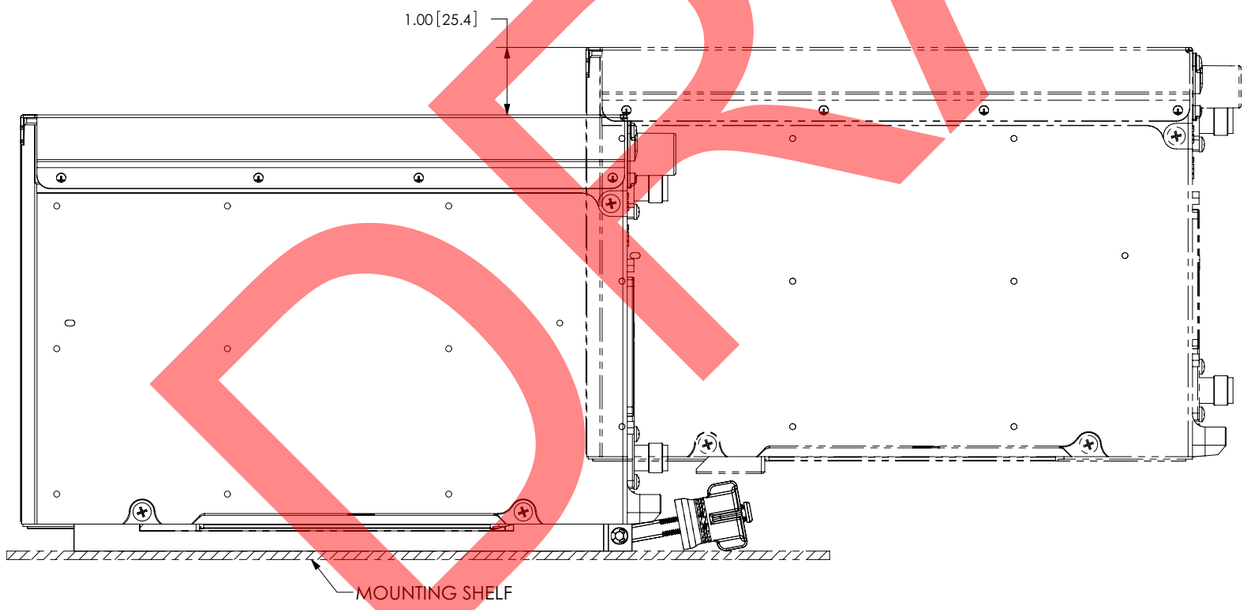


Figure B-3 GTX 3000 Minimum Installation/Removal Clearance