

GTX 328

Transponder

Installation Manual



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Garmin International, Inc.
1200 E. 151st Street
Olathe, KS 66062 USA
Telephone: 913-397-8200
Aviation Dealer Technical Support Line (Toll Free): (888) 606-5482

www.garmin.com

Garmin (Europe) Ltd.
Unit 5, The Quadrangle, Abbey Park Industrial Estate
Romsey, SO51 9DL, U.K.
Telephone: 44/0870.851241

RECORD OF REVISIONS

Revision	Revision Date	Description	ECO #
A	01/05/07	Initial Release	---
B	02/05/07	Corrected EUROCAE Spec. & changed max. antenna cable loss spec.	43124
C	03/05/07	Removed Non-Applicable TSO Deviation	43519

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This manual reflects the operation of software version 5.00. Some differences in operation may be observed when comparing the information in this manual to earlier or later software versions.

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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.

CAUTION

The GTX 328 lens is coated with a special anti-reflective coating that is very sensitive to skin oils, waxes and abrasive cleaners. **CLEANERS CONTAINING AMMONIA WILL HARM THE ANTI-REFLECTIVE COATING.** It is very important to clean the lens using a clean, lint free cloth and an eyeglass lens cleaner that is specified as safe for anti-reflective coatings.

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GTX 328 HARDWARE MOD LEVEL HISTORY

The following table identifies hardware modification (Mod) Levels for the GTX 328 Mode S Transponders. Mod Levels are listed with the associated service bulletin number, service bulletin date, and the purpose of the modification. The table is current at the time of publication of this manual (see date on front cover) and is subject to change without notice. Authorized Garmin Sales and Service Centers are encouraged to access the most up-to-date bulletin and advisory information on the Garmin Dealer Resource web site at www.garmin.com using their Garmin-provided user name and password.

MOD LEVEL	SERVICE BULLETIN NUMBER	SERVICE BULLETIN DATE	PURPOSE OF MODIFICATION

1 GENERAL DESCRIPTION

1.1 Introduction

This manual presents the mechanical and electrical installation requirements for the GTX 328 Mode S Transponder.

1.2 Equipment Description

CAUTION

The operation of cellular telephones or other cellular mobile devices aboard aircraft while airborne is prohibited by FCC rules. Due to the potential for interference with onboard systems, the operation of cellular communication devices while onboard an aircraft that is on the ground is subject to (FAA) 14 CFR 91.21.

(FCC) 47 CFR 22.925 prohibits airborne operation of cellular telephones installed in or carried aboard aircraft. Cellular telephones must not be operated aboard any aircraft while the aircraft is off the ground. When any aircraft leaves the ground, all cellular telephones on board that aircraft must be turned off.

Cellular telephones that are on, even in a monitoring state, can disrupt GPS performance.

The Garmin GTX 328 is a panel mounted Non-Diversity Mode S Transponder. The design meets RTCA/DO-181C and EUROCAE ED-73 B specifications.

The GTX 328 transponder is a radio transmitter and receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to ground-based radar on a frequency of 1090 MHz. The GTX 328 is equipped with IDENT capability that activates the Special Position Identification (SPI) pulse for 18 seconds.

The GTX 328 replies to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Mode A replies consist of any one of 4,096 codes, which differ in the position and number of pulses transmitted. Mode C replies include framing pulses and encoded altitude. Mode S interrogations are selective. The Mode S transponders can respond to a single directed interrogation from the ground station or another aircraft.

The GTX 328 is a Level 2 transponder, providing downlink of aircraft information. Ground stations can interrogate Mode S Transponders individually using a 24-bit ICAO Mode S address, which is unique to the particular aircraft. In addition, ground stations may interrogate a GTX 328 for its Transponder data capability and the aircraft's Flight ID, which may be the registration number or other call sign. The GTX 328 makes the maximum airspeed capability (set via configuration pages, see Section 5) available to TCAS systems on-board nearby aircraft to aid in the determination of TCAS advisories.

In addition to displaying the code, reply symbol and mode of operation, the GTX 328 screen displays pressure altitude, density altitude, temperature, and timer functions, depending on equipment connections and configuration selection. The unit also features an altitude monitor and flight timers. A voice or tone audio output announces altitude deviation and count down timer expiration.

The GTX 328 features multiple transmit/receive ARINC 429 and RS-232 data ports. The unit concentrates data from three ARINC 429 inputs, gray code, RS-232 input data and discrete inputs to the high-speed ARINC 429 output bus used by display systems such as the Garmin 400 Series/500 Series units.

The GTX 328 is configured with all key controls. The layout of the front panel keys and displays segregates the transponder's primary functions from the secondary functions. The unit can be configured so the aircraft avionics master bus can turn the unit on.

Provision is made for unit software upgrade by means of RS-232 data through rear connector pins. The installation of an optional connector is highly recommended. If the optional connector is placed in the aircraft, transponder removal and reinstallation for software upgrade is not required. The software can be changed while the unit is still mounted inside the aircraft.

1.3 Mutual Suppression Pulses

Other equipment on board the aircraft may transmit in the same frequency band as the transponder, such as DME or another transponder. Mutual suppression is a synchronous pulse that is sent to the other equipment to suppress transmission of a competing transmitter for the duration of the pulse train transmission. The transponder transmission may be suppressed by an external source and other equipment on board may be suppressed by the transponder. This feature is designed to limit mutual interference.

1.4 Interface Summary

The GTX 328 provides the following interface connections via the rear connector:

- Ten (10) encoding altimeter inputs.
- External IDENT input.
- External STBY input (useful for dual transponder installations).
- External suppression pulse input.
- Switched power output of up to 1.5 amps (for digital altitude encoder power).
- Aircraft dimming bus input voltage.
- Aircraft master switch turn-on option.
- Serial altitude or GPS groundspeed input.
- Serial altitude input. (Reduces wire count vs. parallel wire gray code altimeter interface.)
- Software update input.
- Supports Comm-A and Comm-B protocol.
- Temperature, Altitude Hold and Density Altitude.
- Digitally recorded voice and discrete warning annunciator activated by Altitude Hold when limits are exceeded.

The GTX 328 supports the following list of Binary Data Selector (BDS) 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,D) Mode S Specific Services Protocols (MSP) Capability Report
- BDS (2,0) Aircraft Identification

BDS register information is presented for the installation agency to understand the functionality of the GTX 328, and make a determination that the unit complies with the requirements of their civil aviation authorities. No further wiring or configuration programming is required for the unit.

Note that BDS (3,0) is only required for transponders compatible with ACAS/TCAS II. The GTX 328 does not support BDS (3,0).

1.5 Technical Specifications

1.5.1 Environmental Qualification Form

It is the responsibility of the installing agency to obtain the latest revision of the GTX 330/GTX 33/GTX 328 Environmental Qualification Form. The form is available directly from Garmin under the following part number:

GTX 330/GTX 33/GTX 328 Environmental Qualification Form,
Garmin part number 005-00131-03.

To obtain a copy of this form, see the dealer/OEM portion of the Garmin web site (www.garmin.com). The following tables present general environmental specifications. For detailed specifications, see the Environmental Qualification Form.

1.5.2 Electrical Specifications

Characteristic	Specification
TSO ENV CAT	Refer to Environmental Qualification Form
FCC Authorization	Emission Designator 12M0M1D
Applicable Documents	RTCA DO-160D, DO-181C, EuroCAE ED-73B
Unit Software	RTCA DO-178B Level D
Temperature Range	-45°C to +70°C (continuous operation)
Humidity	95% @ +50°C for 6 hours; 85% @ +38°C for 16 hours; Tested to Category A in DO-160D
Altitude	55,000 Feet
Transmitter Frequency	1090 MHz ±1 MHz
Transmitter Power	125 Watts minimum, 250 Watts nominal.
Receiver Frequency	1030 MHz
Receiver Sensitivity	-74 dBm nominal for 90% replies
Mode A Capability	4096 Identification Codes
Mode C Altitude Capability	100 Foot increments from -1000 to 62,700 feet.
Mode S Altitude Capability	25 Foot increments from -1000 to 50,175 feet with suitable serial data altitude. 100 Foot increments from -1000 to 62,700 feet.
Mode S Capability	Selective Identification Codes, Aircraft Type
External Suppression Input	Low ≤ 0.5 V; High ≥ 8 V, maximum is +33vDC
External Suppression Output	Output: minimum is +18V (for 300 ohm load) and maximum of +23V (for 2000 ohm load).
Audio Output	4.04 Vrms to 7.85 Vrms into a 500 Ω load

* **Note:** Refer to Paragraph 2.2.1 Configurations Available, for TSO class.

1.5.3 Physical Characteristics

Characteristic	Specification
Bezel Height	1.65 inches (42 mm)
Bezel Width	6.25 inches (159 mm)
Rack Height (Dimple to Dimple)	1.68 inches (43 mm)
Rack Width	6.30 inches (160 mm)
Depth Behind Panel with Connectors (measured from face of aircraft panel to rear of connector backshells)	11.25 inches (286 mm)
GTX 328 Unit Weight	3.4 lbs. (1.5 kg)
GTX 328 Rack Weight (Installed with rack and connectors)	4.2 lbs. (1.9 kg)

1.5.4 Power Requirements

Characteristic	Specification
Input Voltage Range	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, Code7777	1.6 A @ 27.5 Vdc, 3.1 A @ 13.75 Vdc
Maximum Quiescent	0.85 A @ 27.5 Vdc, 1.1A @ 13.75 Vdc

1.6 Certification

This installation manual does not constitute an approval to install this equipment. The installation must be approved by the appropriate competent aviation authority.

The aircraft installation must have a 'Certificate of Return to Service' signed by an appropriately licensed (EASA Part 66/NAA) engineer before flight; or other certification as agreed with the local national airworthiness authority.

The conditions and tests required for TSO/ETSO 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/ETSO standards. TSO/ETSO 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. For antenna TSO/ETSO compliance, refer to antenna manufacturer's literature.

1.6.1 TSO/ETSO Compliance

See the following table for GTX 328 TSO/ETSO compliance.

Function	Performance Standard (TSO/ETSO/RTCA/ICAO)	Category	Applicable LRU SW Part Numbers
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/MODE S) Airborne Equipment	TSO-C112	Class 2A	006-B0172-03 Rev. ()
Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/MODE S) Airborne Equipment	ETSO-2C112b	2C112b Level 2s	006-B0172-03 Rev. ()

1.6.2 TSO/ETSO Deviation

See the following table for GTX 328 TSO/ETSO deviations.

TSO/ETSO	Deviation
TSO-C112	1. Garmin was granted a deviation to use RTCA DO-178B, instead of RTCA DO-178A.
	2. Garmin was granted a deviation to use RTCA DO-160D instead of RTCA DO-160B.
	3. Garmin was granted a deviation to use DO-181C instead of DO-181/DO-181B, given the following modification: DO-181C Section 2.2.16.2.6.2 requires Mode S Transponders to include extended squitter capability. The GTX will not provide Mode S Extended Squitter for an ADS-B system.
ETSO-2C112b	1. Garmin was granted a deviation from ED73B, 1.4.2.2 to allow marking level indication on the chassis.

1.7 Aircraft Station Licensing 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 328 installation must comply with current transmitter licensing requirements. To find out the specific details on whether a particular installation is exempt from licensing, 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 328 owner accepts all responsibility for obtaining the proper licensing before using the transponder.

CAUTION

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

For non-US installations consult the local spectrum management agency for requirements.

1.8 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.

Garmin International, Inc.
1200 East 151st Street
Olathe, Kansas 66062, U.S.A.
Phone: 913/397.8200
FAX: 913/397.8282

Garmin (Europe) Ltd.
Unit 5, The Quadrangle, Abbey Park Industrial Estate
Romsey, SO51 9DL, U.K.
Phone: 44/0870.851241
FAX: 44/0870.851251

2 INSTALLATION OVERVIEW

2.1 Introduction

This section provides hardware equipment information for installing the GTX 328 Mode S Transponder, related hardware and optional accessories. Installation of the GTX 328 should follow the data detailed in this manual. Cabling is fabricated by the installing agency to fit each particular aircraft. The installation should follow the guidance of FAA Advisory Circulars AC 43.13-1B and AC 43.13-2A where applicable.

2.2 Installation Materials

The GTX 328 is available under the following part numbers:

2.2.1 Configurations Available

Model	Catalog Part Number	Unit Part Number	Front Panel Color	Install Kit/Docs*	TSO Class
GTX 328	010-00634-00	011-01684-00	Black	No	2A1 121 010
GTX 328	010-00634-01	011-01684-00	Black	Yes	2A1 121 010

* **Note:** Documentation includes pilot's guide and warranty registration card.

2.2.2 Equipment Available

Item	Garmin P/N
Sub Assy, Connector Kit, GTX 330	011-00583-00
SMP, GTX 330 Install Rack	115-00294-00
Sub Assy, Backplate, GTX 330	011-00582-00

* **Note:** A transponder antenna approved to TSO C66() or C74() that has been installed to meet the requirements of this manual may be approved for use with the GTX 328.

2.2.3 Additional Equipment Required

- Cables - The installer will supply all system cables including circuit breakers. Cable requirements and fabrication are detailed in Section 3 of this manual.
- Hardware - #6-32 x 100° Flat Head SS Screw [(MS24693, AN507R or other approved fastener) (6 ea.)] and #6-32 Self-Locking Nut [MS21042 or other approved fastener (6 ea.)]. Hardware required to mount the installation rack is not provided.
- Encoding Altitude Digitizer - Use encoding altimeter manufacturer's instructions, install according to FAA Advisory Circulars AC 43.13-1B and AC 43.13-2A. 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

The GTX 328 can interface with equipment including altimeters, Air Data Computer (ADC) and a temperature probe. RS-232 and ARINC 429 provide a serial communication path between interfacing equipment. Fabrication of a wiring harness is required.

Optional available discrete line interfaces are described in Section 4.5.2, Discrete Inputs, and shown in installation diagrams provided in Appendix C.

2.4 Antenna Installation

2.4.1 Antenna Location Considerations

Antenna mounting should utilize the aircraft manufacturer's Type Certificated antenna location and style of antenna. 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 2.6)

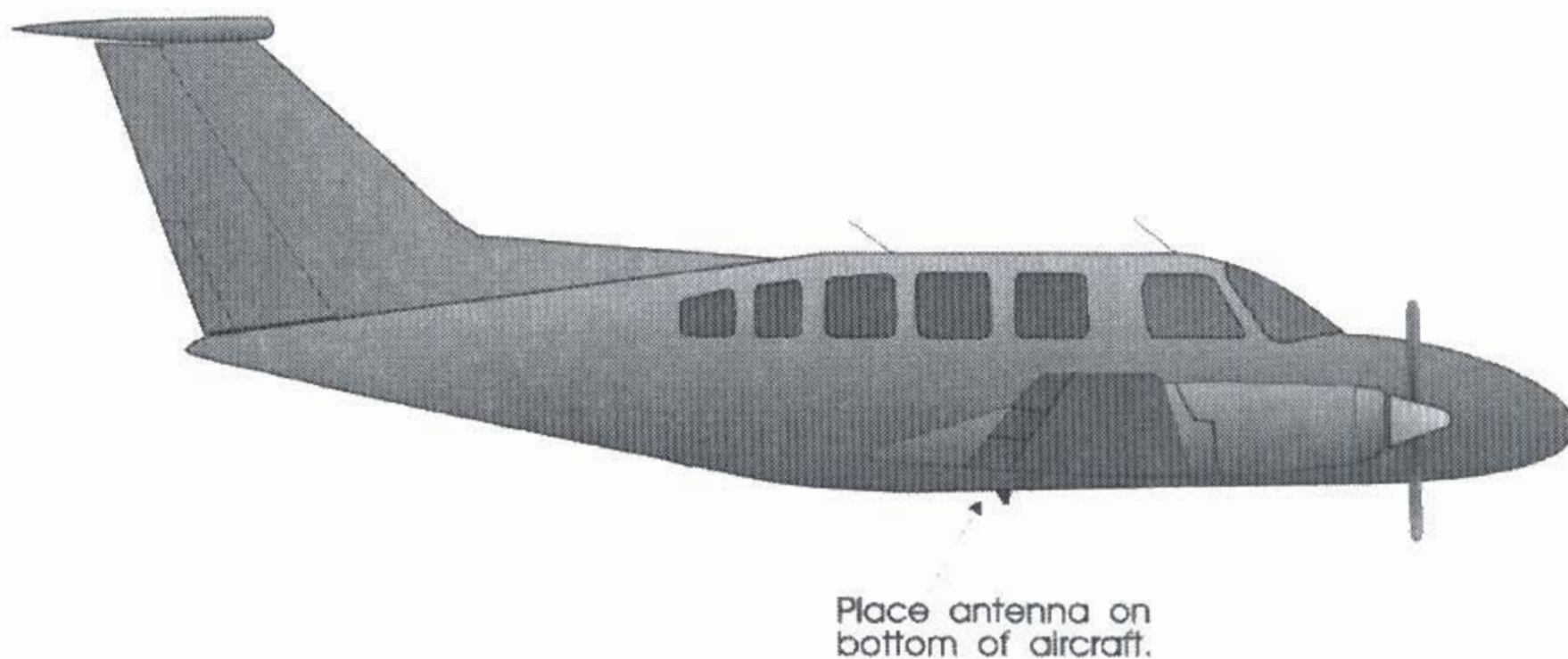


Figure 2-1. Antenna Installation Considerations

-
- A. The antenna (Garmin P/N 010-10160-00) 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 affect its radiation pattern.
 - B. The main antenna should be mounted vertically on the bottom of the aircraft.
 - C. 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 328.

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 pattern (gain) to be maximized for optimum transponder performance.

2.4.2 Antenna Installation

Install the antenna according to the antenna manufacturer's instructions and FAA Advisory Circulars AC 43.13-1B and AC 43.13-2A.

2.5 Cabling and Wiring

Use MIL-W-22759/16 or other approved wire, AWG #24 or larger wire for all connections. The standard pin contacts supplied in the connector kit are compatible with up to AWG #22 wire. In cases where some installations have more than one unit sharing a common circuit breaker, sizing and wire gauge is based on aircraft circuit breaker layout, length of wiring, current draw of units, and internal unit protection characteristics. Do not attempt to combine more than one unit on the same circuit breaker unless it is specified on aircraft manufacturer approved drawings.

In some cases, a larger gauge wire such as AWG #18 or #16 may be needed for power connections. If using #16 or #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.

The following table lists examples of the recommended antenna cable vendors and the type of cable to be used for specific lengths of cable. Any cable meeting specifications is acceptable for the installation.

The following table is for reference only, and lists some suitable cable types, along with the maximum length based on an assumed loss figure of 0.2 dB per connector. Any 50 Ω , double shielded coaxial cable assembly that meets airworthiness requirements and less than or equal to (\leq) 2dB maximum loss figure (including connectors) may be used.

Max. Length (feet – [m])	Insertion loss (dB/100ft)	ECS Type	MIL-C-17 Type	RG Type
8' 11" [2.71m]	18.0		M17/128-RG400	RG-400
11' 1" [3.37m]	14.45	3C142B		
13' 4" [4.06m]	12.00		M17/112-RG304	RG-304
18' 2" [5.54m]	8.8	311601	M17/127-RG393	RG-393
22' 6" [6.85m]	7.12	311501		
28' 9" [8.77m]	5.56	311201		
44' 1" [13.43m]	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.

2.5.1 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.
- 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 ADF antenna cable (allow at least a 12-inch separation).

2.6 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.

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 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.

2.7 Cooling Air

The GTX 328 meets all applicable TSO requirements without forced air cooling. The application of forced air cooling to the rear air nozzle of the GTX 328 is highly recommended to provide beneficial cooling to the unit.

The GTX 328 was designed to handle a constant interrogation of 450 Pulse Repetition Frequency (PRF) per second, with short periods of 1200 PRF. Rate limit is set at 1200 PRF. A typical radar site would interrogate the transponder once every 5 to 10 seconds for approximately 100 milliseconds at a 400 PRF rate. In very high traffic areas with multiple ground stations and TCAS traffic it is possible to have long term PRF rates above 450 PRF.

2.8 GTX 328 Installation

2.8.1 Viewing Angle

Ensure that any mounting location will offer sufficient viewing angle. The display has been proven to meet specifications when seen within the following envelope of viewing positions:

Direction	Pilot's Viewing Angle
Left and Right	$\pm 45^\circ$
From Top	30°
From Bottom	10°

2.8.2 Mechanical Installation

NOTE

Avoid installing the unit near heat sources. If this is not possible, ensure that additional cooling is provided. Allow adequate space for installation of cables and connectors. The installer will supply and fabricate all of the cables. All wiring must be in accordance with FAA Advisory Circulars AC 43.13-1B and AC 43.13-2A.

1. Assemble the connector/rack kit according to Figure B-2. Install the rack assembly according to the dimensions given in Figure B-1 and paragraph 1.6.2, Physical Characteristics. Mounting brackets are not supplied due to the wide range of mounting configurations available. Suitable mounting brackets may be fabricated from sheet metal or angle stock. To ensure a sturdy mount, rear support for the unit must be provided.
2. Looking at the bottom of the transponder, make sure the front lobe of the locking mechanism is in a vertical position. This can be accomplished by using a 3/32" hex wrench through the face plate.
3. Slide the unit into the rack until the front lobe of the unit touches the rack.
4. Turn the hex wrench clockwise until unit is secured in the rack. Continue turning until tight. Do not overtighten the screw.
5. To remove the unit from the rack, turn the 3/32" hex wrench counterclockwise until it disengages from the rack.

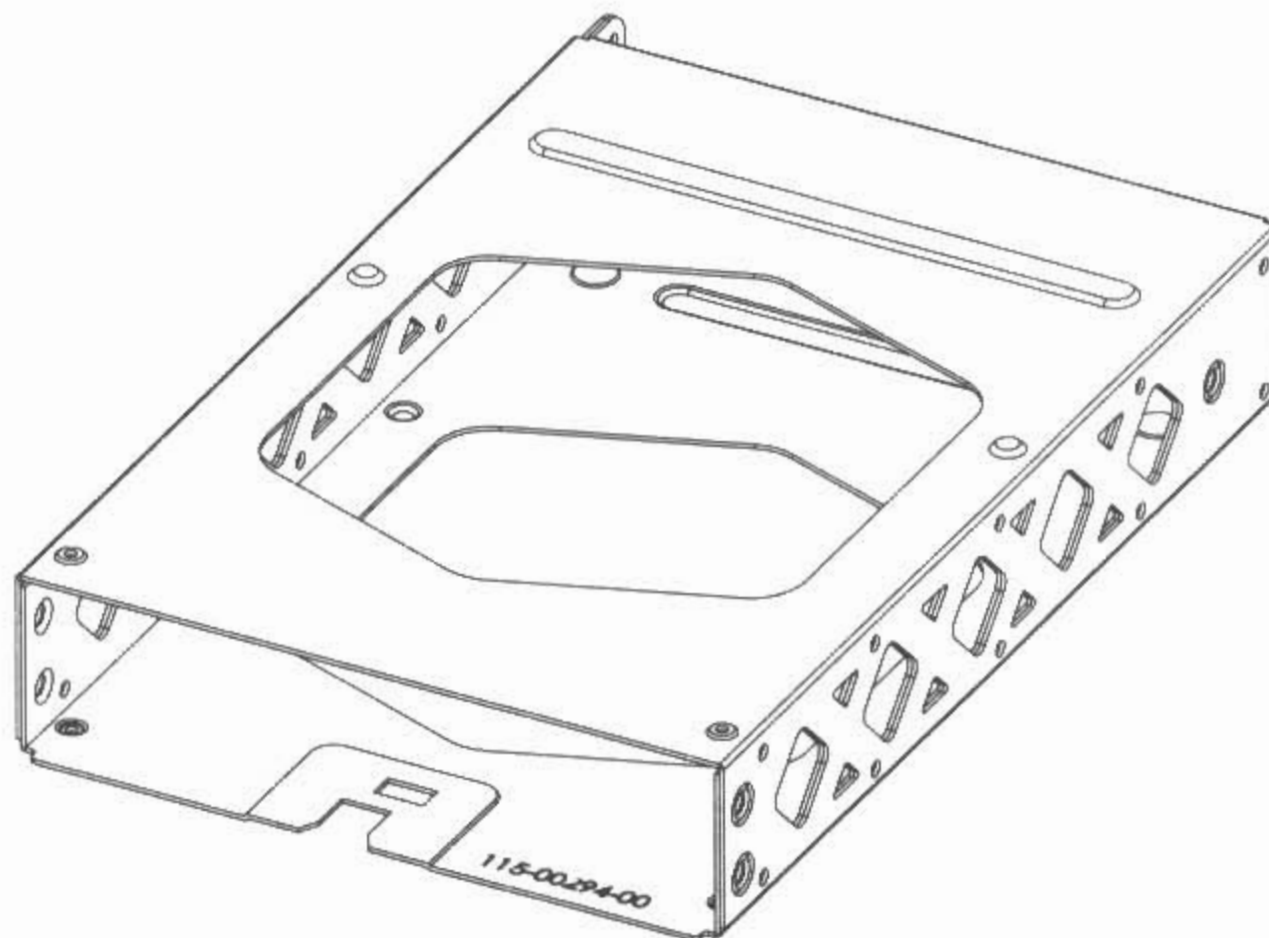


Figure 2-2. GTX 330 Install Rack (115-00294-00)

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 of the item within the container.

3.2 Electrical Connections

All electrical connections, except for the antenna(s) and shield ground, are made through a single, 62 pin D-subminiature connector (see Figure 4-1). The card-edge connector may be used to terminate shield grounds to the GTX 328 back plate. Table 4-1 lists the electrical connections of all input and output signals. See Appendix C for interconnect wiring diagrams and cable requirements for each signal. Required connector and associated hardware are supplied in the connector kit (P/N 011-00583-00).

CAUTION

Check wiring connections for errors before inserting the GTX 328 into the rack. Incorrect wiring could cause internal component damage.

Table 3-1. Pin Contact Part Numbers (Hi Density)

Manufacturer (Note 1)	62 pin D-Subminiature connector (P3281)		
	16 AWG (Power Only)	18-20 AWG (Power Only)	22-28 AWG
Garmin P/N	336-00044-01	336-00044-00	336-00021-00
Military P/N	N/A	N/A	M39029/58-360
AMP	N/A	N/A	204370-2
Positronic	N/A	N/A	MC8522D
ITT Cannon	N/A	N/A	030-2042-000

Table 3-2. Recommended Crimp Tools (Hi Density)

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

NOTES

1. Non-Garmin part numbers shown are not maintained by Garmin and consequently are subject to change without notice.
2. Extracting the 16 and 18 AWG contact 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. Contact Garmin for crimp instructions for use with 16 AWG contact.

3.3 Circuit Breaker Placard

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

3.4 Post Installation Checkout

After the installation is complete, refer to Section 5 for system configuration.

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

4 SYSTEM INTERCONNECTS

4.1 Pin Function List

4.1.1 J3281

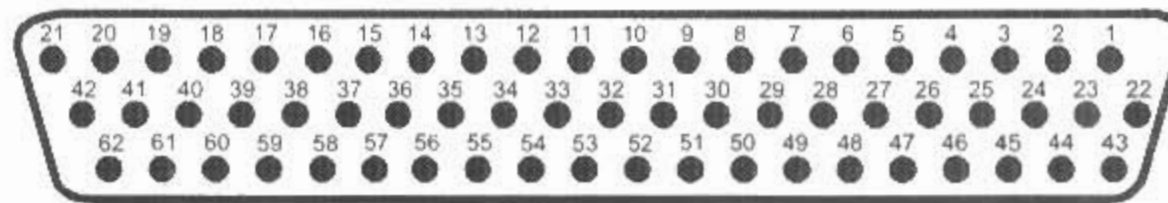


Figure 4-1. Rear Connector, J3281

Table 4-1. P3281 Pin Assignments

Pin	Pin Name	I/O
1	AVIONICS MASTER ON SELECT	In
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	28 V LIGHTING BUS HI	In
15	AUDIO OUT HI	Out
16	AUDIO OUT LO	Out
17	SQUAT SWITCH IN	In
18	RESERVED	--
19	ALTITUDE ALERT ANNUNCIATE*	Out
20	RESERVED	--
21	AIRCRAFT POWER 1	In
22	RS-232 IN 1	In
23	RS-232 OUT 1	Out
24	RS-232 IN 2	In
25	RS-232 OUT 2	Out
26	ARINC 429 IN 3 A	In
27	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. P3281 Pin Assignments (Cont'd)

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	--
39	RESERVED	--
40	SPARE	--
41	CURRENT TEMPERATURE PROBE OUT	Out
42	AIRCRAFT POWER 1	In
43	POWER GROUND	--
44	CURRENT TEMPERATURE PROBE IN	In
45	14 V/5 V LIGHTING BUS HI	In
46	RESERVED	--
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	--
52	RESERVED	--
53	RESERVED	--
54	RESERVED	--
55	SPARE	--
56	AIRCRAFT POWER 2	In
57	SPARE	--
58	RESERVED	--
59	SPARE	--
60	AIRCRAFT POWER 2	In
61	SPARE	--
62	SWITCHED POWER OUT	Out

* Denotes Active Low (Ground to activate).

4.2 Power and Lighting Function

Power Input requirements and Lighting Bus input are listed in the following tables. The power-input pins accept 14/28 Vdc. AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses. Switched Power Out is a power source available for devices such as a remote digital altitude encoder. Refer to Figures C-1 and C-2 for power and lighting interconnections.

4.2.1 Aircraft Power

Table 4-2. Aircraft Power Pin Assignments

Pin Name	Pin Number	I/O
AIRCRAFT POWER 1	21	In
AIRCRAFT POWER 1	42	In
AIRCRAFT POWER 2	56	In
AIRCRAFT POWER 2	60	In
SWITCHED POWER OUT	62	Out
POWER GROUND	27	--
POWER GROUND	43	--

4.2.2 Lighting Bus

The GTX 328 unit can be configured to track a 28 Vdc, 14 Vdc, 5 Vdc or 5 Vac lighting bus using these inputs. The GTX 328 can also automatically adjust for ambient lighting conditions based on the photocell. Refer to Sections 5.2.4 and 5.2.5 for lighting configuration.

Table 4-3. Aircraft Lighting Pin Assignments

Pin Name	Pin Number	I/O
14 V/5 V LIGHTING BUS HI	45	In
28 V LIGHTING BUS HI	14	In

4.3 Temperature Inputs

Table 4-4. Temperature Probe Pin Assignments

Pin Name	Pin Number	I/O
CURRENT TEMPERATURE PROBE OUT	41	Out
CURRENT TEMPERATURE PROBE IN	44	In

Temperature input is used for Outside Air Temperature (OAT) display and Density Altitude computations. The type of temperature probe required is a current sensor type, such as an EDMO P/N 655-PROBE or Davtron P/N C307PS. Connect the red wire to pin 41 and the black wire to pin 44. The GTX 328 is not configurable for different types of temperature sensors. The temperature-input specification is 1 microamp per degree Kelvin (1 $\mu\text{A}/^\circ\text{K}$). Refer to Figure C-6 for the temperature probe interconnect and to Section 5.2.11 for probe configuration.

4.4 Altitude Functions

Parallel gray code altitude inputs are considered active if either the voltage to ground is $< 1.9\text{ V}$ or the resistance to ground is $< 375\ \Omega$. These inputs are considered inactive if the voltage to ground is 11-33 Vdc. Refer to Figures C-6 and C-9 for parallel gray code and serial data altitude interconnections. Carefully check encoder input lines for correct connection after wiring is complete.

NOTES

The GTX 328 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 328, 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 altimeters 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.

Among the surveillance items the Mode S transponder will transmit to the ground stations and other aircraft are altitude reporting in 25-foot increments with the proper encoder. In order to report altitude in 25-foot increments the GTX 328 must receive altitude from suitable altitude reporting devices through serial input connections. Altitude input to the GTX 328 received from parallel wire gray code encoders is supplied to the unit in 100-foot increments and thus reported in 100-foot increments.

4.4.1 Altimeter Inputs

Table 4-5. Encoded Altitude Pin Assignments

Pin Name	Pin Number	I/O
ALTITUDE D4	11	In
ALTITUDE A1	2	In
ALTITUDE A2	4	In
ALTITUDE A4	5	In
ALTITUDE B1	7	In
ALTITUDE B2	9	In
ALTITUDE B4	10	In
ALTITUDE C1	8	In
ALTITUDE C2	3	In
ALTITUDE C4	6	In
ALTITUDE COMMON	50	--
RS-232 IN 2	24	In

4.4.2 Altimeter Calibration and Checkout

Refer to Section 5.2.14 for the gray code altitude checkout.

4.4.3 Altimeter Interconnect, Dual GTX 328 Installation

A dual GTX 328 installation can accept either parallel wire gray code altimeter input or RS-232 serial data input as shown in Figure 4-2. If transponder number 2 is a Garmin GTX 327, connect the RS-232 output from the altitude encoder to J3271 pin 19 (refer to GTX 327 Transponder Installation Manual, P/N 190-00187-02).

Refer to Figure C-9, Sheet 1 for dual GTX 328 gray code altimeter interconnections. Refer to Figure C-9, Sheets 2 and 3 for dual altimeter interconnections to a GNS 480 (CNX80). The GNS 480 (CNX80) can receive digital data from only one transponder at a time. Due to system configuration, dual transponders must be identical, i.e. dual GTX 328s, in a system with one GNS 480 (CNX80).

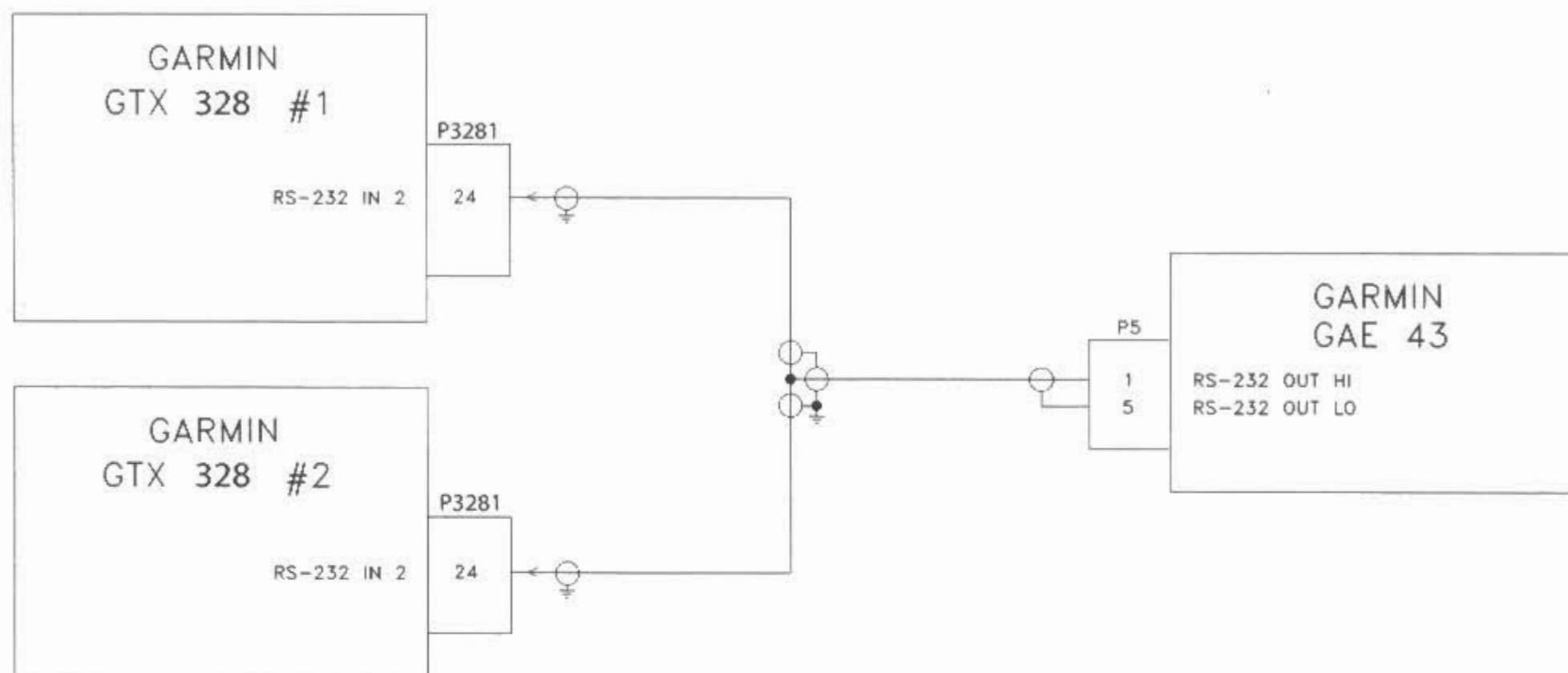


Figure 4-2. Dual GTX 328, Single Encoder, Serial Input Connections

For complete dual installations containing two encoders, it is best to connect one encoder to each transponder.

4.4.4 Altimeter Selection Priority

The installer must be aware of the GTX 328 priority for selecting encoded altimeter interconnections. The GTX 328 searches in this sequence for altitude, and stops when it finds a valid pressure altitude input.

Only approved devices may provide altitude to the GTX 328 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.

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) if so connected*
- 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')

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 Section 5.2.8 and 5.2.9 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 328 to a GNS 480 (CNX80).

4.5 Discrete Functions

4.5.1 Discrete Outputs

External suppression should be connected if a DME is installed in the aircraft avionics system. The GTX 328 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 328 mutual suppression output. In this case, leave the suppression pin open.

Table 4-6. Discrete Outputs Pin Assignments

Pin Name	Pin Number	I/O
ALTITUDE ALERT ANNUNCIATE*	19	Out
EXTERNAL SUPPRESSION I/O	31	In/Out

* This output is considered active if either the voltage to ground is < 1.9 V or the resistance to ground is < 375 Ω . This output is considered inactive if the voltage to ground is 11-33 Vdc.

4.5.2 Discrete Inputs

Table 4-7. Discrete Inputs Pin Assignments

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

* These inputs are considered active if either the voltage to ground is < 1.9 V or the resistance to ground is $< 375 \Omega$. These inputs are considered inactive if the voltage to ground is 11-33 Vdc.

EXTERNAL IDENT SELECT (remote IDENT) is a momentary input.

Refer to Figure C-4 for the squat switch interconnect and to Sections 5.2.10. and 5.2.15 for the squat switch configuration.

EXTERNAL STANDBY SELECT (remote STANDBY) is a momentary input used when two GTX 328 systems are installed in an aircraft. Refer to Figures C-4, C-7 and C-9 for the EXTERNAL STANDBY SELECT interconnect and to Sections 5.2.15 for verifying external standby configuration. When EXTERNAL STANDBY SELECT is grounded, ARINC 429 OUT PORT 1 remains active, while PORT 2 is inactive.

The muting feature may be enabled through a Multi-Function display. In order to prevent inadvertent muting, the status of muting must default to "Mute off" upon each power cycle. Refer to Figures C-1, C-4, and C-8 for AUDIO MUTE SELECT connections and to Sections 5.2.2 for AUDIO configuration.

4.6 Serial Data Electrical Characteristics

The GTX 328 can be configured to include GPS, Airdata, AHRS, EFIS/Airdata, and ADLP ARINC 429 inputs, functioning as an ARINC 429 data concentrator.

Since the Garmin 400/500 Series products have only two ARINC 429 input ports, the GTX 328 manages support for several equipment interfaces. The GTX 328 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 port. This line is then wired to an ARINC 429 input port on the 400/500 Series products.

Airborne Data Link Processor (ADLP) is reserved for future data link applications. ADLP requires an ARINC 429 input and output. The ADLP interface allows the Mode S data link transponder to function as a modem. An ADLP performs functions requiring sending and/or receiving data from ground sensors via Mode S interrogations and replies.

4.6.1 RS-232 Input/Output

Table 4-8. RS-232 Pin Assignments

Pin Name	Pin Number	I/O
RS-232 OUT 1	23	Out
RS-232 IN 1	22	In
RS-232 OUT 2	25	Out
RS-232 IN 2	24	In

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 4-3, C-2, C-3, C-5, C-6, C-7, C-8, and C-9 for RS-232 serial data interconnect and to Sections 5.2.9 and 5.2.17 for RS-232 serial data configuration.

When connecting two GTX 328 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-9, Sheets 2 and 3.

4.6.2 RS-232 Input/Output, Software Update Connections

When the GTX 328 is installed in an aircraft 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 panel. The connector can be mounted anywhere convenient for access, such as under the instrument panel, on a remote avionics shelf 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 328 installation interfaces with a GNS 480 (CNX80) in the aircraft, the GNS 480 (CNX80) must be turned off during GTX 328 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 J3282 to an antenna or a 50 Ω , 5-Watt load. The GTX 328 transmits Mode S acquisition squitter replies about once per second whether interrogations are received or not.

The GTX 328 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. See Figure 4-3 for software update connections.

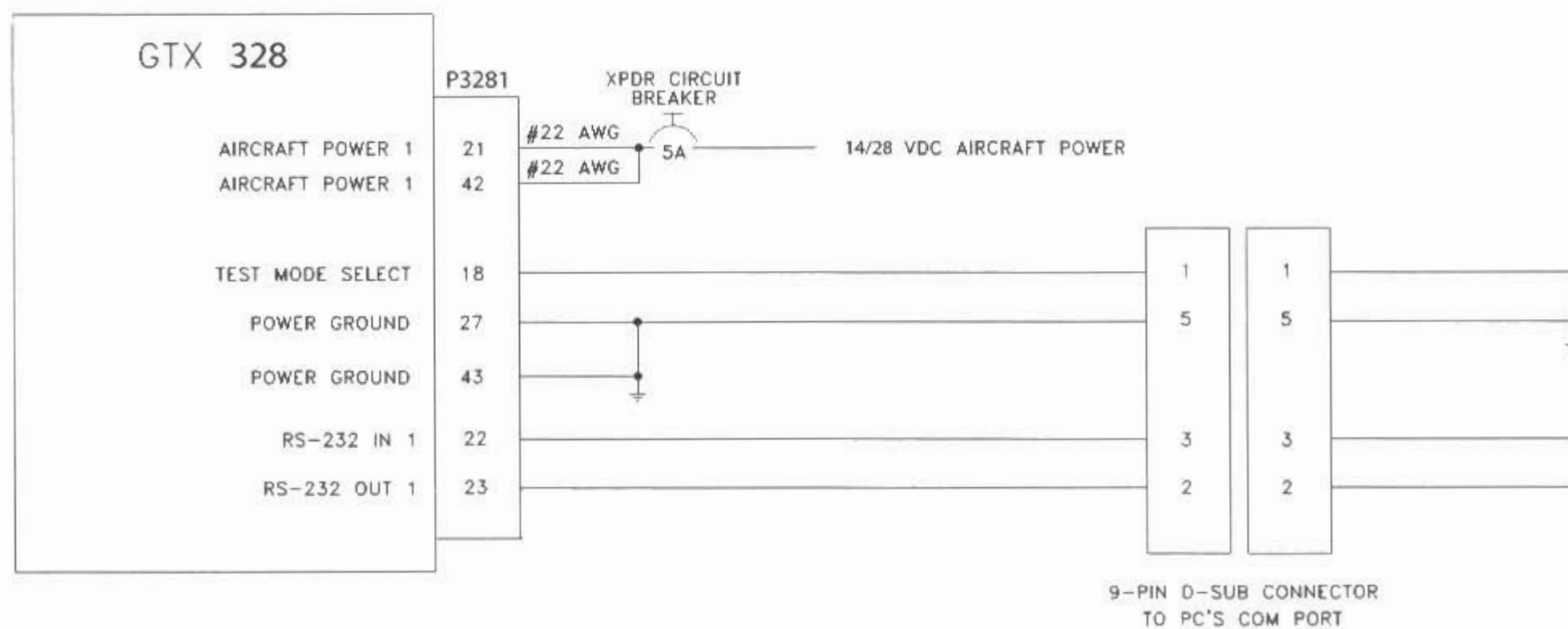


Figure 4-3. GTX 328, Software Update Connections

4.6.3 ARINC 429 Input/Output

The ARINC 429 Output 2 port (J3281 pins 30 and 28), is at a high-impedance when in remote standby, therefore not active. When two GTX 328s are installed, the two ARINC 429 Output 2 ports may be hard wired together since the EXTERNAL STANDBY SELECT input is active for only one of the two GTX 328s at any given time.

The GTX 328 ARINC 429 Output 1 port is active when J3281 pin 13 is grounded [EXTERNAL STANDBY SELECT (remote STANDBY)]. In installations having a transponder combination of GTX 328/GTX 330 (or GTX 328/other transponder), the GARMIN format from the ARINC 429 Output 1 port (J3281 pins 34 and 37) is available.

Table 4-9. ARINC 429 Pin Assignments

Pin Name	Pin Number	I/O
ARINC 429 OUT 1A	37	Out
ARINC 429 OUT 1B	34	Out
ARINC 429 IN 1A	32	In
ARINC 429 IN 1B	35	In
ARINC 429 IN 2A	33	In
ARINC 429 IN 2B	36	In
ARINC 429 OUT 2A	30	Out
ARINC 429 OUT 2B	28	Out
ARINC 429 IN 3A	26	In
ARINC 429 IN 3B	29	In
ARINC 429 IN 4A	48	In
ARINC 429 IN 4B	49	In

The ARINC 429 outputs conform to ARINC 429 electrical specifications when loaded with up to 5 standard ARINC 429 receivers. Refer to Figures C-1, C-3, C-5, C-7 and C-8 for the ARINC 429 serial data interconnect and Sections 5.2.8 and 5.2.18 for ARINC 429 serial data configuration.

5 POST INSTALLATION CONFIGURATION AND CHECKOUT PROCEDURE

Perhaps the most important factor in the GTX 328 transponder configuration and checkout is the Mode S address entry. Refer to Section 5.2.12 for Mode S address entry pages.

CAUTION

Be sure to check all aircraft control movements before flight is attempted to ensure that the wiring harness does not touch any moving part.

Verify proper operation of the transponder during a flight test under VFR conditions. If the unit detects an internal failure mode the word FAIL is displayed on the screen.

Make sure an approved device is installed for reporting altitude in accordance with 14 CFR 91.217. Refer to Section 4.4.4 for altimeter data selection priority.

5.1 Operation

NOTE

The coverage you can expect from the GTX 328 is limited to line of sight. Low altitude or antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.



Figure 5-1. GTX 328 Front Panel

NOTE

The GTX 328 should be turned off before starting aircraft engine(s).

5.1.1 Function Selector Switches

The function selection switches are:

- **OFF** — Powers off the GTX 328. Pressing the STBY, ON or ALT key powers on the transponder displaying the last active identification code.
- **STBY** — Selects the standby mode. When in standby mode, the transponder does not reply to any interrogations. Pressing and holding the STBY key selects ground (GND) mode if Automated Airborne Determination is not otherwise selected from another source. When GND is annunciated, the transponder does not respond to ATCRBS interrogations but squitters and replies to discretely addressed Mode S interrogations.
- **ON** — Selects Mode A and Mode S. In this mode, the transponder replies to Mode A, Mode C and Mode S interrogations, as indicated by the Reply Symbol (“®”), but the replies do not include altitude information.
- **ALT** — Selects Mode A, Mode C and Mode S. In ALT mode, the transponder replies to identification, altitude and Mode S interrogations as indicated by the Reply Symbol (“®”). Replies to altitude interrogations include the standard pressure altitude received from an external altitude source, which is not adjusted for barometric pressure. The ALT mode may be selected in aircraft not equipped with an optional altitude encoder; however, the reply signal does not include altitude information.

NOTE

Any time the function switch is in the ON or ALT position the transponder becomes an active part of the Air Traffic Control Radar Beacon System (ATCRBS). The transponder also responds to interrogations from TCAS equipped aircraft.

- **IDENT** — Pressing the IDENT key activates the Special Position Identification (SPI) Pulse for 18 seconds, identifying the transponder return from others on an air traffic controller’s screen. During the IDENT period the word ‘IDENT’ appears in the upper left corner of the display.
- **VFR** — Sets the transponder code to the pre-programmed VFR code selected in Configuration mode (Set to 7000 at the factory). Pressing the VFR key again restores the previous identification code.
- **FUNC** — Changes the page shown on the right side of the display. Display data includes Pressure Altitude, Flight Time, Altitude Monitor, Count Up and Count Down timers. In the Configuration mode, steps through the function pages.
- **START/STOP** — Starts and stops the Altitude Monitor, Count Up, Count Down and Flight timers. In Configuration mode, steps through functions in reverse.

- **CRSR** — Initiates entry of the starting time for the Count Down timer and cancels transponder code entry. Selects changeable fields in Configuration mode.
- **CLR** — Resets the Count Up, Count Down and Flight timers. Cancels the previous keypress during code selection and Count Down entry. Used in Configuration mode.
- **8** — Reduces Contrast and Display Brightness when the respective fields are displayed and enters the number eight into the Count Down timer. Used in Configuration mode.
- **9** — Increases Contrast and Display Brightness when the respective fields are displayed and enters the number nine into the Count Down timer. Used in Configuration mode.

5.1.2 Code Selection

Code selection is entered with eight keys (0 – 7) providing 4,096 active identification codes. Pushing one of these keys begins the code selection sequence. The new code is not activated until the fourth digit is entered. Pressing the CLR key moves the cursor back to the previous digit. Pressing the CLR key when the cursor is on the first digit of the code, or pressing the CRSR key during code entry, removes the cursor and cancels data entry, restoring the previous code. You may press the CLR key up to five seconds after code entry is complete to return the cursor to the fourth digit. The numbers 8 and 9 are not used for code entry, only for entering a Count Down time, contrast and display brightness, and data selection in the Configuration mode.

NOTE

The selected identification code should be entered carefully, either one assigned by air traffic control for IFR flight or an applicable VFR transponder code.

- **Important Codes:**

1200 — VFR code for any altitude in the US (Refer to ICAO standards elsewhere)

2000 — VFR code commonly used in Europe (Refer to ICAO standards)

7000 — VFR code commonly used in Europe (Refer to ICAO standards)

7500 — Hijack code (Aircraft is subject to unlawful interference)

7600 — Loss of communications

7700 — Emergency

Avoid selecting code 7500 and all codes in the 7600-7777 range. These codes trigger special indicators in automated facilities. An aircraft's transponder code is used for ATC tracking purposes, therefore exercise care when making routine code changes.

5.1.3 Function Display

PRESSURE ALT	Displays the altitude data supplied to the GTX 328 in feet, hundreds of feet (i.e., flight level), or meters, depending on configuration.
FLIGHT TIME	Displays the Flight Time, controlled by the START/STOP key or by one of four airborne sources (squat switch, GPS ground speed recognition, airdata airspeed recognition or altitude increase) as configured during installation. The timer begins when the GTX 328 determines that the aircraft is airborne.
ALTITUDE MONITOR	Controlled by START/STOP key. Activates a voice alarm and warning annunciator when altitude limit is exceeded.
OAT/DALT	Displayed when the GTX 328 is configured with temperature input. Displays Outside Air Temperature and Density Altitude.
COUNT UP TIMER	Controlled by START/STOP and CLR keys.
COUNT DOWN TIMER	Controlled by START/STOP, CLR, and CRSR keys. The initial Count Down time is entered with the 0 – 9 keys.
CONTRAST	This page is only displayed if manual contrast mode is selected in Configuration mode. Contrast is controlled by the 8 and 9 keys.
DISPLAY	This page is only displayed if manual backlighting mode is selected in Configuration mode. Backlighting is controlled by the 8 and 9 keys.

5.2 Configuration Pages

NOTES

The configuration descriptions given in this section reflect software version 5.00 or higher.

When connecting the GTX 328 to a GNS 480 (CNX80) the transponder can be configured from either the GNS 480 (CNX80) or the GTX 328. Although possible from the GNS 480 (CNX80), configuration from the GTX 328 front panel offers more functions and easier to interpret displays.

Holding down the FUNC key and pressing the ON key provides access to the configuration pages. The FUNC key sequences forward through the configuration pages. The START/STOP key reverses through the pages, stopping at the Menu page. The CRSR key highlights selectable fields on each page. When a field is highlighted, the 0 – 9 keys enter numeric data and the 8 or 9 keys move through list selections. Press the CRSR key to accept changes. When a field is highlighted, pressing the FUNC key moves to the next configuration page without saving the changes.

Changes made through the configuration pages are stored in EEPROM memory. To exit the configuration pages, turn the power off. Then turn on again (without holding the FUNC key) for normal operation.

The configuration page sequence is as follows (menu categories are listed in parentheses):

- 'Jump To' Menu
- Audio and Messages #1
- Audio and Messages #2
- Display Mode
- Display Backlight
- Key Backlight
- Contrast
- VFR Key Configuration
- ARINC 429 Input #1 (First I/O Configuration page)
- ARINC 429 Input #2 (Second I/O Configuration page)
- ARINC 429 Output
- RS-232 Input Output
- Operation Configuration #1 (First Aircraft Configuration page)
- Operation Configuration #2 (Second Aircraft Configuration page)
- Temperature
- Aircraft Address
- Flight ID
- Aircraft Type
- Gray Code Input
- External Switch State
- Analog Input
- RS-232 Input Display
- ARINC 429 Input Display #1
- ARINC 429 Input Display #2

5.2.1 Configuration Menu Page

JUMP TO **DIAGNOSTICS**

CONFIGURATION MENU

CONFIGURATION MENU Page

The JUMP TO menu page provides the capability to select a Configuration mode starting page without having to step through all of the pages. Press the CRSR key and sequence through to the desired selection with the 8 and 9 keys. Jump to the selection by pressing the CRSR key again with the desired selection highlighted.

The FUNC key steps to the next configuration page, after which the START/STOP key reverses until stopping at the JUMP TO menu page.

SELECTION	DESCRIPTION
DIAGNOSTICS	Jumps to Gray Code Input page.
DISPLAY/AUDIO	Jumps to Audio Volume page.
I/O CONFIG	Jumps to ARINC 429 INPUT #1 page.
ACFT CONFIG	Jumps to Operation Configuration #1 page.

5.2.2 Audio Mode Pages

VOICE and VOLUME

Select desired VOICE. Make sure the volume level is sufficient for the aircraft environment involved.

AUDIO **VOLUME**
VOICE FEMALE **MESSAGE 0**

AUDIO MODE (First) Page

ALTITUDE MONITOR **OFF** **DISABLE**
 COUNT DOWN TIMER **OFF**

AUDIO MODE (Second) Page

MESSAGE

Message is used as a test function only. Message 0 is a continuous tone. Message 1 is a short tone, 2 and 4 are voice messages. Choose each selection to listen to the message.

SELECTION	DESCRIPTION
VOICE (MALE/FEMALE)	Sets the voice to male or female. Default is male voice.
VOLUME	Volume is adjusted from 0 (default) to maximum with the 8 or 9 key.
MESSAGE (0-9)	Selected audio tones and messages: 0 = Toggles a continuous tone on and off. 1 = Attention Tone, precedes voice messages to attract the pilot's attention. 2 = "Leaving Altitude," when altitude monitor is active and the altitude deviation is exceeded. 4 = "Timer Expired," when the countdown timer expires. 3, 5, 6, 7, 8, and 9 are not used at this time.
ALTITUDE MONITOR	Off, tone or message
COUNT DOWN TIMER	Off, tone or message
PAGE CHANGE	Enables/Disables Altitude Monitor sub page when altitude deviation is exceeded.

5.2.3 Display Mode Page

DISPLAY MODE **AUTO** LEVEL **75**

DISPLAY MODE Page

DISPLAY MODE

SELECTION	DESCRIPTION
AUTO (Automatic)	DEFAULT. Display automatically changes between Positive mode (during the day) and Negative mode (at night), depending on ambient light level received by the photocell.
NGTV (Negative)	Display always has light characters on a black background, regardless of ambient lighting.
PSTV (Positive)	Display always has black characters on a light background, regardless of ambient lighting.

LEVEL

Sets the ambient light level for AUTO mode to change between negative and positive display. The higher the number, the brighter the ambient light level to change over. This field has a range of 0 (zero) to 99, with the default set to 75.

5.2.4 Display Backlight Page

BKLT **AUTO** LVL **624** RSP TIME **4** MIN **88**

BKLT SRCE **PHOTO** SLOPE **50** OFFSET **50**

DISPLAY BACKLIGHT Page

BKLT (Backlight)

SELECTION	DESCRIPTION
AUTO (Automatic)	DEFAULT. Display backlighting is automatically controlled, based on the parameters entered on this configuration page. When AUTO is selected, the DISPLAY page does not appear to the pilot.
MAN (Manual)	Display backlighting is controlled manually by the pilot on the GTX 328 DISPLAY page. No backlight parameters can be entered when the manual mode is selected.

LVL (Level)

Shows the current level of display backlighting, based on the lighting input source (lighting bus voltage, or the ambient light if the source is PHOTO) and the settings on this configuration page. This field has a range of 0 (zero) to 999. The level is set by pressing the 8 and 9 keys when MAN mode is selected. When in AUTO mode, the field is for display only.

RSP TIME (Response Time)

Sets the speed with which the brightness responds to ambient light changes (only for AUTO backlight mode). The higher the number, the slower the display responds. This field has a range of 0 to 7, with the default set to 4.

