AT7000

Mode S Transponder

Installation Manual

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RELATED DOCUMENTS

AT7000 Mode S Transponder Factory Service Manual 560-7016-000

NOTES

Record of Revisions

For each revision, insert the revised pages into your manual and discard the replaced pages. On this record page, note the revision number and date, date pages were inserted into the manual, and the initials of the person inserting the pages.

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Section 1 - Introduction

The AT7000 is a Mode S Data Link Transponder that provides surveillance functions to ground-based and airborne interrogators. It responds to ATCRBS interrogations as well.

1.1 About This Manual

This manual describes the installation of the UPS Aviation Technologies AT7000 Mode S Transponder along with a description of the other units that connect to the transponder. This manual is intended for use by persons certified by the Federal Aviation Administration (FAA) to install avionics devices. It includes installation and checkout procedures for the UPS Aviation Technologies AT7000 Mode S Transponder.

1.2 System Description

1.2.1 System Overview

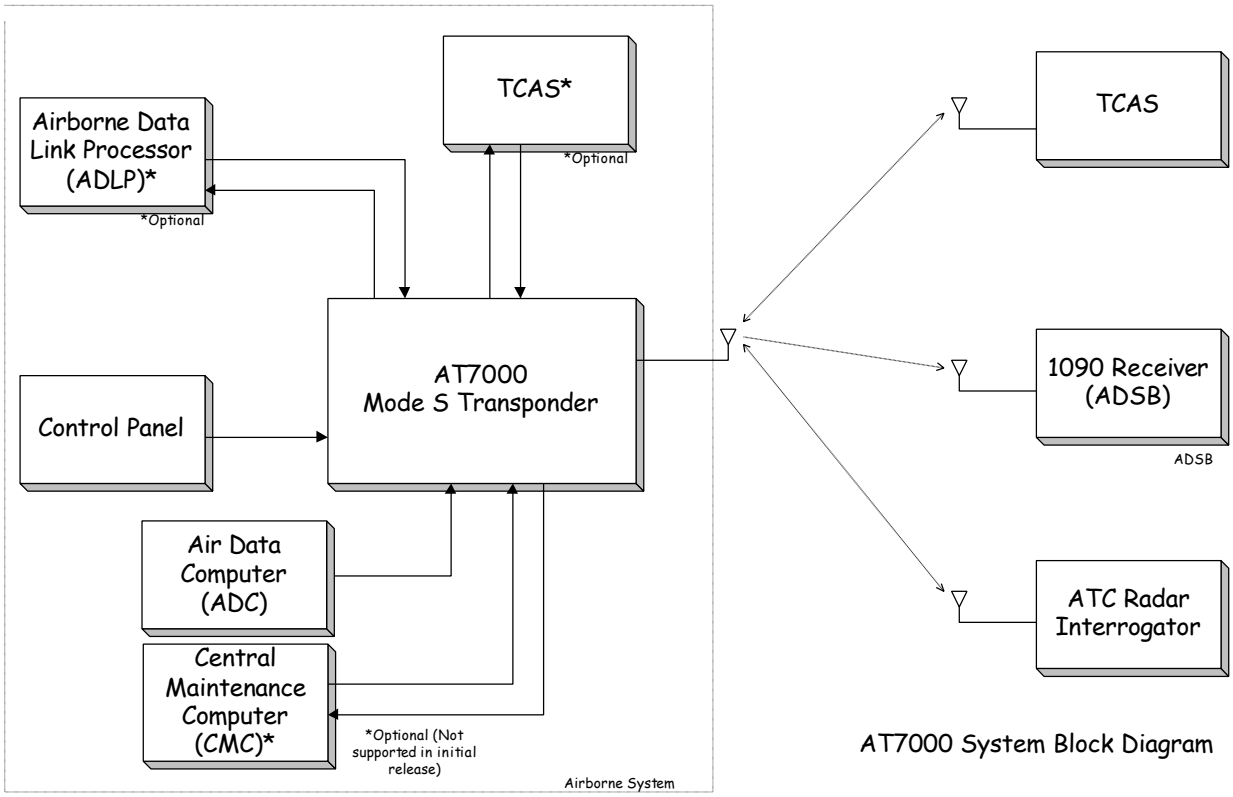


Figure 1 -- AT7000 System Block Diagram

1.2.2 AT7000 Mode S Transponder

The AT7000 transponder is packaged in a 4-MCU (Modular Concept Unit) outlined as defined in ARINC Characteristic 600-7. The basic mechanical chassis is constructed of lightweight aluminum alloy sheet metal. The unit uses forced air cooling per ARINC 404 or 600. ARINC standard LRU restraints are used as means of holding the transponder in the mounting rack or tray. The maximum weight of the transponder is 11.5 pounds (5.2 kilograms). The rear connector receptacle is a size 2-shell assembly with inserts and contacts as defined in ARINC Characteristic 718-4/718A. The unit features a fixed carrying handle, self-test switch with discrete LED STATUS annunciators, and a LCD display for system setup and verification.

1.2.3 Control Panel

The control panel for the Mode S System provides for mode control of the ATC Transponders. Communication with the Mode S Transponders is accomplished via an ARINC 429 bus as defined in ARINC Characteristic 718. Control panel functions includes a 4096-ident code selection and display, altitude source and mode control switch, and selection between two onboard transponders. The control panel also input FID into the transponder.

1.2.4 Antenna

When installing the transponder antennas, a TSO'd antenna should be selected. Two antennas are required. Having two antennas (one on top of the aircraft and one on the bottom) provides the best coverage for receiving interrogations from ground radar, planes above, and below. L-Band type recommended antennas are P/N S65-5366-7L, manufactured by Sensor Systems and P/N DM N150-2, manufactured by DM Antenna Technologies.

1.2.5 Altitude Source

The transponder contains dual inputs for acceptable types of altitude sources. The pin configuration selection specifies which of the two inputs are used for obtaining altitude information. Altitude sources are ADC (429), Synchro, or Gillham. The input uses a ground/open logic level, where a 'ground' logic level specifies altitude source #2, and an 'open' logic level specifies altitude source #1.

1.2.6 Data Link Processor

Four high speed ARINC 429 busses are provided for interfacing to a Mode S Airborne Data Link Processor (ADLP). The Comm A/B input and Comm A/B output busses are used for transferring messages to and from the ADLP.

1.2.7 TCAS

The AT7000 contains an interface that allows it to work with an onboard TCAS II system. The interface consists of two ARINC 429 high speed data busses, an XT Coordination bus that is an output from the transponder to TCAS, and a TX Coordination bus that is an output from TCAS to the transponder.

1.3 Functional Operation

Mode S System operation begins when aircraft power is applied. An initial self-test is performed automatically upon power-up and is completed in approximately one second. Self-testing of the transponder occurs continuously while powered on. If a transponder failure occurs, it is indicated on the control panel. Other failures are indicated via front panel mounted LEDs on the transponder, however, these failure indications are not available to the pilot. All failures, whether hard or intermittent, are recorded in the transponder maintenance memory for analysis by maintenance personnel.

1.4 Regulatory Compliance

The following standards are described in relationship to the functioning and certification of the AT7000.

1.4.1 CFR 47, Part 87 (FCC)

Aviation Services, Subpart D, Technical Requirements

1.4.2 TSO C112

The AT7000 complies with TSO C112, Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment.

1.4.3 ARINC 718-4 and ARINC 718A

The AT7000 complies with ARINC Characteristic 718-4 and 718A, Mark 3 Air Traffic Control Transponder. The AT7000 meets the minimum subset of ARINC 718A and is software upgradeable for most DAPS parameters. See Transponder Description, Section 2.

NOTES

Section 2 - Transponder Description

2.1 General

This section defines the system functionality for the AT7000 Mode S transponder. It is a Level 2es transponder indicating that it performs basic Mode S functions, and is also capable of transmitting extended squitters with encoded aircraft information to support ADS-B functions. The unit is also upgradeable to ICAO Level 5 (Downlinked Aircraft Parameters, (DAPS)) capability through software upgrades.

2.2 Overview

The AT7000 transponder is a full-featured Mode S transponder in an ARINC 600 form factor that has been designed with a built-in capability for future growth. This transponder is compatible with Change 7 TCAS systems, as well as UPS AT ADS-B systems. When utilized with a UPS AT Link and Display Processing Unit (LDPU), the unit serves as an integral part of a complete ADS-B system. ADS-B is currently certified for use as a traffic surveillance system.

The AT7000 responds to both the Air Traffic Control Radar Beacon System (ATCRBS), and Mode S (Mode Select) interrogations. The AT7000 meets all requirements described in DO-181B and EUROCAE ED-73A. This also meets Eurocae elementary surveillance requirements including SI capability (six bit Mode S sensor interrogator codes) and flight ID transmission. Flight ID (FID) may be input to the AT7000 for extended squitter transmission by either external serial data interface or by using a Gables transponder control panel capable of accepting and transmitting FID information.

TCAS is fully supported with antenna diversity (top and bottom) antenna ports. The AT7000 is designed to operate with all ARINC 718/735 and conforming TCAS II computers.

To provide maximum reliability, the unit has extensive built in test and evaluation (BITE) capabilities. This is further augmented by a LCD display on the front panel allowing for display of descriptive messages allowing for far greater comprehensive testing and troubleshooting capabilities on aircraft.

Software on board the AT7000 is certified to DO-178B Level B. Software updates can be completed via an RS232 serial data and will be upgraded to interface with an ARINC 615 data loader. The data loader port is located on the front panel of the unit.

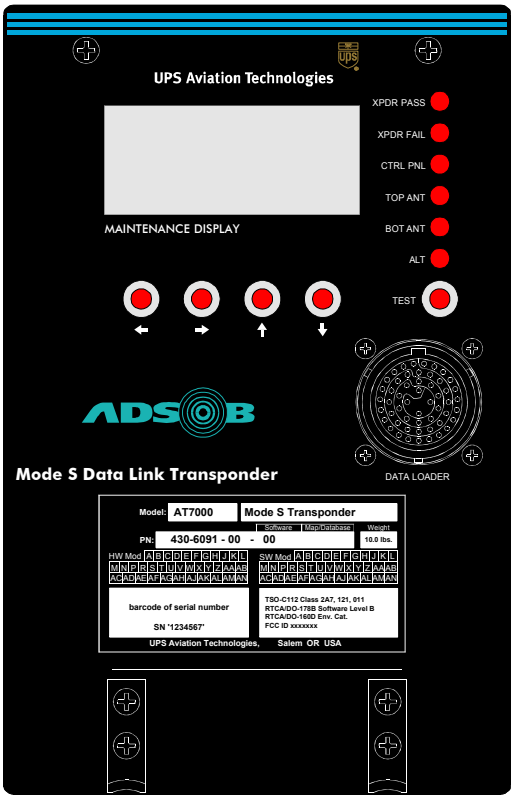


Figure 2 – Front Panel of AT7000

2.3 AT7000 Product Summary

The transponder is an ARINC 718-4/718A mode S transponder.

General features of the transponder includes:

- ARINC 718-4/718A compliant, ARINC 600 format and interconnect, with 4 MCU size form factor
- ATCRBS and Mode S operation
- TSO-C112 certification
- Includes Comm A and Comm B operation, (Comm C, Comm D, and DAPS capable.)
- Includes extended squitter capability
- Supports Mode S services
- Operates from 115 volts AC, 400Hz, or 28 volts DC
- Transmit power of 400 watts typical
- Includes built-in self-test and diagnostics

2.3.1 Gillham to A429 Serial Data Converter

The AT7000 includes a Gillham code to ARINC 429 serial data converter integral to the unit to support installation in non-ADC equipped aircraft needing serial altitude data. This is compliant to ARINC 706-4 output.

2.3.2 Inputs to the AT7000 for Extended Squitter Position Reports

Some users of the AT7000 may not wish to install an ADLP concurrently with the transponder, but wish to output basic position reports to comply with future European requirements. This may be accomplished by inputting the required ARINC labels to the transponder. The minimum label set is as follows for airborne position squittering:

Minimal Necessary Labels			
Label #	Description	Minimum Rate	Alternate Labels
110 (120)	Latitude (Fine)	5 Hz	310
111 (121)	Longitude (Fine)	5 Hz	311
150	Time Word	5 Hz	
140	Fractional Seconds (should be last word of data block)	5 Hz	
130	HPL	5 Hz	247
377	Equipment ID – must be 142	0.5 Hz	

Minimal Necessary Labels (Only Type 1&2 or Type 3&4 Required)			
Label #	Description	Minimum Rate	Alternate Labels
174	NS Velocity – Type Code 1&2	5 Hz	103 and 112 (or 311 and 312)
166	EW Velocity – Type Code 1&2	5 Hz	103 and 112 (or 311 and 312)
OR			
320	Magnetic Heading – Type Code 3&4	5 Hz	
210	True Airspeed – Type Code 3&4 (from ADC)	5 Hz	206

2.4 Display / Control

The transponder is designed to work with a standard transponder control panel. The control panel may output FID for transmissions.

2.5 Data Loader Interface

The transponder includes a front panel mounted data loader interface connector. The interface connector will include an RS-232 serial interface for use with a PC. An ARINC 615 input is provisioned, but not implemented in the software for the initial product release.

2.6 Built-In Test Equipment (BITE) and Diagnostics

The transponder includes a built-in test and diagnostics to automatically test the transponder functions at system power up and monitor the operation performance during normal operation.

2.6.1 Self-Tests

The built-in tests include the following and are completed at power up of the transponder.

a) power supply voltages

b) memory checks

c) transmitter (monitor replies)

d) synthesizers

e) transponder interfaces

f) top and bottom antenna test

2.6.2 Status Indicators

The transponder includes status indicators on the front panel of the unit that can be easily viewed with the unit installed in its standard mounting. The purpose of the status indicators is to help determine the source of a potential failure to determine the fault condition. The status indicators includes status for the following conditions:

a) transponder pass/fail

b) control panel failure

c) top antenna failure

d) bottom antenna failure

e) altitude compare failure

The unit also has a LCD front panel display that allows for descriptive text messages to be displayed for the purpose of determining aircraft system faults, as well as transponder faults.

2.6.3 Maintenance and BITE Data

The transponder is capable of outputting maintenance data using the data loader interface. An RS-232 interface is supported.

The transponder includes maintenance data that can be output on the test data interfaces. The data includes the following:

a. aircraft system power On/Off times, aircraft Airborne/Ground times.

b. power on cycle count

c. airframe cycle count (air/ground cycle count)

d. fault identification (if applicable)

NOTES

Section 3 - Installation

This section describes the installation of the AT7000 Mode S Transponder.

3.1 Pre-Installation Information

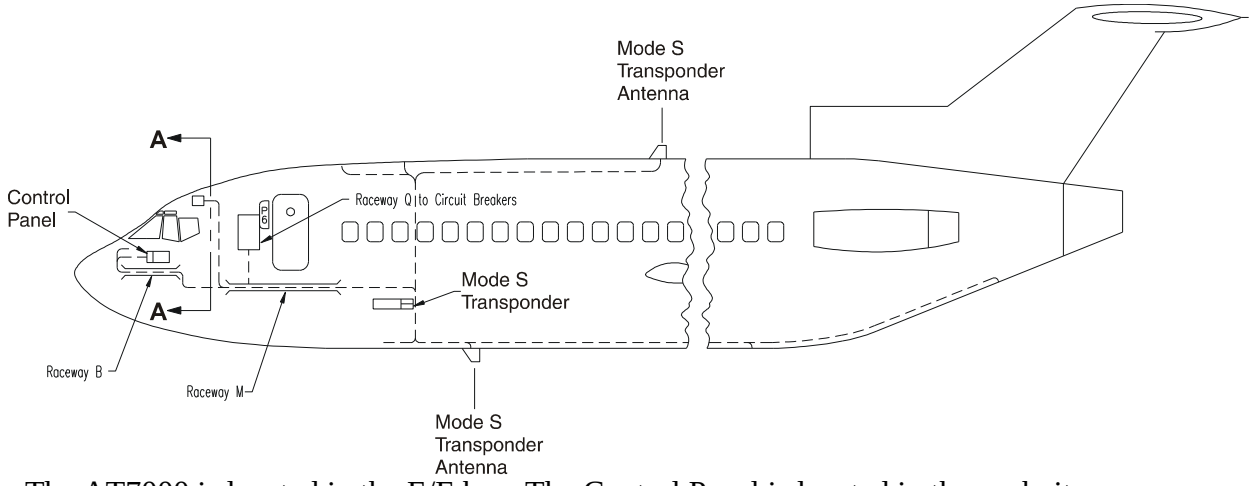
The transponder can be mounted in any convenient location in the E/E bay; however, it should be mounted within 50 feet of the antenna unless a low-loss coaxial cable is used to maintain a worst case loss of 3 dB per ARINC 718-4/718A. Top and bottom coaxial run length differences can be compensated for by use of the antenna delay program pins. See Figure 4, TP3C through TP3F The unit can utilize external cooling air in accordance with ARINC 600, ARINC 404, or operate in convection cooled environments. However cooled, the airflow rate provided to the transponder should be 13 kg/hr and the pressure drop of the coolant air flow through the equipment should be 5 ± 3mm of water.

3.2 Equipment Required

Table 1 - Equipment for Installation		
LRU	**Mating Connector**	**Qty/System**
AT7000	NSXN2P203X0105	1

3.3 Mechanical Installation

3.3.1 Location of LRUs



The AT7000 is located in the E/E bay. The Control Panel is located in the cockpit.

Figure 3 – Potential Equipment Locations

3.3.2 AT7000 Provisions

The AT7000 is mounted in a 4 MCU mounting tray per ARINC 600. See Figure 3.

3.3.2.1 Mounting Tray

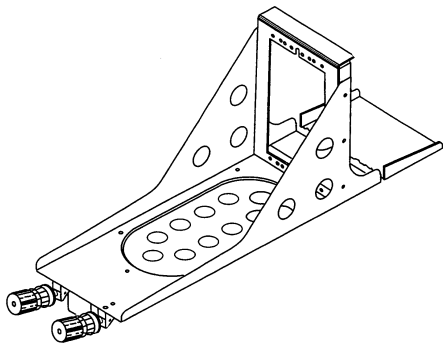


Figure 4 - ARINC 600 4 MCU Mounting Tray

3.3.3 Antenna Provisions

Install antenna in accordance with manufacturer specifications.

Sealant should be applied as required to the antenna base to prevent leakage of water and condensation while also preventing corrosion. Any sealant or aerodynamic smoother used around the edge of the antenna base must be applied only after the antenna has been bolted and secured to the aircraft. Each antenna should have a maximum of 2.5 milli-ohm ground bond resistance.

Table 2 - Antenna Minimum Spacing

Antenna	Minimum Spacing
DM-N150-2 (Dorne-Margolin P/N) S65-5366-7L (Sensor Systems P/N) Or equivalent L-Band Antenna	20” from other L-band antennas in same range.

3.4 Electrical Installation

Reference Section	Signal Name		Pin No.	Equipment Connection
3.5.2	Gillham Code Altitude Input #2	A1	TP 1A	
		A2	TP 1B	
		A4	TP 1C	
		B1	TP 1D	
		B2	TP 1E	
		B4	TP 1F	
		C1	TP 1G	
		C2	TP 1H	
		C4	TP 1J	
		D2	TP 1K	
	*MSP Bus Input ARINC 429	A	TP 2A	From Airborne Data Link Processor Unit (LDPU)
		B	TP 2B	
3.5.14	DAPS Input ARINC 429	A	TP 2C	
		B	TP 2D	
	Hardware Provisioned Output ARINC 429	A	TP 2E	
		B	TP 2F	
	Reserved #1 Output ARINC 429	A	TP 2G	
		B	TP 2H	
	Reserved Discrete Input #1		TP 2J	
3.5.2	Gillham Code Altitude Input #2	D4	TP 2K	From Encoding Altimeter #2
	Reserved Discrete Output		TP 3A	
3.5.11.2	Transponder Fail Output #2		TP 3B	To Mode S Control Panel J1-12
3.4.6	Antenna Cable Delay Program	Top/Bot	TP 3C	
		B	TP 3D	
		A	TP 3E	
		Common	TP 3F	
3.4.4	SDI Program	B	TP 3G	
		A	TP 3H	
		Common	TP 3J	
3.5.2	Gillham Code Altitude Input #2	Common	TP 3K	
3.5.3	Synchro Altitude Input #1	X course	TP 4A	
		Y course	TP 4B	
		Z course	TP 4C	
		Ref H	TP 4D	
		Ref C	TP 4E	
		X fine	TP 4F	From Air Data Computer #1
		Y fine	TP 4G	
		Z fine	TP 4H	
		flag	TP 4J	

***Optional**

Figure 5 – Top Plug Interconnect Description (Sheet 1)

Reference Section	Signal Name		Pin No.	Equipment Connection
3.4.5	Max Airspeed Program	A B C COM	TP 5A TP 5B TP 5C TP 5D	
3.5.15	TX Coordination TCAS 429	A B	TP 5E TP 5F	To Pin 12D of TCAS Computer To Pin 12E of TCAS Computer
3.5.15	XT Coordination TCAS 429	A B	TP 5G TP 5H	To Pin 14F of TCAS Computer To Pin 14G of TCAS Computer
3.5.7	Air/Ground Discrete Inputs	#2 #1	TP 5J TP 5K	To Air/Ground Relay
3.5.12	NAV Data/Flight ID 429 Input Bus	A B	TP 6A TP 6B	From LDPU (ADLP)
	Reserved	A B	TP 6C TP 6D	
	Reserved	A B	TP 6E TP 6F	
	Reserved		TP 6G	
	Reserved	A B	TP 6H TP 6J	
3.4.7	Antenna Program		TP 6K	
3.5.5	Control Panel Input Bus #1	A B	TP 7A TP 7B	To Pin 22 of Control Panel (Optional) To Pin 23 of Control Panel (Optional)
	Reserved		TP 7C	
3.5.5.1	Control Panel Data Port Select		TP 7D	
3.5.5	Control Panel Input Bus #2	A B	TP 7E TP 7F	To Pin 22 of Control Panel To Pin 23 of Control Panel
3.5.6	Standby		TP 7G	
3.5.4	Air Data #1 ARINC 429 Input	A B	TP 7H TP 7J	To #1 Air Data Computer
	Reserved		TP 7K	

Figure 4 – Top Plug Interconnect Description (Sheet 2)

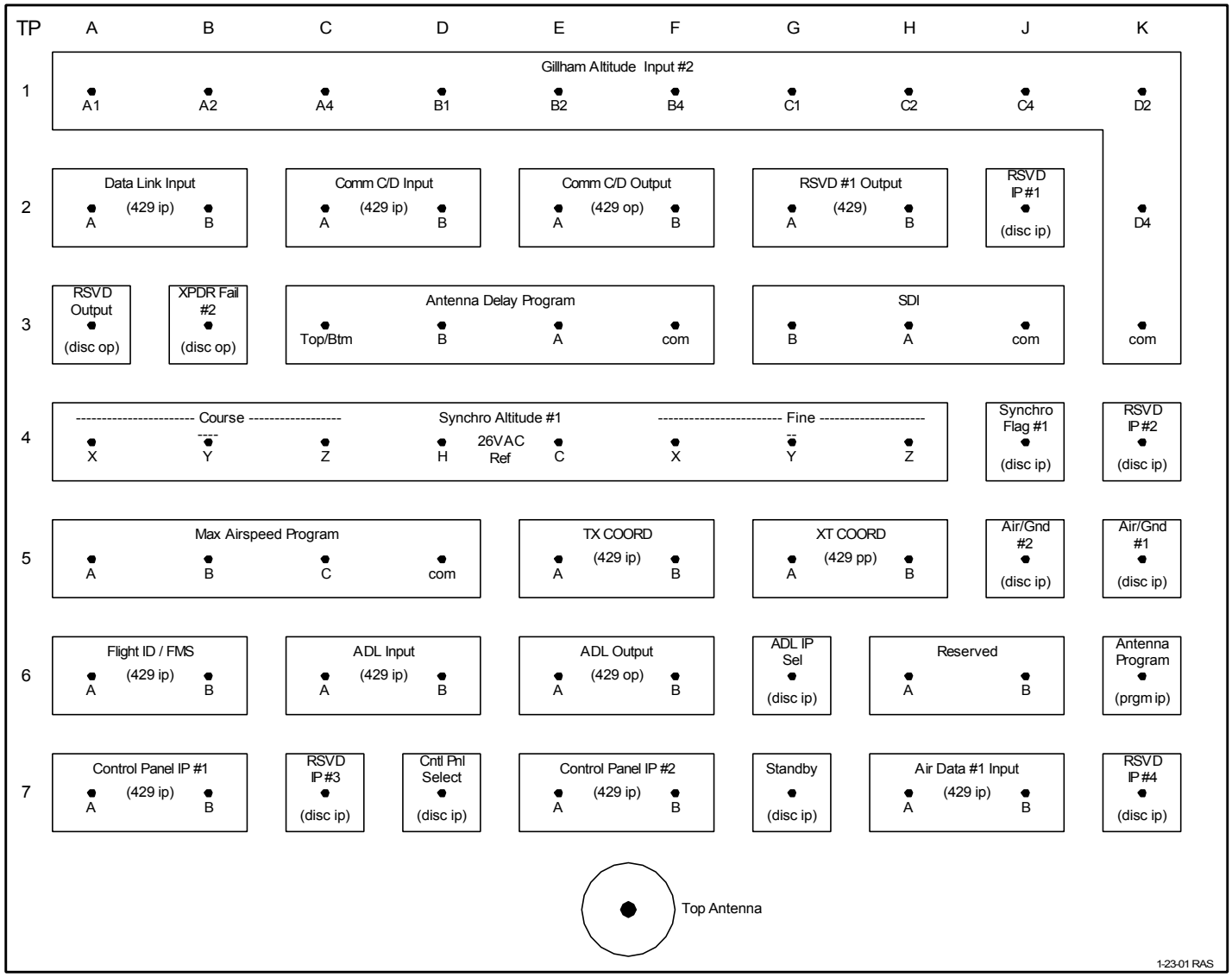


Figure 6 –Top Plug Connector Layout

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3.4.1 Middle Plug

Reference Section	Signal Name		Pin No.	Equipment Connection
3.4.3.1	Reserved Mode S Address	Address 1	MP 1A	
		Address 2	MP 1B	
		Address 3	MP 1C	
		Address 4	MP 1D	
		Address 5	MP 1E	
		Address 6	MP 1F	
		Address 7	MP 1G	
		Address 8	MP 1H	
		Address 9	MP 1J	
		Address 10	MP 1K	
		Address 11	MP 2A	
		Address 12	MP 2B	
		Address 13	MP 2C	
		Address 14	MP 2D	
		Address 15	MP 2E	
		Address 16	MP 2F	
		Address 17	MP 2G	
		Address 18	MP 2H	
		Address 19	MP 2J	
		Address 20	MP 2K	
		Address 21	MP 3A	
		Address 22	MP 3B	
		Address 23	MP 3C	
		Address 24	MP 3D	
		Address Com	MP 3E	
	Reserved #1 ARINC 429 Input	A	MP 3F	Reserved for mode control panel or other DAPS inputs.
		B	MP 3G	
3.5.1.1	Functional Test Discrete Input		MP 3H	
3.5.10.2	Altitude Compare Fail Output		MP 3J	
3.5.11.1	XPDR Fail #1 Output		MP 3K	
3.5.2	Gillham Code Altitude Input #1	A1	MP 4A	From Altimeter
		A2	MP 4B	
		A4	MP 4C	
		B1	MP 4D	
		B2	MP 4E	
		B4	MP 4F	
		C1	MP 4G	
		C2	MP 4H	
		C4	MP 4J	
		D2	MP 4K	
3.5.4	Air Data #2 ARINC 429 Input	A	MP 5A	From #2 Air Data Computer
		B	MP 5B	
	Reserved		MP 5C	Reserved for inputs for DAPS
			MP 5D	
	Data Link 429 Output	A	MP 5E	MSP Bus to LDPU
		B	MP 5F	

Figure 7 – Middle Plug Interconnect Description (Sheet 1)

Reference Section	Signal Name		Pin No.	Equipment Connection
3.5.10.1	Altitude Compare Input		MP 5G	To Pin 17 of Control Panel
3.6	DL/DHL	Program Pin	MP 5H	
3.4.8	Antenna BITE Enable Program	Program Pin	MP 5J	
3.5.2	Gillham Code Altitude Input #1	D4	MP 5K	
	Maintenance Data 429 Input	A B	MP 6A MP 6B	Hardware Provisions
	Maintenance Data 429 Output	A B	MP 6C MP 6D	Hardware Provisions
3.5.9	Altitude Input Source Selection		MP 6E	To Pin 16 of Control Panel
3.4.9	Altitude Type Selection Program	B A COM	MP 6F MP 6G MP 6H	
	Reserved #2 ARINC 429 Input		MP 6J	Tied to MP 7K
3.5.2	Gillham Code Altitude Input #1	COM	MP 6K	
3.5.3	Synchro Altitude Input #2	X Course Y Course Z Course Ref H Ref C X Fine Y Fine Z Fine Synchro #2	MP 7A MP 7B MP 7C MP 7D MP 7E MP 7F MP 7G MP 7H MP 7J	Discrete Input
	Reserved #2 IP 429	B	MP 7K	Tied to MP 6J

Figure 6 – Middle Plug Interconnect Description (Sheet 2)

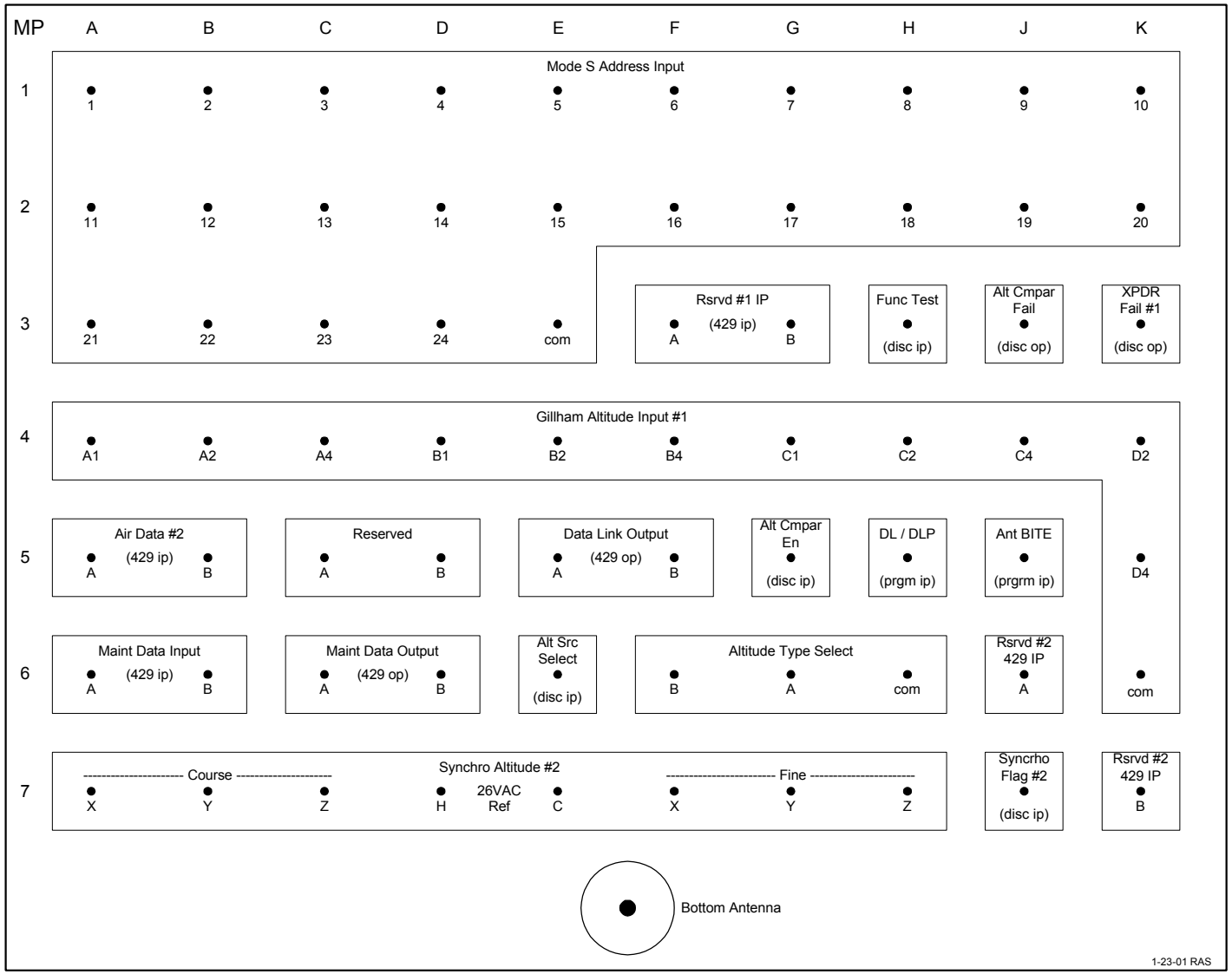

Figure 8 – Middle Plug Connector Layout

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3.4.2 Bottom Plug

Signal Name	Pin No.	Equipment Connection
115 VAC Input HOT	BP 1	
Future Spare	BP 2	
28 VDC Input Return	BP 3	
Future Spare	BP 4	
Future Spare	BP 5	
Future Spare	BP 6	
115 VAC Input Return	BP 7	
Signal Ground	BP 8	
Future Spare	BP 9	
28 VDC	BP 10	
Chassis Ground	BP 11	
Suppression	BP 12	
Suppression	BP 13	

Figure 9 – Bottom Plug Interconnect Description

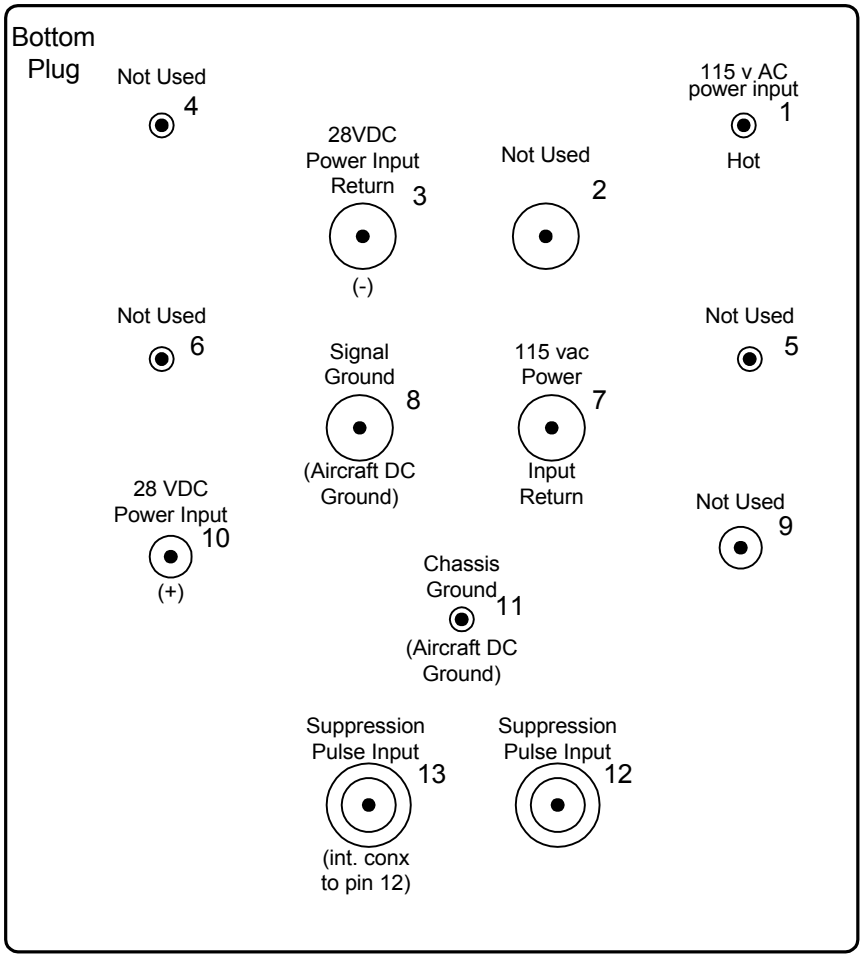


Figure 10 – Bottom Plug Connector Layout

3.4.3 Program Pin Inputs

The transponder will require program pin connections defined by the particular installation. The transponder is programmed by connecting the appropriate input pins to common (ground) as defined in this section.

3.4.3.1 Mode S Address

The Mode S address is a unique 24-bit code assigned to each aircraft.

The 24-bit address is programmed by making the appropriate connections to the address input pins. For each "1" bit in the address, connect the corresponding address input to the address common pin (MP 3E), leave the pin open for a "0" bit.

Address 1 input (MP 1A) is the MSB (most significant bit) address, 24-input (MP 3D) is the LSB (least significant bit). The address is normally defined as an eight character octal code.

In the United States, the Mode S address can be obtained from:

Federal Aviation Administration
FAA Aircraft Registry
PO Box 25504
Oklahoma City, OK 73125
Telephone: (405) 954-3116
Fax: (405) 954-3548

3.4.4 SDI Program

The SDI program inputs are used to identify the transponder system number. The transponder number is made by connecting the defined SDI inputs to the SDI common pin (TP 3J) as follows:

Table 3 - SDI Program Pins

Transponder #	SDI Prgm B TP 3G	SDI Prgm A TP 3H
Not Applicable	Open	Open
1	Open	Common
2	Common	Open
3	Common	Common
Common pin	TP 3J	

3.4.5 Max Airspeed Program

The maximum (max) airspeed program pins are used to identify the aircraft's maximum cruise airspeed capability. The maximum airspeed is programmed by connecting the maximum airspeed program pins to the common pin (TP 5D) as follows:

Table 4 - Max Airspeed Program			
Max Airspeed	**Max airspeed connections**		
	Prgm C TP 5C	**Prgm B TP 5B**	**Prgm A TP 5A**
Not available	Open	Open	Open
Up to 75 knots	Open	Open	Common
75 to 150 knots	Open	Common	Open
150 to 300 knots	Open	Common	Common
300 to 600 knots	Common	Open	Open
600 to 1200 knots	Common	Open	Common
Above 1200 knots	Common	Common	Open
Not assigned	Common	Common	Common
Common pin	TP 5D		

3.4.6 Antenna Delay Program

The antenna cables from the transponder to the top and bottom antennas may vary in length. The transponder must be programmed for the cable delay if the difference between the top and bottom antennas is greater than 50 nsec. This is accomplished by connecting the appropriate pins to the common pin as defined in the following table.

Table 5 - Antenna Delay Program			
Differential Delay (nsec)	**Delay Program Connections**		**Programmed Delay (nsec)**
	Delay B TP 3D	**Delay A TP 3E**	
0 to 50	Open	Open	0
51 to 150	Open	Common	100
151 to 250	Common	Open	200
251 to 350	Common	Common	300
TP 3C	**Open**	**Common**	
	Add delay to top antenna	Add delay to bottom antenna	
Common Pin	TP 3F		

3.4.6.1 Antenna Delay Calculation

The antenna cable delay is defined as the round trip propagation delay between the transponder and the antenna. Typical cable delay is 1.54 nsec/ft.

To compute the cable delay:

1. Calculate the difference in cable lengths between the top and bottom antennas in feet.
2. Determine the cable delay: difference in length x 2 x 1.54 nsec/ft.
3. Select the coding and make the connections to the antenna delay program pins.
4. Select the top or bottom code: connect TP 3C to common if the top antenna coax is longer than the bottom.

3.4.7 Antenna Program

This program pin is used to identify installations in which only the bottom antenna is used.

Ground single bottom mount antenna installation

Open dual antenna installation

3.4.8 Antenna BITE Program

This program pin is used to enable the antenna BITE test. Antennas capable of the BITE test will have a DC path to ground. If enabled, the transponder will perform a continuity test to verify the antenna is connected.

Ground enable antenna BITE test

Open disable antenna BITE test

3.4.9 Altitude Type Selection

The transponder is capable of using altitude data from one of four types. The altitude type used is programmed by making the connections as defined in the following table.

Table 6 - Altitude Type Selection

	Program Pins	
Data Source	**MP 6F**	**MP 6G**
429 Data	Open	Open
Synchro Data	Open	Common
Gillham Data	Common	Common
Common Pin	MP 6H	

3.5 Interface Connections

3.5.1 Discrete I/O Levels

3.5.1.1 Discrete Inputs

The discrete inputs have the following logic level thresholds:

Ground ..... < 3.5 volts DC or a resistance of < 10 ohms to ground

Open..... > 18 volts DC or a resistance of > 100K to ground

Series isolation diodes are included on all discrete inputs.

3.5.1.2 Discrete Outputs

The discrete outputs, unless otherwise defined, are open drain outputs. When active, the output will be pulled low to ground. When inactive, the output be open (or pulled high to 28 volts with 100K ohm).

Active..... pulled low to ground

Inactive..... open (100k pull-up)

3.5.1.3 Valid Flag Inputs

The valid flag inputs are intended for connection to valid superflag outputs on connected equipment. The levels for these inputs are as follows:

Valid..... > 18 volts DC input relative to ground

Invalid ..... < 3.5 volts DC input relative to ground

3.5.2 Gillham Code Altitude Input

The transponder allows connection to an altitude source using the 11 wire Gillham code interface. Two inputs are provided, and the source can be selected with the altitude source discrete input, see 3.5.9.

3.5.3 Synchro Altitude Input

The altitude information for the transponder may be obtained from an analog synchro altitude interface.

3.5.3.1 Synchro Valid Flag Input

The synchro valid flag inputs are used to indicate the validity of the corresponding synchro input. The transponder will not use the synchro altitude if the valid flag input indicates an invalid condition. The synchro valid flag is a high level input.

3.5.4 ARINC 706 Air Data Inputs

The altitude information for the transponder may be obtained from an ARINC 706 air data system via two low speed ARINC 429 data busses.

3.5.5 Control Panel Input

The control panel data may be entered into the transponder on either of two low speed ARINC 429 data busses (Ports A and B). The port is selected by the control data port select discrete input. See paragraph 3.5.5.1.

3.5.5.1 Control Panel Port Selection

The control port selection input is used to select which control panel port the transponder will use:

Ground .....uses control panel port A

Open.....used control panel port B

This input is a discrete input as defined in 3.5.1.1.

3.5.6 Standby Input

The standby discrete input is used to place the transponder in either the standby or active modes and is normally connected to the transponder control panel. In the standby mode, the transponder will not respond to any interrogations or generate squitters. BITE will continue to operate in the standby mode. In the active mode, the transponder will respond to valid interrogations and generate squitters.

Ground .....standby

Open.....active

This input is a discrete input as defined in 3.5.1.1.

3.5.7 Air/Ground Discrete Inputs

The air/ground discrete inputs are used by the transponder to determine air / ground status of the aircraft. This is used to control or inhibit replies and to indicate whether the aircraft is on the ground or airborne for Mode S replies.

3.5.7.1 Air/Ground #1

This input is used to not inhibit ATCRBS replies when on the ground, and is typically used for ramp test functions so that the transponder can reply to all types of interrogations.

Ground .....aircraft on the ground

Open.....aircraft airborne

This input is a discrete input as defined in 3.5.1.1.

3.5.7.2 Air/Ground #2

This input is used to indicate that the aircraft is on the ground, and is normally connected to the air/ground switch. When on the ground, the transponder will inhibit replies to ATCRBS interrogations.

Ground .....aircraft on the ground

Open.....aircraft airborne

This input is a discrete input as defined in 3.5.1.1.

3.5.8 Functional Test Discrete Input

The functional test input is used to place the transponder in a functional test mode.

Ground .....enable functional test

Open.....normal operation

This input is a discrete input as defined in 3.5.1.1.

3.5.9 Altitude Input Selection

This input is used to select the active port used for the altitude data input.

Ground .....uses altitude input #2

Open.....uses altitude input #1

This input is a discrete input as defined in 3.5.1.1.

3.5.10 Altitude Compare

3.5.10.1 Altitude Compare Enable

The altitude compare enable discrete input is used to enable the altitude compare function. Both altitude inputs must be valid. This feature works with Gillham, synchro, or ADC inputs, as selected.

Ground ..... altitude compare enabled

Open..... altitude compare inhibited

This input is a discrete input as defined in 3.5.1.1.

3.5.10.2 Altitude Compare Fail Output

The altitude fail discrete output is used to indicate invalid altitude input data, and is normally connected to an indicator on the control panel.

Ground .....valid data, or altitude compare normal

Open.....invalid, or altitude compare failure

The function of the altitude fail output is dependent on the altitude source selected as follows:

Gillham data.....when the altitude compare is enabled, the output will indicate failed when the two Gillham inputs are not within 500 feet

ARINC 429 data ...output will indicate failed when the ARINC 429 input is invalid or ADC altitude inputs differ by more than 200 feet.

Synchro data.....output will indicate failed when the Synchro input is invalid

3.5.11 Transponder Fail Outputs

3.5.11.1 Transponder Fail Discrete Output #1

This output will supply 5 volts DC (capable of 25 mA) when the transponder has failed, and will be open when the transponder is operating normally.

3.5.11.2 Transponder Fail Discrete Output #2

This output is open when the transponder has failed and is pulled low to ground when the transponder is operating normally.

Valid..... pulled low to ground

Failed..... open

This output is a discrete output as defined in 3.5.1.2.

3.5.12 Flight ID Input

The flight ID may be input to the transponder from multiple serial inputs, depending upon installation requirements. The transponder will accept flight identification from any of these inputs, which is contained within four ARINC 429 data words.

3.5.13 Data Link Interface

Four high speed ARINC 429 busses are provided for interfacing to a Mode S Airborne Data Link Processor (ADLP). The input and output busses are used for transferring messages to and from the ADLP.

3.5.14 Downlinked Aircraft Parameters (DAPS)

The DAPS input busses and DAPS output busses are used for transferring aircraft specific parameters to the requesting ground station. Enabling this feature requires a software upgrade. See ARINC 718A.

3.5.15 TX / XT Coord TCAS Interface

The TCAS/Transponder interface consists of two high-speed ARINC 429 busses. Interface standards are listed in ARINC 735 and DO-185b. The transponder is operable with both Collins and ACSS TCAS units.

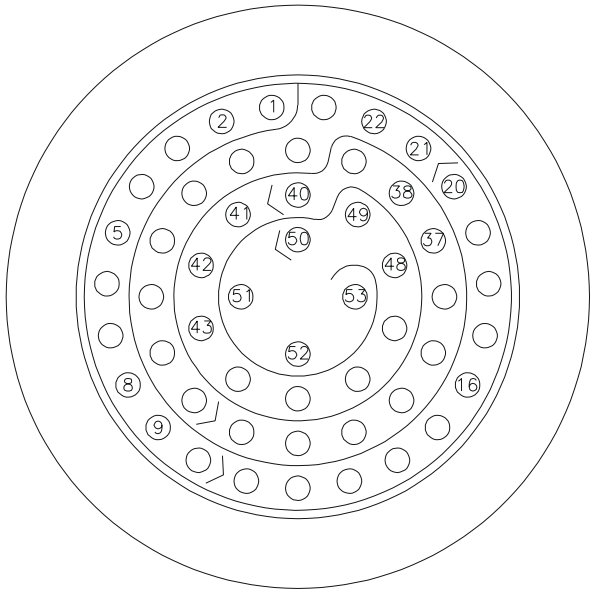
3.6 Data Loader Interface

Table 7 - Data Loader Plug

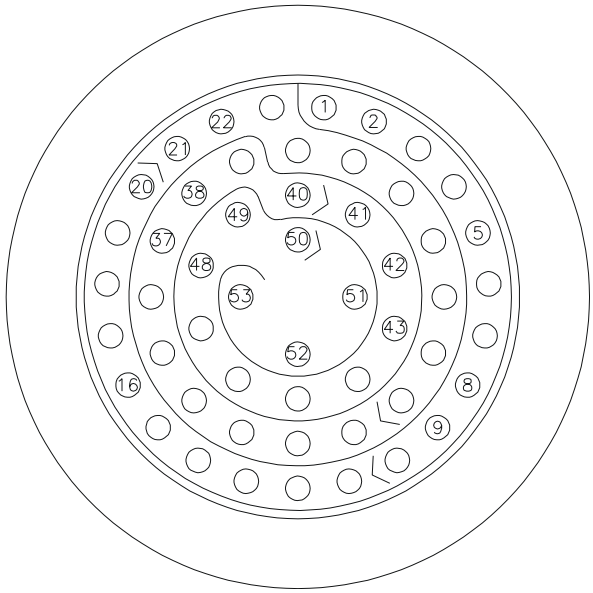
Reference Section	Signal Name		Pin No.	Equipment Connection
2.5	Portable Data Loader (PDL) ARINC 615 Input Bus	A	1	429 Input (Provisions Only)
		B	2	429 Input (Provisions Only)
	Spare		3	
	Spare		4	
	Chassis Ground (429 Input Bus Shield)	GND	5	Shield Ground
	Spare		6	
	Spare		7	
	PDL ARINC 615 Output Bus	A	8	429 Output (Provisions Only)
		B	9	429 Output (Provisions Only)
	Spare		10	
	Spare		11	
	Spare		12	
	Spare		13	
	Spare		14	
	Spare		15	
	Chassis Ground (429 Output Bus Shield)	GND	16	Shield Ground
	Spare		17	
	Spare		18	
	Spare		19	
	115 Volt AC Power Input HOT		20	
	Chassis Ground	GND	21	
	115 Volt AC Power Input COMMON		22	
	Spare		23	
	Spare		24	
	Spare		25	
	Spare		26	
	Spare		27	
	Spare		28	
	Spare		29	
	Spare		30	
	Spare		31	
	Spare		32	
	Spare		33	

Table 7 - Data Loader Plug (Continued)

Reference Section	Signal Name		Pin No.	Equipment Connection
	Spare		34	
	Spare		35	
	Spare		36	
	28 Volt DC Power Input	POS	37	
	28 Volt DC Power Return	NEG	38	
	Spare		39	
	RS-232 Input		40	Maintenance Data/Software Update Port
	RS-232 Output		41	Maintenance Data/Software Update Port
	PDL CTS Input		42	
	PDL RTS Output		43	
	Spare		44	
	Spare		45	
	Spare		46	
	Spare		47	
	Chassis Ground	GND	48	
	Chassis Ground	GND	49	
	PDL Function Discrete	#1	50	
	PDL Function Discrete	#2	51	
	PDL Function Discrete	#3	52	
	PDL Function Discrete	#4	53	



VIEW OF MATING CONNECTOR ON AIRCRAFT



VIEW OF CONNECTOR ON UNIT

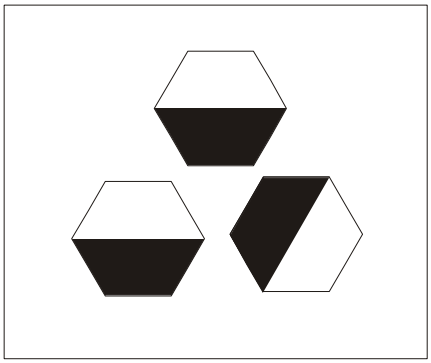
Figure 11 – Data Loader

Section 4 - Post-Installation Checkout

The Post Installation System Checkout verifies the wiring in the aircraft after installation. The AT7000 includes Built-In Test Equipment (BITE) software functions. The BITE software is used in the post-installation wiring checkout. The actual tests conducted will be determined by the selected installation options.

4.1 Key Pin Orientation

Verify the key pin orientation on the ARINC connector is correct in the mounting tray. Pin orientation is ARINC polarization index code 5. The view of the figure below is from the back of the unit, and the dark areas are the solid part of the key. This is specifically keyed for a Mark 3 transponder.



4.2 Pre-Installation Checkout Procedures

Prior to installing the equipment, perform power check as outlined below.

Power Check	Transponder
115 VAC	BP1 (see note below)
115 Return	BP7
28 VDC	BP10 (see note below)
28 Return	BP 3

Note: The unit is able to accept either 28 VDC or 115 VAC.

NOTES

Section 5 - Equipment Removal and Replacement

5.1 Removal

5.1.1 Transponder

Remove the transponder from the tray with ARINC 600 hold-downs as follows:

1. Loosen unit hold-down knobs.

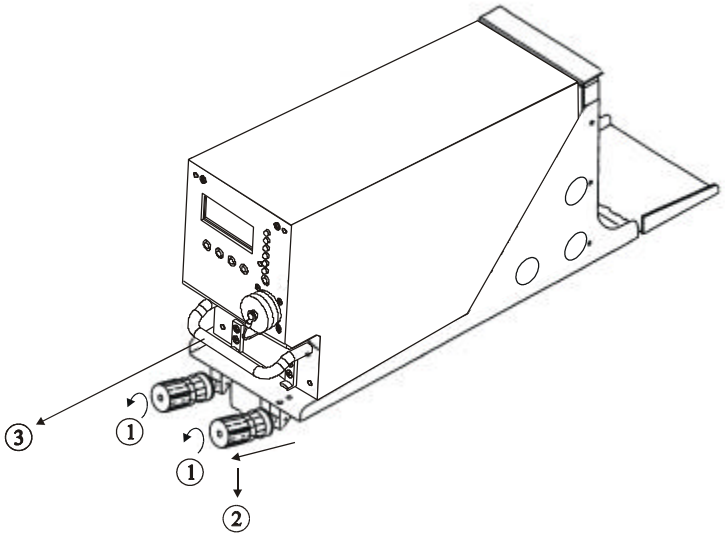


Figure 12 – Removal of Unit from Tray

2. Pull out and down to release the knob from the hook of component.
3. Slowly pull forward on unit handle to separate unit and tray connectors. Transponder is now free to be removed from mounting tray. Place electrostatic protective covers over transponder connector and aircraft mating electrical connector.

5.2 Replacement

5.2.1 Transponder

Replace the transponder in mounting tray as follows:

1. Remove protective plastic covers from aircraft connectors. Remove electrostatic protective covers from transponder connectors.
2. Slide transponder into mounting tray.

CAUTION: DO NOT FORCE FIT. IF MATING IS DIFFICULT, REMOVE THE TRANSPONDER AND CHECK FOR CONNECTOR PINS THAT MAY BE BENT OR OUT OF ALIGNMENT. ALSO, CHECK THE ALIGNMENT OF THE RECEPTACLE IN MOUNTING TRAY.

3. Carefully apply firm pressure until transponder connector is mated with connector receptacle on mounting tray.
4. Pull knobs of mounting tray over hooks on the component and tighten unit hold-down knobs, ensuring proper engagement is made.

Section 6 - Operation

The Mode S Data Link System can be configured in the following ways: two Mode S Transponders or one Mode S Transponder and one ATCRBS Transponder. Single transponder installations are acceptable. The function of the Mode S System is to provide air traffic information to Mode S and ATCRBS ground stations to aid in the air traffic control. The Mode S System receives ATCRBS interrogations (ground to air) and transmits ATCRBS replies (air to ground); receives Mode S interrogations (ground to air) and transmits Mode S replies (air to ground); receives TCAS interrogations (air to air) and transmits Mode S replies (air to air).

NOTES

Section 7 - Specifications

This section includes detailed electrical, physical, environmental, and performance specifications for the AT7000.

7.1 Electrical

Power Requirements (28VDC)

Operating Voltage .....18 to 32.2VDC; 28 VDC typical

Power Consumption:

Standby Mode .....20 Watts

Active Mode (typical load) .....30 Watts

Active Mode (maximum load .....60 Watts

Power Requirements (115V, 400 Hz):

Operating Voltage .....90 to 135VAC, 400 Hz; 115VAC, 400 Hz typical

Power Consumption:

Standby Mode .....24 Watts

Active Mode (typical load) .....36 Watts

Active Mode (maximum load .....65 Watts

7.2 Physical

ARINC 600 4MCU Type 2 Connector; (Polarization code “05”)

Height .....7.64"

Width .....5.04"

Depth .....14.107"

AT7000 Weight .....9.6 lbs.

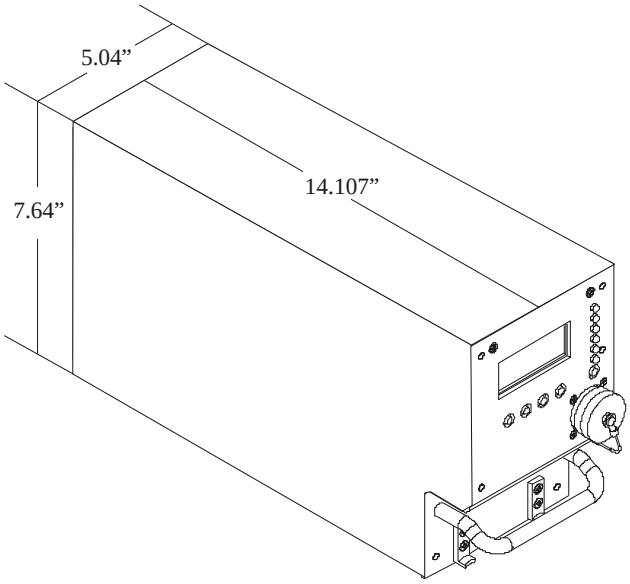


Figure 13 – AT7000 Dimensions

7.3 Environmental

The AT7000 Mode S Transponder is designed and tested to meet appropriate categories of RTCA/DO-xxx. The Environmental Qualification Form is included in Section 10.

Operating temperature	-20°C to +70°C
Storage temperature	-55°C to +85°C
Temperature variation	5°C per minute (minimum)
Humidity	95% RH at 65°C for 6 hours (10 day cycle)
Maximum altitude	55,000 feet
Cooling	The unit can utilize external cooling air in accordance with ARINC 600, ARINC 404 or operate in convection cooled environments.

7.4 Transponder Performance

TSO	TSO-C112
TSO Class	CL 2A7, 121, 011
Warm-up	None required
Receiver Frequency	1030 MHz
Sensitivity (MTL)	-72 dBm +/- 1 dB
Dynamic Range	>50 dB
Side Lobe Suppression	2 pulse (P1, P2), -60 dBm
Transmitter Frequency	1090 MHz +/- 120 kHz

Transmitter Power.....250 watts minimum, 400 watts typical, 600 watts maximum

Mode A Capability.....4096 codes plus SPI ident pulse

Mode C Capability.....-1000 to 126,700 feet, 100 foot increments.

Mode S Capability .....-1000 to 126,700 feet, 25 foot increments.

NOTES

Section 8 - Limitations

8.1 Installation

Installations are to be made in accordance with all appropriate FAA approved guidelines for each given installation. It is the responsibility of the installer to ensure that aircraft installation conditions meet the appropriate standards for the specific type and class and operation of aircraft involved.

NOTES

Section 9 - Troubleshooting

9.1 Introduction and Overview

9.1.1 Introduction

The AT7000 includes a status display located on the unit front panel which provides additional information from the status LEDs. The display is used to display the maintenance information. The four buttons located below the display are used to scroll through the available display information.

The maintenance display includes an LED backlight. The backlight turns on when a button is pushed and remains on for five minutes after the last button is pressed.

9.1.2 Overview

The AT7000 consists of the following interfaces for the user. On the front panel is a four line by 16-character LCD display with backlight, five push buttons, and six status LEDs. These interfaces are used to provide information useful for unit diagnostics, installation checkout and verifying of aircraft interface inputs.

The maintenance display provides information about the unit, including: software version number, system failure information, configuration pin inputs, discrete inputs, external interfaces, and receiver/transmitter enable status.

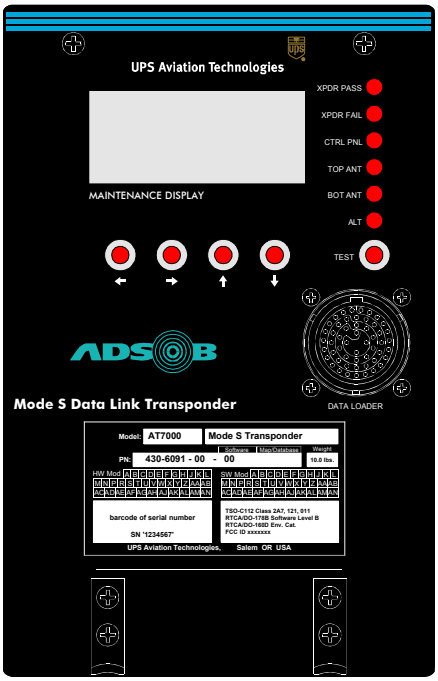


Figure 14. AT7000 Mode S Transponder

9.2 Interfaces

9.2.1 Buttons

The TEST button located under the front panel fault status LEDs is pushed to initiate the 'Self Test' and 'Leg Fault' status information.

The front panel buttons under the display are used for navigating display pages as follows:

← and → These buttons are used to select the column. When pressing one of these buttons, the top page of either the previous (←) or next (→) group will be displayed.

↑ and ↓ These buttons are used to scroll through the pages within a column. Pressing the ↑ button will move the previous page, the ↓ button will move to the next page.

Note: The pages wrap around. The display is used only for displaying transponder information. No configuration or data can be input using the front panel display and buttons.

9.2.2 Test Status LEDs

The AT7000 includes six test status LEDs on the front panel. These LEDs are used to provide transponder test results and are generally used by aircraft mechanics. Failure lights will stay illuminated for 3 seconds after powering up. Once in the self test mode the fail light will stay illuminated for 10 seconds. When in this mode, pressing any button will illuminate the failure for 30 seconds.

Table 8 - Status LEDs Summary

LED	Color	Description
XPDR PASS	Green	Transponder pass, turned on if B.I.T.E. passes and the transponder is able to operate.
XPDR FAIL	Red	Transponder fail, turned on if B.I.T.E. fails and the transponder is not able to receive interrogations or generate replies.
CTRL PNL	Red	Control panel fail, turned on if the transponder is not receiving valid control information on the selected control panel ARINC 429 input port.
TOP ANT	Red	Top antenna fail, turned on if the top antenna B.I.T.E. test fails.
BOT ANT	Red	Bottom antenna fail, turned on if the bottom antenna B.I.T.E. test fails.
ALT	Red	Altitude fail, turned on if a valid altitude is not available from the selected altitude input or if the altitude compare fails (when enabled).

9.2.3 Maintenance Display Pages

The diagram on the next page illustrates the operating modes and access matrix. The software version page is displayed only once at power up and is only displayed until the self-test starts.

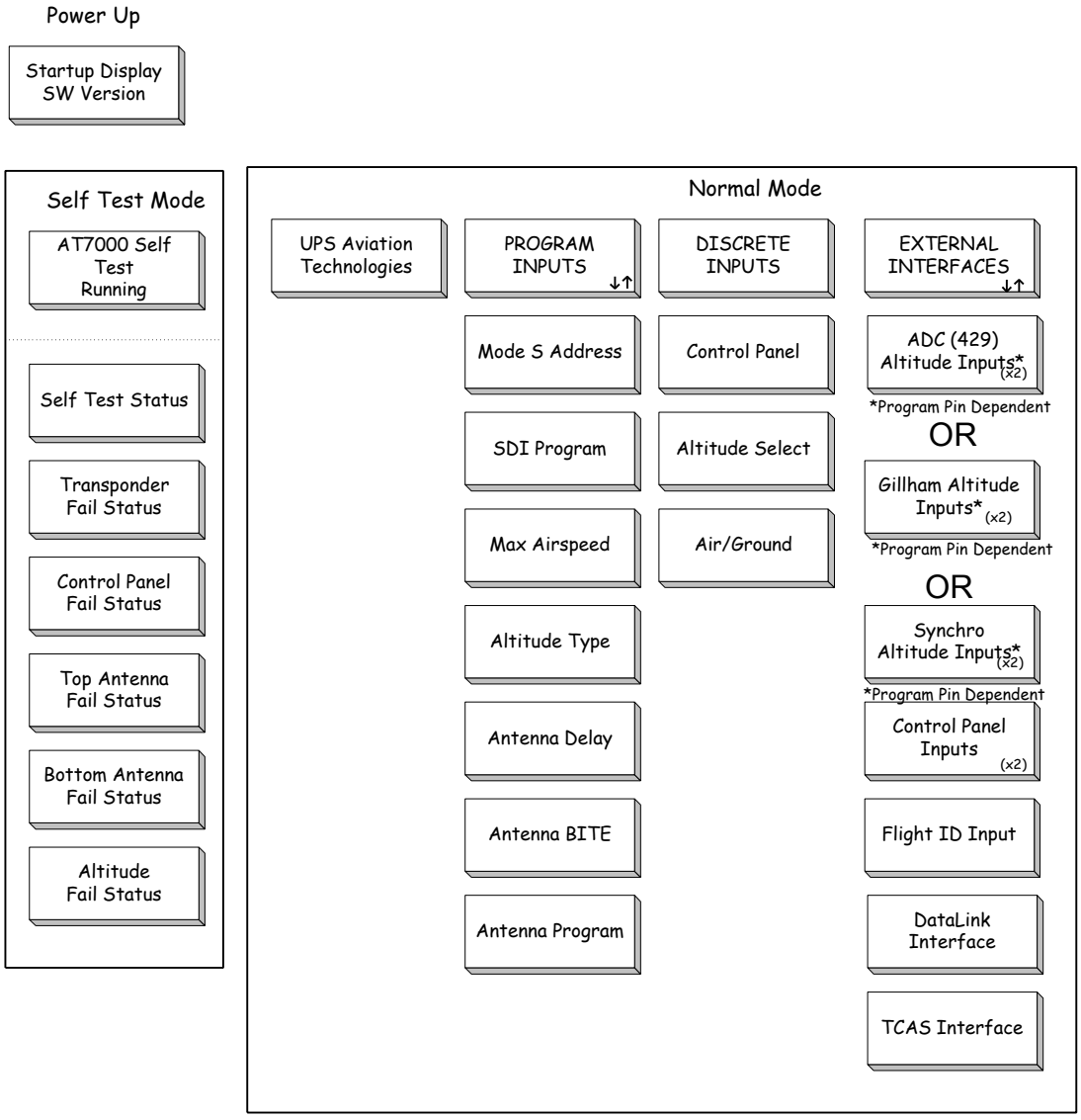


Figure 15. Maintenance Displays

9.2.3.1 Page Descriptions

9.2.3.2 Display Functions

The front panel status display is used to display information useful for:

a. aircraft installation checkout

b. isolating aircraft system/wiring problems

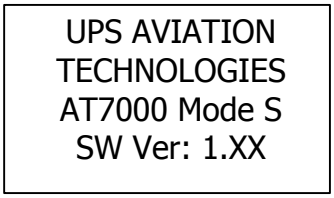
c. displaying B.I.T.E. test results

d. transponder maintenance

9.2.3.3 Startup Page

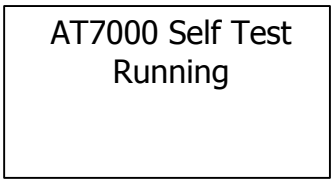
When the transponder is turned on, the following page is displayed for a moment (during boot up), then the display changes to the 'AT7000 Self Test Running' display.

The start up display is used to display the unit model number and main application software version.



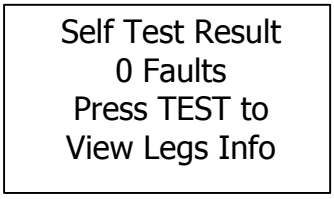
9.2.3.4 Self Test Running Page

The AT7000 Self Test page is displayed for three seconds every time 'Self Test' mode is initiated.



9.2.3.5 Self Test Status Pages

The 'Self Test Status' page displays the number of currently active fault types.

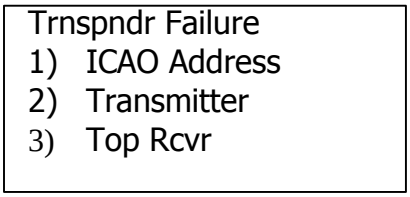


9.2.3.6 Flight Legs Fault Status Page

The 'Flight Legs Fault Status' page displays the number fault types for the leg defined as current leg – 0 to 9. '0' being the current leg and '9' being nine legs prior to the current. In the event an EEPROM log failure occurs, LOG FAILURE appears on the second line. The log failure only pertains to the leg attempting to be viewed.

9.2.3.7 Transponder Fail Status

The Transponder Fail Status page is used to display the failure status of the transponder when the transponder fail LED is turned on.

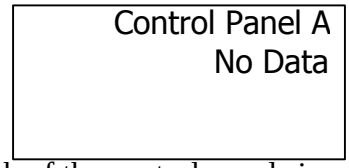


If internal failures are detected (causing the XPDR FAIL LED to illuminate), then the cause of the failure will be displayed. Only one page will be displayed, with the three most significant internal failures displayed.

a. ICAO Address
b. Internal component of Transponder
c. Top Transmitter
d. Bottom Transmitter
e. Tx Synth Lock
f. Rx Synth Lock
g. Top Receiver
h. Bottom Receiver
i. Squitter Mon

9.2.3.8 Control Panel Fail Status

This display is used to display the failure status of the selected control panel input if a failure is detected and the control panel fail LED is illuminated.

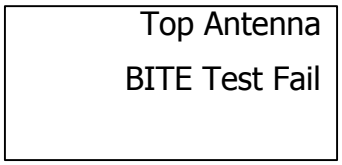


The first line is used to display which of the control panels is selected, either A or B. The failure is displayed on the second line, either “Invalid”, “Rate Failed”, or “No Data”.

For flight leg results all three faults can be displayed one per line starting on the second line. Both Control Panel A and B pages can be displayed if failures occurred on each while they were selected.

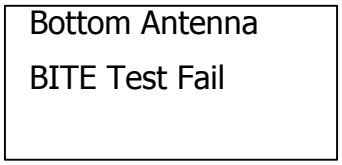
9.2.3.9 Top Antenna Fail Status

This display is used to display the top antenna BITE failure if a failure is detected and the top antenna fail LED is illuminated.



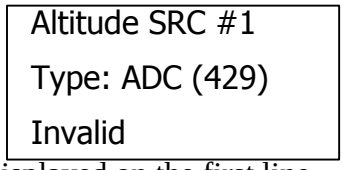
9.2.3.10 Bottom Antenna Fail Status

This display is used to display the bottom antenna BITE failure if a failure is detected and the bottom antenna fail LED is illuminated.



9.2.3.11 Altitude Fail Status

This display is used to display the altitude failure. The failure displayed is dependent upon the selection of the altitude type program input.



The altitude source, either 1 or 2, is displayed on the first line.

The altitude type is displayed on the second line: ADC (429), Gillham, or Synchro.

The failure is displayed on the third line, depending on the type.

If ADC (429) is selected, then the failures will be “Invalid” or “No data”.

If Gillham is selected, then the failure will be “Invalid” if an invalid code is input, or “Compare Fail” if the altitude compare is enabled and the compare fails.

If synchro is selected, then the failures will be “Invalid” if an invalid synchro or reference input is detected or “Flagged” if the synchro flag input indicates an invalid condition.

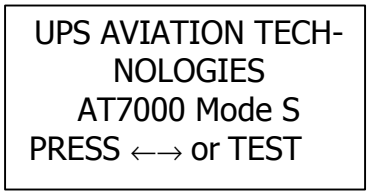
For flight leg results all two faults can be displayed one per line starting on the second line. Both Altitude Source 1 and Altitude Source 2 pages can be displayed if failures occurred for each while they were selected.

9.2.4 Normal Mode

In normal mode the pages are intended for system checkout or fault isolation when the aircraft is on the ground.

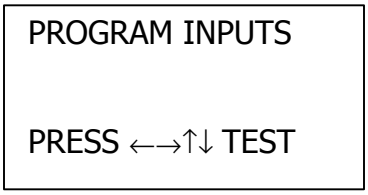
9.2.4.1 Default Page

The transponder will always return to the default page. This occurs when test mode times out, or if any other page is displayed in Normal Mode and a button has not been pressed in five minutes.



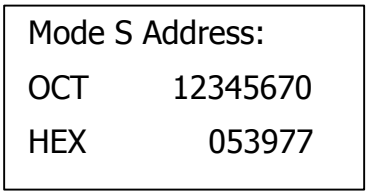
9.2.4.2 Program Inputs

The program inputs group is used to display the settings of each of the transponder's rear panel program inputs.



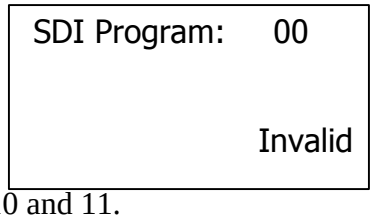
9.2.4.3 Mode S Address

This display is for decoding the 24-bit mode S address, displayed in octal and hexadecimal.



9.2.4.4 SDI Program Input

This display is SDI program input as 2 bits binary.



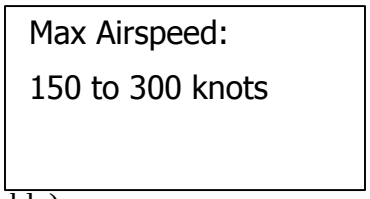
Possible numbers are 00, 01, 10 and 11.

If 00 is displayed, then also display “Invalid” on the bottom line.

9.2.4.5 Max Airspeed Program

This display is for the max airspeed program input.

The airspeed displays are:

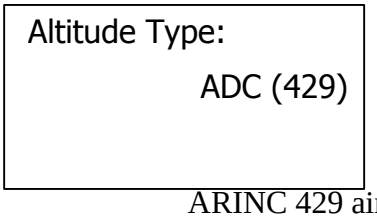


0) invalid (0 is not available)
1) up to 75 knots
2) 75 to 150 knots
3) 150 to 300 knots
4) 300 to 600 knots
5) 600 to 1200 knots
6) above 1200 knots
7) invalid (7 is not assigned)

9.2.4.6 Altitude Type Program

This is used to display the current altitude input type selected by the program pin inputs.

The altitude selection displays are:

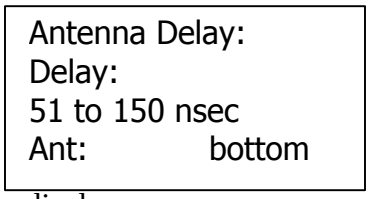


0) ADC (429) ARINC 429 air data input
1) Synchro

2) Gillham
3) Invalid

9.2.4.7 Antenna Delay Program

This display is for the antenna delay program input.



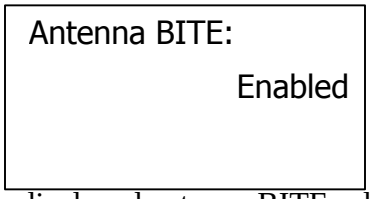
The delay selection displays are:

0) 0 to 50 nsec
1) 51 to 150 nsec
2) 151 to 250 nsec
3) 251 to 350 nsec

The antenna is either the bottom or top.

9.2.4.8 Antenna BITE Program

This page is for the antenna BITE program input.

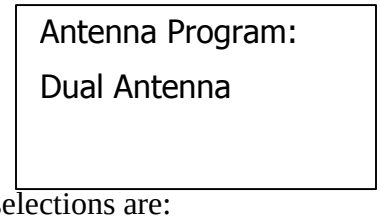


The possible displayed antenna BITE selections are:

0) Disabled
1) Enabled

9.2.4.9 Antenna Program

This page displays the antenna program input.



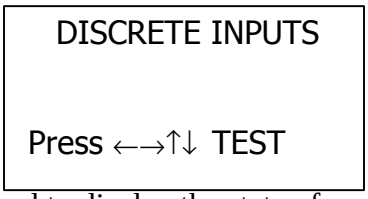
The antenna program selections are:

0) Dual antenna

1) Bottom only

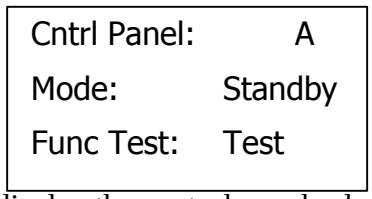
9.2.5 Discrete Inputs

The Discrete Input group is used to display the status of the rear panel discrete inputs, such as the altitude select and control panel select.



These displays are used to display the state of each of the discrete inputs, grouped in the following pages.

Discrete Inputs Page 1:



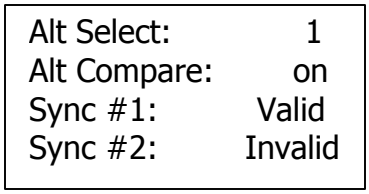
The top line is used to display the control panel selected, either A or B.

The second line is used to display the current mode of the standby input, either “Standby” or “Active”.

The third line is used to display the state of the functional test input, either “Test” or “Norm”

Discrete Inputs Page 2:

The top line is used to display the altitude source selection, either 1 or 2.

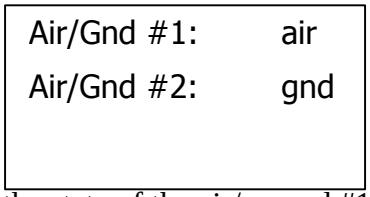


The second line is used to display the state of the altitude compare input, either “on” or “off”.

The third line is used to display the state of the synchro #1 valid flag input, either “valid” or “Invalid”.

The fourth line is used to display the state of the synchro #2 valid flag input, either “valid” or “Invalid”.

Discrete Inputs Page 3:

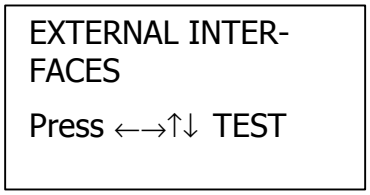


The top line is used to display the state of the air/ground #1 input, either “air” or “gnd”.

The second line is used to display the state of the air/ground #2 input, either “air” or “gnd”.

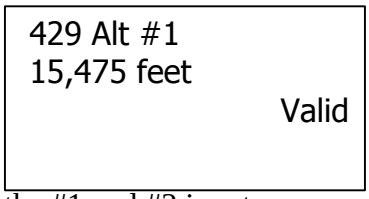
9.2.6 External Interfaces

The external interfaces group is used to display the status of the rear panel interface inputs, such as the altitude and control panel inputs.



9.2.6.1 ADC Altitude Inputs

This page is used to display the altitude and status from the air data computer inputs.



The data is displayed for both the #1 and #2 inputs.

The altitude is displayed in feet, with 1 foot resolution.

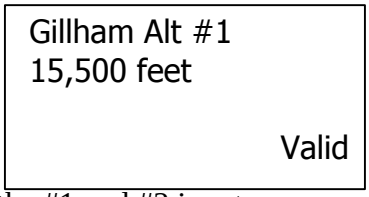
The status of the input is displayed on the bottom line as:

- Valid
- Invalid (invalid status on 429 input data)
- No data (no 429 altitude input data)

Note: During aircraft ground maintenance operation, only the selected altitude input needs to be displayed. During bench maintenance operation, all four altitude inputs will be displayed.

9.2.6.2 Gillham Altitude Inputs

This page is used to display the altitude from the two Gillham altitude inputs.



The data is displayed for both the #1 and #2 inputs.

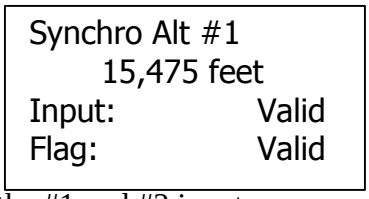
The altitude is displayed in feet, with a 100 foot resolution.

The status of the input is displayed on the bottom line as:

- Valid
- Invalid (for an invalid Gillham code input)
- Compare Fail (if the altitude compare is enabled and the compare fails)

9.2.6.3 Synchro Altitude Inputs

This page is used to display the altitude and status from the two synchro altitude inputs



The data is displayed for both the #1 and #2 inputs.

The altitude is displayed in feet, with a 1 foot resolution.

The status of the input is displayed on the 3rd line as:

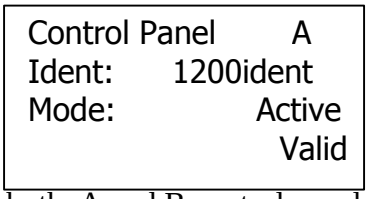
- Valid
- Bad Ref (reference out of tolerance)
- Bad Input (XYZ inputs out of tolerance… sig level, …)

The status of the corresponding valid flag input is displayed on the bottom line as:

- Valid
- Invalid

9.2.6.4 Control Panel Inputs

These pages are used to display the info and status from the two control panel inputs.



The data is displayed for both A and B control panel inputs.

On the second line, the ident code displayed as four character octal, followed by “ident” if SPI is enabled.

The operation mode is displayed on the third line as follows:

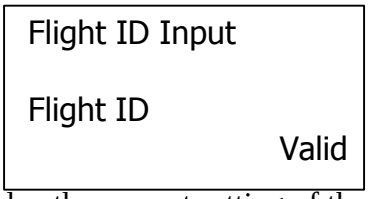
- Standby
- AltOff (active, altitude reporting is off)
- Active (active, altitude reporting is enabled)
- NotSelected

The status of the input is displayed on the bottom line as:

- Valid
- Invalid (invalid status on the 429 input data)
- No data (no 429 control panel data)

9.2.6.5 Flight ID Input

This page is used to display the status of the flight ID input.



The third line is used to display the current setting of the input:

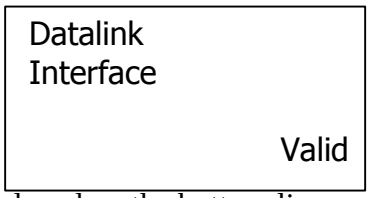
- Flight ID (if the input is set to the flight ID function)
- Nav Data (if the input is set to the Nav data input function)

The status of the input is displayed on the bottom line as:

- Valid
- Invalid (invalid status on the input data)
- No data (no input data)

9.2.6.6 DataLink Interface

This page is used to display the status of the ARINC 429 data link interface.

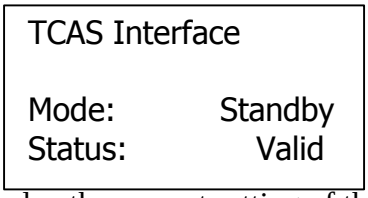


The status of the input is displayed on the bottom line as:

- Valid
- Invalid (invalid status on the input data)
- No data (no input data)

9.2.6.7 TCAS Interface

This page is used to display the status of the ARINC 429 TCAS interface.



The third line is used to display the current setting of the input:

- Standby
- TA Only
- TA/RA
- TCAS IV
- (BLANK when No Data)

The status of the input is displayed on the bottom line as:

- Valid
- Invalid (invalid status on the input data)
- No data (no input data)

9.3 Troubleshooting

The transponder has several system checks that can assist in troubleshooting. A self-test can be conducted from the transponder front panel and from the control panel.

9.3.1 System Test

Before conducting this test, verify the following:

- Air data computer breaker(s) are closed and the unit(s) function
- Mode S transponder breaker is closed
- Transponder control panel breaker is closed

The table on the following page offers some troubleshooting information. The screens are accessed in the 'Self Test Mode'. To enter the 'Self Test Mode', at power up, press the test button on the front panel. The start of 'Self Test Mode' turns all six front panel lights ON for 3 seconds and displays the 'Self Test Running' page.

The panel lamps and display indicates the current faults until the test mode ends. Pressing the test button while in test mode displays faults beginning with current flight leg. Subsequent presses of the test button cycles through the flight leg faults for up to ten flight legs.

At the end of the 'Self Test Mode', the lamps all turn off and the user interface changes to the normal mode.

Table 9 - Troubleshooting Guide		
Problem	**Cause**	**Corrective Action**
XPDR PASS LED is illuminated.	Normal operation.	No action necessary.
XPDR FAIL LED is illuminated.	The 'Trnspndr Failure' page will show up to three most significant failures: 1. ICAO Address 2. Internal component of Transponder 3. Top Transmitter 4. Bottom Transmitter 5. Tx Synth Lock 6. Rx Synth Lock 7. Top Receiver 8. Bottom Receiver 9. Squitter Mon	
CTRL PNL failure light is illuminated and the 'Control Panel Fail Status' page reads 'Invalid', 'Rate Failed' or 'No Data'.	Control panel not connected.	Check wiring. Replace faulty control panel.
TOP ANT failure light is illuminated and 'Top Antenna' page reads 'BITE Test Fail'.	Top antenna not connected correctly.	
BOT ANT failure light is illuminated and 'Bottom Antenna' page reads 'BITE Test Fail'.	Bottom antenna not connected correctly.	
ALT SIG failure light is illuminated. The 'Altitude Fail Status' will read 'Invalid' or 'No Data' if the type of altitude source is ADC (429). If Gillham is selected as the source the display will read 'Invalid' or 'Compare Fail'. If Synchro is selected as the source, the failures will be 'Invalid' or 'Flagged'.		

Section 10 - Periodic Maintenance

10.1 Maintenance

There are no internal manual adjustments needed.

NOTES

Section 11 - Environmental Qualifications

The AT7000 has been tested to the following environmental categories per procedures defined in RTCA/DO-160D.

Table 10 - Environmental Requirements

Nomenclature: AT7000 Part No.: 430-6091-100 TSO No.: TSO C112		Manufacturer: UPS Aviation Technologies 2345 Turner Road SE Salem, Oregon 97302	
Environment	**Section**	**Category**	**Comment**
Temperature and Altitude	4	A2	Operating Temp ..... -20°C to +70°C Short Time Hi Temp ..... to +70°C Cooling .....Required Ground survival temp ... -55°C to +85°C Altitude ..... 55,000 feet Overpressure ..... –15,000 feet Decompression ..... 55,000 feet
Temperature Variation	5	B	Minimum 5°C per minute
Humidity	6	B	Severe humidity environment.
Operational Shocks and Crash Safety	7	B	Tested for operational shock and crash safety. Aircraft type 5, test type R
Vibration	8	S & T	S (curves B and M), T (curves B, B1 and R)
Explosion Proofness	9	X	Not applicable, no test required
Waterproofness	10	X	Not applicable, no test required
Fluids Susceptibility	11	X	Not applicable, no test required
Sand and Dust	12	X	Not applicable, no test required
Fungus Resistance	13	X	Not applicable, no test required
Salt Spray	14	X	Not applicable, no test required
Magnetic Effect	15	Z	< 0.3 meter
Power Input	16	A & E	28 volt DC and 115 volt 400 Hz AC
Voltage Spike	17	A	
Audio Frequency Conducted Susceptibility - Power Inputs	18	A & E	
Induced Signal Susceptibility	19	C	Z is minimum requirement, C is the goal
Radio Frequency Susceptibility (Radiated and Conducted)	20	V	U is minimum requirement, V is the goal
Emission of Radio Frequency Energy	21	M	
Lightning Induced Transient Susceptibility	22	A3 C2 E2	Pin injection Unshielded cables Shielded cables
Lightning Direct Effects	23	X	Not applicable, no test required
Icing	24	X	Not applicable, no test required
Electrostatic Discharge (ESD)	25	A	

NOTES

UPS Aviation Technologies